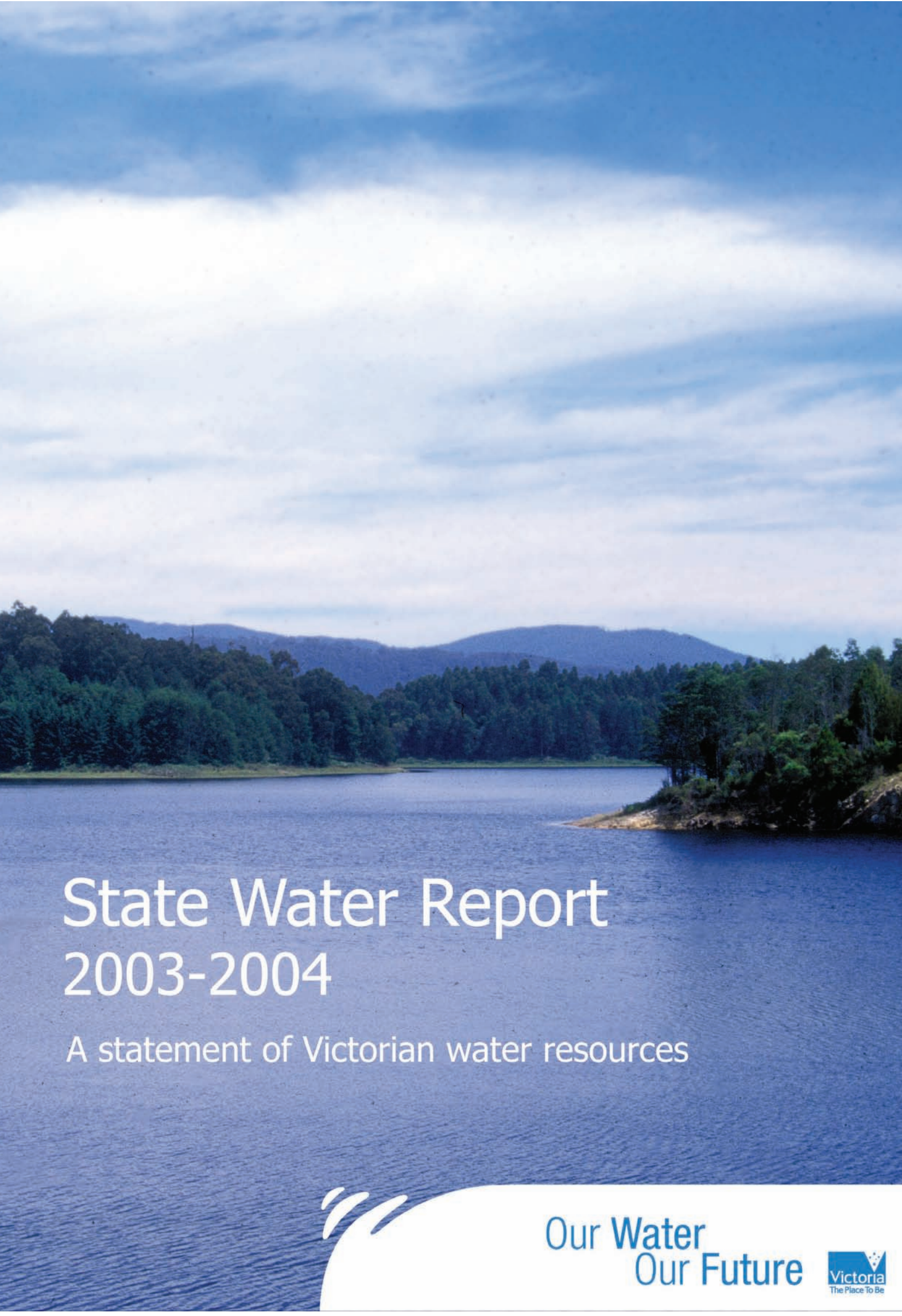

# State Water Report 2003-2004

## A statement of Victorian water resources

Our Water Our Future

Victoria The Place To Be

Published by the Victorian Government Department of Sustainability and Environment
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# Foreword

The Government's 2004 water action plan, *Our Water Our Future, Securing Our Water Future Together* White Paper has set the future directions for sustainable water management in Victoria

In setting out a program of reforms to ensure we have a sustainable water future, the White Paper recognises the need to improve our understanding of Victoria's precious water resources through monitoring and reporting the State's water resources and ensuring that water resource information is publicly accessible.

Whilst water managers have a good understanding of the water resources in their own immediate areas, there is a need to make more of this information available to a wider audience, from government through to community interest groups and people seeking water for new developments.

It is also imperative to have an up to date understanding of trends in the availability of water resources in Victoria, its condition, how much and where it is being used, and what it is being used for. Information of this type allows us to respond to change, and ensure the continuation of safe and secure water supplies to urban and rural communities, business and agriculture, while protecting the health of our waterways.

This State Water Report 2003/04 is the first in what will be a regular reporting framework that monitors Victoria's water resource availability and use, and identifies trends.

It allows us to assess emerging trends and issues that help us better understand ways to ensure sustainable water use.  We need to change our water use to become sustainable.

By collecting the information detailed in this Report, we can better understand where the next challenges are emerging. This allows the Victorian Government to implement frameworks to support growing communities and a thriving economy, while protecting our rivers, creeks, lakes and water environments.

By identifying trends in the reliability of various water supplies, water trading and catchment and waterways health, we can build on the strong strategies and management frameworks *Our Water Our Future* provides to ensure sustainable decisions are made to secure our water future.

**John Thwaites**

Minister for Water

# Contents

# Introduction

This is the first annual State Water Report on Victoria's water resources. It combines the outcome of two actions proposed in the Victorian Government's 2004 *Our Water Our Future* White Paper: namely the State Water Inventory (Action 2.10) and the State Water Accounts (Action 2.18).

This State Water Report 2003/04 consists of two parts. The first part, **Overview of State Water Resources**, forms the White Paper's initial State Water Inventory. The second part forms the initial **State Water Accounts.**

The Overview of State Water Resources is a commentary on the state of our water resources in the current year and uses data from previous years to help identify emerging issues and trends which demand the attention of the Victoria Government to ensure safe and secure water supplies and a healthy riverine environment.

The Overview of State Water Resources draws principally on data from the State Water Accounts 2003/04. Future reports will expand on trends in water resources over time, as data becomes available. Section 1 provides an overview of water availability in 2003/04. This data is compared with previous years, and leads on to commentary on the current drought and the pressing issue of climate change. Section 2 is a summary of the effect on the environment of taking water out for consumptive use. Section 3 is a state- wide summary of the water taken from streams and aquifers in 2003/04 for consumptive use, and Section 4 reports on how water users and the environment are managing the continuation of the drought. Section 5 concludes with a discussion on initiatives that will improve the way water is managed in Victoria in future.

The State Water Accounts 2003/04 is a record of water allocation and use across Victoria over a single water year from July to June. We need to monitor the quantity and quality of our water resources and the environmental condition of Victoria's rivers and groundwater to ensure they are managed sustainably.

The State Water Accounts 2003/04 report on water availability, allocation and use for surface water, groundwater and recycled water in each of Victoria's 29 river basins. The Water Accounts are prefaced by a summary of the key assumptions made in preparing and presenting the data. Each basin section outlines: a map showing location of significant water resources; responsibilities for management of water resources; an overview of seasonal conditions affecting water resource availability and use; and the volume of total water resources available and used for the environmental water reserve, surface water, groundwater, and recycled water.

This first State Water Report 2003/04 concentrates on water allocation and water extraction, whilst areas such as the environmental condition of streams are not as comprehensive. The reason for this imbalance is simply a matter of data availability. Water authorities and Catchment Management Authorities already routinely report on water allocation and extraction and river improvement works for a number of different purposes and in different formats, and information included in this Report is based on this existing information. However, the Department of Sustainability and Environment has projects underway to ensure improved information is available in future reports.

# Part 1

# Overview of the State's Water Resources 2003/04

# 1. Water Availability

The amount of water available for use in Victoria at any given time depends on how much rain has fallen over the previous years to cause rivers to run and to replenish reservoirs and aquifers. This Section describes how much water was available in Victoria during 2003/04, and how this compares with previous years. Rainfall, streamflow, reservoirs, groundwater resources, and water quality are reported.

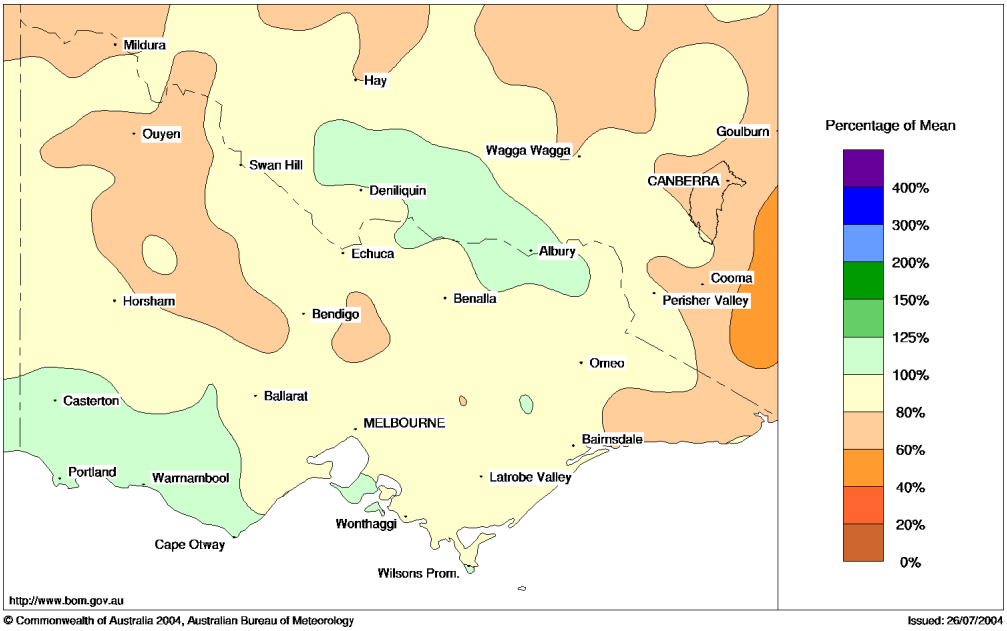
## 1.1 Rainfall

Much of the rainfall that occurs in Victoria is not available for consumptive use by humans. Of the rain or snow falling across the State, around 84 per cent evaporates or is transpired by vegetation (evapotranspiration), around 15 per cent runs off land as surface runoff and streamflow, and around one per cent infiltrates into the soil and to groundwater aquifers.

Victoria's rainfall in 2003/04 was characterised into three main bands as shown in Figure 1-1:

- Areas in the north-west of the State, central Victoria and East Gippsland received substantially less than average rainfall, with only 60 to 80 per cent of normal rainfall being received.
- Most of the State, including the Great Dividing Range (where most catchments for our major water supply systems are located) received average or slightly lower than average rainfall (up to 20 per cent lower than average).
- Slightly better than average rainfall conditions were experienced in south-west Victoria and in an area in the North East of the State near the River Murray.

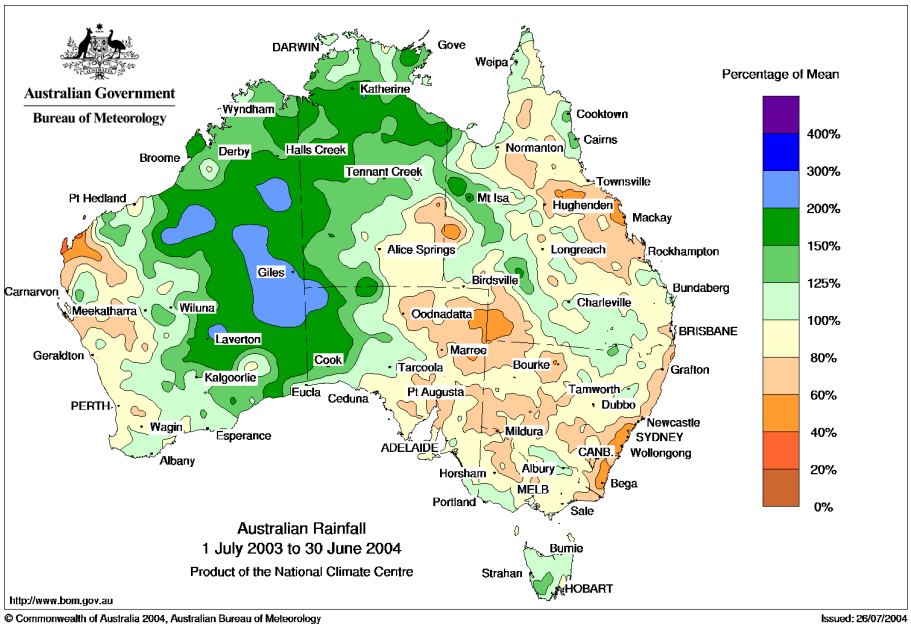
**Figure 1-1 Victorian rainfall, percentage of mean, 1 July 2003 to 30 June 2004**




Issued: 26/07/2004

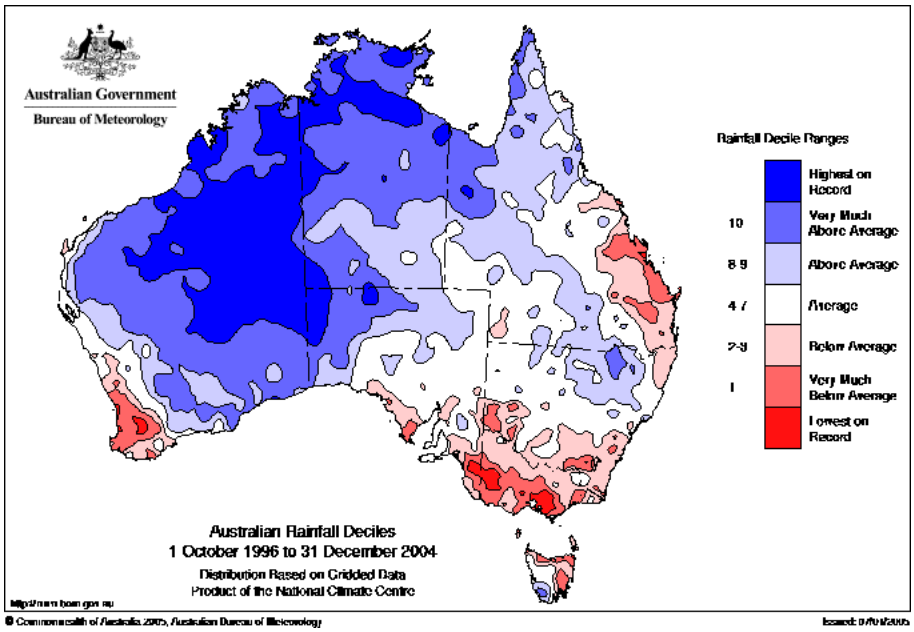
The pattern of below average rainfall in many parts of Victoria for 2003/04 is repeated along much of the east and west coasts of Australia as shown in Figure 1-2. New South Wales and the eastern half of South Australia had similar rainfall patterns to Victoria, where rainfall ranged from between 20 to 40 per cent below average. The New South Wales coast south of Sydney was exceptionally dry in 2003/04, with only 40 to 60 per cent of average rainfall recorded for the year. Most of the Northern Territory and interior of Western Australia received above average rainfall.

**Figure 1-2 Australian rainfall, percentage of mean, 1 July 2003 to 30 June 2004**




The 2003/04 rainfall conditions are a continuation of generally below average rainfall experienced across the State since 1996 (Figure 1-3). The implications of this pattern of rainfall on river flows and water supplies are discussed in the following Section.

**Figure 1-3 Australian rainfall deciles 1 October 1996 to 31 December 2004**



## 1.2 Streamflow

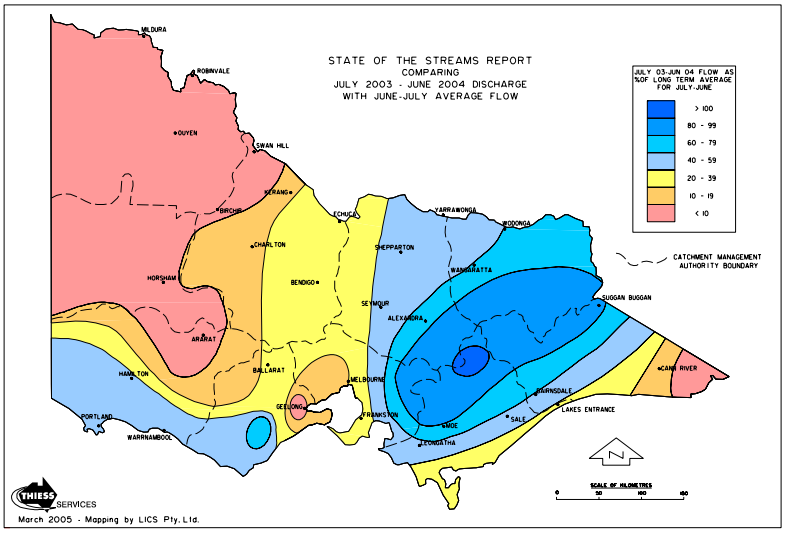
The pattern of rainfall described in Section 1.1 has caused a decline in the flow of many of Victoria's rivers. Furthermore, the decline in streamflow is proportionally greater than the decline in rainfall. The reasons for this decline are found in the complex relationship that determines how much rain finds its way into streams. This relationship depends on the amount and intensity of rainfall and its ability to infiltrate into the soil and recharge groundwater stores before being lost by evapotranspiration through vegetation. The water held in the soil and in groundwater stores is depleted during dry periods and needs to be recharged by infiltration of rainfall in order for river flows to return to normal. This depletion is magnified during extended dry periods, such as the eight year period of below average rainfalls (starting in 1996/97) many parts of Victoria are experiencing.

The decline in streamflows and below average rainfall in 2003/04, combined with the effect of the extended dry period, can be observed by comparing the map of 2003/04 rainfall (Figure 1-1) with Table 1-1. Data presented in Table 1-1 is an estimate of total streamflow in each basin, before any water is extracted. Streamflow data in Table 1-1 is either based on gauged data or calculated from a basin water balance (refer to each of the basin chapters in the State).

In the East Gippsland Basin, which is located in a high rainfall depletion band (20 to 40 per cent below average), the total streamflow was very much below average with only 18 per cent of normal streamflow recorded in 2003/04. Similarly, for a number of other river basins including the Loddon, Avoca, Wimmera, Tambo, Maribyrnong, Werribee, Moorabool, and Millicent Coast, 2003/04 rainfall was in the just below average band (0 to 20 per cent below average), while streamflows were 50 per cent of average or less.

The south-west coast, and the east of Victoria recorded the highest streamflow (between 60 to 99 per cent of the long-term average) in 2003/04 relative to the rest of the State (Figure 1-4). The water supply catchments east of Melbourne are located in this area. Only one small area recorded over 100 per cent of long-term average streamflow in 2003/04. This area is located in the upper Macalister Catchment, near the town of Licola. Central Victoria, including Ballarat and Bendigo, recorded between 20 to 39 per cent of long-term average streamflow over the year.

**Figure 1-4 Streamflow in 2003/04 expressed as a percentage of long-term average flow(1)**




(1) Figure shows 2003/04 streamflow as a percentage of long-term average streamflow, based on data from 28 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 2003/04 compared with long-term mean**

| Basin | Average annual streamflow (ML/year)[1] | 2003/04 streamflow (ML)[2] | 2003/04 streamflow (% of average) |
|---|---|---|---|
| Murray | 3,179,000 | 4,057,210 | 128% |
| Kiewa | 339,500 | 647,500 | 191% |
| Ovens | 1,692,000 | 1,609,800 | 95% |
| Broken | 326,000 | 270,760 | 83% |
| Goulburn | 3,366,000 | 2,813,340 | 84% |
| Campaspe | 305,000 | 158,750 | 52% |
| Loddon | 415,000 | 168,480 | 41% |
| Avoca | 136,200 | 33,910 | 25% |
| Mallee | 0 | 0 | Not applicable |
| Wimmera | 316,400 | 107,270 | 34% |
| East Gippsland | 887,000 | 160,470 | 18% |
| Snowy | 863,000 | 544,260 | 63% |
| Tambo | 329,000 | 89,180 | 27% |
| Mitchell | 1,100,000 | 754,260 | 69% |
| Thomson | 1,080,580 | 843,850 | 78% |
| Latrobe | 887,000 | 628,180 | 71% |
| South Gippsland | 851,000 | 908,210 | 107% |
| Bunyip | 354,000 | 432,460 | 122% |
| Yarra | 1,200,000 | 755,710 | 63% |
| Maribyrnong | 125,400 | 36,670 | 29% |
| Werribee | 137,000 | 43,650 | 32% |
| Moorabool | 91,400 | 34,270 | 37% |
| Barwon | 250,800 | 155,900 | 62% |
| Corangamite | 120,500 | 97,580 | 81% |
| Otway Coast | 750,000 | 891,610 | 119% |
| Hopkins | 405,600 | 251,050 | 62% |
| Portland Coast | 231,000 | 209,700 | 91% |
| Glenelg | 704,400 | 467,170 | 66% |
| Millicent Coast | 4,000 | 180[3] | 5% |
| **Total** | **20,446,780** | **17,171,380** | **84%** |

(1) From the National Land and Water Resources Audit (2001), except for Murray Basin, which is from a model. Data is mean annual basin outflow under 'current' level of development.

(2) Catchment inflow as shown in each basin water balance in the State Water Accounts 2003/04, excluding inter-basin transfers, irrigation return flows and recycled water to avoid double accounting

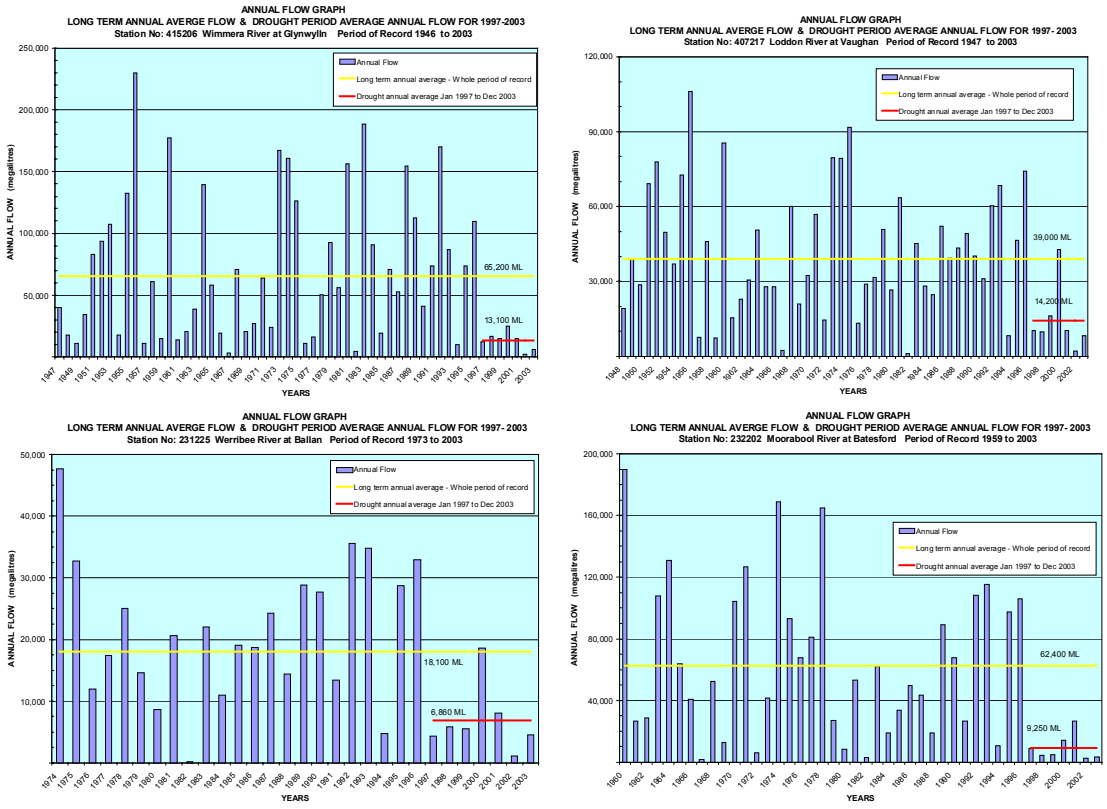
(3) 2003/04 streamflow estimated as the volume of water diverted.

Annual streamflow at four stream gauges in Victoria is shown in Figure 1-5. The historical long-term average streamflow is contrasted with the average streamflow for the current drought period (1997 to 2003). The four rivers shown in Figure 1-5 – the Wimmera, Loddon, Werribee and Moorabool rivers, have all recorded low streamflows over the drought. Streamflows in the Wimmera River are recorded at Glynwylln, upstream of Glenorchy in the upper reaches of the 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 streamflow for the Loddon River is recorded at Vaughan, upstream of Cairn Curran Reservoir. Around one third of average streamflow was recorded at this site, compared with around 41 per cent of average streamflow occurring in the basin in 2003/04. The Loddon River and associated reservoirs is

an important source of water for towns and licenced diverters, and also provides water for the irrigation in the Goulburn system.

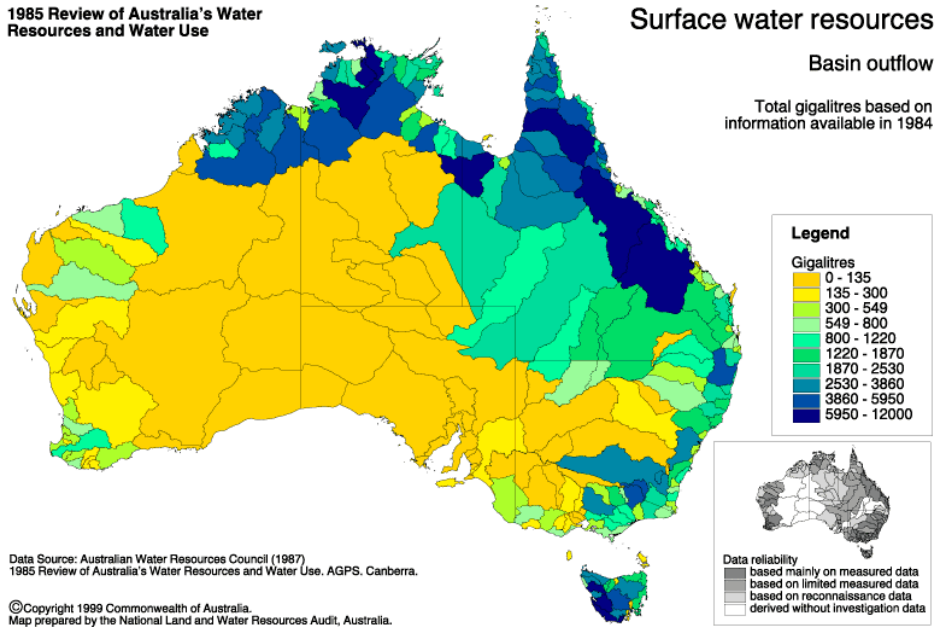
The Werribee River at Ballan is located in the upstream reaches of the river. While additional streamflow occurs further downstream from tributaries, at a basin scale, flow in the river was around 32 per cent of the long-term average in 2003/04, while in the upper reaches, streamflow averaged around 21 per cent of the long-term mean during the drought. 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 at Batesford (near Geelong) recorded flows as low as around 15 per cent of the long-term average over the past eight years of drought. This has impacted on Geelong's water supply, which experienced water restrictions for a number of these years. At a basin scale, streamflow in the Moorabool was around 37 per cent of the long-term average in 2003/04. The Moorabool Basin is the main source of water for Ballarat, and the prolonged lower than average streamflows has also seen water restrictions for Ballarat and surrounds for a number of years.

**Figure 1-5 Annual streamflow at Wimmera River, Loddon River, Werribee River and Moorabool River**




Streamflow in different parts of Australia is shown in Figure 1-6. Mean annual basin outflow is the estimated outflow from a river basin under natural conditions. The basin outflow is either to the sea or to an adjacent basin but not to a sink or closed lake within the basin. The data used in Figure 1-6 is the best information available at December 1984. The accuracy of the data varies appreciably between basins and although the data is at least 20 years old, it provides an indication of the distribution surface water across Australia and an historical context of surface water availability in Victoria.

**Figure 1-6 Basin outflow for river basins in Australia (GL/year)**




The prolonged dry conditions across Victoria are a result of natural climate variability. However, the question of climate change and the impact on Victoria's water resources are outlined in the box below.

**Box 1 Climate Change and Victoria's Water Resources**

- *Enhanced Greenhouse Effect*

Earth's atmosphere is composed of a mixture of gases, mainly nitrogen and oxygen plus smaller amounts of carbon dioxide, water vapour, methane and ozone. About half of the sun's energy reaching the top of our atmosphere penetrates to Earth's surface. The rest is either reflected back into space by the atmosphere or absorbed by gases and dust particles. The gases, water vapour, carbon dioxide and methane (greenhouse gases) have the ability to absorb some of the infrared radiation that penetrates to Earth's surface, leading to warming of the lower atmosphere. This absorption of heat is called the 'greenhouse effect' and keeps the surface of our planet warm enough to sustain us. Without heat-trapping greenhouse gases in the air, Earth's surface temperature would be a freezing -18˚C, rather than 15˚C.

Human activities over the past 200 years (such as burning of fossil fuels and land clearing) have led to an increase in the concentration of greenhouse gases in the atmosphere. This has resulted in an increase in the amount of infrared radiation trapped by the atmosphere, which in turn has lead to an increase in the average temperature of the lower atmosphere, producing an enhanced greenhouse effect. Earth's climate is finely balanced and increased temperatures in the lower atmosphere are likely to produce changes to weather and climate world-wide. Consequently, the enhanced greenhouse effect is often referred to as 'climate change' or 'global warming'.

- *Historical Climate Trends in Victoria*

The average temperature in Victoria has increased by 0.8°C since 1900. Since 1950, Victoria's average maximum temperature has increased by 0.11ºC per decade, the minimum by 0.07ºC per decade and the average temperature by 0.09ºC per decade. Compared to national trends, Victorian maximum temperature indicates a faster rate of increase, while minimum temperature shows a slower rate of increase (CSIRO, 2002). Trends in Victorian annual rainfall from the 1880s to present are not strongly evident because they are masked by natural climatic variability. Most of Victoria showed a slight upward trend in rainfall from the 1890s to the 1950s, and a slight downward trend since 1950. Extreme wet and dry periods have occurred throughout the historical record and are part of our naturally variable climate. Extreme rainfall events have become more common in Victoria during the past century, although there is much variation between decades (CSIRO, 2002).

- *Projected Changes to Victoria's Climate*

Across Victoria, climate change is expected to increase temperatures, reduce rainfall and increase potential evaporation. Extreme events, such as flooding and drought, are likely to increase in frequency and severity. CSIRO (2004) has estimated the magnitude of expected changes on rainfall using Global Simulation Models (Table 1-2). The impact is expected to be greater in northern Victoria than southern Victoria, and marked seasonal changes are expected. However, there is still a high degree of uncertainty about the likely magnitude of these changes.

**Table 1-2 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% |

- *Projected Impact of Climate Change on Victoria's Water Resources*

*Streamflows* – Climate change is expected to decrease average annual streamflows and increase the frequency and severity of extreme events such as drought and floods. Runoff will only be 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 runoff.

The effect of climate change on streamflows has been estimated by several water authorities across Victoria. Melbourne Water, for example, has undertaken detailed studies of climate change impacts on Melbourne's water supplies. The runoff in the Yarra River catchment is estimated to decrease by up to 25 per cent by 2030, whilst dry conditions that currently occur one in four years may occur one in three years (DSE, 2004). North of the Great Dividing Range, the Murray-Darling Basin Commission has estimated that by 2023 there will be 5 per cent less water flowing into the Murray-Darling system (DSE, 2004b).

*Water Use* – Increased temperatures and evapotranspiration predicted under climate change scenarios are predicted to lead to increased water use as the water requirements for plants increase. For this reason, the demand for irrigation water due to climate change is expected to increase more than urban water demands.

Potential future changes in the demand for water due to climate change are expected to be mitigated or offset by demand reduction initiatives, such as education and awareness campaigns about water use and the Victorian Government's rebate system for water efficient appliances.

*Water Quality* – Increased water treatment costs will be the main impact of water quality deterioration resulting from climate change. The increase in water temperature and decrease in streamflows may increase the risk of algal blooms in some storages (AGO, 2003).

- *Further Research*

In the *Our Water Our Future* White Paper (DSE, 2004b), a commitment was made to further research climate change. Victoria is participating in a three-year, collaborative research program, covering a large part of Australia, which is focussing on improving the understanding and predictability of key climate parameters for specific regions over a range of time scales. The studies undertaken as part of this program will help to differentiate between long-term climate change and normal climate variability. This research will also be used to develop the triggers that indicate when water entitlements need to be adjusted in response to long-term climate change. For further information on Victoria's climate change research, visit http://www.greenhouse.vic.gov.au/index.htm.

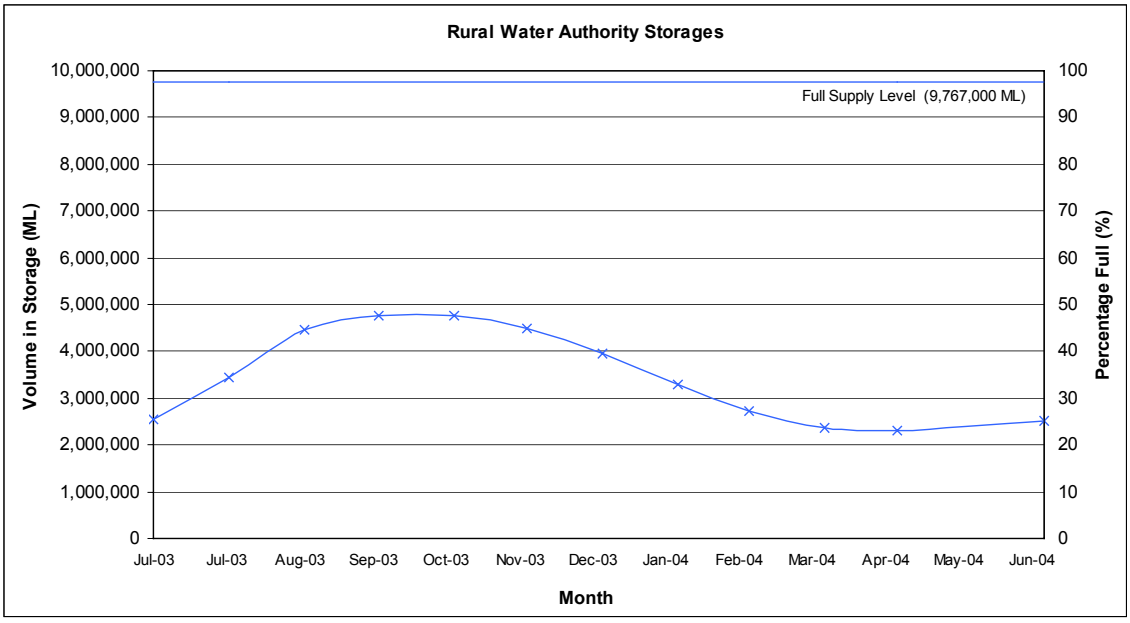
## 1.3 Reservoirs

The high year-to-year and within-year variability of Victoria's river flow means that large reservoirs are necessary to even out fluctuations to provide towns and farms with a continuous and reliable water supply. 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 storage supply in any one year. For example, Melbourne's total water consumption in 2003/04 (while Stage 2 water restrictions were in place) was around 439,000 ML.

When the water levels in our reservoirs fall, this shows they are doing the job they were designed to do, which is to store water to maintain a supply through dry summers and extended dry periods.

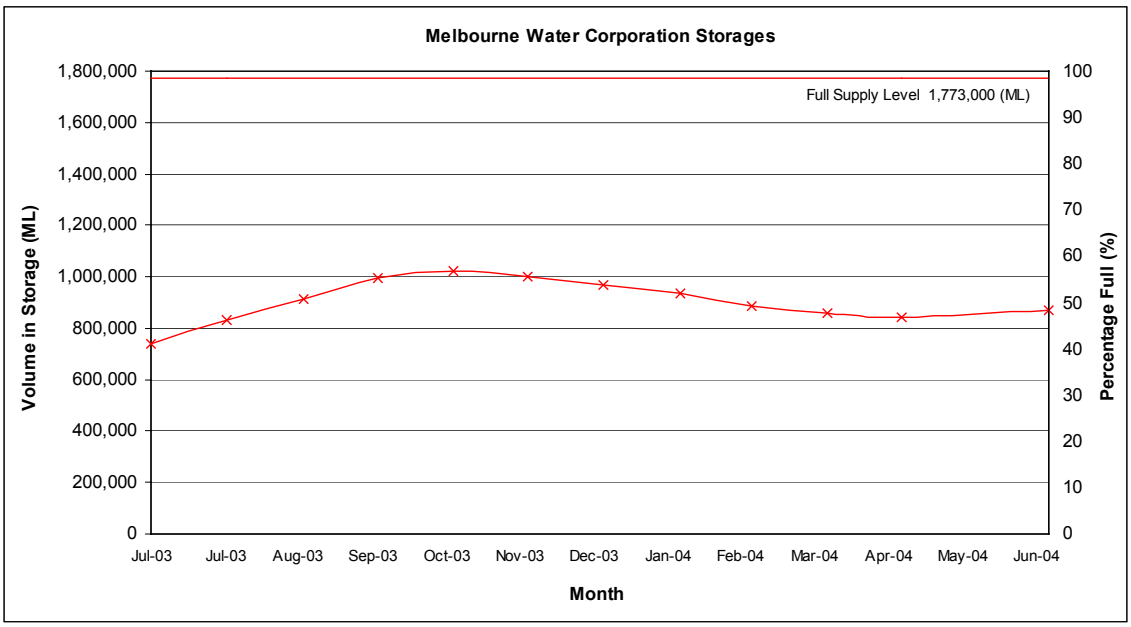
The total volume of water in rural water authority reservoirs increased over the winter/spring filling period, and were drawn down over summer/autumn to supply irrigation and urban demands. Storages at the end of July 2003 held 2,556,775 ML (26.2 per cent of capacity). A year later, at the end of June 2004, these storages were holding slightly less (2,524,936 ML or 25.9 per cent of capacity), which is still well below full (refer Figure 1-7). This substantial use of water stored in the reservoirs reflects below average streamflows over the year.

**Figure 1-7 Volume in major Rural Water Authority Storages during 2003/04**



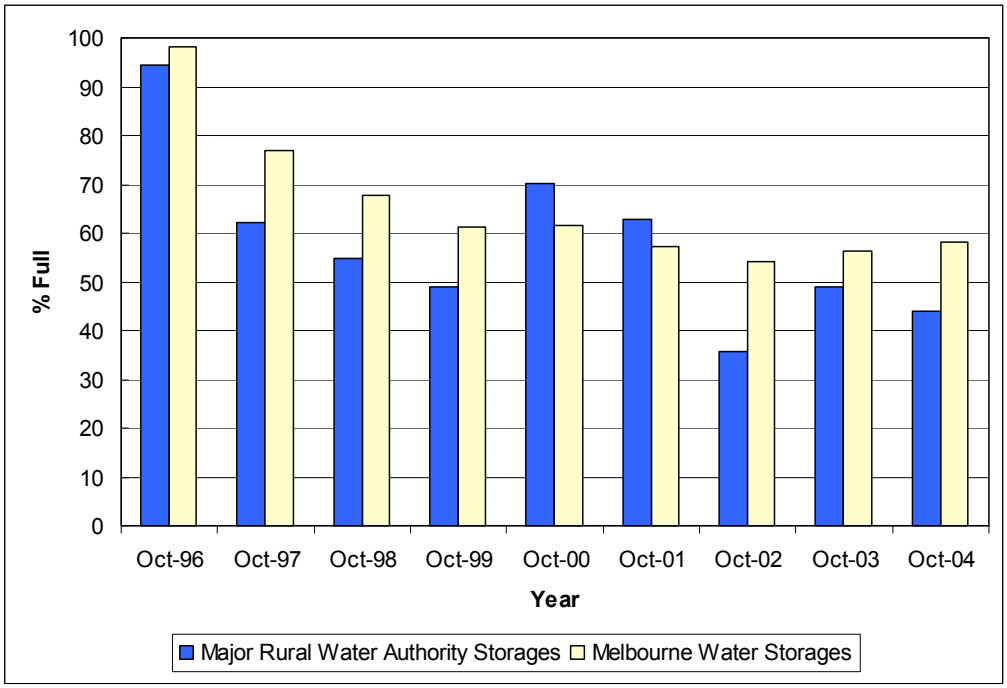

Melbourne's water storages increased from 741,382 ML (41.8 per cent of capacity) at the end of July 2003 to 868,797 ML (49.0 per cent of capacity) at the end of June 2004 (refer Figure 1-8). This increase reflects the fact that 2003/04 streamflows in Melbourne's catchments were higher than the previous year. Melbourne's catchments received better rainfall and streamflow during 2003/04 than the water supply catchments filling most rural water authority storages.

**Figure 1-8 Volume in Melbourne Water Corporation storages during 2003/04**




Storage levels at the end of October from 1996 to 2004 are shown in Figure 1-9. 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 runoff, before they start to be drawn down for the summer period. Late spring in 1996 was the last time many of Victoria's major reservoirs were full or close to full. Storage levels have generally declined from 1996 to 2002, when storages reached their lowest levels although they have shown signs of increasing over the past two years.

**Figure 1-9 Water stored in reservoirs at the end of October, 1996 to 2004 (shown as a percentage of total storage capacity)**



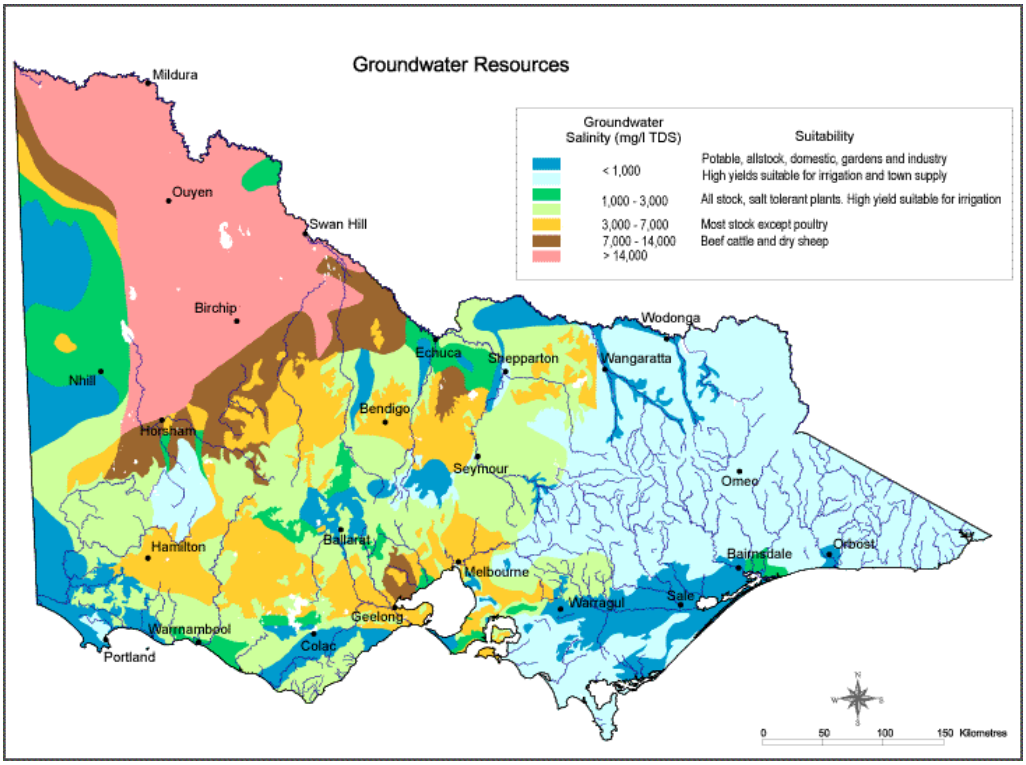
## 1.4 Groundwater resources

Historically, groundwater was an important supplementary water supply for Victoria during periods of low rainfall and drought. Over recent years, groundwater has increasingly been recognised as a primary water source, particularly where caps limit 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. Figure 1-10 identifies the location and quality of Victoria's groundwater resources. Groundwater resources and surface water are inextricably linked. Much of the rain that falls on the land percolates into soil and aquifers. Many aquifers then flow into rivers and contribute to baseflow. 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 around 1,000,000 ML of water recharges aquifers in Victoria annually.

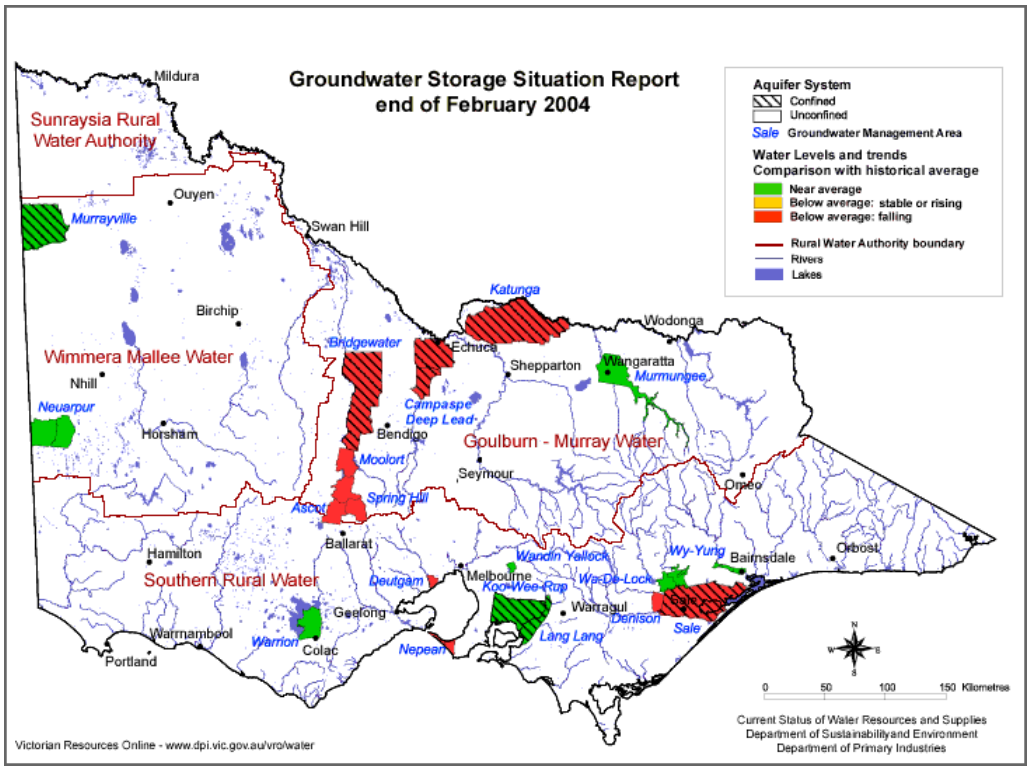
The *Our Water Our Future* White Paper (DSE, 2004b) recognised that where an aquifer is highly connected to surface water, a decline in groundwater levels will affect the groundwater and the connected surface water. In response to this, the Victorian Government has announced it will establish Environmental Water Reserves for aquifers to protect their integrity, the interaction between surface water and groundwater, and provide for the needs of groundwater dependent ecosystems. A project to better understand the interactions between groundwater and surface water will also be undertaken.

**Figure 1-10 Location and quality of Victoria's groundwater resources**



Trends in water and pressure levels in 18 key groundwater systems are monitored around the State on a quarterly basis. Trends at the end of summer 2004 are shown in Figure 1-11. Groundwater levels recorded at the end of summer reflect the seasonal effects of pumping.

**Figure 1-11 Groundwater storage situation at end of February 2004**




Levels for the Neuarpur, Murrayville, Koo Wee Rup, Warrion, Murmungee, Wy Yung, Wa De Lock and Wandin Yallock Groundwater Management Areas, which are coloured green in Figure 1-11, were at historic average levels or agreed management levels for that time of year. In most other GMAs, levels were near the historic minimums for that time of year (ie. lowest groundwater level recorded). This has been a pattern that has been observed for many GMAs since 1993.

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. That is, the soil water holding capacity has to be exceeded to enable recharge. This effect is exacerbated during extended dry periods such as the period observed for some GMAs since 1993.

In areas where groundwater is more intensively developed, the decline in groundwater storage arising from the combined effect of pumping and reduced recharge storage is more pronounced, including in the Upper and mid-Loddon, Katunga, Campaspe, Sale and Deutgam GMAs.

## 1.5 Water quality

Good water quality is a critical factor in delivering safe, secure and reliable water supplies. The Victorian Water Quality Monitoring Network (VWQMN) is an extensive system consisting of around 280 water quality monitoring stations located throughout the State. A range of water quality indicators is measured at these stations and data has been recorded for up to 25 years at approximately monthly intervals. This data is stored on DSE 's Data Warehouse where it is accessible to the public online at http://www.vicwaterdata.net. DSE produces an annual review of water quality throughout the State. This review summarises water quality in light of the objectives and guidelines outlined in the *State Environment Protection Policy (Waters of Victoria)* and the *National Water Quality Management Strategy: Australian and New Zealand Water Quality Guidelines for Fresh and Marine Waters (ANZECC).* These annual Water Quality Monitoring Reports are also available on this website under 'Published Reports'.

Three main factors affecting the quality of Victoria's water supplies are turbidity, salinity and nutrients. High turbidity in waterways is caused by water running off exposed land, and erosion in streams. High salinities can occur when high accessions to the water table mobilise saline groundwater through drainage into waterways. High nutrient loads in streams are associated with eroded sediments, drainage from agricultural land, urban stormwater drainage and the return of treated effluent from cities and towns. High nutrient levels can cause algal blooms in rivers and reservoirs. A range of prescriptive water quality parameters applies to drinking water supplies to protect human health.

To some extent, the dry conditions in 2003/04 had a mitigating influence on turbidity and salinity levels, with several notable exceptions. The bushfires of January and February 2003 continue to have a major impact on water quality in rivers in eastern Victoria, as detailed in the box below.

Salinity levels in the River Murray were generally very low for much of 2003/04, helped by the dry conditions. However, floodwaters from Queensland and northern New South Wales made their way down the Darling River system, bringing relief to the parched Menindee Lakes in January 2004. However, this also resulted in an unprecedented salt slug entering the River Murray from the Darling River with a peak salinity of 4,000 EC. This event required careful management of water releases and communications with irrigators to prevent damage to crops.

Significant outbreaks of blue-green algae in rivers, reservoirs and lakes can be a health risk for our water supplies. A system of monitoring and reporting of algal cell and toxin levels is in place for water bodies used for water supply and recreational use. Incidents of algal bloom outbreaks are reported to the Departments of Sustainability and Environment and Human Services, and protocols are in place to manage the outbreaks and for communicating with the relevant authorities and the public. A number of warnings and outbreaks of algal blooms occurred in Victoria during 2003/04. Many occurred in pools in the lower reaches of rivers exacerbated by very low flows. A number of reservoirs also experienced outbreaks. For example, Lake Hume experienced a number of algae alerts, and Yan Yean Reservoir was taken off line for several months.

Victoria's Catchment Management Authorities all have programs to improve water quality in waterways and receiving waters. These include initiatives to protect stream frontages through removing exotic species, completing revegetation and fencing, stabilising gullies, constructing rock chutes and beaching to control erosion, establishing carp control programs, and building sediment traps and gross pollutant traps for urban stormwater. In additional, local government plays an active role in improvement of stormwater quality in the urban context.

**Box 2 Impact of the 2003 Bushfires on Rivers**

In January and February 2003, lightning storms ignited bushfires in Victoria, which eventually burnt around 1.3 million hectares of land in the North East and East Gippsland. These fires were the largest Victoria had experienced since 1939. Most of the burnt areas were National Parks and State Forests, although around 90,000 ha of private land was also burnt. Six river basins were affected by the fires. Around 95 per cent of the Upper Murray basin was burnt, 28 per cent of the Snowy basin, 20 per cent of the Kiewa and Ovens basins, 22 per cent of the Mitchell, and 16 per cent of the Tambo.

The bushfires affected the environment in both the short and long-term. A coordinated response between government departments, agencies, water authorities, Catchment Management Authorities, research institutions and other stakeholders has been established under the Bushfire Recovery Program to understand and manage these impacts. Of particular interest here is the impact of the fires on rivers, including water quality, catchment yield and river ecosystems, and our response to these impacts.

- *Water Quality*

The fires burnt much of the vegetation in the affected areas, leaving the landscape blackened and bare. Normally, rainfall is intercepted by vegetation and evapotranspirates or is absorbed by soil, before running off across the land. After the fire, rain fell straight onto the exposed ground. The reduction in vegetation cover reduced evapotranspiration rates and increased runoff as the fire had baked the soil, making it resistant to moisture absorption. Each time it rained, the rain ran off quickly into local stream and river systems, carrying with it ash and topsoil eroded from the exposed slopes. This had a major effect on water quality and aquatic habitats locally and further down catchments.

Increased sedimentation in waterways can lead to high suspended solids (muddiness), reduced oxygen levels, (which can result in fish kills), and increased nutrient levels, which in turn may lead to outbreaks of blue-green algae. Increased sedimentation also impacts on the quality of water for household and stock use.

Following the bushfires, a number of town water supplies were disrupted by increased sedimentation in rivers after rainfall events. These impacts generally passed quickly, however the towns of Swifts Creek and Buchan have continued to use alternative water supplies due to the impact of the fires on the quality of water in the Buchan and Tambo rivers.

A broad assessment of the impact of the fires on water quality, in particular total suspended solids, total phosphorus and total nitrogen was undertaken in eight catchments, comparing the pre and post-bushfire water quality for baseflow conditions and after rainfall events. The study was limited by the number of post-bushfire rainfall events in 2003 and the study is likely to be extended to include more current data. The findings of the study vary between the catchments. Suspended solids had increased about 170 times the pre-bushfire levels for the Mitta Mitta River in the Upper Murray Basin, while increases in suspended solids were around 24 times the pre-bushfires levels in the Ovens catchment. Total nitrogen and phosphorus were also at elevated levels, but to a lesser extent compared with total suspend solids. A longer term assessment of sediment and nutrient export from the Kiewa catchment and the likely significance for water quality at a broader scale is still to be completed.

A research project examining the effect of the bushfires on the quality of receiving waters (lakes, reservoirs, estuaries), in particular Dartmouth Reservoir and the Tambo River (including its estuarine mouth) was undertaken in mid 2004. While there have been high nutrient and suspended solid concentrations observed in both the Tambo River and Mitta Mitta River (which flows into Dartmouth), the research found no significant impact of increased nutrient and sediment loads on these receiving waters to date. Further research will use a modelling tool to determine the potential for algae bloom development. The impact of the fires on the Gippsland Lakes is being further assessed.

- *Catchment Water Yield*

Vegetation type and age and the severity of the fire vary across the bushfire affected areas. These factors largely influence the impact of fire on water yield. Runoff from bushfire affected areas is expected to immediately after the fires and remain at elevated levels until a tree canopy is re-established. If the trees were not killed by the fire, this may take around three to five years. However, if trees were killed by fire, the forest must regenerate from seed. In this situation, as the regrowth forest develops, runoff can drop below pre-fire levels after about five to ten years, reaching a minimum about 25 to 30 years after the fire. It then slowly recovers to pre-fire levels.

Research is underway to determine the extent of any reduction in yield from the burnt catchments. Modelling will provide predictions of the impact over the next 100 years. A broad scale assessment of the impact of the fires on streamflow was completed in mid 2004. This research identified streamflow response functions for mountain ash, mixed eucalypt species and snow gum by assessing the severity of the fire on these vegetation types with respect to rainfall. This research was extended to model the detailed impacts of fire on water yield for specific catchments important to water resource management. Further findings are expected towards the end of 2005.

- *River Ecosystems*

Aquatic communities (fish and macro-invertebrates) are affected by fire in a number of ways: including loss of habitat, increased risk of predation, loss of refuge areas, and loss of riparian and instream food sources. These impacts can lead to increased mortality of species, particularly after heavy rain which increase sediment loads in streams, and can cause changes in instream flora and fauna composition. Fish deaths were observed in the Ovens River in March 2003 after heavy rainfall, while yabbies and crayfish were observed leaving the muddy water.

Macro-invertebrates are used as an indicator of river health as they are easy to sample and identify and are an important food source for fish. Using data from before the fires as a comparison, macro-invertebrates will be monitored for a number of years post-fire to assess any impacts and the recovery of these communities. Native fish are also likely to be impacted by poor water quality after the fires. Projects examining the response of threatened fish (such as Murray Cod, Australian grayling, golden perch and blackfish) and decapod crustacea (crayfish) are underway and will continue until 2005.

Preliminary results from both sets of projects indicate that impacts on aquatic communities are closely tied to rainfall events, which create 'slugs' of sediment moving down waterways, decreasing oxygen concentrations and smothering habitat. Decreased fish and macro-invertebrate numbers, as well as altered community structure has been observed at some sites.

# 2. Water for the Environment

## 2.1 Introduction

Victoria's water resources provide a wide range of services for all citizens. In addition to sustaining life, economic value is derived from irrigation, agriculture and industry, while healthy rivers and aquifers provide environmental, social and recreational values. If too much water is extracted for consumptive uses, the risk of degrading the environmental condition of rivers and aquifers increases and they will no longer be able to provide the community with the full range of benefits.

The way in which the State's water resources are allocated is therefore crucial to Victoria's future economic development, the capacity to provide for its growing urban centres, and the health of the environment. Industry, irrigated agriculture and towns require secure and long-term entitlements to water to provide them with certainty for long-term planning, investment and development. However, in providing this, enough water needs to be left in rivers and aquifers to ensure they remain healthy and can sustain both consumptive and non-consumptive uses in the future.

## 2.2 Understanding river health

River health is a term used to describe the ecological condition of a river. Health is more than just the flora and fauna that live in a river, or the quality of the water. In general terms, when considering the health of a river system, the diversity of the habitats and biota and the maintenance of ecological processes need to be considered.

Flow is a major factors influencing the health of a river. Each part of a river's pattern of flows plays an important role in supporting that river's ecology. For example, high flows in a river stimulate fish migration and breeding and help maintain estuary openings to the sea. Groundwater also provides base flows in many waterways, which maintain pools as refuges for fish over summer when river flow declines or even ceases, and high flows that break out from the river channel replenish floodplains and flush organic material into a river.

An ecologically healthy river need not be pristine. A change from a river's natural state can occur, but the overall major natural features, biodiversity and functions of a river can still be present. An ecologically healthy river is one where a balance has been achieved between the ecological needs of the river and the consumptive needs for humans.

## 2.3 The condition of Victoria's rivers

The condition of Victoria's rivers was quantified in 1999 using the *Index of Stream Condition* to provide a snapshot of river heath. This Index provides a quantitative measure of the health of approximately 1,000 reaches of rivers and streams across Victoria. It is designed to include measures of the five major components of rivers that contribute to stream health, namely hydrology, water quality, aquatic life, physical form and streamside vegetation. A second snapshot of river health using the *Index of Stream Condition* was undertaken five years later in 2004, and the findings will be available in mid 2005.

Table 2-1 shows the proportion of annual flow remaining in the river at the basin outlet after water is extracted for all consumptive uses for 2003/04. It also shows the proportion available to the environment in an average year. This provides a coarse indicator of which Victorian rivers are likely to be stressed due to reduced flow. In 2003/04, this proportion varied from only 7 per cent in the Loddon Basin, to slightly more than 100 per cent in the Kiewa Basin.

This indicator should be used with caution for the following reasons:

- It provides no information about which components of the flow regime are affected by extractions of water for consumptive use. For example, Table 2-1 shows a large proportion of flow in the Mitchell River is available to the environment, although 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 there is available water available for additional consumptive use. River basins such as the Kiewa and Ovens in North East Victoria, which show a high proportion of flow remaining in the rivers, 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, however a cap on allocation of additional water has been placed on these streams to prevent the health of the Gippsland Lakes further deteriorating. Poor water quality that is unsuitable for consumptive use is yet another reason why there might be a high proportion of flow remaining in a river (eg. the highly saline water in the Corangamite and Hopkins basins).
- The percentage of water available to the environment is calculated at the basin outlet and does not incorporate the range of flows that occurs in different parts of a river at different times of the year.
- Victorian streams are highly variable, which means the amount of water flowing in the river can vary dramatically from year to year. The variability of streams tends to increase towards the west of Victoria. This can be seen in Figure 1-5 in the streamflow of the Loddon and Wimmera rivers. Whilst Table 2-1 shows the proportion of flow available for the environment in an average year; an ‘average year’ flows are less likely to occur if streamflow is highly variable from year to year.

**Table 2-1 Water available for the environment at the basin outlet in 2003/04, compared with average year**

| Basin | 2003/04 streamflow (ML) | 2003/04 | | Proportion in average year (%)[5] |
|---|---|---|---|---|
| | | Water avail for environment (ML) | Proportion of total flow (%) | |
| Murray | 4,057,210 | 1,175,000 | 29% | 22% |
| Kiewa[1] | 647,500 | 650,630 | 100% | 97% |
| Ovens | 1,609,800 | 1,560,220 | 97% | 98% |
| Broken | 270,760 | 125,650 | 46% | 99% |
| Goulburn | 2,813,340 | 533,150 | 19% | 42% |
| Campaspe | 158,750 | 8,220 | 5% | 60% |
| Loddon | 168,480 | 12,030 | 7% | 74% |
| Avoca | 33,910 | 9,770 | 29% | 98% |
| Mallee[4] | - | - | - | - |
| Wimmera | 107,270 | 2,000 | 2% | 70% |
| East Gippsland | 160,470 | 158,490 | 99% | 100% |
| Snowy[2] | 544,260 | 536,570 | 99% | 100% |
| Tambo | 89,180 | 80,100 | 90% | 99% |
| Mitchell | 754,260 | 732,720 | 97% | 99% |
| Thomson | 843,850 | 310,500 | 37% | 68% |
| Latrobe | 628,180 | 493,090 | 78% | 82% |
| South Gippsland | 908,210 | 838,750 | 92% | 99% |
| Bunyip | 432,460 | 344,190 | 80% | 97% |
| Yarra[3] | 755,710 | 304,440 | 40% | 65% |
| Maribyrnong | 36,670 | 16,470 | 45% | 94% |
| Werribee | 43,650 | 10,970 | 25% | 76% |
| Moorabool | 34,270 | 4,850 | 14% | 82% |
| Barwon | 155,900 | 96,790 | 62% | 84% |
| Corangamite | 97,580 | 70,740 | 72% | 99% |
| Otway Coast | 891,610 | 856,670 | 96% | 97% |
| Hopkins | 251,050 | 156,100 | 62% | 98% |
| Portland Coast | 209,700 | 190,260 | 91% | 100% |
| Glenelg | 467,170 | 342,210 | 73% | 90% |
| Millicent Coast[4] | 180 | - | - | - |
| **Total** | **17,171,380** | **9,620,580** | **56%** | **71%** |

(1) Water available to the environment is greater than total flow as releases from storages exceeded the amount of water extracted.

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

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

(4) No reliable estimate of flows available.

(5) Water available to environment calculated as average annual streamflow minus average annual diversions. Data from National Land and Water Resources Audit.

The right hand column of Table 2-1 shows the proportion of a river's total flow that could be expected to be available for the environment in an average year. This shows that in many river basins where the drought has hit hardest, the environment received a significantly lower proportion of the total flow in 2003/04. For example, water available for the environment in the Campaspe and Loddon basins in 2003/04 is 5 per cent and 7 per cent

respectively, whereas in an average year, around 60 per cent and 74 per cent respectively is available for the environment.

Water available to the environment in the Murray Basin in 2003/04 was around 29 per cent at the basin outlet. In an average year, around 22 per cent of water is left for the environmental at the basin outlet. This reflects the high level of water extractions in the basin to meet the needs of irrigators, towns and industry. In contrast, East Gippsland Basin, which has a far lower level of development, has a much higher proportion of water available to the environment in an average year.

## 2.4 Enhancing river health

In releasing the *Our Water Our Future* White Paper in June 2004, the Victorian Government recognised that in the past, the environment was not sufficiently considered in water allocation decisions and as a result, many rivers and some aquifers are now stressed and their environmental condition is degrading. To address this, the Government will provide a higher degree of legal protection and recognition for the environment's share of our water resources by creating environmental water reserves.

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 establishing the initial environmental water reserve, the rights of existing consumptive entitlement holders will be recognised. Given this, the approach taken in setting up the initial environmental reserve will differ depending on whether or not the system is over-allocated (refer to DSE 2004b).

Following the release of *Our Water Our Future*, work has started on setting the foundation for protecting and restoring the health of Victoria's waterways through:

- Amending legislation to provide a legal basis for recognising and protecting the environment's share of Victoria's water resources. The legislation will establish the Environmental Water Reserves, which set aside a share of water in rivers and aquifers across the State for the environment.
- Formally delineating water authorities' rights to take water from waterways to support existing urban and irrigation development, to ensure there is a clear starting point for any future discussions about changing the balance between consumptive and environmental requirements for water. The two major Victorian water supply systems where formal bulk entitlements are still in progress are the Loddon and Melbourne systems.
- Determining the environmental flow needs of waterways for the Werribee, Latrobe, Goulburn, Yarra, Glenelg, Wimmera, Maribyrnong and Gellibrand rivers. This work uses the Flows Methodology to compare the pre-development flow to the current flow, and identify which components of the natural flow regime are impacted by extractions, and where the remedial actions should be concentrated to restore river health.
- Ensuring waterways are protected from further degradation due to the allocation of new water entitlements. Sustainable diversion limits have been determined for all waterways in Victoria. In some basins, the sustainable diversion limits allow allocation of new entitlements to water, while in river basins that are already highly developed, no new water entitlements can be issued. The sustainable diversion limits are due for completion during 2005.

For some large rivers, the degraded nature of the waterways caused by a high level of water extraction and water management practices has long been recognised. Progress with restorative action has been spurred on by *Our Water Our Future.* The main projects include:

- **Snowy River** – The Victorian Government, together with the Commonwealth and New South Wales governments, have committed to increase the Snowy River's flow below Jindabyne Dam from approximately 1 to 21 per cent of its natural flow. This requires 212,000 ML of water be recovered by water savings projects in New South Wales and Victoria. Water savings projects initiated in Victoria include the decommissioning of Lake Mokoan, pipelining open channel water supply systems in the Woorinen and Normanville areas, and the Total Channel Control project in the Goulburn-Murray Irrigation District.
- **River Murray** – The Living Murray initiative aims to improve the ecological health of the River Murray, initially focussing on six priority sites. Under the First Step Decision by the Murray Darling Basin Ministerial Council, 500 GL will be returned to the river for the environment. 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.
- **Unbundling water entitlements** – The main purpose of this project is to improve the security of irrigation water entitlements and enhance the water market. The agreed implementation package for irrigation areas in northern Victoria includes a transfer of 20 per cent of the new sales entitlements to the environment. This project is expected to provide an average volume of 120,000 ML a year for environmental flows. A further 25,000 ML of high reliability water will be made available to the environment by investing in improvements in the delivery of water. Work is progressing on the planning and legislative amendments required to support this major initiative.

  The initiative 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 formal environmental entitlements, which will improve environmental flows in the River Murray as well as the Goulburn, Broken, Campaspe and Loddon rivers.
- **Thomson/Macalister** – An additional 10,000 ML of water for environmental flows in the Thomson River is to be transferred to the environment from Melbourne Water's Thomson River entitlement. In accordance with *Our Water Our Future*, the transfer will occur in early June 2005, three months after Melbourne's Stage 2 restrictions were lifted. This is the first instalment of a 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 $5 million project is initially expected to save an estimated 5,000 ML for the environment, with more savings expected to follow as efficiency improvements are extended to other parts of the district.
- **Wimmera-Glenelg** – Planning for a $500 million project to pipeline the Wimmera-Mallee system of open channels is well advanced. This 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 per cent to an estimated 60 per cent.

  The successful precursor to the Wimmera-Mallee Pipeline project was the $50 million Northern Mallee Pipeline project completed in 2002. This project saved 50,000 ML of water, of which 35,000 ML was allocated to the environment. This amount was granted to the environment under a formal entitlement that provides a discrete volume of water each year to release as environmental flows in the Wimmera and Glenelg rivers. The first annual allocation of water to the Wimmera and Glenelg rivers under the new entitlement was made in November 2004.

# 3. Water Taken in Victoria for Consumptive Use

## 3.1 Entitlements to water

Water for consumptive use in Victoria is taken from reservoirs, streams and aquifers under entitlements issued by the Victorian Government and authorised under the *Water Act 1989*. Generally, water for consumptive use is allocated to either water authorities, which are granted bulk entitlements, or to individuals who are issued a licence. Exceptions to this include private power generating companies in the Latrobe Valley, which hold bulk entitlements, as does Southern Hydro, and the Minister for Environment. Water authorities also 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 (eg. from a farm dam or a groundwater bore). Table 3-1 shows how water was allocated for consumptive use in Victoria in 2003/04.

**Table 3-1 Water allocated for consumptive use in Victoria 2003/04**

| Entitlement | Total (ML) |
|---|---|
| **Surface Water** | |
| Bulk entitlements(1) | 4,619,970 |
| Licences(2) | 233,300 |
| Private right (farm dams)(3) | 512,670 |
| **Groundwater** | |
| Licences | 804,065 |
| **Total water entitlements** | **6,170,005** |

(1) An estimate of the total volume of bulk entitlement granted as at 30 June 2003. 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 2003/04, 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.

The environment currently does not have a formal right to water in rivers and aquifers not taken for consumptive purposes, except where discrete volumes for specific purposes have been granted as bulk entitlements to the Minister administering the *Conservation Forests and Lands Act 1987*. This will change in the near future when, as proposed in *Our Water Our Future*, legislation is amended to establish the Environmental Water Reserve and provide it with legal protection.

The size and use of Victoria's water resources for 2003/04 is summarised in Table 3-2. Stormwater re-use data was not available and has not been included in the 2003/04 accounts. However, the total stormwater resource is included as part of the surface water resource. It is proposed that stormwater be included in this Report when data becomes available.

It is important to note that the water use data presented in the Overview of the State's Water Resources 2003/04 and in the State Water Accounts Surface 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 diverted from a stream or groundwater bore.

**Table 3-2 Victoria's water availability and water taken for consumptive use in 2003/04**

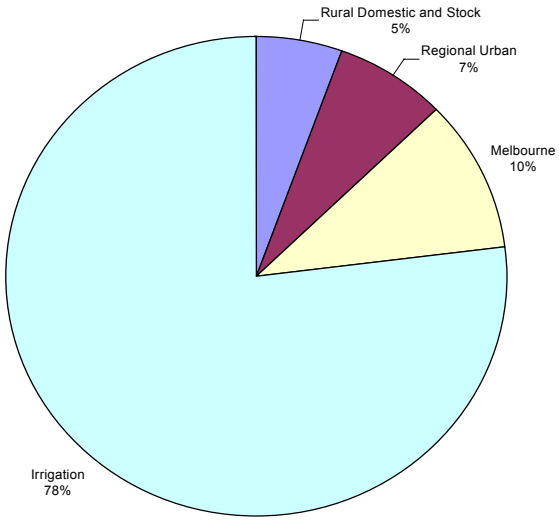
| | Surface Water (GL) | Groundwater (GL) | Treated effluent (GL) |
|---|---|---|---|
| Total Resource | 17,272[1] | Not available[2] | 418 |
| Entitlement/Allocation | 5,366 | 804 | Not available |
| Use | 4,984 | 422 | 70 |

(1) Includes streamflow, effluent discharge to streams and irrigation return flows, but excludes the inter-basin transfers included in the water accounts for individual river basins.

(2) An estimate of the total resource for groundwater is not available.

The distribution of water use in 2003/04 by user group is shown in Figure 3-1. It can be seen from this figure that despite the low seasonal irrigation water allocations, irrigation water use still accounted for 78 per cent of Victoria's total water use. Water use in Melbourne was 10 per cent of the State's total water use. The proportion of water use in Victoria in 2003/04 is typical of an average year.

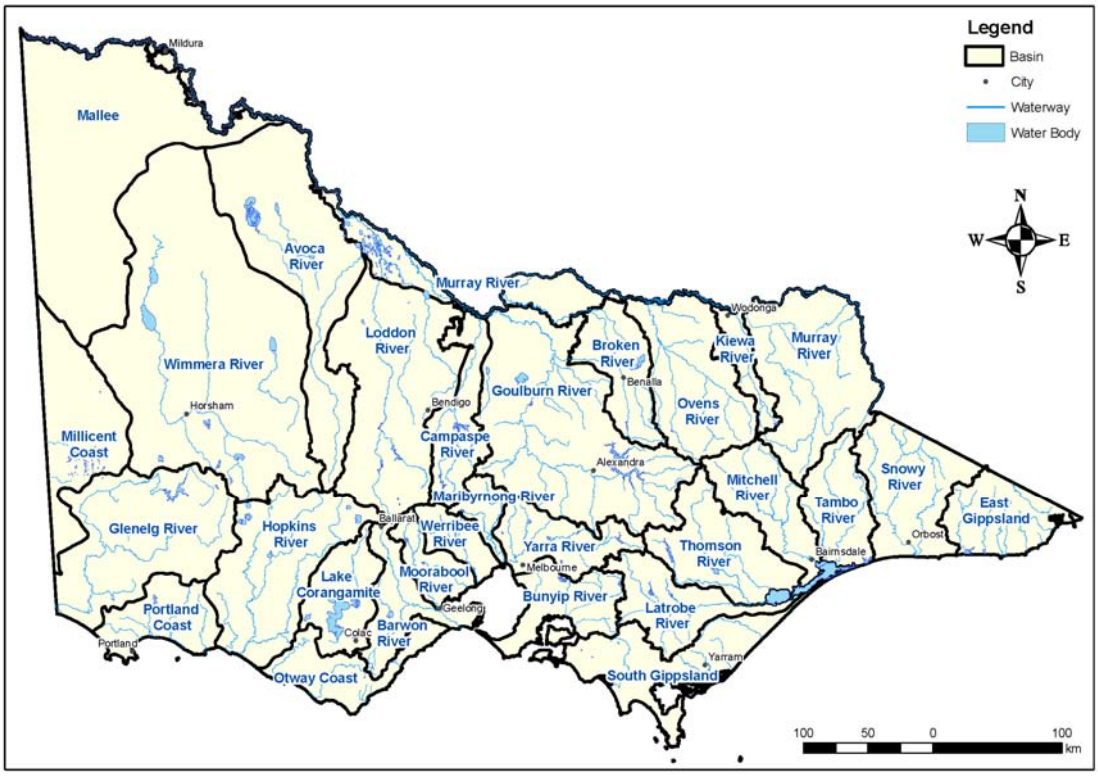
**Figure 3-1 Consumptive uses of water in Victoria, 2003/04**



## 3.2 Surface water use

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

**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 appointed by the Minister for Water for all bulk entitlements in a river basin. The current resource managers are Goulburn-Murray Water in northern Victoria, and Southern Rural Water, the West Gippsland Catchment Management Authority and the Department of Sustainability and Environment in southern Victoria. Each of these resource managers produces a detailed assessment of water authority compliance with bulk entitlements. Some resource manager reports were yet to be completed when the Water Accounts were prepared.

River basins in northern Victoria are subject to the Murray-Darling Basin Cap on diversions. The volume of water that can be diverted under the Cap is adjusted each year for climatic conditions and for the volume of water traded between 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 2003/04 was not available when this Report was prepared (it is due for release later in 2005).

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 2003/04. In each basin the volume diverted is within the entitlement. 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 Oven, Broken, Loddon, Wimmera, Yarra, and Bunyip basins. The bulk entitlements for these systems are either still in progress or was granted after 30 June 2003. This entitlement volume will be included in future reports. The information on catchment farm dams, which includes stock and domestic dams, is presented to illustrate the volume used by farm dams relative to bulk entitlements and private licensed diversions.

Where the data is reported, there is a pattern showing that the volume of water taken is around half to two-thirds of the entitlement volume. This can be attributed to the drought, which means there is insufficient water in the system to meet the needs of entitlement holders. 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 rolling average upper limit will allow a very large volume to be taken in recent years even though there is insufficient water to take advantage of the upper limit.

**Table 3-3 Volume allocated and taken under surface water entitlements in 2003/04**

| Basin | Bulk Entitlement | | | Unregulated River Licensed Private Diversions | | | Farm Dams |
|---|---|---|---|---|---|---|---|
| | Entitlement volume (ML)[1] | Volume taken in 2003/04 (ML)[2] | % entitlement taken in 2003/04 | Licence volume (ML) | Volume taken in 2003/04 (ML) | % entitlement taken in 2003/04 | Volume taken in 2003/04 (ML)[3] |
| Murray | 1,499,297* | 1,422,770 | - | 15,090 | 10,770 | 71% | 6,450 |
| Kiewa | 1,075* | 770 | - | 14,670 | 8,170 | 56% | 3,930 |
| Ovens | 3,911* | 14,753 | - | 15,391 | 7,200 | 47% | 15,890 |
| Broken | 2,484* | 19,467 | - | 2,022 | 1,460 | 72% | 15,740 |
| Goulburn | 1,960,269* | 1,662,195 | - | 21,587 | 13,730 | 64% | 47,510 |
| Campaspe | 129,243 | 71,627 | 55% | 1,766 | 1,150 | 65% | 28,780 |
| Loddon | 890* | 10,836 | - | 16,091 | 5,730 | 36% | 50,030 |
| Avoca | * | 173 | - | 3,290 | 1,530 | 47% | 12,700 |
| Mallee | 0 | 0 | n/a | 0 | 0 | n/a | 0 |
| Wimmera | 60* | 52,021 | - | 2,600 | 1,880 | 72% | 14,330 |
| East Gippsland | 620 | 260 | 42% | 750 | 550 | 73% | 1,100 |
| Snowy | 2,200 | 810 | 37% | 3,830 | 2,840 | 74% | 3,360 |
| Tambo | 3,650 | 50 | 1% | 4,100 | 3,080 | 75% | 3,970 |
| Mitchell | 5,900 | 4,960 | 84% | 15,240 | 11,020 | 72% | 4,560 |
| Thomson | 539,800 | 341,185 | 63% | 13,790 | 11,380 | 83% | 6,980 |
| Latrobe | 251,660 | 134,400 | 53% | 18,160 | 12,680 | 70% | 20,550 |
| South Gippsland | 14,020 | 9,040 | 64% | 11,220 | 7,490 | 67% | 24,260 |
| Bunyip | * | 7,310 | - | 11,570 | 6,010 | 52% | 15,520 |
| Yarra | * | 438,800 | - | 33,360 | 26,070 | 78% | 15,820 |
| Maribyrnong | 8,650* | 3,000 | - | 2,000 | 1,270 | 64% | 7,780 |
| Werribee | 27,630* | 10,710 | - | 910 | 400 | 44% | 9,350 |
| Moorabool | 89,100 | 23,410 | 26% | 3,330 | 630 | 19% | 11,900 |
| Barwon | 55,733 | 31,910 | 57% | 3,580 | 2,560 | 72% | 30,900 |
| Corangamite | 0 | 0 | n/a | 870 | 580 | 67% | 12,370 |
| Otway Coast | 19,230 | 14,600 | 76% | 5,730 | 4,660 | 81% | 12,730 |
| Hopkins | * | 465 | - | 9,940 | 5,290 | 53% | 64,540 |
| Portland Coast | 0 | 0 | n/a | 1,220 | 780 | 64% | 16,140 |
| Glenelg | 4,550* | 46,010 | - | 1,100 | 790 | 72% | 55,480 |
| Millicent Coast | 0 | 0 | n/a | 90 | 60 | 67% | - |
| **Total** | **4,619,972** | **4,321,532** | **-** | **233,297** | **149,760** | **64%** | **512,670** |

* Indicates there are bulk entitlements in this basin still to be granted as at 30 June 2003. Percentage of entitlement taken in 2003/04 not calculated for these basins.

(1) Estimate of the total volume of bulk entitlement granted as at 30 June 2003. Estimate is for an average year and is not adjusted for trade or caps that are climatically adjusted, or specified as volume available in 2003/04 where long-term rolling averages apply.

(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 2003/04).

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

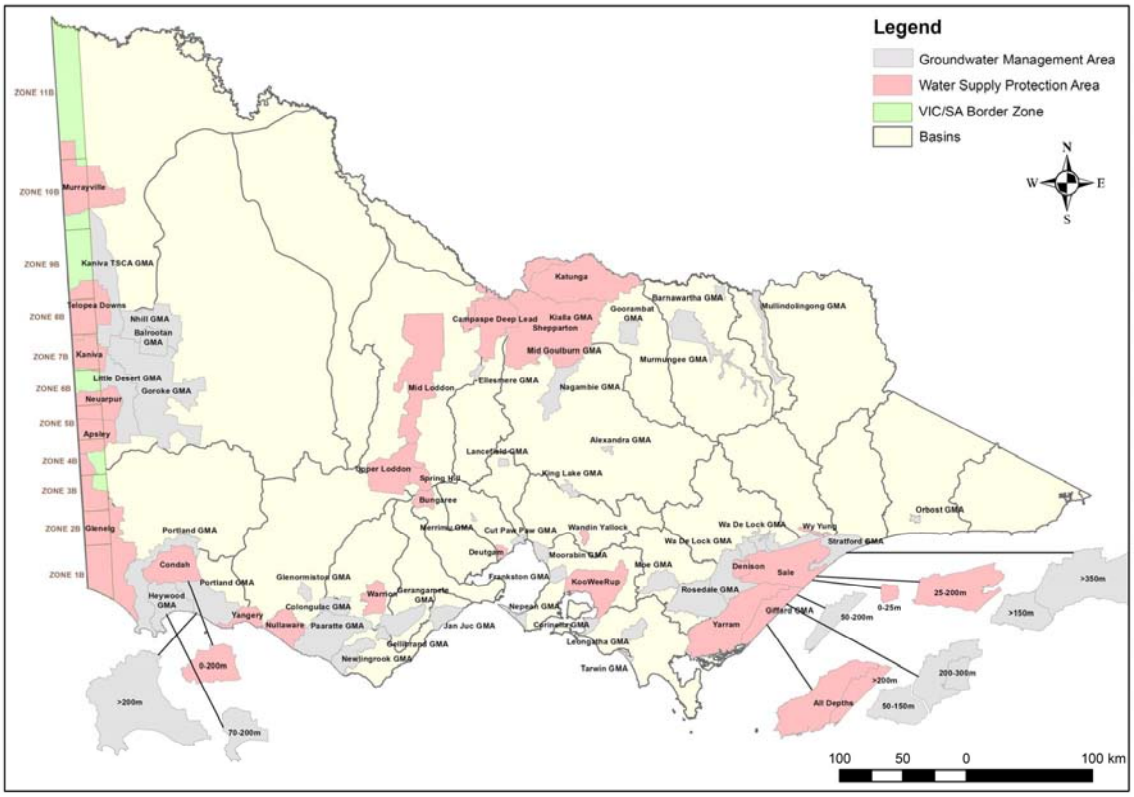
## 3.3 Groundwater use

Although the presence or absence of groundwater is generally well known, until recently little effort was made to quantify the volume of available resource and to allocate water use within sustainable limits. Prior to 1995, groundwater licences were readily 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.

Since that time, Groundwater Management Areas (GMAs) and Water Supply Protection Areas (WSPAs) have been defined to improve the sustainable management of this important resource (see Figure 3-3). These are areas in Victoria where significant groundwater use has occurred or is likely to occur. These areas account for over 80 per cent of the useable resource in Victoria. 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, unquantified resources of varying yield and quality.

GMAs concern specific aquifers and accordingly are defined spatially and by aquifer depth. In the Gippsland area for instance, groundwater is drawn from different overlapping aquifers. Aquifers (and respective GMAs and WSPAs) do not follow the river basin boundaries and often overlap more than one river basin. While groundwater usage in the State Water Report is included for GMAs and WSPAs, unincorporated areas are not included this year, primarily due to limited data available for these areas.

**Figure 3-3 Groundwater Management Areas 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 determine 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 the estimates.

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 ensure that the Environmental Water Reserve is protected, 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 target groundwater levels need to be 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
- 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 respect to the initial estimates of sustainable yield. These areas were given priority for declaration of WSPAs. Since then the number of WSPAs has increased, and 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. In a number of these WSPAs there is insufficient information at this stage to be sure whether and to what extent the resource has been over-allocated.

The level of metering of groundwater resources varies throughout Victoria. Generally, metering within WSPAs is approaching 100 per cent of the total number of licensed bores. Metering of licensed bores within GMAs has not received as high priority in the past and, as such is further from completion. *Our Water Our Future* proposes to meter all groundwater licences that are deemed to be of significant use (eg. irrigation and/or commercial use).

In non-metered areas, an estimate of use is provided for this Report. This estimate is based on average metered use, where the ratio of metered volume to allocated volume is determined, and this ratio applied to non-metered areas. The average metered usage, as a percentage of allocated volume is 48 per cent. Non-metered groundwater use is therefore estimated as 48 per cent 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.

For the purpose of this 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 GMAs and WSPAs is just over 804,000 ML (see Table 3-4). Full details of water allocated and extracted for each GMA and WSPA is contained in Appendix A. The volume allocated in the 76 GMA and WSPAs varies from zero per cent of Permissible Annual Volumes (PAV) for Gellibrand GMA to over 200 per cent of PAV for Koo Wee Rup WSPA and Alexandra GMA. Stock and domestic use account for around 9 per cent of Victoria's total estimated groundwater use. The total estimated groundwater usage in GMAs and WSPAs across the State is 421,710 ML. This represents around 52 per cent of licensed groundwater allocations in Victoria in 2003/04.

**Table 3-4 Victoria's groundwater entitlement and use**

| Item | Volume (ML) |
|---|---|
| Permissible Annual Volume | 802,500 |
| Licensed allocated volume (as at 30/06/2004) | 804,065 |
| Licensed use (metered) | 279,550 |
| Licensed use (non-metered)(1) | 104,360 |
| Estimated Domestic and Stock use(2) | 37,800 |
| **Total Estimated use** | **421,710** |

(1) Estimate assumes usage is 48 per cent of licensed volume

(2) Estimate assumes 2 ML/year/bore is used

## 3.4 Use of recycled water

During 2003/04, a total of 418 GL of treated effluent was produced by the 181 sewage treatment plants located around Victoria. Of this, around 70 GL or 17 per cent was recycled (see Table 3-5).

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

In 2000/01, 9 per cent of treated effluent was recycled. However, this figure did not include internal recycling at Eastern Treatment Plant (ie. recycled water used within the treatment plant process). If this water is excluded from the 2003/04 figures, then 14 per cent of effluent produced in 2003/04 was recycled. Nearly all of this increase in water recycling occurred in the Melbourne Metropolitan area, with the percentage water recycling for regional urban water authorities declining slightly from 32 per cent in 1999/00 to 30 per cent in 2003/04. 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).

**Table 3-5 Volume of effluent recycled in 2003/04**

| Basin[1] | Total Volume Effluent (ML)[2] | Volume Effluent Recycled (ML) | % Effluent Recycled |
|---|---|---|---|
| Murray | 12,800 | 5,980 | 47% |
| Kiewa | 290 | 120 | 41% |
| Ovens | 2,990 | 1,040 | 35% |
| Broken | 850 | 580 | 68% |
| Goulburn | 9,390 | 6,240 | 66% |
| Campaspe | 1,420 | 820 | 58% |
| Loddon | 9,150 | 1,360 | 15% |
| Avoca | 380 | 350 | 92% |
| Mallee | 0 | 0 | - |
| Wimmera | 2,660 | 2,540 | 95% |
| East Gippsland | 20 | 20 | 100% |
| Snowy | 320 | 320 | 100% |
| Tambo | 940 | 940 | 100% |
| Mitchell | 1,420 | 1,420 | 100% |
| Thomson | 410 | 360 | 88% |
| Latrobe | 22,810 | 830 | 4% |
| South Gippsland | 5,000 | 450 | 9% |
| Bunyip | 143,230 | 17,520 | 12% |
| Yarra | 8,660 | 280 | 3% |
| Maribyrnong | 3,030 | 1,820 | 60% |
| Werribee | 148,430 | 22,160 | 15% |
| Moorabool | 0 | 0 | - |
| Barwon | 29,770 | 2,120 | 7% |
| Corangamite | 2,510 | 450 | 18% |
| Otway Coast | 1,470 | 400 | 27% |
| Hopkins | 6,110 | 1,020 | 17% |
| Portland Coast | 2,250 | 250 | 11% |
| Glenelg | 1,390 | 960 | 69% |
| Millicent Coast | 330 | 140 | 42% |
| **Total** | **418,030** | **70,490** | **17%** |

(1) Recycled water is reported in the river basin where the effluent is treated (eg. most of the effluent recorded for the Werribee and Bunyip 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.

# 4. Managing Through Drought

Drought is a normal, recurring feature of the Australian climate that is characterised by a prolonged period of rainfall deficiency. Over the past eight years (commencing in about October 1996), rainfalls have been below average over much of Victoria. This has resulted in considerable stress on urban and rural water supplies.

There is a well-established framework in place for managing urban and rural water supplies and the environment during drought times. This framework has been very successful in managing the difficult conditions that have resulted from the below average rainfalls.

The effects of this prolonged dry period on the Victoria's water resources include depleted levels in our reservoirs necessitating restrictions on urban and rural water use, reduced recharge to aquifers, reduced flows in waterways, less reliable supplies from farm dams, and reductions in direct extractions from waterways.

## 4.1 Urban restrictions

The framework for managing urban water supplies during drought centres around Drought Response Plans. All urban water authorities (metropolitan and regional) are required by the Victorian Government to develop Drought Response Plans for the supply systems they manage. These Plans were first developed in detail in 1993, and authorities are required to update them periodically. They outline a staged plan of action to reduce water demand using water restrictions and/or augmenting supplies should the highest level of restriction be insufficient to conserve dwindling supplies. Over the past eight years, the Drought Response Plans have proved to be effective for managing the response to dry conditions. While restrictions of varying degrees of severity have been in place for many towns over the past eight years, no towns have been threatened with running out of water.

At the end of June 2003, a total of 214 towns were on water restrictions (DSE, 2003a). Of these towns, 55 were on severe levels of restriction (Stages 3 and 4 of 4 stages), 107 on moderate (Stage 2) levels and 52 on low (Stage 1) levels. A year later, at the end of June 2004, 199 towns were on water restrictions (DSE, 2004a). This included 62 towns on severe levels of restriction, 72 on moderate levels and 65 on low levels. This information indicates that state-wide, there was no significant increase in the availability of water during 2003/04 with respect to the number of towns on water restrictions. At the peak of the drought in March 2003 (following the very dry winter/spring of 2002) around 270 towns were on some form of restriction.

## 4.2 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 (or water right), which 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 per cent of entitlement. Seasonal allocations are made early in the irrigation season based on the current volume of water in storage, estimated inflows during the season and the amount of water required to provide for water in subsequent years. Allocations are reviewed throughout the irrigation season and increased when actual inflows exceed estimated inflows. 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. Allocations are never decreased as the season progresses. Restrictions on supplies are therefore not announced as restrictions, but are manifest as reduced seasonal allocations.

The 2003/04 seasonal allocations to irrigators in Victoria's irrigation systems are shown in Table 4-1. Initial allocations were typically zero or very low, and 100 per cent of entitlement was available in most supply systems by February 2004. Because of the below average rainfall conditions and previous years of drought, the February 2004 allocations were lower than long-term median allocations. End of season allocations in 2003/04 remained below 100 per cent in the Coliban, Loddon, Werribee, Wimmera, Bacchus Marsh and Maribyrnong systems.

**Table 4-1 Seasonal Irrigation Water Allocations 2003/04 (DPI, 2005)**

| Irrigation System | Initial Allocation July 2003 (% of entitlement) | Mid Season Allocation February 2004 (% of entitlement) | Final Allocation May 2004 (% of entitlement) | Median Long-Term February Allocation (% of entitlement)(2) |
|---|---|---|---|---|
| Murray | 16 | 100 | 100 | 200 |
| Goulburn | 0 | 100 | 100 | 160 |
| Broken | 0 | 170 | 170 | 170 |
| Campaspe | 0 | 92 | 100 | 220 |
| Coliban | 40 | 65 | 65 | 130 |
| Loddon | 0 | 67 | 67 | 150 |
| Bullarook Creek | 0 | 126 | 177 | 190 |
| Wimmera | 0 | 0 | 0 | 200 |
| Thomson-Macalister | 60 (1) | 105 | 105 | 130 |
| Werribee and Bacchus Marsh | 5 | 40 | 40 | 120 |
| Maribyrnong -SRW(3) | 0 | 0 | 0 | 100 |
| Maribyrnong - Melbourne Water(3) | 0 | 0 | 0 | 100 |

(1) 19 August 2003.
(2) Derived from water resource allocation models and historical records.
(3) Allocations apply to the summer period only. Maribyrnong irrigators have access to unregulated high flows outside the summer period.

Irrigators supplied from the Wimmera, Werribee and Bacchus Marsh and Maribyrnong systems were worst affected by the drought in 2003/04. In the Wimmera, reservoirs were at around 8.7 per cent of capacity at the end of July 2003, and there was no water available to allocate to irrigators for the second year in a row. Storage levels in February 2004 were slightly higher at 10 per cent of capacity, however the irrigation allocation remained zero for the whole season. Wimmera Mallee Water worked with irrigators to keep permanent plantings alive.

Irrigators in the Werribee and Bacchus Marsh systems were also severely impacted by the drought in 2003/04. Prior to 2003/04, seasonal allocations through the prior six years of drought in the Werribee system were maintained at or above 100 per cent of entitlement. The final 2003/04 seasonal allocation of 40 per cent coincided with a ban on groundwater for Werribee irrigators. Southern Rural Water was able to arrange access to emergency supplies for Werribee irrigators from its Thomson entitlement in Gippsland, which was delivered through an extension of the Melbourne reticulation system. The opportunity was taken by the Victorian Government and Southern Rural Water to initiate a scheme to augment the Werribee irrigator's supply with recycled water from Melbourne's Western Treatment Plant.

Irrigators on the Maribyrnong system received an irrigation allocation of zero per cent in 2003/04, which meant that no water was released from Rosslynne Reservoir to irrigators on Jacksons Creek and the Maribyrnong River during 2003/04. Irrigators were able to access reticulated water from the Melbourne system as an emergency measure to irrigate their high value vegetable crops. Irrigators can pump from the river when flows are in excess of the environmental flow requirements, which usually occurs in winter and spring.

## 4.3 Restrictions on unregulated stream diversions

Licensing Authorities can restrict access to diversions on unregulated streams by implementing rosters and bans on pumping. This enables available flow in an unregulated river or stream to be shared amongst licensed diverters and the environment. Where Streamflow Management Plans exist, these specify details on rostering and restriction of diversions to protect environmental values of unregulated streams.

A total of 54 unregulated streams across Victoria had some form of restriction or ban on diversions at the end of June 2003 (DSE, 2003b). Twelve months later, a total of 49 streams were similarly on restrictions or bans.

## 4.4 Restrictions on groundwater

Restrictions on groundwater use were placed on the consumers in the Werribee region located in the Deutgam WSPA from 10 November 2003. This was to prevent seawater intrusion into the aquifer, which was at low levels due to climatic conditions and previous groundwater pumping. Recovery of water levels resulted to amendment of the restrictions in October 2004 and an allocation of 25 per cent of licenced volume was made.

In the Katunga and Campaspe GMAs, some restrictions on existing allocations were implemented in September 2004 in accordance with the 'Management Plan Volumes' developed for this area. In the Katunga WSPA, a new groundwater management plan is being prepared to address declining levels.

## 4.5 Water entitlement transfers

The water market is the main mechanism irrigators and urban water authorities use to manage their water supplies during a drought. The most active trading markets are centred around the extensive Goulburn and Murray 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 2003/04 is shown in Table 4-2. Around 59,000 ML of water entitlement was permanently transferred, and 380,000 ML temporarily transferred in that year. There was also a net permanent transfer of 260 ML of water entitlement from interstate and a net temporary transfer of 12,060 ML from Victoria to other states. The unaccounted difference in Table 4-2 is due to minor differences in water trading figures reported by different water authorities. Most of this 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 Water Accounts.

Groundwater entitlement transfers are taking place within Victoria and in other States. The process for groundwater entitlement transfers at present varies between the regions, ranging from well structured trading markets (based on surface water trading) to advertisements in local papers. Within Victoria, groundwater trading occurs on both a permanent and temporary basis. The latest figures available for Victoria indicate that in 2002/2003, two permanent transfers (having a total volume 101 ML) and 27 temporary transfers (having a total volume of 1,915 ML) occurred. These trades occurred within the Goulburn-Murray Water and Southern Rural Water areas. In 2003/04, 730 ML of groundwater entitlement was permanently transferred and 4,293 ML was temporarily transferred in southern Victoria. As only part of the State is accounted for in these figures, this indicates the volume of groundwater entitlement that was transferred in 2003/04 was higher than in the previous year.

**Table 4-2 Surface water entitlement transfers in 2003/04**

| Basin | Permanent Entitlement Transfer (ML) | | | Temporary Entitlement Transfer (ML) | | |
|---|---|---|---|---|---|---|
| | Bought | Sold | Net transfer to basin | Bought | Sold | Net transfer to basin |
| Murray (within Victoria) | 39,920 | 20,080 | 19,840 | 168,250 | 153,130 | 15,120 |
| Kiewa | 0 | 0 | 0 | 830 | 887 | -57 |
| Ovens | 224 | 226 | -2 | 2,210 | 2,150 | 60 |
| Broken | 430 | 430 | 0 | 720 | 720 | 0 |
| Goulburn | 7,860 | 22,180 | -14,320 | 136,540 | 145,020 | -8,480 |
| Campaspe | 400 | 410 | -10 | 7,197 | 7,054 | 142 |
| Loddon | 9,590 | 15,780 | -6,190 | 37,700 | 55,580 | -17,880 |
| 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 | 107 | 107 | 0 | 11,625 | 11,625 | 0 |
| Latrobe | 0 | 0 | 0 | 0 | 0 | 0 |
| South Gippsland | 0 | 0 | 0 | 0 | 0 | 0 |
| Bunyip | 0 | 0 | 0 | 0 | 0 | 0 |
| Yarra | 65 | 65 | 0 | 383 | 383 | 0 |
| Maribyrnong | 0 | 0 | 0 | 2,565 | 2,565 | 0 |
| Werribee | 1 | 1 | 0 | 1,384 | 1,384 | 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 |
| Unregulated Rivers in southern Victoria | 72 | 72 | 0 | 2,157 | 2,157 | 0 |
| **Total within Victoria** | **58,597** | **59,279** | **-682** | **369,403** | **380,497** | **-11,094** |
| Interstate | 1,940 | 1,672 | 268 | 25,427 | 13,366 | 12,061 |
| Unaccounted difference | n/a | n/a | -414 | n/a | n/a | 967 |

n/a = Not applicable

# 5. Water Reporting in the Future

In *Our Water Our Future* (DSE, 2004b), the Victorian Government committed to improving the monitoring and reporting of the State's water resources, and ensuring that water resource information is publicly accessible.

This State Water Report is one of the first steps in this direction. The other major step is the development of a new water register.

This Report was assembled using information that was readily available, so some topics are covered in more detail than others. There is much scope for improvement, both in the topics covered, the quality of data reported, and in the timing and production values.

Some of the main directions for improvement are discussed below.

## 5.1 Reporting on the environmental water reserve

Reporting on the environmental water reserve is required in a number of areas.

- *Is the environmental water reserve being provided?*

This requirement is already in place, as water authorities are obliged under the conditions of their water entitlements to report on their compliance with meeting environmental flows in rivers and streams at sites where they harvest water. Future State Water Reports will include a more systematic reporting by exception on authorities' compliance with meeting environmental flows.

- *Measuring the environmental health of rivers and streams*

DSE reports on the health of rivers and streams through the *Index of Stream Condition* report. An update of the ISC will be available in the first half of 2005 and will thereafter be updated every five years.

- *Monitoring the effectiveness of environmental flows*

The Victorian Government is investing large amounts of money in water recovery projects to significantly improve environmental flows in six large regulated rivers across Victoria, including the Wimmera, Glenelg, Goulburn, Broken, Thomson and Macalister systems.

As demand for consumptive uses of water continues to grow it will be increasingly important to be confident that water recovered for the environment is achieving the stated ecological outcomes. Future decisions about the provision of environmental flows will rely on adequate scientific monitoring and benchmarking to indicate the benefits of environmental allocations of water.

A study is underway to monitor ecological and environmental responses to environmental flows in six to eight regulated rivers that have received significant enhancements to their flow regime. This study is a research partnership between the Department of Sustainability and Environment and the Co-operative Research Centre for Freshwater Ecology (whose role will be continued by the e-Water Co-operative Research Centre upon its inception in mid 2005).

This study will establish scientific monitoring programs for each river system and develop data analysis and reporting procedures. The information provided from the monitoring and trend analysis is expected to be available for inclusion in future State Water Reports.

- *Management of the environmental water reserve*

Environmental flow managers have been appointed for each Catchment Management Authority to manage the environmental water reserve. It is expected they will provide the focal point for reporting on the environmental water reserve in their area and coordinating inputs to future State Water Reports.

## 5.2 Future Water Reporting

The White Paper identified the need to improve the way water is reported in Victoria. Water-related data is collected and held by various government departments, water authorities and Catchment Management Authorities across the State. At the same time, there are many different types of reports areas required to meet operational, planning, and compliance needs of water management agencies and governments. Most data collected on water allocation and use is not in a form that can be adapted readily to reporting needs outside the specific operational needs of particular agencies. This means that data is not readily accessible, and collector agencies spend much time accessing the same data in different forms for different purposes. Often the reliability of data is not well understood and may be used for purposes that are incompatible with the data reliability.

The new water register is a major initiative outlined in the *Our Water Our Future* White Paper, and will improve the recording of water entitlements. This project is a key part of the reform to unbundle irrigation entitlements, but will eventually record all authorities' and individuals' water entitlements across the State, water allocations, the amount of water used under these entitlements and water trades. The water register is expected to adopt a robust system of accounting for water similar to that for financial accounting, which will ensure the integrity of Victoria's water allocation system. Work on the register has commenced and will be introduced in northern Victorian irrigation systems in mid 2006, before being extended across the whole of the State.

Another major initiative included in *Our Water Our Future* to improve the accessibility of water data is the web-based water reporting facility. This will provide a common system for water reporting throughout the State, and include standard protocols for data collection and storage. It will also provide a tool for accessing primary water data and standard protocols for water accounting and other routine analyses. Further, it will provide public access to water data and reports.

The water reporting facility will be used to generate the water allocation and use components of the State Water Accounts and with the water register, will be a primary source of data. Work has just commenced on scoping the water reporting facility. Its development is expected to be staged to coincide with the water register.

# Glossary of Terms

**Aquifer:** A layer of underground sediments that holds water and allows water to flow through it.

**Base Flows:** The component of streamflow supplied by groundwater discharge.

**Bulk Entitlement (BE):** 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.

**Cap:** An upper limit for the diversion of water from a waterway, catchment or basin.

**Catchment:** An area of land where run-off from rainfall goes into one river system.

**Catchment Management Authorities (CMAs):** Catchment Management Authorities are the caretakers of river health, responsible for regional and catchment planning and coordination, and waterway, floodplain, salinity and water quality management.

**Effluent:** As applied to sewage treatment, wastewater which flows from treatment works.

**Environment:** Surroundings in which an organisation operates including air, water, land, natural resources, flora, fauna, humans and their interdependence.

**Environmental Flow:** The streamflow required downstream of a water storage 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 which are dependent on the environmental condition of the system.

**Floodplain:** The relatively smooth valley floors adjacent to and formed by alluviating rivers which are subject to overflow during flood events.

**Groundwater:** All subsurface water, generally occupying the pores and crevices of rock and soil.

**Groundwater Allocation**: the sum of licensed volumes in a Groundwater Management Area or Water Supply Protection Area.

**Seasonal Irrigation Water Allocation:** The maximum percentage of water entitlement that can be diverted at any given time based on water resource availability.

**Irrigation District:** An area with definite geographic boundaries within which water is allocated for irrigation under the control of a local or State authority or other body.

**Murray-Darling Basin Cap:** The climatically adjusted cap on surface water diversions in the Murray-Darling Basin, agreed by Victoria under the Murray-Darling Basin Agreement.

**Nutrient:** Plant food, generally refers to nitrogen and phosphorous in water.

**Permissible Annual Volume**: The estimated volume of groundwater that can sustainably be pumped from a groundwater aquifer.

**Potable:** Suitable for drinking.

**Reclaimed Water:** Water recovered from sources that are considered to be waste or unwanted supplies.

**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.

**Reticulation:** The network of pipelines used to take water into areas of consumption.

**Riparian:** Vegetated corridor along streams and rivers

**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.

**Runoff:** The volume of water that enters lakes and streams 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.

**Sedimentation:** Process where solid particles in water sink to the bottom, forming sediment.

**Sewage:** The waterborne wastes of a community.

**Sewerage:** A physical arrangement of pipes and plant for the collection, removal, treatment and disposal of liquid waste.

**Spills:** An uncontrolled release of water into river systems.

**Stormwater:** Untreated rainfall run-off from urban areas.

**Stream:** Body of water flowing in bed, river or brook.

**Streamflow Management Plan:** A plan developed with community input to ensure that the water resources of the area are managed sustainably.

**Triple Bottom Line (TBL):** Integrated approach to the achievement of environmental, social and economic outcomes.

**Unregulated River:** A river which does not contain any structures (dams, major diversion weirs) that control the flow of water in the river.

**Unregulated River Licensed Private Diverter:** Licensed private diverters located on unregulated rivers. These diverters are allocated individual licences. These differ from regulated river licensed private diverters, who are managed under the relevant water authority's bulk entitlement.

**Water Authorities:** Authorities charged with supplying water to towns and cities across Victoria, for urban, industrial and commercial use. They administer the diversion of water from waterways and the extraction of groundwater.

**Water Entitlement:** The volume of water that is authorised under the *Water Act 1989* to be taken and used by a water authority or person.

**Water Right:** Rights to water held by irrigators in an irrigation district.

**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. A waterway includes 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 which may be permanent or temporary, fresh or saline.

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# Part Two

# State Water Accounts 2003/04

# 1. Introduction

The State Water Accounts is a record of water availability and use across Victoria for the 2003/04 water year. The 2003/04 water year spans from 1 July 2003 to 30 June 2004. This is the first year that the water accounts have been completed at a State level and draw upon readily available information from water authorities across Victoria. Sources of information for the water accounts include:

- Basin water accounts prepared by resource managers.
- Water authority annual reports.
- Specific data requests for information from water authorities, Catchment Management Authorities and the Murray-Darling Basin Commission.
- Other hydrologic or climatic data as required.

The principal reporting unit for the State Water Accounts is the river basin. The structure of the Report is as follows:

- Section 2 provides a summary of some of the key assumptions in preparing and presenting the data.
- Sections 3 to 31 provide information on water availability and extraction in each of the 29 river basins across Victoria. 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 2003/04.
  - A summary of total water resources in the basin for:
    - The environmental water reserve
    - Surface water resources
    - Groundwater resources
    - Recycled water.
- Section 32 lists the references in this Report.

# 2. Overview of Data Presented

## 2.1 Introduction

The data presented in the State Water Accounts 2003/04 is collected from a number of sources. Due to the various data sources, qualifications are placed on the data and its interpretation. These qualifications have generally been placed in notes below each individual table. This Section of the water accounts provides an overview of some of the key assumptions and limitations of the data presented, which should be borne in mind when viewing the accounts.

## 2.2 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. However, some data sets are not aligned with river basin boundaries and this data has been treated in various ways.

### 2.2.1 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 utilised in another. Surface water users in Victoria are allocated a bulk entitlement based on the source of water and hence all surface water information is reported relative to the 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.

### 2.2.2 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 (eg. salinity control). Collectively, WSPAs and GMAs cover less than 10 per cent 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, WSPA. Unincorporated areas are not presented, as this information is not readily available. Future reports may incorporate groundwater use in unincorporated areas. Information for the water accounts has thereafter been compiled according to river basin boundaries. The reporting of groundwater by river basin presents a number of reporting difficulties.

Groundwater Management Areas often fall across more than one river basin. Where this is the case, groundwater allocation and use 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 per cent by area. The concentration of bores and groundwater use is non-uniform across management areas. As a result it is not meaningful to apportion groundwater allocations and use to each river basin based on the GMA or WSPA surface area that falls within each river basin. 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 2004.

The boundaries of the management areas for groundwater are evolving on a regular basis to keep pace with increasing development, the identification of new resources and changes to groundwater extraction rates. Boundaries may be modified or new areas created to, for example, 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 spatially, 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* White Paper recognised the implication that surface water and groundwater interaction has for the management of water resources within Victoria, in particular, 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 Victorian 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 the White Paper and to this end, for example, the PAV for Gellibrand is set to zero due to the concerns about groundwater pumping adversely affecting base flow to the Gellibrand River.

### 2.2.3 Recycled water data

Towns with wastewater treatment plants have been assigned to river basins according to the point of discharge from the plant into receiving waters. If all water is reused and none is discharged to rivers or lakes, the treatment plant is assigned to river basins according to the location of the treatment plant.

## 2.3 Units

The volumes in the water accounts are generally reported in megalitres (ML), which are one million litres. Volumes of water entitlement, entitlement transfer and use from entitlements has been reported to the nearest ML as required to assess compliance. All other values in this Report, such as catchment inflows, the surface water balance and catchment farm dam usage have been rounded to the nearest 10 ML to reflect the uncertainty in these estimates.

## 2.4 Water management responsibilities

The responsibilities for water management presented in the State Water Accounts represent those that existed during 2003/04. Changes to water management responsibilities since June 2004 will be reflected in subsequent water accounts. For example, during 2003/04

Lower Murray Water and Sunraysia Rural Water Authority were separate entities, but have since been amalgamated into the Lower Murray Sunraysia Water Authority. Similarly, Grampians Water and Wimmera Mallee Water were amalgamated after June 2004. The water accounts present information on the basis of their separate status during 2003/04.

## 2.5 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 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. The restriction by-laws for each water authority are developed for each water supply system. A small number of towns in Victoria have more than four stages of restriction, but these restriction policies are in the process of being standardised to a four stage restriction policy.

## 2.6 Surface water balance

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

- Only in-stream storages greater than 1,000 ML were included in the water balance. Off-stream storages are not reported on because this would involve double counting of water that has already been diverted from rivers or extracted from groundwater. Storages 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 in-stream loss term. Where the in-stream loss is known or assumed to be zero, basin inflows are generally the unknown term.
- Inflows are estimated in two ways. Where diversions are small (~ < 10 per cent) relative to the total volume in the stream, inflows have been back calculated as the sum of basin outflows plus diversions. Where diversions are large relative to streamflow, inflows have been estimated using indicator gauges relative to known long-term average values. This is an approximation of total surface water availability that is accurate at a broad scale, but which is likely to be improved upon by more detailed assessments within each river basin.
- Unless otherwise reported by water authorities, stock and domestic and commercial/industrial 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.
- Where wastewater treatment plant effluent is not reused, it is assumed the treated effluent is discharged to streams unless otherwise indicated by a water authority. The method of disposal for treated effluent (land, evaporative ponds, river or ocean) was generally not readily available.

## 2.7 Catchment farm dams

Catchment farm 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. This information is average annual data, because usage from farm dams was not readily available for the 2003/04 year.

## 2.8 Groundwater metering

The level of metering of groundwater resources varies throughout the State between areas. Generally metering within WSPAs is approaching 100 per cent of the total number of licensed bores. Metering of licensed bores within GMAs has not received as high priority in the past and, as such, is further from completion.

In non-metered areas, an estimate of use is provided for this Report. This estimate is based on average metered use, where the ratio of metered volume to allocated volume is determined, and this ratio applied to non-metered areas. The average metered use, as a percentage of allocated volume is 48 per cent. Non-metered groundwater use is therefore estimated as 48 per cent 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.

## 2.9 Overview of compliance with entitlements

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

- The volume of surface water diverted from rivers relative to bulk entitlement volumes for each bulk entitlement conversion order. For private licensed diversions, this is assessed at the water authority level and not at the individual licence holder level, which is assessed separately by water authorities.
- The volume of groundwater extracted relative to licenced 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 2003, 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 2003/04 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.

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

The State Water Accounts 2003/04 has 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 completing 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 Sunraysia Rural Water Authority only report on water trading that they have 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.

The entitlement volume of granted bulk entitlements may not be directly comparable to other data sources as this volume varies depending on how the entitlement is specified, such as a long-term cap, rolling average etc.

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.

# 3. Murray Basin

## 3.1 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. Lake Victoria and the Menindee Lakes are physically located in New South Wales, but under the Murray-Darling Basin Agreement, Victoria has a share of these storages.
- 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 in the water accounts.
- Water diversions in Victoria for the length of the River Murray and its tributaries upstream of Lake Hume, such as the Mitta Mitta River and Corryong Creek.

A map of the river basin is shown in Figure 3-1. The basin boundary corresponds to the Australian Water Resource Council's 'Upper Murray' river basin upstream of Lake Hume. However, 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. 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.

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.

## 3.2 Responsibilities for Management of Water Resources

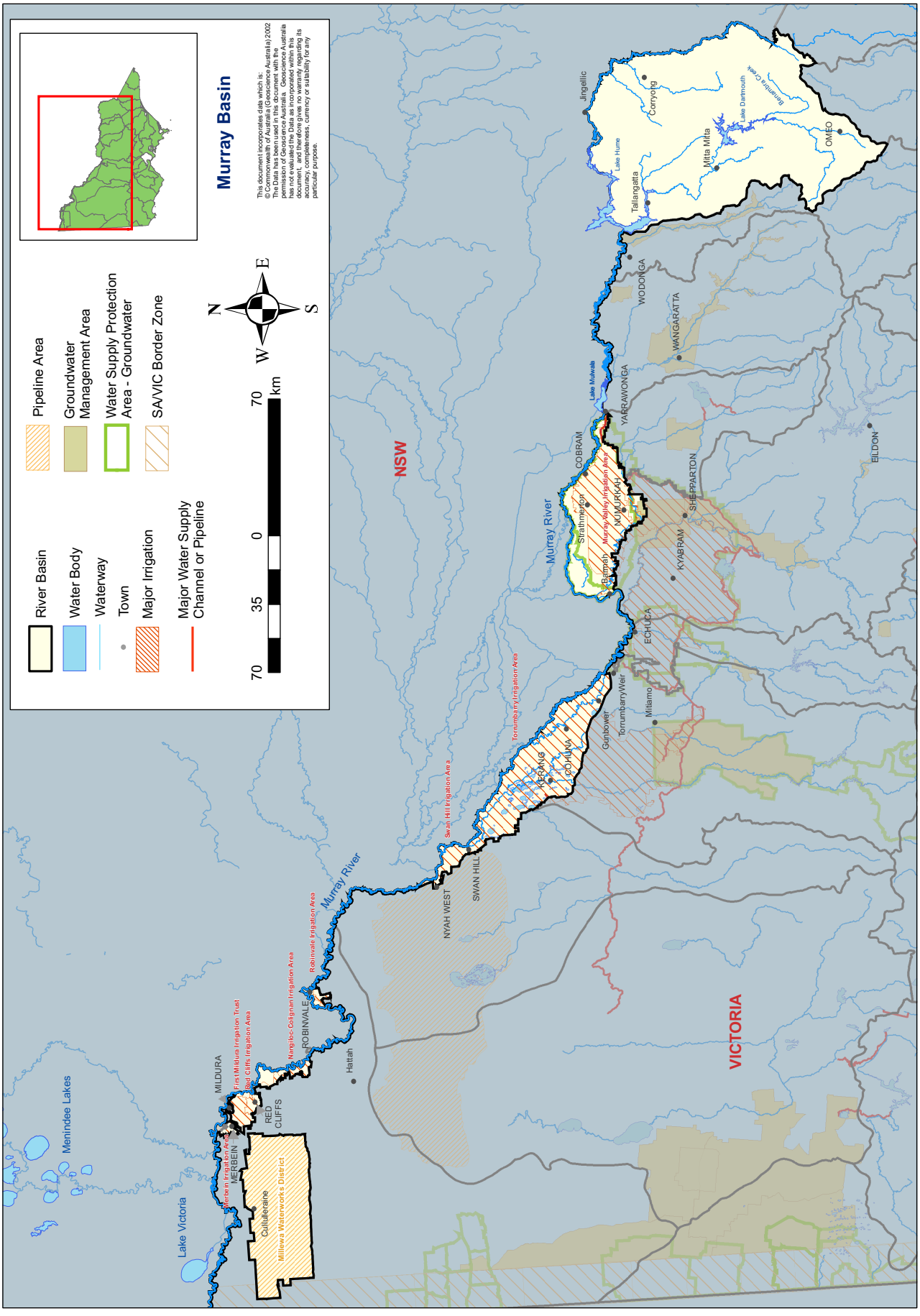
The Murray-Darling Basin Commission is responsible for managing the water resources of the Murray system on behalf of the Victoria, NSW and South Australia. Goulburn-Murray Water is responsible for managing the Murray Valley, Torumbarry, Tresco and Nyah irrigation areas and major storages not under the control of the Murray-Darling Basin Commission, and is the licensing authority for groundwater and surface water on the Victorian side of the Murray Basin as far downstream as Nyah. 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 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 supplied towns from Swan Hill to the border. East Gippsland Water is the provider of urban water services to the towns of Omeo and Dinner Plain.

Various authorities operate the water supply storages in the Murray Basin. Lake Hume, Lake Dartmouth, Lake Victoria and the Menindee Lakes are operated by the Murray-Darling Basin Commission. Goulburn-Murray Water is responsible for allocating water to bulk entitlement holders from Victoria's share of these storages. Victoria shares the volume in these 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. Southern 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 (CMA), the Goulburn-Broken CMA, the North Central CMA and the Mallee CMA, with the Department of Sustainability and Environment and the Murray-Darling Basin Commission coordinating and integrating waterway management along the length of the River Murray.

**Figure 3-1 Map of the Murray Basin**



## 3.3 Seasonal Overview

Rainfall conditions in the Murray Basin in 2003/04 were average across most of the basin, with significantly lower than average rainfall only occurring in parts of the Sunraysia region. Streamflows in 2003/04 in the River Murray at Jingellic (streamflow gauge number 401201), upstream of Lake Hume, were approximately 90 per cent of the long-term average streamflow at this location.

Despite close to average streamflows, water restrictions were put in place in parts of the river basin at various times during the year:

- Irrigation bans and restrictions were imposed in several unregulated tributaries upstream of Lake Hume in July 2003 and again from March to June 2004.
- Stage 3 (of 4) urban restrictions were lifted at the town of Dartmouth on 9 July 2003. Temporary Stage 4 (of 4) restrictions were placed on Dartmouth in November 2003 because of water quality problems due to runoff from bushfire affected catchments.
- Seasonal irrigation water allocation in the Murray System was 16 per cent at the start of July 2003. Allocations rose to 100 per cent by September and remained at that level until the end of the season. No sales water was allocated. The median February allocation in the Murray system is 200 per cent of licence and water right. This end of season allocation is the lowest on record and is a reflection of the low volume in storage from a succession of dry years.

A few poor water quality events were reported in this basin, but apart from urban water restrictions at Dartmouth, discussed above, there were no incidents of water quality restricting water use during 2003/04. Lake Hume experienced algae alerts that persisted in the lake unusually late into the irrigation season (MDBC, 2004), whilst algal blooms were reported in the Kerang Lakes and Gunbower Creek systems. A salt slug travelled down the Darling River in February 2004 and was measured at 1,400 EC (in microSiemen/cm) at Wentworth. This value of 1400 EC was well above the 200-400 EC typically observed in the river at this location and is also above the point at which some irrigated crops will experience stress due to the applied salt (Maas, 1990). River salinity was on the whole lower than average in 2003/04 because of the prolonged dry conditions experienced in the basin in previous years, which has served to lower groundwater levels and hence reduce flow into the River Murray from saline discharge areas. 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.

Flow in the River Murray to South Australia was lower than entitlement in early 2003/04. Low opening storage levels and the water-sharing rules under the Murray-Darling Basin Agreement resulted in South Australia electing to take a reduction in its entitlement flow of 80 per cent in June and July, 70 per cent in August and 85 per cent in September. However, improved inflows to the upper storages and from Victorian tributaries helped to relieve this position and bring higher than entitlement flows to South Australia during August, September and October. Total flow to South Australia from New South Wales and Victoria for the year was 2,023,000 ML, which is 173,000 ML above its entitlement of 1,850,000 ML (MDBC, 2004).

## 3.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Murray Basin are shown in Table 3-1. The total surface water resource includes Victoria's share of inflows to Lake Dartmouth, Lake Hume, Lake Victoria and the Menindee Lakes, as well as outflows from Victoria's rivers (Kiewa, Ovens, Broken, Goulburn, Campaspe, Loddon) into the River Murray.

**Table 3-1 Summary of total Victorian water resources and use in Murray Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 4,210,630 | 1,439,990 |
| Groundwater (1) | Not applicable | Not applicable |
| Recycled water | 12,800 | 5,980 |

(1) Groundwater allocation and use in Groundwater Management Areas that overlap the Murray Basin are reported in upstream river basins.

## 3.5 Environmental Water Reserve

The Minister for Environment holds an allocation of 27,600 ML/yr 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 Cardross Lake. The use of this entitlement varies from year to year in relation to natural fluctuations in environmental water requirements. In 2003/04, a total of around 18,500 ML of this entitlement was used, whilst a further 2,602 ML was traded to consumptive users on a temporary basis in 2003/04. This volume delivered included:

- 1,570 ML for emergency redgum watering trials in the Mallee
- 2,000 ML for the Cardross Lakes
- Approximately 12,000 ML (plus surplus flows of around 5,000 ML) to 3 wetland complexes (Little Gunbower Creek, Little Reedy Lagoon and Big Reedy Lagoon) in Gunbower Forest.

The water delivered to Gunbower Forest occurred between August and November, including two surplus flow periods. An area of approximately 1,000 to 2,000 hectares of permanent, semi-permanent and red gum forest was inundated. Cormorants, Darters, Egrets, Spoonbills, Herons, waterfowl and the White Bellied Sea-Eagle have been observed breeding and/or feeding in the forest. Significant frog breeding occurred in the early months of flooding. Red gums and aquatic vegetation have responded with a fresh burst of growth.

The Minister for Environment was also granted an entitlement of 6,988 ML/year in January 2005. This entitlement came from water savings achieved through the Woorinen pipeline and improved measurement of small volume supplies in irrigation districts. This entitlement forms one of proposed several entitlements that will be used to return water to the Snowy River. Additional water savings on the River Murray have been identified and will be used to return additional water to the Snowy River to meet Victoria's target of returning 141,000 ML of water by 2012.

Each year Victoria contributes 50,000 ML of water right entitlement and 25,000 ML of sales entitlement when the seasonal sales allocation reaches 30 per cent to the Barmah-Millewa Forest Environmental Water Allocation. New South Wales also contributes to this account. A total of 125,000 ML had accumulated in Victoria's contribution to this account as at the end of 2003/04. The water in the account is used to enhance natural flood events in the forest. The water in this account was not called on in 2003/04 and was carried over to be added to the 2004/05 allocation. The last time that the account was drawn upon to flood the forest was in 2000/01 (Barmah-Millewa Forum, 2004).

The barrages to the sea on the River Murray in South Australia remained closed until September 2003, creating the longest period on record that they have remained closed (twenty-one months from the end of November 2001 to September 2003, compared with a period of seventeen months in the 1967–68 drought) (MDBC, 2004).

The 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 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. This Cap ensures that river diversions do not keep increasing and exacerbate river health problems.

## 3.6 Surface Water Resources

### 3.6.1 Water Balance

A surface water balance for the Murray Basin in Victoria is shown in Table 3-2. Note that only 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 Mulwala, Torrumbarry Weir, Lake Cullulerainе, Kings Billabong, Lake Victoria and the Menindee Lakes.

There is a high degree of uncertainty in the estimate of the in-stream loss term in the water balance for this river basin and the final value is approximately double the long-term average in-stream loss estimated using the Murray resource allocation model (REALM).

**Table 3-2 Balance of Victorian surface water in the Murray Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 1,505,020 |
| Volume in storage at end of year | 1,921,060 |
| **Change in storage** | **416,040** |
| **Inflows** | |
| Catchment inflow [(1)] | 4,057,210 |
| Spills from NSW share of storages | 0 |
| Irrigation return flow | 146,600 |
| Treated effluent discharged back to river [(2)] | 6,820 |
| **Sub-total** | **4,210,630** |
| **Gross diversions** | |
| Urban diversions | 41,560 |
| Irrigation district diversions | 1,112,800 |
| Unregulated licensed private diversions | 10,770 |
| Regulated licensed private diversions | 253,500 |
| Environmental water reserve | 14,910 |
| Catchment farm dams | 6,450 |
| **Sub-total** | **1,439,990** |
| **Losses** | |
| Evaporation losses from major storages | 172,460 |
| Losses from catchment farm dams | 1,190 |
| In-stream losses to groundwater, evaporation and floodplain [(3)] | 410,810 |
| **Sub-total** | **584,460** |
| **Water passed at outlet of basin** | |
| River Murray flow to South Australia from Victoria's allocation | 1,175,000 |
| Spills to NSW share of storages | 487,800 |
| Ceding to NSW storages | 107,340 |
| | |
| **Volume available to the environment in the Murray System** | **1,175,000** |

Note: The volumes in this table may not be consistent wit the MDBC's final accounts these were not available when this table was complied, and different methods may also have been used.

(1) Sum of outflows from other Victorian river basins plus Victoria's share of inflows to MDBC storages

(2) Assumes all effluent discharged to river if not reused

(3) Back calculated based on the difference between flow inputs and outputs

### 3.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Murray Basin is estimated to be around 10.5 GL (Table 3-3). All of these are located upstream of Lake Hume. Average annual usage from the dams is estimated to be 6.5 GL, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 7.6 GL. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Existing farm dams used for irrigation and commercial use are in the process of being registered and when the registration licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 3-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 7,150 | 3,580 | n/a |
| Irrigation | 3,410 | 2,870 | n/a |
| **TOTAL** | **10,560** | **6,470** | **7,640** |

n/a = information not available

### 3.6.3 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 2003/04 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 3-4, whilst a summary of the transfer of entitlements with the Murray Basin is shown in Table 3-5. Approximately 264 ML of water entitlement was permanently transferred to Victoria from interstate, whilst around 12,060 ML of water entitlement was temporarily transferred to other states. The values in Table 3-5 show a net permanent transfer of water entitlement of 17,900 ML to the Murray Basin, with the net temporary transfer of 15,130 ML to the Murray Basin.

**Table 3-4 Interstate transfer of entitlements in the Murray Basin**

| Entitlement | Net transfer to New South Wales (ML) | Net transfer to South Australia (ML) | Net transfer to interstate (ML) |
|---|---|---|---|
| Permanent transfer of water right | 1,280 | -1,550 | -260 |
| Permanent transfer of sales | 0 | 0 | 0 |
| **Total permanent transfers** | **1,280** | **-1,550** | **-260** |
| Temporary transfer of water right | -2,300 | 2,520 | 230 |
| Temporary transfer of sales | 11,390 | 450 | 11,840 |
| **Total temporary transfers** | **9,090** | **2,970** | **12,060** |

**Table 3-5 Transfer of Victorian entitlements in the Murray Basin**

| Bulk entitlement | Permanent Entitlement Transfer (ML) | | | Temporary Entitlement Transfer (ML) | | |
|---|---|---|---|---|---|---|
| | Bought | Sold | Net transfer to entitlement | Bought | Sold | Net transfer to entitlement |
| *Coliban Water* | | | | | | |
| River Murray – Coliban Water | 0 | 0 | 0 | 0 | 1,000 | -1,000 |
| *Goulburn Valley Water* | | | | | | |
| River Murray – Goulburn Valley Water | 0 | 0 | 0 | 170 | 0 | 170 |
| *Lower Murray Water* | | | | | | |
| River Murray – Lower Murray Water | 1,910 | 0 | 0 | 0 | 6,170 | -6,170 |
| *North East Water* | | | | | | |
| River Murray – North East Water | 0 | 0 | 0 | 0 | 1,000 | -1,000 |
| Corryong | 0 | 0 | 0 | 0 | 0 | 0 |
| Cudgewa | 0 | 0 | 0 | 0 | 0 | 0 |
| Dartmouth | 0 | 0 | 0 | 0 | 0 | 0 |
| Walwa | 0 | 0 | 0 | 0 | 0 | 0 |
| *Goulburn-Murray Water* | | | | | | |
| Murray Valley – Private diverter water right | 1,380 | 1,750 | -370 | 46,280 | 27,170 | 19,110 |
| Murray Valley – Private diverter sales | | | | 1,780 | 1,350 | 430 |
| Kerang-Cohuna – Private diverter water right | 2,540 | 7,510 | -4,970 | 66,730 | 20,960 | 45,770 |
| Kerang-Cohuna – Private diverter sales | | | | 8,140 | 1,300 | 6,840 |
| Swan Hill – Private diverter water right | 330 | 1,830 | -1,500 | 11,080 | 10,160 | 920 |
| Swan Hill – Private diverter sales | | | | 380 | 0 | 380 |
| Woorinen – Private diverter water right | 290 | 10 | 280 | 690 | 1,600 | -910 |
| Woorinen – Private diverter sales | | | | 0 | 0 | 0 |
| Nyah – Private diverter water right | 10 | 160 | -150 | 370 | 2,200 | -1,830 |
| Nyah – Private diverter sales | | | | 0 | 0 | 0 |
| Tresco – Private diverter water right | 20 | 100 | -80 | 390 | 1,040 | -650 |
| Tresco – Private diverter sales | | | | 40 | 0 | 40 |
| Mitta Mitta River – Private diverter water right | 0 | 320 | -320 | 520 | 2,540 | -2,020 |
| Mitta Mitta River – Private diverter sales | | | | 0 | 0 | 0 |

| Bulk entitlement | Permanent Entitlement Transfer (ML) | | | Temporary Entitlement Transfer (ML) | | |
|---|---|---|---|---|---|---|
| | Bought | Sold | Net transfer to entitlement | Bought | Sold | Net transfer to entitlement |
| River Murray– Private diverter water right | 1,050 | 620 | 430 | 4,310 | 16,690 | -12,380 |
| River Murray– Private diverter sales | | | | 350 | 0 | 350 |
| *Sunraysia Rural Water* [(1)] | | | | | | |
| Merbein ID – water right | 240 | 640 | -400 | 590 | 2,280 | -1,690 |
| Merbein ID – sales | | | | 0 | 0 | 0 |
| Red Cliffs ID – water right | 490 | 180 | 310 | 2,040 | 4,250 | -2,210 |
| Red Cliffs ID – sales | | | | 0 | 0 | 0 |
| Robinvale ID – water right | 170 | 130 | 40 | 840 | 1,220 | -380 |
| Robinvale ID – sales | | | | 0 | 0 | 0 |
| River Diverters – water right | 30,090 | 5,550 | 24,540 | 22,300 | 37,070 | -14,770 |
| River Diverters – sales | | | | 0 | 0 | 0 |
| *First Mildura Irrigation Trust* | | | | | | |
| FMIT – water right | 310 | 1,280 | -970 | 1,250 | 12,180 | -10,930 |
| FMIT - sales | | | | 0 | 0 | 0 |
| *Wimmera Mallee Water* | | | | | | |
| River Murray – Wimmera Mallee Water | 1,090 | 0 | 1,090 | 0 | 350 | -350 |
| *Minister for Environment* | | | | | | |
| River Murray – Flora and Fauna | 0 | 0 | 0 | 0 | 2,600 | -2,600 |
| **TOTAL** | **39,920** | **20,080** | **17,930** | **168,250** | **153,130** | **15,120** |

(1) district figures include transfers to and from area outside of district that are supplied from the district

### 3.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 3-6. Licences on unregulated streams are not currently metered and water usage is an estimate provided by Goulburn-Murray Water (G-MW). Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume that could have been diverted in 2003/04. Full details of compliance with bulk entitlements will be provided in the Resource Manager's 2003/04 Report for the Murray Basin (G-MW, in press).

**Table 3-6 Volume of water diverted under surface water entitlements in the Victorian Murray Basin**

| Entitlement | Entitlement volume (ML) | Net temporary transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Coliban Water* | | | | | |
| River Murray – Coliban Water | 6,285 | -1,000 | 5,285 | 5,170 | Yes |
| *East Gippsland Water* | | | | | |
| Omeo[1] | n/a | 0 | n/a | 68 | n/a |
| *First Mildura Irrigation Trust* | | | | | |
| River Murray – First Mildura Irrigation Trust | 95,278 | -10,935 | 84,343 | 58,906 | Yes |
| *Goulburn-Murray Water* | | | | | |
| River Murray – Goulburn-Murray Water | 971,763 | 54,270 | 1,026,033 | 1,025,178 | Yes |
| *Goulburn Valley Water* | | | | | |
| River Murray – Goulburn Valley Water | 4,869 | 174 | 5,043 | 4,377 | Yes |
| *Lower Murray Water* | | | | | |
| River Murray – Lower Murray Water | 29,198 | -5,918 | 23,280 | 21,120 | Yes |
| *Minister for Environment* | | | | | |
| River Murray – Flora and Fauna | 27,600 | -2,602 | 24,998 | 14,909 | Yes |
| *North East Water* | | | | | |
| Corryong | 680 | 0 | 680 | 475 | Yes |
| Cudgewa | 29 | 0 | 29 | 0 | Yes |
| Dartmouth | 60 | 0 | 60 | 35 | Yes |
| Walwa | 61 | 0 | 61 | 39 | Yes |
| River Murray – North East Water [2] | 12,062 | -1,000 | 11,062 | 10,279 | Yes |
| *Sunraysia Rural Water Authority* | | | | | |
| River Murray – Sunraysia Rural Water [3] | 347,820 | -19,035 | 328,785 | 279,127 | Yes |
| *Wimmera-Mallee Water* | | | | | |
| River Murray – Wimmera Mallee Water | 3,592 | -350 | 3242 | 3,084 | Yes |
| **Total volume of bulk entitlements** | **1,499,297** | **13,604** | **1,512,901** | **1,422,767** | **Yes** |
| *Unregulated licensed diverters* | 15,090 | 0 | 15,090 | 10,770 | Yes |

(1) Bulk entitlement conversion order for Omeo is in progress. Usage in 2003/04 was within draft entitlement volumes.

(2) Assumed to consist of Bellbridge, Rutherglen/Wahgunyah, Tallangatta, Wodonga, Yarrawonga and the volume supplied to Kiewa/Tangambalanga from Wodonga

(3) Includes irrigation districts and licensed diverters from Nyah to the border, excluding FMIT

### 3.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

The bulk entitlements in the Murray Basin have various passing flow requirements. Goulburn-Murray Water, as resource manager for the Murray Basin, had not completed its compliance report at the time of publication of the water accounts and thus no specific information on authority's compliance with its environmental flow obligations in its bulk entitlements is available. None of the water authorities drawing water from the Murray Basin reported any non-compliance with environmental passing flows.

### 3.6.6 Compliance with Streamflow Management Plans

There are currently no Streamflow Management Plans being developed for streams in the Murray Basin.

## 3.7 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 uses groundwater to supply the town of Dinner Plain. East Gippsland Water holds a licence for 60 ML/year. In 2003/04 extractions of 61.1 ML were recorded, a volume much greater than the recorded consumption of 31.8 ML. The unaccounted water at Dinner Plain is subject to review by East Gippsland Water, including assessment of meter performance during sub zero conditions.

## 3.8 Recycled Water

Around 46 per cent of the volume of effluent passed through treatment plants in the basin was recycled for consumptive use, as shown in Table 3-7. Details on the methods of disposal (evaporative disposal or discharge to stream) of the non-recycled water were not readily available.

**Table 3-7 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Kerang | Lower Murray Water | 460 | 0 |
| Koondrook | Lower Murray Water | 0 | 0 |
| Koorlong | Lower Murray Water | 1153 | 1153 |
| Merbein | Lower Murray Water | 86 | 0 |
| Mildura | Lower Murray Water | 1764 | 1764 |
| Nyah/Nyah West | Lower Murray Water | 37 | 0 |
| Red Cliffs | Lower Murray Water | 160 | 160 |
| Robinvale | Lower Murray Water | 213 | 213 |
| Swan Hill | Lower Murray Water | 1130 | 0 |
| Bellbridge | North East Water | 16 | 16 |
| Corryong | North East Water | 161 | 161 |
| Dartmouth | North East Water | 21 | 0 |
| Tallangatta | North East Water | 62 | 62 |
| Omeo | East Gippsland Water | 30 | 30 |
| Baranduda | North East Water | 0 | 0 |
| West Wodonga | North East Water | 4,107 | 193 |
| Barnawartha | North East Water | 11 | 11 |
| Bundalong | North East Water | 0 | 0 |
| Chiltern | North East Water | 12 | 12 |
| Rutherglen | North East Water | 234 | 234 |
| Yarrawonga | North East Water | 402 | 402 |
| Cobram | Goulburn Valley Water | 493 | 493 |
| Nathalia | Goulburn Valley Water | 156 | 142 |
| Numurkah | Goulburn Valley Water | 114 | 114 |
| Strathmerton | Goulburn Valley Water | 0 | 0 |
| Echuca | Coliban Water | 1757 | 823 |
| Cohuna | Coliban Water | 223 | 0 |
| **TOTAL** | | **12,802** | **5,983** |

# 4. Kiewa Basin

## 4.1 Location of Water Resources

The Kiewa Basin is located within the Murray-Darling Drainage Division. It includes the Kiewa River, which runs along the length of the basin, 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 4-1.

Groundwater Management Areas (GMAs) within the Kiewa Basin include part of the Mullindolingong GMA.

## 4.2 Responsibilities for Management of Water Resources

Goulburn-Murray Water (G-MW) 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.

## 4.3 Seasonal Overview

Rainfall conditions in the Kiewa Basin in 2003/04 were close to average across most of the basin. This was reflected in the streamflow from the basin recorded at Bandiana (streamflow gauge number 402205). Streamflow at this location for 2003/04 was only four per cent lower than the long-term average.

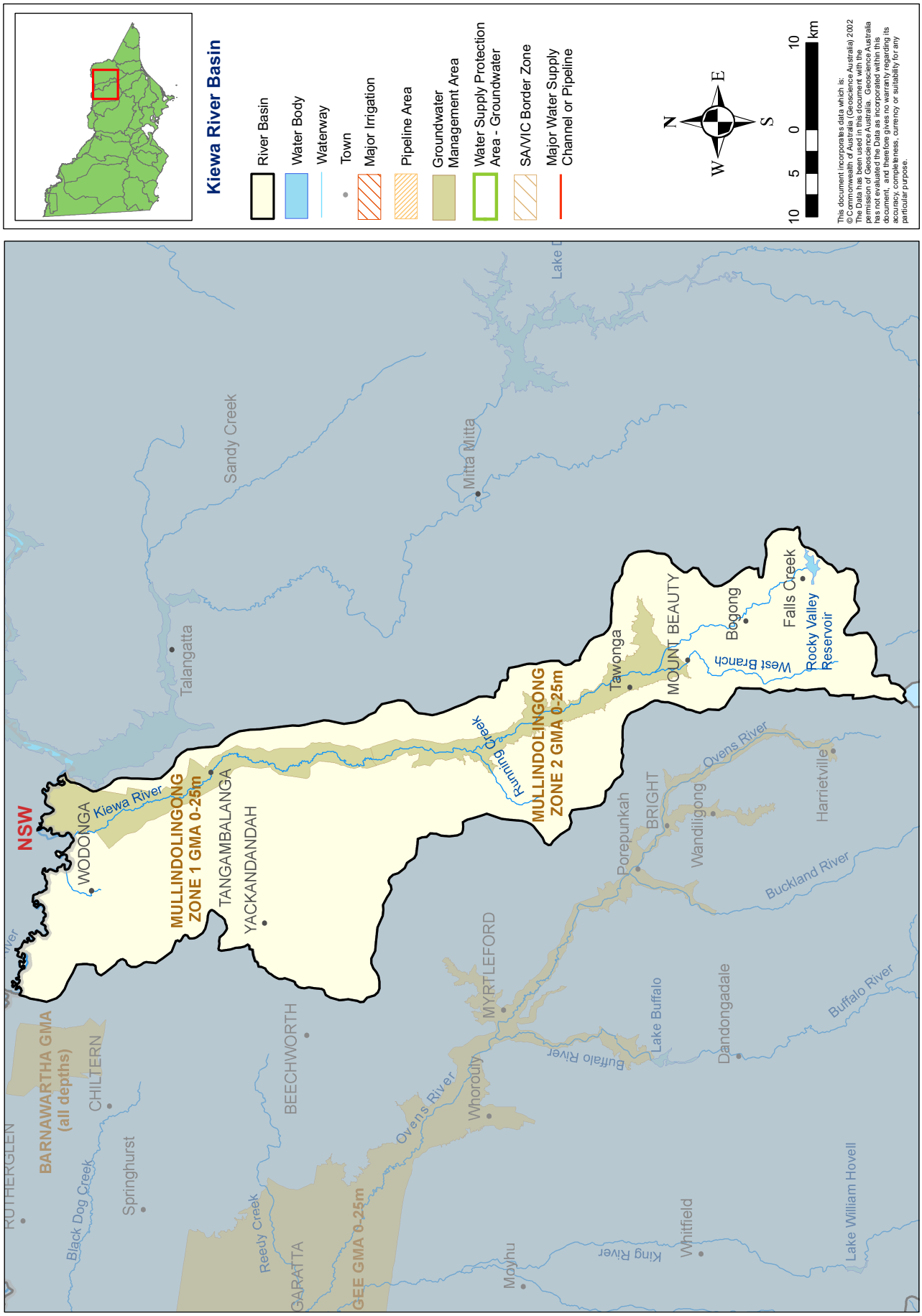
Despite close to average streamflows, water restrictions were put in place in parts of the river basin at various times during the year:

- Irrigation bans and restrictions were imposed on a number of tributaries in July 2003 and from February to June 2004.
- Stage 1 (of 4 stages) urban restrictions in the town of Beechworth were lifted on 2 July 2003. No other urban restrictions were reported in the Kiewa Basin in 2003/04.

There are no seasonal irrigation water allocations in the Kiewa Basin.

Water quality in the Kiewa Basin remained good and there were no reports of water quality adversely affecting consumptive use or environmental condition. There were no fish kills or algal blooms reported in the Kiewa Basin. Works were undertaken to improve water quality in the upper parts of the Kiewa River catchment. The Falls Creek Resort completed the installation of swale drainage along some of the unsealed roads within the resort and the construction of a sediment retention basin to reduce the amount of sediment being discharged from the resort area into the upper reaches of the Kiewa River. The Kiewa Basin still experiences major sediment movement in streams after rainfall events as a result of the 2003 bushfire.

**Figure 4-1 Map of the Kiewa Basin**



## 4.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Kiewa Basin are shown in Table 4-1. It can be seen from this table that only a fraction of the surface and groundwater resources in the Kiewa basin were extracted for consumptive use in 2003/04.

**Table 4-1 Summary of total water resource and water use in Kiewa Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 324,200 (1) | 12,870 |
| Groundwater (2) | 6,980 | 722 |
| Recycled water | 290 | 120 |

(1) Victoria's share (50 per cent) of total inflows.

(2) Much of the available resource discharges to streams and will be included in the total water resource for surface water. These volumes exclude the resource and extraction from unincorporated areas.

## 4.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Kiewa 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 Kiewa Basin. The cap on the Kiewa basin is accounted under the Murray/Kiewa/Ovens 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.

Water for the environment in the Kiewa basin was also provided under passing flow obligations in consumptive bulk entitlements for water authorities. At a basin scale, the water available to the environment was 650,630 ML at the basin outlet, which is slightly higher than the total surface water inflows into basin (Table 4-2). This is due to additional releases of water from storage that was accumulated in previous years. This amount includes environmental passing flows required under bulk entitlements in the basin.

Although water quantity was largely unaffected in 2003/04 in the Kiewa basin, the timing of diversions in the unregulated sections of the basin can affect the flow regime at a catchment scale. In the upper Kiewa, private diversions during the irrigation season can also have a significant impact on the flow regime. A Streamflow Management Plan is in progress 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.

When the water available to the environment 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, the Kiewa River water is accounted as 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.

## 4.6 Surface Water Resources

### 4.6.1 Water Balance

A surface water balance for the Kiewa Basin is shown in Table 4-2. 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. Hydropower is a significant use of surface water in the Kiewa Basin, but it is a non-consumptive use of water. This water for hydropower does not appear in the surface water balance for 2003/04, but it is intended that it be included in the accounts in future years as a non-consumptive use.

**Table 4-2 Balance of surface water in the Kiewa Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 26,080 |
| Volume in storage at end of year | 9,130 |
| **Change in storage** | **-16,950** |
| **Inflows** | |
| Catchment inflow (1) | 647,500 |
| Irrigation return flow | 0 |
| Treated effluent discharged back to river (2) | 170 |
| **Sub-total** | **647,670** |
| **Gross diversions** | |
| Urban diversions | 770 |
| Unregulated licensed private diversions | 8,170 |
| Catchment farm dams | 3,930 |
| **Sub-total** | **12,870** |
| **Losses** | |
| Evaporation losses from major storages | 30 |
| Losses from catchment farm dams | 1,090 |
| In-stream losses to groundwater, floodplain and evaporation (3) | 0 |
| **Sub-total** | **1,120** |
| **Water passed at outlet of basin** | |
| Kiewa River outflow to River Murray | 650,630 |
| | |
| **Volume available to the environment in the Kiewa Basin** | **650,630** |

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

(2) Assumes all effluent discharged to river if not reused

(3) Assumed to be zero because not readily available

### 4.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Kiewa Basin is estimated to be around 6,300 ML. Average annual usage from the dams is estimated to be 3,900 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 5,000 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 4-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 3,970 | 1,990 | n/a |
| Irrigation | 2,310 | 1,940 | n/a |
| **TOTAL** | **6,280** | **3,930** | **5,020** |

n/a = information not available

### 4.6.3 Water Entitlement Transfers

The following inter-basin transfers of water entitlement occurred with water users in the Kiewa Basin in 2003/04:

- 57 ML of temporary transfer by North East Water from Kiewa-Tangambalanga to Chiltern, which is located in the Ovens Basin.
- A net 2 ML of permanent transfer of water rights and diversion licences to the Kiewa basin. No temporary transfers to or from the Kiewa basin occurred in 2003/04.

A total of 828 ML of water entitlement was temporarily transferred between water users within the Kiewa Basin, while 2 ML of entitlement was permanently transferred.

### 4.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 4-4. Licences on unregulated streams are not currently metered and water usage is an estimate provided by Goulburn-Murray Water (G-MW). Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume that could have been diverted in 2003/04. Full details of compliance with bulk entitlements will be provided in the Resource Manager's 2003/04 Report for the Kiewa Basin (G-MW, in press).

Private diversions in the Kiewa Basin are licensed by Goulburn-Murray Water. Compliance against this bulk entitlement is discussed in the water account for the Murray Basin, however it is noted that private diversions in 2003/04 from the Kiewa basin of 8,170 ML were less than the licensed entitlement of 14,670 held by licensed diverters in the Kiewa Basin.

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

**Table 4-4 Volume of water diverted under surface water entitlements in the Kiewa Basin**

| Entitlement | Bulk entitlement | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied ? |
|---|---|---|---|---|---|
| *North East Region Water Authority* | | | | | |
| Kiewa – Tangambalanga | 179 | -57 | 122 | 110 | Yes |
| Mount Beauty – Tawonga | 718 | 0 | 718 | 468 | Yes |
| Yackandandah | 178 | 0 | 178 | 166 | Yes |
| *Southern Hydro Ltd* | | | | | |
| Bogong Village | n/a | 0 | n/a | 25 | n/a |
| Kiewa – Southern Hydro Ltd | 0 | 0 | 0 | 0 | Yes |
| **Total volume of bulk entitlements** | **1,075** | **-57** | **1,018** | **769** | |
| *Unregulated licensed diverters* | 14,665 | 0 | 14,665 | 8,195 | Yes |

n/a indicates that the bulk entitlement conversion order was not finalised at the start of 2003/04. A bulk entitlement may not be required at this diversion point.

### 4.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

The bulk entitlements for North East Water and Southern Hydro Partnership 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 not available. Neither North East Water nor Southern Hydro Partnership reported any non-compliance with passing flow conditions in specified in their bulk entitlements during 2003/04.

### 4.6.6 Compliance with Streamflow Management Plans

The Kiewa River was identified in the *Our Water Our Future* White Paper 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 2003/04.

## 4.7 Groundwater Resources

A summary of licensed volume and use in the Mullindolingong GMA in the Kiewa Basin, excluding stock and domestic use, is shown in Table 4-5. It can be seen from this table that the licensed allocation in this GMA is less than 25 per cent of the permissible annual volume. An estimate of stock and domestic use within these management areas is provided in Table 4-6.

The Kiewa Basin contains more than 90 per cent of the Mullindolingong GMA by surface area. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

**Table 4-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area | GMA/ WSPA Depth Limits [1] | PAV (ML/year) | Licensed Allocation[2] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas [3] (ML) | Total Water Resource[4] (ML) |
|---|---|---|---|---|---|---|
| Mullindolingong GMA | 0 – 25 | 6,980 | 1,504 | Not available | 722 | 6,980 |

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

(2) Allocated volume includes domestic and stock usage.

(3) Where estimate is not available, figure is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(4) The sum of PAVs or licensed volume, whichever is greater.

**Table 4-6 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) [1] |
|---|---|---|
| Mullindolingong GMA | 202 | 404 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 4.8 Recycled Water

The volume of water recycled in the Kiewa basin is shown in Table 4-7. All sewage treatment plants in the Kiewa Basin are operated by North East Water. Around 42 per cent of the volume of effluent passed through treatment plants in the basin was recycled for consumptive use. Details on the methods of disposal (evaporative disposal or discharge to stream) of the non-recycled water were not readily available.

**Table 4-7 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Mount Beauty | North East Water | 210 | 43 |
| Yackandandah | North East Water | 78 | 78 |
| **TOTAL** | | **288** | **121** |

# 5. Ovens Basin

## 5.1 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 at Lake Mulwala. A map of the river basin is shown in Figure 5-1.

Groundwater Management Areas (GMAs) within the Ovens Basin include the Murmungee GMA and the Barnawartha GMA.

## 5.2 Responsibilities for Management of Water Resources

Goulburn-Murray Water is the licensing authority responsible for managing groundwater pumping and private diversions from the Ovens Basin. Goulburn-Murray Water operates the major reservoirs of Lake Buffalo and Lake William Hovell. North East Water is responsible for urban water supply in the Ovens Basin, whilst the North East Catchment Management Authority is responsible for waterway management.

## 5.3 Seasonal Overview

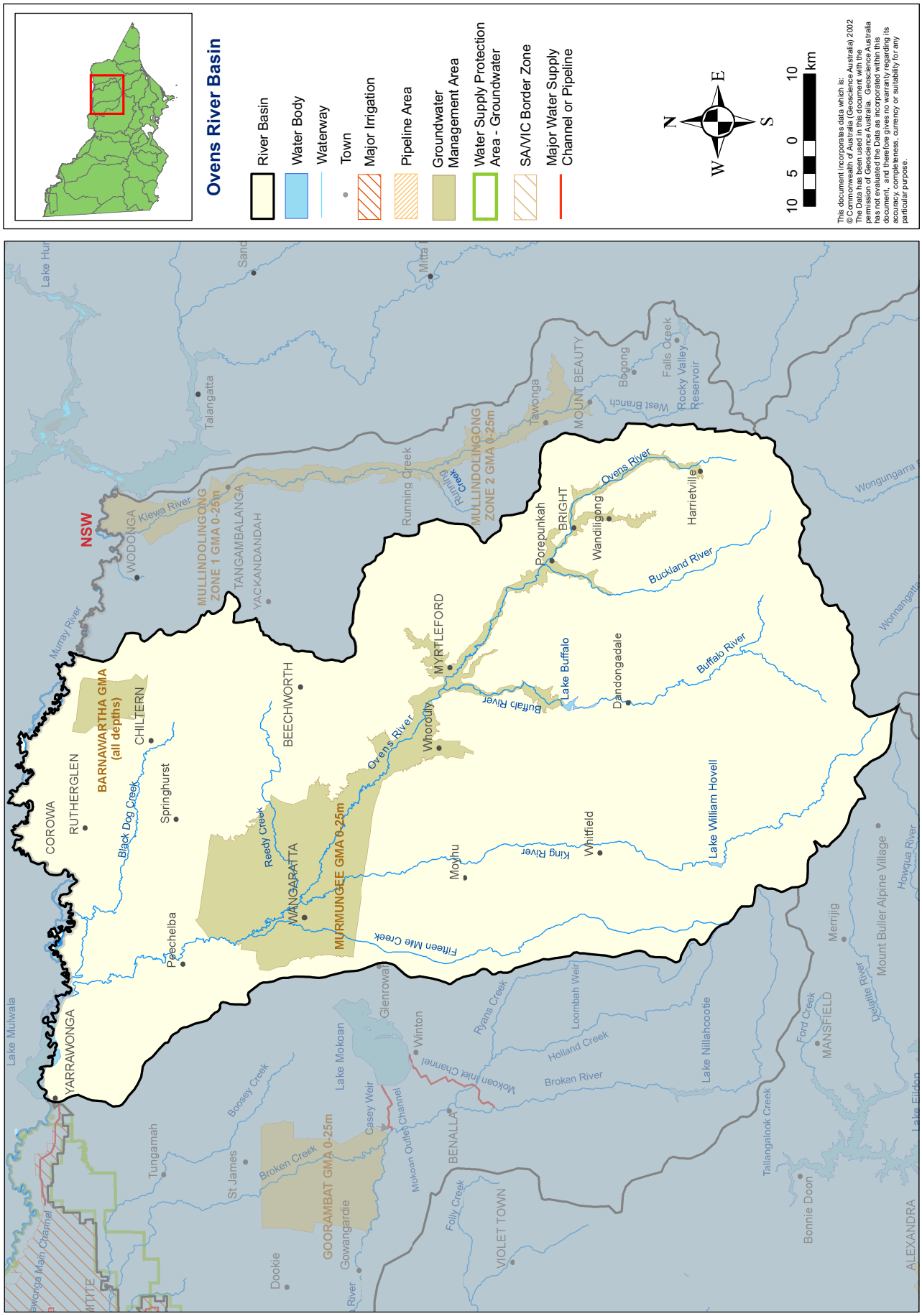
Rainfall conditions in the Ovens Basin in 2003/04 were close to average across most of the basin. This was reflected in the streamflow from the basin recorded at Myrtleford (streamflow gauge number 403210). Streamflow at this location for 2003/04 was equal to the long-term average.

Despite close to average streamflows for the year, bans and restrictions were in place in many parts of the basin:

- Irrigation bans and restrictions were put in place in several tributaries in the Ovens Basin from February to June 2004. At different times over this period, this included restrictions or bans on diversions from 15 Mile Creek, Middle Creek, Hurdle Creek, Scrubby Creek, Roberts Creek and Hodgsons Creek.
- Domestic and stock restrictions were imposed on Buffalo Creek, Barwidgee Creek, Myrtle Creek, Happy Valley Creek, Havilah Creek, Jackson Creek and Snowy Creek over the same period.
- Urban restrictions eased in July and August 2003 and generally did not re-occur during the year. Towns restricted during this period included Springhurst, Whitfield and Glenrowan. Restrictions were briefly re-introduced at Glenrowan in May and June 2004.

Water quality in the Ovens Basin remained good and there were no reports of water quality adversely affecting consumptive use or environmental condition. There were no fish kills or algal blooms reported in the Ovens Basin. The Mount Hotham Resort completed the development of sediment retention basins along the Corral Carpark to reduce the amount of sediment being discharged from road maintenance activities into waterways. The Ovens Basin still experiences major sediment movement in streams after rainfall events as a result of the 2003 bushfire.

**Figure 5-1 Map of the Ovens Basin**



## 5.4 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 5-1.

**Table 5-1 Summary of total water resource and extraction in Ovens Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 1,611,750 | 37,840 |
| Groundwater (1) | 18,810 | 6,052 |
| Recycled water | 2,990 | 1,040 |

(1) Much of the available resource discharges to streams and will be included in the total resource for surface water. These volumes exclude the resource and extraction from unincorporated areas.

## 5.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Ovens Basin, however the Murray-Darling Basin Cap was in place to limit further water development to trade only. Water for the environment was also provided under passing flow obligations in consumptive bulk entitlements for water authorities in the basin. At a basin scale, the water available to the environment was 1,560,220 ML at the basin outlet, which is around 97 per cent of the total amount of surface water in the basin in 2003/04 (Table 5-2).

Although water quantity was largely unaffected in 2003/04, 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. A Streamflow Management Plan is in progress 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.

When the water available to 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 it has reached the River Murray, water from the Ovens River is accounted as a Victorian State tributary input to the River Murray.

## 5.6 Surface Water Resources

### 5.6.1 Water Balance

A surface water balance for the Ovens Basin is shown balance in Table 5-2. 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.

**Table 5-2 Balance of surface water in the Ovens Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 28,540 |
| Volume in storage at end of year | 25,140 |
| **Change in storage** | **-3,400** |
| **Inflows** | |
| Catchment inflow [2] | 1,609,800 |
| Irrigation return flow | 0 |
| Treated effluent discharged back to river [3] | 1,950 |
| **Subtotal** | **1,611,750** |
| **Diversions** | |
| Urban diversions | 2,980 |
| Regulated licensed private diversions | 11,770 |
| Unregulated licensed private diversions | 7,200 |
| Catchment farm dams | 15,890 |
| **Subtotal** | **37,840** |
| **Losses** | |
| Evaporation losses from major storages | 3,220 |
| Losses from catchment farm dams | 4,500 |
| In-stream losses to groundwater and evaporation [1] | 9,370 |
| **Subtotal** | **17,090** |
| **Water passed at outlet of basin** | |
| Ovens River outflow to River Murray | 1,560,220 |
| | |
| **Volume available to the environment in the Ovens Basin** | **1,560,220** |

(1) Long-term average from Ovens River REALM model

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

(3) Assumes all effluent discharged to river if not reused

### 5.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Ovens Basin is estimated to be around 24,900 ML (Table 5-3). Average annual usage from the dams is estimated to be 15,900 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 20,400 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 5-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 14,740 | 7,370 | n/a |
| Irrigation | 10,140 | 8,520 | n/a |
| **TOTAL** | **24,880** | **15,890** | **20,390** |

n/a = information not available

### 5.6.3 Water Entitlement Transfers

The following inter-basin transfers of water entitlement occurred with water users in the Ovens Basin in 2003/04:

- 57 ML temporary transfer from Kiewa (Kiewa) to Chiltern (Ovens) by North East Water.
- Net 2 ML of permanent transfer of private diversion licences out of the Ovens Basin.

Within the Ovens Basin, transfers which occurred included:

- 58 ML from Myrtleford to Porepunkah.
- 12 ML from Moyhu Diversion Licence to Whitfield. The Moyhu diversion licence was purchased on the water market.

### 5.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 5-4. 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 if water use is not more than the maximum volume that could have been diverted in 2003/04.

The Glenrowan Drought Reserve was drawn upon to provide an additional 9 ML to Glenrowan above its base entitlement. The reserve was in surplus from previous years.

**Table 5-4 Volume of water diverted under surface water entitlements in the Ovens Basin**

| Entitlement | Bulk entitlement or licensed volume (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *North East Water* | | | | | |
| Beechworth | 1,100 | 0 | 1,100 | 746 | Yes |
| Bright | 704 | 0 | 704 | 672 | Yes |
| Chiltern | 180 | 57 | 237 | 236 | Yes |
| Glenrowan | 130 | 0 | 130 | 98 | Yes |
| Harrietville | 91 | 0 | 91 | 74 | Yes |
| Myrtleford | 1,470 | -58 | 1,412 | 865 | Yes |
| Porepunkah | 166 | 58 | 224 | 223 | Yes |
| Springhurst | 36 | 0 | 36 | 27 | Yes |
| Whitfield | 34 | 12 | 46 | 42 | Yes |
| *Goulburn-Murray Water* | | | | | |
| Ovens system | n/a | -12 | n/a | 11,770 | n/a |
| **Total volume of bulk entitlements** | **3,911** | **57** | **3,980** | **14,753** | |
| *Unregulated licensed diverters* | 15,391 | 0 | 15,391 | 7,200 | |

n/a indicates that the bulk entitlement conversion order was not finalised at the start of 2003/04

### 5.6.5 Compliance with Passing and Environmental 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 2003/04. There were two bulk entitlement orders in the Ovens Basin that were not yet finalised in 2003/04. These forthcoming bulk entitlements 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 entitlements are finalised and information becomes available.

### 5.6.6 Compliance with Streamflow Management Plans

A Streamflow Management Plan (SFMP) is currently being developed in the Upper Ovens Basin. This SFMP was not in operation in 2003/04. The consultation process for this plan was undertaken in 2003/04 and a draft plan will be made available for comment in the coming year.

## 5.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Ovens Basin, excluding stock and domestic use, is shown in Table 5-5. An estimate of stock and domestic use within these management areas is provided in Table 5-6. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

The Ovens Basin contains all of the Barnawartha GMA and the Murmungee GMA. It can be seen from Table 5-5 that the Barnawartha GMA has only 25 per cent of its PAV allocated,

whilst the Murmungee GMA is approaching 75 per cent. The higher level of allocation in the Murmungee GMA is notable given the high degree of stream-aquifer interaction in the Ovens River Valley.

**Table 5-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area | GMA/ WSPA Depth Limits[1] | PAV (ML/year) | Licensed Allocation[2] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[3] (ML) | Total Water Resource[4] (ML) |
|---|---|---|---|---|---|---|
| Barnawartha GMA | All Depths | 2,100 | 595 | Not available | 286 | 2,100 |
| Murmungee GMA | 0 – 25 | 16,710 | 12,012 | Not available | 5,766 | 16,710 |

(1) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(2) Allocated volume includes domestic and stock usage.
(3) Where estimate is not available, figure is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.
(4) The sum of PAVs or licensed volume, which ever is greater.

**Table 5-6 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)[1] |
|---|---|---|
| Barnawartha GMA | 80 | 160 |
| Murmungee GMA | 1,390 | 2,780 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 5.8 Recycled Water

All sewage treatment plants in the Ovens Basin are operated by North East Water (Table 5-7). Around 35 per cent of the volume of effluent passed through treatment plants in the basin was recycled for consumptive use. Details on the methods of disposal (evaporative disposal or discharge to stream) of the non-recycled water were not readily available.

**Table 5-7 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Beechworth | North East Water | 469 | 152 |
| Bright | North East Water | 263 | 33 |
| Myrtleford | North East Water | 340 | 0 |
| Wangaratta (Domestic) | North East Water | 1,918 | 853 |
| **TOTAL** | | **2,990** | **1,038** |

# 6. Broken Basin

## 6.1 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 5-1. For the purposes of the water accounts, the Broken Basin excludes the Murray Valley Irrigation Area, which is primarily supplied from the River Murray and which 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 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.

## 6.2 Responsibilities for Management of Water Resources

Goulburn-Murray Water is responsible for managing groundwater pumping and private diversions in the Broken Basin. Goulburn-Murray Water operates the major reservoirs of 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 river basin. The Goulburn-Broken Catchment Management Authority is responsible for waterway management and river health.

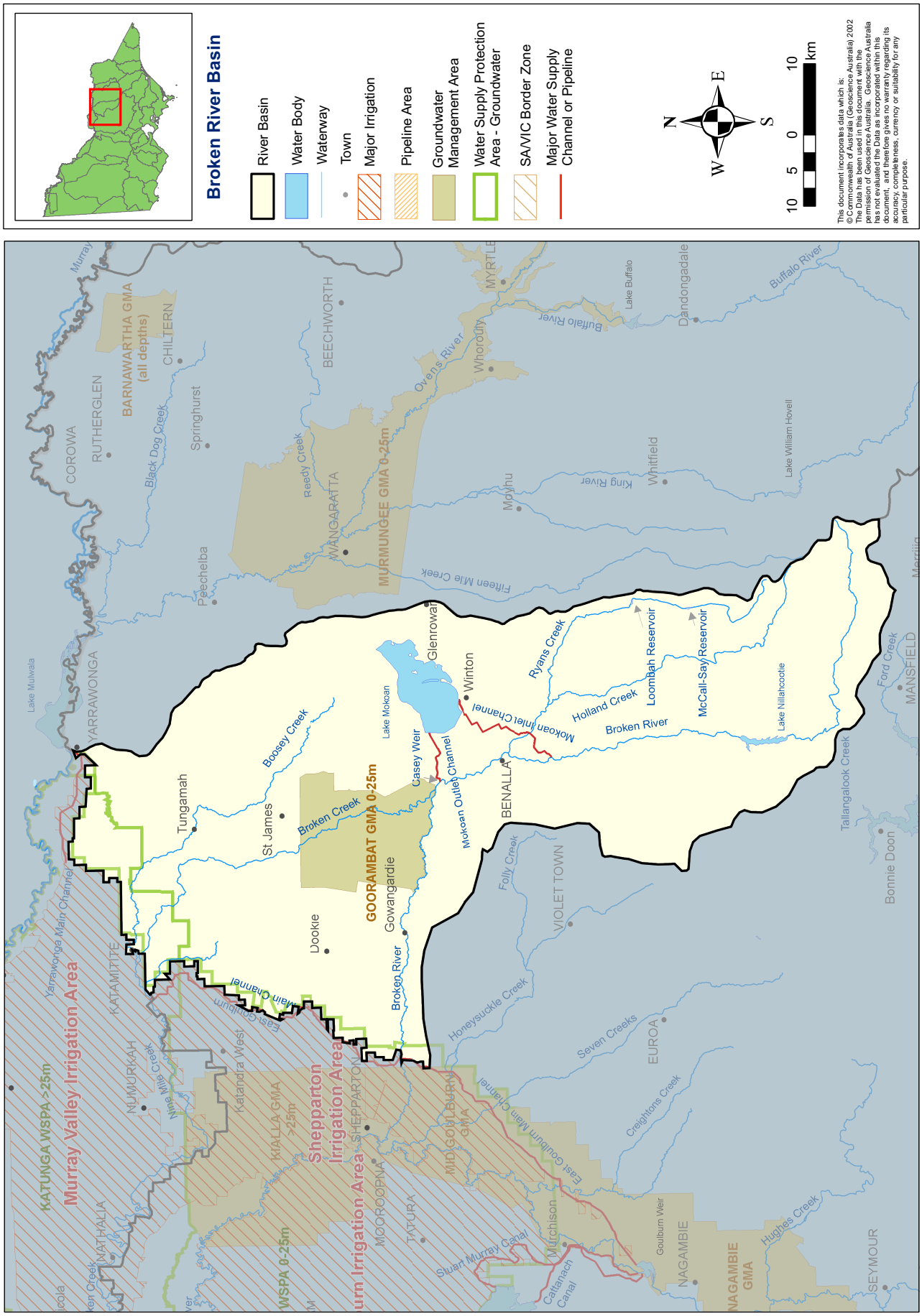
## 6.3 Seasonal Overview

Rainfall conditions in the Broken Basin in 2003/04 were slightly drier than average across most of the basin. This was reflected in the streamflow from the basin recorded at Gowangardie (streamflow gauge number 404224). Streamflow at this location for 2003/04 was 37 per cent lower than the long-term average for the available period of record (1992 to date).

The seasonal irrigation water allocation in the regulated parts of the Broken River system was well above the licensed volume with a sales component equal to 70 per cent of water right. On unregulated river systems, irrigation bans were imposed on Boosey Creek for the whole of 2003/04 and on Holland Creek from February 2004 to June 2004. Voluntary urban restrictions were imposed on Benalla in April 2004, because of very low rainfall in late summer and throughout autumn, but were lifted in early June 2004.

Water quality in the Broken Basin remained good and there were no reports of water quality adversely affecting consumptive use or environmental condition. There were no reported fish kills or blue-green algae events. A fishway was designed for the Broken River at Casey's Weir in 2003/04, which is listed as a priority barrier needing fish passage under the State Fishway Program.

**Figure 6-1 Map of the Broken Basin**



## 6.4 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 6-1.

**Table 6-1 Summary of total water resource and water use in Broken Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 271,030 | 36,670 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 850 | 580 |

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

## 6.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Broken 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 Broken Basin. Water for the environment was also provided through passing flow obligations for water authorities in the basin. A bulk entitlement conversion process was in progress during 2003/04 to convert existing water extractions to a clearly defined entitlement and will provide flows for environmental purposes.

The water available to the environment was 125,650 ML at the basin outlet, which is around 56 per cent of the total amount of surface water in the basin (Table 6-2).

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 from by redirecting irrigation water from the River Murray into the Broken Creek (via the Mulwala Canal) and returning the water to the River Murray at Rice's Weir. Whilst this additional was not a specific environmental entitlement, it highlights the potential for water authorities to use irrigation releases for environmental benefits in some circumstances. The water available to environment for the Barmah Forest, located at the outlet of Broken Creek, is discussed in the water account for the Murray Basin.

When the water available to the environment 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 Broken 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.

## 6.6 Surface Water Resources

### 6.6.1 Water Balance

A surface water balance for the Broken Basin is shown balance in Table 6-2. Note that only those storages greater than 1,000 ML capacity have been included in the water balance. In the Broken Basin 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 6-2 Balance of surface water in the Broken Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 90,490 |
| Volume in storage at end of year | 110,720 |
| **Change in storage** | **20,230** |
| **Inflows** | |
| Catchment inflow (1) | 270,760 |
| Irrigation return flow | 0 |
| Treated effluent discharged back to river (2) | 270 |
| **Sub-total** | **271,030** |
| **Diversions** | |
| Urban diversions | 2,020 |
| Regulated licensed private diversions (4) | 17,450 |
| Unregulated licensed private diversions | 1,460 |
| Catchment farm dams | 15,740 |
| **Sub-total** | **36,670** |
| **Losses** | |
| Evaporation losses from major storages | 81,340 |
| Losses from catchment farm dams | 7,140 |
| In-stream losses to groundwater and evaporation (3) | 0 |
| **Sub-total** | **88,480** |
| **Water passed at outlet of basin** | |
| Broken River at Gowangardie to Goulburn Basin | 114,340 |
| Boosey Creek at Tungamah to Murray Basin | 9,030 |
| Broken Creek at Katamatite to Murray Basin | 2,280 |
| | |
| **Volume available to the environment in the Broken Basin** | **125,650** |

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

(2) Assumes all effluent discharged to river if not reused

(3) Assumed to be zero because not readily available

(4) Includes Tungamah stock and domestic system

Evaporative losses from Lake Mokoan represented in the order of 90 per cent 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 investigate water savings options by decommissioning the Lake.

### 6.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Broken Basin is estimated to be around 25,000 ML (Table 6-3). Average annual usage from the dams is estimated to be 15,800 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 22,900 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 6-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 15,380 | 7,690 | n/a |
| Irrigation | 9,580 | 8,050 | n/a |
| **TOTAL** | **24,960** | **15,740** | **22,880** |

n/a = information not available

### 6.6.3 Water Entitlement Transfers

There was no net inter-basin or within basin transfer of water entitlement in the Broken Basin in 2003/04. Within the Broken Basin, urban transfers which occurred included:

- 16 ML from Dookie to the water market by Goulburn Valley Water.

### 6.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 6-4. 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 if water use is not more than the maximum volume that could have been diverted in 2003/04.

**Table 6-4 Volume of water diverted under surface water entitlements in the Broken Basin**

| Entitlement | Bulk entitlement or licensed volume | Net temporary transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Goulburn Valley Water* | | | | | |
| Dookie | 160 | -16 | 144 | 117 | Yes |
| *North East Water* | | | | | |
| Broken System – Tungamah, Devenish & St James – North East Water | n/a | 0 | n/a | 114 | n/a |
| Loombah-McCall Say (Benalla) | 2,324 | 0 | 2,324 | 1,786 | Yes |
| *Goulburn-Murray Water* | | | | | |
| Broken Goulburn – Murray Water | n/a | 0 | n/a | 17,450 | n/a |
| **Total Volume of Bulk Entitlements** | **2,484** | **-16** | **2,468** | **19,467** | |
| *Unregulated licensed diverters* | 2,022 | 0 | 2,022 | 1,460 | |

n/a indicates that the bulk entitlement conversion order was not finalised at the start of 2003/04

### 6.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

The bulk entitlements for North East Water and Goulburn Valley Water have various passing flow requirements. There were two bulk entitlements in the Broken Basin that were not yet completed in 2003/04. These entitlements will contain passing flow obligations that will reported upon in future water accounts.

### 6.6.6 Compliance with Streamflow Management Plans

There is no Streamflow Management Plan (SFMP) in operation in the Broken Basin. There are none planned in the next five years in this river basin. However, other programs to improve the environmental water reserve are being undertaken.

## 6.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Broken Basin, excluding stock and domestic use is shown in Table 6-5. An estimate of stock and domestic use within these management areas is provided in Table 6-6.

The Broken Basin contains all of the Goorambat GMA and part of the Katunga WSPA and Shepparton WSPA. The volumes described in the Table 6-5 are totals for the management areas and include the area that falls outside the Broken Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

**Table 6-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area | GMA/ WSPA Depth Limits[1] | PAV (ML/year) | Licensed Allocation[2] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[3] (ML) | Total Water Resource[4] (ML) |
|---|---|---|---|---|---|---|
| Goorambat GMA | 0 – 25 | 4,888 | 1,651 | Not available | 792 | 4,888 |
| Katunga WSPA (94%) | >25 | Not available[5] | 31,456 | 23,784 | Not applicable | 31,456 |
| Shepparton WSPA (42%) | 0 – 25 | Not available[6] | 202,576[7] | 64,288 | Not applicable | Not available[8] |

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

(2) Allocated volume includes domestic and stock usage.

(3) Where metered use is not available, figure is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(4) The sum of PAVs or licensed volume, which ever is greater.

(5) The Katunga WSPA does not have a PAV against which licensed entitlements are measured. Groundwater monitoring is undertaken with the aim of tracking water level decline. Licensed allocations are adjusted on an annual basis to ensure groundwater levels remain above a minimum annual average water level.

(6) The Shepparton WSPA does not have a PAV against which licensed entitlements are compared. Groundwater monitoring and management in the Shepparton WSPA is undertaken to allow salinity and watertable control works to be targeted in the high risk, high watertable areas.

(7) The licensed allocation total for the Shepparton WSPA includes 20,201 ML for salinity dewatering.

(8) No estimate of Total Water Resource is applicable as >10 per cent GMA/WSPA is located outside the river basin

**Table 6-6 Number of Stock and Domestic Bores and Estimated**

| Water Supply Protection Area/Groundwater Management Area | No. of Stock and Domestic Bores[1] | Estimated Stock and Domestic Use (assuming 2ML/bore)[1] |
|---|---|---|
| Goorambat GMA | 71 | 142 |
| Katunga WSPA | 120 | 240 |
| Shepparton WSPA | 412 | 824 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 6.8 Recycled Water

The volumes of water recycled in the Broken Basin are shown in Table 6-7. Around 68 per cent of the volume of effluent passed through the treatment plant in the basin was recycled for consumptive use. Details on the methods of disposal (evaporative disposal or discharge to stream) of the non-recycled water were not readily available.

**Table 6-7 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Benalla | North East Water | 846 | 577 |
| **TOTAL** | | **846** | **577** |

# 7. Goulburn Basin

## 7.1 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 Goulburn River discharges to the River Murray east of Echuca. A map of the river basin is shown in Figure 7-1. For the purposes of the water accounts, the Goulburn Basin includes the Shepparton and Central Goulburn Irrigation Areas, but excludes the Rochester Irrigation Area, which has been assigned to the Campaspe Basin. The Broken River flows into the Goulburn River at Shepparton.

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.

## 7.2 Responsibilities for Management of Water Resources

Goulburn-Murray Water manages the large 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, whilst the Goulburn Broken Catchment Management Authority is responsible for waterway management.

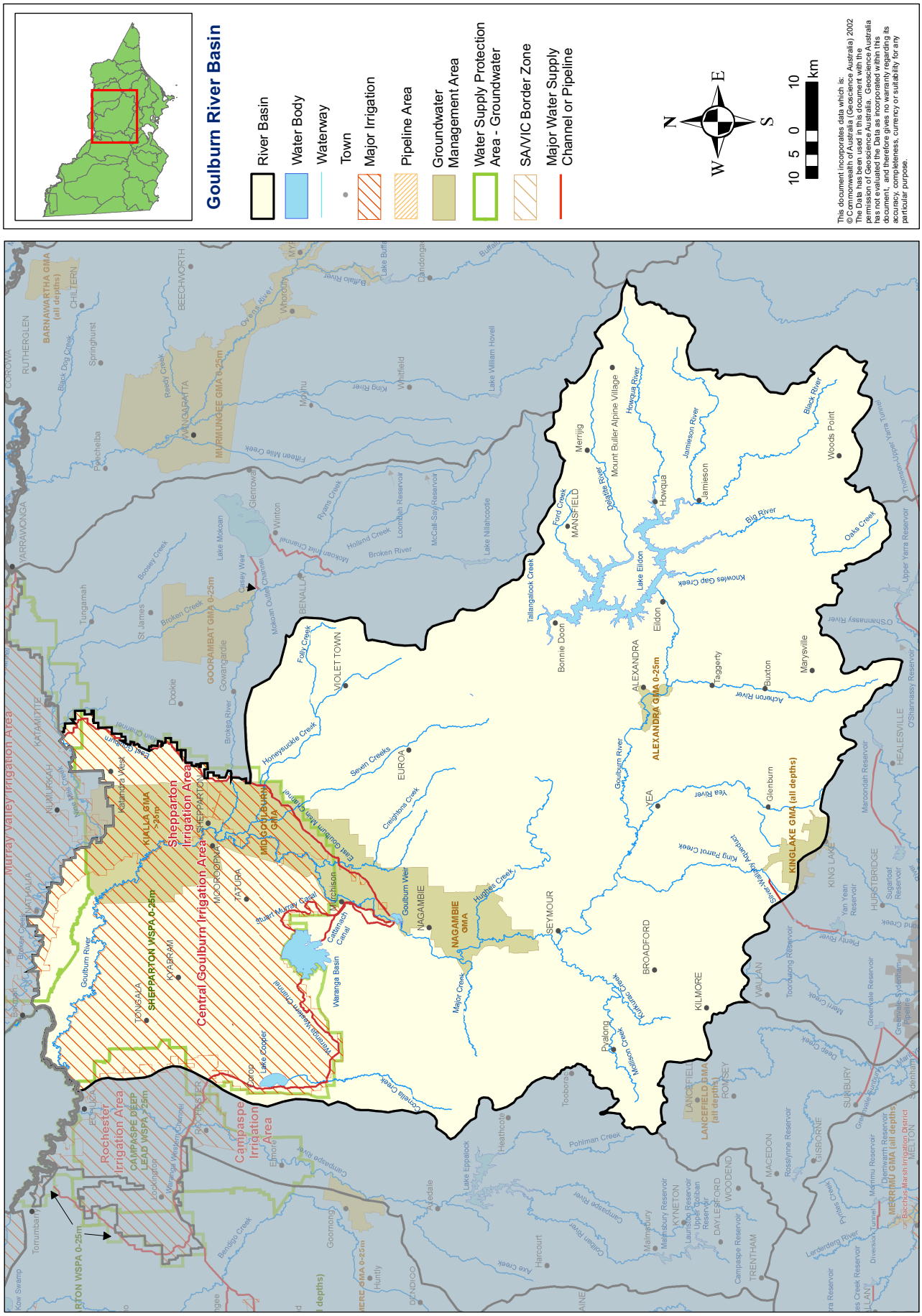
## 7.3 Seasonal Overview

Rainfall conditions in the Goulburn Basin in 2003/04 were close to average across most of the basin. However, streamflows were below average across much of the catchment, possibly due to the prolonged effects of previous dry years. Streamflows in the Delatite River at Tonga Bridge, upstream of Lake Eildon, were 47 per cent of the long-term average streamflow, whilst outflows from the Goulburn River at McCoy's Bridge were 32 per cent of the long-term average streamflow.

An initial seasonal irrigation water allocation of zero per cent was made in July 2003. This increased to 100 per cent of entitlement by February 2004 and stayed at this level for the remainder of the season. The median long-term February allocation in this system is 160 per cent, hence irrigators in the Goulburn system were effectively restricted in 2003/04.

Bans and restrictions were put in place in several tributaries in the Goulburn Basin during the year. Irrigation bans were imposed on Sunday Creek and Sevens Creek in July 2003. After lifting those bans in August, they were reintroduced in January 2004 and continued until the end of the irrigation season. An irrigation ban was imposed on King Parrot Creek in February 2004, which eased to Stage 3 restrictions from March 2004 to May 2004. Stage 3 restrictions were imposed for Hughes Creek, Chyser Creek, Johnstons Creek, Wallaby Creek, Pheasant Creek, Stony Creek and Cummins Creek from March 2004 to May. Irrigation was banned on Hughes Creek from May 2004 to June 2004.

**Figure 7-1 Map of the Goulburn Basin**



Stage 9 (of 10 stages) urban restrictions were in place in July 2003 for the Broadford/Kilmore/ Wallan supply system. Stage 3 (of a new 4 stage restriction policy, which replaced the more severe Stage 9 of a 10 stage policy) restrictions were implemented on 17 December 2003 and continued into the 2004/05 water year. Stage 2 restrictions were imposed for Bonnie Doon from 24 March 2004 to 25 May 2004. Stage 5 restrictions were lifted during July 2003 in Rushworth.

Stage 2 restrictions were in place in July 2003, continuing from 31 March 2003, for towns along the Waranga Western Channel supplied from the Goulburn system (Boort, Dingee, Lockington, Macorna, Mitiamo, Mysia, Pyramid Hill and Rochester). Stage 2 restrictions were eased to Stage 1 in October 2003.

A substantial fish kill occurred in the Goulburn River downstream of Goulburn Weir in 2003/04. Investigations into the cause indicated the fish kill was associated with low dissolved oxygen levels, however, the exact cause was unable to be determined. There were no reports of algal blooms in the catchment. Waterway management works included the protection of 217 km of stream frontages through binding agreements with landholders and the installation of gross pollutant traps for urban stormwater.

## 7.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Goulburn Basin are shown in Table 7-1.

**Table 7-1 Summary of total water resource and water use in Goulburn Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 2,930,830 | 1,590,890 |
| Groundwater(1) | Not available | Not available |
| Recycled water | 9,389 | 6,239 |

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

## 7.5 Environmental Water Reserve

Two environmental entitlements to return water to the Snowy River have been brought into effect in the Goulburn Basin. An entitlement of 3,600 ML/yr was brought into effect in June 2004 and second entitlement was granted in January 2005 for 10,762 ML/year. While these were not part of the Goulburn supply system operation in 2003/04, 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 from the improved measurement of small volume supplies in a number of irrigation districts. Water savings for the Snowy River also occurred in the River Murray (refer Section 3.5). 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 2003/04 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 water available to the environment was 533,150 ML at the basin outlet, which is around 19 per cent of the total amount of surface water in the basin (Table 7-2).

Upstream of Goulburn Weir (Nagambie), where the majority of water is diverted for irrigation, the volume of water in-stream was significantly greater than at the basin outlet

and comprised around 44 per cent of the total amount of surface water in the basin. This amount includes environmental passing flows required under bulk entitlements in the basin as well as releases made from Lake Eildon to supply irrigators.

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. A Streamflow Management Plan is in progress to develop water sharing rules that will minimise the impacts of such diversions and to ensure the water resources of the area are managed equitably and sustainably.

When the water available to the environment 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 under the control of the Murray-Darling Basin Commission and may be used to meet the River Murray 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 Goulburn Basin is shown balance in Table 7-2. Note that only those storages greater than 1,000 ML capacity have been included in the water balance. In the Goulburn Basin this includes Lake Eildon, Lake Nagambie, Waranga Basin, Greens Lake and Sunday Creek Reservoir.

**Table 7-2 Balance of surface water in the Goulburn Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 476,110 |
| Volume in storage at end of year | 859,590 |
| **Change in storage** | **383,480** |
| **Inflows** | |
| Catchment inflow | 2,813,340 |
| Inflow from Broken River at Gowangardie | 114,340 |
| Irrigation return flow | 0 |
| Treated effluent discharged back to river (1) | 3,150 |
| **Sub-total** | **2,930,830** |
| **Diversions** | |
| Urban diversions | 25,550 |
| Irrigation district diversions | 1,476,280 |
| Regulated licensed private diversions | 24,820 |
| Unregulated licensed private diversions | 13,730 |
| Silver and Wallaby Creeks to Yarra Basin | 3,000 |
| Catchment farm dams | 47,510 |
| **Sub-total** | **1,590,890** |
| **Losses** | |
| Evaporation losses from major storages | 119,790 |
| Losses from catchment farm dams | 9,730 |
| In-stream losses to groundwater and evaporation (2) | 293,795 |
| **Sub-total** | **423,315** |
| **Water passed at outlet of basin** | |
| Goulburn River outflow to River Murray | 494,290 |
| Goulburn River to River Murray via Broken Creek | 38,860 |
| | |
| **Volume available to the environment in the Goulburn Basin** | **533,150** |

(1) Assumes all effluent discharged to river if not reused

(2) Back calculated as the difference between inflows and outflows. Includes losses from channels transferring water to other basins

### 7.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Goulburn Basin is estimated to be around 71,100ML (Table 7-3). Average annual usage from the dams is estimated to be 47,500 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 57,200 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 7-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 35,880 | 17,940 | n/a |
| Irrigation | 35,210 | 29,570 | n/a |
| **TOTAL** | **71,090** | **47,510** | **57,240** |

n/a = information not available

### 7.6.3 Water Entitlement Transfers

Transfers of water entitlements within the Goulburn Basin are listed in Table 7-4. It can be seen from this table that there was a net export of water entitlement from the basin, with 14,320 ML being permanently traded and 8,480 ML being temporarily traded to other basins. Goulburn Valley Water was a significant seller of entitlement to the water market.

**Table 7-4 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 |
| *Goulburn Valley Water* [(1)] | | | | | | |
| Alexandra | 0 | 0 | 0 | 0 | 470 | -470 |
| Bonnie Doon | 0 | 0 | 0 | 0 | 40 | -40 |
| Colbinabbin | 0 | 0 | 0 | 0 | 40 | -40 |
| Corop | 0 | 0 | 0 | 0 | 30 | -30 |
| Eildon | 0 | 0 | 0 | 0 | 290 | -290 |
| Kyabram | 0 | 0 | 0 | 0 | 580 | -580 |
| Mooroopna | 0 | 0 | 0 | 0 | 210 | -210 |
| Murchison | 0 | 0 | 0 | 0 | 130 | -130 |
| Nagambie | 0 | 0 | 0 | 0 | 300 | -300 |
| Rushworth | 0 | 0 | 0 | 0 | 120 | -120 |
| Seymour | 0 | 0 | 0 | 0 | 2,770 | -2,770 |
| Shepparton | 0 | 0 | 0 | 0 | 3,390 | -3,390 |
| Stanhope | 0 | 0 | 0 | 0 | 60 | -60 |
| Tatura | 0 | 0 | 0 | 0 | 480 | -480 |
| *Goulburn-Murray Water* [(2)] | | | | | | |
| Goulburn River – Water right | 1,010 | 1,210 | -200 | 4,280 | 17,100 | -12,820 |
| Goulburn River – Sales | | | | 110 | 0 | 110 |
| Central Goulburn – Water right | 2,960 | 10,930 | -7,970 | 71,710 | 50,230 | 21,480 |
| Central Goulburn – Sales | | | | 2,350 | 770 | 1,580 |
| Rochester – Water right | 2,150 | 6,180 | -4,030 | 36,940 | 29,000 | 7,940 |
| Rochester – Sales | | | | 0 | 0 | 0 |
| Shepparton Irrigation District – Water right | 1,740 | 3,860 | -2,120 | 21,110 | 39,010 | -17,900 |
| Shepparton Irrigation District – Sales | | | | 40 | 0 | 40 |
| **TOTAL** | **7,860** | **22,180** | **-14,320** | **136,540** | **145,020** | **-8,480** |

(1) Goulburn Valley Water entitlements not listed did not transfer any of that entitlement

(2) These service areas form part of Goulburn-Murray Water's bulk entitlement for Eildon-Goulburn Weir.

### 7.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 7-5. Licences on unregulated streams are not currently metered and water usage is an estimate provided by Goulburn-Murray Water (G-MW). Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume that could have been diverted in 2003/04. Full details of compliance with bulk entitlements will be provided in the Resource Manager's 2003/04 Report for the Goulburn Basin (G-MW, in press).

**Table 7-5 Volume of water diverted under surface water entitlements in the Goulburn Basin**

| Entitlement | Bulk entitlement volume (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount Diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Goulburn Valley Region Water Authority* | | | | | |
| Alexandra | 916 | -471 | 445 | 413 | Yes |
| Bonnie Doon | 112 | -35 | 77 | 61 | Yes |
| Broadford, Kilmore and Wallan | 2,238 | 0 | 2,238 | 1,479 | Yes |
| Buxton | 110 | 0 | 110 | 0 | Yes |
| Colbinabbin | 89 | -40 | 49 | 41 | Yes |
| Corop | 44 | -25 | 19 | 10 | Yes |
| Eildon | 480 | -290 | 190 | 173 | Yes |
| Euroa System | 1,990 | 0 | 1,990 | 774 | Yes |
| Girgarre | 100 | 0 | 100 | 53 | Yes |
| Katandra West | 64 | 0 | 64 | 47 | Yes |
| Kyabram | 1,980 | -576 | 1,404 | 1,323 | Yes |
| Longwood | 120 | 0 | 120 | 70 | Yes |
| Mansfield | 1,300 | 0 | 1,300 | 725 | Yes |
| Marysville | 462 | 0 | 462 | 343 | Yes |
| Merrigum [(1)] | 0 | 0 | 0 | 0 | Yes |
| Mooroopna | 500 | -209 | 291 | 250 | Yes |
| Murchison | 350 | -130 | 220 | 214 | Yes |
| Nagambie | 825 | -300 | 525 | 525 | Yes |
| Pyalong | 75 | 0 | 75 | 32 | Yes |
| Rushworth | 530 | -122 | 408 | 373 | Yes |
| Seymour | 5,340 | -2,768 | 2,572 | 1,767 | Yes |
| Shepparton | 18,320 | -3,388 | 14,932 | 13,353 | Yes |
| Stanhope | 200 | -58 | 142 | 121 | Yes |
| Tatura | 2,600 | -480 | 2,120 | 1,847 | Yes |
| Thornton | 120 | 0 | 120 | 90 | Yes |
| Tongala | 1,440 | 0 | 1,440 | 1,127 | Yes |
| Toolamba [(2)] | 0 | 0 | 0 | 0 | Yes |
| Upper Delatite | 235 | 0 | 235 | 85 | Yes |
| Violet Town [(3)] | 270 | 0 | 270 | 0 | Yes |
| Woods Point | 21 | 0 | 21 | 19 | Yes |
| Yea | 438 | 0 | 438 | 232 | Yes |
| *Melbourne Water Corporation* | | | | | |
| Silver & Wallaby Creek System [(4)] | n/a | 0 | n/a | 2,995 | n/a |
| *Southern Hydro Partnership* | | | | | |
| Rubicon – Southern Hydro Ltd[(6)] | 0 | 0 | 0 | 0 | Yes |
| *Goulburn-Murray Rural Water Authority* | | | | | |
| Eildon-Goulburn Weir [(5)] | 1,919,000 | 430 | 1,919,430 | 1,633,653 | Yes |
| **Total volume of bulk entitlements** | **1,960,269** | **-8,462** | **1,951,807** | **1,662,195** | |
| *Unregulated licensed diverters* | 21,587 | 0 | 21,587 | 13,730 | |

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

(2) Toolamba is now supplied from Shepparton

(3) Violet Town is now supplied from Euroa

(4) n/a indicates that the bulk entitlement conversion order was not finalised at the start of 2003/04

(5) Bulk entitlement is a ten-year rolling average of 1,919,000 ML. The bulk entitlement shown is calculated after taking into account the previous nine years of diversions. Bulk entitlement and usage quoted includes Rochester, which is in the Campaspe Basin.

(6) This is a non-consumptive entitlement.

### 7.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

The bulk entitlements for Goulburn-Murray Water and Goulburn Valley Water have various passing flow requirements. Goulburn-Murray Water, as resource manager for the Goulburn Basin, had not completed its compliance report at the time of publication of the water accounts and thus no information on authorities' compliance with their environmental flow obligations is available.

### 7.6.6 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 Goulburn 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.

## 7.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Goulburn Basin, excluding stock and domestic use, is shown in Table 7-6. An estimate of stock and domestic use within these management areas is provided in Table 7-7.

The Goulburn Basin contains the whole of the Nagambie GMA and Alexandra GMA as well as part of the Campaspe Deep Lead WSPA, Shepparton WSPA, Kialla GMA and Kinglake GMA. The volumes described in the Table 7-6 are totals for the management areas and include the area that falls outside the Goulburn Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

## Table 7-6 Compliance with Licensed Groundwater Volumes

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits [2] | PAV (ML/year) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Alexandra GMA | 0 – 25 | 900 | 1,821 | Not available | 874 | 1,821 |
| Campaspe Deep Lead WSPA (10%) | >25 | Not available[6] | 46,545 | 23,931 | Not applicable | Not available[7] |
| Kialla GMA (53%) | >25 | 2,795 | 2,213 | Not available | 1,062 | Not available[7] |
| Kinglake GMA (78%) | All Depths | 3,830 | 2,012 | Not available | 966 | Not available[7] |
| Nagambie GMA | All Depths | 5,650 | 6,476 | 1,335 | Not applicable | 6,476 |
| Shepparton WSPA (40%) | 0 – 25 | Not available[8] | 202,576[9] | 64,288 | Not applicable | Not available[7] |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage.

(4) Where estimate is not available, figure is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) The Campaspe Deep Lead WSPA does not have a PAV against which licensed entitlements are measured. Groundwater monitoring is undertaken with the aim of tracking water level decline. Licensed allocations are adjusted on an annual basis to ensure groundwater levels remain above a minimum annual average water level.

(7) No estimate of Total Water Resource is applicable as >10 per cent GMA/WSPA is located outside the river basin.

(8) The Shepparton WSPA does not have a PAV against which licensed entitlements are compared. Groundwater monitoring and management in the Shepparton WSPA is undertaken to allow salinity and watertable control works to be targeted in the high risk, high watertable areas.

(9) The licensed allocation total for the Shepparton WSPA includes 20,201 ML for salinity dewatering.

## Table 7-7 Number of Stock and Domestic Bores and Estimated

| Water Supply Protection Area/Groundwater Management Area | No. of Stock and Domestic Bores[1] | Estimated Stock and Domestic Use (assuming 2ML/bore)[1] |
|---|---|---|
| Alexandra GMA | 69 | 138 |
| Campaspe Deep Lead WSPA | 250 | 500 |
| Kialla GMA | 161 | 322 |
| Kinglake GMA | 425 | 850 |
| Nagambie GMA | 99 | 198 |
| Shepparton WSPA | 412 | 824 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 7.8 Recycled Water

The volume of water recycled in the Goulburn Basin is shown in Table 7-8. All sewage treatment plants in the Goulburn Basin are operated by Goulburn Valley Region Water Authority. Around 66 per cent of the volume of effluent passed through treatment plants in the basin was recycled for consumptive use. Details on the methods of disposal (evaporative disposal or discharge to stream) of the non-recycled water were not readily available.

**Table 7-8 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Alexandra | Goulburn Valley Water | 243 | 35 |
| Avenel | Goulburn Valley Water | 0 | 0 |
| Bonnie Doon | Goulburn Valley Water | 4 | 4 |
| Broadford | Goulburn Valley Water | 120 | 120 |
| Eildon | Goulburn Valley Water | 159 | 56 |
| Euroa | Goulburn Valley Water | 230 | 228 |
| Girgarre | Goulburn Valley Water | 0 | 0 |
| Kilmore | Goulburn Valley Water | 152 | 0 |
| Kyabram | Goulburn Valley Water | 223 | 223 |
| Mansfield | Goulburn Valley Water | 252 | 252 |
| Marysville | Goulburn Valley Water | 41 | 41 |
| Mooroopna | Goulburn Valley Water | 739 | 739 |
| Murchison | Goulburn Valley Water | 0 | 0 |
| Nagambie | Goulburn Valley Water | 105 | 105 |
| Rushworth-Stanhope | Goulburn Valley Water | 0 | 0 |
| Seymour | Goulburn Valley Water | 550 | 549 |
| Shepparton | Goulburn Valley Water | 5,012 | 2,482 |
| Tatura | Goulburn Valley Water | 685 | 685 |
| Tongala | Goulburn Valley Water | 416 | 416 |
| Upper Delatite | Goulburn Valley Water | 13 | 13 |
| Violet Town | Goulburn Valley Water | 0 | 0 |
| Wallan | Goulburn Valley Water | 335 | 182 |
| Yea | Goulburn Valley Water | 110 | 109 |
| **TOTAL** | | **9,389** | **6,239** |

# 8. Campaspe Basin

## 8.1 Location of Water Resources

The Campaspe Basin is located within the Murray-Darling Drainage Division. It includes the Campaspe River, which runs along the length of the basin, the Coliban River and various smaller tributaries such as Mount Pleasant Creek and Sheepwash Creek. The Campaspe River discharges to the River Murray at Echuca. A map of the river basin is shown in Figure 8-1

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.

## 8.2 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.

## 8.3 Seasonal Overview

Rainfall conditions in the Campaspe Basin in 2003/04 were close to average across most of the basin. However, streamflows were below average across much of the catchment, possibly due to the prolonged effects of previous dry years. Streamflows in Axe Creek at Longlea were 33 per cent of the long-term average streamflow, whilst outflows from the Campaspe River at Rochester were five per cent of the long-term average streamflow (but marginally higher than 2002/03 outflows).

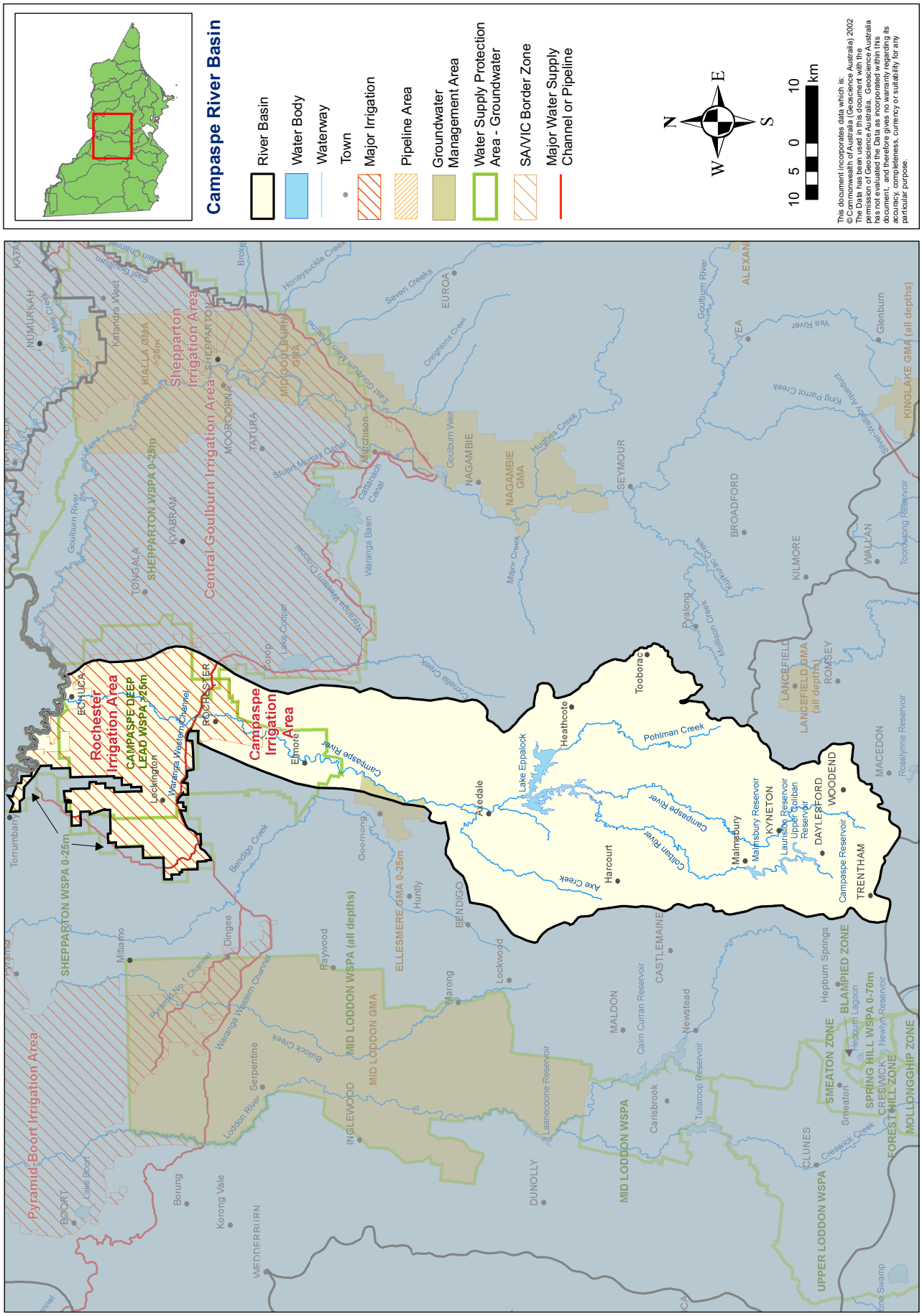
Seasonal irrigation water allocations for the Campaspe Irrigation District were initially zero, but rose to 92 per cent of water right by the end of February. The seasonal irrigation water allocations for Coliban Channel diverters was initially 40 per cent and only rose to 65 per cent of entitlement by the end of the February. The long-term median February allocation of the Campaspe System is 220 per cent, while in the Coliban System the long-term average allocation is 130 per cent. Irrigation bans were imposed on licensed diverters on the Coliban River, Jones Creek, Little Coliban River, Smiths Creek and Stoney Creek for July 2003. Irrigation bans on the Campaspe River and Coliban River were reintroduced from January 2004 to June 2004.

Relatively severe urban water restrictions, typically Stage 3 (of 4 stages), were in place at the start of 2003/04 and eased after spring rainfalls. Towns restricted early in the year included Tooborac, Heathcote and the Bendigo/Castlemaine/Kyneton/Heathcote systems supplied from the Upper Coliban storages. Restrictions were also in place at Axedale, Goornong and Woodend.

The continuing drought resulted in extremely low levels in Lake Eppalock and reduced flows in the Campaspe River. There were no fish kills in 2003/04, despite the high risk of occurrence. The drought also impacted on the success of revegetation.

The North Central CMA undertook erosion control works in the Upper Campaspe catchment on Forest Creek, Wild Duck Creek, Pipers Creek and Mt Pleasant Creek. The aim of the work was to protect water quality by reducing gully and bank erosion and associated nutrient and sediment impacts on waterways. During 2003/04 rock chutes were installed, 12 new beaching sites were installed (including repairs) and approximately 41 km of waterway was protected.

**Figure 8-1 Map of the Campaspe Basin**



## 8.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Campaspe Basin are shown in Table 8-1. The total surface water resource for the Campaspe Basin includes 1,380 ML which is transferred into the Campaspe River from the Waranga Western Channel.

**Table 8-1 Summary of total water resource and water use in Campaspe Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 160,730 | 95,530 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 1,420 | 820 |

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

## 8.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Campaspe 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 Campaspe Basin. The water available to the environment was 8,220 ML at the basin outlet, which is around five per cent of the total amount of surface water generated within the basin (Table 8-2). This amount includes environmental passing flows required under bulk entitlements in the basin.

When the water available to the environment 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, the Campaspe River water is under the control of the Murray-Darling Basin Commission and may be used to meet the River Murray environmental flow requirements and/or be diverted for consumptive use.

## 8.6 Surface Water Resources

### 8.6.1 Water Balance

A surface water balance for the Campaspe 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 Campaspe Basin this includes the Upper Coliban, Lauriston and Malmsbury Reservoirs, as well as Lake Eppalock.

**Table 8-2 Balance of surface water in the Campaspe Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 36,920 |
| Volume in storage at end of year | 32,860 |
| **Change in storage** | **-4,060** |
| **Inflows** | |
| Catchment inflow | 158,750 |
| Irrigation return flow | 0 |
| Waranga Western Channel to Campaspe River | 1,380 |
| Treated effluent discharged back to river (1) | 600 |
| **Sub-total** | **160,730** |
| **Diversions** | |
| Urban diversions | 12,710 |
| Coliban Main Channel (Castlemaine urban and Coliban rural) | 16,830 |
| Irrigation district diversions (2) | 23,870 |
| Regulated licensed private diversions (2) | 10,850 |
| Unregulated licensed private diversions (2) | 1,150 |
| Catchment farm dams | 28,780 |
| Campaspe River to Waranga Western Channel | 1,340 |
| **Sub-total** | **95,530** |
| **Losses** | |
| Evaporation losses from major storages | 12,340 |
| Losses from catchment farm dams | 14,720 |
| In-stream losses to groundwater, floodplain and evaporation (2) | 33,990 |
| **Sub-total** | **61,050** |
| **Water passed at outlet of basin** | |
| Campaspe River outflow to River Murray | 8,220 |
| | |
| **Volume available to the environment in the Campaspe Basin** | **8,220** |

(1) Assumes all effluent discharged to river if not reused

(2) From G-MW Annual Report

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

### 8.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Campaspe Basin is estimated to be around 40,300 ML (Table 8-3). Average annual usage from the dams is estimated to be 28,800 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 43,500 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 8-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 15,030 | 7,520 | n/a |
| Irrigation | 25,310 | 21,260 | n/a |
| **TOTAL** | **40,340** | **28,780** | **43,500** |

n/a = information not available

### 8.6.3 Water Entitlement Transfers

Transfers of water entitlements within the Campaspe Basin are listed in Table 8-4. It can be seen from this table that there was a net import of water entitlement to the basin, with 10 ML being permanently traded out of the basin and 142 ML being temporarily traded into the basin.

**Table 8-4 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 and Part Rochester | 0 | 0 | 0 | 0 | 0 | 0 |
| Rochester | 0 | 0 | 0 | 220 | 0 | 220 |
| Lockington | 0 | 0 | 0 | 0 | 20 | -20 |
| Campaspe System – Coliban Water | 0 | 0 | 0 | 1,030 | 410 | 620 |
| *Western Water* | | | | | | |
| Woodend | 0 | 0 | 0 | 0 | 0 | 0 |
| *Goulburn-Murray Water* | | | | | | |
| Campaspe District – Water right | 50 | 380 | -330 | 4,377 | 2,084 | 2,292 |
| Campaspe District – Sales | | | | 0 | 0 | 0 |
| Campaspe River – Water right | 350 | 30 | 320 | 1,570 | 4,540 | -2,970 |
| Campaspe River – Sales | | | | 0 | 0 | 0 |
| **TOTAL** | **400** | **410** | **-10** | **7,197** | **7,054** | **142** |

### 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 that could have been diverted in 2003/04. Full details of compliance with bulk entitlements will be provided in the Resource Manager's 2003/04 Report for the Campaspe Basin.

**Table 8-5 Volume of water diverted under bulk entitlements in the Campaspe Basin**

| Bulk entitlement | Bulk entitlement or licensed volume | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Coliban Regional Water Authority* | | | | | |
| Rochester | 1,400 | 215 | 1,615 | 1,484 | Yes |
| Axedale, Goornong and Part Rochester | 500 | 0 | 500 | 370 | Yes |
| Lockington | 130 | -18 | 112 | 87 | Yes |
| Campaspe System – Coliban Water | 50,260 | 625 | 50,885 | 28,744 | Yes |
| *Western Water* | | | | | |
| Woodend | 470 | 0 | 470 | 420 | Yes |
| *Goulburn-Murray Water* | | | | | |
| Campaspe System – Goulburn-Murray Water | 76,483 | -678 | 75,805 | 40,522 | Yes |
| **Total volume of bulk entitlements** | **129,243** | **144** | **129,387** | **71,627** | |
| *Goulburn-Murray Water* | 1,766 | 0 | 1,766 | 1,150 | |

(1) Bulk entitlement compliance for Rochester Irrigation District is presented as part of the Eildon-Goulburn Weir bulk entitlement in the Goulburn Basin water account

### 8.6.5 Compliance with Passing and Environmental 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 and thus no information on authorities' compliance with their environmental flow obligations is available. No instances of non-compliance with passing flows were reported in 2003/04 by Coliban Water or Goulburn-Murray Water.

### 8.6.6 Compliance with Streamflow Management Plans

No Streamflow Management Plans (SFMP) are currently being developed nor are in operation in the Campaspe Basin.

## 8.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Campaspe Basin, excluding stock and domestic use, is shown in Table 8-6. An estimate of stock and domestic use within these management areas is provided in Table 8-7.

The Campaspe Basin contains part of the Campaspe Deep Lead WSPA and part of the Ellesmere GMA. The volumes described in the Table 8-6 are totals for the management areas and include the area that falls outside the Campaspe Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

### Table 8-6 Compliance with Licensed Groundwater Volumes

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/year) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Campaspe Deep Lead WSPA (10%) | >25 | Not available[6] | 46,545 | 23,931 | Not applicable | Not available[7] |
| Ellesmere GMA (28%) | 0 – 25 | 1,900 | 1,124 | Not applicable | 540 | Not available[7] |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with <5per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage.

(4) Where estimate is not available, figure is based on the State average use for metered areas ('State average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) The Campaspe Deep Lead WSPA does not have a PAV against which licensed entitlements are measured. Groundwater monitoring is undertaken with the aim of tracking water level decline. Licensed allocations are adjusted on an annual basis to ensure groundwater levels remain above a minimum annual average water level.

(7) No estimate of Total Water Resource is applicable as >10 per cent GMA/WSPA is located outside the river basin.

### Table 8-7 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)[1] |
|---|---|---|
| Campaspe Deep Lead WSPA | 250 | 500 |
| Ellesmere GMA | 68 | 136 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 8.8 Recycled Water

The volumes of recycled water in the Campaspe Basin are shown in Table 8-8. All sewage treatment plants in the Campaspe Basin are operated by the Coliban Region Water Authority apart from Woodend, which is operated by the Western Region Water Authority. Around 58 per cent of the volume of effluent passed through treatment plants in the basin was recycled for consumptive use. Details on the methods of disposal (evaporative disposal or discharge to stream) of the non-recycled water were not readily available.

**Table 8-8 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Elmore | Coliban Water | 40 | 0 |
| Heathcote | Coliban Water | 132 | 87 |
| Kyneton | Coliban Water | 700 | 352 |
| Lockington | Coliban Water | 27 | 0 |
| Rochester | Coliban Water | 308 | 210 |
| Woodend | Western Region WA | 214 | 171 |
| **TOTAL** | | **1,421** | **820** |

# 9. Loddon Basin

## 9.1 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 River Murray and the Kerang Lakes. A map of the river basin is shown in Figure 9-1.

Water Supply Protection Areas (WSPA) within the Loddon Basin includes the whole of the Mid Loddon WSPA and Spring Hill WSPA as well as parts of the Campaspe Deep Lead WSPA. Groundwater Management Areas (GMAs) within the Loddon Basin include part of the Ellesmere GMA.

## 9.2 Responsibilities for Management of Water Resources

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

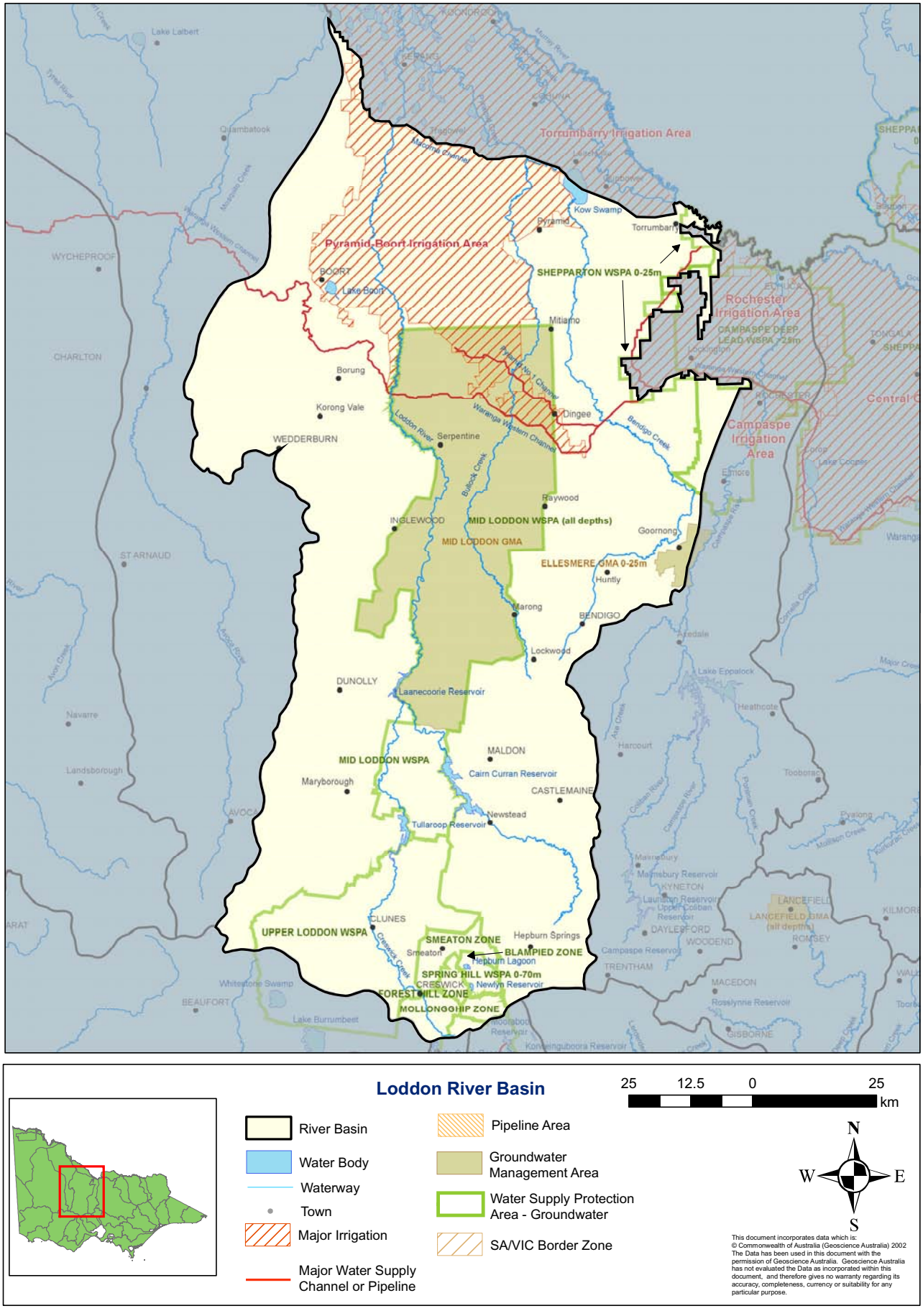
## 9.3 Seasonal Overview

Rainfall conditions in the Loddon Basin in 2003/04 were close to average across most of the basin. However, streamflows were very much below average across much of the catchment, possibly due to the prolonged effects of previous dry years. The streamflow from the basin recorded at Appin South (streamflow gauge number 407205) was around seven per cent of the long-term average. Further upstream on the Loddon River at Newstead (streamflow gauge number 407213), the streamflow was around 24 per cent of the long-term average.

The low inflows in the Loddon Basin in 2003/04 resulted in restrictions and bans throughout the year. In irrigation districts in the Loddon Basin, the initial allocation was zero per cent of entitlement, rising to only 67 per cent of entitlement by the end of the season. 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 diversions were put in place in several tributaries in the Loddon Basin at various times throughout 2003/04. These included Upper Bullock Creek, Upper Loddon River, Campbells Creek, Lower Loddon River, Barkers Creek, Jim Crow Creek, Kangaroo Creek, Leitch's Creek, Wallaby Creek, Wombat Creek and McCallum Creek as well as Lake Meran.

**Figure 9-1 Map of the Loddon Basin**



Urban restrictions on water use existing for various towns within the basin were in place for much of the year, with restrictions generally easing from October onwards. Up to Stage 4 (of 4 stages) restrictions were in place in July 2003 for Daylesford, Hepburn and Hepburn Springs, easing to Stage 2 from October 2003 and Stage 1 in December 2003. Other towns restricted during the year were Maryborough, Adelaide Lead, Alma/Moonlight, Carisbrook, Daisy Hill, Havelock, Majorca, Rodborough, Simson/Bet Bet, Talbot, Timor/Bowenvale and Clunes.

Stage 2 restrictions were in place in July 2003, continuing from 31 March 2003, for towns supplied from the Loddon system (Bealiba, Bridgewater, Dunolly, Inglewood, Jarklin, Laanecoorie, Serpentine and Tarnagulla). Stage 3 restrictions were increased from Stage 2 on 1 September 2003.

The continuing drought in the basin resulted in low flow levels in the Loddon River, including cease to flow in unregulated reaches (eg. downstream of Loddon Weir). The drought impacted the success of revegetation. Algal blooms occurred in storages including Cairn Curran, Laanecoorie, Newlyn and Tullaroop.

During 2003/04 the North Central CMA undertook erosion control works in the Muckleford sub-catchment. To achieve the desired gully stabilisation and associated water quality improvements 8 rock chutes were installed to stabilise eroding gullies, 450 m of beaching was undertaken to stabilise eroding stream banks and 4,800 m of riparian fencing was erected to protect banks from stock and enhance the riparian zone. Erosion control works within the sub-catchment are continuing in 2004/2005, along with riparian zone protection and enhancement via further fencing and revegetation.

The North Central CMA is working with local government to implement stormwater management plans, including the installation of a large sediment/litter trap on Bendigo Creek downstream of Bendigo city.

## 9.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Loddon Basin are shown in Table 9-1.

**Table 9-1 Summary of total water resource and water use in Loddon Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 176,270 | 66,600 |
| Groundwater(1) | Not available | Not available |
| Recycled water | 9,150 | 1,360 |

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

## 9.5 Environmental Water Reserve

In 2003/04 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 2003/04 to convert existing water use 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 water available to the environment was 12,030 ML at the basin outlet, which is around 7 per cent of the total amount of surface water in the basin (Table 9-). When the water available to the environment 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.

## 9.6 Surface Water Resources

### 9.6.1 Water Balance

A surface water balance for the Loddon Basin is shown in Table 9-. Note that only those storages greater than 1,000 ML capacity have been included in the water balance. In the Loddon Basin this includes 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, Evansford Reservoir, Spring Gully Reservoir and Sandhurst Reservoir.

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.

### 9.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Loddon Basin is estimated to be around 72,400 ML (Table 9-). Average annual usage from the dams is estimated to be 50,000 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 79,500 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 9-2 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 31,650 | 15,820 | n/a |
| Irrigation | 40,730 | 34,210 | n/a |
| **TOTAL** | **72,380** | **50,030** | **79,570** |

n/a = information not available

**Table 9-3 Balance of surface water in the Loddon Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 23,390 |
| Volume in storage at end of year | 20,620 |
| **Change in storage** | **2,770** |
| **Inflows** | |
| Catchment inflow | 168,480 |
| Irrigation return flow | 0 |
| Treated effluent discharged back to river [2] | 7,790 |
| **Sub-total** | **176,270** |
| **Diversions** | |
| Urban diversions [3] | 2,850 |
| Irrigation district diversions | 0 |
| Regulated licensed private diversions | 7,990 |
| Unregulated licensed private diversions | 5,730 |
| Catchment farm dams | 50,030 |
| **Sub-total** | **66,600** |
| **Losses** | |
| Evaporation losses from major storages | 12,610 |
| Losses from catchment farm dams | 29,540 |
| In-stream losses to groundwater and evaporation [1] | 52,730 |
| **Sub-total** | **94,880** |
| **Water passed at outlet of basin** | |
| Loddon River outflow to River Murray (Appin South) | 5,540 |
| Mount Hope Creek at Mitiamo | 6,490 |
| Bullock Creek, Calivil and Nine Mile Creek | n/a |
| | |
| **Volume available to the environment in the Loddon Basin** | **12,030** |

(1) Estimated from inflows and diversions

(2) Assumes all effluent discharged to river if not reused

(3) Excludes Castlemaine & Bendigo, which were included in the Campaspe Basin water account.

### 9.6.3 Water Entitlement Transfers

Transfers of water entitlements within the Loddon Basin are listed in Table 9-2. It can be seen from this table that there was a net export of water entitlement from the basin, with 6,190 ML being permanently traded out of the basin and 17,880 ML being temporarily traded out of the basin.

**Table 9-2 Water entitlement transfers in the Loddon Basin**

| Entitlement | Permanent Entitlement Transfer (ML) | | | Temporary Entitlement Transfer (ML) | | |
|---|---|---|---|---|---|---|
| | Bought | Sold | Net transfer to entitlement | Bought | Sold | Net transfer to entitlement |
| *Coliban Water* | | | | | | |
| Boort | 0 | 0 | 0 | 0 | 170 | -170 |
| Dingee | 0 | 0 | 0 | 0 | 20 | -20 |
| Macorna | 0 | 0 | 0 | 0 | 30 | -30 |
| Mitiamo | 0 | 0 | 0 | 0 | 0 | 0 |
| Mysia | 0 | 0 | 0 | 0 | 0 | 0 |
| Pyramid Hill | 0 | 0 | 0 | 20 | 0 | 20 |
| *Goulburn-Murray Water* | | | | | | |
| Loddon River – water right | 0 | 0 | 0 | 1,530 | 3,240 | -1,710 |
| Loddon River – sales | | | | 0 | 0 | 0 |
| Pyramid-Boort – water right | 9,590 | 15,780 | -6,190 | 34,270 | 51,440 | -17,170 |
| Pyramid-Boort – sales | | | | 1,880 | 680 | 1,200 |
| Bullarook – water right | 0 | 0 | 0 | 0 | 0 | 0 |
| Bullarook – sales | | | | 0 | 0 | 0 |
| **TOTAL** | **9,590** | **15,780** | **-6,190** | **37,700** | **55,580** | **-17,880** |

Note: There was no transfer of water entitlement by Central Highlands Water for entitlements in the Loddon Basin

### 9.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 9-3. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume that could have been diverted in 2003/04. It should be noted that many of the bulk entitlements for the Loddon Basin were not completed by the start of 2003/04 and values are not reported against those bulk entitlements. A number of these bulk entitlement conversion orders were completed during 2003/04 and will be reported against in subsequent water accounts.

**Table 9-3 Volume of water diverted under surface water entitlements in the Loddon Basin**

| Bulk entitlement | Bulk entitlement or licensed volume | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Central Highlands Water* | | | | | |
| Talbot-Clunes | n/a | 0 | n/a | 254 | n/a |
| Lexton | n/a | 0 | n/a | 29 | n/a |
| Creswick | n/a | 0 | n/a | 28 | n/a |
| Daylesford | n/a | 0 | n/a | 601 | n/a |
| Maryborough | n/a | 0 | n/a | 863 | n/a |
| *Coliban Water* | | | | | |
| Boort | 425 | -170 | 255 | 242 | yes |
| Bridgewater/Inglewood/ Serpentine/Jarklin | n/a | 0 | 0 | 295 | n/a |
| Dingee | 50 | -20 | 30 | 2 | yes |
| Laanecoorie, Dunolly, Bealiba, Tarnagulla | n/a | 0 | n/a | 165 | n/a |
| Macorna | 40 | -25 | 15 | 7 | yes |
| Mitiamo | 60 | 0 | 60 | 33 | yes |
| Mysia | 15 | 0 | 15 | 9 | yes |
| Pyramid Hill | 300 | 18 | 318 | 318 | yes |
| *Goulburn-Murray Water* | | | | | |
| Loddon | n/a | -1,713 | n/a | 7,990 | n/a |
| Bullarook | n/a | 0 | n/a | 0 | n/a |
| **Total volume of bulk entitlements** | **890** | **-1,910** | **693** | **10,836** | |
| *Unregulated licensed diverters* | 16,091 | 0 | 16,091 | 5,730 | |

n/a indicates that the bulk entitlement conversion order was not finalised at the start of 2003/04

### 9.6.5 Compliance with Passing and Environmental 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.

### 9.6.6 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 2003/04.

## 9.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Loddon Basin, excluding stock and domestic use is shown in Table 9-4. It can be seen from this table that areas of high allocation include the mid-Loddon WSPA (91 per cent of PAV), Spring Hill WSPA (97 per cent of PAV) and the Bungaree WSPA (120 per cent of PAV), all of which are sources of good quality irrigation supplies and therefore are under increasing

pressure of development. An estimate of stock and domestic use within these management areas is provided in Table 9-5.

The Loddon Basin contains all of the Mid Loddon WSPA and the Spring Hill WSPA as well as part of the Upper Loddon WSPA, Campaspe Deep Lead WSPA and part of the Ellesmere GMA. The volumes described in the Table 9-4 are totals for the management areas and include the area that falls outside the Loddon Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

**Table 9-4 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits [2] | PAV (ML/year) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas [4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Campaspe Deep Lead WSPA (22%) | >25 | Not available[6] | 46,545 | 23,931 | Not applicable | Not available [7] |
| Ellesmere GMA (72%) | 0 – 25 | 1,900 | 1,124 | Not available | 540 | Not available [7] |
| Mid Loddon WSPA | All Depths | 37,200 | 33,761 | 12,655 | Not applicable | 37,200 |
| Upper Loddon WSPA (80%) | | Not available | 12,743 | 2,339 (part) | Not applicable | Not available [7] |
| Spring Hill WSPA | <70 | 5,062 | 4,905 | 2,137 | Not applicable | 5,062 |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPAs with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage.

(4) Where estimate is not available, figure is based on the State average use for metered areas ('State average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) The Campaspe Deep Lead WSPA does not have a PAV against which licensed entitlements are measured. Groundwater monitoring is undertaken with the aim of tracking water level decline. Licensed allocations are adjusted on an annual basis to ensure groundwater levels remain above a minimum annual average water level.

(7) No estimate of Total Water Resource is applicable as >10 per cent GMA/WSPA is located outside the river basin.

**Table 9-5 Number of Stock and Domestic Bores and Estimated**

| Water Supply Protection Area/Groundwater Management Area | No. of Stock and Domestic Bores[1] | Estimated Stock and Domestic Use (assuming 2ML/bore)[1] |
|---|---|---|
| Campaspe Deep Lead WSPA | 250 | 500 |
| Ellesmere GMA | 68 | 136 |
| Mid Loddon WSPA | 330 | 660 |
| Upper Loddon WSPA | 451 | 902 |
| Spring Hill WSPA | 20 | 40 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 9.8 Recycled Water

The sewage treatment plants in the Loddon Basin are operated by the Coliban and Central Highlands Water Authorities. Around 15 per cent of the volume of effluent passed through treatment plants in the basin was recycled for consumptive use (Table 9-6). Details on the methods of disposal (evaporative disposal or discharge to stream) of the non-recycled water were not readily available.

**Table 9-6 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Bendigo | Coliban Water | 7,001 | 692 |
| Bridgewater/Inglewood | Coliban Water | 58 | 0 |
| Castlemaine | Coliban Water | 1,048 | 0 |
| Pyramid Hill | Coliban Water | 14 | 0 |
| Clunes | Central Highlands Water | 42 | 0 |
| Creswick | Central Highlands Water | 189 | 0 |
| Daylesford | Central Highlands Water | 279 | 279 |
| Maryborough | Central Highlands Water | 518 | 385 |
| **TOTAL** | | **9,149** | **1,356** |

# 10. Avoca Basin

## 10.1 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, but also includes a number of distributaries that flood wetlands to the North East of the river during high flow periods. A map of the river basin is shown in Figure 10-1.

There are no Groundwater Management Areas or Water Supply Protection Areas located within the Avoca Basin.

## 10.2 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, with Grampians Water supplying towns in the northern part of the basin. Wimmera Mallee Water is responsible for delivery of bulk water supplies via the Wimmera-Mallee Channel system, the Northern Mallee Pipeline, the western end of the Waranga Western Channel and diversions from rivers. Wimmera Mallee Water is the groundwater licensing authority across most of the basin, whilst Goulburn-Murray Water is the groundwater licensing authority in the north of the basin. The North Central Catchment Management Authority is responsible for waterway management in the Avoca Basin.

## 10.3 Seasonal Overview

Rainfall conditions in the Avoca Basin in 2003/04 were drier than average across most of the basin. This was reflected in the streamflow from the basin recorded at Quambatook (streamflow gauge number 408203). Streamflow at this location for 2003/04 was just six per cent of the long-term average. This was an increase on the previous year, when no flow was recorded at this streamflow gauge. Streamflows further upstream at Coonooer Bridge (streamflow gauge number 408200) were approximately 13 per cent of long-term average flows at this location in 2003/04. The Avoca River flows into a terminal lake system, Lake Bael Bael and The Marshes which can overflow into the Murray system in wet years. There was no overflow in 2003/04 because of the extended dry period.

Stage 3 (of 8 stages) restrictions were in place in July 3003 at Redbank, Landsborough and Navarre. Stage 2 (of 4 stages) restrictions were in place in July 2003 continuing from 1 March 2003, at Amphitheatre. Stage 2 restrictions were reduced to voluntary from 1 September 2003. No restrictions on water use by licensed diverters were reported in the Avoca Basin.

## 10.4 Summary of the Total Water Resources in the Basin

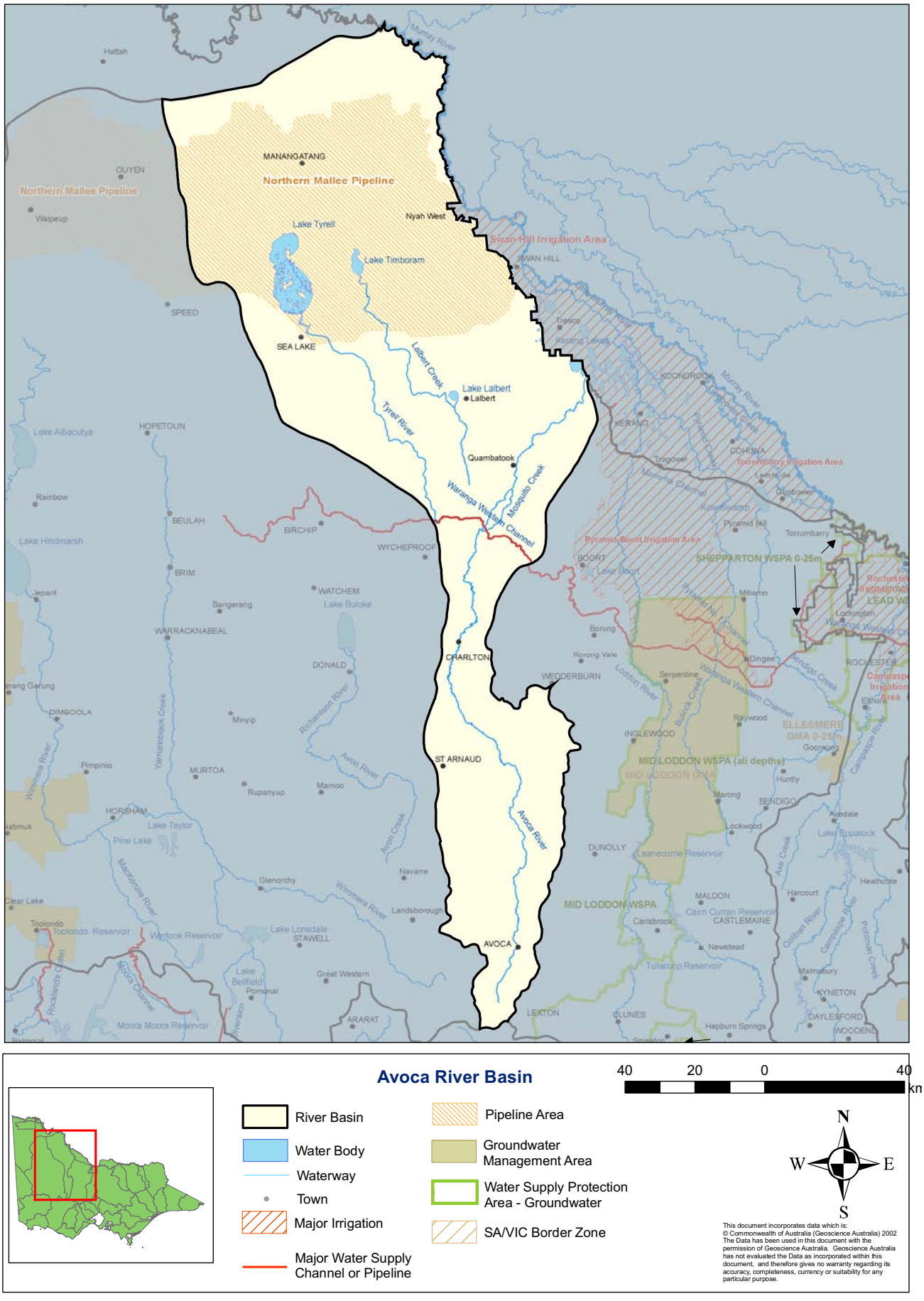
The total volume of water available and supplied from water resources in the Avoca Basin are shown in Table 10-1.

**Table 10-1 Summary of total water resource and water use in Avoca Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 33,940 | 14,430 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 380 | 350 |

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

**Figure 10-1 Map of the Avoca Basin**

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## 10.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Avoca 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 Avoca Basin. The Cap on the Avoca Basin is accounted under 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.

No flow was recorded in 2003/04 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 in the basin during major flood events. No such events occurred in 2003/04. In its lower reaches, the Avoca River is a perched river that loses substantial volumes to groundwater when it overflows it banks and breaks out on to the floodplain.

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

## 10.6 Surface Water Resources

### 10.6.1 Water Balance

A surface water balance for the Avoca Basin is shown in Table 10-2. It can be seen from the water balance that catchment farm dams are the main source of water supply in the catchment, with no major regulating storages.

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

**Table 10-2 Balance of surface water in the Avoca Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** [1] | |
| Volume in storage at start of year | - |
| Volume in storage at end of year | - |
| **Change in storage** | **0** |
| **Inflows** | |
| Catchment inflow | 33,910 |
| Irrigation return flow | - |
| Treated effluent discharged back to river [2] | 30 |
| **Sub-total** | **33,940** |
| **Diversions** | |
| Urban diversions | 170 |
| Irrigation district diversions | - |
| Unregulated licensed private diversions | 1,560 |
| Catchment farm dams | 12,700 |
| **Sub-total** | **14,430** |
| **Losses** | |
| Evaporation losses from major storages | - |
| Losses from catchment farm dams | 9,740 |
| In-stream losses to groundwater, floodplain and evaporation [3] | 9,770 |
| **Sub-total** | **19,510** |
| **Water passed at outlet of basin** | |
| Avoca River outflow to Kerang Lakes (Loddon Basin) | 0 |
| | |
| **Volume available to the environment in the Avoca Basin** [4] | **9,770** |

(1) Excludes wetlands in the Avoca Basin

(2) Assumes all effluent discharged to river if not reused

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

(4) Includes in-stream losses to floodplain, groundwater and evaporation.

### 10.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Avoca Basin is estimated to be around 19,400 ML. Average annual usage from the dams is estimated to be 12,700 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 22,400 ML (Table 10-3). Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

**Table 10-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 10,510 | 5,260 | n/a |
| Irrigation | 8,850 | 7,440 | n/a |
| **TOTAL** | **19,370** | **12,700** | **22,440** |

n/a = information not available

### 10.6.3 Water Entitlement Transfers

There were no records of water entitlement transfers to or from the Avoca Basin in 2003/04.

### 10.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 10-4. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume that could have been diverted in 2003/04. It should be noted that all of the bulk entitlement conversion orders for the Avoca Basin were not completed by the start of 2003/04 and values are not reported against those bulk entitlements. All of these bulk entitlement conversion orders were completed during 2003/04 and will be reported against in subsequent water accounts.

**Table 10-4 Volume of water diverted under surface water entitlements in the Avoca Basin**

| Entitlement | Bulk entitlement or licensed volume | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Central Highlands Water* | | | | | |
| Amphitheatre | n/a | 0 | n/a | 10 | n/a |
| Avoca | n/a | 0 | n/a | 160 | n/a |
| Redbank | n/a | 0 | n/a | 10 | n/a |
| **Total volume of bulk entitlements** | **n/a** | **0** | **n/a** | **180** | |
| *Unregulated licensed diverters* | 3,290 | 0 | 3,290 | 1,560 | |

Note: All bulk entitlements approved during 2003/04

### 10.6.5 Compliance with Passing and Environmental 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 2003/04 by Central Highlands Water.

### 10.6.6 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 2003/04.

## 10.7 Groundwater Resources

There are no Groundwater Management Areas or Water Supply Protection Areas located within the Avoca Basin. This is due to the lack of good quality groundwater resources in most of the Avoca Basin. Increased groundwater development is occurring in the highlands of this basin, largely due to growth in viticulture and horticulture. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

## 10.8 Recycled Water

Sewage treatment plants in the Avoca Basin are listed in Table 10-5. Around 91 per cent of the volume of effluent passed through treatment plants in the basin was recycled for consumptive use. Details on the methods of disposal (evaporative disposal or discharge to stream) of the non-recycled water were not readily available.

**Table 10-5 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Avoca | Central Highlands Water | 33 | 0 |
| Charlton | Grampians Water | 75 | 75 |
| Sea Lake | Grampians Water | 63 | 63 |
| St. Arnaud | Grampians Water | 169 | 169 |
| Wycheproof | Grampians Water | 43 | 43 |
| **TOTAL** | | **383** | **350** |

# 11. Mallee Basin

## 11.1 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 Channel. Groundwater is a significant source of water supply in the region. Water Supply Protection Areas within the Mallee Basin include all of the Murrayville WSPA. Groundwater Management Areas within the Mallee include part of both the Telopea Downs GMA and the Kaniva TCSA 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 11-1.

## 11.2 Responsibilities for Management of Water Resources

Sunraysia Rural Water Authority is the licensing authority for the issuing of groundwater licences in the Mallee. Grampians Water is responsible for urban water supply in the Mallee region, whilst the Mallee Catchment Management Authority is responsible for waterway management. Wimmera Mallee Water is responsible for supplying 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 during 2003/04.

## 11.3 Seasonal Overview

Rainfall conditions in the Mallee Basin in 2003/04 were below average across most of the basin.

No restrictions on urban or irrigation water use were reported in the Mallee region in 2003/04 for supplies from the Murray system. There were restrictions on farmers and towns supplied from the Wimmera-Mallee system. These restrictions are described under the Wimmera Basin.

Activities undertaken by the Mallee CMA to monitor and improve the quality of water resources include the determination of the Index of Stream Condition for 58 river reaches across the Mallee, Avoca and Wimmera basins.

## 11.4 Summary of the Total Water Resources in the Basin

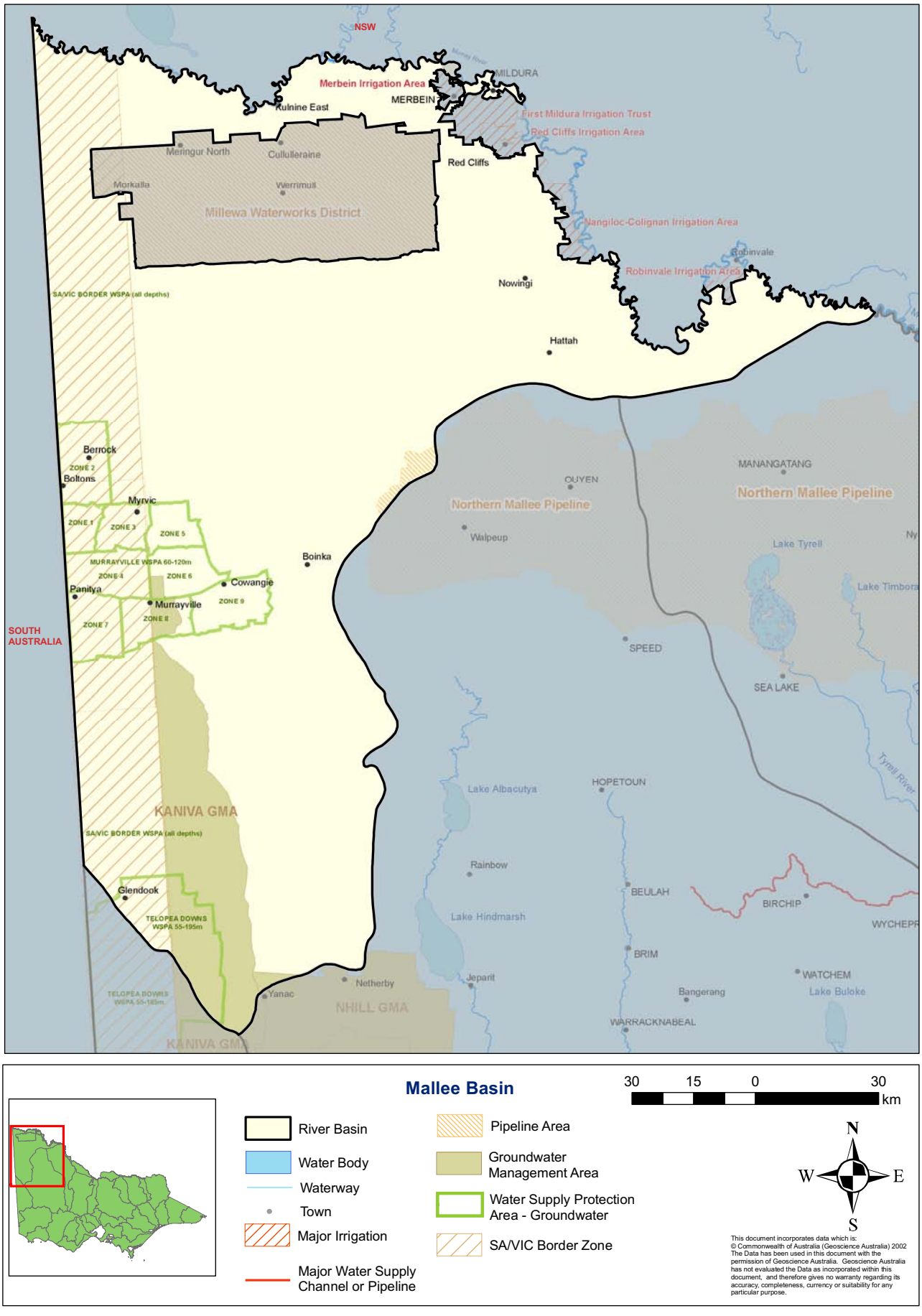
The total volume of water available and supplied from water resources in the Mallee Basin are shown in Table 11-1.

**Table 11-1 Summary of total water resource and water use in Mallee Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 0 | 0 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 0 | 0 |

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

**Figure 11-1 Map of the Mallee Basin**



## 11.5 Environmental Water Reserve

In 2003/04 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 under 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.

## 11.6 Surface Water Resources

### 11.6.1 Water Balance

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

### 11.6.2 Catchment Farm Dams

There is known to be some catchment farm dams in the Mallee Region, however there is no information on them and they are not a significant source of water to the region, so their capacity is assumed to be zero.

### 11.6.3 Water Entitlement Transfers

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

### 11.6.4 Volume Diverted

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

### 11.6.5 Compliance with Passing and Environmental 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 region itself. Compliance with passing flows at the source of water diverted is reported in the water accounts for adjacent river basins.

### 11.6.6 Compliance with Streamflow Management Plans

No Streamflow Management Plans (SFMPs) exist or are being developed in the Mallee Basin.

## 11.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap with the Mallee Basin, excluding stock and domestic use, is shown in Table 11-2. An estimate of stock and domestic use within these management areas is provided in Table 11-3.

The Mallee Basin contains all of the Murrayville WSPA as well as part of the Telopea Downs WSPA and part of the Kaniva TCSA GMA and Kaniva WSPA. The Mallee Basin also includes the border groundwater management zones 9B, 10B and 11B, and part of Zone 8B. The volumes described in the Table 11-2 are totals for the management areas and include the area that falls outside the Mallee Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

**Table 11-2 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/year) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Kaniva WSPA (<90%) | 25 – 140 | 6,950 | 6,918 | Not available | 3,321 | Not available [6] |
| Kaniva TCSA GMA (80%) | TCSA[7] | 1,100 | 0 | Not available | Not available | Not available [6] |
| Murrayville WSPA | TLA[8] | 10,883 | 8,317 | 4,868 | Not applicable | 10,883 |
| Telopea Downs WSPA (39%) | 55 – 195 | 13,435 | 10,682 | 3,556 | Not applicable | Not available [6] |
| Border Zone 8B (<90%) | All Depths | 6,760 | 2,210 | Not available | 1,061 | Not available [6] |
| Border Zone 9B | All Depths | 5,960 | 1,500 | Not available | 720 | Not available [6] |
| Border Zone 10B | All Depths | 6,720 | 6,178 | Not available | 2,965 | Not available [6] |
| Border Zone 11B | All Depths | 1,823 | 1,000 | Not available | 480 | Not available [6] |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage (except Grampians Wimmera Mallee Water).

(4) Where estimate is not available, figure is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) No estimate of Total Water Resource is applicable as >10 per cent GMA/WSPA is located outside the river basin.

(7) TSCA – Tertiary Sand Confined Aquifer.

(8) TLA – Tertiary Limestone Aquifer.

**Table 11-3 Number of Stock and Domestic Bores and Estimated**

| Water Supply Protection Area/Groundwater Management Area | No. of Stock and Domestic Bores[1] | Estimated Stock and Domestic Use (assuming 2ML/bore)[1] |
|---|---|---|
| Kaniva WSPA | 180 | 360 |
| Kaniva TSCA GMA | N/A | N/A |
| Murrayville WSPA | 320 | 640 |
| Telopea Downs WSPA | 190 | 380 |
| Border Zone 8B | 115 | 230 |
| Border Zone 9B | 50 | 100 |
| Border Zone 10B | 240 | 480 |
| Border Zone 11B | 20 | 40 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 11.8 Recycled Water

There are no sewage treatment plants within the Mallee Basin.

# 12. Wimmera Basin

## 12.1 Location of Water Resources

The Wimmera Basin is located within the Murray-Darling Basin. 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 terminate at Lake Hindmarsh and Lake Albacutya. The Avon and Richardson Rivers, which are also include in the water accounts for the Wimmera Basin, flow into and terminate in Lake Buloke. A map of the river basin is shown in Figure 12-1.

Groundwater Management Areas (GMAs) within the Wimmera Basin include the whole Balrootan GMA and Nhill GMA, and part of the Goroke GMA.

## 12.2 Responsibilities for Management of Water Resources

In 2003/04 Wimmera Mallee Water was 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. Wimmera Mallee Water was responsible for managing groundwater pumping and surface water resources including farm dams and private diversions. Grampians Water was responsible for urban water supply in the Wimmera and Mallee Basins, including Horsham, Stawell and Halls Gap, and some towns in the Hopkins Basin including Ararat, which uses water from the Wimmera-Mallee system. Central Highlands Water supplies the towns of Landsborough and Navarre. The Wimmera Catchment Management Authority was responsible for waterway management in the Wimmera River Catchment, and the North Central Catchment Management Authority was responsible for waterway management in the Avon and Richardson River catchments.

## 12.3 Seasonal Overview

Conditions in the Wimmera Basin remained extremely dry in 2003/04. In July 2003 the storages in the Wimmera Mallee Supply system were only 10 per cent full, with many large storages such as Lake Lonsdale and Toolondo Reservoir empty. Rainfall conditions in the Wimmera Basin in 2003/04 were drier than average cross the whole of the basin. The effect on streamflows across the basin varied. Inflows to Wartook Reservoir located in the Grampians Ranges were 85 per cent of their long-term average and inflows to Lake Bellfield were 77 per cent. Inflows in the upper Wimmera River at Glenorchy were less than 10 per cent of long-term averages and inflows to the Avon and Richardson River were close to zero during the year.

**Figure 12-1 Map of the Wimmera Basin**

Due to the extreme dry conditions, Wimmera Mallee Water had plans in place in July 2003 to cart water by truck to towns and farmhouses usually supplied by the channel system. After rainfall in July and August increased storage levels, water could be supplied via the channel system, but with severe restrictions in place. Only one dam per enterprise was filled during the winter stock and domestic season, this was approximately 18 per cent of the allocations. Only one dam per enterprise was filled during the summer stock and domestic season, with additional water being supplied to properties with significant stock numbers, but with severe restrictions in place.

The seasonal allocation to irrigators in the Wimmera basin was zero per cent of entitlement. The urban restrictions in place during the year are listed below:

- Stage 3 (of 4 stage) restrictions were in place in July 2003, continuing from 17 March 2003, at Wychitella, Borung, Wedderburn and Korong Vale (supplied from Wimmera system).
- Stage 3 (of 5 stages) restrictions were in place in July 2003, continuing from 1 February 2003, in Ararat, Birchip, Donald, Edenhope (groundwater), Glenorchy, Great Western, Halls Gap, Harrow (groundwater), Horsham, Jeparit, Minyip, Murtoa, Natimuk, Noradjuha, Patchewollock, Pimpinio, Pomonal, Quambatook, St Arnaud, Stawell, Reids (Taits) Lane. Restrictions were lifted from Stage 3 in Patchewollock on 24 October 2003. Stage 3 restrictions were eased to Stage 1 at Quambatook on 20 February 2004.
- Stage 3 restrictions were in place in July 2003, continuing from 1 November 2003, in Berriwillock, Beulah, Charlton, Clear Lake, Culgoa, Dimboola, Dooen, Hopetoun, Lalbert, Marnoo, Nullawil, Rainbow, Tarranyurk, Warracknabeal, Watchem, and Wycheproof.
- Stage 4 restrictions were in place in July 2003, continuing from 1 February 2003, in Antwerp, Brim, Jung, Lascelles, Rupanyup, Woomelang, and Yaapeet. Stage 4 restrictions were eased to Stage 3 on 21 November 2003.
- Stage 2 restrictions were in place in July 2003, continuing from 1 February 2003, in Elmhurst. Stage 2 restrictions were eased to Stage 1 on 31 October 2003. Stage 1 restrictions were lifted on 21 November 2003.

Water quality in the Wimmera River below harvesting points was affected because of the very low flows.

Some small algal blooms occurred in the lower Wimmera River over summer and a fish kill in the Jeparit Weir pool occurred in November and December 2003.

## 12.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Wimmera Basin are shown in Table 12-1.

**Table 12-1 Summary of total water resource and water use in Wimmera Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 142,320 | 58,090 |
| Groundwater [1] | Not available | 732 |
| Recycled water | 2,660 | 2,540 |

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

## 12.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Wimmera Basin.

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 under 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.

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 the 1st of November 2004.

A total of 8,215 ML was allocated from the Wimmera-Mallee system to the Glenelg and Wimmera rivers in 2003/04. The water allocated to the environment included 3,300 ML of Glenelg River compensation flow and 4,915 ML environmental flows generated from the Northern Mallee Pipeline Scheme. The Inter-Catchment Advisory Group determined the split of the environmental allocation between the Glenelg and Wimmera basins. As a result of these negotiations, the Wimmera River received an environmental allocation of 3,856 ML. This water was released from storage to the Wimmera River and MacKenzie River.

Environmental flows were released in the lower Wimmera River from Taylors Lake between December 2003 and March 2004. These releases were made in line with the recommendations from an environmental flow study conducted for the river in 2002. However due to the limited volume of water available, not all of the environmental flows needed to maintain basic environmental health could be released. Therefore, priority flow components including a spring fresh, base flow and a summer fresh were released into the river. Flows reduced surface water salinities in the lower Wimmera.

Environmental flows were released in the MacKenzie River from Lake Wartook between December 2003 and April 2004. Again, due to the limited amount of water available, releases were prioritised, and summer freshes were provided to connect the pools, reduce cease-to-flow periods and maintain base flow. There are large water losses in the Wimmera River and only 2,000 ML of flows was recorded in the Wimmera River at Lochiel (gauge 415246) during 2003/04.

Water that is available to the environment in the Wimmera River flows into 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 Wimmera Catchment Management Authority continued to work on waterway restoration, primarily in the upper catchment. Works included bed, bank and gully erosion stabilisation, fencing and revegetation of the Wimmera River and important tributaries such as Seven Mile, Six Mile and Concongella Creeks.

In 2003/04 the Wimmera-Mallee domestic and stock water supply system delivered approximately 19,000 ML. However the losses incurred in supplying this water were in the order of 54,000 ML. The Wimmera-Mallee Pipeline Project aims to pipe the domestic stock

water supply system, covering an area of approximately 2.3 million hectares, to reduce losses via seepage and evaporation. Approximately 83,000 ML of annual savings will be available for other uses, such as additional environmental flows in the Wimmera and Glenelg Rivers. Despite a formal allocation being made to the environmental water reserve for these rivers, the available water is still insufficient to provide for the long-term health of the Wimmera River. 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 and the expected projects costs are about $500 million dollars, which will be funded by Federal, State and Local governments and the community.

## 12.6 Surface Water Resources

### 12.6.1 Water Balance

In July 2003 the major storages in the Wimmera Basin held only 10 per cent of their capacity. During the year the catchment inflows were 107,270 ML, approximately 34 per cent of the long-term average of 316,400 ML (NLWRA, 2001). In June 2004 the volume in storage had increased to 15 per cent of capacity.

The largest diversions from the basin were for irrigation and stock and domestic use of 32,420 ML. However, the losses from the system (not including losses from the stock and domestic supply system) were larger, estimated to be 63,940 ML. The evaporation from storages alone was 16 per cent of the catchment inflows. The losses accounted for in the water balance do not include any losses that occur while water is being transferred from storages to the point of use.

Wimmera Mallee Water received 10,430 ML of inflows from the Waranga Western Channel and 34,930 ML was transferred to the Wimmera basin from the Glenelg Basin. These inter-basin transfers are from diversions made in other basins and are not shown in the surface water balance for the Wimmera River. Wimmera Mallee Water supplied 1000 ML to the Avoca Basin via the Wimmera-Mallee Domestic and Stock Water Supply System.

Grampians Water transferred 1,200 ML to the Hopkins Basin to supply urban centres including Ararat, Willaura and Lake Bolac. Grampians Water also supplied 30 ML to Glenelg Water for the town of Glenthompson. Irrigation and stock and domestic water are supplied to the Avoca Basin via the Wimmera channel system.

**Table 12-2 Balance of surface water in the Wimmera Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 43,290 |
| Volume in storage at end of year | 61,580 |
| **Change in storage** | **18,290** |
| **Inflows** | |
| Catchment inflow | 107,270 |
| Inflows from the Glenelg Basin | 34,930 |
| Irrigation return flow | 0 |
| Treated effluent discharged back to river [(1)] | 120 |
| **Subtotal** | **142,320** |
| **Diversions** | |
| Urban diversions | 9,460 |
| Irrigation and domestic and stock diversions | 32,420 |
| Unregulated licensed private diversions | 1,880 |
| Catchment farm dams | 14,330 |
| **Subtotal** | **58,090** |
| **Losses** | |
| Evaporation losses from major storages | 22,060 |
| Losses from catchment farm dams | 8,590 |
| In-stream losses to groundwater and evaporation | 33,290 |
| **Subtotal** | **63,940** |
| **Water passed at outlet of basin** | |
| River outflows to Wimmera terminal lakes (measured at Lochiel) | 2,000 |
| River outflows to Lake Buloke | 0 |
| | |
| **Volume available to the environment in the Wimmera Basin** | |
| Environmental releases to the river from storage | 3,860 |
| River outflows to terminal lakes (measured at Lochiel) | 2,000 |

(1) Assumes non-reused water is discharged to waterways

### 12.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Wimmera Basin is estimated to be around 22,310 ML (Table 12-3). Average annual usage from the dams is estimated to be 14,330 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 22,920 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 12-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 12,950 | 6,470 | n/a |
| Irrigation | 9,360 | 7,860 | n/a |
| **TOTAL** | **22,310** | **14,330** | **22,920** |

n/a = information not available

### 12.6.3 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 12-4. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume that could have been diverted in 2003/04. Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

In 2004 bulk entitlements were granted to Grampians Water, the Minister for Environment and Wimmera Mallee Water for the Wimmera and Glenelg Rivers. There are also three bulk entitlements currently in progress for Grampians Water. Values are not reported against these bulk entitlements. The bulk entitlement conversion orders completed during 2003/04 will be reported against in subsequent water accounts.

**Table 12-4 Volume of water diverted under surface water entitlements in the Wimmera Basin**

| Entitlement | Bulk entitlement or licensed volume | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Central Highlands Water* | | | | | |
| Landsborough – Navarre | 60 | 0 | 60 | 18 | Yes |
| *Grampians Water* | | | | | |
| Ararat, Great Western, Halls Gap & Stawell | n/a | 0 | n/a | 1,964 | n/a |
| Elmhurst | n/a | 0 | n/a | 20 | n/a |
| Willaura, Moyston, Lake Bolac & Wickliffe | n/a | 0 | n/a | 247 | n/a |
| Wimmera and Glenelg Rivers | n/a | 0 | n/a | 7,260 | n/a |
| *Wimmera Mallee Water* | | | | | |
| Wimmera and Glenelg Rivers | n/a | 0 | n/a | 34,298 | n/a |
| *Minister for Environment* | | | | | |
| Wimmera and Glenelg Rivers | n/a | 0 | n/a | 8,265 | n/a |
| **Total volume of bulk entitlements** | **60** | **0** | **60** | **52,072** | |
| *Unregulated licensed diverters* | 2,601 | 0 | 2,601 | 1,875 | |

n/a – not applicable because the bulk entitlement conversion order was not finalised at the start of 2003/04

### 12.6.4 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

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

### 12.6.5 Compliance with Streamflow Management Plans

There is no Streamflow Management Plans (SFMP) currently in operation in the Wimmera Basin. A SFMP is being prepared for the Upper Wimmera River.

## 12.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Wimmera Basin, excluding stock and domestic use, is shown in Table 12-5. This table shows that the Balrootan GMA, which supplies the town of Nhill, is over allocated (156 per cent of PAV), but estimated usage in 2003/04 was below the PAV. An estimate of stock and domestic use within these management areas is provided in Table 12-6.

The Wimmera Basin contains all of the Balrootan GMA and Nhill GMA and part of the Goroke GMA. The volumes described in the Table 12-5 are totals for the management areas and include the area that falls outside the Wimmera-Avon River Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

**Table 12-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits [2] | PAV (ML/year) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas [4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Balrootan GMA | 60 – 125 | 980 | 1,524 | Not available | 732 | 1,524 |
| Goroke GMA (63%) | TCSA [6] | 2,200 | 0 | Not available | 0 | Not available [7] |
| Nhill GMA | TCSA [6] | 1,200 | 0 | Not available | 0 | 1,200 |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage (except Grampians Wimmera Mallee Water).

(4) In non-metered areas, estimate of use is based on the 'State Average' use for metered areas equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) TSCA – Tertiary Sand Confined Aquifer.

(7) No estimate of Total Water Resource is applicable as >10 per cent GMA/WSPA is located outside the river basin.

**Table 12-6 Number of Stock and Domestic Bores and Estimated**

| Water Supply Protection Area/Groundwater Management Area | No. of Stock and Domestic Bores[1] | Estimated Stock and Domestic Use (assuming 2ML/bore)[1] |
|---|---|---|
| Balrootan GMA | 85 | 170 |
| Goroke GMA | N/A | N/A |
| Nhill GMA | N/A | N/A |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 12.8 Recycled Water

Grampians Water operated 12 sewage treatment plants in the Wimmera Basin, and reuses 100 per cent of the effluent at eight of these plants. During 2003/04 approximately 95 per cent of the treated effluent was reused for activities such as pasture improvement, horticulture and vineyards and for watering recreational facilities and parks (Table 12-7).

**Table 12-7 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Birchip | Grampians Region WA | 62 | 62 |
| Dimboola | Grampians Region WA | 110 | 110 |
| Donald | Grampians Region WA | 102 | 102 |
| Horsham | Grampians Region WA | 1,210 | 1,210 |
| Halls Gap | Grampians Region WA | 150 | 150 |
| Jeparit | Grampians Region WA | 29 | 0 |
| Murtoa | Grampians Region WA | 64 | 64 |
| Natimuk | Grampians Region WA | 22 | 0 |
| Nhill | Grampians Region WA | 189 | 149 |
| Rainbow | Grampians Region WA | 26 | 0 |
| Stawell | Grampians Region WA | 590 | 590 |
| Warracknabeal | Grampians Region WA | 106 | 106 |
| **TOTAL** | | **2,660** | **2,543** |

# 13. East Gippsland Basin

## 13.1 Location of Water Resources

The East Gippsland Basin is located within the South East Coast Drainage Division, and is the most eastern river basin in Victoria. The headwaters of the most eastern river, the Genoa River, originate in New South Wales and flow through Victoria before reaching the ocean near Mallacoota. Other rivers in the basin include the Betka 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 13-1.

There are no Groundwater Management Areas or Water Supply Protection areas located within the East Gippsland Basin.

## 13.2 Responsibilities for Management of Water Resources

Southern Rural Water is the licensing authority in this basin and manages groundwater and surface water licensed diversions. East Gippsland Water is responsible for urban water supply in the basin, including the towns of Mallacoota, Cann River and Bemm River. The East Gippsland Catchment Management Authority is responsible for waterway management in the basin.

## 13.3 Seasonal Overview

Rainfall conditions in the East Gippsland Basin in 2003/04 were drier than average across the whole of the basin. This was reflected in the streamflow recorded at Cann River (gauge number 221201) where for 2003/04, the streamflow was only 14 per cent of the long-term average.

There were no irrigation bans imposed in the region, and no water restrictions in any towns. There are no seasonal irrigation allocations in the East Gippsland Basin.

Water quality in the East Gippsland Basin remained good throughout 2003/04 and there were no reports of water quality adversely affecting consumptive use or environmental condition. In 2003/04 East Gippsland Catchment Management Authority removed 2.5 km of willows on the Combienbar River at Combienbar. Management of streamside and in-stream environmental weeds on the Genoa and Cann Rivers, which were predominantly willows and blackberries, also took place. Construction and maintenance of fencing was undertaken throughout the far east of the basin, including the Combienbar River, which flows into the Heritage Listed Bemm River. Fencing was completed to protect intact native and newly rehabilitated riparian zones and exclude stock access from waterways. The benefits of this work to protect the riparian zone and include reduction in sediment and nutrient run off and the provision of food and shade for aquatic flora and fauna.

## 13.4 Summary of the Total Water Resources in the Basin

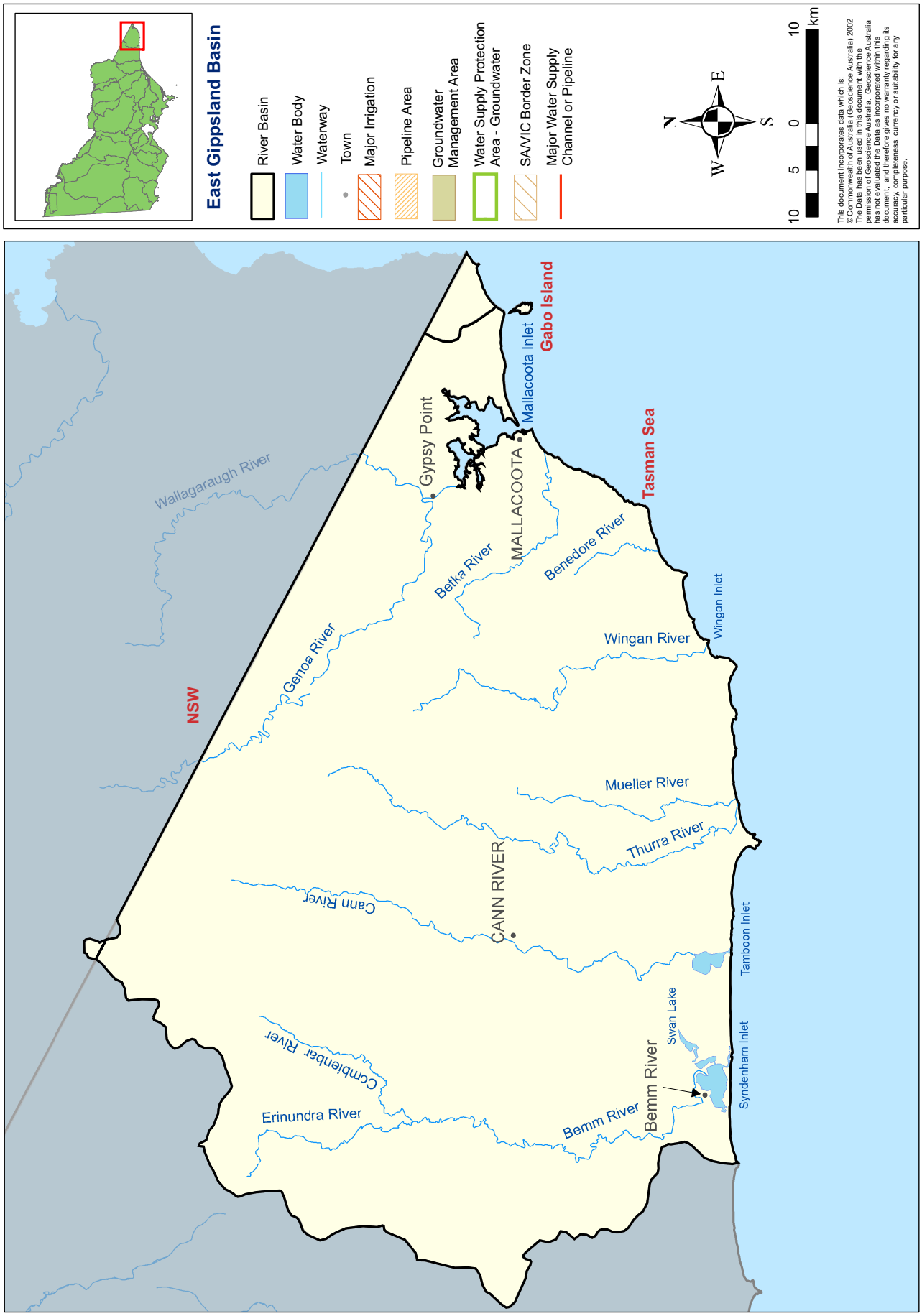
The total volume of water available and supplied from water resources in the East Gippsland Basin are shown in Table 13-1. It can be seen from this table that the East Gippsland Basin has low extraction relative to the available resource.

**Table 13-1 Summary of total water resource and water use in East Gippsland Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 160,470 | 1,920 |
| Groundwater (1) | 0 | 0 |
| Recycled water | 20 | 20 |

(1) There are no GMAs or WSPAs in the East Gippsland Basin. Groundwater use from unincorporated areas was not available for the water accounts.

**Figure 13-1 Map of the East Gippsland Basin**



## 13.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the East Gippsland Basin. The water available to the environment at the basin outlet was 158,490 ML, which is about 99 per cent of the total streamflow in the basin. This amount consists of environmental 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.

## 13.6 Surface Water Resources

### 13.6.1 Water Balance

A surface water balance for the East Gippsland Basin is shown in Table 13-2. The inflows to the East Gippsland Basin originate in both New South Wales and Victoria. On average NSW contributes 26 per cent of total inflows to the basin. In 2003/04 the total inflows to the East Gippsland Basin were only 18 per cent of their long-term average. Approximately two per cent of the catchment inflows were diverted for consumptive use, predominantly by farm dams. There are no major storages in the East Gippsland Basin with a capacity greater than 1,000 ML.

The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. In the East Gippsland Basin the inflows were back calculated by adding diversions to outflows and so no estimate of these losses is available.

**Table 13-2 Balance of surface water in the East Gippsland Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | - |
| Volume in storage at end of year | - |
| **Change in storage** | **0** |
| **Inflows** | |
| Catchment inflow(1) | 160,470 |
| Irrigation return flow | - |
| Treated effluent discharge back to river | 0 |
| **Subtotal** | **160,470** |
| **Diversions** | |
| Urban diversions | 260 |
| Unregulated licensed private diversions | 560 |
| Catchment farm dams | 1,100 |
| **Subtotal** | **1,920** |
| **Losses** | |
| Evaporation losses from major storages | - |
| Losses from catchment farm dams | 60 |
| In-stream losses to groundwater and evaporation(2) | 0 |
| **Subtotal** | **60** |
| **Water passed at outlet of basin** | |
| River outflows to the ocean | 158,490 |
| | |
| **Volume available to the environment in the East Gippsland Basin** | **158,490** |

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

(2) Assumed to be zero because not readily available

### 13.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the East Gippsland Basin is estimated to be around 1,600 ML (Table 13-3). Average annual usage from the dams is estimated to be 1,100 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 1,200 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 13-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 770 | 390 | n/a |
| Irrigation | 850 | 710 | n/a |
| **TOTAL** | **1,620** | **1,100** | **1,160** |

n/a = information not available

### 13.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water rights, diversion licences or sales water within the basin in 2003/04.

### 13.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk 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 that could have been diverted in 2003/04. Full details of compliance with bulk entitlements are provided in the Resource Manager's 2003/04 Report for the Gippsland Urban Basin Water Accounts (SRW, 2004). Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

**Table 13-4 Volume of water diverted under surface water entitlements in the East Gippsland Basin**

| Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *East Gippsland Water* | | | | | |
| Bemm River | 100 | 0 | 100 | 36 | yes |
| Cann River | 192 | 0 | 192 | 61 | yes |
| Mallacoota | 330 | 0 | 330 | 165 | yes |
| **Total volume of bulk entitlements** | **622** | **0** | **622** | **262** | |
| *Unregulated licensed diverters* | 752 | 0 | 752 | 546 | |

### 13.6.5 Compliance with Passing and Environmental 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 2003/04. The maintenance of these passing flow requirements was not independently audited.

### 13.6.6 Compliance with Streamflow Management Plans

There is no Streamflow Management Plan (SFMP) currently in operation in the East Gippsland Basin.

## 13.7 Groundwater Resources

There are no Groundwater Management Areas or Water Supply Protection Areas located within the East Gippsland Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

East Gippsland Water operates a groundwater bore for the town of Mallacoota. In 2003/04 it extracted 31.5 ML.

## 13.8 Recycled Water

A summary of the volume of water recycled in 2003/04 in East Gippsland Basin is shown (Table 13-5). 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. The water recycled by East Gippsland Water (not only in the East Gippsland Basin) is re-used on a number of applications including pasture and tree plantations.

**Table 13-5 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Mallacoota | East Gippsland Water | 16 | 16 |
| **TOTAL** | | **16** | **16** |

# 14. Snowy Basin

## 14.1 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 is 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 14-1. Groundwater Management Areas (GMAs) within the Snowy Basin include the whole of the Orbost GMA.

## 14.2 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 Snowy Basin, including the towns of Buchan and Orbost. The East Gippsland Catchment Management Authority is responsible for waterway management in the Snowy Basin.

## 14.3 Seasonal Overview

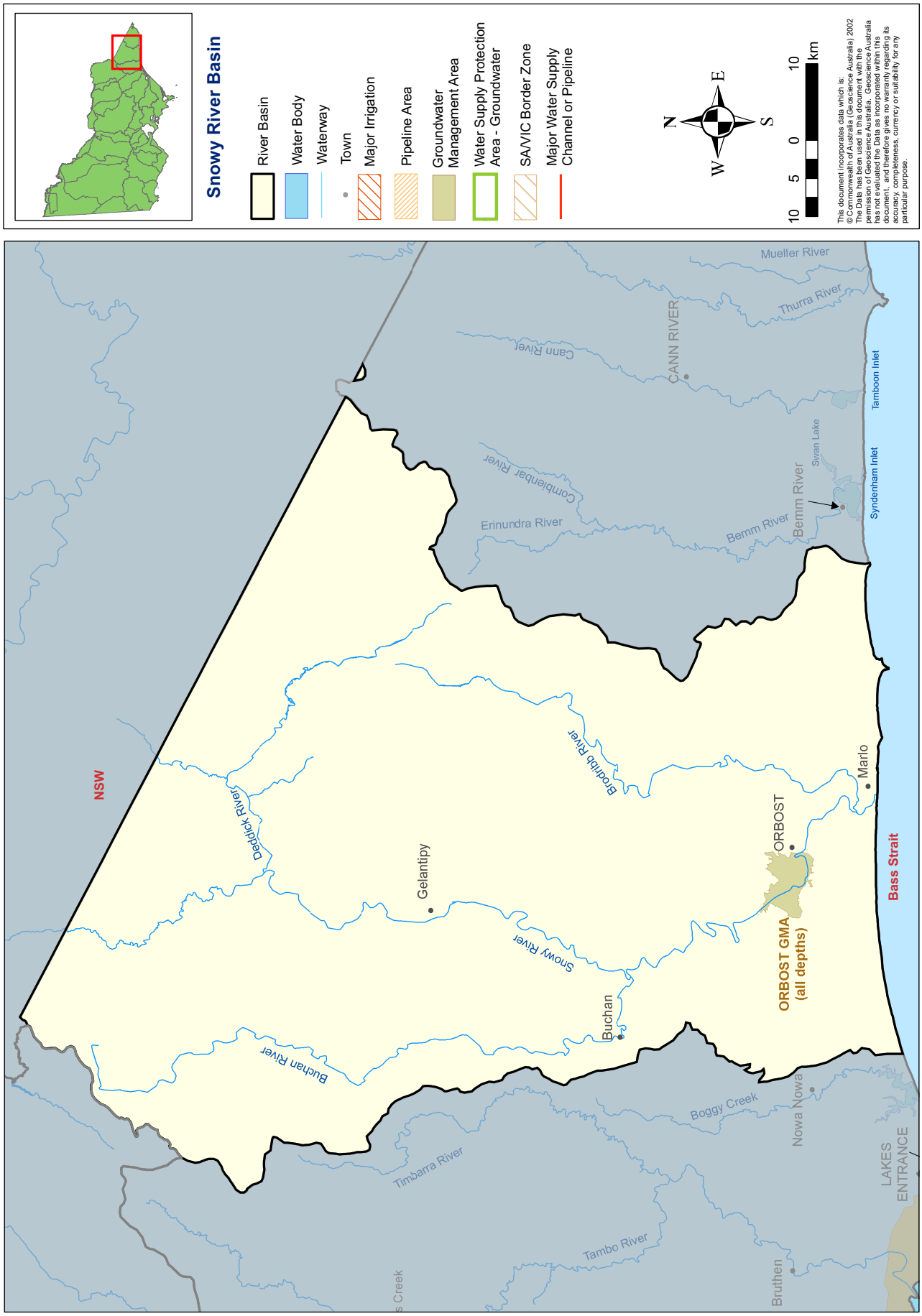
The Snowy Basin experienced less rainfall than average. This was reflected in the streamflows, which were also less than average. The streamflow recorded at Brodribb River (gauge number 222202) in 2003/04 was only 26 per cent of the long-term average.

The impacts of the 2003 bushfires both during and after the event were significant, the fire burnt 366,308 ha of the Snowy, Mitchell and Tambo catchments. There are ongoing concerns about the impacts of the 2003 bushfires on affected catchments and waterways. Investigations into the recovery status of fire affected catchments have noted that some areas are slow to recover, posing an increased potential risk to the receiving waters, through sedimentation, nutrient transport, etc. High levels of turbidity, resulting from the 2003 bushfires, were experienced in the Buchan River, affecting the supply for the Buchan Township. Stage 2 (of 4 stages) restrictions were in operation in the town of Buchan for the whole of 2003/04 due to the water quality issues.

Maintenance of existing plantation fences and replanting native vegetation was undertaken in 2003/04 on the Heritage Listed Snowy River and the Buchan River. The rehabilitation program included planting and establishment of 60,000 rainforest plant species. The benefits of this work to the waterway's riparian zone include reduction in sediment and nutrient run off and the provision of food and shade for aquatic flora and fauna. The intensive revegetation program aims to encourage a 'self sustaining' riparian zone, where native species regenerate naturally and exotic species are out-competed by a strengthening native riparian zone.

In April 2004 the East Gippsland Catchment Management Authority commenced a willow control program covering 32 km along the Snowy River, from the Victorian and New South Wales border to McKillops Bridge. The willow program is part of the Snowy River Rehabilitation Project. The program is expected to take at least seven years. Stock crossings were also constructed in Spring and Wall Creeks, to encourage a minimal impact approach to the necessary crossing of stock through a waterway.

**Figure 14-1 Map of the Snowy Basin**



## 14.4 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 14-1.

**Table 14-1 Summary of total water resource and water use in Snowy Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 544,260 | 7,000 |
| Groundwater [1] | 1,200 | 464 |
| Recycled water | 320 | 320 |

(1) Much of the available resource discharges to streams and will be included in the total water resource for surface water. These volumes exclude the resource and extraction from unincorporated areas.

## 14.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Snowy Basin. However, 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 21 per cent of the original flow (212,000 ML) to the Snowy River by 2012. Ultimately, the inter-governmental commitment aims to return 28 per cent of original flow levels (294,000 ML) to the Snowy River. Water savings projects in the Goulburn and Murray basins have provided 26,600 ML to the Snowy River, which will be available for release from May 2005. Further water savings projects are underway to achieve the 141,000 ML of flow Victoria has committed to the Snowy River.

In the Snowy Basin, the water available to the environment was 536,570 ML, which is around 99 per cent of the total streamflow in the basin (Table 14-2). This amount consists of the water flowing into Victoria from NSW, environmental flows required under 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.

## 14.6 Surface Water Resources

### 14.6.1 Water Balance

A surface water balance for the Snowy Basin is shown in Table 14-2. The total volume of water flowing into the Victorian Snowy Basin from NSW in the Snowy River was recorded to be 75,690 ML in 2003/04. This accounts for 14 per cent of the total basin inflows. The Victorian inflows to the Snowy River were 470,000 ML, only 55 per cent of the long-term average.

The Victorian diversions from the Snowy River were less than two per cent of the Victorian inflows to the Snowy River. There are no major storages in the Snowy Basin greater than 1,000 ML in size.

The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. In the Snowy Basin the inflows were back calculated by adding diversions to outflows and so no estimate of these losses is available.

**Table 14-2 Balance of surface water in the Snowy Basin**

| Water Account Component | Volume (ML) |
|---|---|
| Storage Volume | |
| Volume in storage at start of year | 0 |
| Volume in storage at end of year | 0 |
| **Change in storage** | **0** |
| **Inflows** | |
| Inflows from NSW[(1)] | 75,690 |
| Catchment inflow[(2)] | 468,570 |
| Irrigation return flow | 0 |
| Treated effluent discharge back to river[(3)] | 0 |
| **Subtotal** | **544,260** |
| **Diversions** | |
| Urban diversions | 800 |
| Unregulated licensed private diversions | 2,840 |
| Catchment farm dams | 3,360 |
| **Subtotal** | **7,000** |
| **Losses** | |
| Evaporation losses from major storages | 0 |
| Losses from catchment farm dams | 690 |
| In-stream losses to groundwater and evaporation[(4)] | 0 |
| **Subtotal** | **690** |
| **Water passed at outlet of basin** | |
| River outflows to the ocean | 536,570 |
| | |
| **Volume available to the environment in the Snowy Basin** | **536,570** |

(1) Inflows from NSW recorded on the Snowy River at Burnt Hut Crossing (gauge 222013)

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

(3) Assumes non-reused water is discharged to waterways

(4) Assumed to be zero because not readily available

### 14.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Snowy Basin is estimated to be around 5,300 ML (Table 14-3). Average annual usage from the dams is estimated to be 3,400 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 4,100 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 14-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 3,140 | 1,570 | n/a |
| Irrigation | 2,120 | 1,780 | n/a |
| **TOTAL** | **5,260** | **3,350** | **4,050** |

n/a = information not available

### 14.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water rights, diversion licences or sales water within the basin in 2003/04.

### 14.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 14-4. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume that could have been diverted in 2003/04. Full details of compliance with bulk entitlements are provided in the Resource Manager's 2003/04 Report for the Gippsland Urban Basin water Accounts (SRW, 2004). Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

**Table 14-4 Volume of water diverted under surface water entitlements in the Snowy Basin**

| Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *East Gippsland Water* | | | | | |
| Buchan | 170 | 0 | 170 | 33 | yes |
| Orbost | 2,031 | 0 | 2,031 | 772 | yes |
| **Total Volume of bulk entitlements** | **2,201** | **0** | **2,201** | **805** | |
| *Unregulated licensed diverters* | 3,833 | 0 | 3,833 | 2,842 | |

### 14.6.5 Compliance with Passing and Environmental 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 2003/04.

### 14.6.6 Compliance with Streamflow Management Plans

There are no Streamflow Management Plans (SFMP) currently in operation or planned in the Snowy Basin.

## 14.7 Groundwater Resources

The Snowy Basin contains all of the Orbost GMA. A summary of licensed volume and use in this GMA, excluding stock and domestic use, is shown in Table 14-5. An estimate of stock and domestic use is provided in Table 14-6. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

**Table 14-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits [2] | PAV (ML/year) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas (ML) | Total Water Resource [4] (ML) |
|---|---|---|---|---|---|---|
| Orbost GMA | 20 – 45 | 1,200 | 1,200 | 464 | Not applicable | 1,200 |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage

(4) The PAV or licensed volume, which ever is greater

**Table 14-6 Number of Stock and Domestic Bores and Estimated**

| Water Supply Protection Area/Groundwater Management Area | No. of Stock and Domestic Bores[1] | Estimated Stock and Domestic Use (assuming 2ML/bore)[2] |
|---|---|---|
| Orbost GMA | Not available | Not available |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 14.8 Recycled Water

The volume of water recycled in the Snowy Basin is shown in Table 14-7. 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. The water recycled by East Gippsland Water (not only in the Snowy Basin) is re-used on a number of applications including pasture and tree plantations.

**Table 14-7 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Orbost | East Gippsland Water | 323 | 323 |
| **TOTAL** | | **323** | **323** |

# 15. Tambo Basin

## 15.1 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 15-1. There are no Groundwater Management Areas or Water Supply Protection Areas in the Tambo Basin.

## 15.2 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.

## 15.3 Seasonal Overview

Rainfall in the Tambo Basin was below average in 2003/04. This is reflected in the streamflow recorded in the Nicholson River (gauge number 223206), which was 35 per cent of the long-term average.

The impacts of the 2003 bushfires, both during and after the event, were significant. The fire burnt 366,308 ha of the Snowy, Mitchell and Tambo catchments. There are ongoing concerns about the impacts of the 2003 bushfires on affected catchments and waterways. Investigations into the recovery status of fire affected catchments have noted that some areas are slow to recover, posing an increased potential risk to the receiving waters, through sedimentation, nutrient transport, etc. High levels of turbidity, resulting from the 2003 bushfires, were experienced in the Tambo River, affecting the supply for the Swifts Creek Township.

Stage 2 (of 4 stages) restrictions were in operation in the town of Swifts Creek for the whole of 2003/04 due to the water quality issues. There were stage 1 restrictions for irrigation extractions from the Lower Tambo River in March 2004. There are no seasonal allocations in the Tambo Basin.

In 2003/04 instream and stream side management of pest plants along the Tambo River was undertaken for a length of eight kilometres. Trial works were also undertaken in the Tambo Basin to control gully erosion in creeks running into the Ramsar-listed Gippsland Lakes on North Arm, Lakes Entrance, by planting rainforest species. Plants suitable for each location were planted in a pattern that will realign the flow path of the creek to reduce nutrient inflows to the Gippsland Lakes.

Waterline revegetation works took place along the lower Tambo River using salt tolerant plants that will bind the bank and protect it from wave actions for a distance of one kilometre. The upper section was planted with species that respond to bank slumping by root coppicing.

**Figure 15-1 Map of the Tambo Basin**

## 15.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Tambo Basin is shown in Table 15-1. The total extraction does not include the 1,250 ML of surface water transferred from the Mitchell River to the towns of Bruthen, Nicholson, Johnsonville, Swan Reach, Metung and Lakes Entrance located in this basin.

**Table 15-1 Summary of total water resource and water use in Tambo Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 89,180 | 7,100 |
| Groundwater (1) | 0 | 0 |
| Recycled water | 937 | 937 |

(1) There are no GMAs or WSPAs in the Tambo Basin. Groundwater use from unincorporated areas was not available for the water accounts.

## 15.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Tambo Basin. The water available to the environment at the basin outlet was 80,100 ML in 2003/04, which is about 90 per cent of the total streamflow in the basin. This amount consists of environmental 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. The outlet of the Basin is the Tambo River, which passes water out of the basin into the Gippsland Lakes.

## 15.6 Surface Water Resources

### 15.6.1 Water Balance

A surface water balance for the Tambo Basin is shown in Table 15-2. Inflows to the Tambo Basin were only 27 per cent of the long-term average of 329,000 ML. The largest diversion of water from the basin was via farm dams.

The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. In the Tambo Basin the inflows were back calculated by adding diversions to outflows and so no estimate of these losses is available.

**Table 15-2 Balance of surface water in the Tambo Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 0 |
| Volume in storage at end of year | 0 |
| **Change in storage** | **0** |
| **Inflows** | |
| Catchment inflow[1] | 89,180 |
| Irrigation return flow | 0 |
| Treated effluent discharge back to river[2] | 0 |
| **Subtotal** | **89,180** |
| **Diversions** | |
| Urban diversions | 50 |
| Unregulated licensed private diversions | 3,080 |
| Catchment farm dams | 3,970 |
| **Subtotal** | **7,100** |
| **Losses** | |
| Evaporation losses from major storages | 0 |
| Losses from catchment farm dams | 1,970 |
| In-stream losses to groundwater and evaporation[3] | 0 |
| **Subtotal** | **1,970** |
| **Water passed at outlet of basin** | |
| River outflows to the ocean | 80,100 |
| | |
| **Volume available to the environment in the Tambo Basin** | **80,100** |

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

(2) Assumes non-reused water is discharged to waterways

(3) Assumed to be zero because not readily available

### 15.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Tambo Basin is estimated to be around 6,500 ML (Table 15-3). Average annual usage from the dams is estimated to be 4,000 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 5,900 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 15-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 4,490 | 2,250 | n/a |
| Irrigation | 2,050 | 1,720 | n/a |
| **TOTAL** | **6,540** | **3,970** | **5940** |

n/a = information not available

### 15.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water rights, diversion licences or sales water within the basin in 2003/04.

### 15.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 14-4. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume that could have been diverted in 2003/04. Full details of compliance with bulk entitlements are provided in the Resource Manager's 2003/04 Report for the Gippsland Urban Basin water Accounts (SRW, 2004). Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

No water was extracted under the Bruthen and Lakes Entrance Bulk Entitlements. These towns were supplied by water diverted from the Mitchell Basin under the Bairnsdale Bulk Entitlement.

**Table 15-4 Volume of water diverted under surface water entitlements in the Tambo Basin**

| Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *East Gippsland Water* | | | | | |
| Bruthen | 313 | 0 | 313 | 0 | yes |
| Lakes Entrance | 2,993 | 0 | 2,993 | 0 | yes |
| Nowa Nowa | 118 | 0 | 118 | 23 | yes |
| Swifts Creek | 224 | 0 | 224 | 31 | yes |
| **Total Volume of bulk entitlements** | **3,648** | **0** | **3,648** | **54** | |
| *Unregulated licensed diverters* | 4,100 | 0 | 4,100 | 3,080 | |

### 15.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

There are no minimum passing flow requirements of any bulk entitlement in the Tambo Basin.

### 15.6.6 Compliance with Streamflow Management Plans

There is no Streamflow Management Plan (SFMP) currently in operation in the Tambo Basin.

## 15.7 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 has not been included in the 2003/04 water accounts.

## 15.8 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 15-5). The water recycled by East Gippsland Water (not only in the Tambo Basin) is re-used on a

number of applications including pasture and tree plantations. The construction of the Bruthen Sewerage scheme was completed in June 2004. After treatment the reclaimed water will be re-used on a farm owned and operated by East Gippsland Water.

**Table 15-5 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Lakes Entrance | East Gippsland Water | 657 | 657 |
| Metung | East Gippsland Water | 88 | 88 |
| Paynesville | East Gippsland Water | 192 | 192 |
| **TOTAL** | | **937** | **937** |

# 16. Mitchell Basin

## 16.1 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-listed rivers. A map of the river basin is shown in Figure 16-1. Water Supply Protection Areas within the Mitchell Basin include the whole Wy Yung WSPA.

## 16.2 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 Mitchell Basin, including Bairnsdale. The East Gippsland Catchment Management Authority is responsible for waterway management in the Mitchell Basin.

## 16.3 Seasonal Overview

The Mitchell Basin experienced close to average rainfall in 2003/04 with streamflow recorded at the Dargo River (gauge number 224213) four per cent higher than the long-term average.

In April 2004, heavy rains in southern lowland areas of the Mitchell Basin resulted in major flooding in a number of tributary streams on the Redgum Plains and surrounding districts. Impacts of this event included major erosion of banks, loss and damage to stream stabilisation works, damage to stock exclusion fencing, sedimentation and damage to infrastructure, including roads and bridges.

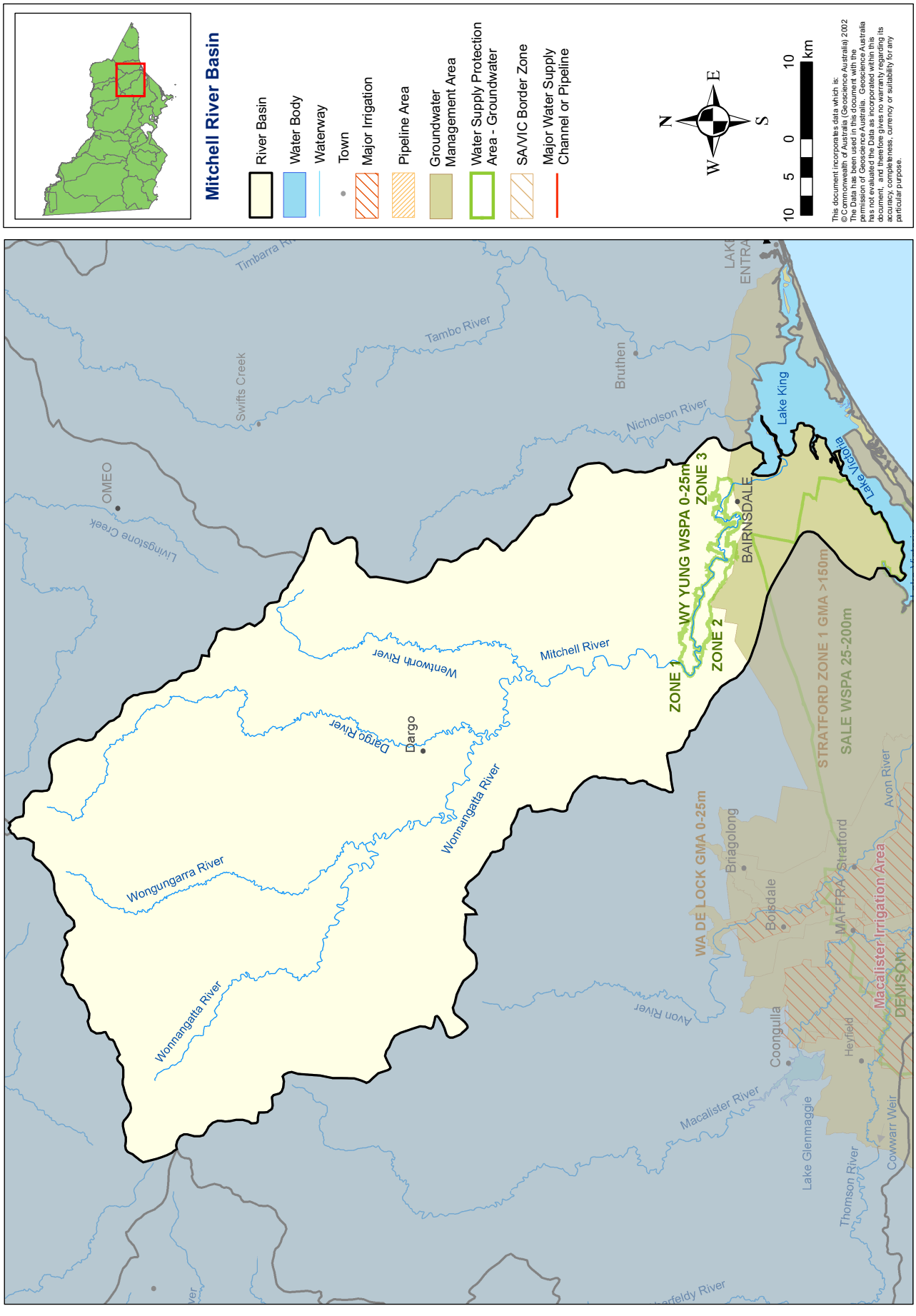
The impacts of the 2003 bushfires both during and after the event were significant, the fire burnt 366,308 hectares of the Snowy, Mitchell and Tambo Basins. There are ongoing concerns about the impacts of the bushfires on affected catchments and waterways. Investigations into the recovery status of fire affected catchments have noted that some areas are slow to recover, posing an increased potential risk to the receiving waters, through sedimentation, nutrient transport, etc. In 2003/04 there were high levels of turbidity in the Mitchell River, probably resulting from the 2003 bushfires. These water quality issues meant water was extracted very selectively during periods of lower turbidity.

During 2003/04 large capital works were undertaken in the basin to repair infrastructure in the upper Mitchell River catchment (Crooked River). Damaged during periods of high flow, repairs were made to four Large Woody Debris (LWD) structures and riparian fencing. These were important assets to repair, as the LWD structure provides valuable in stream habitat and fencing excludes stock access and protects riparian areas.

In-stream and streamside management of pest plants on the Dargo, Wonnangatta and Mitchell Rivers and Mount Taylor and Clifton Creeks were also carried out in 2003/04. The work included spraying of blackberries, willows, periwinkle and thistles for a total of 10 km. Pest animals (including rabbits and wombats) were managed along the upper reaches of the Mitchell River floodplain for a length of 1.5 km. Waterline revegetation works along the lower Mitchell River were undertaken to give protection to the bank from waterline to the top bank, for a length of 1.5 km. A selection of native plants suitable for this application were selected as well as salt tolerant plants to rectify damaged caused by wave action.

Stage 8 restrictions were imposed on unregulated diverters in the Mitchell River for a short period in March 2004. No urban restrictions were required during the year due to drought or water quality issues. However, there were periods during the year when East Gippsland Water had limited ability to divert water from the Mitchell River to supply the town of Bairnsdale due to low river levels.

**Figure 16-1 Map of the Mitchell Basin**



## 16.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Mitchell Basin are shown in Table 16-1. 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, which received 1,250 ML in 2003/04.

**Table 16-1 Summary of total water resource and water use in Mitchell Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 754,260 | 20,540 |
| Groundwater (1) | 9,070 | 2,438 |
| Recycled water | 1420 | 1420 |

(1) The total resource and use in the Mitchell Basin only includes GMAs or WSPAs that have more than 90 per cent of their surface area within the river basin boundary (i.e. the Wy Yung WSPA).

## 16.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Mitchell Basin. The water available to the environment at the basin outlet was around 97 per cent of the total amount of streamflow in the basin. This amount consists of environmental flows 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.

The water available to the environment in the Mitchell River passes out of the basin into the Gippsland Lakes, which have high environmental values, including Ramsar listing. 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 summer flow stress. 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 findings of a study into the freshwater needs of the Gippsland Lakes.

## 16.6 Surface Water Resources

### 16.6.1 Water Balance

A water balance for the Mitchell Basin is shown in Table 16-2. During 2003/04 streamflow in the Mitchell Basin was approximately 69 per cent of the long-term average flow, which is 1,100,000 ML/year (NLWRA, 2001). Approximately three per cent of the total basin inflows were diverted for consumptive use. There are no major storages in the Mitchell Basin that have a capacity greater than 1,000 ML.

The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. In the Mitchell Basin the inflows were back calculated by adding diversions to outflows and so no estimate of these losses is available.

**Table 16-2 Balance of surface water in the Mitchell Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 0 |
| Volume in storage at end of year | 0 |
| **Change in storage** | **0** |
| **Inflows** | |
| Catchment inflow(1) | 754,260 |
| Irrigation return flow | 0 |
| Treated effluent discharge back to river(2) | 0 |
| **Subtotal** | **754,260** |
| **Diversions** | |
| Urban diversions | 4,960 |
| Unregulated licensed private diversions | 11,020 |
| Catchment farm dams | 4,560 |
| **Subtotal** | **20,540** |
| **Losses** | |
| Evaporation losses from major storages | 0 |
| Losses from catchment farm dams | 1,000 |
| In-stream losses to groundwater and evaporation(3) | 0 |
| **Subtotal** | **1,000** |
| **Water passed at outlet of basin** | |
| River outflows to the ocean | 732,720 |
| | |
| **Water available to the environment in the Mitchell Basin** | **732,720** |

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

(2) Assumes non-reused water is discharged to waterways

(3) Assumed to be zero because not readily available

### 16.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Mitchell Basin is estimated to be around 7,100 ML (Table 16-3). Average annual usage from the dams is estimated to be 4,600 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 5,600 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 16-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 4,220 | 2,110 | n/a |
| Irrigation | 2,920 | 2,450 | n/a |
| **TOTAL** | **7,130** | **4,560** | **5,560** |

n/a = information not available

### 16.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water rights, diversion licences or sales water within the basin in 2003/04.

### 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 that could have been diverted in 2003/04. Full details of compliance with bulk entitlements are provided in the Resource Manager's 2003/04 Report for the Gippsland Urban Basin water Accounts (SRW, 2004). Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

**Table 16-4 Volume of water diverted under surface water entitlements in the Mitchell Basin**

| Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *East Gippsland Water* | | | | | |
| Bairnsdale | 5,902 | 0 | 5,902 | 4,957 | yes |
| **Total volume of bulk entitlements** | **5,902** | **0** | **5,902** | **4,957** | |
| *Unregulated licensed diverters* | 15,235 | 0 | 15,235 | 11,023 | |

### 16.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

East Gippsland Water complied with the passing flow requirements of the Bairnsdale Bulk Entitlement during 2003/04.

### 16.6.6 Compliance with Streamflow Management Plans

There is no Streamflow Management Plan (SFMP) currently in operation in the Mitchell Basin.

## 16.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Mitchell Basin, excluding stock and domestic use, is shown in Table 16-5. An estimate of stock and domestic use within these management areas is provided in Table 16-6.

The Mitchell Basin contains the entire Wy Yung WSPA. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

**Table 16-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits [2] | PAV (ML/yr) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas (ML) | Total Water Resource[4] (ML) |
|---|---|---|---|---|---|---|
| Wy Yung WSPA | 0 – 25 | 9,070 | 6,994 | 2,438 | Not applicable | 9,070 |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage

(4) The PAV or licensed volume, whichever is greater

**Table 16-6 Number of Stock and Domestic Bores and Estimated**

| Water Supply Protection Area/Groundwater Management Area | No. of Stock and Domestic Bores[1] | Estimated Stock and Domestic Use (assuming 2ML/bore) [2] |
|---|---|---|
| Wy Yung WSPA | 116 | 232 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 16.8 Recycled Water

The volume of water recycled in the Mitchell Basin is shown in Table 16-7. The only sewage treatment plant in the basin is at Bairnsdale and is operated by East Gippsland Water. All of the effluent passed through the treatment plant was recycled. The water recycled by East Gippsland Water (not only in the Mitchell Basin) is re-used on a number of applications including pasture and tree plantations.

**Table 16-7 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Bairnsdale | East Gippsland Water | 1,418 | 1,418 |
| **TOTAL** | | **1,418** | **1,418** |

# 17. Thomson Basin

## 17.1 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 (MID) located within the basin. 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 into Lake Wellington directly. A map of the river basin is shown in Figure 17-1.

Water Supply Protection Areas 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.

## 17.2 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 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, including the town of Sale, Maffra and Heyfield. The West Gippsland Catchment Management Authority is responsible for waterway management in the Thomson Basin.

## 17.3 Seasonal Overview

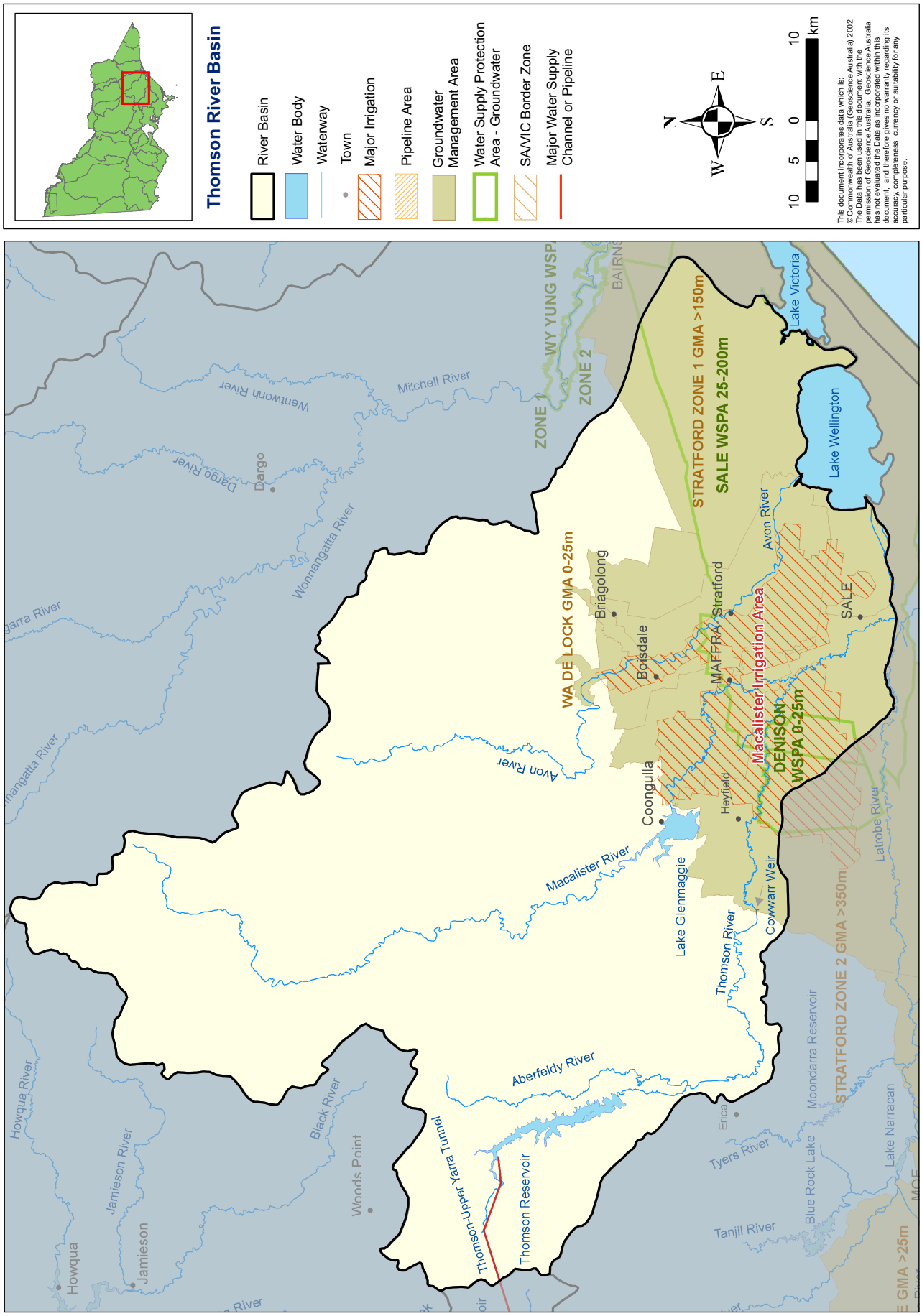
Rainfall throughout the Thomson Basin was around average during 2003/04 with streamflows into the Thomson Reservoir and Lake Glenmaggie close to average. However in the east of the basin, flows were less than average. Recorded streamflows in Freestone Creek (a tributary of the Avon River, near the township of Briagolong) was only 21 per cent of the long-term average.

All urban centres in the Thomson Basin were on Stage 1 restrictions during the whole of 2003/04. There were six instances during the year where the turbidity in the Thomson River was too high for water to be extracted and treated at the Heyfield water treatment plant.

In 2003/04 the irrigation seasonal allocation for the Thomson Basin was 105 per cent of entitlement and 109 per cent was actually delivered. The allocation was the same for the Macalister and Thomson River licensed diverters as for the Macalister Irrigation District. An average of 95 per cent of entitlement was delivered to the river diverters and 122 per cent to irrigators in the Macalister Irrigation District. In the Macalister system, the volume delivered can be greater than the seasonal allocation because irrigators are permitted to take water when Lake Glenmaggie spills which is not included in their allocations.

There were numerous other irrigation restrictions in place in the Thomson Basin during 2003/04. There was a total irrigation ban for Valencia Creek diverters during December 2003 to April 2004 and Stage 1 restrictions over July 2003, August 2003, November 2003, May 2004 and June 2004. Section 1 of the Avon River was on Stage 3 restrictions for May 2004, Stage 4 restrictions during December 2003 and irrigation bans were in place for the period from January 2004 to March 2004. Sections 2 and 3 of the Avon River were on Stage 1 restrictions during December 2003, Stage 4 restrictions during January 2004 and February 2004 and an irrigation ban was imposed for March 2004.

**Figure 17-1 Map of the Thomson Basin**



The Thomson and Macalister Rivers are identified as priority rivers within the Victorian Government's White Paper *Securing Our Water Our Future* and within the West Gippsland Regional River Health Strategy. Major riparian improvement works along these rivers commenced in 2003. Works involved removal of exotic vegetation, re-establishment of wetlands, revegetation, fencing and remnant vegetation protection. The works aimed to complement the recommendations of the Thomson and Macalister Environmental Flow Task Force Report. The works also contributed to improved water quality and biodiversity values in-stream, along the riparian zone and within the receiving waters of the Ramsar-listed Gippsland Lakes and wetlands.

Regular macro invertebrate monitoring over the past six years within the Thomson Basin has demonstrated an improvement in water quality in areas where exotic vegetation removal, fencing of streams to prevent stock access and revegetation works have been undertaken. However, at high flows, turbidity increases rapidly creating issues with water treatment at Heyfield. Increasing landholder support across the basin for these types of riparian works is also contributing towards biodiversity and habitat values throughout the region.

## 17.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Thomson Basin are shown in Table 17-1. The total extraction includes 84,560 ML transferred from the Thomson Basin to the Yarra Basin by Melbourne Water.

**Table 17-1 Summary of total water resource and water use in Thomson Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 863,070 | 359,550 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 410 | 360 |

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

## 17.5 Environmental Water Reserve

In the Thomson Basin, the water available to the environment was 310,500 ML, which is about 37 per cent of the total amount of water in the basin. This amount consists of environmental flows released from the Thomson Reservoir and Lake Glenmaggie 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.

The water available to the environment in the Thomson River passes out of the basin into the Latrobe River and then into the Gippsland Lakes, which have high environmental values, including Ramsar listing.

In 2004 the Thomson Macalister Environmental Flows Task Force assessed the environmental flow requirements of the Thomson and Macalister Rivers, based on previous environmental flow studies. Based on this Task Force report, over the next ten years the government will progressively improve the environmental flows and river habitat of the two rivers and committed to maintaining the current capability meet irrigator and Melbourne's water demands. On average this will result in 25,000 ML of additional environmental flows each year.

In 2003/04 there was no formal environmental water reserve established in the Thomson Basin although work had begun to establish a bulk entitlement for the environment and develop documents to strategically manage this future entitlement for maximum environmental flow benefits.

## 17.6 Surface Water Resources

### 17.6.1 Water Balance

A water balance for the Thomson Basin is shown in Table 17-2. In June 2003 Lake Glenmaggie held only a fifth of its total capacity. The storage volume increased throughout the year to fill in late spring, then fell again over the summer/autumn period to finish with a volume of 27 per cent. The Thomson Reservoir started the year with 25 per cent of capacity and finished with 32 per cent. Inflows to the basin were 83 per cent of their long-term average of 1,080,580 ML (NLWRA, 2001).

The largest diversions occurring within the basin were for irrigation usage and were equivalent to 30 per cent of total inflows. The Thomson Reservoir supplies water to Melbourne. In 2003/04 Melbourne Water transferred 84,560 ML from the Thomson Basin to the Yarra Basin. This is equal to less than 10 per cent of the basin inflows.

The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. The losses accounted for in the water balance do not include losses occurring between the point of water diversions and the point of use.

**Table 17-2 Balance of surface water in the Thomson Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 364,000 |
| Volume in storage at end of year | 465,281 |
| **Change in storage** | **101,281** |
| **Inflows** | |
| Catchment inflow | 843,850 |
| Irrigation return flow | 19,170 |
| Treated effluent discharge back to river(1) | 50 |
| **Subtotal** | **863,070** |
| **Diversions** | |
| Urban diversions | 86,530 |
| Irrigation district diversions | 254,660 |
| Unregulated licensed private diversions | 11,380 |
| Catchment farm dams | 6,980 |
| **Subtotal** | **359,550** |
| **Losses** | |
| Evaporation losses from major storages | 9,310 |
| Losses from catchment farm dams | 2,510 |
| In-stream losses to groundwater and evaporation | 79,920 |
| **Subtotal** | **91,740** |
| **Water passed at outlet of basin** | |
| River outflows to the Latrobe River | 260,180 |
| River outflows to Lake Wellington | 50,320 |
| | |
| **Volume available to the environment in the Thomson Basin** | **310,500** |

(1) Assumes non-reused water is discharged to waterways

### 17.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Thomson Basin is estimated to be around 10,600 ML. Average annual usage from the dams is estimated to be 6,990 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 9,500 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 17-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 5,640 | 2,820 | n/a |
| Irrigation | 6,960 | 4,170 | n/a |
| **TOTAL** | **10,600** | **6,990** | **9,500** |

n/a = information not available

### 17.6.3 Water Entitlement Transfers

The following transfers of water entitlement occurred within the Thomson Basin in 2003/04:

- 107 ML of permanent transfer within the Macalister Irrigation District (MID)
- 1,559 ML of temporary transfer from the Thomson River to the MID
- 741 ML of temporary transfer from the MID to the Thomson River
- 182 ML of temporary transfer from the Macalister River to the MID
- 831 ML of temporary transfer from the MID to the Macalister River
- 68 ML of temporary transfer from the Macalister River to the Thomson River
- 1,189 ML of temporary transfer along the Thomson River
- 48 ML of temporary transfer along the Macalister River
- 5,819 ML of temporary transfer within the MID.

Overall there were 107 ML of permanent transfers and 10,437 ML of temporary transfers within the basin.

### 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 that could have been diverted in 2003/04. Full details of compliance with bulk entitlements are provided in the Resource Manager's 2003/04 Report for the Thomson Basin (WGCMA, 2004). Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

Within the Thomson Basin, Gippsland Water supplies the urban demands of Coongulla, Glenmaggie, Heyfield, Stratford and Maffra. It should be noted that the Gippsland Water bulk entitlement within the Thomson Basin was not completed by the start of 2003/04 and values are not reported against the bulk entitlement.

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. The Thomson Macalister bulk entitlements were not gazetted five years ago and hence a five-year rolling average could not be calculated. The maximum volume divertible presented in Table 17-4 has been calculated using the 1999/00 usage, although this was not governed by the bulk entitlement.

**Table 17-4 Volume of water diverted under surface water entitlements in the Thomson Basin**

| Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML)(1) | Amount diverted (ML) | Complied?(2) |
|---|---|---|---|---|---|
| *Melbourne Water* | | | | | |
| Thomson River - Melbourne Water Corporation bulk entitlement | 265,000 | 0 | 661,300 | 84,564 | yes |
| *Southern Rural Water* | | | | | |
| Thomson/Macalister - Southern Rural Water bulk entitlement | 274,800 | 0 | 474,364 | 254,656 | yes |
| *Gippsland Water* | | | | | |
| Thomson/Macalister Towns | n/a | 0 | n/a | 1,965 | n/a |
| **Total volume of bulk entitlements** | **539,800** | **0** | **1,135,664** | **341,185** | |
| *Unregulated licensed diverters* | 13,790 | 0 | 13,790 | 11,381 | |

(1) Refers to the volume that could be diverted under the bulk entitlement, however, the volume of water may not be physically available for extraction.

(2) n/a indicates that the bulk entitlement conversion order was not finalised at the start of 2003/04.

### 17.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

Southern Rural Water (SRW) is responsible for gauged flows 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 km reach immediately downstream of the Thomson Dam. In 2003/04 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 2003/04 Report for the Thomson Basin (WGCMA, 2004).

### 17.6.6 Compliance with Streamflow Management Plans

There is no Streamflow Management Plan (SFMP) currently in operation in the Thomson Basin. A SFMP for the Avon River is being developed.

## 17.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Thomson Basin, excluding stock and domestic use, is shown in Table 17-5. The Thomson Basin contains part of the Wa De lock GMA, Sale WSPA, Denison WSPA, Rosedale GMA and Stratford GMA. The volumes described in the Table 17-5 are totals for the management areas and include the area that falls outside the Thomson Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

The Sale WSPA has been established to comprise the Boisdale Formation aquifer, which partly supplies the town of Sale and is also heavily used for irrigation. It is over-allocated to the extent that allocations are 161 per cent of the PAV. Metered usage is also above the PAV.

**Table 17-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/yr) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Denison WSPA (51%) | 0 – 25 | 12,000 | 17,743[6] | 15,224 | Not applicable | Not available[7] |
| Sale WSPA (69%) | 25 – 200 | 13,000 | 20,893 | 14,680 | Not applicable | Not available[7] |
| Rosedale GMA (35%) | 200 – 350<br>25 –350<br>50 – 150 | 9,000 | 21,971 | 15,457[8] | Not applicable | Not available[7] |
| Stratford GMA (38%) | >350 /<br>>150 | Not available | 27,643 | 27,355[8] | Not applicable | Not available[7] |
| Wa De Lock GMA (40%) | 0 – 25 | 29,700 | 25,197 | Not available | 12,095 | Not available[7] |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage.

(4) In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) The licensed allocation total for the Denison WSPA includes 4677 ML of salinity dewatering.

(7) No estimate of Total Water Resource is applicable as >10 per cent GMA/WSPA is located outside the river basin.

(8) The Stratford GMA and Rosedale GMA metered usage includes 18291 ML and 5101 ML respectively of groundwater pumping undertaken by the Latrobe Valley coal mines.

An estimate of stock and domestic use within these management areas is provided in Table 17-6. The single stock and domestic bore in the Rosedale GMA reflects the depth of the aquifer and the expense required to reach this groundwater supply.

**Table 17-6 Number of Stock and Domestic Bores and Estimated**

| Water Supply Protection Area/Groundwater Management Area | No. of Stock and Domestic Bores[1] | Estimated Stock and Domestic Use (assuming 2ML/bore)[1] |
|---|---|---|
| Denison WSPA | 297 | 594 |
| Sale WSPA | 919 | 1,838 |
| Rosedale GMA | 1 | 2 |
| Stratford GMA | 410 | 820 |
| Wa De Lock GMA | 482 | 964 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

The urban demands of Boisdale, Briagolong and Sale are supplied with Groundwater (Table 17-7). All diversions were well within licensed volumes in 2003/04.

**Table 17-7 Urban Groundwater usage in the Thomson Basin**

| Town | Annual Licence Volume (ML) | Volume Extracted in 2003/04 (ML) |
|---|---|---|
| Sale | 3,500 | 2,140 |
| Boisdale | 40 | 10 |
| Briagolong | 160 | 100 |

## 17.8 Recycled Water

The volume of water recycled in the Thomson Basin is shown in Table 17-8. Gippsland Water operates five sewage treatment plans in the Thomson Basin. The reused 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 STP. A total of 87 per cent of effluent was reused in the basin.

**Table 17-8 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Heyfield | Gippsland Water | 78 | 78 |
| Maffra (Domestic) | Gippsland Water | 184 | 184 |
| Maffra (Murray-Goulburn) | Gippsland Water | 0 | 0 |
| Stratford | Gippsland Water | 94 | 94 |
| Rawson | Gippsland Water | 52 | 0 |
| **TOTAL** | | **408** | **356** |

# 18. Latrobe Basin

## 18.1 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 18-1.

Water Supply Protection Areas 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 as well as part of the Rosedale GMA and Stratford GMA.

## 18.2 Responsibilities for Management of Water Resources

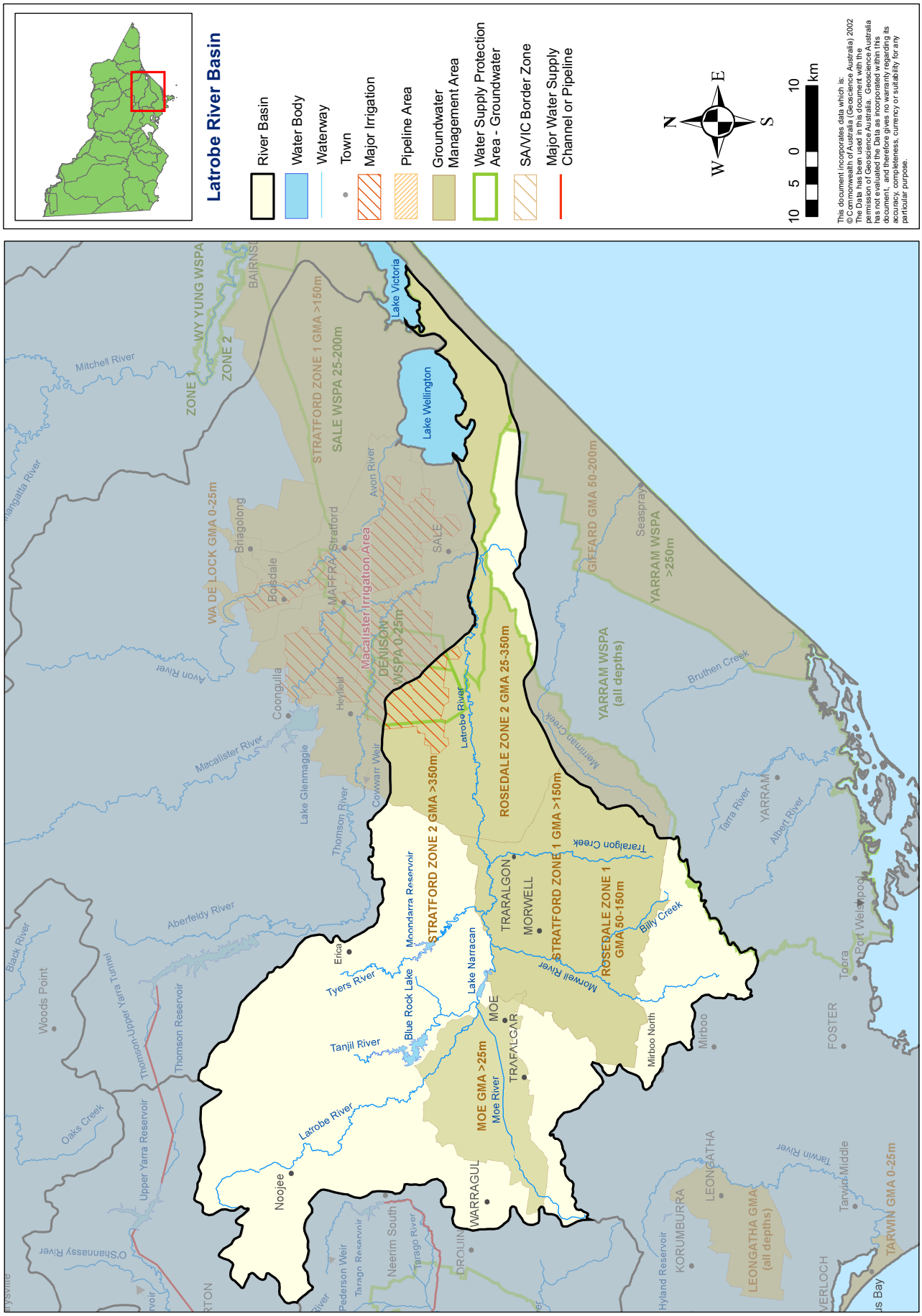
Southern Rural Water (SRW) is responsible for managing part of the Latrobe water supply system including Blue Rock Lake and Lake Narracan. SRW is also the licensing authority and manages groundwater and surface water licensed diversions. Gippsland Water is responsible for urban and major industrial water 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.

## 18.3 Seasonal Overview

Rainfall recorded in the Latrobe Basin was a little lower than average during 2003/04. Streamflow in the upper reaches of the Latrobe River at Willow Grove (recorded at gauge 226204) was only 65 per cent of the long-term average.

All urban centres in the Latrobe Basin were on Stage 1 restrictions for the whole of 2003/04. Irrigation diverters from the Upper Latrobe River were on Stage 1 restrictions during March 2004.

**Figure 18-1 Map of the Latrobe Basin**



## 18.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Latrobe Basin are shown in Table 18-1.

**Table 18-1 Summary of total water resource and water use in Latrobe Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 700,160 | 165,310 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 22,810 | 830 |

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

## 18.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Latrobe Basin. The water available to the environment at the basin outlet was 493,090 ML, which is about 78 per cent of the total amount of water in the basin. This water available to the environment passes out of the basin into the Gippsland Lakes, which have high environmental values, including a Ramsar listing. 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 which was not taken out of the streams for consumptive uses.

Although environmental flows in the basin as a whole appear strong, local environmental flow issues occurred due to dry conditions. In the upper unregulated reaches of the Latrobe River, private diversions during the irrigation season can have a significant impact on the flow regime. A Streamflow Management Plan will 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.

Regular macro invertebrate monitoring over the past six years within the Latrobe Basin has demonstrated an improvement in water quality in areas where exotic vegetation removal, fencing of streams to prevent stock access and revegetation works have been undertaken. Increasing landholder support across the basin for these types of riparian works is also contributing towards biodiversity and habitat values throughout the region.

## 18.6 Surface Water Resources

### 18.6.1 Water Balance

A water balance for the Latrobe Basin is shown in Table 18-2. There are three major storages located in the Latrobe Basin, Blue Rock Reservoir, Lake Narracan and Moondarra Reservoir. In July 2003 the storages were at 96 per cent of capacity. During the year the inflows were only 71 per cent of their long-term average and the storage capacity dropped to 73 per cent at the end of June 2004.

The major industrial water users in the basin include the power companies and Australian Paper Manufacturers. In 2003/04 the power companies returned approximately 50,000 ML of water to the river.

The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. The losses accounted for in the water balance do not include losses occurring between the point of water diversions and the point of use.

**Table 18-2 Balance of surface water in the Latrobe Basin**

| Water Account Component | Volume (ML) |
|---|---|
| Storage Volume | |
| Volume in storage at start of year | 237,330 |
| Volume in storage at end of year | 179,480 |
| **Change in storage** | **-57,850** |
| **Inflows** | |
| Catchment inflow | 628,180 |
| Return flow from power stations and major industry | 50,000 |
| Treated effluent discharge back to river | 21,980 |
| **Subtotal** | **700,160** |
| **Diversions** | |
| Urban and industrial diversions | 125,210 |
| Regulated and unregulated licensed private diversions | 19,550 |
| Catchment farm dams | 20,550 |
| **Subtotal** | **165,310** |
| **Losses** | |
| Evaporation losses from major storages | 3,650 |
| Losses from catchment farm dams | 5,620 |
| In-stream losses to groundwater and evaporation | 90,340 |
| **Subtotal** | **99,610** |
| **Water passed at outlet of basin** | |
| River outflows to the Lakes (excluding Thomson River) | 493,090 |
| River outflows to the Lakes (including Thomson River) | 753,270 |
| | |
| **Volume available to the environment in the Latrobe Basin** | **493,090** |

(1) Assumes non-reused water is discharged to waterways

### 18.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Latrobe Basin is estimated to be around 29,730 ML. Average annual usage from the dams is estimated to be 20,550 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 26,160 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 18-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 13,010 | 6,500 | n/a |
| Irrigation | 16,720 | 14,040 | n/a |
| **TOTAL** | **29,730** | **20,550** | **26,160** |

n/a = information not available

### 18.6.3 Water Entitlement Transfers

Overall there were 31 temporary transfers totalling 2,565 ML in the system. There were no permanent transfers.

### 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 that could have been diverted in 2003/04. Full details of compliance with bulk entitlements are provided in the Resource Manager's 2003/04 Report for the Latrobe Basin (SRW, 2004). Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

The Bulk Entitlement (CGRWA – Blue Rock) Conversion Order held by Gippsland Water covers all water extracted by the Tanjil River. Gippsland Water extracts water from the Tanjil River to supply Moe, and also transfers water from Blue Rock Reservoir to Moondarra Reservoir. All water diverted from the Moondarra Reservoir is accounted for under the Bulk Entitlement (Moondarra Reservoir) Conversion Order. Therefore water transferred from Blue Rock Reservoir to Moondarra Reservoir is accounted for twice under bulk entitlements in the basin. To avoid double accounting, the volume transferred from Blue Rock Reservoir to Moondarra Reservoir is not included in the CGRWA – Blue Rock bulk entitlement in the basin water balance. The volume is reported under both bulk entitlements in Table 18-4.

**Table 18-4 Volume of water diverted under surface water entitlements in the Latrobe Basin**

| Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML)(1) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Central Gippsland Region Water Authority (CGRWA)* | | | | | |
| Boolarra | 145 | 0 | 145 | 93 | Yes |
| CGRWA Blue Rock(2) | 15,150 | 0 | 34,368 | 4,478 | Yes |
| Erica | 340 | 0 | 340 | 119 | Yes |
| Mirboo North | 270 | 0 | 270 | 218 | Yes |
| Moe – Narracan Creek | 3,884 | 0 | 3,884 | 2,119 | Yes |
| Moondarra Reservoir | 62,000 | 0 | 73,002 | 50,948 | Yes |
| Noojee | 73 | 0 | 73 | 0 | Yes |
| Thorpdale | 80 | 0 | 80 | 23 | Yes |
| *Southern Rural Water* | | | | | |
| Latrobe - Southern Rural | 13,400 | 0 | 17,994 | 6,870 | Yes |
| Yallourn Energy Ltd for SRW (to supply Loy Yang B power station) | 20,000 | 0 | 20,000 | 12,096 | Yes |
| *Great Energy Alliance Corporation* | | | | | |
| Yallourn Energy Ltd for Loy Yang Power Ltd (to supply Loy Yang A power station) | 40,000 | 0 | 40,000 | 25,074 | Yes |
| *Minister for Environment* (on behalf of the Dept. of Treasury and Finance) | | | | | |
| Yallourn Energy Ltd for SECV (held for future coal based developments) | 25,000 | 0 | 25,000 | | Yes |
| *Yallourn Energy Ltd* | | | | | |
| Yallourn Energy Ltd | 36,500 | 0 | 36,500 | 32,362 | Yes |
| **Total volume of bulk entitlements** | **216,842** | **0** | **251,656** | **134,400** | |
| *Unregulated licensed diverters* | 18,158 | 0 | 18,158 | 12,684 | |

(1) Refers to the volume that could be diverted under the bulk entitlement upper limit rules, however, the volume of water may not be physically available for extraction.

(2) The amount diverted refers to the volume of water either diverted to Willow Grove or transferred to Moondarra Reservoir. In order to transfer water to Moondarra Reservoir in 2003/04 an additional 17,139 ML was released down the Latrobe River as a result of using the turbines in Blue Rock Reservoir.

### 18.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

All bulk entitlements with monitoring programs complied with their passing and environmental flow obligations specified in their bulk entitlements. Full details of compliance with bulk entitlements are provided in the Resource Manager's 2003/04 Report for the Latrobe Basin (SRW, 2004).

### 18.6.6 Compliance with Streamflow Management Plans

There is no Streamflow Management Plan (SFMP) currently in operation in the Latrobe Basin. There is a SFMP being developed for the Upper Latrobe River.

## 18.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Latrobe Basin (excluding stock and domestic use) is shown in Table 18-5. An estimate of stock and domestic use within these management areas is provided in Table 18-6.

The Latrobe Basin contains all of the Moe GMA as well as part of the Denison WSPA, Sale WSPA, Wa De Lock GMA, Rosedale GMA and Stratford GMA. The volumes described in the Table 18-5 are totals for the management areas and include the area that falls outside the Latrobe Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

Groundwater usage is high in the Latrobe Basin, as evidenced by the large allocations in the GMAs and WSPAs. For example, the Denison WSPA has an allocation of almost 150 per cent of the PAV. A large portion of this extracted groundwater is, however, pumped to manage salinity in shallow watertable areas. The Sale WSPA and the Rosedale and Stratford GMAs also have a licensed allocation greater than the PAV. Only the Moe GMA has readily available additional resources, with only 28 per cent of the PAV being allocated.

**Table 18-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/yr) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Denison WSPA (49%) | 0 – 25 | 12,000 | 17,743[6] | 15,224 | Not applicable | Not available[7] |
| Sale WSPA (17%) | 25 – 200 | 13,000 | 20,893 | 14,680 | Not applicable | Not available[7] |
| Rosedale GMA (58%) | 200 - 350<br>25 –350<br>50 – 150 | 9,000 | 21,971 | 15,457[8] | Not applicable | Not available[7] |
| Stratford GMA (38%) | >350 /<br>>150 | Not available | 27,643 | 27,355[8] | Not applicable | Not available[7] |
| Moe GMA | >25 | 8,193 | 2,288 | Not available | 1,098 | 8,193 |
| Wa De Lock GMA (54%) | 0 – 25 | 29,700 | 25,197 | Not available | 12,095 | Not available[7] |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage.

(4) In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) The licensed allocation total for the Denison WSPA includes 4677 ML of salinity dewatering.

(7) No estimate of Total Water Resource is applicable as >10 per cent GMA/WSPA is located outside the river basin.

(8) The Stratford GMA and Rosedale GMA metered usage includes 18291 ML and 5101 ML respectively of groundwater pumping undertaken by the power companies.

**Table 18-6 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)[1] |
|---|---|---|
| Denison WSPA | 297 | 594 |
| Sale WSPA | 919 | 1,838 |
| Rosedale GMA | 1 | 2 |
| Stratford GMA | 410 | 820 |
| Moe GMA | 197 | 394 |
| Wa De Lock GMA | 482 | 964 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

Gippsland Water holds a licence to extract 100 ML of groundwater to supply Trafalgar and Yarragon. The bore at Trafalgar is not in use and the bore at Yarragon is used for emergencies only.

## 18.8 Recycled Water

The volume of water recycled in the Latrobe Basin is shown in Table 18-7. Gippsland Water operates six sewage treatment plants in the Latrobe basin. Effluent is reused in Mirboo North, Morwell and Willow Grove. In the basin four per cent of all effluent was reused.

**Table 18-7 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Dutson Downs | Gippsland Water | 10760 | 0 |
| Mirboo North | Gippsland Water | 67 | 67 |
| Moe | Gippsland Water | 2070 | 0 |
| Morwell | Gippsland Water | 750 | 750 |
| Warragul | Gippsland Water | 1612 | 0 |
| Willow Grove | Gippsland Water | 9 | 9 |
| Saline Water Outfall Pipe | Gippsland Water | 7,541 | 0 |
| **TOTAL** | | **22,809** | **826** |

# 19. South Gippsland Basin

## 19.1 Location of Water Resources

The South Gippsland Basin is located within the South East Coast Drainage Division. The basin covers rivers flowing into the ocean between the Bass River (located north of San Remo) and Seaspray. A map of the river basin is shown in Figure 19-1.

Water Supply Protection Areas (WSPA) 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.

## 19.2 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 South Gippsland Basin.

## 19.3 Seasonal Overview

Rainfall recorded in South Gippsland Basin over 2003/04 was around average. In the west of the basin streamflows were also average, flows in the Bass River, Powlett River and Tarwin River were 99 per cent, 101 per cent and 93 per cent of their long-term averages. Conditions became drier to the east of the basin. Flows in the Franklin River were 65 per cent of average and only 33 per cent of average in Bruthen Creek.

During July 2003, Stage 4 restrictions were in place for Korumburra and Fish Creek and Stage 3 restrictions were in place for Poowong, Loch and Nyora.

Stage 1 restrictions were in place in the towns of Yarram, Devon North, Alberton and Port Albert during January 2004 and these were increased to Stage 2 during March 2004 then Stage 4 during April 2004 and then decreased to Stage 2 in May 2004. Stage 2 restrictions were in place for Fish Creek during April 2004. All restrictions were lifted in mid-May 2004.

Stage 1 restrictions were also in place at Leongatha, Koonwarra, Archies Creek, Dalyston, Bass, Corinella, Coronet Bay, Cowes, Cowes West, Glen Forbes, Grantville, Kilcunda, Nobbies, Penguin Parade, Pioneer Bay, Rhyll, San Remo, Sunderland Bay, Tenby Point, Ventnor, Woolamai Waters, Newhaven, Wimbledon Heights and Woolamai during July 2003 to September 2003.

There were numerous restrictions in place for unregulated stream diverters in South Gippsland Basin during 2003/04. Greigs Creek had irrigation bans imposed over November 2003 to May 2004. Tarra River had bans imposed over January 2004 to May 2004 and Stage 1 restrictions over November 2003 and December 2003. Bruthen Creek was on an irrigation ban for November 2003 to March 2004 and Jack River and Merrimans Creek were on irrigation bans for December 2003 to March 2004. Albert River, Franklin River, Berrys Creek and Agnes River were on irrigation bans for March 2004 and Franklin River was on Stage 1 restrictions for December 2003 to February 2004. Albert River was also on Stage 2 restrictions during February 2004.

Within the South Gippsland Basin, major riparian improvement works commenced along the Tarra River in 2003/04. Parts of the Tarra River are considered representative of an ecologically healthy river in the Victorian River Health Strategy and it is classified as a high

priority river within the West Gippsland Regional River Health Strategy. Works involved removal of exotic vegetation, fencing, revegetation, bed and bank stabilisation and the construction of fishing platforms. The works aim to improve water quality and biodiversity values in-stream, along the riparian zone and within the receiving waters of the Ramsar-listed Corner Inlet and Nooramunga Marine and Coastal Parks.

Regular macro invertebrate monitoring over the past six years within the South Gippsland Basin has demonstrated an improvement in water quality in areas where exotic vegetation removal, fencing of streams to prevent stock access and revegetation works have been undertaken. Increasing landholder support across the three basins for these types of riparian works is also contributing towards biodiversity and habitat values throughout the region.

## 19.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the South Gippsland Basin are shown in Table 19-1.

**Table 19-1 Summary of total water resource and water use in South Gippsland Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 912,760 | 40,790 |
| Groundwater (1) | 42,640 | 15,787 |
| Recycled water | 5,000 | 450 |

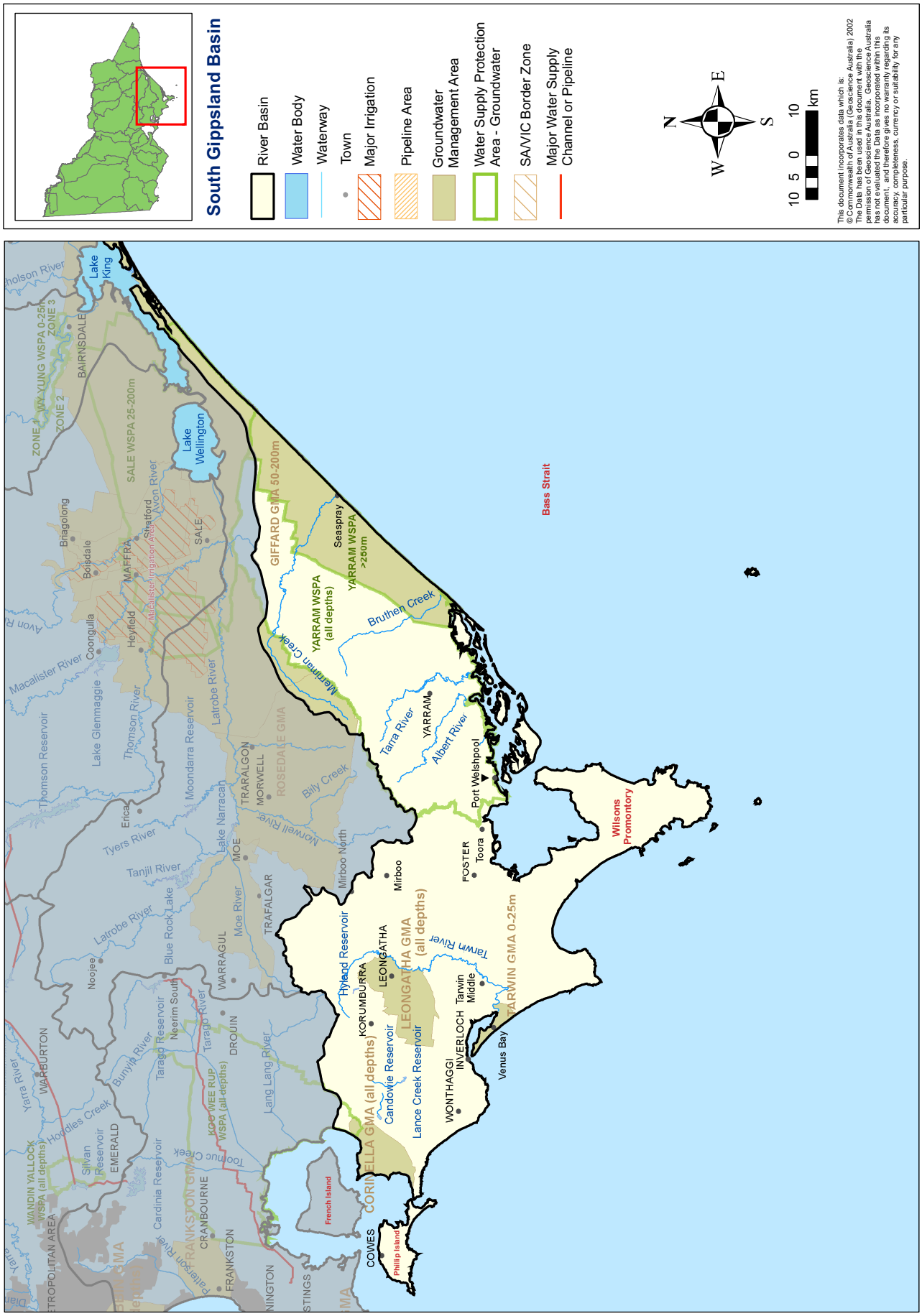
(1) Much of the available resource discharges to streams and will be included in the total water resource for surface water. These volumes exclude the resource and extraction from unincorporated areas.

## 19.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the South Gippsland Basin. The water available to the environment was 838,750 ML, which is about 92 per cent of the total amount of water in the basin. 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.

Although water quantity was largely unaffected in 03/04, issues for the environmental water reserve occur at a catchment scale in the unregulated sections of the basin. In the Tarra River, licensed diversions during the irrigation season can have a significant impact on the flow regime. A Streamflow Management Plan will determine water-sharing rules to minimise the impacts of such diversions and to ensure the water resources of the area are managed equitably and sustainably.

**Figure 19-1 Map of the South Gippsland Basin**



## 19.6 Surface Water Resources

### 19.6.1 Water Balance

A water balance for South Gippsland Basin is shown in Table 19-2. 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. At the start of July 2003 the storages held 35 per cent of their capacity. During 2003/04 the inflows to the basin were similar to the average inflows and the storage volumes increased during the year to 69 per cent of capacity. The largest diversion of water from the basin was via farm dams, which accounted for nearly 60 per cent of all diversions.

The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. The losses accounted for in the water balance do not include losses occurring between the point of water diversions and the point of use.

**Table 19-2 Balance of surface water in the South Gippsland Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 3,330 |
| Volume in storage at end of year | 6,640 |
| **Change in storage** | **3,310** |
| **Inflows** | |
| Catchment inflow | 908,210 |
| Irrigation return flow | 0 |
| Treated effluent discharge back to river(1) | 4,550 |
| **Subtotal** | **912,760** |
| **Diversions** | |
| Urban diversions | 9,040 |
| Unregulated licensed private diversions | 7,490 |
| Catchment farm dams | 24,260 |
| **Subtotal** | **40,790** |
| **Losses** | |
| Evaporation losses from major storages | 540 |
| Losses from catchment farm dams | 4,950 |
| In-stream losses to groundwater and evaporation | 24,430 |
| **Subtotal** | **29,920** |
| **Water passed at outlet of basin** | |
| River outflows to the ocean | 838,750 |
| | |
| **Volume available to the environment in the South Gippsland Basin** | **838,750** |

(1) Assumes non-reused water is discharged to waterways

### 19.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the South Gippsland Basin is estimated to be around 38,200 ML (Table 19-3). Average annual usage from the dams is estimated to be 24,300 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 29,200 ML. Specific information on catchment farm dam behaviour

for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 19-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 22,960 | 11,480 | n/a |
| Irrigation | 15,210 | 12,780 | n/a |
| **TOTAL** | **38,170** | **24,260** | **29,200** |

n/a = information not available

### 19.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water rights, diversion licences or sales water within the basin in 2003/04.

### 19.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement 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 that could have been diverted in 2003/04. Full details of compliance with bulk entitlements are provided in the Resource Manager's 2003/04 Report for the Gippsland Urban Basin water Accounts (SRW, 2004). Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

South Gippsland Water approached the Resource Manager and DSE regarding a qualification of rights for its Tarra bulk entitlement, sufficient rainfall occurred which mitigated its necessity. South Gippsland Water has made a commitment to increase its storage on the Tarra to improve its security.

**Table 19-4 Volume of water diverted under surface water entitlements in the South Gippsland Basin**

| Bulk Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Central Gippsland Region Water Authority* | | | | | |
| Seaspray | 61 | 0 | 61 | 50 | Yes |
| *South Gippsland Region Water Authority* | | | | | |
| Devon North, Alberton, Yarram and Port Albert | 853 | 0 | 853 | 564 | Yes |
| Dumbalk | 100 | 0 | 100 | 32 | Yes |
| Fish Creek | 251 | 0 | 251 | 224 | Yes |
| Foster | 326 | 0 | 326 | 213 | Yes |
| Korumburra | 1,000 | 0 | 1,000 | 640 | Yes |
| Leongatha | 2,476 | 0 | 2,476 | 1,978 | Yes |
| Loch, Poowong and Nyora | 420 | 0 | 420 | 198 | Yes |
| Meeniyan | 200 | 0 | 200 | 73 | Yes |
| Toora, Port Franklin, Welshpool and Port Welshpool | 1,617 | 0 | 1,617 | 580 | Yes |
| Wonthaggi – Inverloch | 3,800 | 0 | 3,800 | 2,388 | Yes |
| *Westernport Region Water Authority* | | | | | |
| Westernport | 2,911 | 0 | 2,911 | 2,104 | Yes |
| **Total volume of bulk entitlements** | **14,015** | **0** | **14,015** | **9,044** | |
| *Unregulated licensed diverters* | 11,223 | 0 | 11,223 | 7,486 | |

### 19.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

All bulk entitlements complied with their passing and environmental flow obligations.

### 19.6.6 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.

## 19.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the South Gippsland Basin, excluding stock and domestic use, is shown in Table 19-5. An estimate of stock and domestic use within these management areas is provided in Table 19-6

The South Gippsland Basin includes the whole Corinella GMA, Leongatha GMA, Giffard GMA and Tarwin GMA, in addition to part of the Yarram WSPA. The volumes described in the Table 19-5 are totals for the management areas and include the area that falls outside the South Gippsland Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts. Allocations within the Yarram WSPA have

reached 90 per cent of the PAV in this area, causing some concern, particularly in the context of declining groundwater levels in this region. The Giffard GMA has a licensed allocation of 189 per cent of its PAV. The allocation in the Leongatha, Tarwin and Corinella GMAs is low relative to the PAV of these aquifers.

**Table 19-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/yr) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Corinella GMA | All Depths | 2,550 | 410 | Not applicable | 197 | 2,550 |
| Giffard GMA | 50 – 200 | 3,000 | 5,665 | Not applicable | 2,719 | 5,665 |
| Leongatha GMA | All Depths | 6,500 | 1,351 | Not applicable | 648 | 6,500 |
| Tarwin GMA | 0 – 25 | 1,300 | 37 | Not applicable | 18 | 1,300 |
| Yarram WSPA (95%) | All Depths[6] | 26,625 | 25,655 | 12,205 | N/A | 26,625 |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage.

(4) In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) The depth restrictions for the Yarram WSPA apply to all aquifers excluding the aquifer incorporated in the Giffard GMA (50 – 200).

**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)[1] |
|---|---|---|
| Corinella GMA | 157 | 314 |
| Giffard GMA | 171 | 342 |
| Leongatha GMA | 114 | 228 |
| Tarwin GMA | 806 | 1,612 |
| Yarram WSPA | 485 | 970 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 19.8 Recycled Water

The volume of water recycled in the South Gippsland Basin is shown in Table 19-7. South Gippsland Water operates eight sewage treatment plants within the basin but only reuses effluent from the Wonthaggi and Yarram STPs. Westernport Water reuses water from both of its STPs. Across the basin only nine per cent of effluent is reused.

**Table 19-7 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Foster | South Gippsland Water | 250 | 0 |
| Korumburra | South Gippsland Water | 395 | 0 |
| Leongatha (Domestic) | South Gippsland Water | 382 | 0 |
| Leongatha (Trade Waste) | South Gippsland Water | 1,297 | 0 |
| Toora | South Gippsland Water | 150 | 0 |
| Welshpool | South Gippsland Water | 30 | 0 |
| Wonthaggi/Inverloch/Cape Paterson | South Gippsland Water | 1,114 | 75 |
| Yarram | South Gippsland Water | 149 | 149 |
| Coronet Bay (King Road) | Westernport Water | 159 | 131 |
| Cowes | Westernport Water | 1,074 | 92 |
| **TOTAL** | | **5,000** | **447** |

# 20. Bunyip Basin

## 20.1 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 Bay 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 20-1.

Water Supply Protection Areas 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 Morbid GMA.

## 20.2 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.

## 20.3 Seasonal Overview

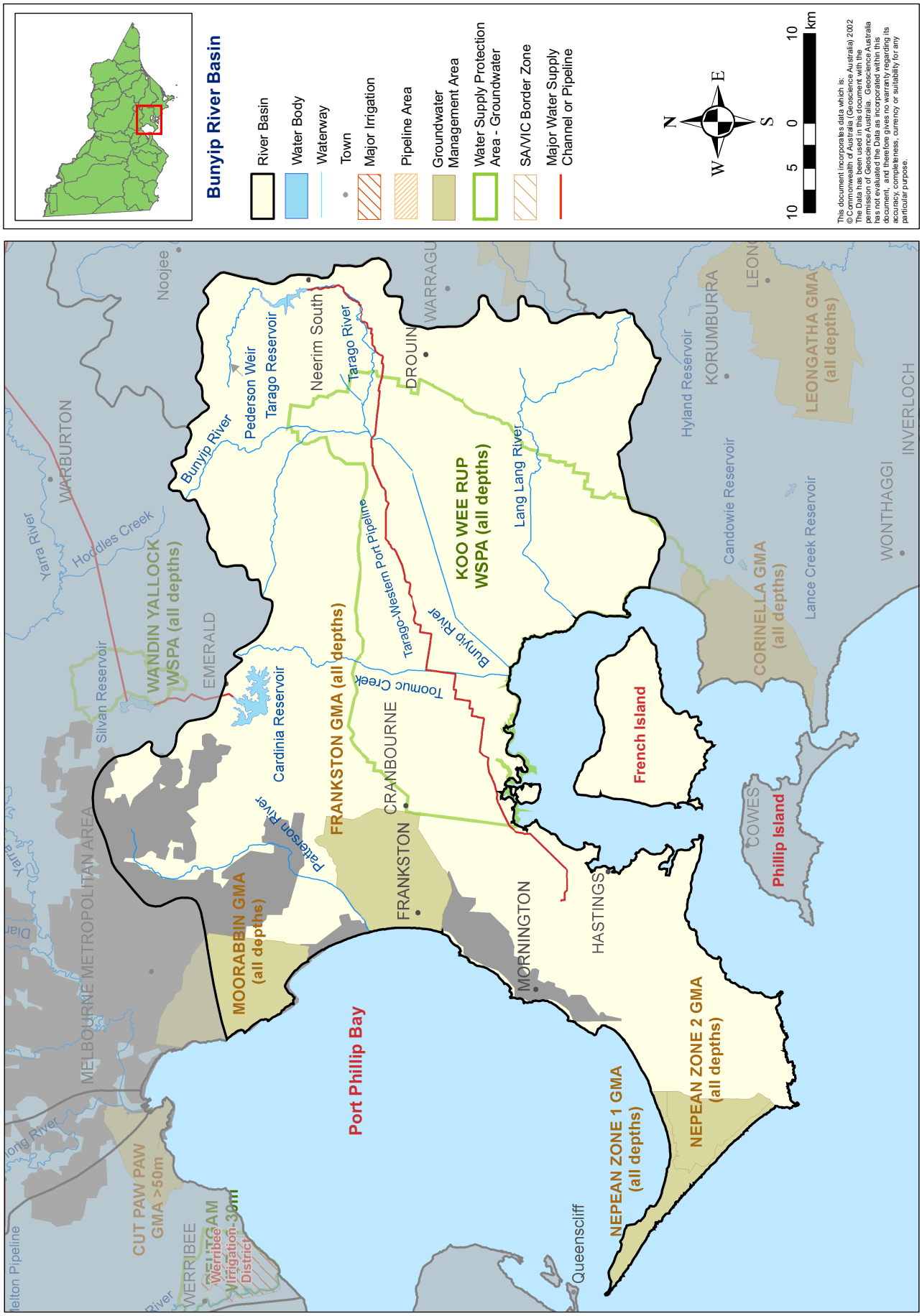
In 2003/04 the rainfall recorded in Bunyip Basin was a slightly lower than average to the east with streamflows in the Tarago River only 80 per cent of their long-term average. However, across the Basin, streamflow were on 122 per cent of the long-term average. In 2003/04 rainfall was higher than average on the Mornington Peninsula.

Irrigation bans were imposed for Dandenong Creek from January 2004 to March 2004. Bans were also in place for Toomuc Creek, Stony Creek, Dunns Creek and Mantons Creek and stage 1 restrictions for Monbulk Creek and Lang Lang River during March 2004. SRW licensed diverters used 66 per cent of entitlement during the irrigation season.

Several rivers within the Bunyip Basin flow into Westernport Bay, which has high environmental values and has wetlands listed under the Ramsar Convention. Increased sediments flowing into the bay from rivers are thought to damage important sea grass beds. In 2003/04 work such as stabilising river and creek banks and beds, revegetation and building sediment traps has been undertaken by Melbourne Water to reduce the sediment input into the bay.

In 2003/04 Melbourne Water undertook works in Cardinia Creek to protect native fish including the Australian Grayling. Melbourne Water constructed three rock weirs, which not only enable better fish movement along the creek, but also help to control erosion.

**Figure 20-1 Map of the Bunyip Basin**



## 20.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Bunyip Basin are shown in Table 20-1. There was a net transfer of water into the basin which is not listed in the available resource or extraction. South East Water purchases all of the water supplied to urban demands in metropolitan Melbourne from Melbourne Water. This water (154,740 ML) was transferred from the Yarra Basin. Gippsland Water diverts water from the Tarago River and Tarago Reservoir to supply the urban demands of Warragul and Noojee in the Latrobe Basin. In 2003/04, 4,340 ML was diverted.

**Table 20-1 Summary of total water resource and water use in Bunyip Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 433,110 | 28,845 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 143,230 | 17,520 |

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

## 20.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Bunyip Basin. The water available to the environment at the basin outlet was 344,190 ML, which is about 88 per cent of the total inflows. This amount consists of 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

Melbourne Water operates Tarago Reservoir which is not currently used to supply metropolitan Melbourne. Tarago Reservoir is currently only used to supply small volumes of water to Neerim South and irrigators in the Koo Wee Rup area. Inflows into the Basin during the year were around 22 per cent higher than the long-term average of 354,000 ML/year (NLWRA, 2001).

The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. The losses accounted for in the water balance do not include losses occurring between the point of water diversions and the point of use.

**Table 20-2 Balance of surface water in the Bunyip Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 27,600 |
| Volume in storage at end of year | 23,900 |
| **Change in storage** | **-3,700** |
| **Inflows** | |
| Catchment inflow | 432,460 |
| Irrigation return flow | 0 |
| Treated effluent discharge back to river(1) | 650 |
| **Subtotal** | **433,110** |
| **Diversions** | |
| Urban diversions | 4,335 |
| Regulated licensed private diversions | 2,980 |
| Unregulated licensed private diversions | 6,010 |
| Catchment farm dams | 15,520 |
| **Subtotal** | **28,845** |
| **Losses** | |
| Evaporation losses from major storages | 1,800 |
| Losses from catchment farm dams | 570 |
| In-stream losses to groundwater and evaporation | 61,405 |
| **Subtotal** | **63,775** |
| **Water passed at outlet of basin** | |
| River outflows to the ocean | 344,190 |
| | |
| **Volume available to the environment in the Bunyip Basin** | **344,190** |

(1) Assumes non-reused water is discharged to waterways

### 20.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Bunyip Basin is estimated to be around 21,730 ML (Table 20-3). Average annual usage from the dams is estimated to be 15,520 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 16,100 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 20-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 8,030 | 4,010 | n/a |
| Irrigation | 13,700 | 11,510 | n/a |
| **TOTAL** | **21,730** | **15,520** | **16,100** |

n/a = information not available

### 20.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water rights, diversion licences or sales water within the basin in 2003/04.

### 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 that could have been diverted in 2003/04. It should be noted that no bulk entitlements for the Bunyip Basin were completed at the start of 2003/04 and values are not reported against these bulk entitlements. Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

**Table 20-4 Volume of water diverted under surface water entitlements in the Bunyip Basin**

| Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Gippsland Water* | | | | | |
| Tarago River (Warragul and Drouin) | n/a | 0 | n/a | 4,073 | n/a |
| Tarago River (Neerim South) | n/a | 0 | n/a | 261 | n/a |
| *Southern Rural Water* | | | | | |
| Tarago River | n/a | 0 | n/a | 2,975 | n/a |
| *Melbourne Water* | | | | | |
| Bunyip and Tarago Rivers | n/a | 0 | n/a | 0 | n/a |
| *Minister of Environment* | | | | | |
| Bunyip and Tarago Rivers | n/a | 0 | n/a | 0 | n/a |
| **Total volume of bulk entitlements** | **n/a** | **0** | **n/a** | **7,309** | |
| *Unregulated licensed diverters* | 11,568 | 0 | 11,568 | 6,007 | |

n/a indicates that the bulk entitlement conversion order was not finalised at the start of 2003/04

### 20.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

There were no bulk entitlements in operation in the Bunyip Basin in 2003/04.

### 20.6.6 Compliance with Streamflow Management Plans

There are no Streamflow Management Plans (SFMP) currently in operation in the Bunyip Basin. There are none planned for the next five years.

## 20.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Bunyip Basin, excluding stock and domestic use, is shown in Table 20-5. An estimate of stock and domestic use within these management areas is provided in Table 20-6.

The Bunyip Basin contains the whole Koo Wee Rup WSPA, Nepean GMA and Frankston GMA, in addition to part of the Moorabbin GMA. The volumes described in Table 20-5 are totals for the management areas and include the area that falls outside the Bunyip Basin. Groundwater

allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

It can be seen in these tables that the licensed allocation in the Nepean GMA is above the PAV. Estimated use in 2003/04 was well below the PAV but stock and domestic use from this GMA is significant. The Koo Wee Rup PAV has an allocation greater than the PAV, but usage in 2003/04 was estimated to be around half of the PAV. The Moorabbin GMA is around 53 per cent allocated but it is undergoing increasing levels of development from golf courses, parks and industries substituting reticulated potable water for alternative sources.

### Table 20-5 Compliance with Licensed Groundwater Volumes

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/yr) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Frankston GMA | All Depths | 3,200 | 1,096 | Not available | 526 | 3,200 |
| Koo Wee Rup WSPA | All Depths | 14,898 | 12,578 | 5,273 | Not applicable | 14,898 |
| Moorabbin GMA (63%) | All Depths | 4,305 | 2,273 | Not available | 1,091 | Not available[6] |
| Nepean GMA | All Depths / 0 – 40 | 5,000 | 5,657 | Not available | 2,715 | Not available[6] |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage (except Grampians Wimmera Mallee Water).

(4) In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) No estimate of Total Water Resource is applicable as >10 per cent 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)[1] |
|---|---|---|
| Frankston GMA | 199 | 398 |
| Koo Wee Rup WSPA | 600 | 1,200 |
| Moorabbin GMA | 238 | 476 |
| Nepean GMA | 1,162 | 2,324 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 20.8 Recycled Water

The volume of water recycled in the Bunyip Basin is shown in Table 20-7. Gippsland Water, South East Water and Melbourne Water operate sewage treatment plants within the Bunyip Basin. The largest is the Eastern Treatment Plant (ETP), operated by Melbourne Water, which has a total effluent volume of 130,700 ML. In 2003/04, 11 per cent of effluent at the ETP was reused. Of this the majority was used in on-site recycling. Recycled effluent was also used in the eastern irrigation scheme on golf courses, recreational areas and residential gardens. Melbourne Water also sells recycled water to some customers. Other treatment plants recycled 20 per cent of effluent, totalling 12 per cent recycled in the basin.

**Table 20-7 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Drouin | Gippsland Water | 433 | 185 |
| Neerim South | Gippsland Water | 55 | 0 |
| Blind Bight | South East Water | 145 | 145 |
| Cranbourne | South East Water | 154 | 154 |
| Somers (Hastings) | South East Water | 1,267 | 118 |
| Kooweerup | South East Water | 119 | 119 |
| Lang Lang | South East Water | 57 | 50 |
| Longwarry | South East Water | 111 | 111 |
| Mt Martha (Mornington) | South East Water | 5,525 | 571 |
| Pakenham | South East Water | 1,459 | 1,123 |
| Boneo | South East Water | 3,168 | 48 |
| Somers Package Plant | South East Water | 1 | 0 |
| Eastern Treatment Plant | Melbourne Water | 130,736 | 14,893 |
| **TOTAL** | | **143,230** | **17,517** |

# 21. Yarra Basin

## 21.1 Location of Water Resources

The Yarra Basin is located within the South East Coast Drainage Division. The Yarra River originates in the Yarra Ranges National Park. Melbourne Water harvests water in the Upper Yarra Reservoir, O'Shannassy Reservoir, Sugarloaf Reservoir and Maroondah Reservoir. The Yarra River flows through the heart of Melbourne before reaching Port Phillip Bay. A map of the Yarra Basin is shown in Figure 21-1.

Water Supply Protection Areas within the Yarra Basin include the whole of the Wandin Yallock WSPA for groundwater and the 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.

## 21.2 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. Port Phillip and Western Port Catchment Management Authority was responsible for waterway management in the Yarra Basin in 2003/04.

## 21.3 Seasonal Overview

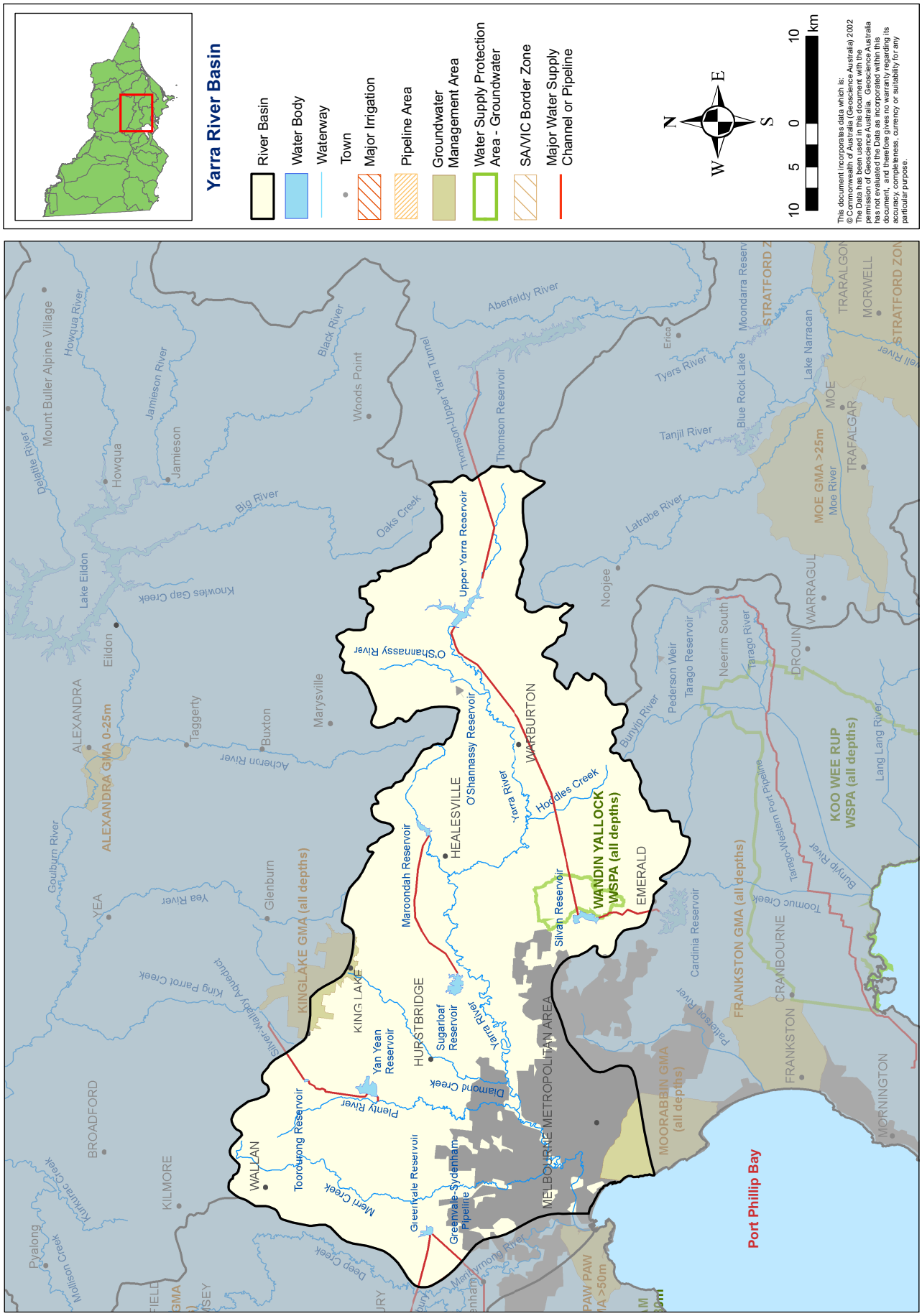
In 2003/04 the highest rainfall occurred in the upper reaches of the catchment near Melbourne Water's major storages (Upper Yarra Reservoir, O'Shannassy Reservoir and Maroondah Reservoir). Streamflows into these reservoirs were equal to the long-term average. The lowest rainfall occurred in the lower reaches of the catchment. Overall rainfall in the Yarra River catchment was slightly lower than average.

Stage 1 restrictions were in place for all of metropolitan Melbourne during July 2003 and these were increased to Stage 2 from August 2003 until December 2003, when these Stage 2 restrictions were modified to allow for the watering of sports grounds. These modified Stage 2 restrictions were still in place at the end of June 2004.

Melbourne Water and community groups worked together in 2003/04 to improve waterways in the Yarra Basin. Projects included reshaping the banks of Steels Creek in Yarra Glen and relaying and stabilising banks of Troups Creek in Narre Warren. Removal of willows also occurred at several locations in the basin, including along the Yarra River in north Kew and along Merri Creek in Brunswick East.

The only water quality issue reported in the Yarra Basin was blue-green algae in Yan Yean Reservoir. Taste and odour complaints resulted in the reservoir being closed on the 6th of December 2003 and it remained off-line at the end of 2003/04.

**Figure 21-1 Map of the Yarra Basin**



The Yarra catchment had many irrigation bans imposed during 2003/04. These occurred in:

- Diamond Creek over July 2003 and January 2004 to June 2004
- Pauls Creek, Steels Creek and Dixons Creek during July 2003 and from December 2003 to June 2004
- Plenty River during July 2003, November 2003 to March 2004, May 2004 and June 2004
- The Little Yarra River over February 2004 to March 2004 and restricted during May 2004
- Stringybark Creek during July 2003 and from January to March 2004
- Don River, Watsons Creek, Woori Yallock Creek and Yarra River during February 2004 and March 2004
- Darebin Creek, Merri Creek, Moonee Ponds Creek, Mullum Mullum Creek during February 2004
- Wandin Yallock Creek over January 2004 to February 2004
- Hoddles Creek in July 2003.

## 21.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Yarra Basin are shown in Table 21-1.

**Table 21-1 Summary of total water resource and water use in Yarra Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 851,650 | 480,690 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 8,660 | 280 |

(1) The total resource and use in the Yarra Basin only includes GMAs or WSPAs that have more than 90 per cent of their surface area within the river basin boundary (i.e. the Wandin Yallock WSPA).

During the year there was a net transfer of water out of the Yarra Basin. Melbourne Water imported 84,564 ML from the Thomson Basin and 2,995 ML from the Goulburn Basin in to the Yarra Basin to supply the Melbourne urban demand. Melbourne Water transferred 109,538 ML to City West Water for supply to those parts of Melbourne within the Maribyrnong and Werribee Basins. Melbourne Water transferred 154,735 ML to South East Water for supply to those parts of Melbourne within the Bunyip Basin. Melbourne Water also transferred approximately 5,500 ML to Western Water to augment its supply to urban centres in the Maribyrnong and Werribee Basins.

## 21.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Yarra Basin. The water available to the environment at the basin outlet was 304,440 ML, which is equivalent to about 40 per cent of the inflows to the Yarra Basin. This amount consists of environmental flows provided by Melbourne Water and all other water flowing in the basin, which 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. 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.

Melbourne Water is required to manage flow in the Yarra River around a trigger level of 245 ML/day at Yering Gorge. The dry conditions in 2003/04 caused flows in the Yarra River to fall as low as 168 ML/day. When the river fell below the 245 ML/day trigger level, Melbourne Water met its obligations by ceasing its pumping from the Yarra River at Yering and harvesting of water from minor tributaries, and restricting licensed diversions from the river.

## 21.6 Surface Water Resources

### 21.6.1 Water Balance

A water balance for surface water in the Yarra Basin is shown in Table 21-2. Melbourne Water operates seven major storages within the Yarra Basin. Upper Yarra Reservoir, O'Shannassy Reservoir and Maroondah Reservoir all harvest water. The remaining four storages, Silvan Reservoir, Yan Yean Reservoir, Sugarloaf Reservoir and Greenvale Reservoir act as service basins. At the start of 2003/04 the storages were at 52 per cent of capacity and increased during the year to 62 per cent of capacity.

Inflows to the three major water harvesting storages in the Yarra Basin were equal to the long-term average inflows. However, across the whole basin, the inflows were equivalent to only 63 per cent of the average inflows. In Table 21-2 the inflows also include transfers from other basins. Melbourne Water imported 84,564 ML from the Thomson Reservoir into the Upper Yarra Reservoir and 2,995 ML from the Goulburn Basin into its storages.

The loss estimate is the total transmission losses occurred by Melbourne Water between the water supply system and the retail water companies' reticulation network which are approximately 1.4 per cent of the volume supplied to demand. Additional losses occur within the individual reticulation network and are not accounted for. Data was not available to make an estimate of the in-stream looses to groundwater and evaporation.

**Table 21-2 Balance of surface water in the Yarra Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 218,100 |
| Volume in storage at end of year | 260,400 |
| **Change in storage** | **42,300** |
| **Inflows** | |
| Catchment inflow | 755,710 |
| Transfers from other basins into waterways | 87,560 |
| Irrigation return flow | 0 |
| Treated effluent discharge back to river(1) | 8,380 |
| **Subtotal** | **851,650** |
| **Diversions** | |
| Urban diversions | 438,800 |
| Unregulated licensed private diversions | 26,070 |
| Catchment farm dams | 15,820 |
| **Subtotal** | **480,690** |
| **Losses** | |
| Evaporation losses from major storages | 16,700 |
| Losses from catchment farm dams | 1,370 |
| Melbourne Water transmission losses | 6,140 |
| **Subtotal** | **24,210** |
| **Water passed at outlet of basin** | |
| River outflows to Port Phillip Bay | 304,440 |
| | |
| **Volume available to the environment in the Yarra Basin** | **304,440** |

(1) Assumes non-reused water is discharged to waterways

### 21.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Yarra Basin is estimated to be around 23,100 ML (Table 21-3). Average annual usage from the dams is estimated to be 15,800 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 17,200 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 21-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 10,520 | 5,260 | n/a |
| Irrigation | 12,570 | 10,560 | n/a |
| **TOTAL** | **23,090** | **15,820** | **17,200** |

n/a = information not available

### 21.6.3 Water Entitlement Transfers

In 2003/04 65 ML of permanent entitlement and 383 ML of temporary entitlement were transferred within the Yarra Basin.

### 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 that could have been diverted in 2003/04. It should be noted that the bulk entitlement in the Yarra Basin was not completed by the start of 2003/04 and values are not reported against the bulk entitlement. Most of the significant licences on unregulated streams are metered.

**Table 21-4 Volume of water diverted under surface water entitlements in the Yarra Basin**

| Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Melbourne Water* | | | | | |
| Melbourne Supply System | n/a | 0 | n/a | 438,800 | n/a |
| **Total volume of bulk entitlements** | **n/a** | **0** | **n/a** | **438,800** | |
| *Unregulated licensed diverters* | 33,356 | 0 | 33,356 | 26,071 | |

n/a indicates that the bulk entitlement conversion order was not finalised at the start of 2003/04

### 21.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

In 2003/04 there were no bulk entitlements operating in the Yarra Basin.

### 21.6.6 Compliance with Streamflow Management Plans

There are two completed Streamflow Management Plans within the Yarra Basin: Diamond Creek and Hoddles Creek.

In Diamond Creek the seven-day average flow dropped below the minimum flow for one day on the 18th of December 2003 without being protected by a ban. A ban on taking water was implemented on the 1st of January 2004 and stayed in place for the remained of the water year. Whenever Running Creek Reservoir contains water available for release, Melbourne Water is required to release some water daily, between 1 December and 28 February in the following year. During the year, releases of one to two megalitres per day were made over the summer months and were continued into autumn and winter as the reservoir filled. The allocation limit within the catchment prior to the farm dam registration process being completed was 790ML. In 2003/04, 31.5 per cent of the allocation limit was used.

Melbourne Water inadvertently monitored flows using an outdated rating table for Hoddles Creek for most of the year. This led to periods of pumping access when flows were below the minimum average daily flow level. While bans were placed on four occasions this year, bans should have remained in place for a longer period. Procedures for updating rating tables have been reviewed. The allocation limit within the catchment is 1,207ML. In 2003/04, 16.2 per cent of the allocation limit was used. Note that this does not cover all winter-fill licence use due to the winter-fill period extending beyond the single financial year.

The following SFMPs are also being developed in the Yarra Basin:

- Plenty River
- Paul, Steels, Dixons Creek
- Olinda Creek
- Stringybark Creek
- Woori Yallock Creek
- Little Yarra / Don Rivers.

## 21.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Yarra Basin, excluding stock and domestic use, is shown in Table 21-5. An estimate of stock and domestic use within these management areas is provided in Table 21-6.

The Yarra Basin contains all of the Wandin Yallock WSPA and part of the Kinglake GMA and Moorabbin GMA. The volumes described in the Table 21-5 are totals for the management areas and include the area that falls outside the Yarra Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

The Wandin-Yallock WSPA is in an area where there is a high degree of surface water and groundwater interaction, along with the potential for interference between groundwater bores.

**Table 21-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/yr) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Wandin Yallock WSPA | All Depths | 3,300 | 2,880 | 608 | Not applicable | 3,300 |
| Moorabbin GMA (63%) | All Depths | 4,305 | 2,273 | Not available | 1,091 | Not available [6] |
| Kinglake GMA (22%) | All Depths | 3,830 | 2,012 | Not available | 966 | Not available [6] |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage.

(4) In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) No estimate of Total Water Resource is applicable as >10 per cent 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)[1] |
|---|---|---|
| Wandin Yallock WSPA | 163 | 326 |
| Moorabbin GMA | 238 | 476 |
| Kinglake GMA | 425 | 850 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 21.8 Recycled Water

Yarra Valley Water operates nine sewage treatment plants within the Yarra Basin. Effluent is reused at four of the plants. Less than 1 ML was reused in the Upper Yarra STP and so is not shown in Table 21-7. Overall three per cent of effluent was reused in the basin.

**Table 21-7 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Brushy Creek | Yarra Valley Water | 3,969 | 45 |
| Craigieburn | Yarra Valley Water | 870 | 111 |
| Healesville | Yarra Valley Water | 380 | 0 |
| Upper Yarra | Yarra Valley Water | 692 | 0 |
| Lilydale | Yarra Valley Water | 2,404 | 0 |
| Emerald - Ferres Rd | Yarra Valley Water | 62 | 0 |
| Avonsleigh - Symons Rd | Yarra Valley Water | 97 | 0 |
| Monbulk | Yarra Valley Water | 11 | 0 |
| Whittlesea | Yarra Valley Water | 177 | 123 |
| **TOTAL** | | **8,663** | **279** |

# 22. Maribyrnong Basin

## 22.1 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 estuary just upstream of Port Phillip Bay. A map of the river basin is shown in Figure 22-1.

Groundwater Management Areas (GMAs) within the Maribyrnong Basin include the whole Lancefield GMA and part of the Cut Paw Paw GMA.

## 22.2 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. 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. 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. The Port Phillip and Westernport Catchment Management Authority was responsible for waterway management in the Maribyrnong Basin in 2003/04.

## 22.3 Seasonal Overview

The Maribyrnong Basin experienced slightly lower than average rainfall during 2003/04. However, streamflows were well below average. Salt Creek, one of the main tributaries flowing into Rosslynne Reservoir, recorded only six per cent of its long-term average (at gauge 230210).

Stage 1 restrictions were imposed for Sunbury, Diggers Rest and Bulla in July 2003 and these were increased to Stage 2 in August 2003. Stage 1 restrictions were in place for Lancefield for the whole of 2003/04. Stage 2 restrictions in Gisborne, Macedon, Mt Macedon, Riddells Creek, were increased to Stage 3 during July 2003 and again increased to Stage 4 in December 2003. Stage 3 restrictions were in place for Romsey, Monegeeta and Woodend from July 2003 until they were eased to Stage 2 in December 2003.

In July 2003, bans were in place for Barringo Creek, Bolinda Creek, Main Creek, Deep Creek, Charlie Creek, Number 3 Creek, Riddells Creek, Turritable Creek and Willimigongon Creek and a Stage 1 restriction was imposed on Jacksons Creek. Later in the year, irrigation bans were placed on Barringo Creek, Bolinda Creek, Main Creek, Deep Creek, Charlie Creek, Witch Creek, Number 3 Creek, Riddells Creek, Turritable Creek, Willimigongon Creek and Jacksons Creek over the period from November 2003 to June 2004.

The Maribyrnong River had an irrigation ban in place from December 2003 to June 2004. There was not enough water in Southern Rural Water's or Melbourne Water's share of Rosslynne Reservoir to provide a seasonal allocation for licensed diverters. Only one per cent of the licensed diverters' entitlements was harvested.

During the year water quality deteriorated due to the dry conditions and there were blue green algae blooms in the lower reaches of the Maribyrnong River.

## 22.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Maribyrnong Basin are shown in Table 22-1. In 2003/04 City West Water transferred approximately 54,769 ML to the Maribyrnong Basin from the Yarra Basin to supply the urban demand of metropolitan Melbourne. Melbourne Water also transferred 3,521 ML to Western Water to supply Sunbury. The volume is not shown in Table 22-1 because this water is diverted from adjacent river basins.

**Table 22-1 Summary of total water resource and water use in Maribyrnong Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 36,670 | 12,050 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 3,030 | 1,820 |

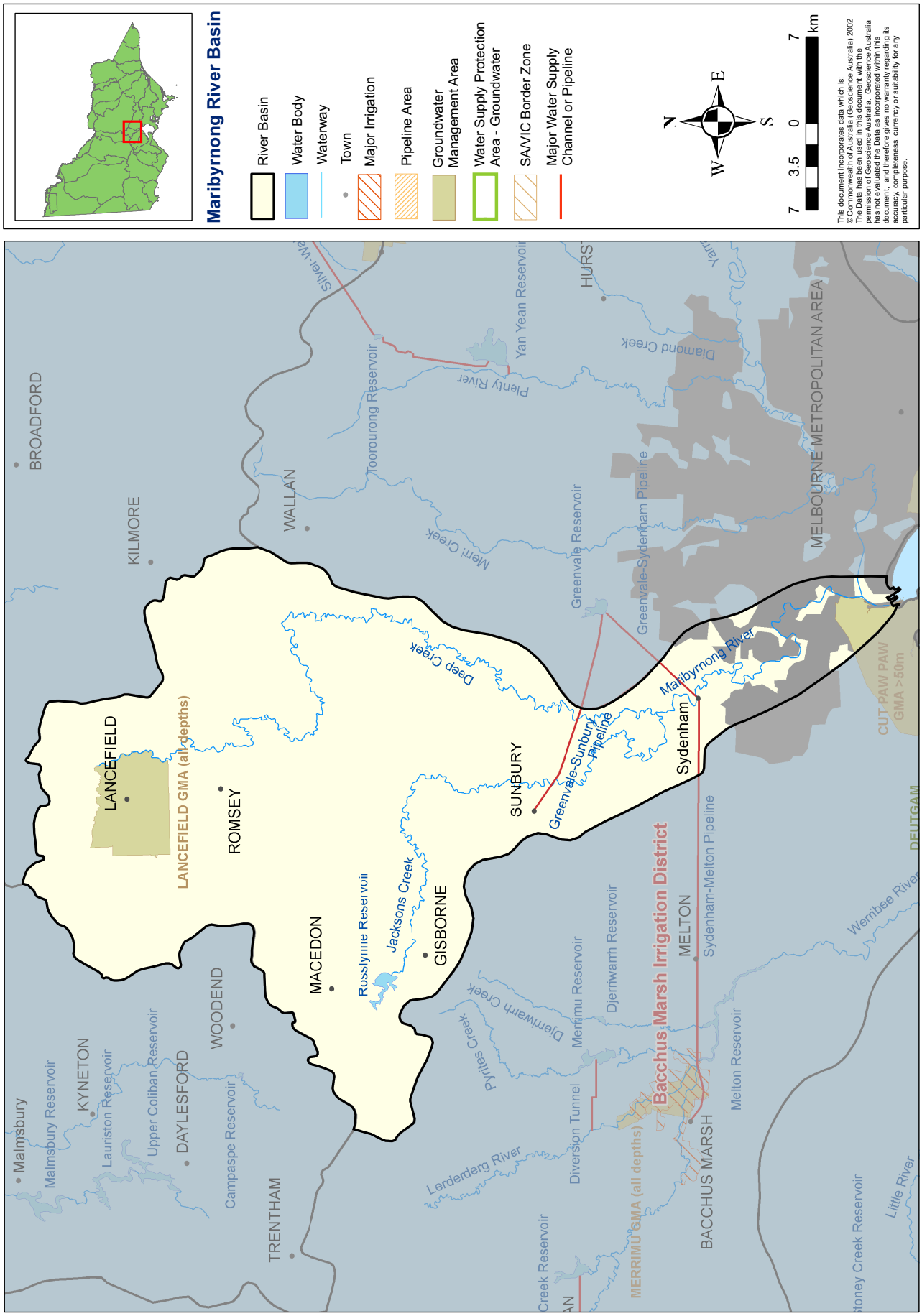
(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90 per cent of their surface area within the river basin boundary.

## 22.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Maribyrnong Basin. The water available to the environment at the basin outlet was around 16,470 ML, which is about 45 per cent of the total amount of water in the basin. 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. A Streamflow Management Plan is proposed for the Upper Maribyrnong River to develop 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.

**Figure 22-1 Map of the Maribyrnong Basin**



## 22.6 Surface Water Resources

### 22.6.1 Water Balance

A surface water balance for the Maribyrnong Basin is shown in Table 22-2. 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 11 per cent of total capacity. The storage volume decreased during 2003/04 and was only six per cent full at the end of June 2004. Catchment inflows were only 29 per cent 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.

The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. The losses accounted for in the water balance do not include losses occurring between the point of water diversions and the point of use.

There were no transmission losses associated with supply to irrigators from Rosslynne Reservoir by Southern Rural Water and Melbourne Water because no irrigation releases were available from the reservoir this year due to drought. Normally transmission losses equate to 50-90 per cent of releases.

**Table 22-2 Balance of surface water in the Maribyrnong Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 2,660 |
| Volume in storage at end of year | 1,610 |
| **Change in storage** | **-1,050** |
| | |
| **Inflows** | |
| Catchment inflow | 36,670 |
| Irrigation return flow | 0 |
| Treated effluent discharge back to river(1) | 1,210 |
| **Subtotal** | **37,880** |
| **Diversions** | |
| Urban diversions | 2,730 |
| Regulated licensed private diversions | 270 |
| Unregulated licensed private diversions | 1,270 |
| Catchment farm dams | 7,780 |
| **Subtotal** | **12,050** |
| **Losses** | |
| Evaporation losses from major storages | 1,170 |
| Losses from catchment farm dams | 4,810 |
| In-stream losses to groundwater and evaporation | 4,440 |
| **Subtotal** | **10,420** |
| **Water passed at outlet of basin** | |
| River outflows to the ocean | 16,470 |
| | |
| **Volume available to the environment in the Maribyrnong Basin** | **16,470** |

(1) Assumes non-reused water is discharged to waterways

### 22.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Maribyrnong Basin is estimated to be around 11,600 ML (Table 22-3). Average annual usage from the dams is estimated to be 7,800 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 12,600 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 22-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 5,770 | 2,880 | n/a |
| Irrigation | 5,830 | 4,900 | n/a |
| **TOTAL** | **11,600** | **7,780** | **12,600** |

n/a = information not available

### 22.6.3 Water Entitlement Transfers

There were 31 temporary transfers within the basin, which totalled 2,565 ML.

### 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 that could have been diverted in 2003/04. Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

Southern Rural Water did not release any water from Rosslynne Reservoir for irrigators during 2003/04. All water diverted under their bulk entitlement was by customers taking direct from the river.

**Table 22-4 Volume of water diverted under surface water entitlements in the Maribyrnong Basin**

| Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Southern Rural Water* | | | | | |
| Maribyrnong | 382 | 0 | 1,661 | 13 | Yes |
| *Melbourne Water* | | | | | |
| Maribyrnong | 1,095 | 0 | 3,726 | 259 | Yes |
| *Western Region Water Authority* | | | | | |
| Gisborne | n/a | 0 | n/a | 589 | |
| Macedon and Mt Macedon | n/a | 0 | n/a | 335 | |
| Lancefield | 315 | 0 | 315 | 41 | Yes |
| Maribyrnong | 6,100 | 0 | 19,674 | 1,402 | Yes |
| Riddells Creek | 300 | 0 | 300 | 0 | Yes |
| Romsey | 460 | 0 | 460 | 360 | Yes |
| **Total volume of bulk entitlements** | **8,652** | **0** | **26,136** | **2,999** | |
| *Unregulated licensed diverters* | 1,997 | 0 | 1,997 | 1,271 | |

### 22.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

Due to the extremely dry conditions, low water levels and the suspension of irrigation flows, Southern Rural Water (SRW) continued to experience difficulties in meeting the passing flow requirements at the Sunbury site, as stipulated under the Maribyrnong-SRW Bulk Entitlement Order. SRW discussed concerns with the Department of Sustainability and Environment and was granted a temporary amendment. These new arrangements will continue to protect the environment and provide some water savings during this drought period.

During the year, the environmental flow requirements in the lower Maribyrnong were met except for two days when flows in the Maribyrnong River fell below the minimum required. In this case the trigger to cease diverting occurred on a weekend and diverters were not able to be notified in time to cease pumping. Management of flows has been improved to prevent a re-occurrence.

Western Water met all passing and environmental flow obligations specified by their bulk entitlements.

### 22.6.6 Compliance with Streamflow Management Plans

There is no Streamflow Management Plan (SFMP) currently in operation in the Maribyrnong Basin. There is a SFMP being developed for the Upper Maribyrnong River.

## 22.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Maribyrnong Basin, excluding stock and domestic use, is shown in Table 22-5. An estimate of stock and domestic use within these management areas is provided in Table 22-6

The Maribyrnong Basin contains all of the Lancefield GMA and part of the Cut Paw Paw GMA. The volumes described in the Table 22-5 are totals for the management areas and include the area that falls outside the Maribyrnong Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

The Lancefield GMA is reaching its available limits in allocation and is subject to increasing pressure from further urban development in the Romsey and Lancefield areas. Western Water holds a groundwater licence to supply Lancefield. In 2003/04 it extracted 211 ML of its 500 ML licence.

**Table 22-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/yr) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Cut Paw Paw GMA (21%) | > 50 | 3,650 | 511 | Not available | 245 | Not available[6] |
| Lancefield GMA | All Depths | 1,485 | 1,238 | 303 | Not applicable | 1,485 |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage.

(4) In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) No estimate of Total Water Resource is applicable as >10 per cent 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)[1] |
|---|---|---|
| Cut Paw Paw GMA | 2 | 4 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 22.8 Recycled Water

All sewage treatment plants within the basin are operated by Western Water. Overall 60 per cent of the effluent was reused. Recycled water was supplied to customers and also used to make environmental releases into Jacksons Creek in lieu of water released from Rosslynne Reservoir as part of the amended bulk entitlement.

**Table 22-7 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Gisborne | Western Water | 405 | 211 |
| Riddells Creek | Western Water | 88 | 88 |
| Romsey | Western Water | 283 | 283 |
| Sunbury | Western Water | 2,255 | 1,237 |
| **TOTAL** | | **3,031** | **1,819** |

# 23. Werribee Basin

## 23.1 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 flows through the township of Werribee before entering Port Phillip Bay. A map of the river basin is shown in Figure 23-1.

Water Supply Protection Areas 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.

## 23.2 Responsibilities for Management of Water Resources

Southern Rural Water is responsible for managing the Werribee and Bacchus Marsh Irrigation Districts and is the licensing authority for groundwater and surface water licensed diversions within the Werribee Basin. 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 is responsible for waterway management in the Werribee Basin.

## 23.3 Seasonal Overview

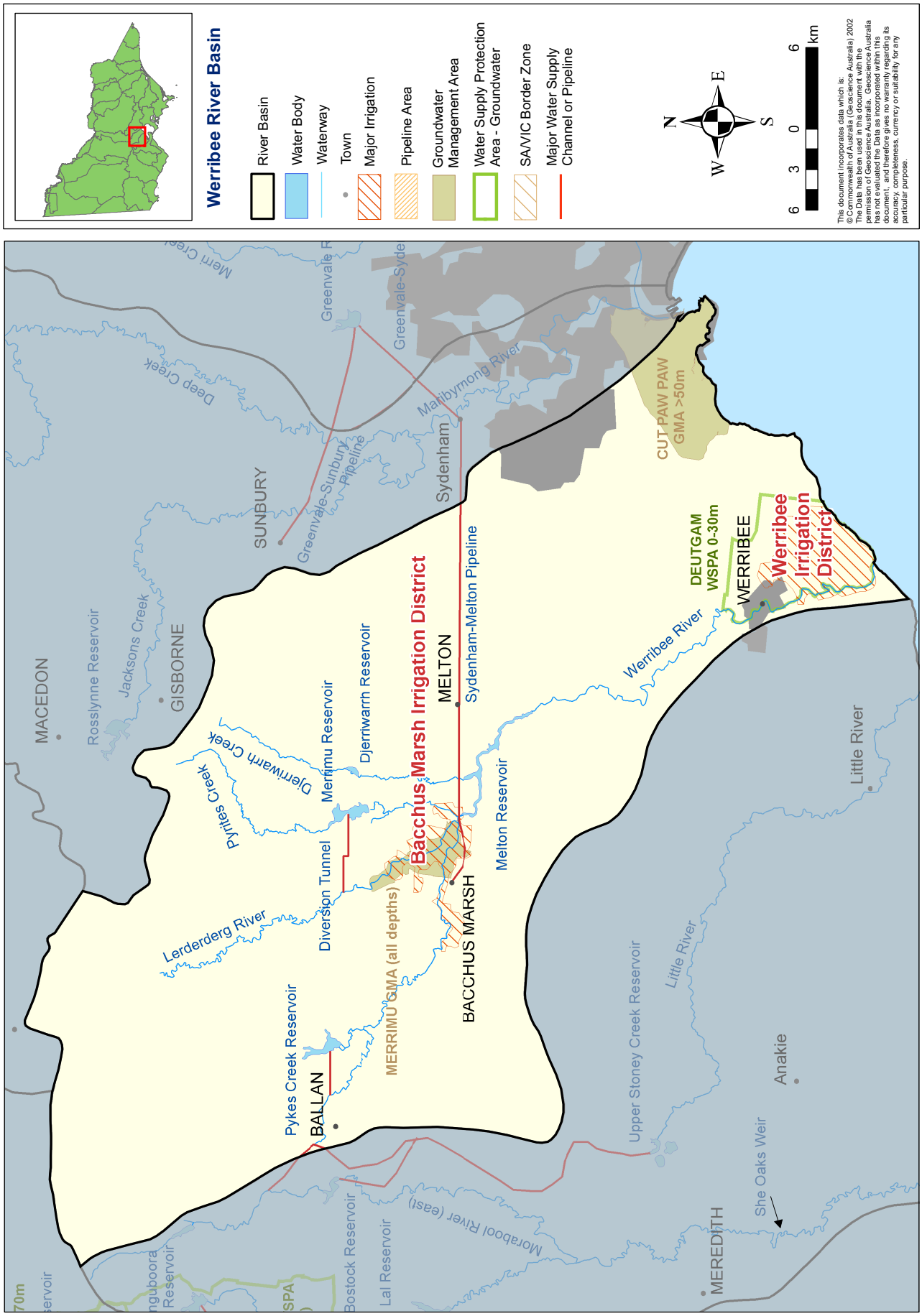
During 2003/04, rainfall in the Werribee river catchment was slightly lower than the long-term average. However the streamflows were well below average. Flows recorded in the upper reaches of the Lerderderg River (gauge 231213) were only 18 per cent of their long-term average. In Toolern Creek which flows near Melton recorded flows only 33 per cent of the long-term average (gauge 231231).

The seasonal allocation for irrigators in the Werribee and Bacchus Marsh Irrigation Districts was only 40 per cent of entitlement, the lowest seasonal allocation since the 1940s. A total of 38.5 per cent of entitlement was actually delivered from the Werribee River to irrigators in the Werribee Irrigation Area and 34.5 per cent was delivered in Bacchus Marsh Irrigation Area.

Stage 1 restrictions were in place for Myrniong during July 2003 to September 2003, were increased to Stage 3 in October 2003 and then increased to Stage 4 in December 2003, which continued for the rest of 2003/04. Myrniong's supply was augmented by tankered water for some 80 per cent of the year due to low supply levels in Pykes Reservoir and the consequent poor water quality. Stage 2 restrictions in Bacchus Marsh, Melton, Rockbank, Long Forest and Toolern Vale were increased to Stage 3 during July 2003 and continued until they were increased to Stage 4 in December 2003 and eased to Stage 2 in May 2004 when water from the Melbourne system became available to the area.

A water shortage was declared for the Werribee River in March 2004 lasting until June 2004. Irrigation bans were in place for Lerderderg River and Koroit Creek over November 2003 to June 2004. In July 2003, there was also a ban in the Lerderderg River and Stage 1 restrictions in Koroit Creek.

**Figure 23-1 Map of the Werribee Basin**



## 23.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Werribee Basin is shown in Table 23-1. City West Water transfers approximately 54,770 ML from the Yarra Basin to supply the Melbourne urban demand. Melbourne Water also transfers 1,816 ML to Western Water for the supply of Bacchus Marsh and Melton. Central Highlands Water supplies 341 ML to a number of towns from Lal Lal Reservoir located in the Moorabool Basin. The largest of these towns is Ballan, which is located in the Werribee Basin. These volumes are not included in the water accounts for the Werribee Basin because they are diverted from adjacent river basins.

**Table 23-1 Summary of total water resource and water use in Werribee Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 43,650 | 22,360 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 148,430 | 22,160 |

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

## 23.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Werribee Basin. The water available to the environment at the basin outlet was 10,970 ML, which is about 25 per cent of the catchment inflows in the basin. This amount consists of environmental 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.

## 23.6 Surface Water Resources

### 23.6.1 Water Balance

A surface water balance for the Werribee Basin is shown in Table 23-2. Southern Rural Water and Western Water operate storages within the basin, including Pykes Creek Reservoir, Melton Reservoir, Merrimu Reservoir and Western Water operates Djerriwarrh Reservoir. At the start of the year the storages were very low at only 12 per cent of capacity. Throughout the year the inflows to the basin were extremely low, only 32 per cent of the long-term average. This resulted in a further drop in the storage volumes to only seven per cent at the end of June 2004.

The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. The losses accounted for in the water balance do not include losses occurring between the point of water diversions and the point of use.

**Table 23-2 Balance of surface water in the Werribee Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 8,330 |
| Volume in storage at end of year | 4,751 |
| **Change in storage** | **-3,579** |
| **Inflows** | |
| Catchment inflow | 43,650 |
| Irrigation return flow | 400 |
| Treated effluent discharge back to river(1) | 5,680 |
| **Subtotal** | **49,730** |
| **Diversions** | |
| Urban diversions | 3,780 |
| Irrigation district diversions | 8,830 |
| Unregulated licensed private diversions | 400 |
| Catchment farm dams | 9,350 |
| **Subtotal** | **22,360** |
| **Losses** | |
| Evaporation losses from major storages | 4,230 |
| Losses from catchment farm dams | 5,320 |
| In-stream losses to groundwater and evaporation | 10,410 |
| **Subtotal** | **19,960** |
| **Water passed at outlet of basin** | |
| River outflows to Port Phillip Bay | 10,970 |
| | |
| **Volume available to the environment in the Werribee Basin** | **10,970** |

(1) Assumes non-reused water is discharged to waterways, excluding the Western Treatment Plant

### 23.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Werribee Basin is estimated to be around 13,500 ML (Table 23-3). Average annual usage from the dams is estimated to be 9,300 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 14,700 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 23-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 5,870 | 2,930 | n/a |
| Irrigation | 7,630 | 6,410 | n/a |
| **TOTAL** | **13,500** | **9,340** | **14,670** |

n/a = information not available

### 23.6.3 Water Entitlement Transfers

The following transfers of water entitlement occurred with water users within the Werribee Basin in 2003/04:

- 0.8 ML of permanent transfer within the Werribee Irrigation District (WID)
- 42 ML of temporary transfer from the Bacchus Marsh Irrigation District to the WID
- 57 ML of temporary transfer from the Bacchus Marsh Irrigation District to the Werribee River
- A net 7 ML of temporary transfer from the WID to the Werribee River
- 628 ML of temporary transfer within the WID
- 23 ML of temporary transfer along the Werribee River
- 576 ML of temporary transfer within the Bacchus Marsh Irrigation District.

Overall there was one permanent transfer of water for a volume of 0.8 ML within the basin and 164 temporary transfers totalling 1,384 ML.

### 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 that could have been diverted in 2003/04. It should be noted that not all of the bulk entitlements for the Werribee Basin were completed by the start of 2003/04 and values are not reported against those bulk entitlements. Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

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.

**Table 23-4 Volume of water diverted under surface water entitlements in the Werribee Basin**

| Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML)[1] | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Central Highlands Water* | | | | | |
| Ballan | 451 | 0 | 451 | 0 | Yes |
| Blackwood & Barry's Reef | 140 | 0 | 140 | 56 | Yes |
| *Southern Rural Water* | | | | | |
| Werribee System – Irrigation | 27,040 | 0 | 73,627[2] | 8,833 | Yes |
| *Western Water* | | | | | |
| Myrniong | n/a | 0 | 58 | 5 | Yes |
| Werribee System | n/a | 0 | n/a | 1,816 | n/a |
| **Total volume of bulk entitlements** | **27,631** | **0** | **649** | **10,710** | |
| *Unregulated licensed diverters* | 910 | 0 | 910 | 403 | |

(1) Refers to the volume that could be diverted under the bulk entitlement cap, however, the volume of water may not be physically available for extraction.

n/a indicates that the bulk entitlement conversion order was not finalised at the start of 2003/04

### 23.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

All passing and environmental flow obligations associated with bulk entitlements in the basin were complied with during 2003/04.

### 23.6.6 Compliance with Streamflow Management Plans

There is no Streamflow Management Plan (SFMP) currently in operation in the Werribee Basin.

## 23.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Werribee Basin, excluding stock and domestic use, is shown in Table 23-5. An estimate of stock and domestic use within these management areas is provided in Table 23-6.

The Werribee Basin contains all of the Deutgam WSPA and Merrimu GMA and part of the Cut Paw Paw GMA. The volumes described in Table 23-5 are totals for the management areas and include the area that falls outside the Werribee Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

The Deutgam WSPA has been subject to a groundwater pumping moratorium. This was due to sharply declining groundwater levels from intensive pumping for irrigation across the region. It is considered that over pumping may change the location and dynamics of the freshwater-seawater interface in the aquifer, leading to irreversible impacts on the groundwater resource. Groundwater levels appear to be stabilising, with monitoring of groundwater levels and salinity continuing.

**Table 23-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/yr) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Deutgam WSPA | 0 – 30 | 2,400 | 5,535 | 547 (part)[6] | Not applicable | 5,535 |
| Merrimu GMA | All Depths | 450 | 421 | 74 | Not applicable | 450 |
| Cut Paw Paw GMA (79%) | > 50 | 3,650 | 511 | Not available | 245 | Not available[7] |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage.

(4) In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, whichever is greater.

(6) Meters were installed in the Deutgam WSPA in February 2004 and were read in May of 2004.

(7) No estimate of Total Water Resource is applicable as >10 per cent 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)(1) |
|---|---|---|
| Deutgam WSPA | 257 | 514 |
| Merrimu GMA | 13 | 26 |
| Cut Paw Paw GMA | 2 | 4 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 23.8 Recycled Water

The volume of water recycled in the Werribee Basin in 2003/04 is shown in Table 23-7. Five sewage treatment plants operate within the Werribee River. Overall 15 per cent of effluent is reused. Melbourne Water operates the largest STP, the Western Treatment Plant. The volume reused at the Western Treatment Plant includes on-site recycling of 17,945 ML. Other recycled water was used at the National Equestrian Centre and the Werribee Park Golf Course. A larger volume of treated effluent will be available for reuse after a major upgrade, and the treatment plant will be capable of supplying recycled water to the Werribee Irrigation District.

**Table 23-7 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Altona | City West Water | 5,676 | 0 |
| Western Treatment Plant | Melbourne Water | 138,668 | 18,075 |
| Ballan | Central Highlands Water | 85 | 85 |
| Melton | Western Water | 3,105 | 3,105 |
| Parwan South | Western Water | 891 | 891 |
| **TOTAL** | | **148,425** | **22,156** |

# 24. Moorabool Basin

## 24.1 Location of Water Resources

The Moorabool Basin is located within the South East Coast Drainage Division, west of Melbourne. Little River is included in the basin and flows into Port Phillip Bay. The Moorabool River joins the Barwon River near Geelong and flows into Bass Strait. A map of the river basin is shown in Figure 24-1.

Groundwater Management Areas (GMAs) within the Moorabool Basin include part of the Bungaree WSPA.

## 24.2 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 supplies part of the urban demands of Greater Geelong, and Central Highlands Water harvests water in the upper reaches of the Moorabool Basin to provide around 95 per cent of Ballarat's demand and 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.

## 24.3 Seasonal Overview

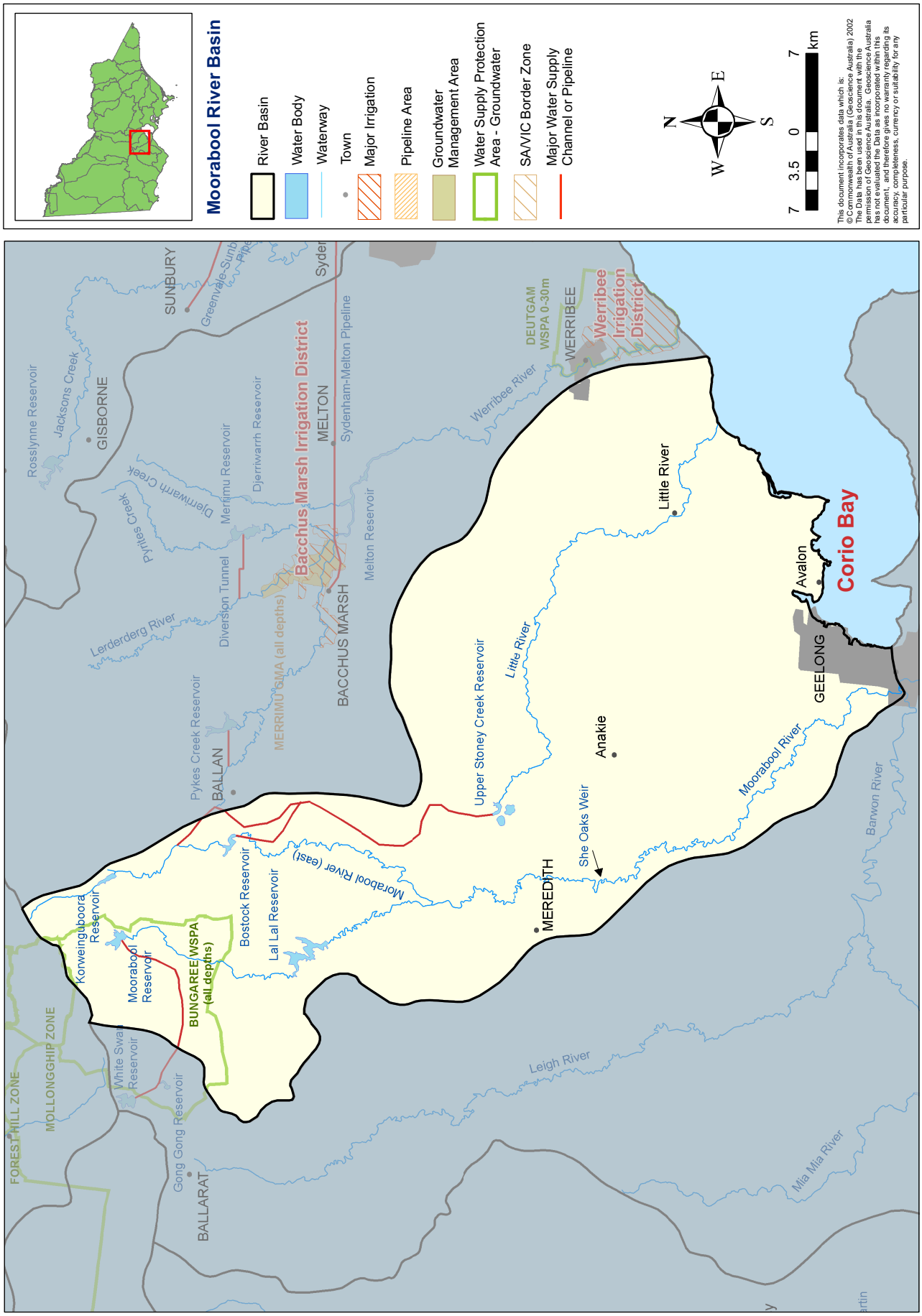
The Moorabool Basin experienced slightly lower than average rainfall during 2003/04. Inflows to Lal Lal Reservoir and Moorabool Reservoir were 15 per cent and 28 per cent of their long-term average respectively. Flow in Little River was only 12 per cent of its long-term average.

Dry conditions in the catchment resulted in restrictions being placed on water use in towns supplied from the basin. In Ballarat, Stage 2 restrictions were increased to Stage 3 (of 4 stage policy) in September 2003. All towns in the Ballarat system continued on Stage 3 restrictions for the rest of 2003/04.

Licensed diverters on the Moorabool River had Stage 5 irrigation restrictions imposed from April 2004 to May 2004 and Stage 3 restrictions over December 2003, February 2004 and June 2004. An irrigation ban was put in place for July 2003 and November 2003.

There were minor disruptions in the West Moorabool system due to heavy rain storms causing a sharp rise in the salinity and turbidity of raw water delivered to the Moorabool and Meredith water treatment plants.

**Figure 24-1 Map of the Moorabool Basin**



## 24.4 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 24-1. Central Highlands Water transferred 13,510 ML from the Moorabool Basin to supply water to Ballarat and Ballan. Barwon Water sources from both the Barwon and Moorabool Basins to supply the urban demand of Geelong, which is located within both basins. It is difficult to determine if there was a net transfer between the two basins during the supply of water to Geelong.

**Table 24-1 Summary of total water resource and water use in Moorabool Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 34,270 | 35,940 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 0 | 0 |

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

## 24.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Moorabool Basin. The water available to the environment at the basin outlet was around 4,850 ML, which is about 14 per cent of the total amount of water in the basin. This amount consists of passing flows required to be released under bulk entitlements, and all other water flowing in the basin which was not taken out of the streams for consumptive uses.

The Corangamite CMA undertook an assessment of waterway health and found that no streams were in excellent or good condition, with the majority rated poor. Investigations concluded this was probably due to the significantly reduced annual volume of water available for the environment and also the modified seasonal flow pattern in the regulated reaches of the basin. As a result of providing water to meet irrigation and town water supply demands, the flow regime of the Moorabool River has changed significantly from the natural pattern, with high flows during the irrigation season and predominantly low flows at other times.

The Moorabool River Water Resource Assessment was completed in 2003 to determine viable flow improvement options. The proliferation of off-stream catchment dams is a major source of concern as they intercept run-off and reduce streamflows.

## 24.6 Surface Water Resources

### 24.6.1 Water Balance

A water balance for the Moorabool Basin is shown in Table 24-2. Storage volumes within the Moorabool started at 33 per cent of total capacity and decreased throughout the year to only 20 per cent. Inflows to the basin were only 37 per cent of the long-term average.

The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. In the Moorabool Basin the inflows were back calculated by adding diversions to outflows and so no estimate of these losses is available. The losses accounted for in the water balance do not include losses occurring between the point of water

diversions and the point of use. Additional losses include the East Moorabool system losses estimated at 15-20 per cent, mainly due to leakage in the Bostock and Ballan channels. West Moorabool system transmission losses estimated at 10 per cent. Barwon Water will undertake a study to review this loss estimate in 2004/05. It is hoped this study will provide further information on suspected potential unauthorised diversions in the Moorabool system.

**Table 24-2 Balance of surface water in the Moorabool Basin**

| Water Account Component | Volume (ML) |
|---|---|
| Storage Volume | |
| Volume in storage at start of year | 26,321 |
| Volume in storage at end of year | 15,790 |
| **Change in storage** | **-10,531** |
| **Inflows** | |
| Catchment inflow(1) | 34,270 |
| Irrigation return flow | 0 |
| Treated effluent discharge back to river(2) | 0 |
| **Subtotal** | **34,270** |
| **Diversions** | |
| Urban diversions | 23,410 |
| Unregulated licensed private diversions | 630 |
| Catchment farm dams | 11,900 |
| **Subtotal** | **35,940** |
| **Losses** | |
| Evaporation losses from major storages | 4,020 |
| Losses from catchment farm dams | 0 |
| In-stream losses to groundwater and evaporation(3) | 0 |
| **Subtotal** | **4,020** |
| **Water passed at outlet of basin** | |
| River outflows to Port Phillip Bay | 1,800 |
| River outflows to the Barwon River | 3,050 |
| | |
| **Volume available to the environment in the Moorabool Basin** | **4,850** |

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

(2) Assumes non-reused water is discharged to waterways

(3) Assumed to be zero because the data is not readily available

### 24.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Moorabool River Catchment (excluding Little River and other small coastal streams) is estimated to be around 16,000 ML. The total catchment runoff that is harvested by the dams is estimated to be 8,370 ML in 2003/04 for the Moorabool River catchment and 11,900 ML for the entire Moorabool Basin in 2003/04.

Catchment farm dams used for irrigation and commercial use are currently being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

### 24.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water rights, diversion licences or sales water within the basin in 2003/04.

### 24.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 24-3. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume that could have been diverted in 2003/04. Full details of compliance with bulk entitlements are provided in the Resource Manager's 2003/04 Report for the Moorabool Basin (DSE, 2004). Licences on unregulated streams are generally not metered and hence compliance has not been assessed.

**Table 24-3 Volume of water diverted under surface water entitlements in the Moorabool Basin**

| Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML)[2] | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Barwon Water* | | | | | |
| Lal Lal Barwon[1] | 21,000 | 0 | 15,851 | 8,035 | Yes |
| Meredith | 600 | 0 | 600 | 281 | Yes |
| She Oaks[1] | 6,000 | 0 | 5,677 | 30 | Yes |
| Upper East Moorabool System | 9,000 | 0 | 9,000 | 1,550 | Yes |
| *Central Highlands Water* | | | | | |
| Lal Lal - Central Highlands[1] | 42,000 | 0 | 29,310 | 10,078 | Yes |
| Upper West Moorabool System | 10,500 | 0 | 10,500 | 3,432 | Yes |
| **Total volume of bulk entitlements** | **89,100** | **0** | **70,938** | **23,406** | |
| *Unregulated licensed diverters* | 3,327 | 0 | 3,327 | 627 | |

(1) The bulk entitlement volume refers to the volume that can be extracted over any consecutive three year period.

(2) Refers to the volume that could be diverted under the bulk entitlement, however, the volume of water may not be physically available for extraction.

### 24.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

Barwon Water reported compliance with the East and West Moorabool River passing flow requirements within operational constraints. Some non-compliance were reported by Barwon Water for provision of daily passing flows at Korweinguboora Reservoir and Bolwarra Weir, as specified in Clause 9 of the Upper East Moorabool bulk entitlement. The extremely low reservoir levels at Korweinguboora have contributed to difficulty in providing passing flows. Furthermore, Barwon Water reasonably assumes that passing flow releases from Korweinguboora will reach Bolwarra Weir and satisfy this site's passing flow requirement. However, this is not the case during dry periods and in an attempt to compensate, Barwon Water has implemented a release regime with higher than required passing flow releases. There were also minor passing flow non-compliances under the same bulk entitlement at Bostock Reservoir, although 91 per cent of releases were greater than 90 per cent of the required release volume.

Central Highlands Water reported compliance with the Lal Lal Reservoir passing flow requirements within operational constraints. A new outlet control was commissioned at Moorabool Reservoir in February 2004 which improved the accuracy of flow measurement and compliance with passing flow requirements.

### 24.6.6 Compliance with Streamflow Management Plans

There is no Streamflow Management Plan (SFMP) currently in operation in the Moorabool Basin. There are none planned in the next five years.

## 24.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Moorabool Basin, excluding stock and domestic use, is shown in Table 24-4. An estimate of stock and domestic use within these management areas is provided in Table 24-5.

The Moorabool Basin contains part of the Bungaree WSPA. The volumes described in the Table 24-4 are totals for the Bungaree WSPA and include the area that falls outside the Moorabool Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

The Bungaree WSPA has been allocated 120 per cent of the PAV and there is a concern that the high level of groundwater extractions is reducing streamflows in the Upper Moorabool catchment. Central Highlands Water holds a licence to supply groundwater to Gordon/Mt Egerton. No water was extracted under this licence in 2003/04.

**Table 24-4 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits [2] | PAV (ML/yr) | Licensed Allocation [3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas [4] (ML) | Total Water Resource [5] (ML) |
|---|---|---|---|---|---|---|
| Bungaree WSPA (67%) | All Depths | 4,400 | 5,272 | 3,737 | Not applicable | Not available[6] |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage (except Grampians Wimmera Mallee Water).

(4) In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) No estimate of Total Water Resource is applicable as >10 per cent GMA/WSPA is located outside the river basin.

**Table 24-5 Number of Stock and Domestic Bores and Estimated**

| Water Supply Protection Area/Groundwater Management Area | No. of Stock and Domestic Bores[1] | Estimated Stock and Domestic Use (assuming 2ML/bore) [1] |
|---|---|---|
| Bungaree WSPA | 252 | 504 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 24.8 Recycled Water

There are no sewerage treatment plants within the Moorabool Basin.

# 25. Barwon Basin

## 25.1 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 it flows into the ocean in Barwon Heads. A map of the river basin is shown in Figure 25-1.

Water Supply Protection Areas within the Barwon Basin include the part of the Bungaree WSPA. Groundwater Management Areas within the Barwon Basin include part of the Gerangamete GMA.

## 25.2 Responsibilities for Management of Water Resources

Southern Rural Water is responsible for managing groundwater pumping and private 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.

## 25.3 Seasonal Overview

Rainfall in the Barwon Basin was slightly lower than the long-term average during 2003/04. Streamflows in the basin were only 62 per cent of the long-term average.

The supply to Geelong was not restricted during 2003/04. Restrictions to Ballarat are covered under the Moorabool Basin, where its main supply of water comes from.

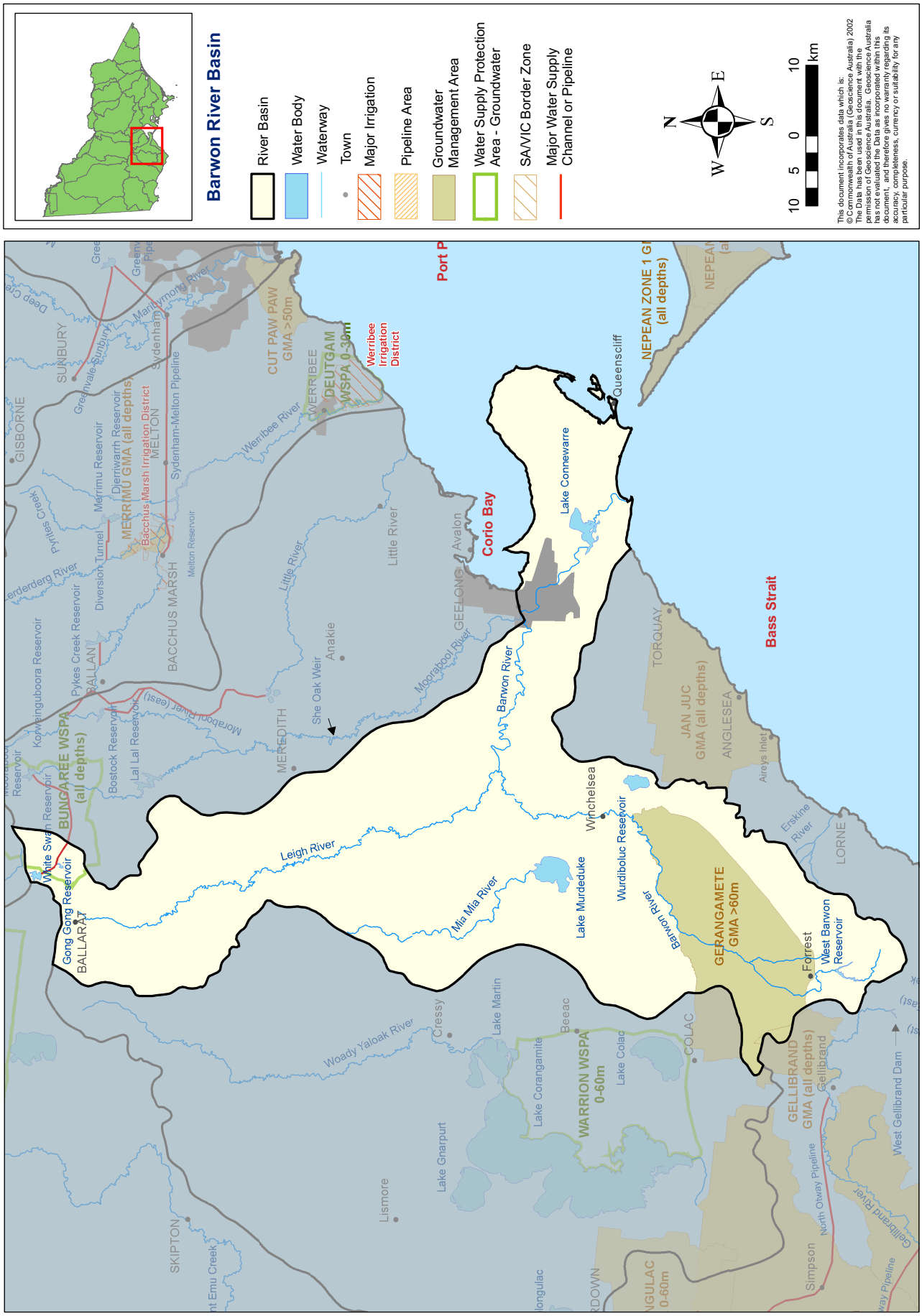
Over the period from March 2004 to May 2004, there was an irrigation ban in place for Zone B of the Barwon River, Stage 4 restrictions in Zone A and Stage 3 restrictions in Zone C. Over the same period, the Leigh River was also on Stage 3 restrictions.

The only reported water quality problem in the Barwon Basin occurred between Christmas 2003 and Easter in 2004, when an algal bloom occurred in the Barwon River in Geelong.

An assessment made by the Corangamite CMAs in 2003/04 found that most streams in the Barwon River were in marginal to poor condition, with few streams in excellent or good condition in water supply catchments. More than 80 per cent of the landscape is cleared and there are many threats to waterways, including high urban water demand, urban development, sedimentation and algal blooms. The proliferation of off-stream catchment dams is a major source of concern on account of their interception of run-off and reduction of streamflows.

During the summer of 2003/04 the Corangamite CMA coordinated a $300,000 major capital works project on Wormbete Creek at Wurdale in the Upper Barwon to reduce silt entering the Barwon River and Lake Connewarre. This work improved water quality by slowing water through two rock chutes upstream and downstream of Barwon Water's siphon and preventing further erosion along three to four kilometres of the creek.

**Figure 25-1 Map of the Barwon Basin**



## 25.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Barwon Basin are shown in Table 25-1. Barwon Water transferred 1,955 ML from the Barwon Basin into the Otway Coast Basin to supply the coastal towns of Torquay and Anglesea. Barwon Water sources water from both the Barwon and Moorabool Basins to supply Geelong, which is located across both basins.

**Table 25-1 Summary of total water resource and water use in Barwon Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 200,371 | 62,940 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 29,770 | 2,120 |

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

## 25.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Barwon Basin. The water available to the environment at the basin outlet was 96,790 ML, which is about 62 per cent of the total amount of water in the basin. This amount consists of environmental 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.

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 will be developed for the Barwon River and will outline water sharing rules to minimise the impacts of such diversions.

## 25.6 Surface Water Resources

### 25.6.1 Water Balance

A water balance for the Barwon Basin is shown in Table 25-2. Central Highlands Water operates two major storages within the basin, White Swan Reservoir and Gong Gong Reservoir. In July 2003 the storage volume was 16 per cent of total capacity. During the year, White Swan storage increased as a result of inflows and transfers from the Moorabool Basin. At the end of the year its volume was 31 per cent of total capacity. Barwon Water operates the West Barwon Dam and Wurdee Boluc Reservoir. Storage volumes also increased, from 46 to 54 per cent.

The inflows in the Barwon Basin were 155,900 ML. This is equivalent to only 62 per cent of the average catchment inflows which are 250,800 ML/year (NLWRA, 2001). The Moorabool River also flows into the Barwon River just upstream of Geelong.

Central Highlands Water transferred 13,510 ML from the Moorabool Basin into the Barwon Basin to supply water to Ballarat. Skipton, which is part of the Ballarat water supply system, is located within the Hopkins Basin and a portion of this volume was transferred to Skipton. Barwon Water transferred 217 ML from the Barwon Downs bore field, which is located in the Otway Coast Basin into the Geelong water supply system.

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

consumptive use. In the Barwon Basin the inflows were back calculated by adding diversions to outflows, so no estimate of these losses is available. The losses accounted for in the water balance do not include losses occurring between the point of water diversions and the point of use. For example, the Wurdee Boluc channel losses are estimated at 8-10 per cent when channel flows around 150 ML/day. The majority of losses are due to seepage and only minor losses are due to evaporation.

**Table 25-2 Balance of surface water in the Barwon Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 29,675 |
| Volume in storage at end of year | 36,823 |
| **Change in storage** | **7,148** |
| **Inflows** | |
| Catchment inflow(1) | 155,900 |
| Inflows from the Moorabool River | 3,050 |
| Transfers from other basins | 13,781 |
| Irrigation return flow | 0 |
| Treated effluent discharge back to river(2) | 27,640 |
| **Subtotal** | **200,371** |
| **Diversions** | |
| Urban diversions | 29,480 |
| Unregulated licensed private diversions | 2,560 |
| Catchment farm dams | 30,900 |
| **Subtotal** | **62,940** |
| **Losses** | |
| Evaporation losses from major storages | 7,610 |
| Losses from catchment farm dams | 12,380 |
| In-stream losses to groundwater and evaporation(3) | 13,510 |
| **Subtotal** | **33,500** |
| **Water passed at outlet of basin** | |
| River outflows to the ocean | 96,790 |
| | |
| **Volume available to the environment in the Barwon Basin** | **96,790** |

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

(2) Assumes non-reused water is discharged to waterways

(3) Assumed to be zero because not readily available

### 25.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Barwon Basin is estimated to be around 41,000 ML. Average annual usage from the dams is estimated to be 30,900 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 43,300 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 25-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 10,370 | 5,190 | n/a |
| Irrigation | 30,610 | 25,710 | n/a |
| **TOTAL** | **40,980** | **30,900** | **43,280** |

n/a = information not available

### 25.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water rights, diversion licences or sales water within the basin in 2003/04.

### 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 that could have been diverted in 2003/04. Licences on unregulated streams are generally not metered and hence compliance has not been assessed.

The bulk entitlement volumes within the Barwon Basin refer to the total volume that can be extracted over any consecutive three-year period. The bulk entitlements became effective in 2003/04. Therefore the volume that could be extracted in 2003/04 was equal to the bulk entitlement volume.

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.

**Table 25-4 Volume of water diverted under surface water entitlements in the Barwon Basin**

| Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML)[3] | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Barwon Water* | | | | | |
| Upper Barwon System[1] | 43,467 | 0 | 68,258 | 29,476 | Yes |
| *Central Highlands Water* | | | | | |
| Yarrowee - White Swan System[2] | 12,267 | 0 | 36,800 | 2,434 | Yes |
| **Total volume of bulk entitlements** | **55,734** | **0** | **105,058** | **31,910** | |
| *Unregulated licensed diverters* | 3,576 | 0 | 3,576 | 2,564 | |

(1) The bulk entitlement volume refers to the volume that can be extracted over any consecutive three year period.

(2) The bulk entitlement volume includes water diverted from the Moorabool Basin. This water is accounted for under the bulk entitlements held by Central Highlands Water in the Moorabool Basin.

(3) Refers to the volume that could be diverted under the bulk entitlement, however, the volume of water may not be physically available for extraction.

### 25.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

Central Highlands Water made substantial progress towards finalising the monitoring proposal for the Yarrowee-White Swan bulk entitlement. Works were installed to pass the required passing flows under this order and install monitoring.

Barwon Water complied with the passing and environmental flow obligations under their Upper Barwon bulk entitlement in 95per cent of days.

### 25.6.6 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.

## 25.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Barwon Basin, excluding stock and domestic use, is shown in Table 25-5. An estimate of stock and domestic use within these management areas is provided in Table 25-6.

The Barwon Basin contains part of the Bungaree WSPA and Gerangamete GMA. The volumes described in the Table 25-5 are totals for the management areas and include the area that falls outside the Barwon Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

The Gerangamete GMA has not been assigned a PAV because it is managed under a single groundwater licence to Barwon Water to supply water to Geelong. Specific comments on the Bungaree WSPA were contained in the water accounts for the Moorabool River catchment.

**Table 25-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/year) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[5] (ML) | Total Water Resource[6] (ML) |
|---|---|---|---|---|---|---|
| Bungaree WSPA (24%) | All Depths | 4,400 | 5,272 | 3,737 | Not applicable | Not available[7] |
| Gerangamete GMA (86%) | > 60 | Not available[8] | 8,000[4] | Not available | 3,840 | Not available[7] |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage.

(4) The Gerangamete PAV is 80,000 ML over a 10 year period.

(5) In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(6) The sum of PAVs or licensed volume, whichever is greater.

(7) No estimate of Total Water Resource is applicable as >10 per cent GMA/WSPA is located outside the river basin.

(8) There is no PAV for Gerangamete GMA as the entitlement is managed under a Groundwater Licence.

**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)[1] |
|---|---|---|
| Bungaree WSPA | 252 | 504 |
| Gerangamete GMA | 5 | 10 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 25.8 Recycled Water

The volume of water recycled in the Barwon Basin in shown in Table 25-7. Barwon Water and Central Highlands Water operate sewage treatment plants within the Barwon Basin. All effluent is reused from the smaller plants at Bannockburn, Portarlington and Winchelsea. Approximately nine per cent of the effluent from the Black Rock sewage treatment plant, which services Geelong, is reused and no effluent from Ballarat is reused. Overall seven per cent of the total basin effluent is reused.

**Table 25-7 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Bannockburn | Barwon Water | 9 | 9 |
| Portarlington | Barwon Water | 313 | 313 |
| Winchelsea | Barwon Water | 38 | 38 |
| Black Rock | Barwon Water | 20,360 | 1,763 |
| Ballarat North | Central Highlands Water | 2,097 | 0 |
| Ballarat South | Central Highlands Water | 6,948 | 0 |
| **TOTAL** | | **29,765** | **2,123** |

# 26. Corangamite Basin

## 26.1 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 is Lake Corangamite. A map of the river basin is shown in Figure 26-1.

Water Supply Protection Areas within the Corangamite Basin include the entire Warrion WSPA. Groundwater Management Areas within the Corangamite Basin include part of the Colongulac GMA, Gerangamete GMA and Paaratte GMA.

## 26.2 Responsibilities for Management of Water Resources

Southern Rural Water is the licensing authority responsible for managing groundwater and surface water licensed diversions. Barwon Water supplies Colac and South West Water supplies Camperdown, Lismore and Derrinallum, all from sources outside this basin. The Corangamite Catchment Management Authority is responsible for waterway management in the Corangamite Basin.

## 26.3 Seasonal Overview

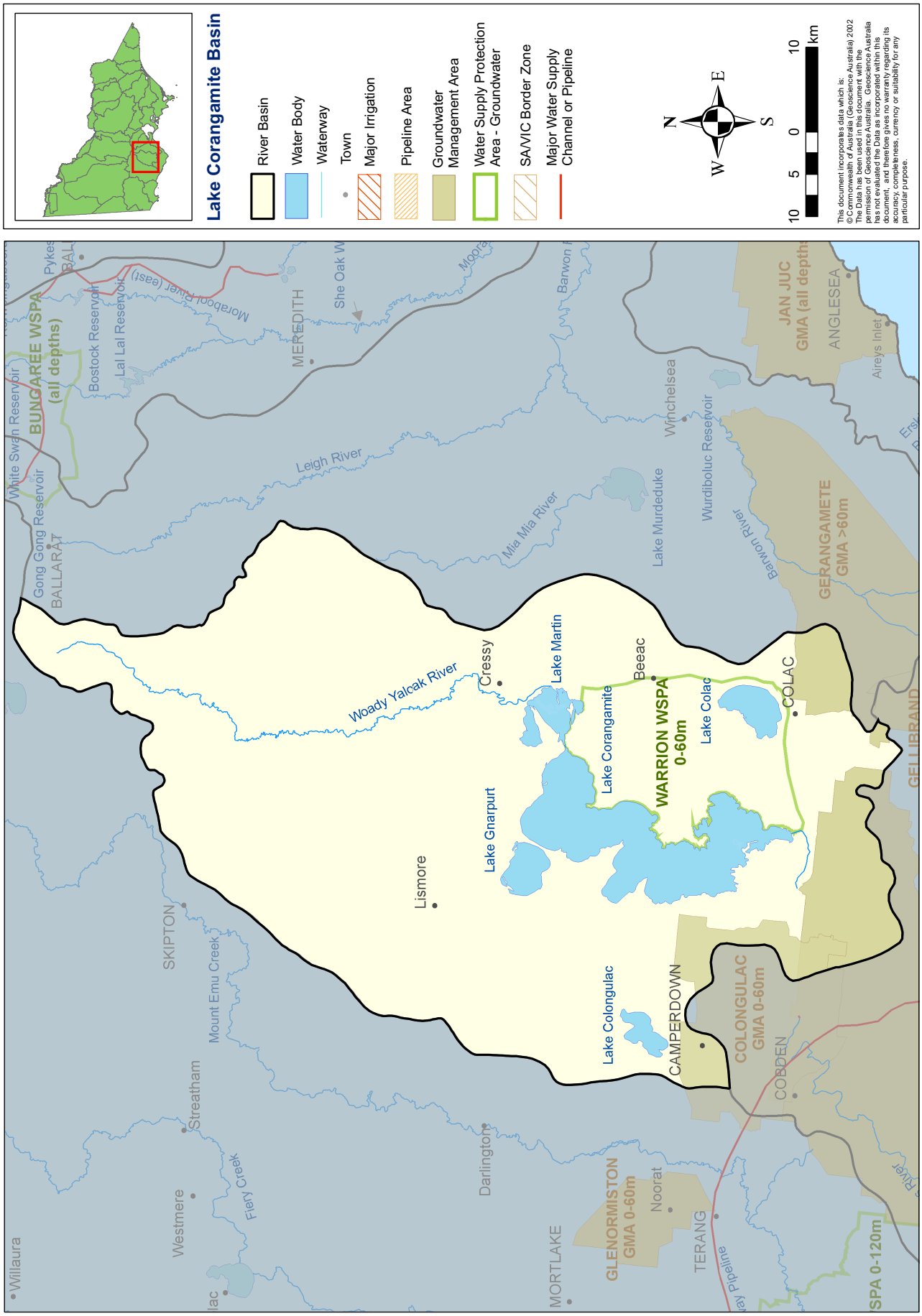
Rainfall was above average in the Corangamite Basin during 2003/04. However, streamflows were still below average. Flows in Woady Yaloak River at Pitfield (gauge 234200) were only 32 per cent of the long-term average.

No restrictions were in place for licensed diverters.

With dry conditions continuing in 2003/04, the water levels in Lake Corangamite were extremely low and its salinity was approximately three times saltier than seawater. Whilst the Lough Calvert Drainage Scheme and Woady Yaloak Diversion Scheme assets were maintained, they remained closed on account of the dry conditions. For the salinity in Lake Corangamite to reduce, increased flows from the Woady Yaloak River are required. At the low levels reached in 2003/04, the lake has little life and only supports a small number of birds that normally reside on this Ramsar-protected waterway.

An assessment made by the Corangamite CMA concluded the streams within the basin were in a marginal or poor condition in 2003/04. Most of the catchment has been cleared for agriculture and many wetlands have been drained.

**Figure 26-1 Map of the Corangamite Basin**



## 26.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Corangamite Basin are shown in Table 26-1. Barwon Water transferred 4,128 ML from the Otway Coast Basin into the Corangamite Basin to supply Colac. South West Water transferred 1,400 ML from the Otway Coast Basin into the Corangamite Basin to supply the towns of Camperdown, Lismore and Derrinallum. These transfers are accounted for under the Otway Coast Basin. All surface water extractions are from farm dams and licensed diverters.

**Table 26-1 Summary of total water resource and water use in Corangamite Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 99,650 | 12,950 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 2510 | 450 |

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

## 26.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Corangamite Basin. The water available to the environment at the basin outlet was 70,740 ML, which is about 72 per cent of the streamflow water in the basin. This amount consists of 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 Corangamite Basin is shown in Table 26-2. Overall the inflows in the Corangamite Basin were 81 per cent of the long-term average. In the Corangamite Basin approximately 20 per cent of the total inflows were diverted for consumptive use, the majority being extracted by catchment farm dams. Transfers from the Otway Coast Basin supply all urban demands within the catchment because of its better water quality, especially with regards to salinity. There are no major storages in the Corangamite Basin (> 1,000 ML in size).

The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. In the Corangamite Basin the inflows were back calculated by adding diversions to outflows, so no estimate of these losses is available. The losses accounted for in the water balance do not include losses occurring between the point of water diversions and the point of use.

**Table 26-2 Balance of surface water in the Corangamite Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 0 |
| Volume in storage at end of year | 0 |
| **Change in storage** | **0** |
| **Inflows** | |
| Catchment inflow[1] | 97,580 |
| Irrigation return flow | 0 |
| Treated effluent discharge back to river[2] | 2,070 |
| **Subtotal** | **99,650** |
| **Diversions** | |
| Urban diversions | 0 |
| Unregulated licensed private diversions | 580 |
| Catchment farm dams | 12,370 |
| **Subtotal** | **12,950** |
| **Losses** | |
| Evaporation losses from major storages | 0 |
| Losses from catchment farm dams | 6,540 |
| In-stream losses to groundwater and evaporation[3] | 9,430 |
| **Subtotal** | **15,970** |
| **Water passed at outlet of basin** | |
| River outflows to the Corangamite Lakes | 70,740 |
| | |
| **Volume available to the environment in the Corangamite Basin** | **70,740** |

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

(2) Assumes non-reused water is discharged to waterways

(3) Assumed to be zero because not readily available

### 26.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Corangamite Basin is estimated to be around 18,000 ML (Table 26-3). Average annual usage from the dams is estimated to be 12,400 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 18,900 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 26-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 8,100 | 4,050 | n/a |
| Irrigation | 9,900 | 8,320 | n/a |
| **TOTAL** | **18,000** | **12,370** | **18,900** |

n/a = information not available

### 26.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water rights, diversion licences or sales water within the basin in 2003/04.

### 26.6.4 Volume Diverted

The only licences utilised in the Corangamite Basin are licences on unregulated streams and are listed in Table 26-4. Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

**Table 26-4 Volume of water diverted under surface water entitlements in the Corangamite Basin**

| Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Unregulated licensed diverters* | 871 | 0 | 871 | 576 | n/a |

### 26.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

There are no bulk entitlements currently in operation in the Corangamite Basin.

### 26.6.6 Compliance with Streamflow Management Plans

There is no Streamflow Management Plan (SFMP) currently in operation in the Corangamite Basin.

## 26.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Corangamite Basin, excluding stock and domestic use, is shown in Table 26-5. An estimate of stock and domestic use within these management areas is provided in Table 26-6.

The Corangamite Basin contains all of the Warrion WSPA as well as part of the Gerangamete GMA, Paaratte GMA and Colongulac GMA. The volumes described in Table 26-5 are totals for the management areas and include the area that falls outside the Corangamite Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

The Warrion WSPA comprises the basaltic stony rises and scoria cones to the north of Colac. Current licensed allocation is 84 per cent of the PAV. The Paaratte GMA is currently allocated 69 per cent of the PAV and is under increased pressure of further development because it is a good source of high yielding groundwater.

**Table 26-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/yr) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas [4] (ML) | Total Water Resource [5] (ML) |
|---|---|---|---|---|---|---|
| Warrion WSPA | 0 – 60 | 16,500 | 13,788 | 5,915 | Not applicable | 16,500 |
| Colongulac GMA (31%) | 0 – 60 | 14,271 | 3,213 | Not available | 1,542 | Not available [6] |
| Paaratte GMA (14%) | > 120 | 4,606 | 3,192 | Not available | 1,532 | Not available [6] |
| Gerangamete GMA (14%) | > 60 | Not available [7] | 8,000 | Not available | 3,840 | Not available [6] |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage (except Grampians Wimmera Mallee Water).

(4) In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) No estimate of Total Water Resource is applicable as >10 per cent GMA/WSPA is located outside the river basin.

(7) There is no PAV for Gerangamete GMA as the entitlement is managed under a Groundwater Licence.

**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) [1] |
|---|---|---|
| Warrion WSPA | 461 | 922 |
| Colongulac GMA | 208 | 416 |
| Paaratte GMA | 4 | 8 |
| Gerangamete GMA | 5 | 10 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

## 26.8 Recycled Water

The volume of water recycled in Corangamite Basin in 2003/04 is shown in Table 26-7. The sewage treatment plant at Colac is operated by Barwon Water and the plant at Camperdown is operated by South West Water. Approximately 80 per cent of the effluent at Camperdown is reused and 18 per cent of the total basin effluent is reused.

**Table 26-7 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Colac | Barwon Water | 1,931 | 7 |
| Camperdown | South West Water | 580 | 438 |
| **TOTAL** | | **2,511** | **445** |

# 27. Otway Coast Basin

## 27.1 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 flowing to the coast between Torquay and Peterborough in the Otway Ranges. A map of the river basin is shown in Figure 27-1.

Water Supply Protection Areas 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 as well as part of the Colongulac GMA and Paaratte GMA.

## 27.2 Responsibilities for Management of Water Resources

Southern Rural Water is the licensing authority responsible for managing groundwater and surface water diversions. Barwon Water supplies the majority of urban demands 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. South West 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 Cobram, Camperdown, Terang, Port Campbell and Allansford on the way. The Corangamite Catchment Management Authority is responsible for waterway management in the Otway Coast Basin.

## 27.3 Seasonal Overview

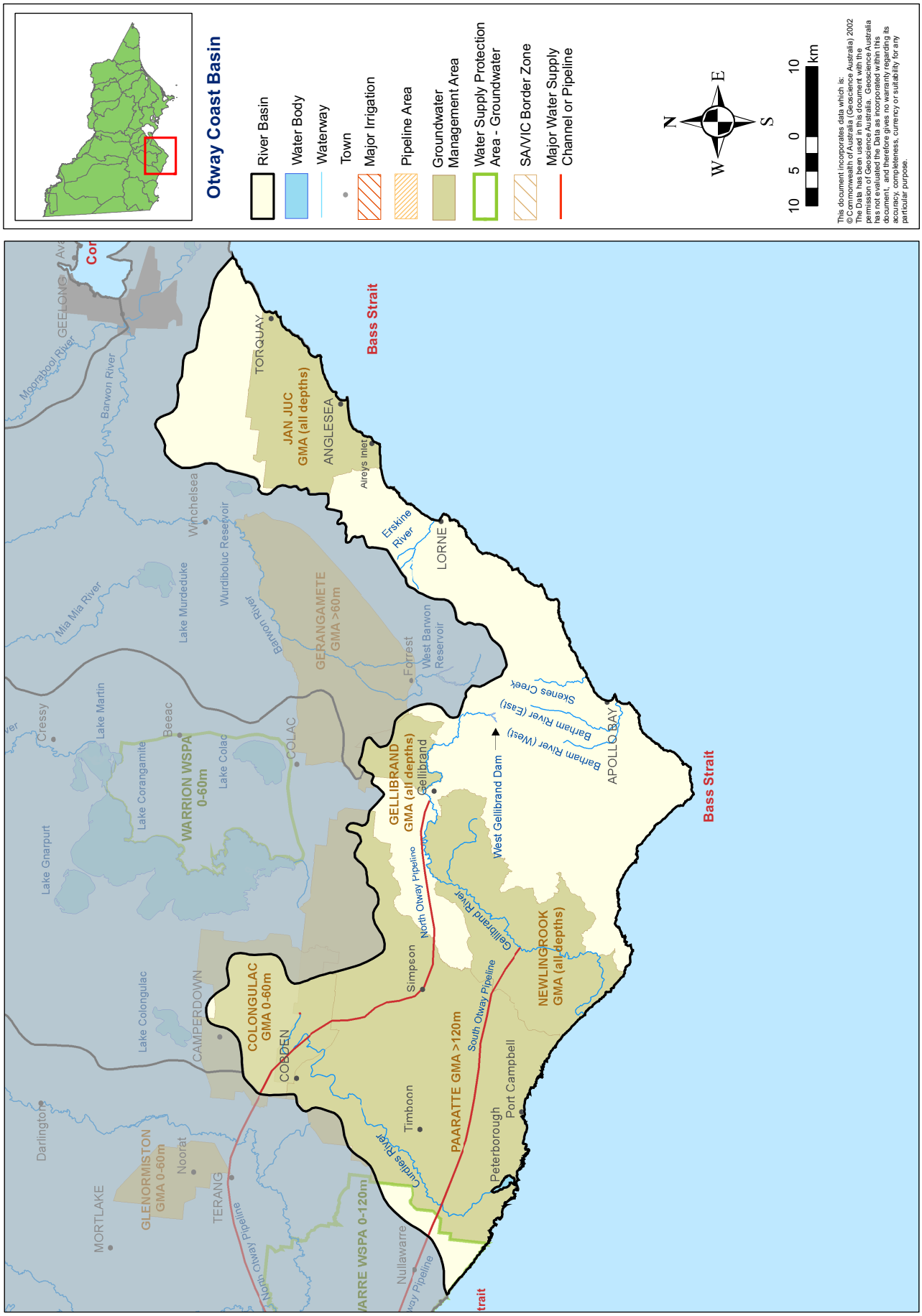
During 2003/04, the eastern side of the Otway Coast Basin experienced lower than average rainfall but to the west the opposite was true. Streamflows in the basin were slightly higher than average. The flows in the Aire River (gauge 235219) were 108 per cent of the long-term average.

Stage 1 restrictions were in place for Apollo Bay, Marengo and Skenes Creek in December 2003 and this was increased to Stage 2 in January 2004. All restrictions were lifted in April 2004. During March 2004, there was an irrigation ban in place for Curdies River and Stage 1 restrictions for the Gellibrand River.

The Corangamite CMA undertook an assessment of stream condition in the Otway Coast Basin in 2003/04 and found that 60 per cent of streams have forest cover and were in good or excellent condition, particularly in the central section of the basin. Streams in marginal or poor condition were generally in the far western and eastern sections of the basin.

In June 2004, box culverts were installed on Thompsons Creek at Horseshoe Bend Road in Torquay to return 100 per cent of the summer tidal flows to the 130 hectares of salt marsh estuary. Parks Victoria, Corangamite CMA, Framlingham Aboriginal trust and local land holders developed a Memorandum of Understanding on managing the artificial opening of the Aire River at Chappel Vale.

**Figure 27-1 Map of the Otway Coast Basin**



## 27.4 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 27-1. There was a net transfer of water out of the Otway Coast Basin. Barwon Water transferred 4,128 ML from the Otway Coast Basin into the Corangamite Basin to supply Colac. South West Water transferred 1402 ML from the Otway Coast Basin into the Corangamite Basin to supply the towns of Camperdown, Lismore and Derrinallum; 5,725 ML from the Otway Coast Basin into the Hopkins Basin to supply the towns of Allansford, Purnim, Mortlake, Terang, Noorat, Glenormiston and Warrnambool; and 325 ML into the Portland Coast Basin to supply Koroit. Barwon Water transferred 1,955 ML from the Barwon Basin to supply the towns of Torquay and Anglesea.

**Table 27-1 Summary of total water resource and water use in Otway Coast Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 892,680 | 32,040 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 1470 | 400 |

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

## 27.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Otway Coast Basin. The water available to the environment at the basin outlet was 856,670 ML, which is about 96 per cent of the total amount of water in the basin. This amount consists of environmental 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. 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 Sustainable Diversion Limit rules) and specified water trading rules. Diversion restriction triggers are also included in the draft Gellibrand SFMP.

## 27.6 Surface Water Resources

### 27.6.1 Water Balance

A water balance for the Otway Coast Basin is shown in Table 27-2. The only major storage in the basin is the West Gellibrand Reservoir. The volume in storage increased in 2003/04 and the storage was at full capacity on the 30th June 2004. During the year the total inflows to the basin were 119 per cent of the average inflows. In the Otway Coast Basin approximately four per cent of the total inflows were diverted for consumptive use, and 32 per cent of the total diversions were transferred to other basins to supply urban demands.

The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. In the Otway Coast Basin the inflows were back calculated by adding diversions to outflows and so no estimate of these losses is available. The losses accounted for in the water balance do not include losses occurring between the point of water diversions and the point of use.

**Table 27-2 Balance of surface water in the Otway Coast Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 1,521 |
| Volume in storage at end of year | 2,000 |
| **Change in storage** | **479** |
| **Inflows** | |
| Catchment inflow[1] | 891,610 |
| Irrigation return flow | 0 |
| Treated effluent discharge back to river[2] | 1,070 |
| **Subtotal** | **892,680** |
| **Diversions** | |
| Urban diversions | 14,650 |
| Unregulated licensed private diversions | 4,660 |
| Catchment farm dams | 12,730 |
| **Subtotal** | **32,040** |
| **Losses** | |
| Evaporation losses from major storages | 0 |
| Losses from catchment farm dams | 3,490 |
| In-stream losses to groundwater and evaporation[3] | 0 |
| **Subtotal** | **3,490** |
| **Water passed at outlet of basin** | |
| River outflows to the ocean | 856,670 |
| | |
| **Volume available to the environment in the Otway Coast Basin** | **856,670** |

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

(2) Assumes non-reused water is discharged to waterways

(3) Assumed to be zero because not readily available

### 27.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Otway Coast Basin is estimated to be around 19,500 ML. Average annual usage from the dams is estimated to be 12,730 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 16,220 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 27-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 10,740 | 5,370 | n/a |
| Irrigation | 8,760 | 7,360 | n/a |
| **TOTAL** | **19,500** | **12,730** | **16,220** |

n/a = information not available

### 27.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water rights, diversion licences or sales water within the basin in 2003/04.

### 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 that could have been diverted in 2003/04. Full details of compliance with bulk entitlements are provided in the Otway Coast Basin Water Accounts and Report on Compliance with Bulk Entitlements (DSE, 2004). Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

Barwon Water extracted an additional 51 ML under licence number 9016503 to supply the Apollo Bay and Skenes Creek.

**Table 27-4 Volume of water diverted under surface water entitlements in the Otway Coast Basin**

| Bulk Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Barwon Water* | | | | | |
| Aireys Inlet | 317 | 0 | 317 | 215 | Yes |
| Apollo Bay and Skenes Creek | 365 | 0 | 365 | 345 | Yes |
| Colac | 5,400 | 0 | 5,400 | 4,128 | Yes |
| Gellibrand | 60 | 0 | 60 | 20 | Yes |
| Lorne | 510 | 0 | 510 | 456 | Yes |
| *South West Water* | | | | | |
| Otway System | 12,580 | 0 | 12,580 | 9,434 | Yes |
| **Total volume of bulk entitlements** | **19,232** | **0** | **19,232** | **14,598** | |
| *Unregulated licensed diverters* | 5,730 | 0 | 5,730 | 4,659 | |

### 27.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

Diversion compliance was achieved for Barwon Water's Gellibrand bulk entitlement. Maximum daily diversions are limited to volumes below the bulk entitlement compliance point. Compliance was achieved for the Apollo Bay and Skenes Creek bulk entitlement. Similar to the arrangement for the Gellibrand bulk entitlement, diversion infrastructure at the Barham Weir limits the maximum possible daily diversion to below the bulk entitlement compliance point. This Apollo Bay and Skenes Creek bulk entitlement was amended on 19th February 2004 to augment the system and include additional off-stream storage and extractions from the lower reaches of the Barham River. The Colac bulk entitlement was amended to include provision of passing flows and came into effect on 6th November 2003. South West Water complied with its obligations under the bulk entitlement.

### 27.6.6 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 is being developed. The draft Gellibrand SFMP is yet to be formally endorsed by the Minister for Water and is currently being reviewed.

## 27.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Otway Coast Basin, excluding stock and domestic use, is shown in Table 27-5. An estimate of stock and domestic use within these management areas is provided in Table 27-6.

The Otway Coast Basin contains all of the Jan Juc GMA, Gellibrand GMA and Newlingrook GMA as well as part of the Nullawarre WSPA, Colongulac GMA and Paaratte GMA. The volumes described in the Table 27-5 are totals for the management areas and include the area that falls outside the Otway Coast Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

**Table 27-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/yr) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Jan Juc GMA | All Depths | 6,804 | 4,000 | Not available | 1,920 | 6,804 |
| Newlingrook GMA | All Depths | 74,970 | 1,927 | Not available | 925 | 74,970 |
| Nullawarre WSPA (11%) | 0 – 250 | 25,100 | 21,140 | 13,543 | Not applicable | Not available[6] |
| Colongulac GMA (62%) | 0 – 60 | 14,271 | 3,213 | Not available | 1,542 | Not available[6] |
| Paaratte GMA (84%) | > 120 | 4,606 | 3,192 | Not available | 1,532 | Not available[6] |
| Gellibrand GMA | All Depths | 0[7] | 0 | 0 | Not applicable | 0 |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage (except Grampians Wimmera Mallee Water).

(4) In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) No estimate of Total Water Resource is applicable as >10 per cent 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 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)[1] |
|---|---|---|
| Jan Juc GMA | N/A | N/A |
| Newlingrook GMA | N/A | N/A |
| Nullawarre WSPA | 1,197 | 2,394 |
| Colongulac GMA | 208 | 416 |
| Paaratte GMA | 4 | 8 |
| Gellibrand GMA | N/A | N/A |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

Barwon Water extracts groundwater from the Barwon Downs bore field to supplement the supply to the Geelong system. South West Water also uses groundwater to service a number of towns within the Otway Coast Basin. The licence volumes and volumes extracted in 2003/04 are provided in Table 27-7.

**Table 27-7 Urban Groundwater usage in the Otway Coast Basin**

| Town | Annual Licence Volume (ML) | Volume Extracted in 2003/04 (ML) |
|---|---|---|
| Barwon Downs Borefield | 20,000 | 270 |
| Port Campbell, Peterborough and Timboon | 1,010 | 370 |
| Carlisle River | 1,800 | 10 |
| Curdie Vale | 2,150 | 0 |

## 27.8 Recycled Water

The volume of water recycled in the Otway Coast Basin is shown in Table 27-8. Sewage treatment plants within the Otway Coast Basin are operated by Barwon Water and South West Water. All plants, except Simpson, have some effluent reuse. Aireys Inlet and Port Campbell reuse their total volume of effluent. Overall 29 per cent of the total volume of effluent was reused within the Otway Coast Basin.

**Table 27-8 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Aireys Inlet | Barwon Water | 117 | 117 |
| Anglesea | Barwon Water | 273 | 84 |
| Apollo Bay | Barwon Water | 387 | 15 |
| Lorne | Barwon Water | 333 | 15 |
| Cobden | South West Water | 210 | 110 |
| Port Campbell | South West Water | 60 | 30 |
| Simpson | South West Water | 38.5 | 0 |
| Timboon | South West Water | 55 | 24 |
| **TOTAL** | | **1,473** | **395** |

# 28. Hopkins Basin

## 28.1 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 28-1.

Water Supply Protection Areas 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.

## 28.2 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 Water supplied water to towns located in the north west of the basin including Ararat. Central Highlands Water supplied 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.

## 28.3 Seasonal Overview

Rainfall in the Hopkins Basin was higher than average during 2003/04 whilst streamflows were less than average. Streamflows in Brucknell Creek at Cudgee were only 62 per cent of the long-term average.

Stage 3 restrictions in Ararat for the whole of 2003/04. Over the period from March 2004 to May 2004, there were Stage 1 irrigation restrictions on Merri River and Stage 3 restrictions on Mt Emu Creek.

## 28.4 Summary of the Total Water Resources in the Basin

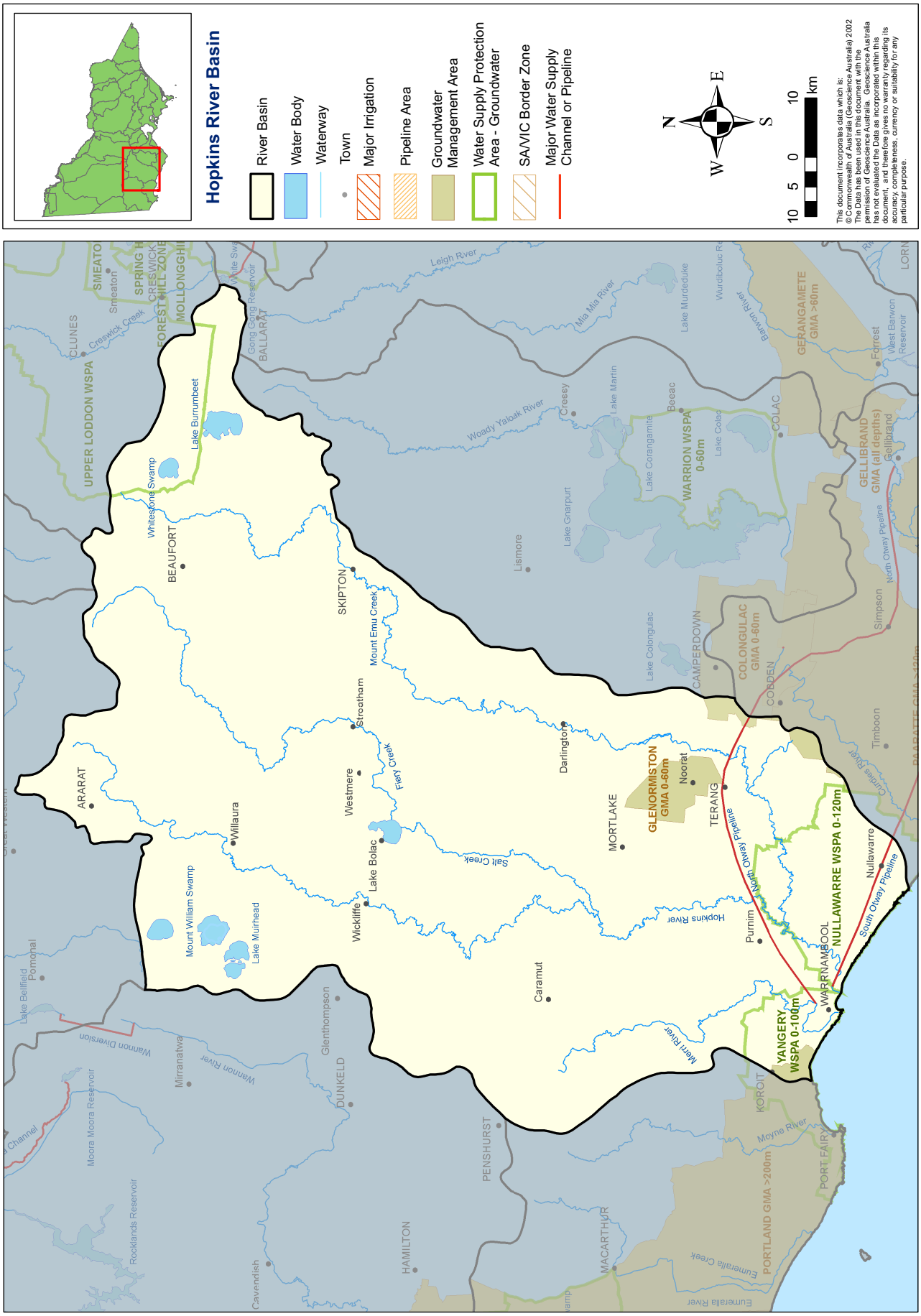
The total volume of water available and supplied from water resources in the Hopkins Basin are shown in Table 28-1. South West Water transferred 5,725 ML from the Otway Coast Basin into the Hopkins Basin to supply urban demands. Central Highlands Water transferred water from the Ballarat supply system in the Barwon Basin into the Hopkins Basin to supply Skipton. Grampians Water transferred 985 ML from the Wimmera Basin to supply the town of Ararat and 217 ML to supply the towns of Moyston, Willaura, Lake Bolac and Wickliffe.

**Table 28-1 Summary of total water resource and water use in Corangamite Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 256,150 | 70,050 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 6,110 | 1,020 |

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

**Figure 28-1 Map of the Hopkins Basin**



## 28.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Hopkins Basin. The water available to the environment at the basin outlet was 156,100 ML, which is about 62 per cent of the total streamflow in the basin. This amount consists of all water flowing in the basin that was not taken out of the streams for consumptive uses. At a catchment scale, the timing of licensed diversions in the unregulated sections of the basin during the irrigation season can have a significant impact on the flow regime.

The declaration of a Water Supply Protection Area for the Hopkins River was 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 diversion restriction triggers.

## 28.6 Surface Water Resources

### 28.6.1 Water Balance

During 2003/04 the inflows in the Hopkins Basin were 62 per cent of their long-term average. In the Hopkins Basin approximately 41 per cent of the total inflows were diverted for consumptive use. The largest use of water was via farm dams. There are no major storages in the Hopkins Basin (> 1,000 ML in size).

The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. In the Hopkins Basin the inflows were back calculated by adding diversions to outflows and so no estimate of these losses is available. The losses accounted for in the water balance do not include losses occurring between the point of water diversions and the point of use.

**Table 28-2 Balance of surface water in the Hopkins Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 0 |
| Volume in storage at end of year | 0 |
| **Change in storage** | **0** |
| **Inflows** | |
| Catchment inflow(1) | 251,050 |
| Irrigation return flow | 0 |
| Treated effluent discharge back to river(2) | 5,100 |
| **Subtotal** | **256,150** |
| **Diversions** | |
| Urban diversions | 220 |
| Unregulated licensed private diversions | 5,290 |
| Catchment farm dams | 64,540 |
| **Subtotal** | **70,050** |
| **Losses** | |
| Evaporation losses from major storages | 0 |
| Losses from catchment farm dams | 30,000 |
| In-stream losses to groundwater and evaporation(3) | 0 |
| **Subtotal** | **30,000** |
| **Water passed at outlet of basin** | |
| River outflows to the ocean | 156,100 |
| | |
| **Volume available to the environment in the Hopkins Basin** | **156,100** |

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

(2) Assumes non-reused water is discharged to waterways

(3) Assumed to be zero because the loss data is not readily available

### 28.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Hopkins Basin is estimated to be around 89,300 ML. Average annual usage from the dams is estimated to be 64,500 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 94,500 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 28-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 30,910 | 15,460 | n/a |
| Irrigation | 58,430 | 49,080 | n/a |
| **TOTAL** | **89,340** | **64,540** | **94,540** |

n/a = information not available

### 28.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water rights, diversion licences or sales water within the basin in 2003/04.

### 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 that could have been diverted in 2003/04. It should be noted that no bulk entitlements in the Hopkins Basin were completed by the start of 2003/04 and values are not reported against these bulk entitlements. Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

No water was extracted under the proposed Skipton bulk entitlement as the demand was supplied from the Ballarat system. The water for Willaura, Moyston, Lake Bolac and Wickliffe is sourced from streams both within the Wimmera Basin and the Hopkins Basin.

**Table 28-4 Volume of water diverted under surface water entitlements in the Hopkins Basin**

| Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Central Highlands Water* | | | | | |
| Beaufort | n/a | 0 | n/a | 206 | n/a |
| Skipton | n/a | 0 | n/a | 0 | n/a |
| *Grampians Water* | | | | | |
| Willaura, Moyston, Lake Bolac & Wickliffe | n/a | 0 | n/a | 247 | n/a |
| Buangor | n/a | 0 | n/a | 12 | n/a |
| **Total volume of bulk entitlements** | **n/a** | **0** | **n/a** | **462** | |
| *Unregulated licensed diverters* | 9,940 | 0 | 9,940 | 5,293 | |

n/a indicates that the bulk entitlement conversion order was not finalised at the start of 2003/04

### 28.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

There are no bulk entitlements currently in operation in the Hopkins Basin.

### 28.6.6 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*.

## 28.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Hopkins Basin, excluding stock and domestic use, is shown in Table 28-5. An estimate of stock and domestic use within these management areas is provided in Table 28-6.

The Hopkins Basin contains part of the Nullawarre WSPA, Yangery WSPA, Upper Loddon WSPA and all of the Glenormiston GMA. The volumes described in the Table 28-5 are totals

for the management areas and include the area that falls outside the Hopkins Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

The Yangery WSPA is over allocated when compared with its PAV, however metered usage is well below the PAV. 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 28-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/yr) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Nullawarre WSPA (89%) | 0 – 250 | 25,100 | 21,140 | 13,543 | Not applicable | Not available[6] |
| Yangery WSPA (60%) | 0 – 100 | 11,500 | 14,045 | 4,912 | Not applicable | Not available[6] |
| Upper Loddon WSPA (20%) | | Not available | 12,743 | 2,339 (part) | Not applicable | Not available[6] |
| Glenormiston GMA | 0 – 60 | 5,042 | 2,253 | n/a | 1,081 | 5,042 |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage (except Grampians Wimmera Mallee Water).

(4) In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) No estimate of Total Water Resource is applicable as >10 per cent 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)[1] |
|---|---|---|
| Nullawarre WSPA | 1,197 | 2,394 |
| Yangery WSPA | 1,432 | 2,864 |
| Upper Loddon WSPA | 451 | 902 |
| Glenormiston GMA | 125 | 250 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

Urban demands are partially supplied by groundwater within the Hopkins Basin (Table 28-7). Approximately one third of the urban demand of Mortlake and one tenth of the urban demand of Warrnambool is supplied by groundwater.

**Table 28-7 Urban Groundwater usage in the Hopkins Basin**

| Town | Annual Licence Volume (ML) | Volume Extracted in 2003/04 (ML) |
|---|---|---|
| Skipton | 150 | 0 |
| Caramut | 50 | 40 |
| Warrnambool | 750 | 490 |
| Mortlake | 300 | 50 |
| Darlington | 10 | 2 |
| Streatham and Westmore | | 20 |

## 28.8 Recycled Water

The volume of water recycled in the Hopkins Basin is shown in Table 28-8. Three water authorities operate sewage treatment plants within the Hopkins Basin. All of the effluent from Ararat is reused by Grampians Water. Overall 17 per cent of the total effluent volume in the basin is reused.

**Table 28-8 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Beaufort | Central Highlands Water | 89 | 0 |
| Ararat | Grampians Water | 750 | 750 |
| Willaura | Grampians Water | 25 | 0 |
| Allansford | South West Water | 0 | 0 |
| Mortlake | South West Water | 106 | 19 |
| Terang | South West Water | 310 | 249 |
| Warrnambool | South West Water | 4,834 | 0 |
| **TOTAL** | | **6,114** | **1,018** |

# 29. Portland Coast Basin

## 29.1 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 29-1.

Water Supply Protection Areas within the Portland Coast Basin include parts of the Condah WSPA and Yangery WSPA. Groundwater Management Areas within the Portland Coast Basin include the entire Heywood GMA and part of the Portland 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 within the basin. South West Water supplies water to the township of Koroit from water sourced from the Otway Coast Basin. Portland Coast Water supplies water within the basin, including the towns of Port Fairy, Heywood and Portland, which is all sourced from groundwater. The Glenelg Hopkins Catchment Management Authority is responsible for waterway management in the Portland Coast Basin.

## 29.3 Seasonal Overview

The Portland Coast Basin recorded higher than average rainfall during 2003/04. Streamflows were less than average, with only 63 per cent of average flows recorded in the Eumeralla River (gauge 237206), 46 per cent in Darlot Creek (gauge 237206) and 74 per cent in the Surry River (gauge 237207). No urban restrictions were in place during 2003/04. During March 2004, there were irrigation bans for unregulated diverters on the Fitzroy River and Moyne River.

## 29.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Portland Coast Basin are shown in Table 29-1. South West Water Authority transferred 325 ML from the Otway Coast Basin into the Portland Coast Basin to supply the urban demands of Koroit.

**Table 29-1 Summary of total water resource and water use in Portland Coast Basin 2003/04**

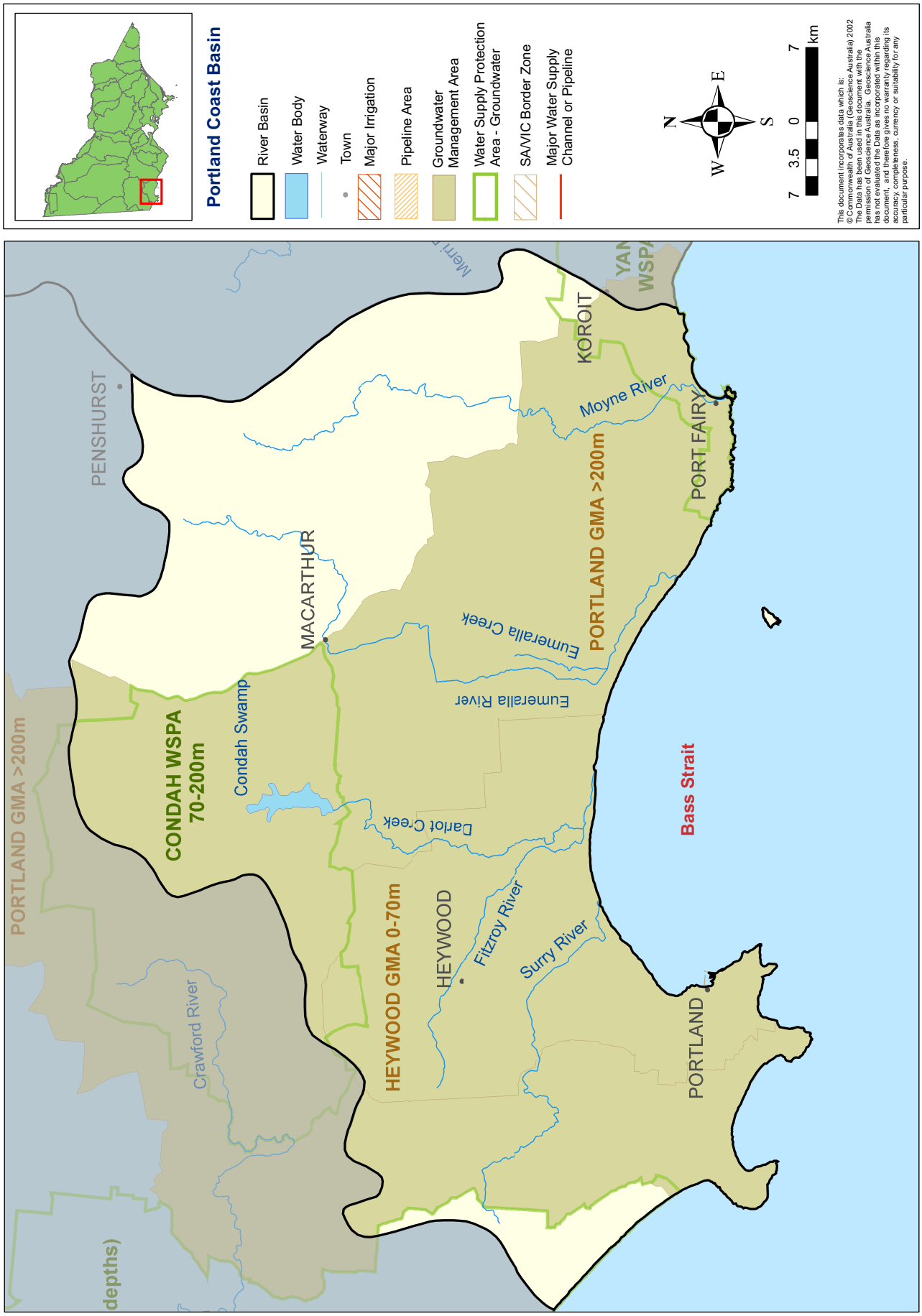
| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 211,690 | 16,920 |
| Groundwater (1) | Not available | Not available |
| Recycled water | 2,250 | 250 |

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

## 29.5 Environmental Water Reserve

In 2003/04 there was no formal environmental water reserve established in the Portland Coast Basin. The water available to the environment at the basin outlet was 190,260 ML, which is about 91 per cent of the total streamflow in the basin. This amount consists of water flowing in the basin that was not taken out of the streams for consumptive uses.

**Figure 29-1 Map of the Portland Coast Basin**



## 29.6 Surface Water Resources

### 29.6.1 Water Balance

A water balance of surface water in the Portland Coast Basin is shown in Table 29-2. The total inflows to the Portland Coast Basin during 2003/04 were 91 per cent of the long-term average. In the Portland Coast Basin, approximately 11 per cent of the total inflows were diverted for consumptive use. The largest diversion of surface water was via farm dams. All towns serviced by Portland Coast Water receive groundwater. There are no major storages in the Portland Coast Basin (> 1,000 ML in size). The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. In the Portland Coast Basin the inflows were back calculated by adding diversions to outflows and so no estimate of these losses is available. The losses accounted for in the water balance do not include losses occurring between the point of water diversions and the point of use.

**Table 29-2 Balance of surface water in the Portland Coast Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 0 |
| Volume in storage at end of year | 0 |
| **Change in storage** | **0** |
| **Inflows** | |
| Catchment inflow(1) | 209,700 |
| Irrigation return flow | 0 |
| Treated effluent discharge back to river(2) | 1,990 |
| **Subtotal** | **211,690** |
| **Diversions** | |
| Urban diversions | 0 |
| Unregulated licensed private diversions | 780 |
| Catchment farm dams | 16,140 |
| **Subtotal** | **16,920** |
| **Losses** | |
| Evaporation losses from major storages | 0 |
| Losses from catchment farm dams | 4,530 |
| In-stream losses to groundwater and evaporation(3) | 0 |
| **Subtotal** | **4,530** |
| **Water passed at outlet of basin** | |
| River outflows to the ocean | 190,260 |
| | |
| **Volume available to the environment in the Portland Coast Basin** | **190,260** |

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

(2) Assumes non-reused water is discharged to waterways

(3) Assumed to be zero because not readily available

### 29.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Portland Coast Basin is estimated to be around 21,000 ML. Average annual usage from the dams is estimated to be 16,100 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 20,600 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 29-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 4,520 | 2,260 | n/a |
| Irrigation | 16,520 | 13,870 | n/a |
| **TOTAL** | **21,040** | **16,130** | **20,660** |

n/a = information not available

### 29.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water rights, diversion licences or sales water within the basin in 2003/04.

### 29.6.4 Volume Diverted

The only licences utilised in the Portland Coast Basin are licences on unregulated streams and are listed in Table 29-4. Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

**Table 29-4 Volume of water diverted under surface water entitlements in the Portland Coast Basin**

| Entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Unregulated licensed diverters* | 1,224 | 0 | 1,224 | 776 | |

### 29.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

There are no bulk entitlements currently in operation in the Portland Coast Basin.

### 29.6.6 Compliance with Streamflow Management Plans

There is no Streamflow Management Plan (SFMP) currently in operation in the Portland Coast Basin.

## 29.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Portland Coast Basin, excluding stock and domestic use is shown in Table 29-5. An estimate of stock and domestic use within these management areas is provided in Table 29-6.

The Portland Coast Basin contains all of the Heywood GMA along with part of the Portland GMA, Condah WSPA and Yangery WSPA. The volumes described in the Table 29-5 are totals for the management areas and include the area that falls outside the Portland Coast Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

The Portland GMA comprises the deep, geothermal waters of the Dilwyn Formation aquifer. This aquifer is recharged in the northern parts of the aquifer, where it is closer to the ground surface. Forestry activities in the recharge zones of the Dilwyn aquifer of the Portland GMA have the potential to impact on the available resource and are being considered in the context of groundwater management.

**Table 29-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/yr) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Condah WSPA (53%) | 70 – 200 | 8,700 | 6,716 | 2,643 | Not applicable | Not available [6] |
| Heywood GMA | 0 – 70 | 21,763 | 5,923 | Not available | 2,843 | 21,763 |
| Portland GMA (72%) | > 200 | 20,683 | 1,628 | Not available | 782 | Not available [6] |
| Yangery WSPA (40%) | 0 – 100 | 11,500 | 14,045 | 4,912 | Not applicable | Not available [6] |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage (except Grampians Wimmera Mallee Water).

(4) In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) No estimate of Total Water Resource is applicable as >10 per cent 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)[1] |
|---|---|---|
| Condah WSPA | 58 | 116 |
| Heywood GMA | 1,735 | 3,470 |
| Portland GMA | 63 | 126 |
| Yangery WSPA | 1,432 | 2,864 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

Portland Coast Water services four towns within the Portland Coast Basin using groundwater (Table 29-7). In 2003/04 extractions were well within the licence volumes. The bore in Dartmoor was installed in 2003/04. Previously water was supplied by an existing bore not owned by Portland Coast Water.

**Table 29-7 Urban Groundwater usage in the Portland Coast Basin**

| Town | Annual Licence Volume (ML) | Volume Extracted in 2003/04 (ML) |
|---|---|---|
| Heywood | 333 | 210 |
| Portland | 6,222 | 1,881 |
| Port Fairy | 1,026 | 750 |
| Dartmoor | 20 | 0 |

## 29.8 Recycled Water

The volume of water recycled in the Portland Coast Basin is shown in Table 29-8. Within the Portland Coast Basin the sewerage system of three towns is operated by Portland Coast Water and one by South West Water. In the basin 11 per cent of the effluent is reused. The recycled effluent from Heywood was used to irrigate a pasture and a trial was undertaken in Portland to use the water in a woodlot.

**Table 29-8 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Heywood | Portland Coast Water | 252 | 252 |
| Port Fairy | Portland Coast Water | 844 | 0 |
| Portland | Portland Coast Water | 1,151 | 2 |
| Koroit | South West Water | 0 | 0 |
| **TOTAL** | | **2,247** | **254** |

# 30. Glenelg Basin

## 30.1 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 30-1.

Water Supply Protection Areas within the Glenelg Basin include part of the Condah WSPA and Glenelg WSPA. Groundwater Management Areas 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.

## 30.2 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 the Casterton-Harrow Road, where Wimmera-Mallee Water had that role in 2003/04. Wimmera Mallee Water also managed 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.

Glenelg Water supplies water to the majority towns within the basin with the exception of Harrow which is supplied by Grampians Water. The Glenelg Hopkins Catchment Management Authority is responsible for waterway management in the Glenelg Basin.

Grampians Wimmera Mallee Water has now merged the responsibilities of Wimmera Mallee Water and Grampians Water since the two authorities amalgamated in July 2004.

## 30.3 Seasonal Overview

During 2003/04, the Glenelg Basin recorded higher than average rainfall. Streamflows recorded in the Crawford River at Lower Crawford (gauge 238235) were only 59 per cent of their long-term average.

Stage 1 restrictions were in place for Balmoral for the whole of 2003/04. During March 2004, there were irrigation bans in place for the Wannon, Glenelg and Eumerella Rivers.

The continued effects of the drought on storage levels in the Wimmera-Mallee system have had an impact on all water users, including the environment, through restricted allocations. Both the Glenelg and Wimmera Rivers are receiving considerably less than minimum flows recommended within respective Stressed Rivers reports. The finalisation of bulk entitlement Orders in May 2004 gave greater certainty to the allocation of water resources for the environment, and in particular, a defined share of Northern-Mallee Pipeline Scheme water savings to be used for environmental flows in the Glenelg and Wimmera Rivers. In the longer-term, the piping of the Wimmera-Mallee system presents an opportunity to overcome high losses and significantly increase environmental allocations to the Glenelg River

A project to enhance in-stream condition along a 1.5 km section of the Glenelg River through Casterton was undertaken in autumn 2004. The project involved the construction of three sand traps to allow removal of excess sand in addition to excavation of a low-flow channel and re-instatement of woody debris to provide habitat for native fish and other biota.

Work commenced in autumn 2004 on the construction of a wetland on the floodplain of the Grange Burn in the Hamilton urban area. The wetland will act as a treatment facility for approximately 70 per cent of the township's stormwater runoff; rehabilitate and protect wetland flora, including some threatened species; be a community recreational asset for walking, picnics, barbeques and fishing; and provide biodiversity enhancement, in particular

habitat for the Eastern Barred Bandicoot and wetland birds. The entire wetland project will take two to three years to complete and involves the CMA and Southern Grampians Shire Council with the EPA providing technical assistance during project planning.

## 30.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Glenelg Basin are shown in Table 30-1. Wimmera Mallee Water transferred 34,900 ML from the Glenelg Basin into the Wimmera Basin. To meet the urban demand of Glenthompson 30 ML was transferred from the Wimmera Basin.

**Table 30-1 Summary of total water resource and water use in Glenelg Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 467,600 | 94,018 |
| Groundwater [(1)] | Not available | Not available |
| Recycled water | 1,390 | 960 |

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

## 30.5 Environmental Water Reserve

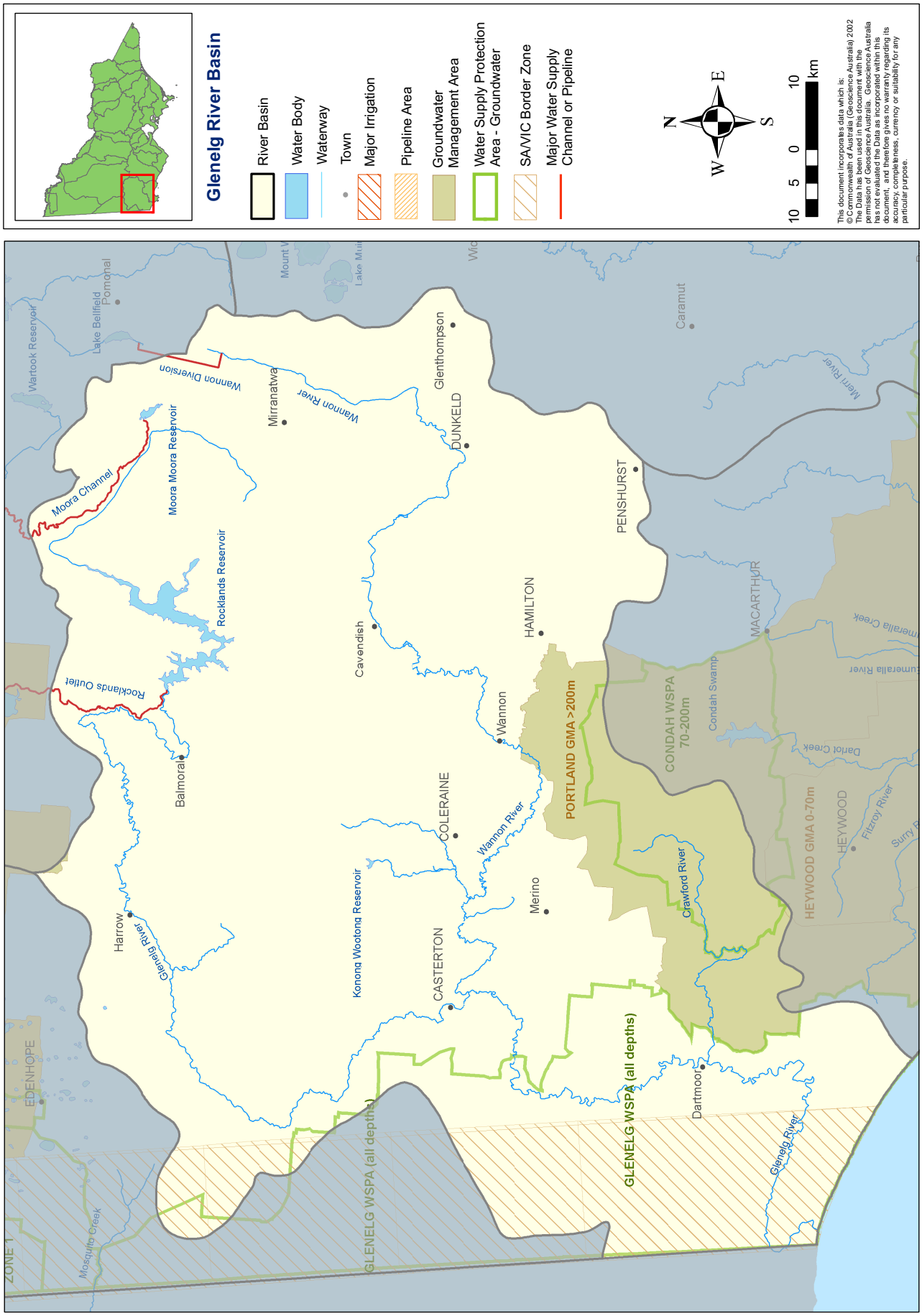
In 2003/04 there was no formal environmental water reserve established in the Glenelg Basin. The water available to the environment was 342,210 ML, which is about 73 per cent of the streamflow in the basin. This amount consists of environmental flow releases and all other water flowing in the basin which was not taken out of the streams for consumptive uses. While the river still receives nearly three-quarters of the natural flow, the construction of Rocklands Reservoir in 1953 has meant the reaches of the river directly below the reservoir remain highly flow stressed.

In total 8,215 ML was allocated to the Glenelg and Wimmera Rivers during the 2003/04 flow season. The majority of this water is the result of water savings created through the Northern Mallee Pipeline Project. This included 3,300 ML of Glenelg River compensation flow and 4,915 ML environmental allocation generated from water savings. The Inter Catchment Advisory Group (ICAG) met to determine the split of environmental allocation between catchments. As a result of these negotiations the Glenelg River received 4,392 ML (including the compensation flow) for implementation of a summer base flow.

Environmental flows were released in the upper Glenelg River (downstream of Rocklands Reservoir) between December 2003 and June 2004. Release of environmental flows as a summer base flow in the Glenelg River did not provide the flow rates intended at Harrow. However, the objective of maintaining refuge habitat with water quality adequate for the survival of many aquatic species appeared to have been achieved.

During 2003/04 a bulk entitlement of 32,240 ML was granted to the Minister for Environment for the Wimmera and Glenelg rivers. However, despite the provision of increased water for the environment, the river below the Rocklands Reservoir is flow stressed.

**Figure 30-1 Map of the Glenelg Basin**



## 30.6 Surface Water Resources

### 30.6.1 Water Balance

A water balance of surface water in the Glenelg Basin is shown in Table 30-2. The largest consumption of water in the Glenelg Basin was via farm dams in 2003/04. Approximately 27 per cent of the basin inflows were diverted or lost during the year. There are four major storages within the basin. During 2003/04 the volume of water held within the two Wimmera Mallee Water storages, Rocklands Reservoir and Moora Moora Reservoir dropped slightly and at the end of June 2004 they held only four per cent of capacity. Glenelg Water operates two storages, Koonongwootong Reservoir and Hayes Reservoir. In 2003/04 the volume in these storages increased to 69 per cent of total capacity. During 2003/04 the inflows in the basin were 67 per cent of the long-term average.

The estimate of in-stream losses to groundwater and evaporation is the volume of unaccounted for water after separately estimating inflows, outflows, change in storage and consumptive use. In the Glenelg Basin the inflows were back calculated by adding diversions to outflows and so no estimate of these losses is available. The losses accounted for in the water balance do not include losses occurring between the point of water diversions and the point of use. The total system transmission losses for Glenelg Water are 10.1 per cent.

**Table 30-2 Balance of surface water in the Glenelg Basin**

| Water Account Component | Volume (ML) |
|---|---|
| **Storage Volume** | |
| Volume in storage at start of year | 14,270 |
| Volume in storage at end of year | 14,771 |
| **Change in storage** | **501** |
| **Inflows** | |
| Catchment inflow(1) | 467,170 |
| Irrigation return flow | 0 |
| Treated effluent discharge back to river(2) | 430 |
| **Subtotal** | **467,600** |
| **Diversions** | |
| Urban diversions | 2,820 |
| Diversions to the Wimmera Mallee Water System | 34,928 |
| Unregulated licensed private diversions | 790 |
| Catchment farm dams | 55,480 |
| **Subtotal** | **94,018** |
| **Losses** | |
| Evaporation losses from major storages | 6,230 |
| Losses from catchment farm dams | 24,650 |
| In-stream losses to groundwater and evaporation(3) | 0 |
| **Subtotal** | **30,880** |
| **Water passed at outlet of basin** | |
| River outflows to the ocean | 342,210 |
| | |
| **Volume available to the environment in the Glenelg Basin** | **342,210** |

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

(2) Assumes non-reused water is discharged to waterways

(3) Assumed to be zero because not readily available

### 30.6.2 Catchment Farm Dams

The capacity of catchment farm dams in the Glenelg Basin is estimated to be around 77,000 ML (Table 30-3). Average annual usage from the dams is estimated to be 55,500 ML, and after allowing for losses, the total catchment runoff that is harvested by the dams is estimated to be 80,100 ML. Specific information on catchment farm dam behaviour for 2003/04 was not readily available and the values provided in the table below are based on estimates of the average annual impact.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

**Table 30-3 Catchment Farm Dam Information**

| Type of catchment farm dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Stock and domestic | 27,110 | 13,550 | n/a |
| Irrigation | 49,920 | 41,930 | n/a |
| **TOTAL** | **77,020** | **55,480** | **80,130** |

n/a = information not available

### 30.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water rights, diversion licences or sales water within the basin in 2003/04.

### 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 that could have been diverted in 2003/04. It should be noted that the Wimmera-Mallee system bulk entitlements were not granted until May 2004 and so diversions are not reported against these entitlements. Licences on unregulated streams are not currently metered and hence compliance has not been assessed.

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 runoff did not occur in the Glenthompson catchment.

**Table 30-4 Volume of water diverted under surface water entitlements in the Glenelg Basin**

| Bulk entitlement | Bulk entitlement (ML) | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Glenelg Water* | | | | | |
| Coleraine, Casterton & Sandford | 855 | 0 | 855 | 391 | Yes |
| Dunkeld | 170 | 0 | 170 | 0 | Yes |
| Glenthompson | 94 | 0 | 94 | 0 | Yes |
| Hamilton | 3,435 | 0 | 3,435 | 2,351 | Yes |
| Wimmera and Glenelg Rivers | n/a | 0 | n/a | 73 | n/a |
| *Minister for Environment* | | | | | |
| Wimmera and Glenelg Rivers | n/a | 0 | n/a | 8,265 | n/a |
| *Wimmera Mallee Water* | | | | | |
| Wimmera and Glenelg Rivers | n/a | 0 | n/a | 34,928 | n/a |
| Harrow | n/a | 0 | n/a | n/a | n/a |
| **Total volume of bulk entitlements** | **4,554** | **0** | **4,554** | **46,010** | |
| *Unregulated licensed diverters* | 1,101 | 0 | 1,101 | 786 | |

n/a indicates that the bulk entitlement conversion order was not finalised at the start of 2003/04

### 30.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

All passing and environmental flow obligations under bulk entitlements in the Glenelg Basin were met in 2003/04.

### 30.6.6 Compliance with Streamflow Management Plans

There is no Streamflow Management Plan (SFMP) currently in operation in the Glenelg Basin.

## 30.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Glenelg Basin, excluding stock and domestic use, is shown in Table 30-5. An estimate of stock and domestic use within these management areas is provided in Table 30-6.

The Glenelg Basin contains part of the Glenelg WSPA, Condah WSPA and Portland GMA, in addition to border groundwater management zone 1B and parts of zones 2B and 3B. The volumes described in the Table 30-5 are totals for the management areas and include the area that falls outside the Glenelg Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

**Table 30-5 Compliance with Licensed Groundwater Volumes**

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/yr) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Condah WSPA (47%) | 70 – 200 | 8,700 | 6,713 | 2,643 | Not applicable | Not available[6] |
| Portland GMA (27%) | > 200 | 20,683 | 1,628 | Not available | 782 | Not available[6] |
| Glenelg WSPA[7] (67%) | All Depths | Not available | 36,339 | Not available | 17,443 | Not available[6] |
| Border Zone 1B | All Depths | 60,220 | 4,451.3 | Not available | 2,137 | Not available[6] |
| Border Zone 2B (<90%) | All Depths | 30,100 | 24,892.8 | Not available | 11,949 | Not available[6] |
| Border Zone 3B (<90%) | All Depths | 17,500 | 515 | Not available | 247 | Not available[6] |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage (except Grampians Wimmera Mallee Water).

(4) In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) No estimate of Total Water Resource is applicable as >10 per cent GMA/WSPA is located outside the river basin.

(7) The Glenelg WSPA was gazetted in July 2004; it supersedes the Lake Mundi GMA and Dartmoor GMA.

**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)[1] |
|---|---|---|
| Condah WSPA | 58 | 116 |
| Portland GMA | 63 | 126 |
| Glenelg WSPA | N/A | N/A |
| Border Zone 1B | N/A | N/A |
| Border Zone 2B | N/A | N/A |
| Border Zone 3B | N/A | N/A |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

Glenelg Water uses groundwater to service urban towns within the Glenelg Basin. In 2003/04 extractions were well within the licence volumes (Table 30-7). Grampians Water also used groundwater to supply water to Harrow.

**Table 30-7 Urban Groundwater usage in the Glenelg Basin**

| Town | Annual Licence Volume (ML) | Volume Extracted in 2003/04 (ML) |
|---|---|---|
| Casterton and Sandford | 1,000 | 231 |
| Hamilton | 120 | 0 |
| Macarthur | 130 | 36 |
| Merino | 100 | 53 |
| Penshurst | 250 | 132 |
| Harrow | | 24 |

## 30.8 Recycled Water

The volume of water recycled in the Glenelg Basin is shown in Table 30-8. Glenelg Water operates four sewage treatment plants in the Glenelg Basin. All effluent from Coleraine and Dunkeld is reused. In total 69 per cent of the effluent is reused within the basin, mainly for irrigation.

**Table 30-8 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Casterton | Glenelg Water | 133 | 93 |
| Coleraine | Glenelg Water | 92 | 92 |
| Dunkeld | Glenelg Water | 23 | 23 |
| Hamilton | Glenelg Water | 1,144 | 755 |
| **TOTAL** | | **1,392** | **963** |

# 31. Millicent Coast Basin

## 31.1 Location of Water Resources

The Millicent Coast Basin is located within the South East Coast Drainage Division. It is located both within Victoria and South Australia. The surface water hydrology of the Victorian section of the basin is determined by numerous internally draining inter-dunal 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 31-1.

The groundwater hydrology is more significant. Water Supply Protection Areas 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.

## 31.2 Responsibilities for Management of Water Resources

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 Water is responsible for urban water supply in the Millicent Coast Basin, including the towns of Edenhope. The Wimmera Catchment Management Authority is responsible for waterway management in the Millicent Coast Basin.

## 31.3 Seasonal Overview

Rainfall within the Millicent Coast Basin was slightly below average during 2003/04.

## 31.4 Summary of the Total Water Resources in the Basin

The total volume of water available and supplied from water resources in the Millicent Coast Basin are shown in Table 31-1.

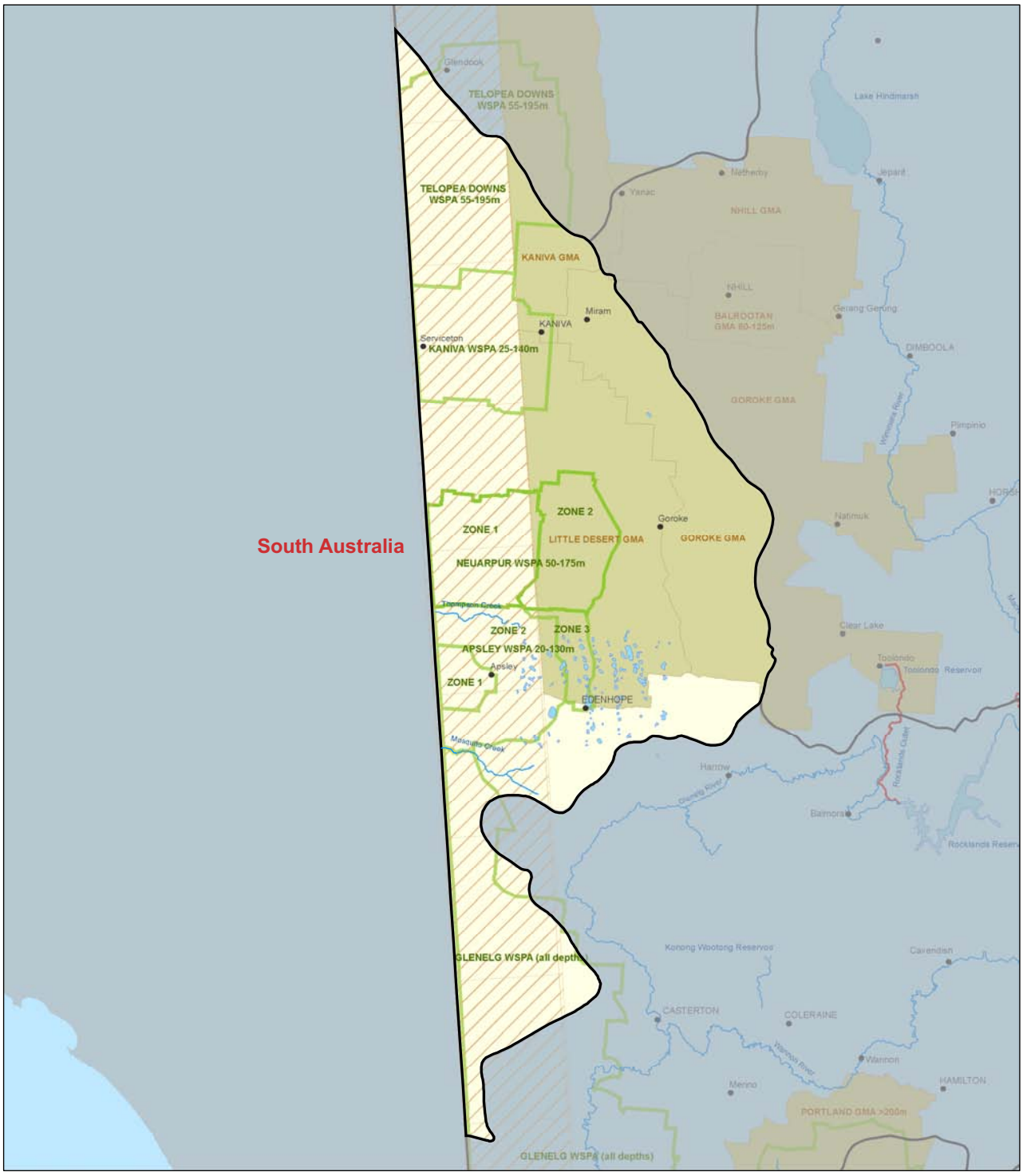
**Table 31-1 Summary of total water resource and water use in Millicent Coast Basin 2003/04**

| Water source | Total Water Resource (ML) | Total Extraction (ML) |
|---|---|---|
| Surface water | 180[1] | 180 |
| Groundwater [2] | Not available | Not available |
| Recycled water | 320 | 140 |

(1) The volume of the water resource has notionally been set to the water diverted from streams for the year. There is no streamflow data available to accurately estimate streamflows.

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

**Figure 31-1 Map of the Millicent Coast Basin**



## 31.5 Environmental Water Reserve

In 2003/04 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 water available to the environment was not made. When the water available to the environment in the Millicent Coast Basin in Victoria passes out of the basin, it becomes a resource to South Australia.

## 31.6 Surface Water Resources

### 31.6.1 Water Balance

There is no reliable estimate of the average annual inflows in the Victorian Millicent Coast Basin, although 4,000 ML/year was estimated for the National land and Water Audit (NLWRA, 2001). As there is no gauging within the Millicent Coast Basin in Victoria an estimate of 2003/04 inflows could not reliably be made and has notionally been set to the volume of diversions, which was 180 ML.

There is currently limited information available regarding farm dam volumes and usage within the Millicent Coast Basin. Therefore, no values could be included in the water balance.

During 2003/04, 120 ML was diverted from surface water to supply Edenhope and approximately 60 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.

### 31.6.2 Catchment Farm Dams

No information regarding farm dams is readily available within the Millicent Coast Basin.

Catchment farm dams used for irrigation and commercial use are in the process of being licensed, and when the licences have been processed, the relevant volume will be accounted for under licensed diversions.

### 31.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water rights, diversion licences or sales water within the basin in 2003/04.

### 31.6.4 Volume Diverted

The bulk entitlement in the Millicent Coast Basin was not completed by the start of 2003/04 and values are not reported against this bulk entitlement. Licences on unregulated streams are not currently metered and hence compliance has not been assessed. See Table 31-2.

**Table 31-2 Volume of water diverted under surface water entitlements in the Millicent Coast Basin**

| Entitlement | Bulk entitlement or licensed volume | Net transfer of entitlement (ML) | Maximum volume divertible in 2003/04 (ML) | Amount diverted (ML) | Complied? |
|---|---|---|---|---|---|
| *Grampians Water* | | | | | |
| Edenhope | n/a | 0 | n/a | 116 | n/a |
| **Total volume of bulk entitlements** | **n/a** | **0** | **n/a** | **116** | |
| *Unregulated licensed diverters* | 87 | 0 | 87 | 63 | |

n/a indicates that the bulk entitlement conversion order was not finalised at the start of 2003/04

### 31.6.5 Compliance with Passing and Environmental Flow Obligations in Bulk Entitlements

No bulk entitlements were operating in the basin during 2003/04.

### 31.6.6 Compliance with Streamflow Management Plans

There is no Streamflow Management Plan (SFMP) in operation in the Millicent Coast Basin.

## 31.7 Groundwater Resources

A summary of licensed volume and use in Groundwater Management Areas that overlap the Millicent Coast Basin, excluding stock and domestic use, is shown in Table 31-3. An estimate of stock and domestic use within these management areas is provided in Table 31-4.

The Millicent Coast Basin contains all of the Apsley WSPA, Neuarpur WSPA and Little Desert GMA, in addition to part of the Telopea Downs WSPA, Glenelg WSPA, Goroke GMA, Kaniva TCSA GMA and Kaniva GMA. The Millicent Coast Basin also includes border groundwater management zones 4B, 5B, 6B and 7B, as well as part of zones 2B, 3B and 8B. The volumes described in the Table 31-3 are totals for the management areas and include the area that falls outside the Millicent Coast Basin. Groundwater allocation and use for unincorporated areas has not been included in the 2003/04 water accounts.

It can be seen from these tables that the Neuarpur, Kaniva and Telopea Downs WSPAs have a licensed allocation that is close to the PAV. The border zones show varying degrees of use relative to the PAV and licensed allocation according to local development.

## Table 31-3 Compliance with Licensed Groundwater Volumes

| Water Supply Protection Area/Groundwater Management Area[1] | GMA/ WSPA Depth Limits[2] | PAV (ML/year) | Licensed Allocation[3] (ML) | Metered Use (ML) | Estimated Use in Unmetered Areas[4] (ML) | Total Water Resource[5] (ML) |
|---|---|---|---|---|---|---|
| Apsley WSPA | 10 – 130 | 24,355 | 4,360 | Not available | 2,093 | 24,355 |
| Neuarpur WSPA | 50 – 175 | 24,750 | 23,471 | 15,281 | Not applicable | 24,750 |
| Kaniva WSPA (<90%) | 25 - 140 | 6,950 | 6,918 | Not available | 3,321 | Not available[6] |
| Telopea Downs WSPA (61%) | 55 – 195 | 13,435 | 10,682 | 3,556 | Not applicable | Not available[6] |
| Little Desert GMA | TCSA[7] | 1,100 | 0 | Not available | Not available | Not available[6] |
| Goroke GMA (37%) | TCSA[7] | 2,200 | 0 | Not available | Not available | Not available[6] |
| Kaniva TCSA GMA (17%) | TCSA[7] | 1,100 | 0 | Not available | Not available | Not available[6] |
| Glenelg WSPA [8] (60%) | All Depths | Not Determined | 36,339 | Not available | 17,443 | Not available[6] |
| Border Zone 2B (<90%) | All Depths | 30,100 | 24,893 | Not available | 11,949 | Not available[6] |
| Border Zone 3B (<90%) | All Depths | 17,500 | 515 | Not available | 247 | Not available[6] |
| Border Zone 4B | All Depths | 14,300 | 804 | Not available | 386 | Not available[6] |
| Border Zone 5B | All Depths | 11,949 | 11,949 | Not available | 5,736 | Not available[6] |
| Border Zone 6B | All Depths | 9,838 | 9,718 | Not available | 4,665 | Not available[6] |
| Border Zone 7B | All Depths | 6,600 | 6,298 | Not available | 3,023 | Not available[6] |
| Border Zone 8B (<90%) | All Depths | 6,760 | 2,210 | Not available | 1,061 | Not available[6] |

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses; where there is no percentage given, the entire management area falls within the river basin. Those GMA/WSPA with < five per cent surface area within the basin have not been included.

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

(3) Allocated volume includes domestic and stock usage (except Grampians Wimmera Mallee Water).

(4) In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use versus PAV) equalling 48 per cent.

(5) The sum of PAVs or licensed volume, which ever is greater.

(6) No estimate of Total Water Resource is applicable as >10 per cent GMA/WSPA is located outside the river basin.

(7) TSCA – Tertiary Sand Confined Aquifer.

(8) The Glenelg WSPA was gazetted in July 2004; it supersedes the Lake Mundi GMA and Dartmoor GMA.

**Table 31-4 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)[1] |
|---|---|---|
| Apsley WSPA | 260 | 520 |
| Neuarpur WSPA | 230 | 460 |
| Telopea Downs WSPA | 190 | 380 |
| Little Desert GMA | N/A | N/A |
| Goroke GMA | N/A | N/A |
| Kaniva TCSA GMA | 180 | 360 |
| Glenelg WSPA | N/A | N/A |
| Border Zone 2B | N/A | N/A |
| Border Zone 3B | N/A | N/A |
| Border Zone 4B | N/A | N/A |
| Border Zone 5B | 160 | 320 |
| Border Zone 6B | 60 | 120 |
| Border Zone 7B | 100 | 200 |
| Border Zone 8B | 115 | 230 |

(1) There are a number of licensed bores that also incorporate stock and domestic use. The estimated use for these bores is not included in the above table.

In 2003/04 Grampians Water supplied a total of 334 ML of groundwater to Apsley, Serviceton, Miran, Kaniva and Goroke.

## 31.8 Recycled Water

The volume of water recycled in the Millicent Coast Basin is shown in Table 31-5. Grampians Water operates three sewage treatment plants within the Millicent Coast Basin. All of the effluent from Edenhope is recycled but no effluent from Kaniva is reused and disposed of in an evaporation basin.

**Table 31-5 Volume of recycled water**

| Sewage Treatment Plant | Water Authority | Total volume of effluent (ML) | Volume reused (ML) |
|---|---|---|---|
| Edenhope | Grampians Water | 144 | 144 |
| Kaniva | Grampians Water | 180 | 0 |
| Serviceton | Grampians Water | 5 | 0 |
| **TOTAL** | | **329** | **144** |

# 32. References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# Appendix A Groundwater entitlement and use

| GMA/WSPA NAME | | | | | | | Sum of Nominal Volumes for Non-Licenceable use (Domestic & Stock purposes)[5] | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Attached to Licences | | GMS | |
| AREA | ZONE | PAV (ML/yr) | Allocated Volume 30/06/2004 (ML/yr)[4,5] | % PAV | Metered Volume (ML/Yr)[5] | Estimated Use in non-Metered Areas (ML/Yr)[10] | Attached | Committed | Registered | Committed[4] |
| **Southern Rural Water** | | | | | | | | | | |
| Bungaree | | 4,400 | 5,272 | 120% | 3,737 | | | | 252 | 504 |
| Condah | | 8,700 | 6,716 | 77% | 2,643 | | | | 58 | 116 |
| Denison | | 12,000 | 17,743 | 148% | 15,224 | | | | 297 | 594 |
| Deutgam | | 2,400 | 5,535 | 231% | 547 | | | | 257 | 514 |
| Koo-Wee-Rup | | 14,898 | 12,578 | 84% | 5,273 | | | | 600 | 1,200 |
| Nullawarre | | 25,100 | 21,140 | 84% | 13,543 | | | | 1,197 | 2,394 |
| Sale | | 13,000 | 20,893 | 161% | 14,680 | | | | 919 | 1,838 |
| Wandin Yallock | | 3,300 | 2,880 | 87% | 608 | | | | 163 | 326 |
| Warrion | | 16,500 | 13,788 | 84% | 5,915 | | | | 461 | 922 |
| Wy Yung | | 9,070 | 6,994 | 77% | 2,438 | | | | 116 | 232 |
| Yangery | | 11,500 | 14,045 | 122% | 4,912 | | | | 1,432 | 2,864 |
| Yarram | | 26,625 | 25,655 | 96% | 12,205 | | | | 485 | 970 |
| Colongulac | | 14,271 | 3,213 | 23% | n/a | 1,542 | | | 208 | 416 |
| Corinella | | 2,550 | 410 | 16% | n/a | 197 | | | 157 | 314 |
| Cut Paw Paw | | 3,650 | 511 | 14% | n/a | 245 | | | 2 | 4 |
| Dartmoor | | 18,600 | | 0% | n/a | 0 | | | | |
| Frankston | | 3,200 | 1,096 | 34% | n/a | 526 | | | 199 | 398 |
| Gellibrand | | 0 | 0 | | n/a | | | | | |
| Gerangamete | | -------[3] | 8,000 | | n/a | 3,840 | | | 5 | 10 |
| Gilffard | | 3,000 | 5,665 | 189% | n/a | 2,719 | | | 171 | 342 |
| Glenormistom | | 5,042 | 2,253 | 45% | n/a | 1,081 | | | 125 | 250 |
| Heywood | | 21,763 | 5,923 | 27% | n/a | 2,843 | | | 1,735 | 3,470 |
| Jan Juc | | 6,804 | 4,000 | 59% | n/a | 1,920 | | | | |
| Lake Mundi[11] | | 48,000 | | 0% | n/a | | | | | |
| Lancefield | | 1,485 | 1,238 | 83% | 303 | | | | 76 | 152 |
| Leongatha | | 6,500 | 1,351 | 21% | n/a | 648 | | | 114 | 228 |
| Merrimu | | 450 | 421 | 94% | 74 | | | | 13 | 26 |
| Moe | | 8,193 | 2,288 | 28% | n/a | 1,098 | | | 197 | 394 |
| Moorabbin | | 4,305 | 2,273 | 53% | n/a | 1,091 | | | 238 | 476 |
| Nepean | | 5,000 | 5,657 | 113% | n/a | 2,715 | | | 1,162 | 2,324 |
| Newlingrook | | 74,970 | 1,927 | 3% | n/a | 925 | | | | |
| Orbost | | 1,200 | 1,200 | 100% | 464 | | | | | |
| Paaratte | | 4,606 | 3,192 | 69% | n/a | 1,532 | | | 4 | 8 |
| Portland | | 20,683 | 1,628 | 8% | n/a | 782 | | | 63 | 126 |
| Rosedale | | 9,000 | 21,971 | 244% | 15,457 | | | | 1 | 2 |
| Stratford | | not determined | 27,643 | | 27,355 | | | | 410 | 820 |
| Tarwin | | 1,300 | 37 | 3% | n/a | 18 | | | 806 | 1,612 |
| Wa De Lock | Zones 1, 2 & 3 | 29,700 | 25,197 | 85% | n/a | 12,095 | | | 482 | 964 |
| Border Zone 1B | | 60,220 | 4,451 | 7% | n/a | 2,137 | | | | |
| Border Zone 2B | | 30,100 | 24,893 | 83% | n/a | 11,949 | | | | |
| Border Zone 3B | | 17,500 | 515 | 3% | n/a | 247 | | | | |
| Border Zone 4B | | 14,300 | 804 | 6% | n/a | 386 | | | | |
| Glenelg WSPA | | not determined | 36,339 | | n/a | 17,443 | | | | |
| **Goulburn-Murray Water[5]** | | | | | | | | | | |
| Campaspe Deep Lead | | n/a | 46,545 | | 23,931 | | | | 250 | 500 |
| Katunga | | n/a | 31,456 | | 23,784 | | | | 120 | 240 |
| Mid Loddon | | 37,200 | 33,761 | 91% | 12,655 | | | | 330 | 660 |
| Shepparton | | n/a | 202,576 | | 64,288 | | | | 412 | 824 |
| Spring Hill | | 5,062 | 4,905 | 97% | 2,137 | | | | 20 | 40 |
| Upper Loddon | | not undertaken | 12,743 | | 2,339 (part) | | | | 451 | 902 |
| Alexandra | | 900 | 1,821 | 202% | n/a | 874 | | | 69 | 138 |
| Barnawartha | | 2,100 | 595 | 28% | n/a | 286 | | | 80 | 160 |
| Ellesmere | | 1,900 | 1,124 | 59% | n/a | 540 | | | 68 | 136 |
| Goorambat | | 4,888 | 1,651 | 34% | n/a | 792 | | | 71 | 142 |
| Kialla (1+2) | | 2,795 | 2,213 | 79% | n/a | 1,062 | | | 161 | 322 |
| Kinglake | | 3,830 | 2,012 | 53% | n/a | 966 | | | 425 | 850 |
| Mullindolingong | Zones 1 & 2 | 6,980 | 1,504 | 22% | n/a | 722 | | | 202 | 404 |
| Murmungee | | 16,710 | 12,012 | 72% | n/a | 5,766 | | | 1,390 | 2,780 |
| Nagambie | | 5,650 | 6,476 | 115% | 1,335 | | | | 99 | 198 |
| **Wimmera Mallee Water** | | | | | | | | | | |
| Apsley | | 24,355 | 4,360 | 18% | n/a | 2,093 | | | 260 | 520 |
| Kaniva | | 6,950 | 6,918 | 100% | n/a | 3,321 | | | 180 | 360 |
| Murrauville | | 10,883 | 8,317 | 76% | 4,868 | | | | 320 | 640 |
| Neuarpur | | 24,750 | 23,471 | 95% | 15,281 | | | | 230 | 460 |
| Telopea Downs | | 13,435 | 10,682 | 80% | 3,556 | | | | 190 | 380 |
| Balrootan (Nhill) | | 980 | 1,524 | 156% | n/a | 732 | | | 85 | 170 |
| Goroke | | 2,200 | 0 | 0% | n/a | | | | | |
| Kaniva TCSA | | 1,100 | 0 | 0% | n/a | | | | | |
| Little Desert | | 1,100 | 0 | 0% | n/a | | | | | |
| Nhill | | 1,200 | 0 | 0% | n/a | | | | | |
| Border Zone 4B | | 14,000 | 1,210 | 9% | n/a | 581 | | | 340 | 680 |
| Border Zone 5B | | 11,949 | 11,949 | 100% | n/a | 5,736 | | | 160 | 320 |
| Border Zone 6B | | 9,838 | 9,718 | 99% | n/a | 4,665 | | | 60 | 120 |
| Border Zone 7B | | 6,600 | 6,298 | 95% | n/a | 3,023 | | | 100 | 200 |
| Border Zone 8B | | 6,760 | 2,210 | 33% | n/a | 1,061 | | | 115 | 230 |
| Border Zone 9B | | 5,960 | 1,500 | 25% | n/a | 720 | | | 50 | 100 |
| Border Zone 10B | | 6,720 | 6,178 | 92% | n/a | 2,965 | | | 240 | 480 |
| Border Zone 11B | | 1,823 | 1,000 | 55% | n/a | 480 | | | 20 | 40 |
| **Total** | | **802,503** | **804,064** | | **279,551** | **104,361** | | | | **37,806** |
| **% against allocated** | | | | | | **48%** | | | | |
| **Sum of usage** | | | | | | **383,912** | | | | |

**Notes:**

1. If unknown assume Domestic and Stock (D&S) use is 2 ML/year/bore.
2. River Basin refers to the surface catchment corresponding to the area covered by the WSPA/GMA. In some cases, a GMA/WSPA may be located over several river Basins, in this case all the relevant basins (encompassing >10 per cent of the GMA/WSPA area) are listed.
3. There is no PAV for Gerangamete GMA as the entitlement is managed under a Groundwater Licence.
4. Allocated Volume includes D&S usage EXCEPT Grampians Wimmera Mallee Water.
5. Not available unless specified.
6. GMW data obtained from Appendix G, Annual Report (2003/04).
7. River Basin encompassing >90 per cent of GMA/WSPA from which totals figures are derived.
8. The sum of PAVs or licensed volume, which ever is greater.
9. No estimate of Total Water Resource is applicable as >10 per cent GMA/WSPA is located outside the respective River Basin.
10. In non-metered areas estimate of use is based on the State average use for metered areas ('State Average' meaning the average percentage metered use (including D&S use) versus PAV) equalling 48 per cent.
11. Lake Mundi has now been superseded by the Glenelg WSPA which encompasses all aquifer depths.

# Appendix A Groundwater entitlement and use (continued)

| GMA/WSPA NAME | | PAV (ML/yr) | Allocated Volume 30/06/2004 (ML/yr)[4,5] | % PAV | Metered Volume (ML/Yr)[5] | Estimated Use in non-Metered Areas (ML/Yr)[10] | Sum of Nominal Volumes for Non-Licenceable use (Domestic & Stock purposes)[5] | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Attached to Licences | | GMS | |
| AREA | ZONE | | | | | | Attached | Committed | Registered | Committed[1] |
| **Southern Rural Water** | | | | | | | | | | |
| Bungaree | | 4,400 | 5,272 | 120% | 3,737 | | | | 252 | 504 |
| Condah | | 8,700 | 6,716 | 77% | 2,643 | | | | 58 | 116 |
| Denison | | 12,000 | 17,743 | 148% | 15,224 | | | | 297 | 594 |
| Deutgam | | 2,400 | 5,535 | 231% | 547 | | | | 257 | 514 |
| Koo-Wee-Rup | | 14,898 | 12,578 | 84% | 5,273 | | | | 600 | 1,200 |
| Nullawarre | | 25,100 | 21,140 | 84% | 13,543 | | | | 1,197 | 2,394 |
| Sale | | 13,000 | 20,893 | 161% | 14,680 | | | | 919 | 1,838 |
| Wandin Yallock | | 3,300 | 2,880 | 87% | 608 | | | | 163 | 326 |
| Warrion | | 16,500 | 13,788 | 84% | 5,915 | | | | 461 | 922 |
| Wy Yung | | 9,070 | 6,994 | 77% | 2,438 | | | | 116 | 232 |
| Yangery | | 11,500 | 14,045 | 122% | 4,912 | | | | 1,432 | 2,864 |
| Yarram | | 26,625 | 25,655 | 96% | 12,205 | | | | 485 | 970 |
| Colongulac | | 14,271 | 3,213 | 23% | n/a | 1,542 | | | 208 | 416 |
| Corinella | | 2,550 | 410 | 16% | n/a | 197 | | | 157 | 314 |
| Cut Paw Paw | | 3,650 | 511 | 14% | n/a | 245 | | | 2 | 4 |
| Dartmoor | | 18,600 | | 0% | n/a | 0 | | | | |
| Frankston | | 3,200 | 1,096 | 34% | n/a | 526 | | | 199 | 398 |
| Gellibrand | | 0 | 0 | | n/a | | | | | |
| Gerangamete | | -------[3] | 8,000 | | n/a | 3,840 | | | 5 | 10 |
| Giffard | | 3,000 | 5,665 | 189% | n/a | 2,719 | | | 171 | 342 |
| Glenormiston | | 5,042 | 2,253 | 45% | n/a | 1,081 | | | 125 | 250 |
| Heywood | | 21,763 | 5,923 | 27% | n/a | 2,843 | | | 1,735 | 3,470 |
| Jan Juc | | 6,804 | 4,000 | 59% | n/a | 1,920 | | | | |
| Lake Mundi[11] | | 48,000 | | 0% | n/a | | | | | |
| Lancefield | | 1,485 | 1,238 | 83% | 303 | | | | 76 | 152 |
| Leongatha | | 6,500 | 1,351 | 21% | n/a | 648 | | | 114 | 228 |
| Merrimu | | 450 | 421 | 94% | 74 | | | | 13 | 26 |
| Moe | | 8,193 | 2,288 | 28% | n/a | 1,098 | | | 197 | 394 |
| Moorabbin | | 4,305 | 2,273 | 53% | n/a | 1,091 | | | 238 | 476 |
| Nepean | | 5,000 | 5,657 | 113% | n/a | 2,715 | | | 1,162 | 2,324 |
| Newlingrook | | 74,970 | 1,927 | 3% | n/a | 925 | | | | |
| Orbost | | 1,200 | 1,200 | 100% | 464 | | | | | |
| Paaratte | | 4,606 | 3,192 | 69% | n/a | 1,532 | | | 4 | 8 |
| Portland | | 20,683 | 1,628 | 8% | n/a | 782 | | | 63 | 126 |
| Rosedale | | 9,000 | 21,971 | 244% | 15,457 | | | | 1 | 2 |
| Stratford | | not determined | 27,643 | | 27,355 | | | | 410 | 820 |
| Tarwin | | 1,300 | 37 | 3% | n/a | 18 | | | 806 | 1,612 |
| Wa De Lock | Zones 1, 2 & 3 | 29,700 | 25,197 | 85% | n/a | 12,095 | | | 482 | 964 |
| Border Zone 1B | | 60,220 | 4,451 | 7% | n/a | 2,137 | | | | |
| Border Zone 2B | | 30,100 | 24,893 | 83% | n/a | 11,949 | | | | |
| Border Zone 3B | | 17,500 | 515 | 3% | n/a | 247 | | | | |
| Border Zone 4B | | 14,300 | 804 | 6% | n/a | 386 | | | | |
| Glenelg WSPA | | not determined | 36,339 | | n/a | 17,443 | | | | |
| **Goulburn-Murray Water[5]** | | | | | | | | | | |
| Campaspe Deep Lead | | n/a | 46,545 | | 23,931 | | | | 250 | 500 |
| Katunga | | n/a | 31,456 | | 23,784 | | | | 120 | 240 |
| Mid Loddon | | 37,200 | 33,761 | 91% | 12,655 | | | | 330 | 660 |
| Shepparton | | n/a | 202,576 | | 64,288 | | | | 412 | 824 |
| Spring Hill | | 5,062 | 4,905 | 97% | 2,137 | | | | 20 | 40 |
| Upper Loddon | | not undertaken | 12,743 | | 2,339 (part) | | | | 451 | 902 |
| Alexandra | | 900 | 1,821 | 202% | n/a | 874 | | | 69 | 138 |
| Barnawartha | | 2,100 | 595 | 28% | n/a | 286 | | | 80 | 160 |
| Ellesmere | | 1,900 | 1,124 | 59% | n/a | 540 | | | 68 | 136 |
| Goorambat | | 4,888 | 1,651 | 34% | n/a | 792 | | | 71 | 142 |
| Kialla (1+2) | | 2,795 | 2,213 | 79% | n/a | 1,062 | | | 161 | 322 |
| Kinglake | | 3,830 | 2,012 | 53% | n/a | 966 | | | 425 | 850 |
| Mullindolingong | Zones 1 & 2 | 6,980 | 1,504 | 22% | n/a | 722 | | | 202 | 404 |
| Murmungee | | 16,710 | 12,012 | 72% | n/a | 5,766 | | | 1,390 | 2,780 |
| Nagambie | | 5,650 | 6,476 | 115% | 1,335 | | | | 99 | 198 |
| **Wimmera Mallee Water** | | | | | | | | | | |
| Apsley | | 24,355 | 4,360 | 18% | n/a | 2,093 | | | 260 | 520 |
| Kaniva | | 6,950 | 6,918 | 100% | n/a | 3,321 | | | 180 | 360 |
| Murrayville | | 10,883 | 8,317 | 76% | 4,868 | | | | 320 | 640 |
| Neuarpur | | 24,750 | 23,471 | 95% | 15,281 | | | | 230 | 460 |
| Telopea Downs | | 13,435 | 10,682 | 80% | 3,556 | | | | 190 | 380 |
| Balrootan (Nhill) | | 980 | 1,524 | 156% | n/a | 732 | | | 85 | 170 |
| Goroke | | 2,200 | 0 | 0% | n/a | | | | | |
| Kaniva TCSA | | 1,100 | 0 | 0% | n/a | | | | | |
| Little Desert | | 1,100 | 0 | 0% | n/a | | | | | |
| Nhill | | 1,200 | 0 | 0% | n/a | | | | | |
| Border Zone 4B | | 14,000 | 1,210 | 9% | n/a | 581 | | | 340 | 680 |
| Border Zone 5B | | 11,949 | 11,949 | 100% | n/a | 5,736 | | | 160 | 320 |
| Border Zone 6B | | 9,838 | 9,718 | 99% | n/a | 4,665 | | | 60 | 120 |
| Border Zone 7B | | 6,600 | 6,298 | 95% | n/a | 3,023 | | | 100 | 200 |
| Border Zone 8B | | 6,760 | 2,210 | 33% | n/a | 1,061 | | | 115 | 230 |
| Border Zone 9B | | 5,960 | 1,500 | 25% | n/a | 720 | | | 50 | 100 |
| Border Zone 10B | | 6,720 | 6,178 | 92% | n/a | 2,965 | | | 240 | 480 |
| Border Zone 11B | | 1,823 | 1,000 | 55% | n/a | 480 | | | 20 | 40 |
| **Total** | | **802,503** | **804,064** | | **279,551** | **104,361** | | | | **37,806** |
| **% against allocated** | | | | | | **48%** | | | | |
| **Sum of usage** | | | | | | **383,912** | | | | |