

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.

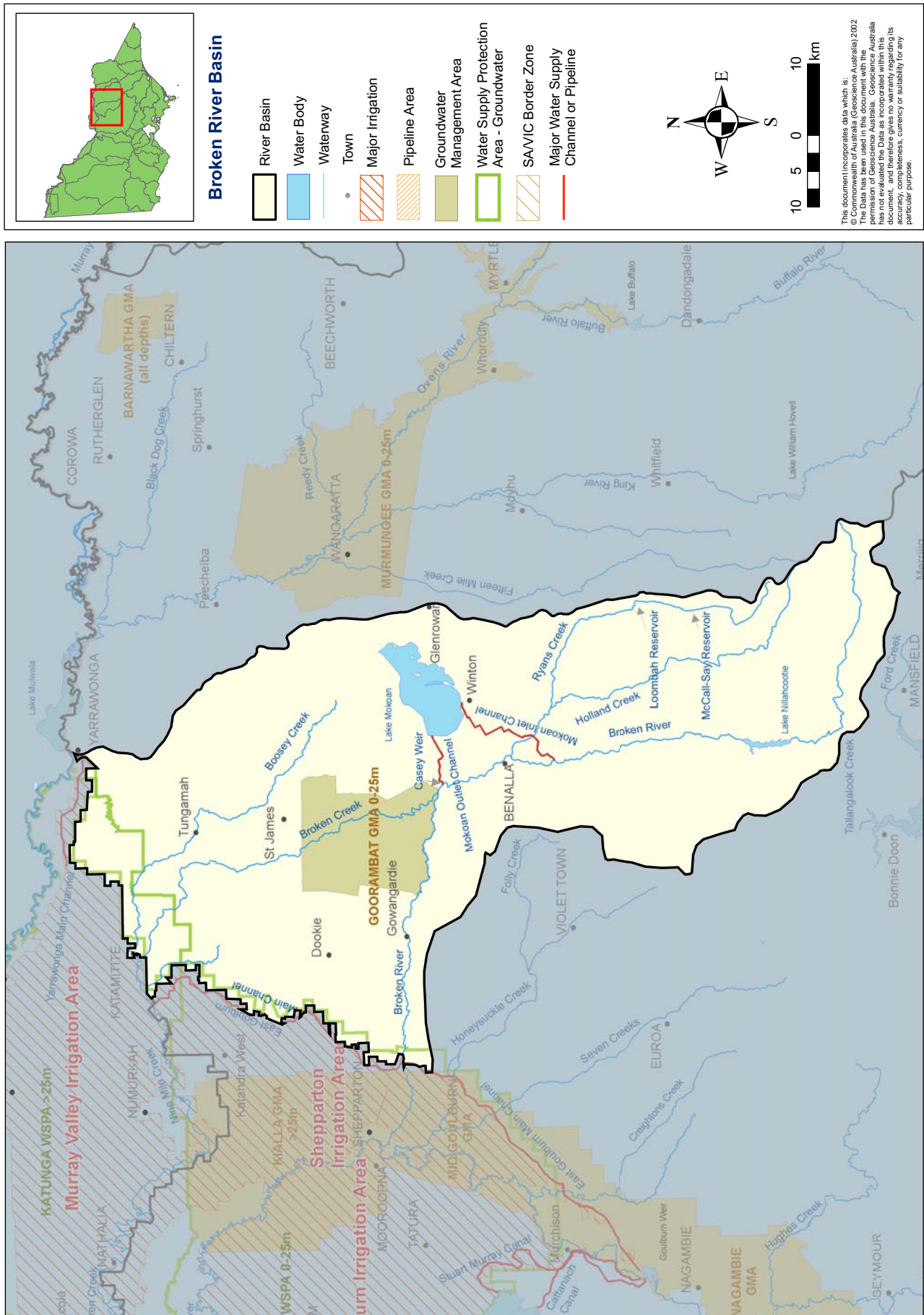
6.3 Seasonal Overview

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?
<i>Goulburn Valley Water</i>					
Dookie	160	-16	144	117	Yes
<i>North East Water</i>					
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
<i>Goulburn-Murray Water</i>					
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	
<i>Unregulated licensed diverters</i>	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 be 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, whichever 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

