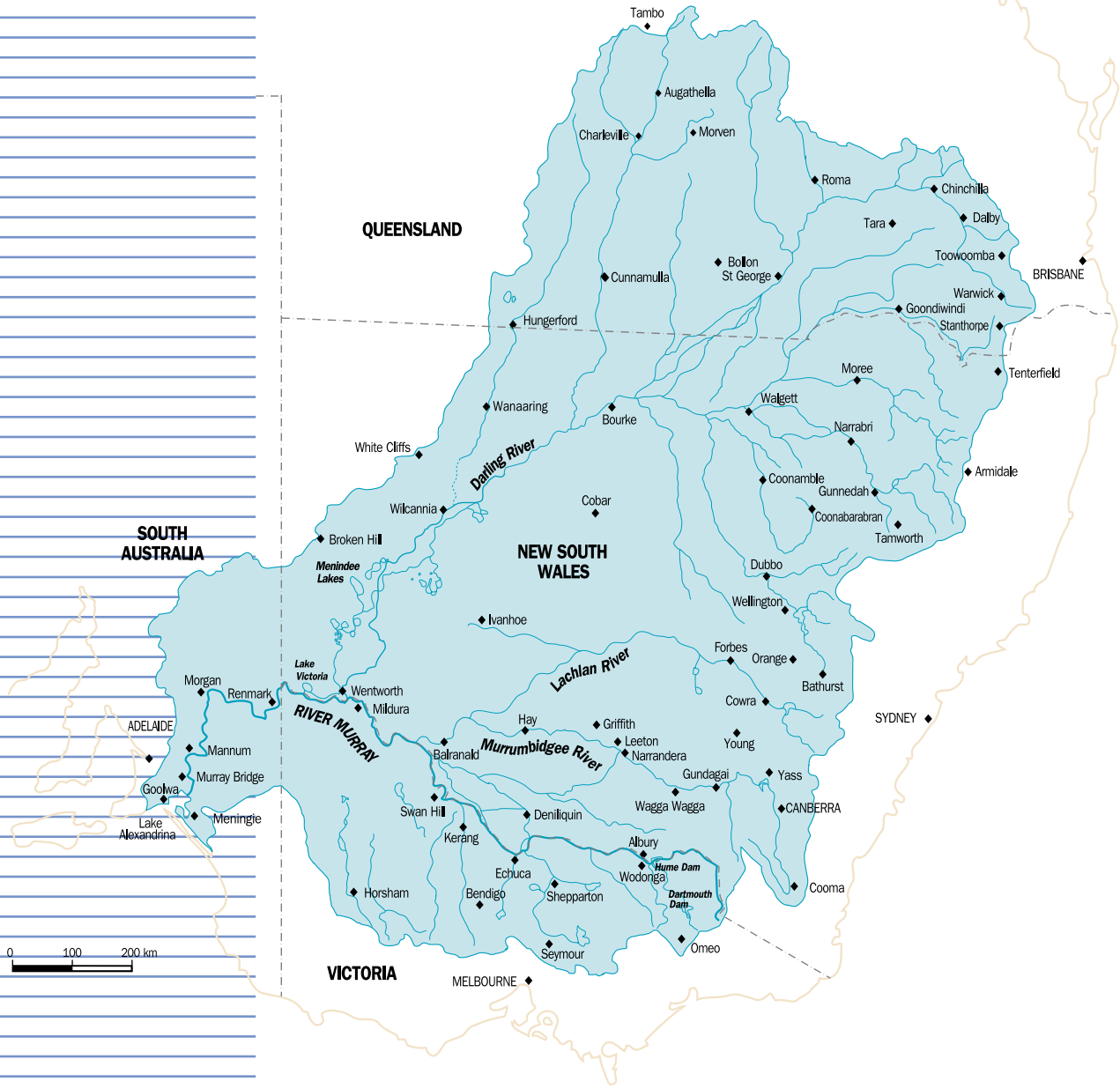
MURRAY-DARLING BASIN COMMISSION



SIX GOVERNMENTS WORKING IN PARTNERSHIP WITH THE COMMUNITY

Water Audit Monitoring Report 1999/00

Report of the Murray-Darling Basin Commission on the Cap on Diversions

SIX GOVERNMENTS WORKING IN PARTNERSHIP WITH THE COMMUNITY

Water Audit Monitoring Report 1999/00

October 2001

Integrated catchment management in the Murray–Darling Basin

A process through which people can develop a vision, agree on shared values and behaviours, make informed decisions and act together to manage the natural resources of their catchment: their decisions on the use of land, water and other environmental resources are made by considering the effect of that use on all those resources and on all people within the catchment.

Our values

We agree to work together, and ensure that our behaviour reflects the following values.

Courage

- We will take a visionary approach, provide leadership and be prepared to make difficult decisions.

Inclusiveness

- We will build relationships based on trust and sharing, considering the needs of future generations, and working together in a true partnership.
- We will engage all partners, including Indigenous communities, and ensure that partners have the capacity to be fully engaged.

Commitment

- We will act with passion and decisiveness, taking the long-term view and aiming for stability in decision-making.
- We will take a Basin perspective and a non-partisan approach to Basin management.

Respect and honesty

- We will respect different views, respect each other and acknowledge the reality of each other's situation.
- We will act with integrity, openness and honesty, be fair and credible, and share knowledge and information.
- We will use resources equitably and respect the environment.

Flexibility

- We will accept reform where it is needed, be willing to change, and continuously improve our actions through a learning approach.

Practicability

- We will choose practicable, long-term outcomes and select viable solutions to achieve these outcomes.

Mutual obligation

- We will share responsibility and accountability, and act responsibly, with fairness and justice.
- We will support each other through necessary change.

Our principles

We agree, in a spirit of partnership, to use the following principles to guide our actions.

Integration

- We will manage catchments holistically; that is, decisions on the use of land, water and other environmental resources are made by considering the effect of that use on all those resources and on all people within the catchment.

Accountability

- We will assign responsibilities and accountabilities.
- We will manage resources wisely, being accountable and reporting to our partners.

Transparency

- We will clarify the outcomes sought.
- We will be open about how to achieve outcomes and what is expected from each partner.

Effectiveness

- We will act to achieve agreed outcomes.
- We will learn from our successes and failures and continuously improve our actions.

Efficiency

- We will maximise the benefits and minimise the costs of actions.

Full accounting

- We will take account of the full range of costs and benefits, including economic, environmental, social and off-site costs and benefits.

Informed decision-making

- We will make decisions at the most appropriate scale.
- We will make decisions on the best available information, and continuously improve knowledge.
- We will support the involvement of Indigenous people in decision-making, understanding the value of this involvement, and respecting the living knowledge of Indigenous people.

Learning approach

- We will learn from our failures and successes.
- We will learn from each other.

Water Audit Monitoring Report 1999/00

Report of the Murray-Darling Basin Commission on the Cap on Diversions

Water Audit Monitoring Report 1999/00

OCTOBER 2001

Acknowledgments

The development of the Murray-Darling Basin Commission's 1999/00 Water Audit Monitoring Report has involved the valuable input, support and commitment of many people. Each stage of the development of the report was overseen by the members of the inter-governmental working groups and committees. Without naming each particular contributor, thanks are due to the following agencies:

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- QLD Department of Natural Resources and Mines;
- SA Department for Water Resources;
- VIC Department of Natural Resources and Environment; and
- VIC Goulburn-Murray Rural Water Authority.

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1. Introduction

In June 1995, in response to an audit of water use in the Murray-Darling Basin, the Murray-Darling Basin Ministerial Council agreed to Cap water use within the Basin. To ensure that the development, management and operation of the Cap is an open and transparent process, the Ministerial Council agreed that a Water Audit Monitoring Report should be produced and published annually.

This report outlines the water usage within the Murray-Darling Basin for the 1999/00 water year, as per the requirements of Schedule F of the *Murray-Darling Basin Agreement*.

In general, the water year is July to June for the Macquarie River and all rivers to the south, and October to September for rivers north of the Macquarie.

This report outlines water usage in the States by designated river valley (Section 3.1), includes estimates of the accuracy of water use figures presented (Section 3.2), provides a climatic overview for the water year (Section 3.3), defines the Cap for each State (Section 3.4) and reviews Cap compliance of States (Section 3.5).

In addition to detailing water use, this report also contains information on the States implementation of management rules in designated river valleys that impact on water use within the Basin. Each State has provided a description of its major activities occurring in 1999/00 and further actions that it plans to undertake over the coming years (Sections 4 to 8).

Other information provided within this report includes water trading throughout the Basin (Section 9), water availability for the year (Section 10), a comparison of actual and natural flows at key sites within the Basin (Section 11) and impoundments and losses in major on-stream storages [above 10 GL capacity] (Section 12).

Section 13 provides information on the use of groundwater in the Basin.

The Diversion Cap Register, which is maintained in accordance with the requirements of Schedule F and Barmah Millewa Forest environmental diversions, is reported in Appendix A and Appendix B, respectively.

To permit rapid assessment of the findings of this report, Table 1 summarises the compliance of each of the Basin States with the objectives of the Cap.

Table 1. 1999/00 Cap Compliance by State

State / Territory	1999/00 Cap Compliance
New South Wales	
Border Rivers	An IQQM (Interim) model, yet to be audited and approved by the Commission, is available to determine the Cap compliance. The NSW Border Rivers exceeded the Cap for 1999/00 and triggered Schedule F exceedance provisions. A supplementary audit by the IAG conducted in February 2001 confirmed the Cap exceedence. Subsequently, Murray-Darling Basin Commission Meeting 58—13 March 2001 declared the NSW Border Rivers in breach of Cap. The NSW Government is to report to Ministerial Council Meeting 31—19 October 2001 on proposed measures to bring diversions in the NSW Border Rivers within Cap limits.
Gwydir	An IQQM (Interim) model, yet to be audited and approved by the Commission, is available to determine the Cap compliance. The Gwydir valley exceeded the Cap for 1999/00 and triggered Schedule F exceedance provisions. A supplementary audit by the IAG conducted in February 2001 confirmed the Cap exceedence. Subsequently, Commission Meeting 58—13 March 2001 declared the NSW Border Rivers in breach of Cap. The NSW Government is to report to Council Meeting 31—11 April 2002 on proposed measures to bring diversions in the NSW Border Rivers within Cap limits.
Namoi/Peel	An IQQM (Interim) model, yet to be audited and approved by the Commission, is available to determine the Cap compliance for the Namoi. A climate diversion relationship is available for Peel and an IQQM model is under development. The diversion of 299 GL for the Namoi/Peel was within the Cap target of 301 GL for the year.
Macquarie/Castlereagh/Bogan	An IQQM (Interim) model, yet to be audited and approved by the Commission, is available to determine the Cap compliance. The 1999/00 diversion of 417 GL for the Macquarie/Castlereagh/Bogan system was below its Cap of 471 GL.
Barwon-Darling/Lower Darling	Council Meeting 29—25 August 2000 decided to combine the Barwon Darling and Lower Darling into a single Designated River valley for Cap accounting purpose. An IQQM (interim) for the Barwon-Darling and MSM (interim) for the Lower Darling, both of which are yet to approved by the Commission, are available to determine the Cap compliance. The combined diversions for the Barwon-Darling/Lower-Darling was 260 GL, which was below the1999/00 Cap target of 327 GL.
Lachlan	An IQQM (Interim) model, yet to be audited and approved by the Commission, is available to determine the Cap compliance. The 1999/00 diversion of 296 GL for the Lachlan valley though was above its Cap target of 241 GL, the valley did not breach the long-term Cap due to Cap credits built in earlier years.

Murrumbidgee	An IQQM (Interim) model, yet to be audited and approved by the Commission, is available to determine the Cap compliance. The 1999/00 diversion of 1,910 GL for the Murrumbidgee was below its Cap of 2,022 GL.
Murray	The MSM (Interim) model, yet to be audited and approved by the Commission, is available to determine the Cap compliance. The 1999/00 diversion of 1,212 GL for the Murray valley was significantly below its Cap of 1,960 GL.
Victoria	
Goulburn/ Broken/Loddon	A computer model known as Goulburn Simulation model (GSM), which is yet to be audited and approved by the Commission, is available to determine the Cap compliance. The 1999/00 diversion of 1,553 GL for the Goulburn/ Broken/Loddon system was within its Cap of 1,648 GL.
Campaspe	The GSM, which is yet to be audited and approved by the Commission, is available to determine the Cap compliance. The diversion of 73 GL for the Campaspe in 1999/00 was within its Cap of 79 GL for the year.
Wimmera-Mallee	An uncalibrated model is available. Though no Cap target for 1999/00 was available, the diversion of 110 GL was below the estimated long-term Cap of 162 GL.
Murray/Kiewa/Ovens	The MSM (Interim) model, yet to be audited and approved by the Commission, is available to determine the Cap compliance. The 1999/00 diversion of 1,574 GL for the Murray valley was below its Cap of 1,593 GL.
South Australia	
Metro-Adelaide & Associated Country Areas	Metro-Adelaide & Associated Country Areas diversions remained below the five-year rolling Cap up to and including 1999/00.
Lower Murray Swamps	Lower Murray Swamp diversions remained within Cap for 1999/00.
Country Towns	Country Towns diversions remained below Cap target for 1999/00.
All Other Uses of Water from the River Murray	Diversions for All Other Uses of Water from the River Murray remained below Cap target for 1999/00.
Queensland	
Condamine/Balonne	Queensland has not yet agreed to a Cap for the valley. A Cap model is also not yet available.
Border Rivers/Macintyre Brook	Queensland has not yet agreed to a Cap for the valley. A Cap model is also not yet available.
Moonie	Queensland has not yet agreed to a Cap for the valley. A Cap model is also not yet available.
Warrego/Paroo	Queensland has not yet agreed to a Cap for the valley. A Cap model is also not yet available.
Australian Capital Territory	A Cap model is not yet available to determine Cap compliance. Negotiations are underway to establish a Cap for the ACT and to establish a framework for trade between the ACT and New South Wales.

2. Background

2.1 Audit of Water Use in the Murray-Darling Basin, June 1995

In June 1995, the Commission completed an audit of water use in the Murray-Darling Basin ("An Audit of Water Use in the Murray-Darling Basin", Murray-Darling Basin Ministerial Council, Canberra, 1995). This audit revealed that water diversions from the rivers within the Basin had increased by 8 per cent in the previous six years and were averaging 10,800 GL/year.

This level of diversion had significantly reduced the flows in the bottom end of the River Murray. It is currently estimated that median annual flow from the Basin to the sea is only 27 per cent of the flow that would have occurred prior to development. The reduction in flow had occurred most significantly for the small to medium size flood events. Many of these events were completely harvested and the frequency of these flood events had been significantly reduced. It was also found that the end of the river system was experiencing severe drought-like flows in over 60 per cent of years compared with 5 per cent of years under natural conditions.

The change in flow regime has had a significant impact on river health. There has been a contraction in the areas of healthy wetland, native fish numbers have declined in response to the reduction in flow triggers for spawning, salinity levels have risen and algal blooms have increased in frequency in line with the increased frequency of periods of low flow. Further deterioration in river health could be expected if diversion levels were to increase.

The audit examined the scope for diversions to grow further under the water allocation system that existed prior to the Cap. The water allocation system evolved at a time when water managers were trying to encourage development of the water resources of the Basin. As such, the system rationed water during periods of shortage but was not effective for controlling diversion during normal non-drought conditions. It was reported that, in the five years before the water audit, only 63 per cent of the water that was permitted to be used was used. The audit found that average diversions could increase by a further 15 per cent if all existing water entitlements were fully developed. Such an increase would reduce the security of supply to existing water users as well as exacerbating river health problems.

2.2 The Cap

The water audit report was presented to the Murray-Darling Basin Ministerial Council in June 1995. The Council determined that a balance needed to be struck between the significant economic and social benefits that have been obtained from the development of the Basin's water resources on the one hand, and the instream uses of water in the rivers on the other. Council agreed that diversions in the Basin had to be capped. An Independent Audit Group (IAG) was appointed to report on the level at which diversions should be capped. In doing so, the group took into account the equity issues between the States.

In December 1996, Council considered the Independent Audit Group's report and agreed that:

- For New South Wales and Victoria, the Cap is the volume of water that would have been diverted under 1993/94 levels of development plus allowances in the Border Rivers for Pindari Dam (NSW), and in the Goulburn/Broken/Loddon system for Lake Mokoan (Victoria);
- For South Australia, highland irrigation diversions were capped at 90 per cent of existing high security entitlements on licence in 1993/94. This represents a small increase in diversions over 1993/94 levels of development; and
- The Cap for Queensland would be determined after the independently audited Water Allocation and Management Planning (WAMP) and Water Management Planning (WMP) processes had been completed.

Subsequently, the Australian Capital Territory joined the Murray-Darling Basin Initiative under a Memorandum of Understanding (MOU) and agreed to participate in the Cap following the completion of discussions with the Murray-Darling Basin Commission (MDBC), the IAG and the New South Wales Government.

The implementation of the Cap will require considerable change to the way the water allocation system is managed across the Basin. It is likely that these changes will alter the expectations that some water users have regarding their water entitlements. In particular, there will be conflict between sleepers (those people who have never used their water entitlement) on the one hand, and those irrigators who have consistently used all their allocation on the other. Both New South Wales and Victoria have established processes implementing the Cap, which will resolve these issues.

Through Capping diversions at 1993/94 levels of development in the two major water using States, coupled with the diversion measures planned for South Australia, Queensland and the ACT, the Ministerial Council has effectively established a new framework for water sharing in the Basin. Because of the value placed on water rights, it is important that each State is only using water in line with its Cap. For this reason, the implementation of the Cap requires an integrated reporting framework including significant improvements to the way that diversions are monitored and reported.

This report is a part of this ongoing Cap process. Given the major change in attitude to the allocation and use of water that has occurred as a result of the Cap, there has been need for significant development of monitoring and reporting systems by the State agencies. In particular, some of the technology based support systems (e.g. improved river modelling), are proving to be more involved, time consuming and labour intensive than originally anticipated.

Thus required outcomes, including water user and catchment community understanding and acceptance, are taking longer to be achieved. As such, this report does not present a complete and final picture, rather it presents information currently available, highlights areas where information is still unavailable and outlines directions proposed to improve monitoring and reporting performance.

2.3 IAG Review of Cap Implementation 1999/00

At the request of the Ministerial Council, the IAG performed a review of the performance of each State and Territory in progressing the implementation of the Cap during 1999/00 ('Review of Cap Implementation 1999/00', published by the Murray-Darling Basin Ministerial Council, March 2001, Canberra).

This present report represents the fourth in a series of annual reports and complements the report of the IAG, however the data presented herein are the final figures for the 1999/00 water year and supersede the data reported by the IAG. Most notably, the Murray-Darling Basin diversions in 1999/00 reported in this present report (Table 2) supersede those reported by the IAG in November 2000 (Table 12 of that report).

3. The Year in Review

3.1 Water Use

The data presented in this report has been collected by the relevant State agencies and collated by the MDBC. Accurate diversion data is difficult to obtain, as it requires the collection and collation of thousands of individual water use figures. Table 2 presents the overall water usage figures for the Basin in 1999/00.

The figures indicate that Basin water use in 1999/00 was 9,542 GL, representing the fifteenth highest on record (since 1983/84). Water use in South Australia was the fifth highest on record, Queensland the third highest, New South Wales the lowest, Victoria the fourteenth highest, whilst diversions in the ACT were thirteenth highest on record.

Figure 1 shows the water use (by State) for the period 1983/84 - 1999/00, which enables a comparison of 1999/00 water use with that of previous years. Figure 2 shows the same data as Figure 1, but has the vertical axis re-scaled, so that the variation for States with lower overall usage is visible.

Not all diversions are metered and some diversions have to be estimated based on area irrigated or duration of diversion. Section 3.2 provides some indication as to the accuracy of the measurements.

Table 2. Murray-Darling Basin Diversions in 1999/00

System	Irrigation Diversion (GL)	Other Diversion[1] (GL)	Total Diversion (GL)
New South Wales[2]			
Border Rivers	197	1	197
Gwydir	444	0	444
Namoi/Peel	294	6	299
Macquarie/Castlereagh/Bogan	409	8	417
Barwon-Darling	175	0	175
Lachlan	289	7	296
Murrumbidgee[4]	1,899	11	1,910
Lower Darling	81	4	85
Murray	1,153	59	1,212
Total NSW[3]	**4,940**	**95**	**5,035**
Victoria			
Goulburn	1,418	34	1,452
Broken	17	8	25
Loddon	70	7	77
Campaspe	40	33	73
Wimmera-Mallee	18	98	116
Kiewa	6	4	9
Ovens	15	9	24
Murray	1,473	67	1,540
Total Victoria	**3,057**	**260**	**3,317**
South Australia			
Metro-Adelaide & Associated Country Areas	0	142	142
Lower Murray Swamps[5]	79	0	79
Country Towns	0	37	37
All Other Uses of Water from the River Murray	364	0	364
Total South Australia	**443**	**179**	**622**
Queensland[2]			
Condamine/Balonne	357	9	366
Border Rivers	148	3	151
Macintyre Brook	11	0	11
Moonie	8	0	8
Warrego	3	0	3
Paroo	0	0	0
Total Queensland[6]	**527**	**13**	**541**
Australian Capital Territory[7]	**5**	**22**	**27**
Total Basin	**8,973**	**569**	**9,542**

1. "Other Diversion" includes domestic & stock, town & industrial uses.
2. New South Wales, Victoria and Queensland diversions include an estimate of unregulated stream diversions.
3. An estimate of NSW floodplain diversions is not available for 1999/00.
4. Murrumbidgee Valley diversions and Lowbidgee diversions are reported together.
5. Water use by Lower Murray Swamp irrigators is based on an estimate of water use. The metering of diversions is currently being implemented.
6. Floodplain diversions in Queensland of 72 GL are not included in valley totals.
7. ACT diversions are reported as a net figure. The primary usage in the ACT is for urban supply, which has a high return component (approximately 50%).

Figure 1. Murray-Darling Basin Diversions - 1983/84 to 1999/00

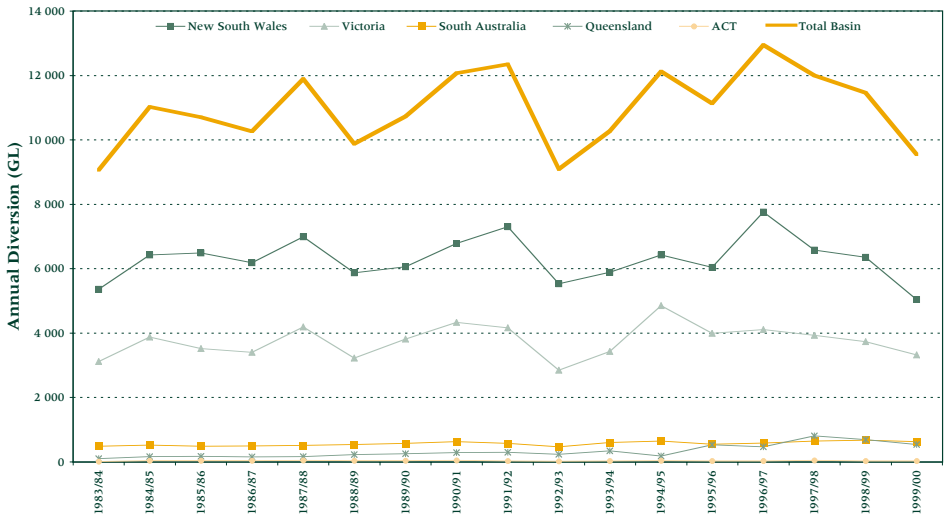
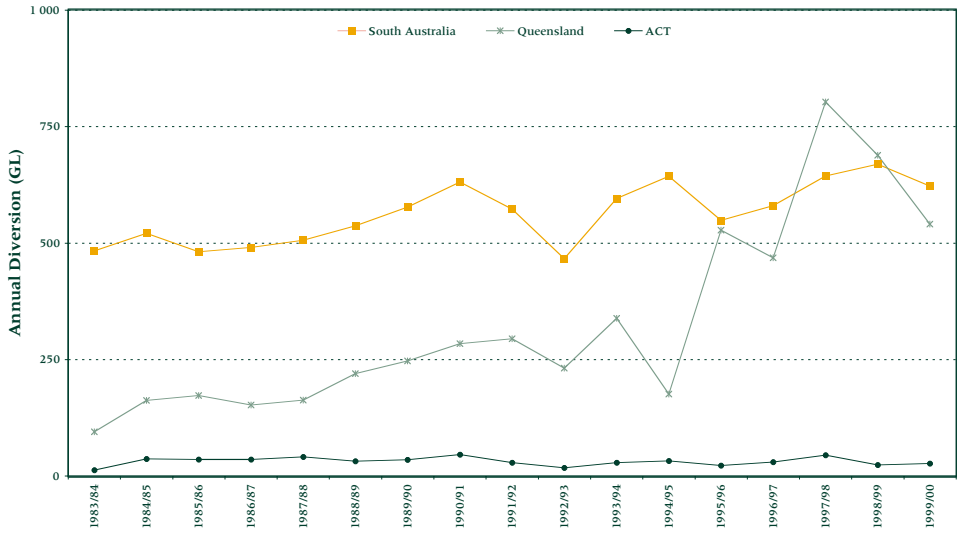


Figure 2. Murray-Darling Basin Diversions - 1983/84 to 1999/00 (usage under 1,000 GL/yr)



3.2 Accuracy of Measurement

An attempt has been made to assess the accuracy of the diversion estimates in each river valley. Many of the diversions are measured reliably using either metered pumps or gauged offtake channels. However, a second category of diversions is estimated from regional surveys of areas planted and a third category of estimates is based only on user returns, which has proved to be very inaccurate.

Table 3 outlines the confidence the States have in their diversion estimates as reported in Table 2. To develop the figures in Table 3, metered diversions have been assumed to have an accuracy of ± 5 per cent, regional surveys ± 20 per cent and user returns ± 40 per cent.

Analysis of reported diversions for 1996/97 to 1999/00 indicates that the accuracy of measurement has remained at 7 per cent.

It is expected that the accuracy of measurement will improve over time as volumetric licenses and allowances are implemented in New South Wales, Queensland and the ACT, in conjunction with the installation of metering in the Lower Murray Swamps, South Australia.

Table 3. Accuracy of Diversion Estimates in 1999/00

System (GL)	Diversion ± GL	Accuracy ± %	Accuracy
New South Wales			
Border Rivers	197	15	8%
Gwydir	444	26	6%
Namoi/Peel	299	29	10%
Macquarie/Castlereagh/Bogan	417	31	8%
Barwon-Darling	175	17	10%
Lachlan	296	18	6%
Murrumbidgee	1,910	126	7%
Lower Darling	85	4	5%
Murray	1,212	60	5%
Total NSW	**5,035**	**328**	**7%**
Victoria			
Goulburn	1,452	87	6%
Broken	25	4	18%
Loddon	77	6	8%
Campaspe	73	4	6%
Wimmera-Mallee	116	8	7%
Kiewa	9	2	22%
Ovens	24	4	15%
Murray	1,540	92	6%
Total Victoria	**3,317**	**208**	**6%**
South Australia			
Metro-Adelaide & Associated Country Areas	142	7	5%
Lower Murray Swamps	79	32	40%
Country Towns	37	2	5%
All Other Uses of Water from the River Murray	364	22	6%
Total South Australia	**622**	**62**	**10%**
Queensland			
Condamine/Balonne	366	55	15%
Border Rivers	151	26	17%
Macintyre Brook	11	1	7%
Moonie	8	3	39%
Warrego	3	1	22%
Paroo	0	0	29%
Total Queensland	**541**	**85**	**16%**
Australian Capital Territory	**27**	**3**	**12%**
Total Basin	**9,542**	**687**	**7%**

3.3 Climatic Overview 1999/00

• Rainfall

Figure 3 shows the rainfall deciles for July 1999 to June 2000 inclusive. Above average rainfall was observed throughout most of the Basin north of the Murray river, with very much above average rainfall recorded in the north-western and central NSW valleys and Queensland south-western valleys. In contrast, the Victorian valleys received only average rainfall, with the southern NSW valleys receiving above average rainfall.

Figure 4 shows the rainfall deciles for the period of November 1999 to April 2000 inclusive. Very much above average to above average rainfall was received throughout most of the Basin, with a strip of average rainfall recorded in high country areas of NSW, Victoria and Queensland.

• Temperature

Figure 5 shows the temperature anomaly (the difference between the recorded temperatures and the long-term average temperatures) for the period of July 1999 to June 2000 inclusive. Minimal variation from average temperature conditions was observed throughout most of the Basin for this period, although slightly lower temperatures (-0.5 to -1.0ºC) were recorded in northern NSW and Queensland.

Figure 6 shows the temperature anomaly for the period of December 1999 to February 2000 inclusive (the primary irrigation season). Lower than average temperatures (-1.0 to -3.0ºC) were observed for the most of NSW and Queensland valleys, whilst average to above average temperature conditions were recorded throughout Victoria.

Figure 3. Rainfall Deciles for the Murray-Darling Basin for the July 1999 to June 2000 Period

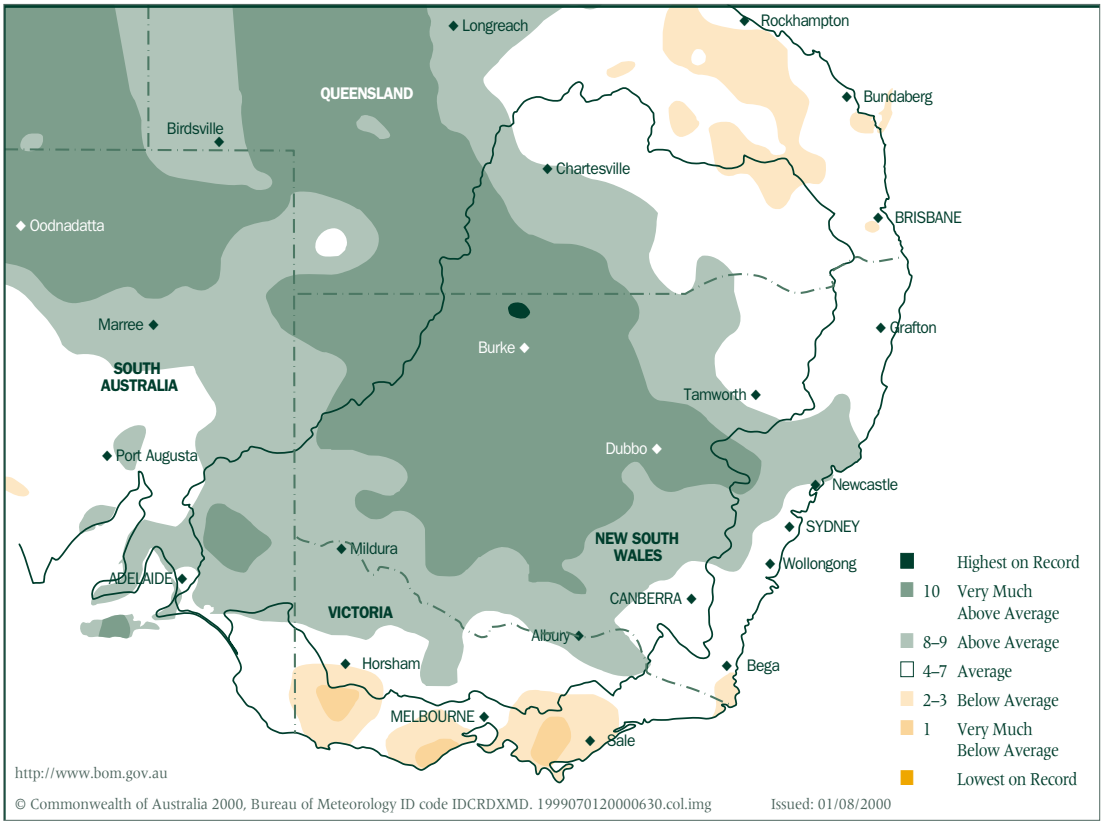


Figure 4. Rainfall Deciles for the Murray-Darling Basin for the November 1999 to April 2000 Period

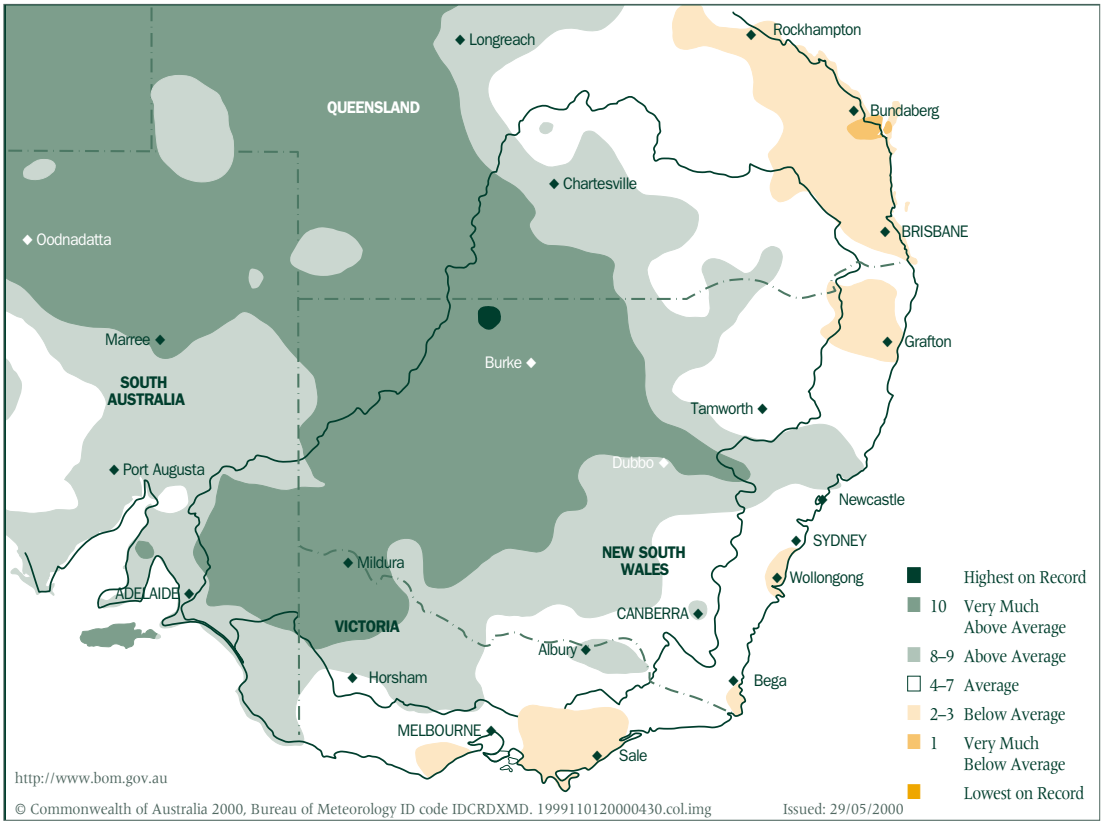


Figure 5. Temperature Anomaly for the 12 Month Period July 1999 to June 2000

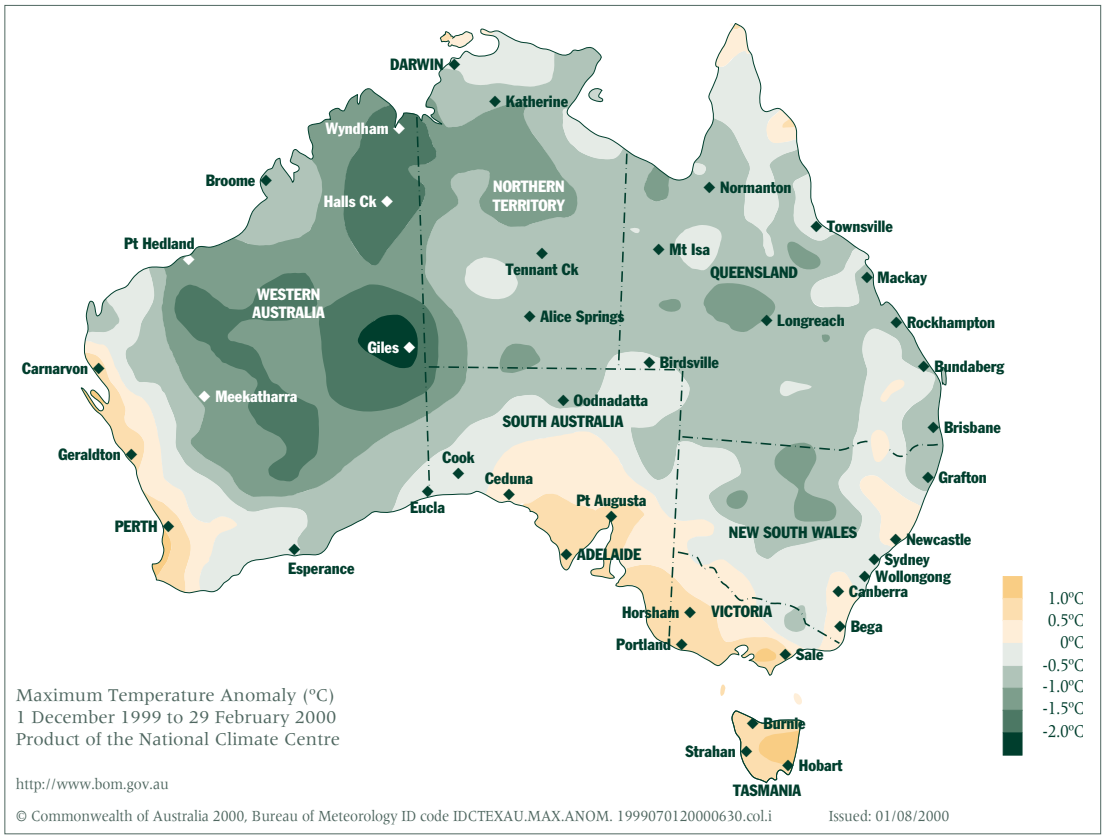
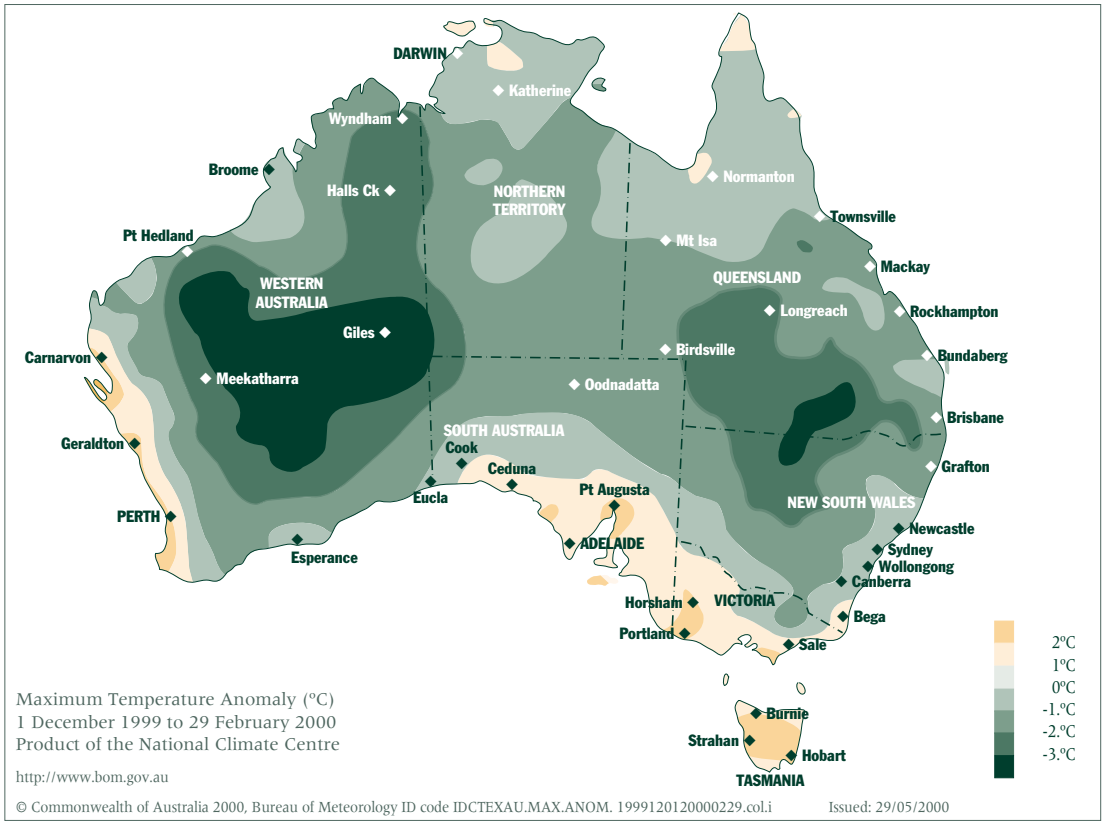


Figure 6. Temperature Anomaly for the 3 Month Period December 1999 to February 2000



3.4 Definition of Cap

The Murray-Darling Basin Ministerial Council has set the long-term diversion Caps for:

- **New South Wales** at the volume of water that would have been diverted under 1993/94 levels of development plus an allowance in the Border Rivers for Pindari Dam;
- **Victoria** at the volume of water that would have been diverted under 1993/94 levels of development plus an allowance (initially 22 GL/year) for Lake Mokoan in the Goulburn/Broken/Loddon system;
- **South Australia** at:
- a total of 650 GL over any five-year period for urban water supply delivered to Metropolitan Adelaide and Associated Country Areas;
- 50 GL/year to supply water to Country Towns;
- 103.5 GL/year for the Lower Murray Swamps (the Council Meeting 30—30 March 2001 increased the Cap for South Australian reclaimed swamps from 83.4 GL/year to 103.5 GL/year comprising (i) 9.3 GL/year for highlands with unrestricted trade, (ii) 72.0 GL/year for swamp use with unrestricted trade and (iii) 22.2 GL/year non-tradeable environmental entitlement); and
- a long-term average diversion for 'All Other Uses of Water from the River Murray' of 440.6 GL/year.

The Ministerial Council has not yet set a long-term Cap for Queensland but will do so following the completion of the Water Allocation and Management Planning (WAMP) and Water Management Planning (WMP) processes in that State.

The ACT has agreed to participate in the Cap on diversions under a Memorandum of Understanding (MOU) and will do so following the completion of discussions with the Commission, the IAG and the New South Wales Government.

The Cap in NSW and Victoria is not the volume of water that was used in 1993/94. Rather, the Cap in any year is the water that would have been used with the infrastructure (pumps, dams, channels, areas developed for irrigation, management rules, etc.) that existed in 1993/94, taking into account the climatic and hydrologic conditions that were experienced during the year under consideration. A primary task in monitoring the Cap in these States is determining the size of the Cap target for each year. This calculation is done at the end of each year and uses the observed climatic and hydrologic data. In the south of the Basin, this will tend to result in lower Cap targets in years when there is significant rainfall in the irrigation areas, and larger Cap targets in years with less rainfall when demand is higher. However, the annual Cap target will also be affected by the availability of water. In very dry years in the south of the Basin, the annual Cap target will reflect the resource constraints. In the north of the Basin, the Cap target will be very much affected by the opportunities to harvest water into on-farm storages.

Because of these complexities, the calculation of the Cap targets will eventually be made by use of computer models with relationships for water use that includes a range of climatic factors and detailed modelling of flows and storage behaviour. Setting up these models is a major task. To date only a few of the models have been completed and none have been subject to either rigorous peer review or an independent audit. An independent audit of each completed Cap model will be conducted prior to approval by the Commission.

The calculation for the Cap in South Australia is relatively straightforward, although the Cap for the fourth category of South Australian diversions described above is a long-term climate adjusted annual average of 440.6 GL and in extremely dry or wet years, may deviate substantially from this value. In the calculation of the Metro-Adelaide Cap, the allocation of 650

GL over 5 years is designed to provide a water supply with 99 per cent security to a major urban city of over 1 million people. This allocation has been based on a 200 year simulation of the amount needed from the River Murray to supplement the primary source from the Mount Lofty Ranges. Actual demand will vary from between about 20 GL (or 10 per cent of Adelaide's needs) to about 190 GL (or about 95 per cent of demand).

Water diversions for 1999/00 are for the sixth water year to be covered by the Cap in the Murray-Darling Basin.

The Ministerial Council has agreed that a State's compliance with the Cap will be tested against the cumulative difference between actual diversions and the calculated Cap targets from 1 July 1997 onwards (Table 4; Appendix A). If that difference exceeds the trigger provisions specified in Schedule F to the *Murray-Darling Basin Agreement*, the Commission must direct the IAG to conduct a special audit of the performance of that State Government in implementing the long-term diversion Cap in the relevant designated river valley. Upon receiving a special audit report from the IAG, which contains a determination that a State has exceeded the long-term diversion Cap in a designated river valley, the Commission must then declare that the State has exceeded the Murray-Darling Basin diversion Cap and must report the matter to the next meeting of the Ministerial Council.

3.5 Comparison of 1999/00 Water Use with the Cap

A comparison of 1999/00 water use with the Cap for each State is as follows:

• New South Wales

Cap compliance in 1999/00 within New South Wales varied between valleys (Table 4).

The interim Cap models for most of New South Wales are available now. However none of these models have been accredited by the Commission. The Lachlan and Macquarie models are expected be accredited by the Commission during 2001/02.

Water use in the Border and Gwydir valleys exceeded Cap for 1999/00 and triggered Schedule F exceedance provisions. A supplementary audit by the IAG was conducted in February 2001, which confirmed Cap exceedance in these valleys. Subsequently, the Murray-Darling Basin Commission Meeting 58—13 March 2001 declared the Border and Gwydir valleys in breach of Cap. The New South Wales Government were scheduled to report to Ministerial Council Meeting 31—11 April 2002 on the reasons of Cap exceedence and the proposed measures to bring diversions in these valleys within Cap limits.

Council Meeting 29—April 2000 decided to combine the Barwon Darling and Lower Darling into a single Designated River valley for Cap accounting purpose. The combined diversion in the Barwon Darling and Lower Darling was below the Cap for 1999/00. The diversion in the Lachlan, although it exceeded Cap target, remained within the exceedance trigger provisions of Schedule F. In contrast, water use in the Murrumbidgee and the Murray Valleys were significantly below the Cap target. The large Cap credit for the Murray Valley is a matter of concern in NSW, and it is being investigated.

• Victoria

Victorian diversions were within Cap target for 1999/00 for all its designated Cap valleys.

Victoria has a Cap model developed for all its Cap valleys except the Wimmera-Mallee system. The Wimmera-Mallee system Cap model, though developed, has not been calibrated for 1993/94 conditions. Victoria remains committed to the ongoing development and improvement of Cap models and implementation of Bulk Entitlements to ensure compliance with the Cap.

• South Australia

South Australia complied with its Cap targets for 1999/00 for the Lower Murray Swamps, Country Towns and 'All Other Uses of Water from the River Murray' (Table 4) and Metro-Adelaide and Associated Country Areas (Table 5).

South Australia continues to undertake improvement programs and forward-moving management initiatives for the sustainability of River Murray water resources and to ensure long-term compliance with the Cap.

• Queensland

Cap definition in Queensland has yet to be completed and therefore, it is not possible to provide a statement pertaining to Cap performance for the Queensland catchments for 1999/00.

The draft Water Resource Plans (WRP) for the Condamine-Balonne, Warrego/Paroo/Nebine and Moonie were released for public comment in May/June 2000, whilst the draft WRP for Border Rivers is expected to be released in late 2001. Due to some legal difficulties, finalisation of Cap for Queensland valleys is not expected before mid 2002.

• Australian Capital Territory

Cap implementation in the ACT is yet to be completed.

Negotiations are under way to establish a Cap for the ACT and to establish a framework for trade between the ACT and New South Wales, which is considered to be a pre-requisite to establishing a Cap for the ACT.

Table 4 presents a comparison of actual diversions to the annual Cap targets for New South Wales, Victoria, South Australia (except Metro-Adelaide & Associated Country Areas), Queensland and the Australian Capital Territory. Table 5 presents a comparison of actual diversions with Cap target for Metro-Adelaide & Associated Country Areas, South Australia.

Table 4. Comparison of Diversions with Cap Levels in 1999/00

System[1]	Cap Target from Cap Model (GL)	Adjustment to Cap Target for Trade[2] (GL)	Cap Target Adjusted for Trade (GL)	Annual Diversion (GL)	Cap Credit[6] (GL)	Cumulative Cap Credit since 1997/986 (GL)	Cap Target Exceedance Trigger (20 per cent of Long-Term Diversion Cap)[7] (GL)
New South Wales							
Border Rivers[3, 5]	150		150	197	-47	-85	-41
Gwydir[5]	397		397	444	-48	-119	-70
Namoi/Peel[5]	301		301	299	2	110	-51
Macquarie/ Castlereagh/Bogan[5]	471		471	417	54	106	-96
Barwon-Darling	144		144	175	-31	-93	-35
Lachlan	241		241	296	-55	61	-70
Murrumbidgee	2,136	-114	2,022	1,910	112	101	-504
Lower Darling	174	9	183	85	98	290	-29
Murray	1,848	112	1,960	1,212	748	870	-374
Victoria							
Goulburn] Broken4] Loddon]	1,672	-10	1,661	1,553	108	133	-417
Campaspe	75	4	79	73	5	51	-24
Wimmera-Mallee5	n/a	0	n/a	116	n/a	n/a	-32
Kiewa] Ovens] Murray]	1,590	3	1,593	1,574	19	143	-331
South Australia							
Metro-Adelaide & Associated Country Areas	see Table 5	see Table 5	see Table 5	see Table 5	see Table 5	see Table 5	see Table 5
Lower Murray Swamps	83	-4	79	79	0	0	-17
Country Towns[8]	50	0	50	37	13	42	-10
All Other Uses of Water from the River Murray	441	11	452	364	88	187	-88
Queensland							
Condamine/Balonne[5]	n/a	n/a	n/a	366	n/a	n/a	n/a
Border Rivers[5]	n/a	n/a	n/a	151	n/a	n/a	n/a
Macintyre Brook[5]	n/a	n/a	n/a	11	n/a	n/a	n/a
Moonie[5]	n/a	n/a	n/a	8	n/a	n/a	n/a
Warrego[5]	n/a	n/a	n/a	3	n/a	n/a	n/a
Paroo[5]	n/a	n/a	n/a	0	n/a	n/a	n/a
Australian Capital Territory[5]	n/a	n/a	n/a	27	n/a	n/a	n/a

1. River valleys grouped thus "]" comprise designated river valleys under Schedule 1 of Schedule F and only a total diversion, cap and difference figure is required for these designated river valleys.
2. Adjustment to Cap target for trade includes exchange rate adjustments to permanent interstate trade.
3. Excludes Cap Target for Pindari Dam.
4. Excludes Cap Target for Lake Mokoan.
5. n/a denotes Cap model is not completed or Cap target has not been able to be determined.
6. The sign convention is that a negative Cap credit value denotes an exceedance of the Cap target adjusted for trade in 1999/00. A negative cumulative Cap credit value indicates an exceedance of the Cap target adjusted for trade on a cumulative basis (since 1997/98).
7. Cap target exceedance trigger values are reported as negative values.
8. The Cap for Country Towns is assessed on an annual basis .

Table 5. Comparison of diversions with Cap levels in 1999/00 for Metro-Adelaide & Associated Country Areas, South Australia

System	Total Diversion in 1999/00 (GL)	Total Diversion - 5 Years to 1999/00 (GL)	5 Year Cap Diversion Target (GL)	Difference between diversion and Cap (GL)	
South Australia					
Metro-Adelaide & Associated Country Areas	142	578	650	72	

4. Review of 1999/00 Water Use in New South Wales

4.1 Overview

When introduced in 1995, the Cap was seen as a necessary first step in the evolution of a more sophisticated method of management that preserves the sustainability of both the environment and the communities that depend upon the water within the Murray-Darling Basin. In accordance with this broad objective, NSW has moved its valleys to long-term management plans with annual Cap monitoring.

The NSW Government has set up community-based River Management Committees (RMC's) charged with the task of recommending environmental flow objectives and associated management rules. In most regulated valleys across the State, each RMC and the Government agreed upon a set of Environmental Flow Rules (EFRs). These rules were implemented for the first time in 1998/99.

Despite NSW having recently committed to moving towards a statutory ten year planning process, the EFRs agreed in 1998/99 remained the governing water management rules for the 1999/00 water year.

The EFRs that were implemented across the State in 1998/99, are targeted at real environmental gains. The NSW Government agrees that the Cap will remain as a monitoring tool to ensure that downstream users' rights, which include the environment, are not degraded. In addition, as part of its role in managing the Cap in NSW, the NSW Department of Land and Water Conservation has developed a set of practical Cap management rules. These rules include limiting the total amount of water available in a valley in any given year by restricting the level of on-allocation and/or off-allocation access and/or the introduction of carryover using a Continuous Accounting allocation system. These rules aim to negate the "use it or lose it" drivers with respect to allocation that has resulted in over use of water in the past. The NSW Department of Land and Water Conservation will continue to use these rules, where necessary, to assist in Cap compliance across the State.

It is recognised that neither EFRs nor on-allocation access rules are fully effective in constraining growth in water use during wet periods. Despite off-allocation access rules being partially effective, it is quite possible to observe increased water use during wet periods. This does not necessarily mean that the long-term Cap will be breached. The EFRs and water access rules may in fact, during drier times when they actively move water from consumptive use to the environment, not only counteract the observed growth in the wet times, but actually reduce long-term diversions below Cap.

In cases where this is not the case, NSW is committed to reducing access to off-allocation to such an extent as to ensure that the environmental outcomes sought by the RMC's are not being eroded by consumptive growth.

The ability of these rules to bring long-term diversions to below 1993/94 levels is based upon the assumption that future infrastructure development remains at current levels. Consequently, if growth is detected, it will be necessary for the NSW Department of Land and Water Conservation, in its review of these rules, to ensure that the benefits of the environmental flow rules are protected. This in turn will ensure that long-term Cap compliance is achieved across the State of NSW.

In summary, by the end of the 1999/00 water year, of the eight NSW valleys being reported, six valleys are below the Cap target exceedance trigger defined in Schedule F of the *Murray-Darling Basin Agreement*. The Gwydir and the Border Rivers valleys are reported to have exceeded the Cap target exceedance trigger. On a state-wide basis NSW has a cumulative Cap credit of 1,241 GL, which compares to a Cap target exceedance trigger of -1,271 GL (Table 4).

In terms of the long-term Cap, NSW manages the Barwon-Darling and the Lower Darling as separate systems. Consequently, NSW has six valleys which have water rules and current

development that will deliver long-term diversions below Cap, and three valleys (the Barwon-Darling, Gwydir and the Border Rivers) which have water rules and current development that will deliver long-term diversions above Cap. Water management changes necessary to deal with these latter valleys are currently being formulated.

4.2 Border Rivers

In the 1999/00 season, the Border Rivers received an allocation of 60 per cent combined with 40 per cent carryover from the 1998/99 season. This provided a total resource availability of 254 GL (Table 8), not including off-allocation. The first few months of the season were quite wet and off-allocation water was made available from October through to January, and then again for a short period in March 2000.

The water year in the Border Rivers runs from October to September. Diversions from the regulated sections of the Border Rivers Valley in the 1999/00 water year totalled 181 GL. Diversions in the unregulated sections of the catchment have been estimated at 16 GL. This gives a total diversion for 1999/00 of 197 GL (Table 2).

Cap accounting was performed using the Border Rivers Integrated Quality - Quantity Model (IQQM). The 1999/00 regulated diversion was found to exceed the Cap target for the year by 47 GL (Table 4). Preliminary Schedule F accounting for the 1997/98 - 1999/00 seasons indicates a cumulative Cap debit of - 85 GL, which exceeds the -41GL Cap target exceedance trigger (Table 4).

4.3 Gwydir

An allocation system called Continuous Accounting (CA) was first introduced in the Gwydir in 1998/99. The system provides licensees with an individual account which can be credited with up to 150 per cent allocation. It also allows all general security licensees to carryover any unused allocation. At any time they may receive a new allocation increment (dependent on resource availability) up to a maximum limit of 150 per cent. In any particular season, each licensee is limited to a maximum on-allocation usage of 100 per cent.

In 1999/00, Gwydir Valley licensees commenced the season with an average of 121 per cent in their individual accounts. Good inflows in the first few months resulted in all accounts reaching 150 per cent by early December. This provided a total resource availability of 529 GL (Table 8), not including water available during off-allocation periods. There were eight incremental allocation increases totalling 49 per cent of entitlement during the season. When total diversions are taken into account this provided a closing balance across the valley of 104 per cent of entitlement.

There were two periods of off-allocation in the Gwydir valley during 1999/00. The first occurred during October and November (up to 6 weeks, depending on the river reach) and the second in March 2000 (for two days only).

The water year in the Gwydir Valley runs from October to September. Diversions from the regulated sections of the Valley in the 1999/00 water year totalled 433 GL. Diversions in the unregulated sections of the catchment have been estimated at 11 GL. This gives a total diversion for 1999/00 of 444 GL (Table 2).

Cap accounting was performed using the Gwydir Valley IQQM. The 1999/00 regulated diversion was found to exceed the Cap target for the year by 48 GL (Table 4). Preliminary Schedule F accounting for the 1997/98 - 1999/00 seasons indicates a cumulative Cap debit of - 119 GL, which exceeds the -70 GL Cap target exceedance trigger (Table 4). NSW is currently completing an assessment of the long-term impact of current management rules (including Environmental Flow Rules (EFR) relative to the 1993/94 Cap benchmark. The impact of current management rules on diversions within the Gwydir River may

not yet have been observed due to a sequence of wet years. Consequently, current Gwydir Cap debits may be offset by future Cap credits during periods in which current management rules are more effective.

4.4 Namoi/Peel

An allocation system called Continuous Accounting (CA) was first introduced in the Namoi Valley in 1998/99. The system provides licensees with an individual account, which can be credited with up to 150 per cent allocation. It also allows all general security licensees to carryover any unused allocation. At any time they may receive a new allocation increment (dependent on resource availability) up to a maximum limit of 150 per cent. In any particular season each licensee is limited to a maximum on-allocation usage of 100 per cent.

The Namoi Valley commenced the season with all accounts at the maximum 150 per cent. Licensees in the Peel were given a 100 per cent allocation for 1999/00. This provided total resource availability in the Namoi and Peel Valleys of 312 GL, not including off-allocation (Table 8). There were three off-allocation events announced for the Namoi River during 1999/00, in October, November and March. Off-allocation was also available in the Peel Valley in 1999/00. The combined volume of water made available in these off-allocation events was 148 GL.

Diversions from the regulated sections of the Namoi and Peel Valleys in the 1999/00 water year totalled 257 GL. Diversions in the unregulated sections of the Namoi catchment have been estimated at 42 GL. This gives a total diversion for 1999/00 of 299 GL (Table 2).

Cap accounting for the Namoi Valley was performed using the Namoi Valley IQQM. Cap accounting for the Peel Valley was carried out using a climate-diversion relationship. An IQQM for the Peel is expected to be available in 2001. The 1999/00 regulated diversion was below the Cap target for the year by 2 GL (Table 4). Preliminary Schedule F accounting for the 1997/98 - 1999/00 seasons indicates a cumulative Cap credit of 110 GL, which compares to the Cap target exceedance trigger of -51 GL (Table 4).

4.5 Macquarie/Castlereagh/Bogan

The first official allocation announcement for the Macquarie Valley of 45 per cent was made in August 1999, with a 60 per cent carryover from the 1998/99 water year. Following significant inflows, the announced allocation was increased to 100 per cent, and all carryover was spilled and reset to zero. This gave licensees a water resource availability of 670 GL, not including off-allocation (Table 8). A further 98.5 GL was available for extraction from six separate off-allocation events in the regulated Macquarie Valley during 1999/00.

Diversions from the regulated sections of the Macquarie/Castlereagh/Bogan Valleys in the 1999/00 water year totalled 386 GL. Diversions were particularly high over the 1999/00 summer period, with record diversions observed in November 1999 and February 2000. Diversions in the unregulated sections of the Valleys have been estimated at 31 GL. This gives a total diversion for 1999/00 of 417 GL (Table 2).

Cap accounting for the Macquarie Valley was performed using the Macquarie Valley IQQM. The 1999/00 regulated diversion was found to be below the Cap target for the year by 54 GL (Table 4). Preliminary Schedule F accounting for the 1997/98 - 1999/00 seasons indicates a cumulative Cap credit of 106 GL, which compares to the Cap target exceedance trigger of -96 GL (Table 4).

4.6 Barwon-Darling

The Barwon-Darling system does not receive a formal allocation of resources, and only unregulated access is available. There is a system of annual quotas that operates within the valley, limiting the total annual extraction to 518 GL.

Of this total, an estimated 350 GL is thought to belong to active licences.

Diversions from the Barwon-Darling River system in the 1999/00 water year totalled 175 GL (Table 2).

Cap accounting for the Barwon-Darling Valley was performed using the Barwon-Darling IQQM. The 1999/00 regulated diversion was found to be above the Cap target for the year by 31 GL (Table 4). Preliminary Schedule F accounting for the 1997/98 - 1999/00 seasons indicates a cumulative Cap debit of -93 GL, which compares to the Cap target exceedance trigger of -35 GL (Table 4).

4.7 Lachlan

The first official allocation announcement for the Lachlan Valley of 55 per cent was made in August 1999 and was increased in December and February, resulting in a final allocation of 74 per cent. A volume of 253 GL was carried over from the 1998/99 water year (Table 9). This provided a water resource availability of 661 GL, not including water accessible during off-allocation periods (Table 8). There was only one quite short off-allocation period during 1999/00.

Diversions from the regulated sections of the Lachlan Valley in the 1999/00 water year totalled 285 GL. Diversions in the unregulated sections of the Valley have been estimated at 11 GL. This gives a total diversion for 1999/00 of 296 GL (Table 2).

Cap accounting for the Lachlan Valley was performed using the Lachlan Valley IQQM. The 1999/00 regulated diversion was found to be above the Cap target for the year by 55 GL (Table 4). Preliminary Schedule F accounting for the 1997/98 - 1999/00 seasons indicates a cumulative Cap credit of 61 GL, which compares to the Cap target exceedance trigger of -70 GL (Table 4).

4.8 Murrumbidgee

The first official allocation announcement for the Murrumbidgee Valley of 50 per cent was made in August 1999 and gradually increased as the season progressed to 78 per cent in February 2000. This was the lowest final allocation since the introduction of the volumetric allocation scheme in the valley in 1980/81. A net temporary transfer of 114 GL out of the Murrumbidgee Valley, to the Murray, the Lower Darling, Victoria and South Australia, occurred during 1999/00. This combined to give total water resource availability in the Murrumbidgee Valley of 2,133 GL (Table 8), excluding water available in off-allocation periods.

In the Murrumbidgee Valley, off-allocation has only been available to those irrigators with a history of use quota, unless the announced allocations are less than 70 per cent. For licensees without a history of use quota, off-allocation use is accounted as on-allocation use when the total usage exceeds 85 per cent or the announced allocation (whichever is the greater). Off-allocation was first announced for the 1999/00 season in September 1999, with another three subsequent off-allocation events in October, December/January and February 2000.

Diversions from the regulated sections of the Murrumbidgee Valley in the 1999/00 water year totalled 1,712 GL. The majority of this water was diverted by the two large irrigation corporations in the Valley (Murrumbidgee Irrigation and Coleambally Irrigation). Controlled diversions through regulators into the Lowbidgee district for 1999/00 were 192 GL. Diversions in the unregulated sections of the Valley have been estimated at 6 GL. This gives a total diversion for 1999/00 of 1,910 GL (Table 2).

Cap accounting for the Murrumbidgee Valley was performed using the Murrumbidgee IQQM. The 1999/00 diversion was found to be below the Cap target for the year by 112 GL (Table 4). Preliminary Schedule F accounting for the 1997/98 - 1999/00 seasons indicates a cumulative

Cap credit of 101 GL, which compares to the Cap target exceedance trigger of -504 GL (Table 4).

4.9 Lower Darling

The Lower Darling system has a small entitlement, which has received a full allocation every year since the volumetric allocation scheme commenced in 1981. A net temporary transfer of 9 GL into the Lower Darling from the Murray, Victoria and South Australia, occurred during 1999/00. This combined to give a total water resource availability in the Lower Darling of 68 GL, excluding water available in off-allocation periods. There were no off-allocation periods during 1999/00.

Diversions from the regulated sections of the Lower Darling in the 1999/00 water year totalled 85 GL (Table 2). This includes 24 GL of water released from Lake Cawndilla for Anabranch replenishment.

Cap accounting for the Lower Darling was performed using the MDBC's MSM. The 1999/00 regulated diversion was found to be below the Cap target for the year (which has been adjusted for transfers) by 98 GL (Table 4). Preliminary Schedule F accounting for the 1997/98 to 1999/00 seasons indicates a cumulative Cap credit of 290 GL, which compares to the Cap target exceedance trigger of -29 GL (Table 4).

4.10 Murray

Overall, allocations for the Murray in 1999/00 were the lowest since the introduction of the formal valley-wide volumetric allocation scheme 23 years previously, in 1977/78. At the commencement of the 1999/00 season, there was a zero allocation for general security water users. The allocation improved gradually throughout the season, with the announced allocation reaching 35 per cent by the end of April, two months before the end of the water year. A further 359 GL was carried over from the 1998/99 water year (Table 9). As a result of the extremely low allocation at the commencement of the water year, an additional volume of up to 300 GL of water was advanced to Murray Valley Irrigators from the Snowy Mountains Scheme during 1999/00 on a commercial basis. By this means, Murray irrigators accessed 100 GL of Snowy Scheme water that would otherwise not have been available until 2000/01. A net temporary transfer of 112 GL into the Murray Valley, from the Murrumbidgee, the Lower Darling, Victoria and South Australia, occurred during 1999/00. This combined to give a total water resource availability of 1,505 GL, not including the water borrowed from the Snowy Scheme or water accessible during off-allocation periods (Table 8).

In the Murray Valley, off-allocation has previously only been available to those irrigators with a history of use quota. However, this constraint was waived for users without a history of use whilst allocations were below 60 per cent. The sole off-allocation period announced for the year of 5 to 22 days duration, depending on the river reach, applied from the first week of September 1999.

Diversions from the regulated sections of the Murray Valley in the 1999/00 water year totalled 1,206 GL. Diversions in the unregulated sections of the Valley have been estimated at 6 GL. This gives a total diversion for 1999/2000 of 1,212 GL (Table 2).

Cap accounting for the Murray Valley was performed using the MDBC's MSM. The 1999/00 regulated diversion was found to be below the Cap target for the year by 748 GL (Table 4). Preliminary Schedule F accounting for the 1997/98 to 1999/00 seasons indicates a cumulative Cap credit of 870 GL, which compares to the Cap target exceedance trigger of -374 GL (Table 4).

5. Review of 1999/00 Water Use in Victoria

5.1 Overview

Details of the factors influencing net water use in each of the Victorian systems in 1999/00 and proposed future water management activities are given below.

5.1.1 Water Use Capping Measures

Victoria has been implementing changes to water management policies since 1990/91 under its water reform package. Ongoing monitoring of the effectiveness of these policies is undertaken. No new policies were introduced for the 1999/00 year and none are proposed for the 2000/01 year. Bulk Entitlements for the Murray system were granted in July 1999. Bulk Entitlements for the Campaspe system were granted in May 2000.

The nature of Victoria's seasonal allocation process also limits diversions. The Goulburn system final allocation was the equal lowest ever (same as in 1998/99), while the Murray system allocations were close to the maximum allowable level.

5.1.2 Volumes Diverted

Volumes diverted during 1999/00 were below Cap level in the Campaspe, Goulburn/Broken/Loddon and Murray/Kiewa/Ovens systems. A Cap target has not been determined for the Wimmera-Mallee system.

The total diversion from the Victorian part of the Murray-Darling Basin during 1999/00 was 3,317 GL. This was less than the diversions in 1997/98 and 1998/99 due to the low allocations caused by dry weather conditions and low resource availability. The total volume authorised for use was 4,375 GL, which included 914 GL losses, 11 GL off allocation and 5 GL net temporary trade out to interstate. The total diversion equates to utilisation of 76 per cent of allocated volume.

5.1.3 Off-Quota

During 1999/00, off-quota allocations were available on the Goulburn River downstream of the Broken River junction and the Loddon River downstream of Laanecoorie Reservoir for 26 days and 14 days respectively. Total use during the off-quota periods was less than 2 GL.

5.1.4 Deliveries

- **Pattern**

Deliveries commenced in September following the low initial allocation announcement in August. Average rainfall throughout the irrigation season combined with low allocations resulted in lower overall deliveries than in 1998/99.

- **Final Deliveries & Historical Comparison**

Total system deliveries for the season were 2,363 GL. Deliveries to customers in all systems were below 10-year averages, and were the third lowest deliveries in the past 30 years - only 1973/74 and 1992/93 were lower.

The low initial allocations and comparatively slow increase in Goulburn and particularly Murray allocations throughout the season, was a major contributor to the low diversions for the year when compared to recent years with similar final allocation levels.

5.1.5 Trading

The low initial allocations encouraged water trading during 1999/2000.

Permanent trade of 21,184 ML occurred during the year. This was about 3,700 ML less than the previous year.

Entitlements of approximately 222,000 ML were temporarily traded during the year. This trading volume was greater than 1998/99, but less than the 1997/98 market total. Trade involving the Murray system was higher than in 1998/99, while Goulburn system trading was similar to 1998/99 levels.

Interstate permanent trading continued to rise, with 796 ML traded to New South Wales and 1,443 ML traded to South Australia. Temporary

interstate trading was lower than in 1998/99, with 4,713 ML traded into Victoria and 9,632 ML traded out.

5.1.6 Environmental Flows

The northern Victorian wetlands used 3,781 ML of its environmental water entitlement during 1999/00.

The Barmah/Millewa forest received an allocation of 50 GL in August following the initial announcement of seasonal allocations. An additional 25 GL was allocated to the forest in February 2000 when the seasonal allocation was increased to 100 per cent of Water Right and 30 per cent of Sales. None of this allocation was used, as the continuing dry conditions did not produce a natural flood suitable to initiate a release.

The 50 GL allocation will be carried over for use in 2000/01. The additional 25 GL was of lower security and will not be carried over, as New South Wales has not allocated a matching volume.

5.2 Goulburn

Announced in August 1999, the initial allocation for gravity customers and private diverters was 35 per cent of Water Right or Licence Volume only. No Sales allocation was available due to the low resource position. This was the lowest ever initial Goulburn allocation.

The allocation gradually increased over the following months and reached 100 per cent of Water Right or Licence Volume in January 2000. There was no further increase beyond this time. Sales remained unavailable throughout the season. This was the equal lowest final allocation ever announced for the Goulburn system, matching that from the 1998/99 season.

Lake Eildon, the main water resource for the Goulburn system, was at 27 per cent of capacity at the beginning of the irrigation season. It rose to a peak of 37 per cent in October 1999 before falling to a record low of 14 per cent in May 2000.

Waranga Basin operations were managed to achieve very low water levels at the end of the season for the third consecutive year. This assisted winter maintenance activities and maximised harvesting capacity in the Basin, which allowed strategic conservation of water in Lake Eildon.

Overall diversions in the Goulburn basin were below the 10-year average. Of the 1,072 GL authorised allocation within the Goulburn basin, 999 GL (or 93 per cent) was used. This includes losses of 333 GL, but excludes 454 GL diverted to other distribution areas.

There was a decrease in trading levels over the previous year. Net permanent trade was 2,239 ML out of the Goulburn valley. Net temporary trades were net inwards at a volume of 1,117 ML. There was 9,226 ML permanently traded and 132,334 ML temporarily traded within the valley.

Bulk Entitlements for the Goulburn system have been in force since 1995.

For the purposes of Cap compliance, the Goulburn basin is included in the Goulburn/Broken/Loddon designated river valley under Schedule F of the Agreement. The Goulburn/Broken/Loddon system diversions were below the modelled Cap target for 1999/00.

5.3 Broken

Broken system diverters received an initial allocation of 100 per cent of Licence Volume. The maximum allowable allocation of 100 per cent Licence Volume plus 70 per cent Sales was announced in September 1999. As in previous years, this supply was only guaranteed while Lake Mokoan remained free of blue-green algae blooms.

At the beginning of the season, Lake Nillahcootie held 64 per cent of capacity and Lake Mokoan held 41 per cent of capacity. Lake Nillahcootie rose to its maximum capacity of 40 GL in early

September 1999. Lake Mokoan peaked at 52 per cent of capacity in October 1999; the storage was closed due to blue-green algae blooms in January 2000.

Broken system diversions were close to the 10-year average. Approximately 25 GL (45 per cent) was used of the total allocation of 55 GL.

Bulk Entitlements for the Broken system are being developed for completion by June 2001.

For the purposes of Cap compliance, the Broken basin is included in the Goulburn/Broken/Loddon designated river valley under Schedule F of the Agreement. The Goulburn/Broken/Loddon system diversions were below the modelled Cap target for 1999/00.

5.4 Loddon

Gravity irrigation customers in the Loddon basin are largely supplied from the Goulburn system via the Waranga Western Channel. These customers received a final allocation of 100 per cent of Water Right. Private diverters were allocated 100 per cent of Licence Volume.

The combined resources of Cairn Curran, Tullaroop and Laanecoorie Reservoirs were at 28 per cent of capacity at the beginning of the season. The combined storages peaked at 47 per cent capacity in January following an unusually intense summer thunderstorm. Approximately 45 GL of water was used to supplement the Pyramid-Boort Irrigation Area.

Use in the Loddon system was 302 GL (or 78 per cent) of the total allocation of 388 GL. The Loddon received approximately 225 GL from the Goulburn basin to supply gravity customers in the Pyramid-Boort Irrigation Area.

Bulk Entitlement development for the Loddon system is to commence in late 2000 and be completed by December 2002.

For the purposes of Cap compliance, the Loddon basin is included in the Goulburn/Broken/Loddon designated river valley under Schedule F of the Agreement. The Goulburn/Broken/Loddon system diversions were below the modelled Cap target for 1999/00.

5.5 Campaspe

The Campaspe basin hosts private diverters, the Campaspe Irrigation District and the Rochester Irrigation Area. Private diverters and irrigators in the Campaspe Irrigation District obtain water from the Campaspe River. Rochester Irrigation Area customers receive water from the Goulburn system via the Waranga Western Channel.

The initial allocation of 100 per cent of Water Right or Licence Volume for irrigators supplied by the Campaspe River was unchanged throughout the season. Irrigators in the Rochester Irrigation Area ultimately received a final allocation of 100 per cent Water Right.

Lake Eppalock was 35 per cent capacity at the beginning of the season and rose to 42 per cent capacity in October. There was no supplement available to the Waranga Western Channel from the Campaspe system due to the low resource position.

Campaspe District irrigators used their full entitlement as well as 4.5 GL of water temporarily traded in. Usage by private diverters was below average. Diverters also temporarily traded a large proportion of their Licence Volume to the Campaspe Irrigation District and other systems.

Of the 318 GL allocated for use, 85 per cent (or 269 GL) was used. This included 32 GL of losses and 195 GL transferred in from the Goulburn basin to supply Rochester Irrigation Area.

Bulk Entitlements for the Campaspe system were approved in May 2000.

The Campaspe system was within Cap for 1999/00.

5.6 Wimmera-Mallee

The 1999/00 season commenced with storages holding only 32 per cent of capacity, the lowest May volume since 1978. The 1999 winter and spring resulted in well-below average inflows, with some key catchments producing their third lowest annual inflow on record.

Restrictions were not imposed to domestic and stock customers in the 1999 winter, however strict enforcement of a requirement to maintain farm drains in clean condition, and a highly cooperative approach to the dam-filling season, led to an efficient winter season and considerable savings in releases from storages beyond those made in the 1998/99 season. The only formal restriction during the winter/spring season was that no supply was made to recreation lakes.

The poor inflows in the winter/spring period led to the introduction of significant restrictions in the summer period. Domestic and stock supplies were limited to 50 per cent, irrigators received a 100 per cent allocation with no sales allocation (i.e. half their normal supply), and much of this volume required pumping from Pine Lake. The environmental allocation was restricted to 30 per cent. Significant restrictions were also required to manage the low volume in Wartook Reservoir. This included ceasing the compensation flow on Burnt Creek. Commensurate urban restrictions in Horsham City were introduced by Grampians Water.

The 2000 Winter domestic and stock season commenced with a continuation of the 50 per cent restrictions which had been initiated for the Summer run. The requirement for efficient on-farm works was strictly enforced and considerable effort was involved in policing implementation of the 50 per cent dam-fill restriction to prevent unauthorised use of water.

At the end of the financial year, Wimmera-Mallee Water storages were holding 13 per cent, their lowest combined volume since all 12 reservoirs were constructed, and the lowest total volume since the 1940s.

The impact of restricted supply, in particular to irrigation and environmental releases, is evident from the table below, which compares diversions with 1998/99 and 1994/95, both of which were dry seasons. The Domestic and Stock (D&S) diversions (including urbans) have decreased marginally on 1998/99 levels, substantiating Wimmera-Mallee Water's (WMW) efforts to improve efficient operation. Overall efficiency improvements are very significant, as can be seen by comparison of diversions with 1994/95 levels.

The Cap model was not yet completed for the Wimmera-Mallee, however it is assumed that usage has remained within Cap, as there has been no net development in the valley.

Completion of Stages 4 and 5 of the Northern Mallee Pipeline has seen additional entitlement for environmental flows in the Wimmera and Glenelg rivers. Drought conditions have meant that this supply was restricted in 1999/00. Releases to the Wimmera River were 3,450 ML and 1,994 ML to the Glenelg River. The environment's entitlement has increased from 17, 700 ML to be 24 900 ML at the end of the 1999/00 financial year.

Year	1994/95	1998/99	1999/00
Total Releases	202	182	148
Irrigation Diversions	29	23	16
D&S Diversions (inc. urbans)	161	127	121
Environmental flows and compensation releases	11	20	9
Northern Mallee Pipeline	0.5	1.5	1.5

5.7 Kiewa

No allocation is announced for the Kiewa basin because it is an unregulated system.

Overall usage during 1999/00 was 9.2 GL (or 57 per cent) of licensed volume of 16 GL. The irrigation usage was below average.

A stream flow management plan for the Kiewa basin is being developed.

For the purposes of Cap compliance, the Kiewa basin is included in the Kiewa/Ovens/Murray designated river valley under Schedule F of the Agreement. The Kiewa/Ovens/Murray system diversions were below the modelled Cap target for 1999/00.

5.8 Ovens

No formal allocation is announced for the Ovens basin. Resources are usually sufficient to satisfy overall demand, which has been consistently less than licensed volume. The Bulk Entitlement conversion process will review these policies.

Lakes Buffalo and William Hovell filled during winter, which is common for these small storages.

Overall, usage during 1999/00 was 24 GL (or 43 per cent) of licensed volume of 57 GL. The volume of irrigation usage was slightly above average.

Bulk Entitlement development for the Ovens system commenced in December 1999 and is scheduled for completion by June 2001.

For the purposes of Cap compliance, the Ovens basin is included in the Kiewa/Ovens/Murray designated river valley under Schedule F of the Agreement. The Kiewa/Ovens/Murray system diversions were below the modelled Cap target for 1999/00.

5.9 Murray (including Mitta Mitta)

The initial allocation for gravity irrigation areas and private diverters was 100 per cent of Water Right or licensed volume, but no Sales. The allocation increased over the following months until it reached a maximum allocation of 100 per cent of Water Right or licensed volume plus 90 per cent Sales in April 2000. Private diverters not on the Mitta Mitta River received 100 per cent of licensed volume and 60 per cent Sales.

At the beginning of the season, Lake Hume was 36 per cent capacity and Dartmouth Dam was 47 per cent capacity. Lake Hume rose to a peak of 59 per cent capacity in November 1999. Dartmouth Dam peaked at 56 per cent capacity in January 2000. Victoria held slightly more resource in Lake Hume and a much greater share of Dartmouth Dam resources than New South Wales throughout the first half of the irrigation season. The Lake Hume shares were even by the end of the season.

No off-quota periods were declared for Murray system irrigators during 1999/00.

Approximately 1,566 GL (or 68 per cent of the 2,318 GL total allocation) was used within the Murray basin. This usage includes 393 GL losses and 25 GL transferred to the lower Broken Creek from the Goulburn system. The overall diversions were below the 10-year average.

Net permanent trading in the Murray valley was 216 ML inwards. The Murray downstream of Nyah received 8,473 ML of the 10,591 ML of entitlement permanently bought in the Murray valley. A net 2,907 ML was temporarily traded out of the Murray valley.

Bulk Entitlements for the Murray system were approved in July 1999.

For the purposes of Cap compliance, the Murray basin is included in the Kiewa/Ovens/Murray designated river valley under Schedule F of the Agreement. The Kiewa/Ovens/Murray system diversions were below the modelled Cap target for 1999/00.

6. Review of 1999/00 Water Use in South Australia

Overview

South Australia reports diversions under four Cap components:

- Metropolitan Adelaide and Associated Country Areas;
- Country (River) Towns;
- Lower Murray Swamps; and
- All Other Uses of Water from the River Murray (sometimes referred to as Highland).

Water diversions from the River Murray were within Cap for each of the designated cap components in 1999/00.

Seasonal factors are likely to have had a minor influence on irrigation water use in South Australia in 1999/00. An outline of these seasonal factors and future water management activities are discussed below.

Season Conditions

The Riverland region in South Australia receives annual average rainfall of less than 300 mm and most of this usually falls in the winter months. The rain that does fall in the Riverland throughout the summer/growing season is not generally considered a significant factor with regard to irrigation practice, as both the duration and intensity of rain during this period is too little to yield any considerable benefit. Weather conditions in South Australia have generally been close to average for the whole 1999/00 water year, although isolated dry spells and un-seasonal rain events did occur.

At Loxton, significant rainfall was recorded for November 1999 and February 2000. The February 2000 rainfall of 93.4 mm was the highest rainfall on record for that month. This figure is about 4.5 times the average for the month of February.

Highland irrigation diversions for 1999/00 were less than the previous year and it is likely that the significant rain events, which occurred during the growing season, had some impact on irrigation practice. Other factors in addition to the un-seasonal rain which could have influenced the drop in this year's diversions include, the slowing of new developments, corporate viticulture operations focusing more on quality of fruit rather than quantity (requiring less water), and continued improvements to irrigation practice.

While conditions have been more favourable for the Riverland region with the assistance of some un-seasonal rain, the status of water supplies for Metropolitan Adelaide has not been so satisfactory. Adelaide and its surrounds are supplied with water from the Mount Lofty Ranges catchments and the River Murray. The amount of water that is diverted from the River to augment the Metropolitan Adelaide supplies is heavily dependent on weather conditions in the Mount Lofty Ranges and the state of storages. Considering that conditions in the Ranges have been drier than average for the last few years and storages have been quite low, diversions from the River were well above average once again for 1999/00.

Metropolitan Adelaide and Associated Country Areas

The Cap for metropolitan Adelaide is reported over a five-year rolling average period of not more than 650 GL (i.e. nominally 130 GL per year). Usage of River Murray water for metropolitan Adelaide in 1999/00 was 142 GL and the total for the five years to 1999/00 was 578 GL, which is well within the Cap.

Country (River) Towns

Water use for Country Towns in 1999/00 was 37 GL. This is 13 GL below the annual Cap limit of 50 GL.

The Cap for Country Towns has been under review, pending the re-evaluation of information under which the Cap for Country Towns was originally set. The Cap of 50 GL per year for Country Towns is likely to be confirmed by Ministerial Council in March 2001.

Lower Murray Swamps

Since trade became available to reclaimed swamp irrigators, the Cap for the reclaimed swamps has decreased from the interim Cap figure of 83.4 GL in 1993/94 to 79.1 GL in 1999/00. Use is currently considered equal to allocation in the reclaimed swamps, however this will change as meters continue to be installed allowing accurate measurement of use. Modelling is currently being pursued to re-assess a fair and equitable Cap for the swamps. The 83.4 GL figure was only ever intended as an interim Cap until an appropriate assessment could be finalised. A final Cap for swamps should be confirmed by Ministerial Council in March 2001.

All Other Uses of Water from the River Murray (Highland Irrigation)

Highland irrigators diverted 364.2 GL or 80 per cent of the permanent trade adjusted Cap of 451.8 GL for 1999/00. This adjusted Cap figure includes an adjustment for incoming and outgoing interstate trade (modified by the exchange rate of 0.9). Diversions for this year represent a decrease compared to 89 per cent usage of Cap target for 1998/99. Factors attributed to this decrease include: interstate trade, a shift in industry focus from quantity of production to quality, temperature, growing season rainfall, improved irrigation efficiency through promotion and development of grower education programs and improved infrastructure. The rate at which new developments emerge has also continued to slow, as the pool of available water entitlement decreases through the take up of sleeper and/or dozer allocations.

Future Water Management Activities

South Australia is committed to improvement programs and forward moving management initiatives for the sustainability of River Murray water resources through:

- Development and implementation of 'Local Action Plans' and 'Land and Water Management Plans' to cover all sections of the River Murray catchment in South Australia to ensure that improved irrigation practice and suitable farm management techniques are adopted in a coordinated manner through strong local community commitment;
- Ongoing and developing partnerships between the River Murray Catchment Water Management Board and Local Action Planning groups in implementing Local Action Plans;
- Adoption of a comprehensive Catchment Plan and Water Allocation Plans by the River Murray Catchment Water Management Board. These should be available to the public mid-late 2001. Some delays have been experienced in developing the plans due to the expansion of the Catchment Board boundaries and associated issues. However, these issues have predominantly been resolved and plans are undergoing final consultation and approval processes;
- Development of a new licensing system with improved audit capabilities. Stage one of this project has now been completed which incorporates a user needs analysis, the development of process and data models, and the development and testing of a prototype system. Stage two, which incorporates the development of necessary aspects of the full system proposal, should begin by mid 2001;
- Continued rehabilitation of highland irrigation areas to reduce system losses and improve irrigation practice. Only the Loxton irrigation area remains to be rehabilitated and approval to proceed was granted last year. This rehabilitation program began in late 2000 and is scheduled to finish in December 2003;
- Installation of metering systems for swamp irrigation areas and implementation of revised water allocation and irrigation management practice; and
- Ongoing grower education programs.

7. Review of 1999/00 Water Use in Queensland

7.1 Management Overview

Details of the factors influencing water use in Queensland in 1999/00 and proposed future water management activities are given below.

Management Planning

Queensland is establishing a basis for Cap performance through water resource planning initiatives currently in progress in the valleys of the Queensland section of the Murray-Darling Basin. These are consultative processes aimed at achieving a balance between consumptive use and the environment, giving security of entitlement for water users, whilst providing for the health of the river system.

A draft plan was released for the Condamine/Balonne in June 2000. At the time of release of the plan, the Minister indicated that water sharing arrangements in the plan may give priority to water users who had constructed, or started construction of works to take overland flow, prior to the release of the plan. This announcement was extended to include stream-based development in August 2000. The provisions of Queensland's new *Water Act 2000* were then used on 20 September 2000 to place a statutory moratorium in the catchment. In addition to putting into statutory effect the administrative hold applied up to September 2000 on dealing with new applications for an entitlement to water, the moratorium prevents further construction of works that take or interfere with water. The intent of the moratorium is to ensure ongoing development doesn't compromise the outcomes of the water resource plan.

Extensive key stakeholder and broader community consultation followed the release of the draft plan. Submissions to the plan closed in December 2000. It is intended that a final plan for the Condamine/Balonne catchment will be released later in 2001, following further technical and scientific assessments, key stakeholder consultation, and Cabinet approval.

The water resource planning process in the Border Rivers is a joint initiative with the NSW Department of Land and Water Conservation. In November 1999, the two States agreed that:

- increases in water use in the system that will cause further deterioration in the flow regime at Mungindi, will not be supported; and
- further growth in diversions in the regulated sections of the system, will not be allowed.

These decisions will form a core element of Queensland's Cap targets and Water Resource Plan for that part of the catchment.

A similar moratorium to that placed in the Condamine/Balonne was placed in the Queensland section of the Border Rivers catchment on 20 September 2000.

The daily flow model for the catchment has been further refined during the year and the two States are developing a common set of principles and objectives for water resource planning in the catchment. These principles will feature in an interstate agreement which will be developed to set core and consistent management elements into each State's statutory water resource/management plan. It will be through these State planning instruments that these core elements will be given effect.

An Information Paper was released in July 2000 to inform the catchment community on the current condition of the water resources and the current water management policies. The draft Interstate Agreement and Queensland draft Water Resource Plan are to be released for the Border Rivers catchment in 2001.

In June 2000, the two States signed the Border Catchments Intergovernmental Memorandum of Understanding (MOU) to provide a basis for development of:

- coordinated water resource management arrangements in the Border Catchments; and
- a regulatory framework to oversee commercial water infrastructure operations in the Border Rivers regulated supply systems.

The MOU provides for the establishment of a Ministerial Forum and Standing Committee to pursue the objectives of the Memorandum. These parties will act to guide and ratify interstate agreement on the various elements of the water resource planning process, e.g., diversion Caps, environmental flows, tributary inflows, cross border trading, etc. The MOU is now being implemented through meetings of the Standing Committee and the Ministerial Forum.

The draft Water Resource Plans for the Moonie River and Warrego/Paroo/Nebine catchments were released in May and June 2000 respectively. New allocation and water access opportunities are expected to be very limited. The draft plans proposed that the planning outcomes for these valleys are to essentially fix development, and water diversions would be held to that associated with the existing water allocation regime. Consequently, end of valley flow performance would be maintained at high levels compared with the positions in most other valleys in Murray-Darling. There are comparatively low levels of water resource development in the catchments and the planning process is intended to control and manage water extraction to maintain a strong emphasis on providing high levels of flow to support the natural ecosystem requirements of these stream systems. Final plans are due to be released in 2001.

Implementation of the Water Resource Plans will be through a Resource Operations Plan (ROP). The ROP will be the mechanism for conversion of existing licences and development of operational rules to achieve the environmental and water entitlement security outcomes specified in the Water Resource Plan. The ROPs are planned to be completed by late 2002 to enable Queensland's Cap compliance measures to be identified and included in Schedule F of the *Murray-Darling Basin Agreement*.

Extensive auditing of irrigation works is currently being carried out in Queensland's catchments to validate hydrologic model inputs and to provide valuable information to assess the impact of proposed methods of conversion of entitlements.

- **Legislative Changes**

New legislation known as the *Water Act 2000* was assented to on 14 September 2000. The Act specifically provides for the sustainable allocation and management and efficient use of water through the establishment of the statutory water resource planning process. It also establishes a regulatory framework for providing water and sewerage services. Provision is also made for the permanent transfer of water allocations under rules developed in the operational planning phase of implementing a water resource plan.

Major parts of the Act commenced on assent including the vesting, water planning, and water service provider provisions. Other parts which bring forward the licensing provisions of the *Water Resources Act 1989*, and implement the separation of works from water allocations, will be phased in during 2001.

For the first time in Queensland the *Water Act 2000* provides for the regulation of overland flow water, but regulation is subject to the area being identified in a water resource plan. The water resource planning process will establish the significance and sensitivity of the impact of overland flow diversions at the catchment scale and make provisions for regulation of this water as considered appropriate. Consultative management planning exercises are underway in the more developed overland flow areas, Upper Condamine and Lower Balonne and also Border Rivers to provide information to the water resource planning process. This same consultative planning network will be used in implementation of the plan.

- **Water Use Efficiency (WUE)**

The Queensland Government's Rural Water Use Efficiency Initiative is a four-year program with a total commitment of $41 million to the initiative through to July 2003.

The four major elements of this initiative are:

- Adoption Programs (including a Research and Development Program) to improve water use efficiency on farms;
- Reducing water losses from storages on farm;
- Financial Incentives to achieve best practice irrigation water management; and
- Reducing water losses in irrigation water supply and distribution systems.

Approximately $4 million in grants was made through the year to the following industry partners for their Adoption programs.

- Sugar represented by Queensland Cane Growers Council;
- Horticulture represented by Fruit and Vegetable Growers;
- Dairy Lucerne and Pasture represented by Queensland Dairyfarmers' Organisation; and
- Cotton and Grains represented by the Australian Cotton Cooperative Research Centre.

Under the Research and Development program, a further $3 million has been allocated over the next three years to funding a range of projects that address key irrigation and water use efficiency issues relevant to the industry partners.

The Financial Incentives scheme has been allocated $11 million over the next three years to support the implementation of 'best practice' irrigation management. This will include subsidies for equipment and system modification to improve irrigation efficiency.

The key aims of the program are:

- Improved productivity and economic returns through the more efficient use of water;
- Reduced impacts on the environment; and
- Development of more sustainable rural water systems and practices.

The Queensland cotton industry has established three water use efficiency advisors in the Queensland Murray-Darling Basin Catchments. The publicity and general industry awareness and consequent on-ground action has increased as a result of this program. The cotton industry has set itself a target of achieving a 10/per cent improvement in rural water use through adoption of improved water management practices by 70 per cent of growers.

For further information the RWUE Web site is http://www.dnr.qld.gov.au/water/rwue/

7.2 Stream Flow and Water Use Overview

Queensland reports on water use and stream flow performance based on a 'water year' extending from 1 October to 30 September.

Major State-owned storages in the Queensland section of the Basin came through the 1999 Winter in the 80 - 100 per cent full range after reasonable flows in all parts of the Basin at the end of the 1998/99 Summer season. The situation was similar for ring tank storages in the upper Condamine and Border Rivers. The first three seasons of the water year were characterized by average rainfalls in the east and above average rainfall in the western part of the Queensland Murray-Darling Catchment. This was followed by an exceptionally dry winter.

Stream flows have been generally well below average. Minor flows occurred in the Condamine/Balonne through the summer months with peaks less than 19,000 ML/day. The situation was similar in the Warrego with a few minor flows of less than 2,000 ML/day. The Border Rivers performed slightly better with a single more significant flow peaking at 45,000 ML/day in November 1999. The Paroo responded well to the above average rainfalls in that Region with several flows right through the year with peaks up to 50,000 ML/day.

The limited flows have restricted water harvesting diversions during the year and this is reflected in the total water use of 541 GL from stream sources with an estimated further 72 GL harvested into storage from overland and floodplain flows.

The diversion profile over the last seven years is shown in Table 6 and Figure 7. Diversions associated with harvesting into storage from overland and floodplain flows are not included in these diversion figures.

Table 6. Water diversion for last seven years in Queensland.

Year	Diversion (GL)
1999/00	541
1998/99	608
1997/98	741
1996/97	467
1995/96	520
1994/95	176
1993/94	338

7.3 Condamine/Balonne

Condamine

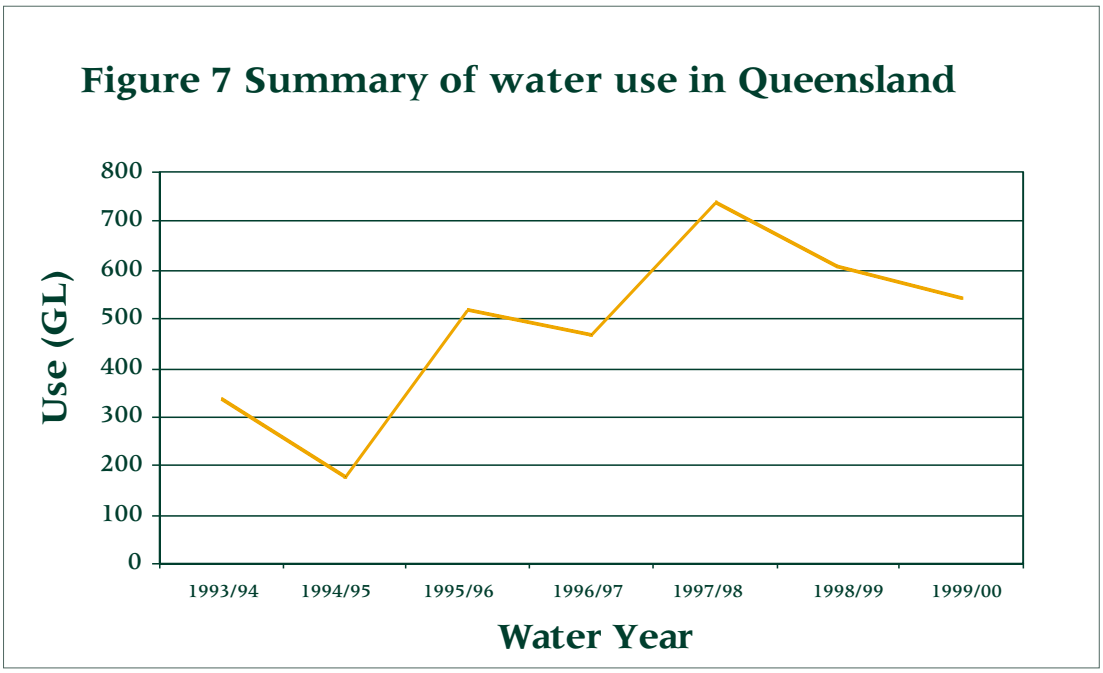
Total diversion from the Condamine River upstream of Chinchilla was 113 GL. Of this approximately 60 GL was water harvesting diversion taken during small flows in the Summer months.

Regulated diversion was 30 GL, with announced allocations of 100 per cent in both the Upper Condamine and Chinchilla Irrigation Projects and significant carryover from the 1998/99 water year. The combined entitlement for these irrigation projects is 26 GL.

Unregulated irrigation totalled 18 GL, with nearly 50 per cent of this relating to access to Toowoomba's effluent water that is discharged to watercourses for downstream use by licensed irrigators. Urban, industrial and stock use totalled 5 GL.

Only 65 GL flowed past Chinchilla during the year. Average annual flow is 604 GL.

Figure 7. Summary of water use in Queensland



Balonne

The flow situation was only marginally better at St. George, with a total volume of flow for the year of only 270 GL, where average annual flow is 1,250 GL.

Total diversion in the Balonne was 253 GL, 100 GL down on the 1998/99 year and 300 GL down on 1997/98. The reduced extraction reflects the limited water harvesting opportunity available through the year. Total water harvesting extraction was 174 GL, again taken from flows in the December to March period.

Regulated supply for the St. George irrigation scheme was limited coming into the water year with the dam at 65 per cent capacity and only 15 per cent announced allocation. This was revised upward to a maximum of 90 per cent as flows occurred in December. Total regulated use for the year was 72 GL, approximately 85 per cent of entitlement.

The balance of diversion was made up in limited use for unregulated irrigation, 4 GL, and 3 GL for urban, industrial and stock use.

7.4 Border Rivers/Macintyre Brook

Total diversion in the Border Rivers was 151 GL for the 1999/00 year.

Over 97 GL of this was taken as water harvesting diversion, most of which was diverted during a minor flood in November 1999 when over 300 GL flowed past Goondiwindi.

The two major dams in the system, Glenlyon Dam near Stanthorpe and Coolmunda Dam near Inglewood, started the year almost full and both with announced allocations of 100 per cent. Regulated usage from the dams was above average with 52 GL out of a total entitlement of 101 GL. This reflected only one major water harvesting opportunity in the regulated section and high announced allocations.

The balance of diversions were made up of 10 GL for unregulated irrigation and 4 GL for urban, industrial and stock.

Total flow through Goondiwindi for the year was 498 GL, with a further 26 GL contributed from the Weir River system in Queensland downstream. Average annual flow past Goondiwindi is 1,030 GL.

7.5 Moonie

Diversions in the Moonie system were estimated at 8 GL for the water year, similar to the diversions in 1998/99. Flows in the Moonie were very limited through the year with less than 12 GL passing through the Fenton gauge near the Queensland - NSW border. Average annual flow for the Moonie system is 160 GL.

Water harvesting diversions accounted for over 95 per cent of diversions in the system.

7.6 Warrego/Paroo

Usage on the Warrego and Paroo Rivers was estimated at 3.5 GL for the year. The bulk of this usage is in the Warrego catchment, with the Paroo catchment virtually undeveloped, i.e., 28 ML diversion. Irrigation diversions in the Warrego were distributed between regulated supply from the Cunnamulla Weir, 1.2 GL, water harvesting, 1.4 GL, and unregulated irrigation diversion, 0.7 GL. The regulated supply entitlement of 2.6 GL is not yet fully utilised in the Warrego, but recent development may see use grow to meet allocation in future years.

The Warrego had very limited flows during the year, with only 33 GL passing Cunnamulla. Long-term annual average for the Warrego is 517 GL.

The Paroo River benefited from good western rainfalls in the earlier parts of the water year, with 890 GL measured flow at Caiwarro approximately 50 km upstream of the Queensland - NSW border. Long-term annual average is 566 GL.

8. Review of 1999/00 Water Use in the ACT

8.1 Review of Water Use in the ACT

The ACT experienced wetter than average conditions during the early part of 1999/00 and a mild summer. Rainfall for the year was above long-term average (similar to that of 1998/99) resulting in lower than average urban diversion of 57.9 GL. Returns from sewage treatment plants were close to average, resulting in a lower than average net urban diversion of 21.5 GL. Urban diversions continue to be below the long-term average. Good winter rain resulted in storages remaining relatively full for the remainder of the year.

The majority of rural diversions are now licensed and metered. Metering has only been in place for part of 1999/00, resulting in consumption this year again being estimated. Non-urban consumption is estimated at 5 GL for 1999/00.

8.2 Progress of Water Reforms in the ACT

Prior to 1998, there was no direct legislative control of water resources in the ACT. Indirect control was exercised through the *Land (Planning and Environment) Act 1991* (ACT). The *Water Resources Act 1998* (ACT) establishes a framework for the sustainable management of water resources in the Territory. The Act was passed in late 1998 and is being progressively implemented. The Act requires the establishment of a Water Resources Management Plan that protects environmental flows and makes provision for the sustainable management of the remaining resource, as well as requiring that the extraction of all groundwater and surface water for other than stock and domestic use, will be licensed. The Act also places controls on the construction of dams and bores and allows for the trade of water both within the Territory and outside.

Environmental Flow Guidelines, which predominantly protect low flows and the variability of remaining flows, have been established. The first prescribed releases from storages for the provision of environmental flows occurred during December 1999. A Water Resources Management Plan has been developed and is being implemented. Progress to date includes the licensing of all known users and the issuing of volumetric allocations. The largest single licence holder and urban water supply provider, ActewAGL, is licensed to extract 63 GL from the Cotter and Googong catchments. It is expected that a small numbers of minor users, mainly urban bore owners, will continue to be discovered over the next one to two years. Licences require all extractions to be metered. It is expected that future reports of rural extraction will be based largely on metered usage.

Discussions to establish an ACT Cap are continuing. A number of options have been considered with detailed discussions centred on a Cap in the 38-61 GL range and associated capacity for future trade. It is expected that further discussions on an ACT Cap and options for trade will continue during 2000/01.

9. Water Trading in the Murray-Darling Basin

9.1 History of Water Trading

In recent years, there has been considerable growth in water trading in the Murray-Darling Basin. Water trading has been encouraged by Governments as a means of moving irrigation from those uses which produce low returns to others which can generate greater economic returns. It is also expected to have environmental benefits, since increased profits from irrigation will make it easier for managers to invest in more efficient water delivery systems which will produce better returns for the volume of water used and reduce accessions to groundwater.

Initially water trading was confined to trades within irrigation systems. However, over time, changes have been made to the trading rules, which have permitted inter-valley and more recently interstate trade to take place. In recent years, Australian Governments have been working together to reduce the differences in water entitlements in preparation for the introduction of increased interstate water trading. These changes are part of the water market reform package, which was endorsed by the Council of Australian Governments (COAG) in 1994.

Trade has an impact on the implementation of the Cap. The trade in previously unused entitlements affects the size of the allocation that can be announced by the water managers, whilst inter-valley and interstate trade affects the Cap targets for the individual river valleys. It is therefore important that data on water trading be collected and published in the Water Audit Monitoring Report.

Table 7 details the total volume of intra-valley water trades and the net inter-valley and interstate water trades that occurred during the 1999/00 water year.

The sign convention used in Table 7 is that a negative value indicates a trade out of the valley and a positive value indicates a trade into the valley. It can be seen from this that compared to the total volumes of water traded, the inter-valley trades in 1999/00 were small and the interstate trades were negligible. Permanent inter-valley trades will result in permanent changes to the valley Caps usually calculated as the volume of entitlement traded multiplied by an agreed transfer factor. Temporary trades will alter the annual Cap targets usually on a one-for-one basis. Trade will therefore affect the Caps for individual valleys, but will not result in an increase in the overall Cap for the Basin.

Interstate water trading between New South Wales, Victoria and South Australia continued to develop in 1999/00, due in large part to the activation of “sleeper and dozer” licenses. However, resource constraints in the New South Wales and Victorian sections of the Murray Valley restricted the supply of available water for trade.

Table 7. Intra-Valley, Net Inter-Valley and Net Interstate Water Entitlement Transfers in 1999/00

System	Permanent Entitlement Transfer				Temporary Entitlement Transfer			
	Total Permanent Entitlement Sold (ML)	Net Inter-valley trade Inwards (ML)	Net Inter-state trade Inwards (ML)	Adjustment to Cap from 2000/01 onwards (ML)	Total Temporary Allocation Sold (ML)	Net Inter-valley Inwards (ML)	Net Inter-state Inwards (ML)	Adjustment to 1999/00 Cap Target (ML)
New South Wales								
Border Rivers	1,671	0	0	0	13,935	-3,505	-3,505	**-3,505**
Gwydir	6,216	0	0	0	39,112	0	0	**0**
Namoi/Peel	1,942	0	0	0	22,359	0	0	**0**
Macquarie/Castlereagh/Bogan	5,140	0	0	0	40,473	0	0	**0**
Barwon-Darling	0	0	0	0	0	0	0	**0**
Lachlan	17,672	0	0	0	24,583	0	0	**0**
Murrumbidgee	6,288	0	0	0	131,098	-113,650	-1,519	**-113,650**
Lower Darling	0	0	0	0	16,444	8,986	2,108	**8,986**
Murray	9,143	-2,564	-2,564	-2,308	92,486	111,654	6,401	**111,654**
Total NSW	**48,072**	**-2,564**	**-2,564**	**-2,308**	**380,490**	**3,485**	**3,485**	**3,485**
Victoria[4]								
Goulburn	9,226	-2,239	0	-2,239	132,334	1,117	-1,773	**1,117**
Broken	45	-2	0	-2	1,067	0	0	**0**
Loddon	448	-206	0	-206	4,042	-2,979	0	**-2,979**
Campaspe	229	0	0	0	7,642	-340	0	**-340**
Wimmera-Mallee	284	0	0	0	1,799	0	0	**0**
Kiewa	152	17	0	17	471	190	0	**190**
Ovens	401	0	0	0	1,033	0	0	**0**
Murray	10,400	216	-2,214	437	73,382	-2,908	-3,146	**-2,908**
Total Victoria	**21,185**	**-2,214**	**-2,214**	**-1,993**	**221,770**	**-4,920**	**-4,919**	**-4,920**
South Australia								
Metro-Adelaide & Associated Country Areas[5]	0	0	0	0	0	0	0	**0**
Lower Murray Swamps	1,109	-593	0	-593	584	-584	0	**-584**
Country Towns	0	0	0	0	0	0	0	**0**
All Other Uses of Water from the River Murray	11,309	5,371	4,778	4,893	51,867	-1,112	-1,696	**-1,112**
Total South Australia	**12,418**	**4,778**	**4,778**	**4,300**	**52,451**	**-1,696**	**-1,696**	**-1,696**
Queensland								
Condamine/Balonne	21	0	0	0	8,733	0	0	**0**
Border Rivers	0	0	0	0	12,345	5,820	3,505	**5,820**
Macintyre Brook	0	0	0	0	4,159	-2,315	0	**-2,315**
Moonie	0	0	0	0	0	0	0	**0**
Warrego	0	0	0	0	0	0	0	**0**
Paroo	0	0	0	0	0	0	0	**0**
Total Queensland	**21**	**0**	**0**	**0**	**25,237**	**3,505**	**3,505**	**3,505**
Australian Capital Territory	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Basin	**81,696**	**0**	**0**	**0**	**679,948**	**374**	**375**	**374**

1. The total Cap adjustment for permanent trade (including exchange rate adjustments to permanent interstate trade) is comprised of the sum of net inter-valley and net interstate trade for each designated river valley, as per the Diversion Cap Register (Appendix A).
2. The total Cap adjustment for temporary trade is comprised of the sum of net inter-valley and interstate trade for each designated river valley, as per the Diversion Cap Register (Appendix A).
3. The sign convention used is that a negative value indicates a trade out of the valley and a positive value indicates a trade into the valley.
4. Temporary entitlement transfers in Victoria, includes temporary trade in both water right and sales entitlement.
5. The Metro-Adelaide & Associated Country Areas Cap component is non-tradeable, unless the Ministerial Council determines otherwise.
6. Figures for NSW are approximate.

10. Water Availability for the Year 1999/00

10.1 Water Availability

The 1995 report to the Ministerial Council "An Audit of Water Use in the Murray-Darling Basin", found that water users had only diverted 63 per cent of the water that they had been authorised to use in the previous five years (the amount allocated was not restricted to the quantity available and in some years exceeded it.). This highlights the fact that the States' allocation systems have evolved to encourage development of the Basin's water resources and are not well suited to being used to impose a Cap on diversions.

A key step in the process to implement the Cap will be the adjustments that are made to the States' allocation systems. In the process, it is expected that many existing water users who are disadvantaged by the implementation of the Cap, will look at other systems and highlight any inconsistencies. To aid such comparisons and to make Cap implementation more transparent, the water used in each valley has been compared with the quantity of water that has been authorised for use in that valley in 1999/00 (see Table 11).

Water is allocated in many different ways across the Basin and there are differences between States, Valleys and Regions depending upon the reliability of supply and the degree of regulation. These types of allocations are summarised below.

10.1.1 Volumetric Allocations

Water users in regulated streams and in some unregulated systems are issued with volumetric entitlements (see Table 8). These entitlements specify a base volume of water that can be diverted each year and come in three main categories:

- High security entitlements, which are available every year;
- Volumetric entitlements on unregulated streams, which are available provided there is flow in the stream; and
- Normal security entitlements, which are subject to allocation announcements, made at intervals throughout the season. These entitlements, which include Victorian Water Right and Sales, are the largest category of volumetric entitlement in the Basin. For these entitlements, the volume allocated is the base entitlement multiplied by the announced percentage allocation at the end of the season.

10.1.2 Announced Overdraw

In some valleys, an announcement is sometimes made during the season permitting irrigators to draw on next year's allocation. This increases the quantity of water that can be diverted in the season but will, if not cancelled by a spill from storage, reduce the volume available for the next season. The base entitlement multiplied by the announced overdraw is reported in the third column of Table 8.

10.1.3 Allocation Transferred into Valley

A temporary inter-valley transfer will increase the allocation in the purchasing valley and reduce the allocation in the selling valley. The net transfer into each valley has been copied from Table 7 to the fourth column in Table 8.

10.1.4 Carryover and Overdraw from the Previous Year

In some valleys, irrigators have been given the right to carry over unused allocation from the previous season. This system allows individual irrigators to adjust their level of water use to change their risk profile (e.g. by use of carryover, the irrigator has a greater security of supply in the following year). Ultimately such a system will allow individual irrigators to select their own security of supply and thus allows for a greater diversity of crop types. A carryover from last season, which has not been cancelled as a result of a spill from storage, will add to this season's allocation. Table 9 shows the balance between

the carryover from last season and the overdraw utilised (as opposed to announced). The net carryover minus overdraw from 1998/99, adjusted where necessary for any cancellation, is included as column 5 in Table 8.

10.1.5 Access to Off-allocation and Water Harvesting

Water is made available to irrigators in regulated streams during periods when storages are spilling or there are unregulated flows, by declarations of period's off-allocation. Water diverted in these periods does not count against an irrigator's allocation for the rest of the season. Historically, there were no controls over the size of these diversions other than the duration of the event and the licensed pump capacity. However, in recent years quotas have been established in some systems and annual limits have been imposed.

Water harvesting licences have been issued in some Queensland streams. Irrigators with these licences are limited by their diversion capacity and by the flow at which they can commence to pump, but not by the volume of water they can divert or by the area they can plant.

In some river valleys, a considerable percentage of the water diverted is authorised by the off-allocation or water harvesting rules. In theory, it would be possible to determine the maximum volume of water that would be possible to divert each year under these rules by assuming that irrigators divert at their diversion capacity for as long as the flow conditions apply. However, in practice, this does not generally occur as diversion capacity is limited by off-stream storage development and related irrigated areas.

Queensland has adopted this method of reporting (see Table 10). In contrast, New South Wales currently reports the use from off-allocation and water harvesting which underestimates the volume of water authorised for diversion (see Table 10).

10.1.6 Area Licences on Unregulated Streams

Some entitlements on unregulated streams specify an area that can be irrigated, but not the volume of water which can be diverted. However, it is possible to estimate the volume of water made available to these licences by multiplying the licensed area by an assumed usage based on crop type.

Queensland has adopted this method of reporting unregulated diversions (see Table 10).

New South Wales is currently moving towards replacing area licences with volumetric entitlements.

10.1.7 Irrigation System Losses

In some irrigation distribution systems, water entitlements specify the rights to water delivered at the farm gate. The losses incurred by the water authority in delivering water from the diversion point on the river to the farm gate are therefore not covered by the announced allocation, and need to be added to the allocation to determine the authorised diversion. These losses are included in the fourth column of Table 10. For other irrigation distribution systems such as the privatised districts in the New South Wales Murray, an allowance for system losses has been included in the water entitlement.

10.2 Comparison of Diversions with Water Authorised for Use

The final column in Table 10 lists the total volume of water that could be diverted in 1999/00 if all authorities to use water in 1999/00 were fully utilised (with the qualifications for off-allocation, water harvesting and area licences made in Sections 10.1.5 and 10.1.6). In Table 11, these volumes are compared with the water used in each valley and the percentage use of the water made available by the water authorities for diversion is presented.

In calculating the water used in the New South Wales and Victorian river valleys, the volumes diverted from each stream have to be adjusted for the water diverted from other valleys (second column of Table 11). For example, in the Victorian river valleys, water is physically transferred from the Goulburn Valley into the Campaspe and Loddon Valleys via the Waranga Western Channel.

It is expected that diversion as a percentage of the water authorised to be diverted will fluctuate from year to year, depending upon the climatic conditions and the degree to which the diversions are constrained by the physical resources available. Typically the utilisation of the allocations will be higher in the drier years and lower in the wetter years, especially in the south of the Basin. It is also expected that allocations would reduce and utilisation increase if the allocation system was tightened to prevent growth in diversions under the Cap. In this context, the 69 per cent utilisation of Basin allocations in 1999/00 is higher than the average of 63 per cent reported for the 5 years to 1993/94 in the 1995 report to the Ministerial Council "An Audit of Water Use in the Murray-Darling Basin".

Table 8. Water Allocated in 1999/00

System	Base Valley Water Entitlement[1] (GL)	Announced Allocation[2] (GL)	Announced Overdraw[3] (GL)	Allocation Transferred into Valley[4] (GL)	Net Carryover / Overdraw from 1998/99[5] (GL)	Total Allocated Water in Valley[6] (GL)
New South Wales						
Border Rivers	270	172	0	-2	85	256
Gwydir	529	529	0	0	0	529
Namoi/Peel	312	312	0	0	0	312
Macquarie/Castlereagh/Bogan	670	670	0	0	0	670
Barwon-Darling[7]	518	518	0	0	0	518
Lachlan	665	504	0	0	158	661
Murrumbidgee	2,791	2,246	0	-114	0	2,133
Lower Darling	49	49	0	9	10	68
Murray	2,230	934	100	112	359	1,505
Total NSW	**8,034**	**5,934**	**100**	**3**	**611**	**6,649**
Victoria						
Goulburn	731	731	0	1	0	732
Broken	37	55	0	0	0	55
Loddon	282	282	0	-3	0	279
Campaspe	286	286	0	0	0	286
Wimmera-Mallee	100	100	0	0	0	100
Kiewa	16	16	0	0	0	16
Ovens	57	57	0	0	0	57
Murray	1,202	1,927	0	-3	0	1,925
Total Victoria	**2,711**	**3,454**	**0**	**-5**	**0**	**3,449**
South Australia						
Metro-Adelaide & Associated Country Areas[8]	130	214	0	0	0	214
Lower Murray Swamps	79	79	0	-1	0	78
Country Towns	50	50	0	0	0	50
All Other Uses of Water from the River Murray	507	507	0	-1	0	506
Total South Australia	**766**	**850**	**0**	**-2**	**0**	**848**
Queensland						
Condamine/Balonne	127	120	0	0	7	127
Border Rivers	87	87	0	6	5	98
Macintyre Brook	19	19	0	-2	0	16
Moonie	0	0	0	0	0	0
Warrego	3	3	0	0	0	3
Paroo	0	0	0	0	0	0
Total Queensland	**236**	**229**	**0**	**4**	**11**	**244**
Aust. Capital Territory[10]	**27**	**27**	**0**	**0**	**0**	**27**
Total Basin	**11,773**	**10,494**	**100**	**2**	**623**	**11,217**

1. Sum of the volumetric entitlements in valley (in NSW this is the sum of general and high security entitlements). Includes unregulated stream entitlements where these are expressed volumetrically (e.g. in Victoria).
2. Sum of base entitlements multiplied, where appropriate, by the largest announced percentage allocation in the season. In NSW this includes high security entitlements.
3. Base entitlement multiplied by the announced percentage overdraw.
4. Net temporary inter-valley entitlement transfer from Table 7.
5. Net Carryover less Overdraw from Previous Year (see Table 9).
6. Allocated water = announced allocation + announced overdraw + inter-valley trade + net carryover from last season (in NSW the addition of high security entitlements are also included).
7. Water is allocated in the Barwon-Darling system on an event basis.
8. Indicative average annual allocation from 5-year rolling total of 650 GL.
9. Volume that could be diverted before the 5-year Cap would be exceeded in 1999/00.
10. There is no formal entitlement in ACT to date. Net diversion shown.

Table 9. Carryovers and Overdraws for 1999/00

System	Overdraw from 1998/99 (GL)	Carryover from 1998/99 (GL)	Overdraw Cancelled in 1999/00 (GL)	Carryover Cancelled in 1999/00[1] (GL)	Net Carryover from 1998/99[2] (GL)	Overdraw from 2000/01 (GL)	Carryover to 2000/01 (GL)
New South Wales							
Border Rivers	0	91	0	6	85	0	134
Gwydir	0	0	0	0	0	0	0
Namoi/Peel	0	0	0	0	0	0	0
Macquarie/Castlereagh/Bogan	0	391	0	391	0	0	601
Barwon-Darling	0	0	0	0	0	0	0
Lachlan	0	253	0	95	158	0	249
Murrumbidgee	0	0	0	0	0	0	183
Lower Darling	0	10	0	0	10	0	0
Murray	0	359	0	0	359	1,000	268
Total NSW	**0**	**1,104**	**0**	**493**	**611**	**100**	**1,435**
Victoria							
Goulburn	0	0	0	0	0	0	0
Broken	0	0	0	0	0	0	0
Loddon	0	0	0	0	0	0	0
Campaspe	0	0	0	0	0	0	0
Wimmera-Mallee	0	0	0	0	0	0	0
Kiewa	0	0	0	0	0	0	0
Ovens	0	0	0	0	0	0	0
Murray	0	0	0	0	0	0	0
Total Victoria	**0**	**0**	**0**	**0**	**0**	**0**	**0**
South Australia							
Metro-Adelaide & Associated Country Areas	0	0	0	0	0	0	0
Lower Murray Swamps	0	0	0	0	0	0	0
Country Towns	0	0	0	0	0	0	0
All Other Uses of Water from the River Murray	0	0	0	0	0	0	0
Total South Australia	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Queensland							
Condamine/Balonne	0	8	0	2	7	0	19
Border Rivers	0	57	0	52	5	0	52
Macintyre Brook	0	0	0	0	0	0	0
Moonie	0	0	0	0	0	0	0
Warrego	0	0	0	0	0	0	0
Paroo	0	0	0	0	0	0	0
Total Queensland	**0**	**66**	**0**	**54**	**11**	**0**	**71**
Australian Capital Territory	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Basin	**0**	**1,170**	**0**	**547**	**623**	**100**	**1,506**

1. Under certain conditions (such as storage spills), carryovers and overdraws from the previous season can be cancelled.
2. Net carryover is defined as: [(carryover less cancelled carryover) - (overdraw less cancelled overdraw)].

Table 10. Water Authorised for Use in 1999/00

System	Total Allocated Water in Valley[1] (GL)	Access to Off-Allocation, Water-harvesting[2] (GL)	Unregulated Stream Use not in Allocation[3] (GL)	System Losses not in Allocation[4] (GL)	Authorised Use in Valley[5] (GL)
New South Wales					
Border Rivers	254	61	16	0	331
Gwydir	529	87	11	0	627
Namoi/Peel	312	148	42	0	502
Macquarie/Castlereagh/Bogan	670	99	31	0	800
Barwon-Darling	518	0	0	0	518
Lachlan	661	9	11	0	681
Murrumbidgee	2,133	621	198	0	2,951
Lower Darling	68	0	24	0	92
Murray	1,505	43	6	0	1,554
Total NSW	**6,649**	**1,067**	**338**	**0**	**8,055**
Victoria					
Goulburn	732	6	0	333	1,072
Broken	55	0	0	0	55
Loddon	279	5	0	104	388
Campaspe	286	0	0	32	318
Wimmera-Mallee	100	0	0	54	152
Kiewa	16	0	0	0	16
Ovens	57	0	0	0	57
Murray	1,925	0	0	393	2,318
Total Victoria	**3,449**	**11**	**0**	**916**	**4,375**
South Australia					
Metro-Adelaide & Associated Country Areas[6]	214	0	0	0	214
Lower Murray Swamps	78	0	0	0	78
Country Towns	50	0	0	0	50
All Other Uses of Water from the River Murray[7]	506	0	0	0	506
Total South Australia	**848**	**0**	**0**	**0**	**848**
Queensland					
Condamine/Balonne[8]	127	234	23	0	383
Border Rivers[8]	98	97	10	0	205
Macintyre Brook	16	0	1	0	17
Moonie	0	8	0	0	8
Warrego	3	1	1	0	5
Paroo	0	0	0	0	0
Total Queensland	**244**	**340**	**34**	**0**	**618**
Aust. Capital Territory	**27**	**0**	**0**	**0**	**27**
Total Basin	**11,217**	**1,418**	**372**	**914**	**13,922**

1. Allocated water from Table 8 (Figures for NSW are approximate).
2. The difference between the off-allocation water declared available for use and the off-allocation water used has not been included in this calculation (excludes Queensland). The volume of off-allocation water used and water harvested has been reported for NSW.
3. Unregulated stream entitlement in Victoria is included in the base entitlement.
4. 'System Losses not in Allocation' are losses in those irrigation systems where the entitlement is defined at the farm gate and losses in the distribution system are not covered by an entitlement.
5. Water is allocated in the Barwon-Darling system on an event basis.
6. The water allocated for Metro-Adelaide & Associated Country Areas in 1999/00 is based upon the usage in the previous four years against the five-year rolling total of 650 GL.
7. Water authorised for use is not equal to the Cap component for 'All Other Uses of Water from the River Murray', as this is defined as 90 per cent of the total licensed allocations.
8. Authorised diversions allowed to operate above account flow thresholds without restriction of storages.

Table 11. Use of Valley Allocations in 1999/00

System	Diversion from valley (GL)	Diverted from other valleys (GL)	Total use in valley (GL)	Authorised use in valley (GL)	Use as a percentage of authorised valley use (%)
New South Wales					
Border Rivers[1]	197	0	197	331	60%
Gwydir	444	0	444	627	71%
Namoi/Peel	299	0	299	502	60%
Macquarie/Castlereagh/Bogan	417	0	417	800	52%
Barwon-Darling[1]	175	0	175	518	34%
Lachlan	296	0	296	681	43%
Murrumbidgee	1,910	0	1,798	2,951	65%
Lower Darling[1]	85	0	92	92	92%
Murray	1,212	0	1,317	1,554	78%
Total NSW	**5,035**	**0**	**5,035**	**8,055**	**63%**
Victoria					
Goulburn	1,452	-454	998	1,072	93%
Broken	25	0	25	55	45%
Loddon	77	225	302	388	78%
Campaspe	73	195	269	318	85%
Wimmera-Mallee	116	8	124	152	82%
Kiewa	9	0	9	16	57%
Ovens	24	0	24	57	43%
Murray	1,540	25	1,566	2,318	68%
Total Victoria	**3,317**	**0**	**3,317**	**4,375**	**76%**
South Australia					
Metro-Adelaide & Associated Country Areas[2]	142	0	142	214	66%
Lower Murray Swamps	79	0	79	78	101%
Country Towns	37	0	37	50	74%
All Other Uses of Water from the River Murray[3]	364	0	364	506	72%
Total South Australia	**622**	**0**	**622**	**848**	**73%**
Queensland					
Condamine/Balonne	366	0	366	383	96%
Border Rivers	151	0	151	205	74%
Macintyre Brook	11	0	11	17	67%
Moonie	8	0	8	8	100%
Warrego	3	0	3	5	70%
Paroo	0	0	0	0	100%
Total Queensland	**541**	**0**	**541**	**618**	**87%**
Aust. Capital Territory	**27**	**0**	**27**	**27**	**100%**
Total Basin	**9,542**	**0**	**9,542**	**13,912**	**69%**

1. The authorised use in valley does not satisfactorily describe the volume of water that could be utilised for water harvesting, off-allocation and area licences on unregulated streams.
2. The volume authorised for use for Metro-Adelaide & Associated Country Areas for 1999/00 is the amount that could be used before the 5-year Cap of 650 GL would be exceeded.
3. Water authorised for use is not equal to the Cap component, as this is defined as 90 per cent of the total licensed allocations.
4. Figure of authorised use in NSW are approximate.

11. Comparison of Actual Flows with Natural Flows

A key factor in the Ministerial Council's decision to implement the Cap, was the major changes that had occurred to the flow regime in many of the Basin's rivers. This either presents itself as a change in the seasonality of flow (as occurs below major dams), or a reduction in the total flow volume (as occurs at the bottom end of many of the river valleys). As part of the Cap monitoring process, the States have agreed to report on the way the natural flows in each river have been altered.

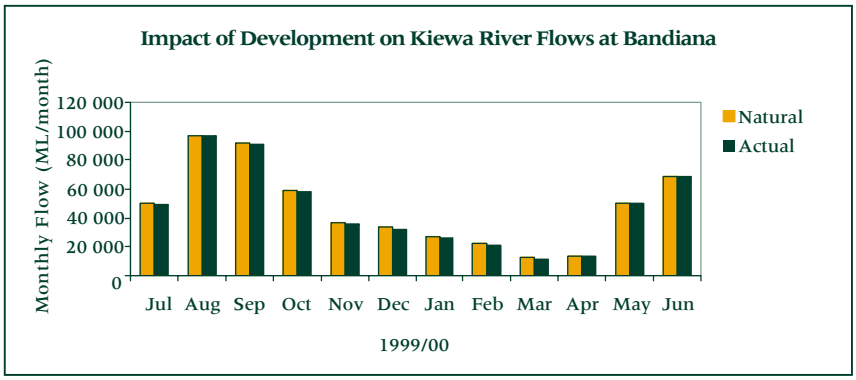
The natural flows are estimated from computer modelling studies. Many of the river models are incomplete or not yet modified to allow these numbers to be readily calculated for 1999/00. Table 12 presents the 1999/00 annual flow volumes recorded and the natural flows at a number of selected key sites within the Murray-Darling Basin, whilst the impact of development can be seen graphically in Figure 8 and Figure 9.

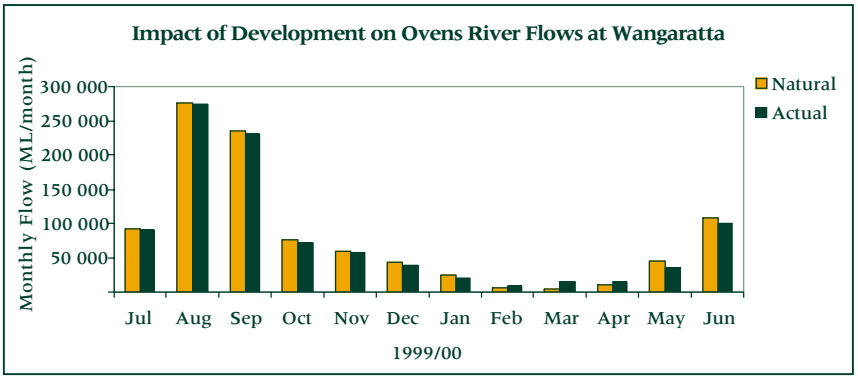
Table 12. Comparison of 1999/00 Actual and Natural Annual Flows for Key Sites within the Murray-Darling Basin.

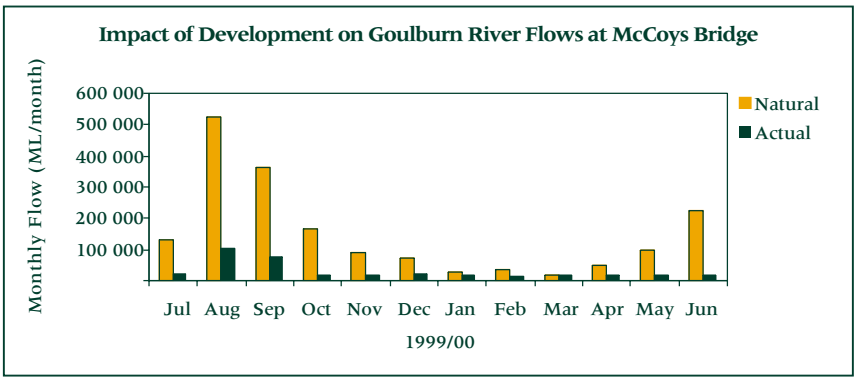
System	Actual Flow (GL)	Natural Flow (GL)	Actual/Natural (%)
Inter-Basin Transfers			
Snowy Mountain Scheme to Murrumbidgee River	486	-	-
Snowy Mountain Scheme to Murray River	695	-	-
Glenelg River Catchment to Wimmera-Mallee	n/a	-	-
Wannon River Catchment to Wimmera-Mallee	n/a	-	-
New South Wales Tributaries[2]			
Barwon River at Mungindi + Boomi River	236	342	69%
Inflows to Gwydir Wetland	157	246	64%
Gwydir System Outflows to Barwon River	200	191	104%
Namoi System Outflows to Barwon River	191	n/a	n/a
Inflows to Macquarie Marshes	705	n/a	n/a
Macquarie/Castlereagh/Bogan Outflows	509	n/a	n/a
Darling River Inflows to Menindee Lakes	2,566	n/a	n/a
Lachlan River at Corrong	84	n/a	n/a
Lachlan River at Booligal	95	n/a	n/a
Murrumbidgee River at Balranald	432	1,850	23%
Lower Darling River at Burtundy	1,000	n/a	n/a
Victorian Tributaries			
Kiewa River at Bandiana	554	563	98%
Ovens River at Wangaratta	954	980	97%
Goulburn River at McCoys Bridge	368	1,792	21%
Campaspe River at Rochester	13	107	12%
Loddon River at Appin South	21	121	17%
Wimmera River at Horsham	n/a	n/a	n/a
Queensland Tributaries			
Condamine/Balonne/Culgoa Flows at NSW Border	55	n/a	n/a
Macintyre River at Goondiwindi	498	n/a	n/a
Moonie River at Fenton	12	n/a	n/a
Warrego River at Cunnamulla	33	n/a	n/a
Paroo River at Caiwarro	890	n/a	n/a
River Murray			
Albury (Doctors Point)	3,210	3,589	89%
Downstream of Yarrawonga Weir	2,898	4,440	65%
Euston	2,731	6,509	42%
South Australian Border	2,669	8,266	32%
Barrages	938	7,334	13%

1. n/a indicates data not available.
2. Operational data, which may be subject to change.

Figure 8. Plots of Flows at Selected Sites Showing 1999/00 Actual and Natural (Modelled) Flows in Victoria







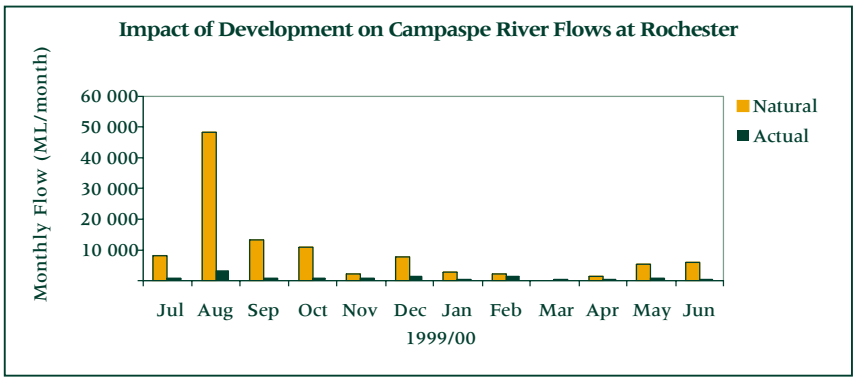
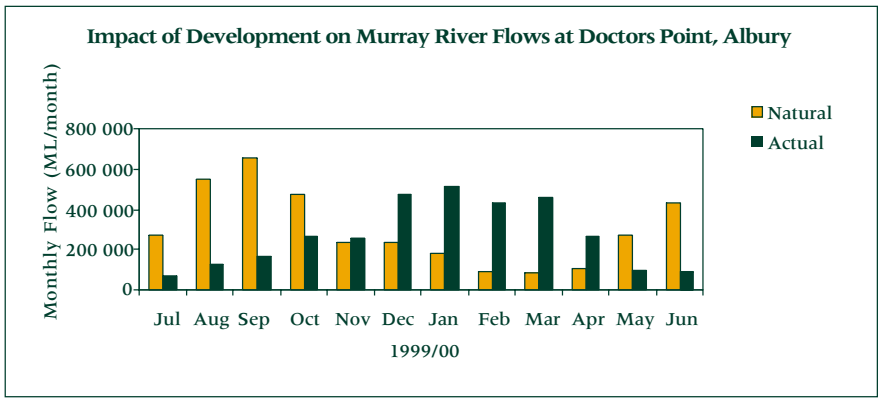
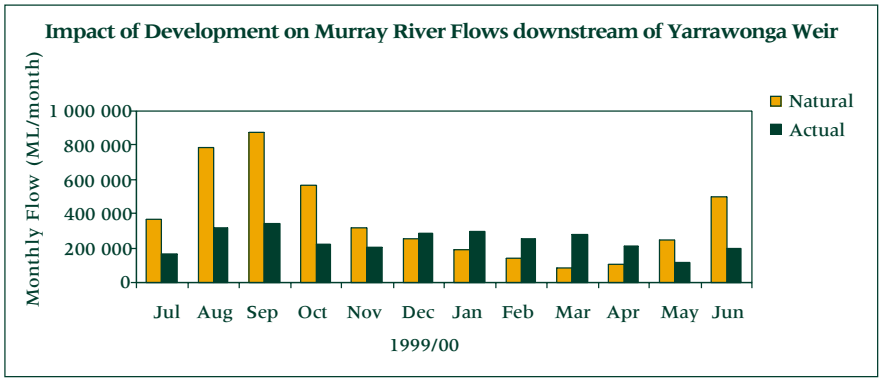
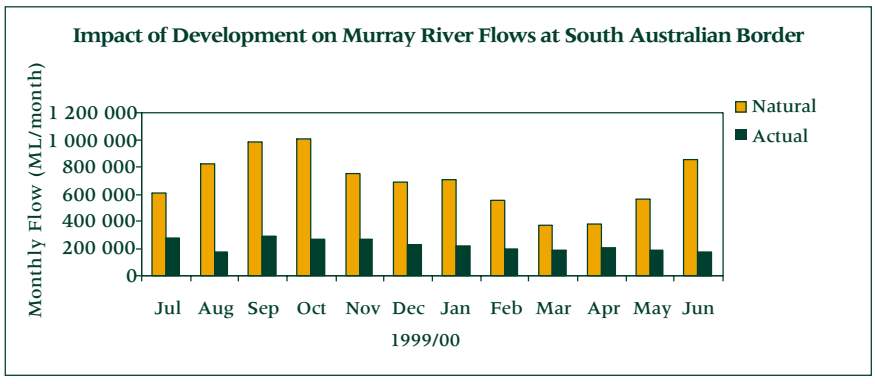
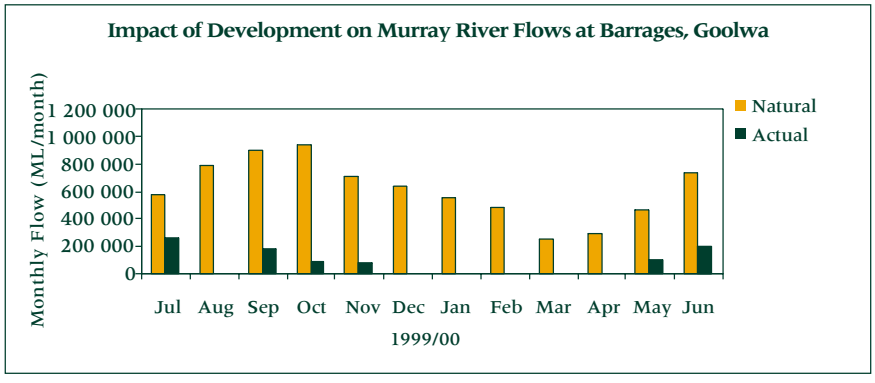


Figure 9. Plots of Flows at Selected Sites Showing 1999/00 Actual and Natural (Modelled) Flows of the Murray River









12. Impoundments and Losses in Major On-Stream Storages

The diversion and impoundment of water into major on-stream storage infrastructure provides security and reliability of supply to water users, particularly during periods of adverse climatic conditions.

Typically in periods of high rainfall and high riverine flow conditions, moderate to average volumes of water are diverted for irrigation use, whilst relatively moderate to large volumes are diverted for impoundment into on-stream storages. In contrast, during periods of low rainfall and low riverine flow conditions, generally large volumes of water are required to satisfy irrigation demand. It is during these periods of low rainfall that the volumes impounded in on-stream storages are used to supplement riverine flows.

The impoundments and losses in major on-stream storages (above 10 GL capacity) within the Basin are reported in Table 13. The volumes reported indicate that the total volume in storage in the Basin in 1999/00 has increased from 12,762 GL to 14,137 GL (56 per cent full). Total evaporative losses for major storages within the Basin were calculated by the respective States and are reported at 1,322 GL, representing 5.2 per cent of total storage capacity and 14 per cent of total diversion from the Basin. The total reduction in flow of 2,697 GL due to impoundment and evaporative losses was 28 per cent of total basin diversion.

Table 13. Impoundments and Losses in Major On-Stream Storages (greater than 10 GL capacity) in 1999/00

	Major On-Stream Storage	Completion Date	Storage Capacity (GL)	Volume of Storage at Beginning of Water Year (GL)	Volume of Storage at End of Water Year (GL)	Percentage of Storage Full at End of Year (%)	Increase in Volume of Storage (GL)	Evaporation Losses (GL)	Net Reduction in Flow due to Storage (GL)
Murray-Darling Basin Commission									
Lower Darling	Menindee Lakes1	1960	1,999	1,922	1,971	99%	49	422	471
Murray	Dartmouth Reservoir	1979	3,906	1,771	2,190	56%	419	-13	406
	Hume Reservoir	1936-61	3,038	709	1,289	42%	579	42	621
	Lake Victoria	1928	680	136	500	73%	364	104	468
Total Murray-Darling Basin Commission			**9,623**	**4,538**	**5,950**	**62%**	**1,412**	**554**	**1,966**
Snowy Mountains Scheme in Murray-Darling Basin									
Murrumbidgee River Valley	Jounama Pondage	1968	44	24	27	62%	3	0	3
	Talbingo Reservoir	1971	921	913	913	99%	0	12	12
	Tantangara Reservoir	1960	254	22	29	11%	7	1	8
	Tumut Pondage	1958	53	33	28	53%	-5	0	-5
Murray River Valley	Geehi Reservoir	1966	21	15	12	57%	-3	0	-3
	Tooma Reservoir	1961	28	4	5	18%	1	0	1
	Khancoban Pondage	1965	22	10	16	74%	6	0	6
Total Snowy Mountains Scheme			**1,342**	**1,021**	**1,030**	**77%**	**9**	**13**	**22**
Border Rivers Commission									
Border Rivers	Glenlyon Dam	1,976	254	214	150	59%	-64	20	-44
Total Border Rivers Commission			**254**	**214**	**150**	**59%**	**-64**	**20**	**-44**
New South Wales									
Border Rivers	Pindari Reservoir	1962-96	312	297	255	82%	-41	16	-25
Gwydir	Copeton Reservoir	1976	1,364	1,068	876	64%	-192	66	-127
Namoi/Peel	Chaffey Reservoir	1979	62	62	62	100%	0	10	10
	Keepit Reservoir	1960	423	262	222	53%	-39	54	15
	Split Rock Reservoir	1987	397	382	355	89%	-27	39	12
Macquarie/Castlereagh/Bogan	Burrendong Reservoir	1967	1,678	1,030	1,207	72%	177	109	286
	Windamere Reservoir	1984	368	211	266	72%	56	20	75
Lachlan	Carcoar Reservoir	1970	36	32	36	99%	4	6	9
	Lake Brewster	1952	153	47	91	59%	44	77	121
	Lake Cargelligo	1902	36	26	36	99%	10	20	30
	Wyangala Reservoir	1936-71	1,220	1,014	1,093	90%	79	74	153
Murrumbidgee	Blowering Reservoir	1968	1,631	573	679	42%	107	26	133
	Burrinjuck Dam	1907-56	1,028	255	397	39%	142	27	169
	Tombullen Off-River Storage	1980	11	2	0	4%	-1	3	2
	Hay Weir	1981	14	13	13	94%	0	5	5
Total NSW			**8,733**	**5,272**	**5,588**	**64%**	**316**	**550**	**867**
Victoria									
Goulburn/Broken/Loddon	Eildon Reservoir	1956	3,390	761	612	18%	-149	-1	-150
	Lake Mokoan	1971	365	132	151	41%	19	48	68
	Lake Nillahcootie	1967	40	17	20	50%	3	0	3
	Cairn Curran Reservoir	1956	148	34	36	24%	2	4	7
	Tullaroop Reservoir	1959	74	18	19	26%	1	2	2
Campaspe	Lake Eppalock	1964	312	89	81	26%	-8	6	-2
	Lauriston Reservoir	1941	20	16	16	80%	0	0	0
	Malmsbury Reservoir	1870	18	11	12	67%	1	1	1
	Upper Coliban Reservoir	1903	37	1	8	22%	7	1	8
Wimmera-Mallee	Lake Bellfield	1966	79	51	25	32%	-26	4	-22
	Lake Fyans	1916	21	12	8	38%	-4	4	0
	Lake Lonsdale	1903	66	0	0	0%	0	0	0
	Lake Taylor	1923	36	23	12	34%	-11	1	-10

Table 13 continued

	Major On-Stream Storage	Completion Date	Storage Capacity (GL)	Volume of Storage at Beginning of Water Year (GL)	Volume of Storage at End of Water Year (GL)	Percentage of Storage Full at End of Year (%)	Increase in Volume of Storage (GL)	Evaporation Losses (GL)	Net Reduction in Flow due to Storage (GL)
	Pine Lake	1928	64	23	9	14%	-14	4	-10
	Tooloondo Reservoir	1953	107	68	37	35%	-31	11	-20
	Wartook Reservoir	1887	29	5	5	17%	0	5	5
Murray/Kiewa/Ovens	Rocky Valley Reservoir	1959	28	15	5	17%	-10	0	-10
	Lake Buffalo	1965	24	14	15	63%	1	0	1
	Lake William Hovell	1973	14	14	14	102%	0	0	0
	Total Victoria		**4,871**	**1,303**	**1,085**	**22%**	**-218**	**90**	**-128**
Queensland									
Condamine/Balonne	Beardmore Dam	1972	82	54	27	33%	-27	36	8
	Chinchilla Weir	1974	10	10	5	53%	-4	4	0
	Cooby Dam	1942	21	19	17	79%	-3	3	1
	Jack Taylor Weir	1953-59	10	10	6	56%	-4	4	0
	Leslie Dam	1985	106	67	54	51%	-12	11	-1
Macintyre Brook	Coolmunda Dam	1968	75	70	41	54%	-29	21	-9
Total Queensland			**304**	**230**	**150**	**49%**	**-80**	**79**	**-1**
Australian Capital Territory									
Murrumbidgee	Bendora Reservoir	1961	11	9	8	75%	-1	1	0
	Corin Reservoir	1968	76	51	52	69%	1	2	3
	Googong Reservoir	1979	125	124	124	100%	-1	13	12
Total ACT			**211**	**184**	**184**	**87%**	**0**	**16**	**16**
Total Basin			**25,338**	**12,762**	**14,137**	**56%**	**1,375**	**1,322**	**2,697**

1. Volume in storage may exceed storage capacity when Lakes are surcharged. Surcharge capacity is 1,999 GL.

13. Groundwater Use in the Basin

Context

Based on the findings from the Review of the Operation of Cap, the Council, in August 2000, agreed to the following the recommendations of the Commission related to Groundwater:

- *Groundwater be managed on an integrated basis with surface water within the spirit of Cap (Recommendation 20); and*
- *A Murray-Darling Basin Groundwater Management Strategy be developed by the Groundwater Technical Reference Group (GTRG) that is based on jurisdictional management of groundwater through sustainable yields and include investigations clarifying how groundwater management practices may impact upon the integrity of Cap in future (Recommendation 21).*

The GTRG is currently running many projects aimed at implementing the above recommendations. This section on groundwater is aimed at establishing an integrated reporting framework for surface and groundwater in line with Recommendation 20.

Groundwater Data for 1999/00

The GTRG, as a part of one of its projects, compiled the estimated data of sustainable yield (SY) allocation and usage of groundwater in 1999/00 for each Groundwater Mangement Unit (GMU) in the Basin. This data, which is shown in Table 15, was further supplemented and analysed using Geographical Information System (GIS) techniques to assign the groundwater data to the designated Cap valleys. Some errors are inevitable in such an analysis because of the absence of precise information to apportion the aquifers to Cap valleys. However, the analysis presented in Table 14 is valuable in itself, as it gives a snapshot of the basin-wide status of groundwater.

The estimated sustainable yields in Groundwater Mangement Units (GMU) of the basin are reported to be 2,326 GL. Out of this, 2,806 GL was already allocated in 1999/00, which constituted 121 per cent of SY. The total usage of groundwater in NSW, SA, Queensland and ACT was 1,052 GL, which was of 40 per cent of allocation and 62 per cent of SY in these states. The groundwater usage was 17 per cent of surface water diversion in these states. This reinforces the fact that groundwater is an important resource in which there is a considrable scope for future development within the current allocation. A recent report by Sinclair Knight Merz (SKM) has estimated that there is strong linkage between groundwater use and surface water flows, with an average reduction in surface water flow of 600 ML for every 1,000 ML of groundwater use. This highlights the management of groundwater to the Cap on diversions.

The original submission of the GTRG is given in the following section.

Table 14. Basin-wide groundwater data for 1999/00 aligned along the designated Cap valleys.

Designated River Valley System	Estimated Sustainable Yield (GL/yr)	1999/2000 Allocation (GL)	1999/2000 Use (GL)	Surface Water Use (GL)*
New South Wales				
Border Rivers	32	34	19	197
Moonie	38	48	48	n/a
Gwydir	71	176	89	444
Namoi/Peel	219	503	197	299
Macquarie/Castlereagh/Bogan	143	279	103	417
Barwon-Darling	5	9	9	175
Lachlan	377	529	131	296
Murrumbidgee	331	393	194	1,910
Lower-Darling	n/a	n/a	n/a	85
Murray	158	351	108	1,212
Total NSW	**1,373**	**2,322**	**898**	**5,035**
Victoria				
Goulburn/Broken/Loddon	274	100	16	1,554
Campaspe	17	27	12	73
Wimmera-Mallee	n/a	n/a	n/a	116
Kiewa/Ovens/Murray	335	80	23	1,573
Total Victoria	**n/a**	**n/a**	**n/a**	**3,317**
South Australia				
Metro-Adelaide & Associated Country Areas	n/a	n/a	n/a	142
Lower Murray Swamps	n/a	n/a	n/a	79
Country Towns	n/a	n/a	n/a	37
All Other Uses of Water from the River Murray	99	90	36	364
Total South Australia	**99**	**90**	**36**	**622**
Queensland				
Condamine/Balonne	133	157	102	366
Border Rivers	19	20	8	151
Macintyre Brook	n/a	n/a	n/a	11
Moonie	1	1	1	8
Warrego	5	6	6	3
Paroo	n/a	n/a	n/a	0
Total Queensland	**158**	**183**	**117**	**541**
Australian Capital Territory	**70**	**4**	**2**	**27**
Total Basin	**2,326**	**2,806**	**1,103**	**9,542**

1. *Refer Table 2
2. n/a not available

14. Review of groundwater data by Groundwater Technical Reference Group

Overview

Groundwater allocation and use for 1999/00 can be compared with sustainable yield estimates for groundwater management units (GMUs) in the Murray-Darling Basin (Table 15). The GMUs presented form part of the National Land and Water Resources Audit (NLWRA) Theme 1 - Water Availability reporting. Extraction of specifically Murray-Darling Basin GMUs has posed some problems as existing boundaries overlap catchment boundaries. The GMUs tabled are those that lie either totally or predominantly within the basin.

This information was compiled adopting a definition for sustainable yield as

> ***"the level of extraction measured over a specified planning time frame, that should not be exceeded to protect the higher value social, environmental and economic uses associated with the aquifer".***

The majority of sustainable yield values are preliminary estimates of low reliability, typically based on simple water balance approaches using limited monitoring of water levels against estimates of water use and with recharge as a function of rainfall. However, in major overstressed systems, considerable work over periods up to 20 years has been undertaken to refine these estimates by constructing groundwater flow numerical models. Jurisdictions and the community are investing heavily in monitoring groundwater levels and salinity using dedicated networks, progressively metering high yield bores, upgrading stream gauging stations and mapping land use change to meet the increasing demands for improved groundwater management.

New South Wales

The groundwater systems in New South Wales assessed as having a high and medium risk of over allocation are all embargoed, with groundwater management plans being developed.

In the over-allocated systems, groundwater management committees are working with the community to develop technical and socially acceptable approaches to lower allocation to sustainable levels. Where the actual usage is greater than the sustainable yield of the aquifer system, there are significant regional economic considerations to be addressed. This is the case for groundwater users accessing the Lower Namoi alluvial system and parts of the Great Artesian Basin (GAB).

In most cases, the critical issue is the portion of sustainable yield to be allocated to groundwater dependant eco-systems.

Victoria

Groundwater management units include Groundwater Management Areas (GMAs) and Unincorporated Areas (UAs) with the latter being the remainder of the Murray Basin region outside of designated GMAs. Groundwater within the GMAs is generally of irrigation quality, while groundwater within the UAs may be highly saline, with limited use potential. Current State policy is to declare a Groundwater Supply Protection Area (GSPA) under the Victorian *Water Act 1989*, and develop a groundwater management plan, where allocation in a GMA exceeds 70 per cent of the estimated sustainable yield.

Within the Murray Basin in Victoria, groundwater management plans are in the process of being developed for the following GMAs as a matter of priority: Murrayville, Neuarpurr, Campaspe, Katunga, and Spring Hill.

There are three areas in the Murray Basin where use may be exceeding the estimated sustainable yield. These are in the Campaspe, Katunga and Neuarpurr GMAs. In all three areas, there is uncertainty in the sustainable yield estimate, and the groundwater management plans being developed are concentrating on monitoring and further investigation to better define the sustainable yield. In the meantime, it is proposed

to limit extraction in all three areas to the 1999/00 metered use.

In the Murrayville GSPA (adjacent to the Mallee PWA in South Australia), it is anticipated that irrigation will expand after an upward revision of the sustainable yield using a methodology consistent with the Border Zone agreement.

In other GMAs, generally use is thought to be well below the sustainable yield, despite the fact that in some GMAs, allocation is above the estimated sustainable yield.

Allocation data is based on licensed allocation and an estimate of stock and domestic use, which is not licensed in Victoria. Groundwater use data is limited, and where available, it is derived from metering.

South Australia

The 1999/00 groundwater abstractions are less than the sustainable yield estimates for the groundwater management units defined in South Australia.

Groundwater pumping from the confined limestone aquifer in the Angas-Bremer PWA has fallen in recent years due to importation of surface water from Lake Alexandrina. This has led to a recovery of groundwater levels and a rise in the shallow watertable. This may cause waterlogging problems in some areas in the future.

In the Mallee PWA, groundwater extractions are slowly rising for the irrigation of mainly potatoes and pistachios, with some olives. A controlled mining policy for pumping from the confined limestone aquifer is taking advantage of the huge storage in the aquifer (100 million ML). Although almost fully allocated, there is little use in higher salinity areas (>1,500 mg/L).

Queensland

The risk of over-development within Queensland GMUs has been assessed and prioritised in conjunction with other risk factors. A number of GMUs have been identified as requiring further detailed assessment, including modelling and the development of aquifer management plans. GMU's identified as being high risk to over-development have been embargoed. In four of the high risk GMUs (Condamine, Oakey, Upper Hodgson and Dumaresq), detailed management guidelines have been developed in consultation with the community and announced allocations are used to regulate system extraction.

Table 15 indicates that the total level of groundwater allocation is in excess of the estimated total sustainable yield. However, the sustainable yield estimates are preliminary only, with the majority being conservative and subject to refinement in the future with more detailed investigations. Water meters have been progressively introduced to resource units where over-allocation and over-use has had a detrimental impact on the resource. Meters were introduced in the Condamine Groundwater Management Area (CGMA) in 1979 and are now installed in 8 of the 25 GMUs listed in the Murray-Darling Basin. The CGMA (Sub-Areas 1-5) is the only groundwater resource within the Queensland section of the Murray-Darling Basin where any attempt to develop sophisticated models to assist in management has occurred.

Estimation of water use is always problematical and the values presented are based on best available information from a number of sources, including water use surveys and estimations based on crop requirement. As monitoring of water levels indicate some long-term stress on the system, groundwater management plans are usually developed with the community concerned. The usual consequence of such action is the closing of the system for increased or new allocation and the introduction of meters or restricted pumping hours. The majority of the shallow groundwater systems in the Queensland part of the Murray-Darling Basin are now subject to an embargo on the issue of new allocation and will remain so until the systems exhibit an ability to sustain existing or increased usage.

Table 15. Estimates of sustainable yield, 1999/00 groundwater use and allocation for groundwater management units (GMUs) in the Murray-Darling Basin.

Groundwater Management Unit GMU	Estimated Sustainable Yield ML/yr	1999/2000 Allocation ML	1999/2000 Use ML
New South Wales			
Lower Namoi Alluvium	95,000	213,264	118,849
Lower Murrumbidgee Alluvium	226,000	384,376	184,063
Lower Gwydir Alluvium	35,000	99,032	40,762
Upper Namoi Alluvium	118,000	279,176	81,800
Peel River Alluvium	10,000	33,000	8,000
Maules Creek Alluvium	7,000	8,833	665
Miscellaneous tributaries of Namoi (Alluvium)	5,000	14,906	4,321
Lower Macquarie Alluvium	48,200	154,021	34,006
Upper Macquarie Alluvium	30,000	43,127	11,000
Cudgegong Valley Alluvium	12,000	15,769	3,200
Upper Lachlan Alluvium	205,000	174,474	47,559
Lower Lachlan Alluvium	94,000	237,452	28,011
Mid Murrumbidgee Alluvium	89,000	50,823	36,956
Billabong Creek Alluvium	20,000	7,461	2,330
Upper Murray Alluvium	30,300	40,041	13,243
Lower Murray Alluvium	136,000	332,976	103,170
Coolaburragundy-Talbragar Valley Alluvium	7,000	7,189	1,800
Bell Valley Alluvium	7,000	5,918	1,050
Belubula River Alluvium	6,000	19,152	3,000
Orange Basalt	17,000	7,684	6,400
Young Granite	15,500	18,010	7,095
Inverell Basalt	8,560	3,015	1,549
GAB - Central - NSW	5,750	6,580	6,580
GAB - Warrego - NSW	38,770	44,390	44,390
GAB - Surat NSW	10,100	36,850	36,850
GAB - Southern Recharge	53,640	70,780	70,780
Victoria			
Alexandra	5,000	1,682	n/a
Ascot	8,100	5,976	n/a
Barnawatha	2,400	493	n/a
Bridgewater	14,200	24,184	n/a
Bungaree	4,400	840.8	n/a
Campaspe GSPA	19,850	47,321.3	21,106
Ellesmere	2,400	1,357.3	n/a
Goorambat	4,850	1,452	n/a
Katunga GSPA	12,500	66,168.8	27,450
Kialla GSPA	4,770	2,030.6	n/a
Kinglake	3,800	2,058	n/a
Moolort	6,650	4,792.1	n/a
Mullindolingong	6,950	1,332.5	n/a
Murmungee	16,700	14,666.4	n/a
Nagambie	5,650	9,003.8	n/a
Salisbury West	9,200	1,093	n/a
Spring Hill GSPA	5,100	5,123.1	n/a
Berrook	1,110	0	0
Boikerbert (Apslay)	24,300	1,812	n/a
Balrootan	1,000	1,451	n/a
Lilimur (Kaniva)	6,950	2,028	n/a
Murrayville	1,815	4,502	2,300
Neuarpurr	10,300	24,750	18,950
Telopea Downs	7,970	2,072	n/a

Unincorporated Area - water table aquifer	770,000	20,450	n/a
Unincorporated Area - middle Tertiary aquifer	42,000	6,300	n/a
Unincorporated Area - lower Tertiary aquifer	27,000	0	0
South Australia			
Mallee PWA	53,000	47,000	19,000
Angas-Bremer PWA	5,000	6,500	2,000
Queensland			
Upper Hodgson Creek	4,800	2,518	1,319
Toowoomba City Basalt	6,500	5,544	2,700
Myall / Moola Creek North	3,500	2,341	2,350
Myall Creek	5,300	1,096	2,750
Lower Oakey Creek Alluvium	6,500	6,013	2,800
Oakey Creek Management Area	7,000	9,663	4,040
Condamine (CGMA) Sub-Area1	1,440	3,560	723
Condamine (CGMA) Sub-Area2	2,490	10,723	4,706
Condamine (CGMA) Sub-Area3	14,810	49,562	23,647
Condamine (CGMA) Sub-Area 4	1,930	3,694	1,666
Condamine (CGMA) Sub-Area5	1,500	1,126	289
Condamine River (DownRiver of CGMA)	3,500	1,898	1,800
Condamine River Alluvium (Kill'y to M'Bridge)	2,300	2,061	1,700
Condamine River Alluvium (M'Bridge to C'ham)	7,000	4,165	4,100
Condamine River Alluvium (C'ham to Ellang'n)	9,400	8,080	6,500
Glengallan Creek	4,330	6,775	8,090
Dalrymple Creek Alluvium	7,560	4,315	3,050
King's Creek Alluvium	4,230	1,780	1,400
Swan Creek Alluvium	900	1,365	850
Nobby Basalts	2,400	2,775	3,700
St. George Alluvium	18,000	6,340	2,200
Border Rivers	30,000	30,890	6,571
GAB - Eastern Recharge B - Q	32,450	37,140	37,140
GAB - Eastern Recharge C - Q	15,690	17,950	17,950
GAB-Eastern Downs	71,960	96,720	96,720

Note : n/a - not available

15. Conclusion

The information and data contained within this report provides a comprehensive review of consumptive water use and management for the 1999/00 water year for the Murray-Darling Basin, as per the requirements of Schedule F of the *Murray-Darling Basin Agreement*.

Total surface water use in the Murray-Darling Basin in 1999/00 was 9,542 GL and Groundwater use was 1,052 GL (excluding Victoria).

Information on groundwater usage has been presented for the first time in this report.

Resource availability was tightened in most valleys throughout the Basin with the implementation of water management policies in each of the States, in conjunction with the Cap.

Total water use in the 1999/00 water year represents a utilisation of 69 per cent of the water allocated throughout the Basin. This compares favourably with the 71 per cent utilisation of Basin allocations in 1998/99 and 76 per cent utilisation in 1996/97 and 1997/98.

The accuracy of diversion measurements remained static at ±7 per cent in the 1999/00 water year in comparison to previous years.

It is expected that the accuracy of measurement will improve over time as volumetric licenses and allowances are implemented in New South Wales, Queensland and the ACT, in conjunction with the installation of metering in the Lower Murray Swamps, South Australia.

Interstate water trading between New South Wales, Victoria and South Australia continued to develop in 1998/99 due in large part to the activation of "sleeper and dozer" licenses.

The effect of regulation on natural river flows in 1999/00 was substantial, with the flow to the Murray mouth being only 13 per cent of the natural flow.

It is envisaged that with the completion of Cap models for New South Wales (IQQM models) and Queensland WRP processes, the calculation and reporting of natural flows throughout the Basin will be complete in future reports.

The total volume of water in major on-storages above 10 GL within the Basin in 1998/99 increased from 12,762 GL to 14,137 GL (56 per cent full). Total evaporative losses for major storages within the Basin was 1,322 GL, representing 5.2 per cent of total storage capacity and 14 per cent of total Basin diversion.

The Cap was exceeded in NSW Border Rivers and Gwydir valley. However, there was large under-usage in the NSW Murray valley. The basin-wide usage was within the Cap.

The estimated sustainable yield of aquifers in GMU in 1999/00 was 2,326 GL. The allocation of groundwater in the basin was 2,806 GL and usage was 1,052 GL (excluding Victoria).

There was no environmental diversions to the Barmah-Millewa Forest in 1999/00.

The monitoring of water use relative to Cap compliance within the Murray-Darling Basin is a large, complex and difficult task, which has required substantial resources, cooperation and management from all the Governments involved in the *Murray-Darling Basin Initiative*.

It is evident from the progress to date of Cap implementation and the development towards more sustainable water use practices throughout the Murray-Darling Basin, that the continuation of a pro-active water management role by all Governments within the *Murray-Darling Basin Initiative* is required. This is to ensure a balance is maintained between the significant economic and social benefits that are derived from the development of the Basin's water resources on the one hand, and the environmental uses of water in the rivers on the other.

GLOSSARY

ACTEW	Australian Capital Territory Electricity and Water.
announced allocation	The percentage of water entitlement declared available for diversion from a regulated stream in a season.
annual allocation	The annual volume of water available for diversion from a regulated stream by an entitlement holder.
authorised use	Total of the water allocated in the valley, plus off-allocation and water harvesting use, plus unregulated stream use not in allocation and system losses not in allocation.
Border rivers	The rivers and tributaries forming, or intersecting the border between NSW and Queensland.
bulk entitlement	A perpetual entitlement to water granted to water authorities by the Crown of Victoria under the *Water Act 1989*.
carryover	An unused entitlement from one season that can be used in the next year.
channel capacity	The maximum rate at which water can be delivered through a river reach or an artificial channel.
COAG	Council of Australian Governments.
diversion	The movement of water from a river system by means of pumping or gravity channels.
diversion licence	Specified licences issued for a specified annual volume and diversion rate.
DLWC	The Department of Land and Water Conservation (of NSW).
DNRM	The Department of Natural Resources and Mines (of Queensland).
DNRE	The Department of Natural Resources and Environment (of Victoria).
dozer allocation	An allocation that is not fully utilised.
DWR	The Department for Water Resources (of South Australia).
EC (unit)	Electrical conductivity unit 1 EC = 1 micro-Siemen per centimetre measurement at 25° Celsius. Commonly used to indicate the salinity of water.
end-of-valley flows	The flow regime at the end of a valley.
floodplain harvesting	The diversion of water from a floodplain into storage(s).
FMIT	First Mildura Irrigation Trust.
gigalitre (GL)	One thousand million or 10^9 litres.
GL	Gigalitre: one thousand million or 109 litres.
G-MW	Goulburn-Murray Water (of Victoria).

gravity districts	Districts which use gravity to divert the flow of water from the river.
high security entitlement	An entitlement which does not vary from year to year and is expected to be available in all but the worst droughts.
IAG	Independent Audit Group.
LV	License Volume.
impoundment	The storage of water diverted from a water course.
irrigation	Supplying land or crops with water by means of streams, channels or pipes.
MDBC	Murray-Darling Basin Commission.
MDBMC	Murray-Darling Basin Ministerial Council.
megalitre (ML)	One million litres. One megalitre is approximately the volume of an Olympic swimming pool.
Ministerial Council, the	Murray-Darling Basin Ministerial Council.
ML	Megalitre: one million litres. One megalitre is approximately the volume of an Olympic swimming pool.
Murray-Darling Basin Agreement	The Agreement between the Governments of the four Basin States and the Commonwealth. The current Agreement is the 1992 Agreement.
off-allocation	When unregulated tributary inflows or spills are sufficient to supply irrigation needs and downstream obligations.
on-farm storage	Privately owned storages used to harvest surplus flows or to store unused allocations for use in the following season.
Overdraw	Water diverted in one season against a prospective allocation in the subsequent year.
overland flow	Water that runs off the land following rainfall, before it enters a watercourse, and floodwater that erupts from a watercourse or lake onto a floodplain.
Permanent transfer	The transfer of water entitlements on a permanent basis. The right to permanent transfers allows irrigators to make long-term adjustments to their enterprise and enables new operators to enter the industry.
Private diverters	Licensed to operate privately owned pumps or diversion channels; includes river pumpers and diverters as well as town water supplies.
property right	In this context, the right to ownership of allocated volumes of water.
RAMSAR wetland	A wetland listed on the Register of internationally significant wetlands established by the Convention at Ramsar.

regulated streams/waterways	Streams where users are supplied by releases from a storage. A water licence for a regulated stream specifies a base water entitlement defining the licence holder's share of the resources from a stream.
riparian	Of, inhabiting or situated on the bank and floodplain of a river.
RIT	Renmark Irrigation Trust.
sales water	In Victoria, water that may be purchased by an irrigator in addition to the basic water right. Access to sales water is announced each season as a percentage of water right depending on the available resource.
salinity	The concentration of dissolved salts in groundwater or river water usually expressed in EC units.
sleeper allocation	An allocation that does not have a history of water usage.
temporary transfer	Water entitlements transferred on an annual basis.
unregulated streams	Streams that are not controlled or regulated by releases from major storages.
utilisation	The amount of water available for diversion that is actually diverted.
water entitlement	The legal right of a user to access a specified amount of water in a given period.
water harvesting	The diversion of water from an unregulated stream in Queensland in which the access to water is defined only by a diversion rate and a starting flow in the stream.
WRP	Water Resources Planning. It is a process currently under way in Queensland to enable the acceptable level of allocatable water to be determined for a river system. This methodology will determine what part of the flow regime should be preserved for environmental flows, and what part can be made available for consumptive use.
WMRWG	Water Market Reform Working Group.
WR	Water Right.
WUE	Water Use Efficiency.

Appendix A. Diversion Cap Register (see Section 3.5 & Table 4)

Designated River Valley	Long Term Cap (GL)	Net Cap Adjustment for Permanent Trade upto 1998/99 (GL)	Permanent Trade Adjustment During 1998/99 (GL)	Net Cap Adjustment for Permanent Trade for 1999/00 = C + D (GL)	Net Temporary Trade During 1999/00 (GL)	Total Cap Adjustment for Trade = E + F (GL)	Cap Target for 1999/00 from the Cap Model (GL)	Trade Adjusted Cap Target for 1999/00 = G + H (GL)	Diversion during the Year (GL)	Cap Credit = H - I (GL)	Cummulative Cap Credit at the Beginning of the Current Year (GL)	Cumulative Cap Credit at theEnd of the Current Year = K + L (GL)	Exceedence Trigger = 0.2 * B (GL)
A	B	C	D	E	F	G	H	I	J	K	L	M	N
New South Wales													
Border Rivers[5]	204.0	0.0	0.0	0.0	-1.5	-1.5	150.0	148.5	197.4	48.9	-36.1	-85.0	-40.8
Gwydir	348.0	0.0	0.0	0.0	0.0	0.0	396.5	396.5	444.3	-47.8	-71.2	-119.0	-69.6
Namoi/Peel	254.0	0.0	0.0	0.0	0.0	0.0	301.0	301.0	299.4	1.6	108.4	110.0	-50.8
Macquarie/Castlereagh/Bogan	479.0	0.0	0.0	0.0	0.0	0.0	471.0	471.0	416.7	54.3	51.7	106.0	-95.8
Barwon-Upper Darling	177.0	0.0	0.0	0.0	0.0	0.0	144.0	144.0	175.0	-31.0	-62.0	-93.0	-35.4
Lachlan	350.0	0.0	0.0	0.0	0.0	0.0	241.0	241.0	295.8	-54.8	115.8	61.0	-70.0
Murrumbidgee	2,521.0	0.0	0.0	0.0	-113.7	-113.7	2135.7	2,022.1	1,909.8	112.3	-11.3	101.0	-504.2
Lower Darling	147.0	0.0	0.0	0.0	9.0	9.0	174.0	183.0	84.8	98.2	191.8	290.0	-29.4
Murray	1,877.0	-3.2	3.4	0.2	111.7	111.9	1,848.0	1,959.9	1,212.1	747.8	122.2	870.0	-375.4
Total NSW	**6,357.0**	**-3.2**	**3.4**	**0.2**	**5.5**	**5.7**	**5,861.2**	**5,866.9**	**5,035.3**	**831.6**	**409.4**	**1,241.0**	**-1,271.4**
Victoria													
Goulburn/Broken/Loddon[6]	2,084.0	-5.7	-2.4	-8.1	-1.9	-9.9	1,658.0	1,638.2	1,553.0	85.2	24.9	110.1	-416.8
Campaspe	122.0	4.2	0.0	4.2	-0.3	3.9	75.0	82.8	73.0	9.8	45.1	54.9	-24.4
Wimmera-Mallee	162.0	0.0	0.0	0.0	0.0	0.0	n/a	n/a	110.0	n/a	n/a	n/a	-32.4
Kiewa/Ovens/Murray	1,656.0	1.1	4.7	5.8	-2.7	3.1	1,590	1,596.2	1,574.0	22.2	123.9	146.1	-331.2
Total Victoria	**4,024.0**	**-0.4**	**2.3**	**2.0**	**-4.9**	**-2.9**	**n/a**	**n/a**	**3,310.0**	**n/a**	**n/a**	**n/a**	**-804.8**
South Australia													
Country Towns[7]	50.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0	37.0	13.0	29.0	42.0	-10.0
Lower Murray Swamps[8]	103.5	-3.0	-0.6	-3.6	-0.6	-4.2	103.5	95.0	99.3	-4.3	0.0	-4.2	-20.7
All Other Uses of Water from the River Murray	452.0	6.6	5.4	12.0	-1.1	10.9	441.0	462.8	364.0	98.8	99.1	197.9	-90.4
Total South Australia	**605.5**	**3.6**	**4.8**	**8.4**	**-1.7**	**6.7**	**594.5**	**607.8**	**500.3**	**107.5**	**128.2**	**107.5**	**128.2**

Designated River Valley	Long Term Cap (GL)	Net Cap Adjustment for Permanent Trade upto 1998/99 (GL)	Permanent Trade Adjustment During 1998/99 (GL)	Net Cap Adjustment for Permanent Trade for 1999/00 = C + D (GL)	Net Temporary Trade During 1999/00 (GL)	Total Cap Adjustment for Trade = E + F (GL)	Cap Target for 1999/00 from the Cap Model (GL)	Trade Adjusted Cap Target for 1999/00 = G + H (GL)	Diversion during the Year (GL)	Cap Credit = H - I (GL)	Cummulative Cap Credit at the Beginning of the Current Year (GL)	Cumulative Cap Credit at theEnd of the Current Year = K + L (GL)	Exceedence Trigger = 0.2 * B (GL)
Queensland[9]													
Condamine/Balonne	n/a	0.0	0.0	0.0	0.0	0.0	n/a	n/a	366.4	n/a	n/a	n/a	n/a
Border Rivers	n/a	0.0	0.0	0.0	5.8	5.8	n/a	n/a	151.3	n/a	n/a	n/a	n/a
Macintyre Brook	n/a	0.0	0.0	0.0	-2.3	-2.3	n/a	n/a	11.4	n/a	n/a	n/a	n/a
Moonie	n/a	0.0	0.0	0.0	0.0	0.0	n/a	n/a	8.2	n/a	n/a	n/a	n/a
Warrego	n/a	0.0	0.0	0.0	0.0	0.0	n/a	n/a	3.5	n/a	n/a	n/a	n/a
Paroo	n/a	0.0	0.0	0.0	0.0	0.0	n/a	n/a	0.0	n/a	n/a	n/a	n/a
Total Queensland	**n/a**	**0.0**	**0.0**	**0.0**	**3.5**	**3.5**	**n/a**	**n/a**	**540.8**	**n/a**	**n/a**	**n/a**	**n/a**
Australian Capital Territory	**n/a**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**n/a**	**n/a**	**27.0**	**n/a**	**n/a**	**n/a**	**n/a**

1. n/a denotes Cap model not completed or data not available.
2. The sign convention is that a negative value indicates a trade out of the valley and a positive value indicates a trade into the valley.
3. A negative difference between annual diversions and Cap target denotes an exeedance of Cap target.
4. Adjustment to Cap target for trade includes exchange rate adjustments to permanent interstate trade.
5. Excludes Pindari Dam Cap.
6. Excludes Lake Mokoan Cap.
7. Cumulative differences between Cap target and annual diversions are not reported for Country Towns, South Australia.
8. Annual diversions are deemed to be equivalent to Cap Target adjusted for Trade for Lower Murray Swamps, South Australia. (only 81.3 GL is tradeable).

	1997/98		1998/99		1999/00	
Designated River Valley	Diversions - 5 Years to 1997/98 (GL)	5 Year Cap Target (GL)	Diversions - 5 Years to 1998/99 (GL)	5 Year Cap Target (GL)	Diversions - 5 Years to 1999/00 (GL)	5 Year Cap Target (GL)
South Australia						
Metro-Adelaide & Associated Country Areas[1]	522.3	650.0	566.0	650.0	578.0	650.0

Appendix B. Barmah-Millewa Forest Environmental Diversions

The Murray-Darling Basin Ministerial Council Meeting 12—25 June 1993, approved in principle the annual allocation of 100 GL of River Murray water (50 GL provided by NSW and Victoria, respectively) to be used to meet the water needs of the Barmah Millewa Forest ecosystem.

In view of the dry season, there of the Barmah-Millewa Forest allocation was not used during 1999/00. The cumulative unused allocation at the end of 1999/00 is as follows:

State (GL)	Annual Allocation (GL)	Allocation Used in 1999/00 (GL)	Cumulative Unused Allocation at the end of 1999/00
NSW	50.0	0.0	50.0
Victoria	50.0	0.0	75.0[1]
Total	100.0	0.0	125.0

1. Victoria allocated an additional 25 GL in February 2000, when its irrigation allocation reached 100 per cent water right plus 30 per cent sales.