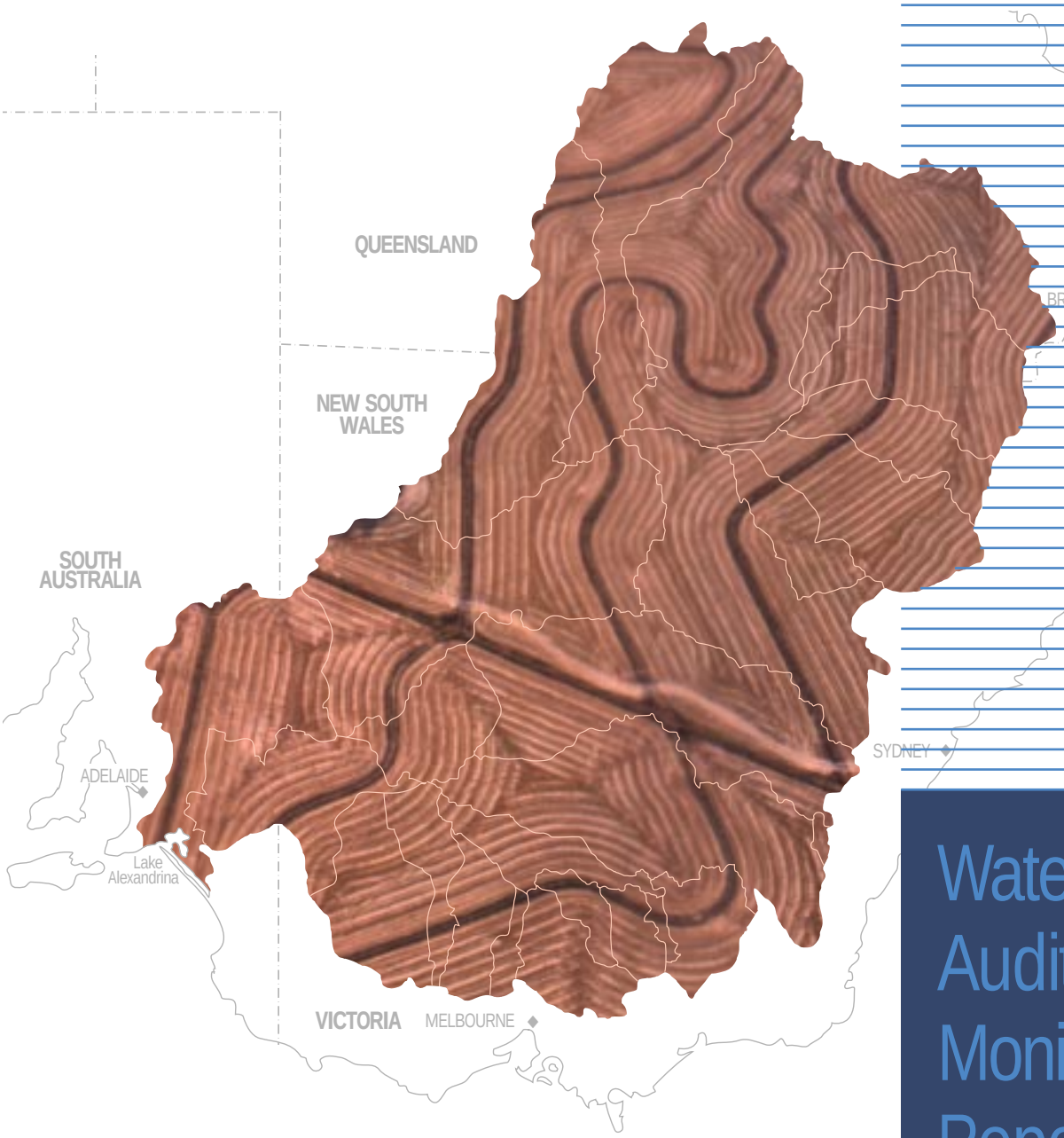
Water Audit Monitoring Report 1997/98

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



SIX GOVERNMENTS WORKING IN PARTNERSHIP WITH THE COMMUNITY

Water Audit Monitoring Report 1997/98

April 1999

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APRIL 1999

Acknowledgments

The development of the Murray-Darling Basin Commission's 1997/98 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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- 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 1997/98 water year. 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 region and includes estimates of the accuracy of the water use figures presented. Where possible, the actual volume of water used has been compared to the volume of water that should have been diverted under the Cap.

In addition to detailing water use, this report also contains information on major activities that impact on water use within the Basin. Each State has provided a description of their major activities occurring in 1997/98 (Sections 4 to 8). A separate section outlines further actions that each State plans to undertake over the coming years (Section 12).

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. 1997/98 Cap Compliance by State

State/Territory	*1997/98 Cap Compliance*
New South Wales	
Border Rivers	A Cap model is not yet available to determine Cap compliance, however diversions in 1997/98 were the highest on record.
Gwydir	A Cap model is not yet available to determine Cap compliance.
Namoi/Peel	The Namoi and Peel Valleys remained within Cap as determined by climate-diversion relationship models.
Macquarie/Castlereagh/Bogan	The Macquarie Valley remained within Cap for 1997/98.
Barwon-Darling	A Cap model is not yet available to determine Cap compliance, however extensive infrastructure development since 1993/94 indicates that the Cap is likely to be exceeded.
Lachlan	The Lachlan Valley exceeded its Cap target for 1997/98.
Murrumbidgee	Although the Murrumbidgee Valley exceeded its mean Cap target for 1997/98, it was well within the confidence limits of its climate-diversion relationship model.
Lowbidgee	A Cap model is not yet available to determine Cap compliance.
Lower Darling	A Cap model is not yet available to determine Cap compliance.
Murray	The Murray Valley was resource constrained and within Cap for 1997/98.
Victoria	
Goulburn/ Broken/Loddon	Diversions for the Goulburn/Broken/Loddon system were below Cap for 1997/98.
Campaspe	Campaspe diversions remained below Cap for 1997/98.
Wimmera-Mallee	A Cap model is not yet available to determine Cap compliance.
Murray/Kiewa/Ovens	Water use in the Murray/Kiewa/Ovens system remained below Cap for 1997/98.
South Australia	
Metro-Adelaide	Metro-Adelaide diversions remained well below Cap for 1997/98.
South Australia except Metro-Adelaide	The remaining South Australian diversions were below Cap for 1997/98. A climate-diversion relationship model for country towns is expected to be completed in March 1999.
Queensland[1]	
Condamine/Balonne	Although the Cap has not been finalised, diversions were at a record high in 1997/98.
Border Rivers	Although the Cap has not been finalised, diversions were at a record high in 1997/98.
Macintyre Brook	A Cap model is not yet available to determine Cap compliance.
Moonie	Although the Cap has not been finalised, diversions were at a record high in 1997/98.
Warrego	A Cap model is not yet available to determine Cap compliance.
Paroo	A Cap model is not yet available to determine Cap compliance.
Australian Capital Territory[2]	A Cap model is not yet available to determine Cap compliance, however, ACT net diversions were the second highest on record.

1. The Queensland Water Allocation and Management Planning (WAMP) and Water Management Planning (WMP) processes are still under development. These processes will define the final Caps in Queensland and are expected to be completed in 2000.
2. A Cap for the ACT will be developed in line with the recent decision of the ACT Government to participate in the Murray-Darling Basin Initiative and the development of water flow and license regulations to be enacted under the ACT Water Resources Act 1998.

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 % 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. The audit concluded that median annual flows from the Basin to the sea were only 21% 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% of years compared with 5% 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% of the water that was permitted to be used was used. The audit found that average diversions could increase by a further 15% 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;
- For South Australia, diversions were to be capped at a level that enabled the development of its existing high security entitlements. This represents a small increase in diversion over 1993/94 levels of development capped at 90% of existing high security entitlement; and
- The Cap for Queensland would be determined after an independently audited Water Allocation Management Planning (WAMP) process has been completed.

Subsequently, the Australian Capital Territory joined the Murray-Darling Basin initiative and agreed to participate in the Cap following the completion of discussions with the Murray-Darling Basin Commission (MDBC) and the IAG.

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 and Queensland, 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 (eg. 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 directions proposed to improve monitoring and reporting performance.

2.3 IAG Review of Cap Implementation 1997/98

At the request of the Ministerial Council, the IAG performed a review of the performance of each State in progressing the implementation of the Cap during 1997/98 ('Review of Cap Implementation 1997/98', published by the Murray-Darling Basin Ministerial Council, November 1998, Canberra).

This present report represents the second in a series of annual reports and complements the report of the IAG, however the data presented herein are the final figures for the 1997/98 water year and supersede the data reported by the IAG. Most notably, the Murray-Darling Basin diversions in 1997/98 reported in this present report (Table 2) supersede those reported by the IAG in November 1998 (Table 8 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 1997/98.

The figures indicate that Basin water use in 1997/98 was the fifth highest on record. Water use in Queensland was the highest on record, in South Australia and the ACT the second highest, New South Wales the fifth highest and Victoria the seventh highest on record.

Figure 1 shows the water use (by State) for the period 1983/84 - 1997/98 which enables a comparison of 1997/98 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 1997/98

System		*Irrigation Diversion (GL)*	*Other[1] Diversion (GL)*	*Total Diversion (GL)*
New South Wales[2]	Border Rivers	204	2	206
	Gwydir	535	0	535
	Namoi/Peel	253	7	260
	Macquarie/Castlereagh/Bogan	425	10	435
	Barwon-Darling	186	0	186
	Lachlan	417	14	431
	Murrumbidgee[4]	2 438	17	2 455
	Lowbidgee	160	0	160
	Lower Darling	39	9	48
	Murray	1 820	43	1 863
	Total NSW[3]	**6 476**	**102**	**6 578**
Victoria	Goulburn	1 781	27	1 807
	Broken	30	9	39
	Loddon	57	7	63
	Campaspe	58	37	96
	Wimmera-Mallee	28	156	184
	Kiewa	10	2	12
	Ovens	25	11	35
	Murray	1 646	48	1 694
	Total Victoria	**3 635**	**295**	**3 930**
South Australia	South Australia except Metro-Adelaide[5]	443	35	478
	Metro-Adelaide	0	153	153
	Total South Australia	**443**	**188**	**631**
Queensland[2]	Condamine/Balonne	536	9	545
	Border Rivers	174	3	177
	Macintyre Brook	8	0	9
	Moonie	8	0	8
	Warrego	2	0	2
	Paroo	0	0	0
	Total Queensland[6]	**729**	**12**	**741**
Australian Capital Territory[7]		**5**	**39**	**44**
Total Basin		**11 287**	**637**	**11 924**

FIGURE 1. Murray-Darling Basin Diversions – 1983/84 to 1997/98

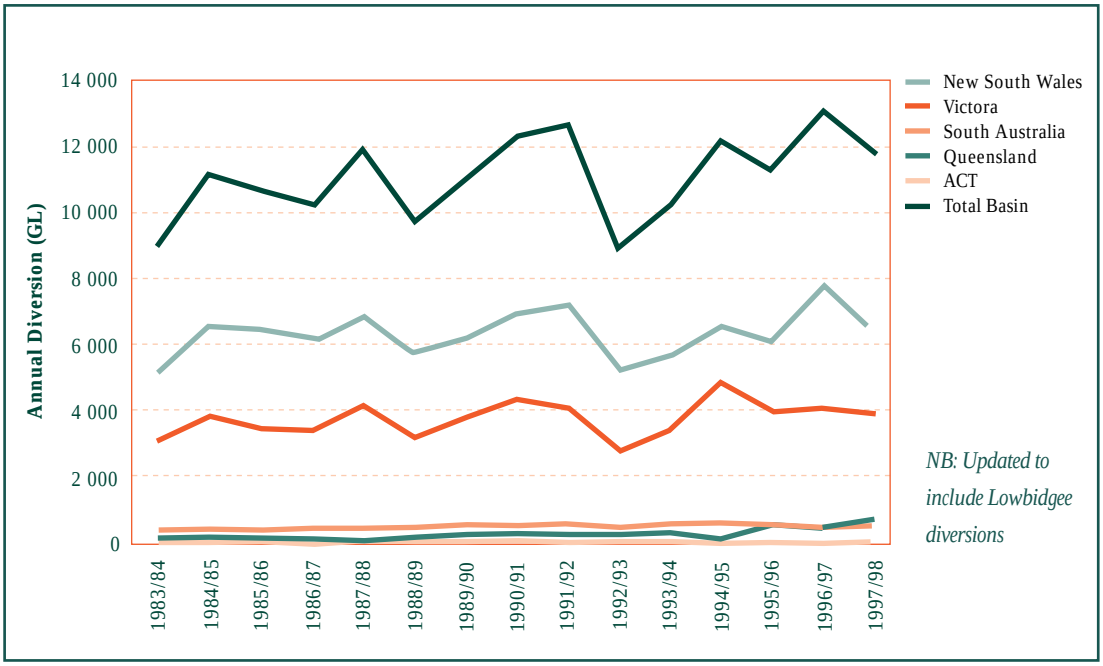
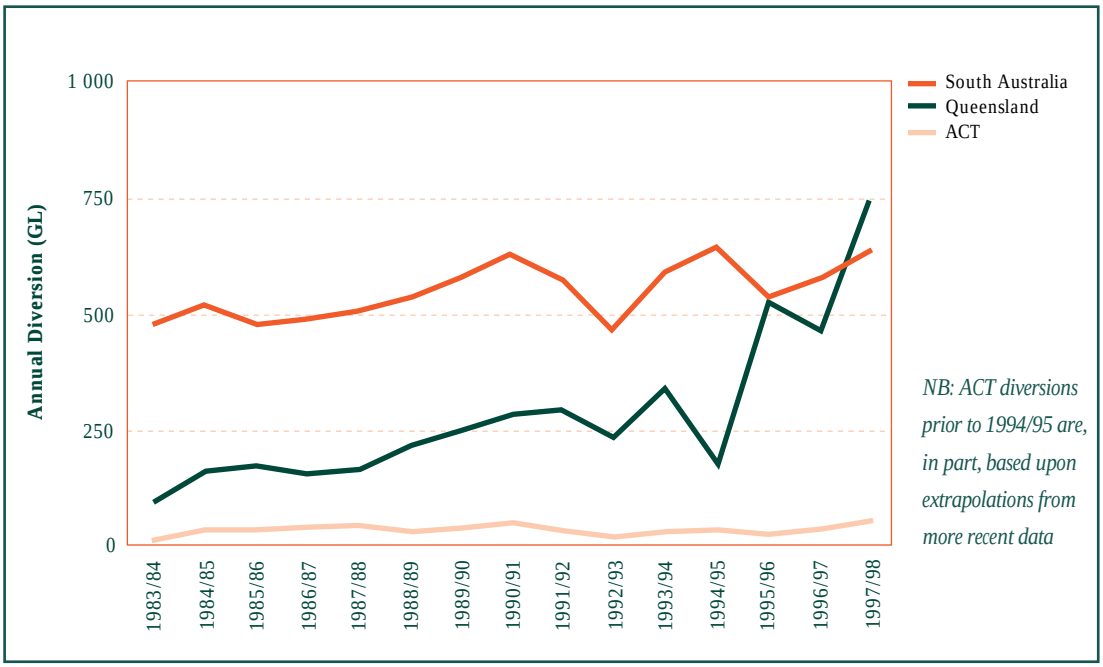


FIGURE 2. Murray-Darling Basin Diversions – 1983/84 to 1997/98 (usage under 1 000 GL/yr)



Footnotes for Table 2:

1. "Other Diversion" includes domestic & stock, town & industrial uses.
2. New South Wales and Queensland diversions include an estimate of unregulated stream diversions.
3. An estimate of NSW floodplain diversions is not available for 1997/98.
4. Murrumbidgee Valley diversions and Lowbidgee diversions are reported separately. Lowbidgee diversions are reported for the first time.
5. Water use by the Lower Murray Swamp irrigators is based on an estimate of actual crop water use. The diversions are not metered at this time, although it is anticipated that rehabilitation of the area including metering will commence within the next year.
6. Diversion from floodplains in Queensland has not been included in these totals but is estimated to have been approximately 62 GL for 1997/98.
7. This is a net diversion figure. The primary usage in the ACT is for urban supply which has a high return component (approximately 50 %), thus it is the net diversion reported.

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 are 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%, regional surveys ± 20% and user returns ± 40%.

TABLE 3. Accuracy of Diversion Estimates in 1997/98

System		*Diversion (GL)*	*Accuracy ± GL*	*Accuracy ± %*
New South Wales	Border Rivers	206	14	7%
	Gwydir	535	32	6%
	Namoi/Peel	260	28	11%
	Macquarie/Castlereagh/Bogan	435	0	5%
	Barwon-Darling	186	15	8%
	Lachlan	431	26	6%
	Murrumbidgee	2 455	123	5%
	Lowbidgee	160	16	10%
	Lower Darling	48	2	5%
	Murray	1 863	93	5%
	Total NSW	**6 578**	**349**	**5%**
Victoria	Goulburn	1 807	96	5%
	Broken	39	6	15%
	Loddon	63	6	10%
	Campaspe	96	5	5%
	Wimmera-Mallee	184	12	7%
	Kiewa	12	2	17%
	Ovens	35	5	14%
	Murray	1 694	123	7%
	Total Victoria	**3 930**	**256**	**7%**
South Australia	South Australia except Metro-Adelaide[1]	478	55	12%
	Metro-Adelaide	153	8	5%
	Total South Australia	**631**	**63**	**10%**
Queensland	Condamine/Balonne	545	82	15%
	Border Rivers	177	30	17%
	Macintyre Brook	9	1	6%
	Moonie	8	2	20%
	Warrego	2	0	19%
	Paroo	0	0	40%
	Total Queensland	**741**	**114**	**15%**
Australian Capital Territory[1]		**44**	**2**	**5%**
Total Basin		**11 924**	**785**	**7%**

1. Consists of country urban diversions of 35.2 GL (5% accuracy), swamp irrigation diversions of 79.4 GL (40% accuracy) and other irrigation of 363.2 GL (7% accuracy).

3.3 Climatic Overview 1997/98

- ***Rainfall***

  Figure 3 shows rainfall deciles for July 1997 to June 1998 inclusive. These were generally average to above average in the northern parts of the Basin with average to below average rainfall recorded in the southern parts of the Basin.

  Figure 4 shows the rainfall deciles for the period of November 1997 to April 1998 inclusive. This shows that much of the southern part of the Basin received below average to very much below average rainfall, which resulted in an increase in water demand during this period (the primary irrigation season). The above average rainfall received in the northern parts of the Basin presented good opportunities for water harvesting and floodplain diversions.

- ***Temperature***

  Figure 5 shows the temperature anomaly (the difference between the recorded temperatures and the long-term average temperatures) for the period of July 1997 to June 1998 inclusive. Minimal variation from average temperature conditions were observed throughout the basin for this period.

  Figure 6 shows the temperature anomaly for the period of December 1997 to February 1998 inclusive (the primary irrigation season). Higher temperatures relative to average temperature conditions for this period were observed throughout the basin.

FIGURE 3. Rainfall Deciles for the Murray-Darling Basin for the July 1997 to June 1998 Period (source: Commonwealth Bureau of Meteorology)

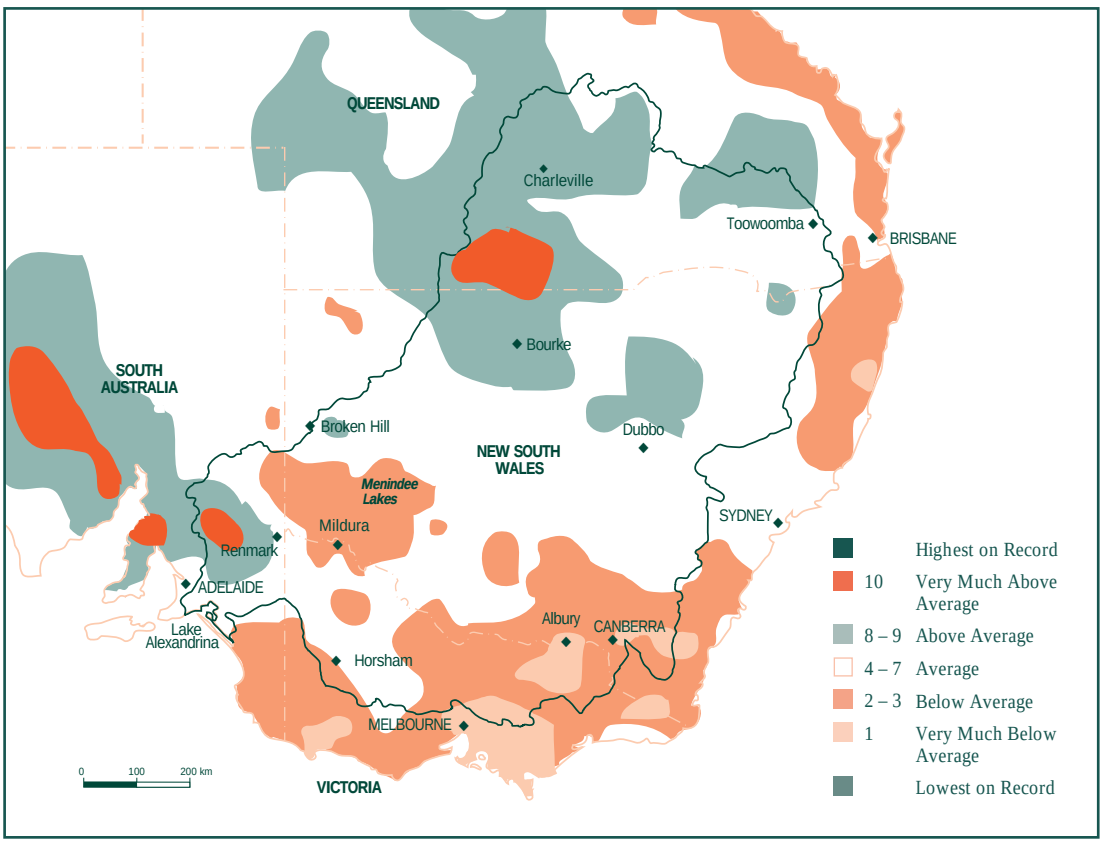
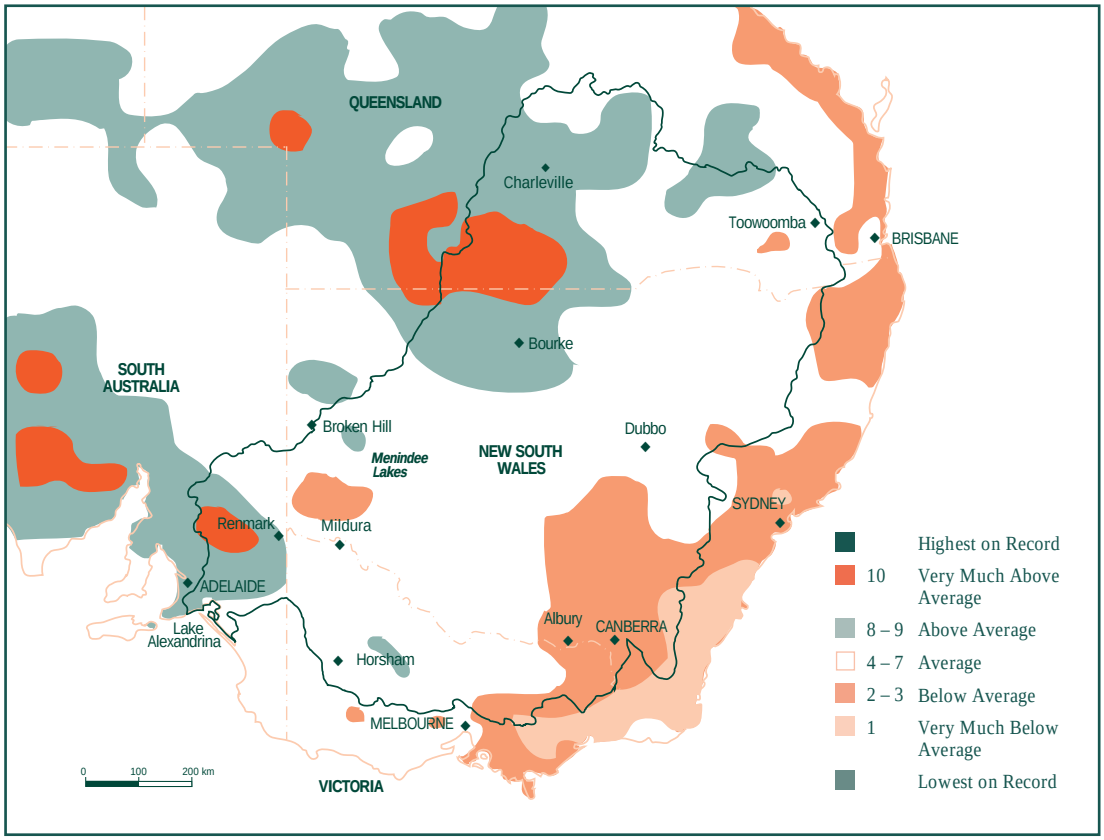


Figure 4. Rainfall Deciles for the Murray-Darling Basin for the November 1997 to April 1998 Period (source: Commonwealth Bureau of Meteorology)



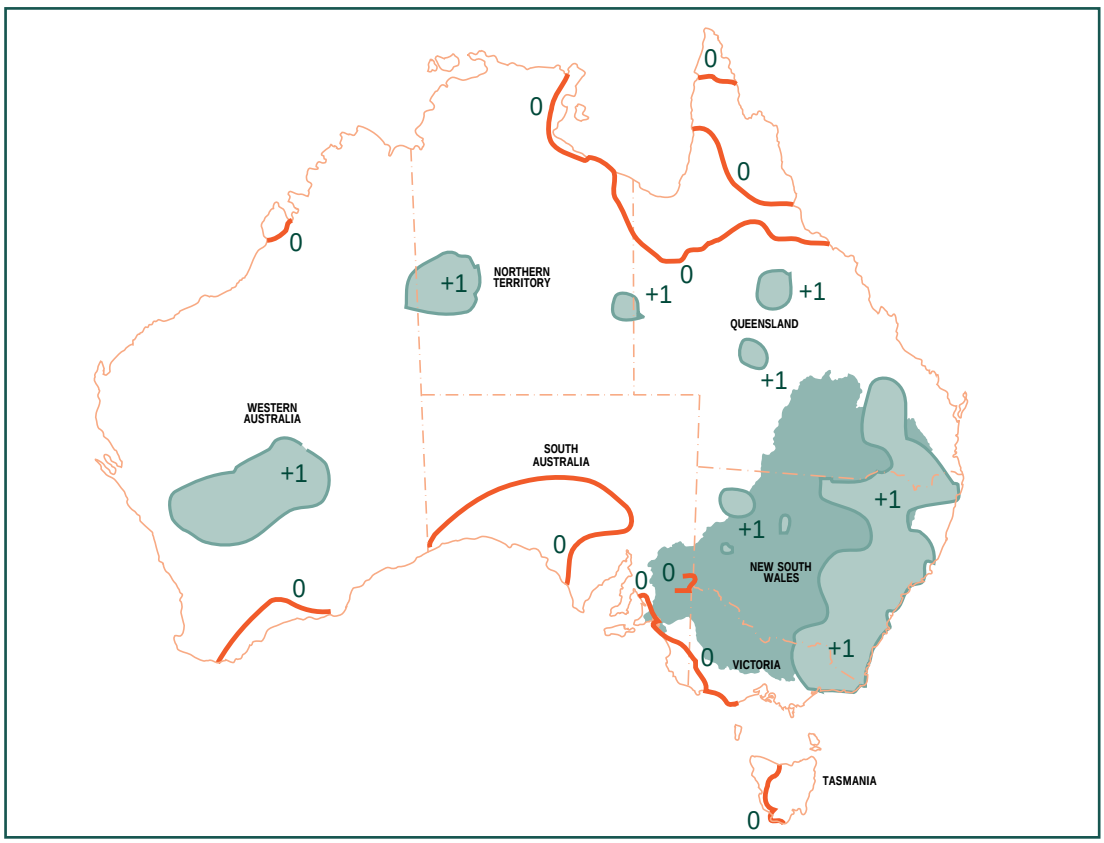
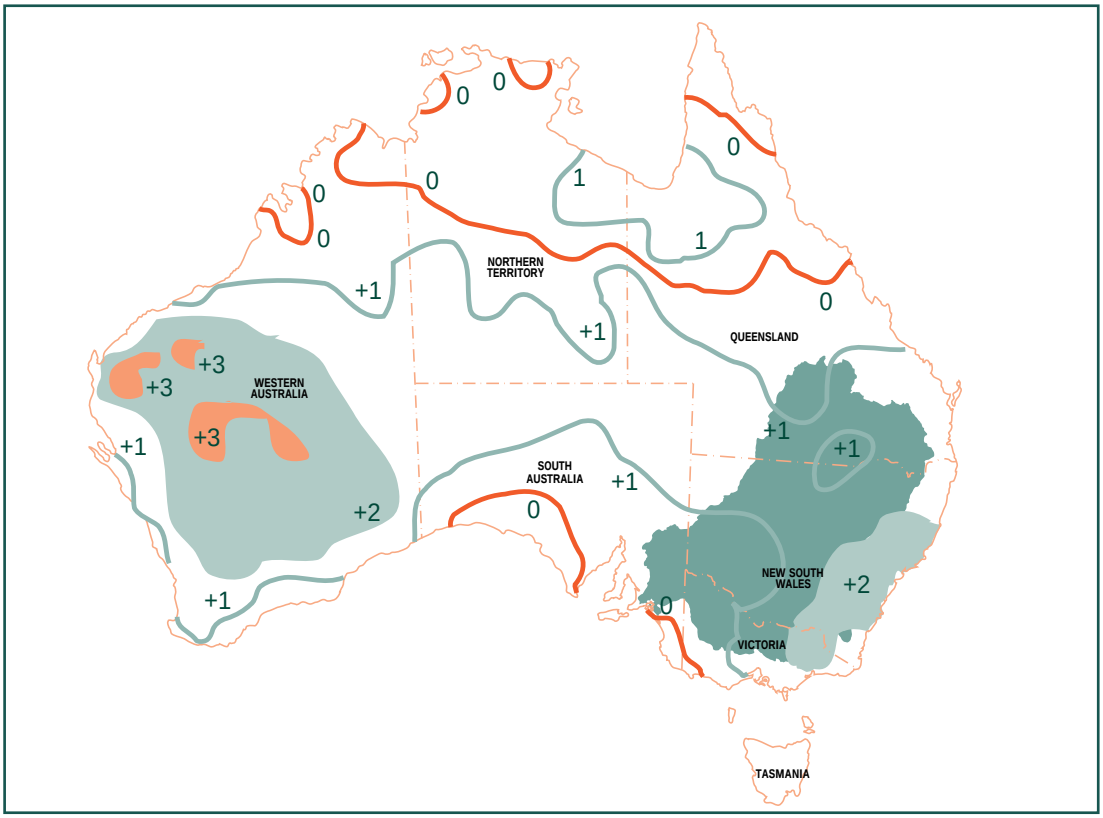


Figure 5. Temperature Anomaly for the 12 Month Period July 1997 to June 1998 (source: Commonwealth Bureau of Meteorology)

Figure 6. Temperature Anomaly for the 3 Month Period December 1997 to February 1998 (source: Commonwealth Bureau of Meteorology)



3.4 Definition of Cap

The Murray-Darling Basin Ministerial Council has set the 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 Mokoan Dam in the Goulburn/Broken/Loddon and/or the Murray Valley systems;
- 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;
  - 83.4 GL/year for irrigation in the reclaimed swamps, and
  - a long-term average diversion for other irrigation of 440.6 GL/year being 90% of the total allocation of 489.6 GL.

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

The ACT has agreed to participate in the Cap on diversions and will do so following the completion of discussions with the Commission and the Independent Audit Group.

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 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 Caps in years when there is significant rainfall in the irrigation areas and larger Caps in years with less rainfall when demand is higher. However the annual Cap year will also be affected by the availability of water. In very dry years in the south of the Basin, the annual Cap will reflect the resource constraints. In the north of the Basin, the Cap will be very much affected by the opportunities to harvest water into on-farm storages.

Because of these complexities, the calculation of the Caps will eventually be made by use of computer models with relationships for water use that include 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 rigorous peer review. The peer review commenced in July 1998 and will continue until all of the models meet the required standards.

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 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% 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% of Adelaide's needs) to about 190 GL (or about 95% of demand).

Diversions for 1997/98 are for the first water year to be covered by the permanent Cap. 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 Caps from 1 July 1997 onwards. If that difference exceeds trigger values that are specified in Schedule F to the Murray-Darling Basin Agreement, the Commission must declare that a State has exceeded the Cap.

3.5 Comparison of 1997/98 Water Use with the Cap

A comparison of 1997/98 water use with the Cap for each State is as follows:

- ***New South Wales***

Cap compliance in 1997/98 within New South Wales varied between valleys (Table 4).

Water use in the Namoi/Peel Valley, the Macquarie/Castlereagh/Bogan Valley and the Murray River Valley remained below Cap for 1997/98. In contrast, diversions exceeded Cap for the Lachlan Valley by 68 GL. Whilst, usage in the Murrumbidgee Valley exceeded the mean Cap in 1997/98, it remained well within the limits of its climate-diversion relationship model.

The Cap models for the Border Rivers system and the Barwon-Darling system have not been completed, therefore a comparative analysis of diversions relative to Cap cannot be undertaken. However, the IAG ('Review of Cap Implementation 1997/98', published by the Murray-Darling Basin Ministerial Council, November 1998, Canberra) concluded that "on the evidence available, it would be difficult to come to a conclusion that diversion was not occurring at levels in excess of 1993/94 diversions."

The Cap models for the Gwydir system, Lowbidgee scheme and the Lower Darling system have not been completed, therefore a comparison of water use and Cap for 1997/98 is not possible in these systems.

- ***Victoria***

Victorian diversions were within Cap for 1997/98 for the Goulburn/Broken/Loddon, Campaspe and the Kiewa/Ovens/Murray systems (Table 4).

The Wimmera-Mallee remains the only Victorian system for which a Cap model has not been completed, however, it is assumed that usage has remained within Cap given that there has been no net development.

Victoria remains committed to implementing the Cap and continues to work on improving Victorian models to enable Cap targets to be determined with improved accuracy.

TABLE 4. Comparison of Diversions with Cap Levels in 1997/98

System[1]		Total Diversion (GL)	Cap Diversion Target (GL)	Difference between Diversion and Cap[2] (GL)
New South Wales	Border Rivers[4]	206	n/a	n/a
	Gwydir[4]	535	n/a	n/a
	Namoi/Peel	260	303	-42
	Macquarie/Castlereagh/Bogan	435	467	-32
	Barwon-Darling[4]	186	n/a	n/a
	Lachlan	431	363	+68
	Murrumbidgee	2 455	2 426	+29
	Lowbidgee[6]	160	n/a	n/a
	Lower Darling[4]	48	n/a	n/a
	Murray[3]	1 863	n/a	n/a
Victoria	Goulburn]			
	Broken]	1 909	1 989	-80
	Loddon]			
	Campaspe	96	130	-34
	Wimmera-Mallee[4]	184	n/a	n/a
	Kiewa]			
	Ovens]	1 741	1 845	-104
	Murray]			
South Australia	South Australia			
	except Metro-Adelaide[1]	478	560[5]	-82
	Metro-Adelaide	*see table 5*	*see table 5*	*see table 5*
Queensland	Condamine/Balonne[4]	545	n/a	n/a
	Border Rivers[4]	177	n/a	n/a
	Macintyre Brook[4]	9	n/a	n/a
	Moonie[4]	8	n/a	n/a
	Warrego[4]	2	n/a	n/a
	Paroo[4]	0	n/a	n/a
Australian Capital Territory[4]		44	n/a	n/a

1. River valleys grouped thus "]" comprise designated river valleys under Schedule 1 of Schedule F (March 1998) and only a total diversion, cap and difference figure is required for these designated river valleys.
2. A positive difference between Diversions and Cap denotes an exceedance of Cap.
3. Resource constrained in 1997/98.
4. n/a denotes Cap model is not completed or a Cap target has not been able to be determined.
5. Comprises Cap components of 79.4 GL swamp irrigation, (1996/97 Cap of 83.4 GL less permanent trade of 4.0 GL), 50 GL country urbans, 430.7 GL other irrigation and is adjusted by 15.5 GL for interstate trade.
6. Lowbidgee diversions will be included in the Murrumbidgee Cap in future years.

TABLE 5. Comparison of diversions with Cap levels in 1997/98 for Metro-Adelaide, South Australia

System	Total Diversion 1997/98 (GL)	Total Diversion –5 Years up to and including 1997/98 (GL)	5 Year Cap Diversion Target (GL)	Difference between Diversion and Cap (GL)
South Australia				
Metro-Adelaide	153	554	650	-96

- ***South Australia***

South Australia complied with the Cap in 1997/98 for both diversions other than Metro-Adelaide (Table 4) and Metro-Adelaide diversions (Table 5). South Australia continues to work towards improving its already high standard of monitoring and reporting procedures, modelling country town diversions and developing policy responses to ensure long-term compliance with the Cap for irrigation diversions.

- ***Queensland***

Cap implementation in Queensland has as yet to be completed and therefore, it is not possible to provide a qualifying statement of Cap performance for the Queensland catchments for 1997/98.

- ***Australian Capital Territory***

A Cap process for the ACT has yet to be determined. Consequently, diversions for the ACT in 1997/98 cannot be qualified in respect of a Cap target.

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

4. Review by New South Wales of Water Use in 1997/98

4.1 Overview

Details of the factors influencing gross water use in each NSW valley in 1997/98 are given below.

4.2 Border Rivers

In 1997/98, the announced 'A' Class allocation in the Borders Rivers was 100% (21 GL) and the 'B' Class allocation was 55% (134 GL). A further 3 GL of high security water and a 20% carryover from 1996/97 (which applied to the 'B' Class entitlement component) were also available. The authorised water use in the valley was 310 GL, comprising of an allocation of 207 GL, off-allocation of 87 GL and 16 GL of unregulated stream use (Table 11).

In 1997/98, 100.5 GL of on-allocation, 87.5 GL of off-allocation, 2 GL of town water supply and 16 GL of unregulated water (Total usage = 206 GL) was used in the NSW section of the Border Rivers. It seems unlikely that this diversion will exceed the annual Cap, given that it is at the very lower end of the diversion range of 200 to 325 GL recommended in the Memorandum of Understanding (MOU). However, Cap compliance will need to be confirmed as soon as the Border Rivers IQQM is completed.

4.3 Gwydir

An announced allocation of 82%, with a 30% carryover from 1996/97 was declared for the Gwydir Valley in the 1997/98 season. The authorised water use in the valley was 754 GL, comprising of an allocation of 585 GL, off-allocation of 158 GL and 11 GL of unregulated stream use (Table 11).

Water diversions of 535 GL in 1997/98 represented the highest on record, with a planted crop area of 83 515 ha, representing a 15% increase in crop area relative to 1996/97. Preliminary estimates based on a crude climate-diversion relationship model indicate that this usage is still within Cap confidence limits. However, Cap performance will need to be confirmed using the Gwydir Valley IQQM which is expected to be completed in 1999/2000.

4.4 Namoi/Peel

The Namoi and the Peel Valleys in 1997/98 received an allocation of 100%. The authorised water use in the Namoi/Peel system was 390 GL, comprising of an allocation of 295 GL, off-allocation of 53 GL and 42 GL of unregulated stream use (Table 11).

The 1997/98 season commenced with generally full on-farm storages within the Namoi/Peel system. On a cumulative basis, net evaporation for the October 1997 to May 1998 period (used in the Namoi climate-diversion relationship model) was below the historical median. The area of cotton planted for irrigation in the Namoi Valley in 1997/98 has been estimated at 74 060 ha, representing a 9% increase from the area planted in 1996/97. Despite the increase in area planted, the 1997/98 diversions were within the confidence limits of the Cap model.

The estimated area irrigated in the Peel Valley in 1997/98 was 1 929 ha. This represented an increase of 17% from the area planted in 1996/97. Despite the increase in area planted, diversions in 1997/98 for the Peel Valley were within the confidence limits of the Cap model.

4.5 Macquarie/Castlereagh/Bogan

In 1997/98 the Macquarie Valley was resource constrained with an allocation of 10% and a 60% carryover from 1996/97. This gave users a water resource availability of 467 GL not including off-allocation. Crop area of 45 000 ha of irrigated cotton were planted in the Macquarie Valley in 1997/98. This represents a 30% increase from the 34 000 ha planted in 1996/97.

Two major water policy changes have significantly influenced the amount of water used in the Macquarie Valley in both the 1996/97 and 1997/98 water years. They are the introduction of continuous accounting incorporating carryover and the 1996 Macquarie Marshes Water Management Plan.

The 1996 Macquarie Marshes Management Plan aims to share flows in the Macquarie Valley between all users in order to provide resource security for users as well as general health benefits to the Macquarie Marshes.

The introduction of carryover has also caused significant changes in the Macquarie irrigation industry. In 1996/97 water use on low value commodities declined significantly and many inefficient crop practices were eliminated. This trend continued in 1997/98. Water usage on two of the most productive crops in the valley, cotton and wine grapes increased substantially.

Total water consumptive usage was 435 GL. Off-allocation was only available on two days and resulted in 10 GL usage. The Macquarie Valley was

resource constrained in 1997/98 and consequently, remained well below the Cap.

4.6 Barwon-Darling

All on-farm storages in the Barwon-Darling were 90% to 100% full at the beginning of the 1997/98 season. The total area planted for irrigation was down slightly at 23 795 ha from the 1996/97 total of 25 670 ha. Water usage was also down slightly totalling 186 GL. Despite these slight declines, extensive infrastructure development since 1993/94 indicates that users in the Barwon-Darling River system are likely to be continually exceeding the MDBMC Cap. Cap auditing is expected to begin as soon as the Barwon-Darling IQQM has been completed.

4.7 Lachlan

In 1997/98 the Lachlan Valley had an allocation 65% plus a 20% carryover. This gave a total water availability of 606 GL, not including off-allocation. No off-allocation was available during the year. Between July 1997 and April 1998, approximately 351 mm of rainfall fell in the Lachlan Valley (based upon the combined rainfall indicator used in the Lachlan climate-diversion relationship model). When compared to historical data for the same period this represents above median rainfall. The area planted for the 1997/98 season was 94 335 ha, compared with the 1996/97 area of 95 145 ha. Total diversions for the year were 431 GL. This exceeded the mean Cap by 68 GL and is above the Cap model confidence limits.

4.8 Murrumbidgee

In 1997/98 the Murrumbidgee Valley had an allocation of 90%. This gave users a water resource availability of 2 137 GL not including off-allocation. Off-allocation was available for a short period in January 1998, however, it was only available to users downstream of Darlington Point. Net evapo-transpiration for the 1997/98 year when compared to historical data for the same period, was found to be above median. An estimated 78 703 ha of rice was planted in the Murrumbidgee Valley in the 1997/98 season. This represents a 3% decrease from the area planted in 1996/97. Total diversions in the Murrumbidgee Valley in 1997/98 were 2 455 GL. Whilst this exceeded the mean Cap by 29 GL, it remained well within the confidence limits of the Cap model.

- ***Lowbidgee***

Diversions in the Lowbidgee have been included within this report for the first time and in this case have been reported separately from the Murrumbidgee Valley. In future reports it is envisaged that Lowbidgee diversions will be reported as part of the Murrumbidgee Cap.

The Lowbidgee scheme (incorporating Redbank and Maude Weirs) was initially developed in the 1940's for the purpose of providing flooding of the riparian forest in the lower Murrumbidgee Valley.

Diversions in the Lowbidgee for 1997/98 were 160 GL. This was considerably less than the 635 GL diverted in 1996/97 and the average diversion from 1983/84 to 1997/98 of 376 GL (see Appendix A).

Cap compliance of the Murrumbidgee Valley including the Lowbidgee has not yet been the subject of analysis. This will be required before Cap compliance can be determined.

4.9 Lower Darling

Total consumptive usage in the Lower Darling in 1997/98 was 48 GL. At present no Cap auditing methodology has been established for this valley. When available, it is envisaged that auditing will be carried out using the Murray-Darling Basin Commission's Monthly Simulation Model of the Murray-Darling Basin System.

4.10 Murray

In 1997/98 the Murray Valley was resource constrained with an allocation of 83%. This gave users a water resource availability of 1 835 GL not including off-allocation. Based on seed orders at rice mills, the area of rice planted in 1997/98 was approximately 20% less than that planted in 1996/97. For the October 1997 to April 1998 period, 195mm of rainfall was recorded in the Murray Valley (based upon the combined rainfall indicator used in the Murray climate-diversion relationship model). When compared to historical data for the same period this represents median rainfall. The Murray Valley consumptive use for 1997/98 was 1 863 GL which included a net transfer into the valley of 26 GL. When plotted on the Murray Valley climate-diversion relationship, the 1997/98 point plots well below the Cap band. This is due to the Murray Valley being resource constrained in 1997/98.

5. Review of 1997/98 Water Use in Victoria

5.1 Overview

Details of the factors influencing net water use in each of the Victorian systems in 1997/98 are given below.

5.1.1 Water Use Capping Measures

Following the Murray-Darling Basin Ministerial Council decision in 1995 to Cap water use within the Murray-Darling Basin, a number of changes to water management have been introduced in Victoria to limit future increases in water use.

The review of the 1996/97 irrigation season and in particular the high delivery rates experienced, gave cause for concern that usage may still be increasing. Further changes to trading and off-quota (off-allocation) policies were therefore introduced for the 1997/98 season, as outlined below. The nature of the seasonal allocation process also limits diversions due to its consideration of the resource position.

The changes prior to the 1997/98 season were:

- ***Trading***

A new trading rule introduced for the 1997/98 season restricts the activation of unused sales water in the gravity irrigation districts by limiting the temporary trading in sales water. Temporary trading of above 30% sales entitlement in the gravity irrigation districts will not be allowed, and no irrigator will be allowed access to sales entitlement above 30% if any of their water entitlement is temporarily traded. These measures are additional to the ban on temporary sales trading by private diverters which have been in place since 1995/96.

The aim of this rule is to prevent the activation of previously unused sales allocations through trading, which would increase usage and therefore restrict allocations in future years due to the Cap.

This rule did not have an impact in the Goulburn and Murray systems in 1997/98 because sales allocations were not greater than 30% of Water Right.

- ***Off-Quota***

From 1997/98, off-quota for the Murray System, including Torrumbarry and the Mitta Mitta River will only be made available when surplus flow is declared in the Hume to Yarrawonga reach of the River Murray. In addition, maximum usage under off-quota allocations is to be limited to 30% of water right or licence volume. The aim of this policy is to protect the security of supply to existing water users, provide equitable access to off-quota for Murray System irrigators, as well as limit growth in diversions through use of off-quota water.

5.1.2 Volumes Diverted

Volumes diverted during 1997/98 were below Cap levels in the three systems where a Cap has been determined (ie, Goulburn/Broken/Loddon, Campaspe and Murray/Kiewa/Ovens). The Caps being determined for the regulated portion of these system. Total diversions including unregulated components were below Cap targets.

The total diversion from the Victorian part of the Murray-Darling Basin was 3 930 GL. The allocated volume authorised for use (which includes system losses) was 4 280 GL, resulting in a utilisation of 92% of allocated volume.

5.1.3 Off-Quota

No off-quota periods were announced during 1997/98 due to the lack of surplus river flows.

5.1.4 Deliveries

- ***Pattern***

The 1997/98 season began slowly, due largely to average to above average rainfall during August and September 1997. Demand began in earnest from mid October 1997 and continued at strong rates until April 1998 (though not as strong as the previous season), with the low allocation affecting delivery rates late in the season.

- ***Losses Audit***

An extensive audit of system losses was conducted throughout the 1997/98 irrigation season in an attempt to identify and prioritise areas for improvement.

- ***Final Deliveries***

Total irrigation deliveries for the season were 2 854 GL. Deliveries to gravity irrigation customers were approximately 7% below the 10 year average and were similar for pumped districts.

- ***Historical Comparison***

Total irrigation deliveries were the below the long term average. Deliveries were slightly higher than

in 1982/83, but sales usage was actually lower and water right utilisation higher than in 1982/83 (Sales allocations in 1982/83 were 30% in both the Murray and Goulburn systems).

5.1.5 Trading

Permanent trade of 20 612 ML occurred during 1997/98. This was the highest level of permanent trading on record and approximately 5 000 ML more than in 1994/95.

There were 236 077 ML of water temporarily traded during 1997/98, which were slightly higher than 1994/95 levels. Approximately 80% of the volume traded was Water Right and Licence Volume and 20% were Sales. This was well above trading levels in 1995/96 and 1996/97, primarily due to the lower allocations in 1997/98 and high demand for water resulting from the dry conditions.

5.1.6 Environmental Flows

The northern Victorian wetlands used 13 275 ML of its environmental water allocation during 1997/98.

There was no usage of the Barmah-Millewa environmental entitlement during 1997/98.

5.2 Goulburn

The initial (August 1997) allocation for gravity customers was full Water Right plus 20% Sales and for private diverters was full Licence Volume only. These allocations did not change for the remainder of the season and were the lowest since 1967/68, when the allocation was Water Right plus 10% Sales. The next lowest historical allocations were Water Right plus 30% Sales in 1982/83 and 1984/85 (the Goulburn Basin supplies gravity customers from Shepparton west to Boort in the Loddon Basin).

At the start of the season the main water resource, Lake Eildon, was at 60% of capacity and rose to a peak of 65% by the end of September 1997. Although not an uncommon level for that time of year, the subsequent lack of spring rainfall resulted in low inflows during what are commonly the highest inflow months of the year. Continued dry conditions throughout the season eliminated the possibility of increases to the allocation and caused strong demand for water. Peak and total demands, however, were not as strong as in 1996/97 when the allocation was at the maximum of Water Right plus 100% Sales.

Drought conditions prevailed through the winter of 1997 and inflows to all storages were below average. The dry winter conditions generated little natural inflow to the Goulburn River downstream of Lake Eildon until late August 1997. Consequently, releases were made from Lake Eildon during July and August 1997 to supplement the filling of the Waranga Basin, which is normally achieved by harvesting natural inflows to Goulburn Weir.

Sustained high demand and the lack of significant rain events during the irrigation season resulted in sustained high releases from Lake Eildon, almost as high as during 1996/97. The high releases were required to maintain target levels in the Waranga Basin and to ensure that adequate rates of delivery to the Waranga Western Channel (WWC) could be maintained towards the end of the season.

Works at Waranga Basin over autumn-winter in 1998 delayed the harvesting of water at Goulburn Weir until July 1998. Dry conditions and low natural inflows to Goulburn Weir meant that only a small volume was not harvested. In other years, there can be significant volumes diverted in the May-June period.

Many of the channels in the gravity irrigation districts were not drained at the end of the season as a conservation measure in view of the low storage volumes and poor outlook for the 1998/99 season.

Overall diversions were slightly below the average of the previous 10 years.

Of the 1 257 GL authorised for use within the Goulburn Basin, 95% or 1 193 GL was actually used. This includes 407 GL of losses within the Basin, but excludes the 614 GL diverted out of the Basin to other valleys, mainly the Campaspe and Loddon.

Net trading in the Goulburn system was close to zero, although there was 7 GL traded permanently and 119 GL traded temporarily within the system.

The Goulburn Bulk Entitlement was completed and implemented in 1995, and covers diversions from the regulated part of the Goulburn River.

For the purposes of Cap compliance, the Goulburn Valley is included the Goulburn/Broken/Loddon designated river valley under Schedule F of the Agreement. The Goulburn/Broken/Loddon system remained within Cap for 1997/98.

5.3 Broken

The initial allocation for the majority of private diverters started at Licence Volume plus 40% Sales and in September 1997 increased to the maximum limit of 70% Sales. However, supply could only be guaranteed while Lake Mokoan remained free of Blue-Green Algae blooms. The small number of irrigators upstream of Casey's Weir were only allocated Licence Volume plus 20% Sales due to the low level of Lake Nillahcootie. Separate allocations for the Broken Basin have only been made in recent years. Prior to this, it was the same as the Goulburn diverters allocation.

At the beginning of the season Lake Mokoan was at 45% of capacity or 164 GL, about 70 GL below the usual target level. Despite the low level, this was still adequate to supply diverters in the Basin for the whole season, although it left the storage at a very low level at the close of the season. Lake Nillahcootie was at 35% of capacity or 14 GL at the start of the season, which limited its use to a small number of customers who couldn't be supplied from other sources, and domestic and stock purposes if Lake Mokoan was closed.

Unexpectedly, Lake Mokoan did not experience any Blue-Green Algae blooms during 1997/98 and there was no requirement to close the storage. This was the first season since at least 1992 that Lake Mokoan had not been closed due to an algal bloom. Irrigators made good use of the available water and as a result, demand was strong throughout the season and the highest use on record was observed. Of the 51 GL allocated, approximately 76% or 39 GL was utilised. For the irrigators this was equal to 112% of Licence Volume.

Bulk entitlements for the Broken Basin are scheduled to be implemented by the end of 1999.

For the purposes of Cap compliance, the Broken Valley is included the Goulburn/Broken/Loddon designated river valley under Schedule F of the Agreement. The Goulburn/Broken/Loddon system remained within Cap for 1997/98.

5.4 Loddon

Gravity irrigation customers in the Loddon Basin are supplied with water from the Goulburn Basin via the Waranga Western Channel (WWC) and received full Water Right plus 20% Sales.

Private diverters in the Loddon basin were allocated Licence Volume plus 10% Sales at the commencement of the season which remained static for the remainder of the season.

The resources of Cairn Curran, Tullaroop and Laanecoorie were at a combined capacity of 37% at the beginning of the irrigation season. Due to the low level of these storages, only a small volume of Loddon water was available to supplement Boort Irrigation Area (via the WWC).

Use by private diverters on regulated streams was equal to Licence Volume (21 GL) or slightly above the average usage. It was estimated that unregulated diverters used only half of their Licence Volume, which reflects the dry season and low stream flows available to be diverted.

Of the 444 GL authorised for use in the Basin, 403 GL or 91% was used. This includes approximately 109 GL of losses and 340 GL transferred in from the Goulburn Basin (via the WWC) to supply gravity customers.

Bulk entitlements for the Loddon Basin are planned to be in place by June 2000.

For the purposes of Cap compliance, the Loddon Valley is included the Goulburn/Broken/Loddon designated river valley under Schedule F of the Agreement. The Goulburn/Broken/Loddon system remained within Cap for 1997/98.

5.5 Campaspe

The Campaspe Basin contains gravity customers supplied from both the Campaspe River and from the Goulburn Basin via the WWC, and also has private diverters within the Basin. The Rochester area is supplied via the WWC and comments made in Section 5.2 above include these irrigators. The Campaspe Irrigation District and Campaspe diverters received an initial allocation of Water Right/Licence Volume plus 40% Sales in August 1997, which rose to 70% Sales in September 1997 and finally 90% Sales in October 1997.

Lake Eppalock, the main storage in the Campaspe Basin, was at 63% of capacity at the beginning of the season and rose to a peak of 73% during September 1997 before falling away. Only a small volume was used to supplement the WWC, although the full 24 GL entitlement was available.

Campaspe Irrigation District irrigators used 93% of the allocated volume (176% of Water Right compared to 190% allocated) which was close to average. Private diverters on regulated streams used 48% of the allocated volume (92% of Licence Volume) which was slightly above average.

Of the 406 GL authorised for use in the basin, 328 GL or 81% was used. This includes approximately 54 GL of losses and 232 GL transferred in from the Goulburn Basin (via the WWC) to supply Rochester gravity customers.

Bulk entitlements for the Campaspe basin are expected to be in place by June 1999.

The Campaspe system remained within Cap for 1997/98 by 34 GL, with a water diversion from the Campaspe of 96 GL compared to a Cap target of 130 GL.

5.6 Wimmera-Mallee

The 1997 domestic and stock (D&S) season started in May 1997 with some 560 000 ML in storage, or 73% of total volume. No restrictions were made to any supply groups during the 1997 domestic and stock season.

Inflows during the 1997 winter-spring were in the order of 16% of average. These low inflows were supplemented by the transfer of 119 GL of water from the Glenelg River Catchment, 7 GL from the Waranga Western Channel and 165 GL supplied from within the Wimmera-Mallee Water (WMW) operational region.

The 1997/98 irrigation seasonal allocation was 200% of Water Right.

Total releases during the 1997/98 season were 188 842 ML, which represents a continuation of a gradually reducing dry year release volume compared to recent dry years such as 1990 and 1994. Releases of 27 616 ML for irrigation also represent a continuation of a slightly decreasing trend in irrigation releases.

No Cap model has been completed for the Wimmera-Mallee, however, it assumed that usage has remained within Cap given that there has been no net development.

In fact, a negative trend can be demonstrated associated with the following initiatives:

- Since 1991, new entitlements have only been issued under the Sale-Of-Savings policy, whereby an entitlement is only created when a capital payment is made which enables water saving works to be undertaken elsewhere in the Wimmera-Mallee system.
- The Northern Mallee Pipeline Project has so far resulted in the saving of about 25 000 ML per annum of water previously released from the WMW headworks. Of this saving, 17 700 ML per annum is provided to the Glenelg and Wimmera Rivers as environmental flows.
- WMW has implemented a buy-back of diversion licences on the Wimmera River. The licensed volume remaining has reduced from 1 800 ML to 1 200 ML. All remaining licences are now metered ensuring improved management of these diversions.

5.7 Kiewa

No allocation is announced for the Kiewa Basin as it is an unregulated system and usage is restricted to Licence Volume or less depending on seasonal conditions. Dry conditions which result in low stream levels can necessitate sharing access to water by rostering, which therefore limits maximum possible use.

Overall usage during 1997/98 was estimated at 72% of the allocated volume or 12 GL, significantly above average.

Total annual flow past Bandiana was 96% of the natural flow, which gives an indication of the relatively low extraction rates from this Basin. The lowest ratio of actual to natural flow of 50% was experienced in March 1998.

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

For the purposes of Cap compliance, the Kiewa Valley is included the Kiewa/Ovens/Murray

designated river valley under Schedule F of the Agreement. The Kiewa/Ovens/Murray system remained within Cap for 1997/98.

5.8 Ovens

No formal allocation announcement is made for the Ovens Basin. Licence Volume is usually available, and Sales entitlement extended whilst storages are spilling. Overall usage has always been less than Licence Volume. This policy shall be reviewed as part of the Bulk Entitlement conversion process.

The two storages that supply this system, Lake Buffalo and Lake William Hovell, both filled during the early part of the irrigation season, which is common behaviour for these small storages.

Irrigation was banned on many of the unregulated streams within this Basin due to very low flows resulting from the severe drought conditions throughout the summer and autumn.

Usage during 1997/98 was estimated at 69% of the allocated volume or 35 GL, significantly above average.

Total annual flow past Wangaratta was 91% of the natural flow. The lowest ratio of actual to natural flow of 65% was experienced in July 1997, when the storages were in a filling phase.

Bulk entitlements for the Ovens system are expected to be in place by the end of 1999.

For the purposes of Cap compliance, the Ovens Valley is included the Kiewa/Ovens/Murray designated river valley under Schedule F of the Agreement. The Kiewa/Ovens/Murray system remained within Cap for 1997/98.

5.9 Murray

Allocations for the Victorian Murray Valley, Torrumbarry gravity irrigation areas and Mitta Mitta river diverters were set at Water Right plus 30% Sales in August 1997 and did not change for the rest of the season. The remaining private diverters were allocated only their Licence Volume. The allocation was last this low in 1982/83, and prior to that in 1967/68 when it was Water Right plus 10% Sales. This was in fact the first year since 1982/83 that the allocation didn't reach Water Right plus 100% Sales (or Licence Volume plus 70% Sales for diverters).

Hume Dam and Dartmouth Dam were at 40% and 78% capacity respectively, at the commencement of the season, and they rose to a peak of 63% and 71% respectively, by late September 1997. Hume Dam resource at that time was apportioned equally between Victoria and New South Wales, while Victoria had a greater share of Dartmouth Dam resource than NSW. In August 1982 Dartmouth Dam was at a similar level, while Hume Dam was only at 20% of capacity, and levels in both storages were falling.

Transfers were made from Dartmouth Dam to Hume Dam on an almost continuous basis from July 1997 to April 1998, at rates of up to 10 GL/d. In total about 2 100 GL was transferred in order to supply commitments along the River Murray.

Of the 1 826 GL authorised for use within the Victorian Murray Basin, 95% or 1 730 GL was actually used. This includes 420 GL of losses within the Basin, and 36 GL transferred in from the Goulburn Basin to the lower Broken Creek (Murray Valley Irrigation Area).

Overall diversions were about 10% above the average of the previous 10 years, although 1997/98 is well down on the list of high diversion years.

Irrigators in gravity and pumped districts and private diverters on regulated streams used 95% of their allocated volume overall.

Many of the channels in the gravity irrigation districts were not drained at the end of the season as a conservation measure, in view of the low storage volumes and poor outlook for the 1998/99 season.

Net permanent trading in the Murray system was about 0.4 GL inwards. A net 23 GL was temporarily traded into the system, largely from interstate.

Bulk entitlements for the Murray system are expected to be in place by June 1999.

For the purposes of Cap compliance, the Murray Valley is included the Kiewa/Ovens/Murray designated river valley under Schedule F of the Agreement. The Kiewa/Ovens/Murray system remained within Cap for 1997/98.

6. Review of 1997/98 Water Use in South Australia

6.1 Overview

Water diversions from the River Murray in South Australia for all components were within Cap for 1997/98. On the recommendation of the Independent Audit Group, water diversions are now reported under only 2 components:

- South Australia except Metro-Adelaide (comprising of Country Towns, Reclaimed Swamp Irrigation and Irrigation other than Reclaimed Swamp Caps listed in Schedule F of the Murray-Darling Basin Agreement); and
- Metro-Adelaide (comprising of the diversions via Swan Reach to Stockwell, Mannum to Adelaide and Murray Bridge to Onkaparinga pipelines supplying water to the city of Adelaide and associated country areas).

6.2 South Australia Except Metro-Adelaide

Diversions for the "South Australia except Metro-Adelaide" component of the Cap comprising total irrigation, stock, domestic, industrial, environment and country urban diversions for 1997/98 were 85.6% of the Cap compared with 83% for 1996/97.

The increase in use is considered to be due to a range of long-term factors including increased interstate temporary trade out of South Australia and increasing usage as recently planted permanent crops mature. The irrigation areas experienced slightly lower than average rainfall during the growing season but this is not believed to have greatly influenced irrigation usage.

These increases have been offset to some degree through the implementation of improved irrigation efficiency as a result of grower education programs and improved infrastructure as part of ongoing rehabilitation programs.

Although "drought conditions" were experienced in the metropolitan Adelaide catchments, average to slightly below average rainfall prevailed throughout the rest of the State. The resultant water use for the Country Urban supplies was only slightly above average and well below the Cap figure of 50 GL (ie, 70.4% of Cap).

6.3 Metro-Adelaide

The Metro-Adelaide component of the Cap consists of the total diversions for the Swan Reach to Stockwell, Mannum to Adelaide and Murray Bridge to Onkaparinga pipelines. These pipelines supply water to urban and rural areas in the general vicinity of Adelaide as well as the city itself. As metropolitan Adelaide and some of the nearby urban areas are supplied with water from the local Mount Lofty Ranges catchments with supplementary supply pumped from the River Murray, diversions from the river vary over a wide range dependent on climatic conditions in the Mount Lofty Ranges.

During 1997/98 inflows to storages in the local catchments were significantly below average due to extremely dry conditions (90% exceedance). This resulted in a marked increase in supplementary pumping from the River Murray. Total water diverted for Metropolitan Adelaide and associated country areas for the 5 year period 1993/94 to 1997/98 was 85.3% of the 5 year Cap of 650 GL.

7. Review of 1997/98 Water Use in Queensland

7.1 Overview

The 1997/98 water year started following a winter of low to very low rainfall and little associated stream flow. Regardless, major storages were in a reasonable position following good flows throughout most of the catchment in February and March of 1997. However due to carryover being restricted in the Border catchment (75% of unused allocation) and unprecedented use for pre-watering in the St George area, significant quantities of water were taken out of storage immediately prior to the beginning of October 1997. The major storages therefore entered the 1997/98 water year in the range of 50% to 75% capacity.

The 1997/98 water year was characterised by average to above average rainfall across the Queensland section of the Basin throughout most of the year, with well above average rainfalls in the July 1998 to September 1998 period. This was reflected in stream flow with most streams experiencing several smaller flows throughout the year and major floods in those latter months. The better than average stream flow situation gave extremely good waterharvesting opportunity leading to a total diversion of 741 GL for Queensland for the 1997/98 water year. This diversion outcome is to be expected given the nature of stream flow behaviour including its timing and the related diversion infrastructure which exists. In wetter years higher levels of diversion can be expected.

The diversion profile over the last 5 years is as follows:

TABLE 6. Summary of Water Use in Queensland

Year	Diversion (GL)
1997/98	741
1996/97	467
1995/96	520
1994/95	176
1993/94	338

Diversions amounted to about 12% of the total stream flow emanating across the Queensland valleys ranging from less than 1% in the lessor developed western streams to 22% in the most developed Condamine/Balonne system.

In view of the unregulated and highly variable nature of Queensland's flow regimes, the end-of-valley flow objective approach is considered by Queensland to be the only practical way in which its river systems can be managed, both from the perspective of its water users and the system's environmental needs. It is a characteristic of Queensland's variable and unregulated river systems that there will be more water diversions possible in wetter years, and reduced water diversions in drier years.

With Queensland yet to establish its basis for final Cap implementation it is not possible to make a qualified Cap performance statement. The various valley water management planning initiatives under way which will make explicit provisions for environmental flows will deliver outcomes progressively in 1999. It is not likely that Queensland will be in a position to comprehensively report against performance measures until the year 2000/01.

7.2 Condamine/Balonne

Total diversion for 1997/98 in the Condamine was 125 GL. This represents access to about 12% of the valley flow. Average annual flow for the valley is 783 GL.

Water taken by waterharvesting comprised 66% of the water diverted. There were several waterharvesting flows during the year. Smaller flows occurred during the summer months along the mid and lower reaches. The most significant extractions were from major flows over the August to September 1998 period when widespread flooding was occurring across much of the upper Darling system.

Regulated supply from the Upper Condamine Irrigation Project and the Chinchilla Weir Irrigation Project accounted for the majority of the balance of water use. Announced allocations in these projects started the year at 80% and 30% respectively but were revised to 100% following flows in December 1997.

Rainfall during the year was generally above average maintaining good supplies for unregulated irrigation in ephemeral streams but usage was also moderated by the good seasonal conditions.

Usage in the Balonne and Lower Balonne increased significantly in 1997/98 to 420 GL. This can be attributed to an increase in waterharvesting diversions which resulted from both extended waterharvesting opportunities available during the

year and increased storage capacity. The total flow passing St George for the year was 1 852 GL which represents an above average flow year. Total diversion from the Condamine Balonne system represented 29% of the valley flow.

Total waterharvesting was 350 GL made up of 120 GL in the project reach around St George and 230 GL in the Lower Balonne distributary system. Extended flows occurred from mid November 1997 to mid February 1998 with Beardmore Dam filling in mid December 1997. Only limited waterharvesting opportunities occurred over this period. Further flood flows occurred in February to March 1998 and August to September 1998, providing the majority of the waterharvesting diversions. With the extended high flow period to finish off the year in August to September 1998, storages were able to be topped up in advance of the 1998/99 season. This end of year diversion opportunity is viewed as an irregular event as it is somewhat unseasonal for flows of this order and extent to occur at this time of the year.

The 1997/98 water year is best described as one of those years when waterharvest volumes will be maximised. Storage replenishment has been available during and following the irrigation season, ie, October 1997 to April 1998, and further access was provided just prior to the start of the next season, ie, August to September 1998.

The St George irrigation scheme started the water year with an allocation of 30%. As with the storages in the Condamine section of the catchment, this was revised up to 100% in December 1997. A total of 56 GL of allocation water was diverted through the St George Irrigation Scheme. This represents 75% of entitlement. The majority was supplied to the channel fed irrigation area as river irrigators had ample access to the alternate waterharvest source.

7.3 Border Rivers/Macintyre Brook

Usage in the Border Rivers also increased from previous years with a total diversion of 186 GL. This increase again reflected the prolonged periods of waterharvesting opportunity available throughout the year. This usage compares with total flow passing Goondiwindi of 1 958 GL. When the further flow from the Weir River sub-catchment is taken into account Queensland access to Border flows represents less than 10% of the valley resource.

Waterharvesting represented 73% of diversions and access was provided from several flows. Smaller flows occurred in October to November 1997 and in February 1998. The major waterharvesting event though was in a continuing series of floods through July, August, and September 1998. Peak flows of 140 000 ML/day were recorded at Goondiwindi and some 80 GL was diverted from these events.

The two major dams in the system, Glenlyon Dam near Stanthorpe and Coolmunda Dam near Inglewood, started the year with announced allocations of 30% and 100% respectively. Allocations from Glenlyon Dam were increased to 45% in March 1998 with the dam filling and overflowing in September 1998 for the first time since December 1996. Regulated usage from these two dams amounted to less than 40 GL for the year. This is about 40% of total entitlement. This shortfall can be attributed to the extended waterharvesting opportunity in the Macintyre/Dumaresq system and a continuing Macintyre Brook practice of using less than available allocation.

7.4 Moonie

Usage for the Moonie River system was 8 GL for the water year. Total flow out of the valley was 312 GL during the year. Diversions represented less than 3% of flow.

There is limited waterharvesting development in the Moonie catchment. The river flowed frequently with several small flows occurring. Major flows occurred in December 1997 and throughout July, August and September 1998, peaking at 28 000 ML/day.

7.5 Warrego/Paroo

Usage on the Warrego and Paroo Rivers was estimated at 2 GL for the water year with negligible access occurring in the Paroo (42 ML).

Recorded flow for the year was 1 017 GL in the Paroo Valley and 122 GL in the Warrego Valley. For the comparatively more developed Warrego Valley this flow was well below the average streamflow of 416 GL (at Cunnamulla), with diversions representing less than 2% of actual flow.

Extraction from the system was slightly down this year due to good rainfall in the area, which reduced the demand for irrigation water.

8. Review of 1997/98 Water Use in ACT

The ACT experienced hot and dry conditions during the early part of the 1997/98 water year resulting in higher than usual gross diversions of 73.1 GL for urban consumption. Diversion returns to the Murrumbidgee River, and thus to Burrinjuck Dam, through the sewage treatment plants did not significantly change from previous years resulting in net diversions of 44.2 GL. Higher than average winter rain in the later part of winter resulted in storages being filled to acceptable levels by the end of the year.

There is no firm information available relating to diversions for agricultural purposes within the ACT, however, the passage of water resource legislation (the ACT Water Resources Act 1998), will allow this information to be collected in the future.

A Cap process for the ACT has yet to be determined. Therefore, the ACT in 1997/98 cannot be assessed in respect of Cap compliance.

9. Water Trading in the Murray-Darling Basin

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

Table 7. Trading in Water Entitlements in 1997/98 (Listed by source of transferred entitlement)

System	*Permanent Entitlement Transfer[1] (ML)*	*Temporary Entitlement Transfer[1] (ML)*
New South Wales		
Border Rivers	5 326	6 223
Gwydir	7 493	28 057
Namoi/Peel	8 998	16 415
Macquarie/Castlereagh/Bogan	6 347	15 602
Barwon-Darling	0	0
Lachlan	1 320	62 439
Murrumbidgee	11 843	224 712
Lowbidgee	0	0
Lower Darling	0	14 003
Murray	6 018	133 366
Total NSW	**47 345**	**500 817**
Victoria		
Goulburn	7 419	118 529
Broken	262	1 577
Loddon	440	2 116
Campaspe	167	5 189
Wimmera-Mallee	80	402
Kiewa	47	1 364
Ovens	115	7 766
Murray	12 082	99 134
Total Victoria	**20 612**	**236 077**
South Australia		
South Australia except Metro-Adelaide	20 365	22 587
Metro-Adelaide	0	0
Total South Australia	**20 365**	**22 587**
Queensland		
Condamine/Balonne	0	3 912
Border Rivers	0	467
Macintyre Brook	0	0
Moonie	0	0
Warrego	0	0
Paroo	0	0
Total Queensland	**0**	**4 379**
Australian Capital Territory	**0**	**0**
Total Basin	**88 322**	**763 860**

1. Temporary Entitlement Transfer includes temporary trade in both water rights and sales entitlement.

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 water trades (both intra-valley and inter-valley) that occurred during the 1997/98 water year.

Table 8 shows the net trade between valleys. The sign convention used in Table 8 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 1997/98 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.

TABLE 8. Net Inter-valley Water Entitlement Transfers in 1997/98

System	*Permanent Entitlement Transfer[1] (ML)*	*Temporary Entitlement Transfer[1] (ML)*
New South Wales		
Border Rivers	0	0
Gwydir	0	0
Namoi/Peel	0	0
Macquarie/Castlereagh/Bogan	0	0
Barwon-Darling	0	0
Lachlan	0	0
Murrumbidgee	0	-30 578
Lowbidgee	0	0
Lower Darling	0	5 512
Murray	-249	25 922
Total NSW	**-249**	**856**
Victoria		
Goulburn	103	-518
Broken	80	-815
Loddon	-321	-381
Campaspe	0	-1 756
Wimmera-Mallee	0	0
Kiewa	-22	549
Ovens	-20	-5 668
Murray	429	23 204
Total Victoria	**249**	**14 615**
South Australia		
South Australia except Metro-Adelaide	0	-15 471
Metro-Adelaide	0	0
Total South Australia	**0**	**-15 471**
Queensland		
Condamine/Balonne	0	0
Border Rivers	0	0
Macintyre Brook	0	0
Moonie	0	0
Warrego	0	0
Paroo	0	0
Total Queensland	**0**	**0**
Australian Capital Territory	**0**	**0**
Total Basin	**0**	**0**

1. 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. Includes inter-State water entitlement transfers.

10. Water Availability for the Year 1997/98

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% of the water that they had been authorised to use in the previous 5 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 1997/98 (see Table 12).

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. 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,
- 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 9.

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 8 to the fourth column in Table 9.

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 (ie, 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, that has not been cancelled as a result of a spill from storage, will add to this season's allocation. Table 10 shows the balance between the carryover from last season and the overdraw utilised (as opposed to announced). The net carryover minus overdraw from 1996/97 adjusted where necessary for any cancellation is included as column 5 in Table 9.

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. Although, in practice this does not occur as diversion capacity is limited by off-stream storage development and related irrigated areas.

Queensland adopted this method of reporting in 1997/98 (Table 11). In contrast, New South Wales currently report the use from off-allocation and water harvesting which underestimates the volume of water authorised for diversion (Table 11).

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. Although, 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 adopted this method of reporting unregulated diversions in 1997/98 (Table 11). Whereas, New South Wales has estimated the volume of water used by area licence, which underestimates the volume of water authorised for use (Table 11).

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 11. 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 11 lists the total volume of water that could be diverted in 1997/98 if all authorities to use water in 1997/98 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 12 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 Victorian river valleys, the volumes diverted from each stream have to be adjusted for the water diverted from other valleys (second column of figures in Table 12). This refers to water that 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 76% utilisation of Basin allocations in 1997/98 is higher than the average of 63% 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 9. Water Allocated in 1997/98

System	Base Valley Water Entitlement[1] (GL)	Announced Allocation[2] (GL)	Announced Overdraw[3] (GL)	Allocation Transfered into Valley[4] (GL)	Net Carryover/ Overdraw from 1996/97[5] (GL)	Total Allocated Water in Valley[6] (GL)
New South Wales						
Border Rivers	266	158	0	0	49	207
Gwydir	523	432	0	0	153	585
Namoi/Peel	295	295	0	0	0	295
Macquarie/ Castlereagh/Bogan	657	86	0	0	381	467
Barwon-Darling[7]	0	0	0	0	0	0
Lachlan	709	474	0	0	132	606
Murrumbidgee	2 380	2 168	0	-31	0	2 137
Lowbidgee	0	0	0	0	0	0
Lower Darling	89	89	0	6	0	95
Murray	2 160	1 835	0	26	0	1 861
Total NSW	**7 079**	**5 537**	**0**	**1**	**715**	**6 252**
Victoria						
Goulburn	735	850	0	-1	0	849
Broken	37	51	0	-1	0	51
Loddon	287	336	0	0	0	335
Campaspe	283	354	0	-2	0	352
Wimmera-Mallee	101	128	0	0	0	128
Kiewa	16	16	0	1	0	16
Ovens	57	57	0	-6	0	51
Murray	1 190	1 384	0	23	0	1 407
Total Victoria	**2 705**	**3 175**	**0**	**15**	**0**	**3 190**
South Australia						
SA except Metro-Adelaide	623	623	0	-15	0	608
Metro-Adelaide[8]	130[8]	248	0	0	0	248[9]
Total SA	**753**	**871**	**0**	**-15**	**0**	**856**
Queensland						
Condamine/Balonne	221	210	0	0	17	227
Border Rivers	133	87	0	0	21	109
Macintyre Brook	19	19	0	0	0	19
Moonie	4	4	0	0	0	4
Warrego	12	12	0	0	0	12
Paroo	0	0	0	0	0	0
Total Queensland	**389**	**332**	**0**	**0**	**39**	**371**
Aust. Capital Territory[10]	**44**	**44**	**0**	**0**	**0**	**44**
Total Basin	**10 970**	**9 959**	**0**	**0**	**754**	**10 713**

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 (eg, in Victoria). Includes permanent trades from Table 8.
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 8.
5. Net Carryover less Overdraw from Previous Year (see Table 10).
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 1997/98.
10. No formal entitlement in ACT; net diversion shown.

TABLE 10. Carryovers and Overdraws for 1997/98

System	Overdraw From 1996/97 (GL)	Carryover From 1996/97 (GL)	Overdraw Cancelled in 1997/98 (GL)	Carryover Cancelled in 1997/98[1] (GL)	Net Carryover from 96/97[2] (GL)	Overdraw from 1998/99 (GL)	Carryover to 1998/99 (GL)
New South Wales							
Border Rivers	0	49	0	0	49	0	97
Gwydir	0	153	0	0	153	0	0
Namoi	0	0	0	0	0	0	0
Macquarie/ Castlereagh/Bogan	0	381	0	0	381	0	0
Barwon-Darling	0	0	0	0	0	0	0
Lachlan	0	132	0	0	132	0	99
Murrumbidgee	0	0	0	0	0	0	0
Lowbidgee	0	0	0	0	0	0	0
Lower Darling	0	0	0	0	0	0	0
Murray	0	0	0	0	0	0	57
Total NSW	**0**	**715**	**0**	**0**	**715**	**0**	**253**
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							
SA except Metro-Adelaide	0	0	0	0	0	0	0
Metro-Adelaide	0	0	0	0	0	0	0
Total SA	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Queensland							
Condamine/Balonne	0	20	0	3	17	0	4
Border Rivers	0	30	0	9	21	0	0
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**	**50**	**0**	**12**	**39**	**0**	**4**
Aust. Capital Territory	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Basin	**0**	**765**	**0**	**12**	**754**	**0**	**257**

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 11. Water Authorised for Use in 1997/98

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	207	87	16	0	310
Gwydir	585	158	11	0	754
Namoi/Peel	295	53	42	0	390
Macquarie/ Castlereagh/Bogan	467	10	31	0	508
Barwon-Darling	0	0	186	0	186
Lachlan	606	0	11	0	617
Murrumbidgee	2 137	25	5	346	2 513
Lowbidgee	0	0	160	0	160
Lower Darling	95	0	0	0	95
Murray	1 861	36	5	0	1 902
Total NSW	**6 252**	**369**	**467**	**346**	**7 434**
Victoria					
Goulburn	849	0	0	407	1 257
Broken	51	0	0	0	51
Loddon	335	0	0	109	444
Campaspe	352	0	0	54	406
Wimmera-Mallee	128	0	0	102	230
Kiewa	16	0	0	0	16
Ovens	51	0	0	0	51
Murray	1 407	0	0	420	1 826
Total Victoria	**3 190**	**0**	**0**	**1 091**	**4 280**
South Australia					
SA except Metro-Adelaide[6]	608	0	0	0	608
Metro-Adelaide[7]	248	0	0	0	248
Total South Australia	**856**	**0**	**0**	**0**	**856**
Queensland					
Condamine/Balonne[8]	227	1 651	0	9	1 887
Border Rivers[8]	109	908	0	0	1 017
Macintyre Brook	19	7	0	0	26
Moonie	4	104	0	0	109
Warrego	12	42	0	0	54
Paroo	0	0	0	0	0
Total Queensland	**371**	**2 712**	**0**	**9**	**3 092**
Aust. Capital Territory	**44**	**0**	**0**	**0**	**44**
Total Basin	**10 713**	**3 081**	**467**	**1 446**	**15 706**

1. Allocated water from Table 9.
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. Water authorised for use is not equal to the Cap component for the South Australia except Metro-Adelaide as this is defined as 90% of the total licensed allocations. The Cap for this component for 1997/98 was 559.7 GL.
7. The water allocated for Metro-Adelaide in 1997/98 is based upon the usage in the previous four years against the five year rolling total of 650 GL.
8. Authorised diversions allowed to operate above account flow thresholds without restriction of storages.

TABLE 12. Use of Valley Allocations in 1997/98

System	Diversion from Valley (GL)	Diverted from other Valleys (GL)	Total use in Valley (GL)	Authorised use in Valley (GL)	Use as a % of Authorised Valley use (%)
New South Wales					
Border Rivers[1]	206	0	206	310	67%
Gwydir	535	0	535	754	71%
Namoi/Peel	260	0	260	390	67%
Macquarie/ Castlereagh/Bogan	435	0	435	508	86%
Barwon-Darling[1]	186	0	186	186	100%
Lachlan	431	0	431	617	70%
Murrumbidgee	2 455	0	2 455	2 513	98%
Lowbidgee	160	0	160	160	100%
Lower Darling[1]	48	0	48	95	50%
Murray	1 863	0	1 863	1 902	98%
Total NSW	**6 578**	**0**	**6 578**	**7 434**	**88%**
Victoria					
Goulburn	1 807	-614	1 193	1 257	95%
Broken	39	0	39	51	76%
Loddon	63	340	403	444	91%
Campaspe	96	232	328	406	81%
Wimmera-Mallee	184	7	191	230	83%
Kiewa	12	0	12	16	72%
Ovens	35	0	35	51	69%
Murray	1 694	36	1 730	1 826	95%
Total Victoria	**3 930**	**0**	**3 930**	**4 280**	**92%**
South Australia					
SA except Metro-Adelaide[2]	478	0	478	608	79%
Metro-Adelaide[3]	153	0	153	248	62%
Total South Australia	**631**	**0**	**631**	**856**	**74%**
Queensland					
Condamine/Balonne	545	0	545	1 887	29%
Border Rivers	177	0	177	1 017	17%
Macintyre Brook	9	0	9	26	34%
Moonie	8	0	8	109	8%
Warrego	2	0	2	54	4%
Paroo	0	0	0	0	70%
Total Queensland	**741**	**0**	**741**	**3 092**	**24%**
Aust. Capital Territory	**44**	**0**	**44**	**44**	**100%**
Total Basin	**11 924**	**0**	**11 924**	**15 706**	**76%**

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. Water authorised for use is not equal to the Cap component as this is defined as 90 % of the total licensed allocations. Water diversions for South Australia except Metro-Adelaide amounted to 85.6 % of the Cap of 558.5 GL.
3. The volume authorised for use for Metro-Adelaide for 1997/98 is the amount that could be used before the 5 year Cap of 650 GL would be exceeded. The total use over the past 5 years of 554.4 GL was 85.3 % of the Cap.

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 1997/98. Table 13 presents the annual flow volumes recorded and the natural flows at a number of selected key sites and the impact of development can be seen graphically in Figure 7. As such, Table 13 provides the available data and indicates the data that will ultimately be included in such a presentation.

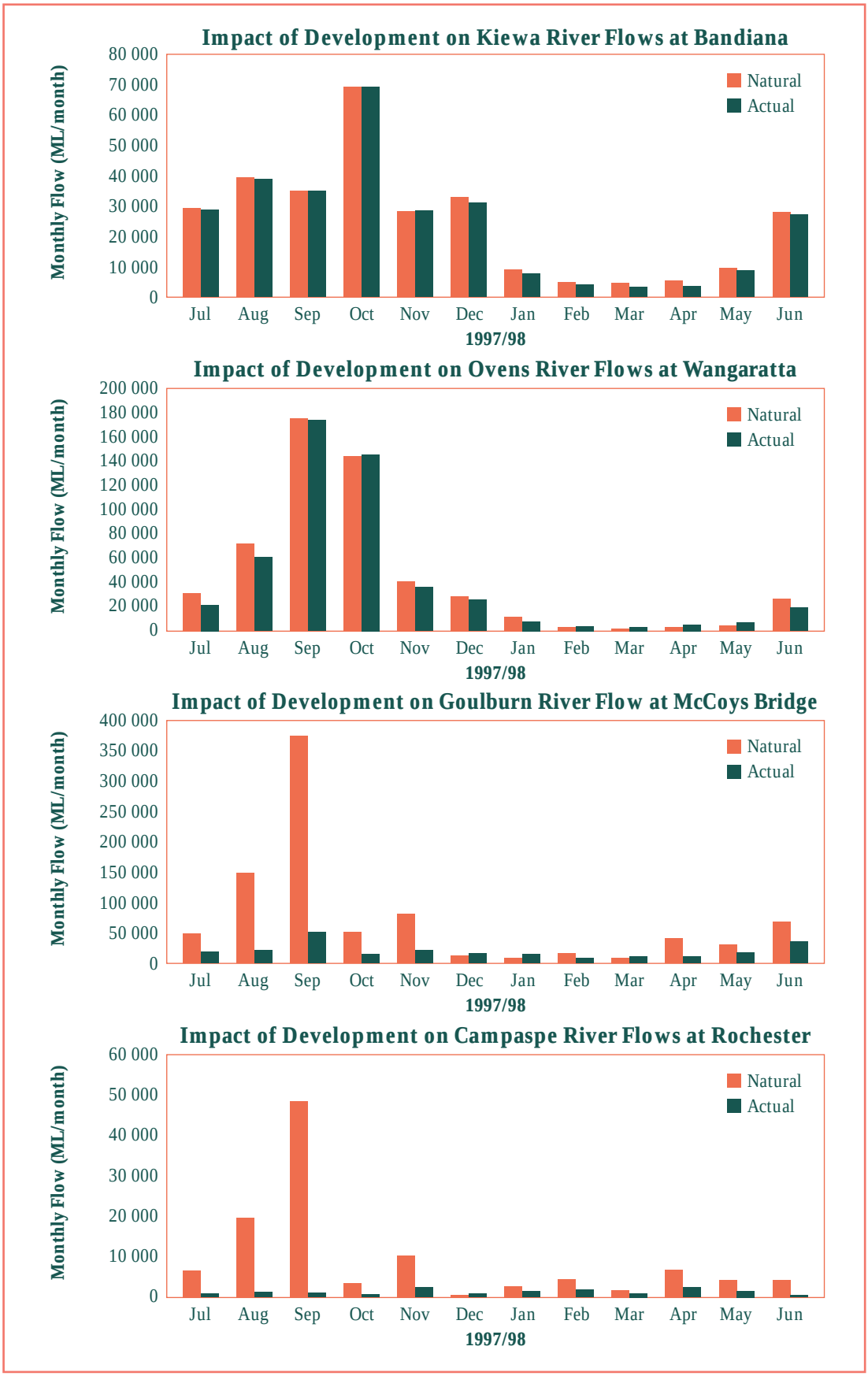
These results show that the flow regime in rivers such as the Kiewa and Ovens are little affected and flows in other streams such as the Goulburn have been significantly reduced.

TABLE 13. Comparison of 1997/98 Actual and Natural Annual Flows for Key Sites

System	*Actual Flow (GL)*	*Natural Flow (GL)*	*Actual/ Natural (%)*
Inter Basin Transfers			
Glenelg River Catchment to Wimmera-Mallee	119	n/a	n/a
Wannon River Catchmentto Wimmera-Mallee	0	n/a	n/a
Snowy River Transfers			
To Murrumbidgee	611	0	-
To Murray	540	0	-
New South Wales Tributaries[2]			
Barwon River at Mungindi + Boomi River	58	n/a	n/a
Inflows to Gwydir Wetland	74	n/a	n/a
Gwydir System Outflows to Barwon River	135	n/a	n/a
Namoi System Outflows to Barwon River	130	n/a	n/a
Inflows to Macquarie Marshes	n/a	n/a	n/a
Macquarie/Castlereagh/Bogan Outflows	n/a	n/a	n/a
Darling River Inflows to Menindee Lakes	127	n/a	n/a
Lachlan River at Coorong	62	n/a	n/a
Lachlan River at Booligal	74	n/a	n/a
Murrumbidgee River at Balranald	405	n/a	n/a
Lower Darling River at Burtundy	n/a	n/a	n/a
Victorian Tributaries			
Kiewa River at Bandiana	263	274	96 %
Ovens River at Wangaratta	372	408	91 %
Goulburn River at McCoys Bridge	283	962	29%
Campaspe River at Rochester	19	112	17 %
Loddon River at Appin South	14	82	17%
Queensland Tributaries			
Condamine/Balonne/Culgoa Flows at NSW Border	694	n/a	n/a
Macintyre River at Goondiwindi	1 968	n/a	n/a
Moonie River at Fenton	312	n/a	n/a
Warrego River at Cunnamulla	127	n/a	n/a
Paroo River at Caiwarro	1 021	n/a	n/a
River Murray			
Albury	4 478	n/a	n/a
Yarrawonga	2 727	n/a	n/a
Euston	2 093	n/a	n/a
South Australian Border	2 091	n/a	n/a
Barrages	567	n/a	n/a

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

FIGURE 7. Plots of Flows at Selected Sites Showing Actual and Natural (Modelled) Flows in Victoria



12. Proposed State Water Management Activities

12.1 General

The following sections outline the States' proposals for further actions aimed at achieving sustainable management of the Basin's rivers and water resources.

12.2 New South Wales

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, from the 1998/99 water year onwards NSW will be moving in many of its valleys to long term management plans with annual Cap monitoring as opposed to annual management and annual 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 valleys across the State, a set of indicative Environmental Flow Rules (EFR's) have been agreed to by the RMC's and the Government. These rules are being implemented in the 1998/99 water year. In the short term, as part of its broader role each of the committees will monitor the impacts of these rules on the environment, the social and economic fabric of a valley and subsequently recommend any appropriate flow modifications. Following five years of experience in the development of flow rules, the Government will establish long term river flow objectives for each regulated valley in NSW, which will be referred to as River Management Plans (RMP's).

The EFR's that are being 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 includes 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" mentality 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 ensure Cap compliance across the State.

It is important to note that whilst the EFR's and current management rules will result in long term average diversions that are below Cap, in some individual years diversions are likely to be above Cap. The ability of these rules to bring long term diversions to below 1993/94 levels are based upon the assumption that future infrastructure development remains at current levels. Consequently, it will be necessary for the NSW Department of Land and Water Conservation and the RMC's in their 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.

12.2.1 Border Rivers

There will be no change to the management rules in place in the Border Rivers for the 1998/99 season. Cap auditing of the Border Rivers will begin as soon as the Border Rivers IQQM has been completed.

12.2.2 Gwydir

A Continuous Accounting allocation system is to be trialed in the Gwydir Valley in 1998/99. In accordance with Continuous Accounting, all irrigators will be credited with a 150% allocation in 1998/99. This will allow all general security licensees to carryover any unused allocation into the 1999/2000 season, at which time they will receive a new allocation (dependent on resource availability) up to a combined limit of 150%. However, in any particular season each licensee will be limited to a maximum on-allocation usage of 100%. Environmental flow rules, which are based on the 1995/96 environmental flow provisions, will also be introduced in the Gwydir

Valley in 1998/99. Whilst not specifically designed as Cap management measures, monthly model runs indicate that the EFR's together with existing management rules do have the side effect of keeping long term average diversions below Cap. The impact of the EFR's and current management rules will be checked as soon as the Gwydir Valley IQQM has been updated.

12.2.3 Namoi/Peel

A Continuous Accounting allocation system is to be trialed in the Namoi Valley in 1998/99. In accordance with the Continuous Accounting allocation system all irrigators will be credited with a 150% allocation in 1998/99. This will allow all general security licensees to carryover any unused allocation into the 1999/2000 season, at which time they will receive a new allocation (dependent on resource availability) up to a combined limit of 150%. However, in any particular season each licensee will be limited to a maximum on-allocation usage of 100%. Environmental flow rules will also be introduced in the Namoi Valley in 1998/99. Whilst not specifically designed as Cap management measures the EFR's together with existing management rules will have the benefit of keeping long term average diversions below Cap.

There will be no change to the management rules in place in the Peel Valley for the 1998/99 season.

12.2.4 Macquarie/Castlereagh/Bogan

No additional Cap action is required in 1998/99. However, environmental flow rules which are an extension of the 1996 Macquarie Marshes Management Plan, will be introduced in the Macquarie Valley in 1998/99. Whilst not specifically designed as Cap management measures the EFR's together with existing management rules will have the benefit of keeping long term average diversions below Cap.

12.2.5 Barwon-Darling

Environmental flow rules, which aim to protect low flows, will be introduced in the Barwon-Darling in 1998/99, subject to the installation of appropriate operational stations. Long term high flow access rules are also currently being developed. In combination, these rules are expected to keep long term average diversions below Cap.

12.2.6 Lachlan

Environmental flow rules will be introduced in the Lachlan Valley in 1998/99. Whilst not specifically designed as Cap management measures the EFR's together with existing management rules do have the benefit of keeping long term average diversions below Cap. Existing management rules include a 100% on-allocation limit and a 30 GL limit on off-allocation. Performance against the Cap will need to be monitored closely by the Department of Land and Water Conservation from the 1998/99 season onwards to ensure that the EFR's and current management rules in combination are effective in keeping usage below Cap in the long term.

12.2.7 Murrumbidgee

Environmental flow rules will be introduced in the Murrumbidgee Valley in 1998/99. Whilst not specifically designed as Cap management measures the EFR's together with existing management rules do have the benefit of keeping long term average diversions below Cap. In the Murrumbidgee Valley (including Lowbidgee) existing management rules include a 100% limit on on-allocation and a 300 GL limit on off-allocation. Carryover is expected to be introduced in the Murrumbidgee sometime during the 1998/99 or 1999/2000 seasons.

12.2.8 Lower Darling

When available, it is envisaged that auditing will be carried out using the Murray Darling Basin Commission's Monthly Simulation Model of the Murray-Darling and Lower Darling Basin Systems.

12.2.9 Murray

Because the 1997/98 diversions did not exceed Cap due to resource constraints, it will not be necessary to alter the on-allocation or off-allocation rules required for the 1998/99 season. In terms of Cap management this means that the 100% allocation

limit and the 269 GL off-allocation limit will both remain. A carryover of 10% is expected to be allowed at June 1999. The carryover aims to negate the "use it or lose mentality" that has caused over usage in some NSW valleys in the past.

12.3 Victoria

12.3.1 Goulburn-Murray Water & Sunraysia Rural Water Authority's

Monitoring of the impact of water use capping measures introduced in recent years has been undertaken and will continue.

The annual allocation process has taken into account all entitlements defined in the development of the Murray Bulk Entitlements. This eliminates the possibility of over allocation of resources.

Stream flow management plans are being prepared for unregulated streams in order to ensure equitable and sustainable allocation of water amongst diverters and the environment.

A review of the effectiveness of water conservation measures such as leaving water in gravity supply channels will be undertaken. In the longer term, proposals for saline groundwater interception works along Lindsay River will reduce the diversions necessary to achieve adequate dilution flows.

Goulburn-Murray Water has embarked on a project to replace open channels with pipelines in the Woorinen area near Swan Hill, which will lead to reductions in losses and diversions.

12.3.2 Wimmera-Mallee Water

Continuation of strict enforcement of no new allocations and the implementation of the Northern Mallee pipelining represent the key areas to reduce consumptive use.

Wimmera-Mallee Water is also actively pursuing increased on-farm efficiency, particularly in relation to losses associated with operation of private channels in the Domestic & Stock system.

A further 25 000 ML of savings is anticipated with the completion of the western half of the Wimmera-Mallee Pipeline Project by the 2001. A further 17 000 ML of these savings will be available to the environment upon completion of the project.

12.4 South Australia

South Australia is continuing to improve the management of the water resources of the River Murray system through:

- Development of Local Action Plans to cover all sections of the River Murray and the River Murray catchment in South Australia to ensure that improved irrigation practice and farm management are implemented in a coordinated manner through strong local community commitment;
- Ongoing and developing partnership between the River Murray Catchment Water Management Board and Local Action Groups in implementing Local Action Plans;
- Development of a Comprehensive Catchment Plan, a Water Allocation Plan and a Drought Allocation Plan by the River Murray Catchment Water Management Board over an 18 month period;
- Development of a new licensing system that will include improved audit capability;
- Continued rehabilitation of highland irrigation areas to reduce system losses and improve irrigation practice;
- Trialing different water metering systems for the swamp irrigation areas prior to rehabilitation and the introduction of metering; and
- Ongoing grower education programs to facilitate improved irrigation practice.

12.5 Queensland

12.5.1 Management Planning

Valley based water management planning processes are progressing for the two eastern catchments (the Condamine/Balonne and the Border Rivers systems), where maturing water

economies exist. For the Condamine/Balonne system the Water Allocation and Management Planning (WAMP) process will provide the framework for integrated and proactive river management. The Flow Management Planning (FMP) initiative for the Border Rivers (a joint initiative with the NSW Department of Land and Water Conservation) will similarly deliver clear flow performance objectives for that valley.

Water Management Plans (WMP's) will be developed for the remainder of the major stream systems (Warrego, Paroo, Nebine and Moonie Rivers systems). Water Management Plans are being developed where there is an identified need to limit water extraction to preserve delicate environmental balances in the river ecosystem. They do not lead to the establishment of transferable water entitlement regimes and are generally applied in valleys having comparatively low levels of water resource development and/or available data. They do not involve the same complexity of hydrologic modelling as is required for the WAMP's and are applied in valleys which have comparatively low levels of water resource development.

These planning initiatives aim to improve planning confidence for water users, increase community involvement in the way water is used, and provide healthier river systems.

The WAMP for the Condamine/Balonne system and the FMP for the Border Rivers system are expected to provide new river management directions during 1999 with the Condamine/Balonne plan scheduled for completion in mid 1999, and the Border Rivers plan towards the end of that year. The Water Management Planning (WMP) initiatives are also scheduled to deliver findings in the later part of 1999.

12.5.2 Operational Directions

It is expected that implementation of these plans will require consideration of a number of allocation and operational changes including:

- The development of key flow performance objectives at various locations across each valley including "end of valley" perspective's;
- Conversion of hectare based irrigation licenses to a volumetric entitlement where this has not already occurred;
- The introduction of volumetric allowances for waterharvesting. Waterharvesting is currently limited only by pump size and pass flow conditions;
- Conversion of pump size to daily diversion rates on extraction licences;
- Event based flow management approaches where diversion opportunity will recognise prevailing climatic and river health conditions;
- The installation of additional gauging station sites to assist in more responsive and accurate flow sharing decision making. Related to this will be the development of multi-criteria decision making approaches to river management. The establishment of a more extensive monitoring network will support more accurate and detailed water audit monitoring; and
- More comprehensive metering of diversions including time and event recording to improve diversion accountability. It is estimated that 30% of current diversions in the region are not metered.

12.5.3 Transferable Water Entitlements Framework

New approaches to dealing with water trading are currently being developed. The proposed system envisages establishing a better defined set of water entitlements with a focus on shares of the allocatable resource and entitlements no longer being tied to land but to location.

This will enable permanent transfer of entitlements to occur. Related transfer rules will be developed using the valley hydrologic flow models, which are nearing completion. Transfer rules are necessary to cater for the effects that movements in water diversions may have on other users and the environment.

12.5.4 Floodplain Management

Floodplain waterharvesting is perceived as an issue of Basin wide concern. A number of consultative

management planning exercises are presently under way to examine and address overall floodplain management issues including floodplain harvesting. Work is currently under way in the Upper Condamine and Lower Balonne areas.

The WAMP and WMP processes will establish the significance and sensitivity of the impacts of floodplain diversions at the Basin wide scale. In addition they will ultimately establish the Basin wide boundary conditions or performance targets to assist in the subsequent development of floodplain management strategies.

This will establish a sound basis upon which appropriate policy responses and necessary legislative actions can be formulated over the next couple of years to address the issue.

It is intended that these responses will be developed in a way that recognises the Council's Community Advisory Committee's (CAC) request for an approach that provides a consistent policy framework across the Murray-Darling Basin.

12.5.5 Water Use Efficiency (WUE)

Improvements in rural water use efficiency will be promoted through the development and implementation of the Rural Water Use Efficiency Initiative.

The goal will be to promote efficient and sustainable use of rural water and the achievement of best water management practice on and off farm.

The expected outcomes of this initiative will include:

- Improved productivity and economic returns;
- Reduced impacts on the environment;
- Reduced impacts from water reform; and
- Development of more sustainable rural water systems and practices;

To achieve these goals it is planned to pursue the following strategies:

- Involvement of rural industry, private enterprise and other stakeholders in the development and management of the initiative;
- Benchmarking performance both on and off farm;
- Use of participative techniques to improve knowledge of, and speed adoption of, currently available WUE technology which would improve farm productivity and returns;
- Use of financial incentives where there are benefits to the community as a whole from improving WUE;
- A whole property approach to planning water management;
- Whole system planning to optimise supply of water to farms;
- Supporting R & D to address priority issues; and
- Development of training opportunities.

A package of measures is currently in development with implementation expected to commence in 1999/2000.

12.6 Australian Capital Territory

The ACT government passed legislation through the ACT Legislative Assembly in late November 1998 to enable the ACT Water Resources Act 1998. The Water Resources Act will provide for a comprehensive water allocation and licensing scheme covering all waters (including groundwater and stormwater) under the control of the Territory Executive.

The ACT Water Resources Act 1998 has been enacted to ensure that all water withdrawals from surface water and groundwater including that by Australian Capital Territory Electricity and Water (ACTEW) and all private diverters will be licensed (except surface water used for stock and domestic purposes). It will be through this licensing scheme that water withdrawals will be managed to ensure the achievement of the environmental flows specified in the ACT Environmental Flow Guidelines which have been formalised as part of the ACT Water Resources Act legislation.

The ACT expects to begin developing its approach to the Murray-Darling Basin water Cap within the 1998/99 water year.

13. Conclusion

The monitoring of water use relative to Cap targets 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. The information and data contained within this report provides a review of consumptive water use and management for the 1997/98 water year for the Murray-Darling Basin.

Computer modelling continues to be developed for most of the NSW valleys, while Victoria has completed all climate adjusted models, with the exception of the model for the Wimmera-Mallee system. Modelling of country town diversions in South Australia is expected to be completed in March 1999, whilst the Queensland Water Allocation and Management Planning (WAMP) processes are expected to be completed in 2000. A Cap for the ACT will be developed in line with the recent decision of the ACT Government to participate in the Murray-Darling Basin Initiative and the enactment of the ACT Water Resources Act 1998.

It is evident from the progress to date of implementing the objectives of the Cap 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.

14. 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).
dozer allocation	An allocation that is not fully utilised.
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.
FMIT	First Mildura Irrigation Trust.
gigalitre (GL)	One thousand million or 10^9 litres.
GL	Gigalitre: one thousand million or 10^9 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.
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.
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 or 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	Diversion of water from a stream during periods when the flow exceeds other water use requirements.
WAMP	Water Allocation and Management Planning. It is a process currently underway 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.

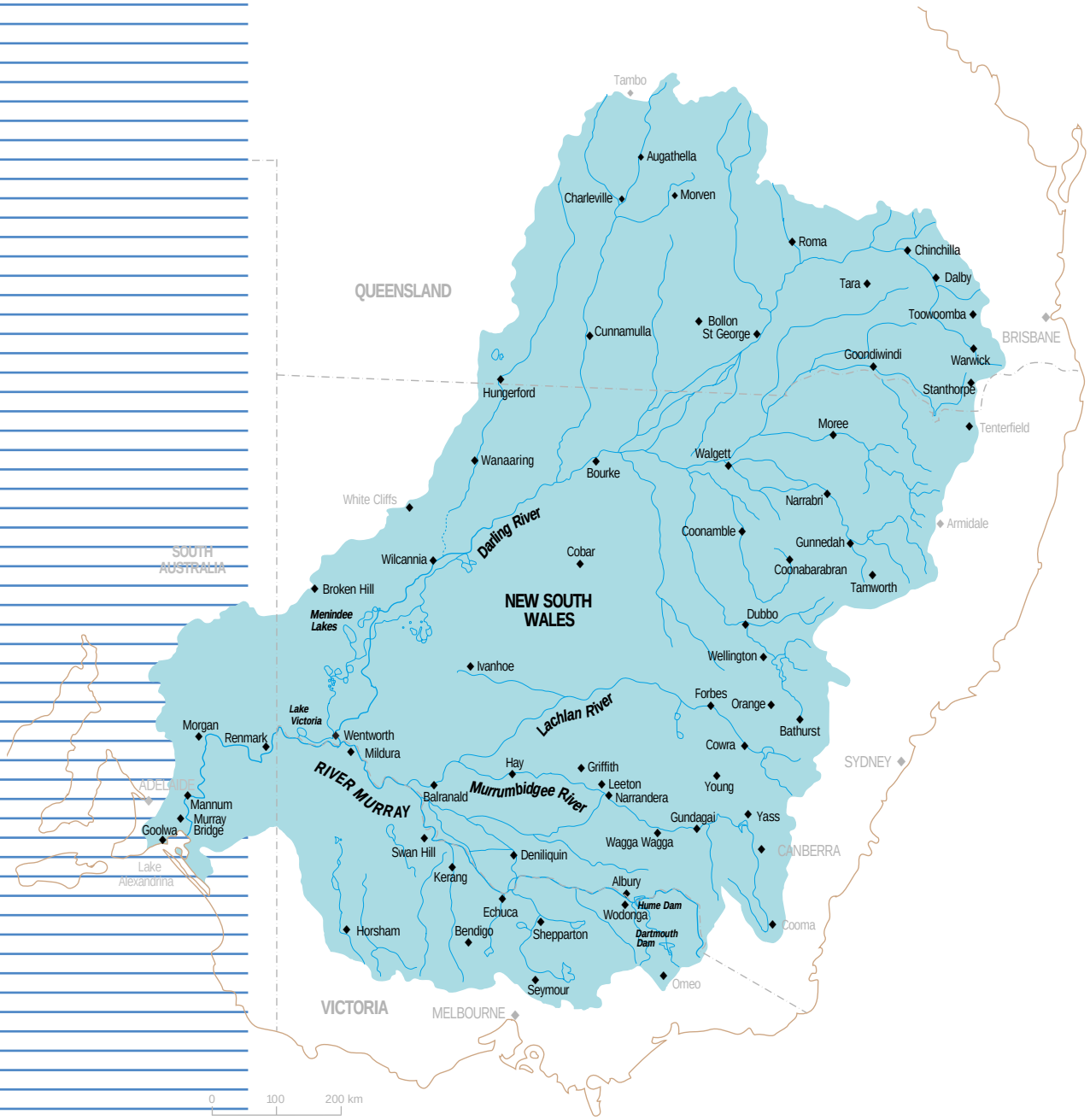
15. Appendix A. NSW Lowbidgee Diversions

Diversions in the Lowbidgee have been included within this report for the first time. In future, it is envisaged that Lowbidgee diversions will be reported as part of the Murrumbidgee Cap, however, for the purposes of this report Lowbidgee diversions are reported separately.

TABLE A1. NSW Lowbidgee Diversions

Water Year	*Annual Total (GL)*
1983/84	446
1984/85	235
1985/86	426
1986/87	681
1987/88	402
1988/89	562
1989/90	132
1990/91	173
1991/92	410
1992/93	577
1993/94	364
1994/95	121
1995/96	310
1996/97	635
1997/98	160
Average	376

MURRAY-DARLING BASIN COMMISSION



SIX GOVERNMENTS WORKING IN PARTNERSHIP WITH THE COMMUNITY