Water and the Murray Darling Basin - A Statistical Profile

Australia

2000–01 to 2005-06

Chapter 3 — Water use in the Murray-Darling Basin

Brian Pink
Australian Statistician

AUSTRALIAN BUREAU OF STATISTICS

EMBARGO: 11.30AM (CANBERRA TIME) FRI 15 AUG 2008

ABS Catalogue No. 4610.0.55.007

Photos on front cover courtesy of the Murray-Darling Basin Commission.

Produced by the Australian Bureau of Statistics

INQUIRIES

- For further information about these and related statistics, contact the National Information and Referral Service on 1300 135 070 or Bernard Morrisson on Canberra (02) 6252 5321

CHAPTER 3 WATER USE IN THE MURRAY-DARLING BASIN .....

INTRODUCTION

This chapter provides an overview of water use by major industries and households. It includes a more detailed analysis of water use by the Agriculture industry - the main water user in the Murray-Darling Basin (MDB). The statistics presented in this section are mainly from ABS Agricultural Surveys and Censuses conducted from 2000–01 to 2005–06.

Water is an essential input for the operation of Australia's businesses and households, and is critical to maintain ecosystem health within the environment. The most recent assessment of water use across industries and households was conducted for 2004–05 and presented in *Water Account, Australia 2004–05* (ABS cat. no. 4610.0) and Australian Water Resources 2005 (NWC 2007).

OVERVIEW OF WATER CONSUMPTION

Australia's Agriculture industry is particularly dependent on water to sustain its production. In 2004–05, the distribution of water consumption in the Australian economy was:

- 65% by Agriculture
- 11% by Households
- 11% lost in delivery systems (defined as Water supply industry consumption)
- 3% by Manufacturing
- 10% by Other industries (for example Mining, Electricity and gas, Service industries).

In contrast, water consumption in the MDB in 2004–05 was more skewed towards Agriculture:

- 83% by Agriculture
- 13% lost in delivery systems
- 2% by Households
- 1% by Manufacturing
- 2% by Other industries.

In 2004–05, the MDB comprised 65% of Australia's agricultural water consumption, and contributed 45% of Australia's Gross Value of Irrigated Agricultural Production (GVIAP). The majority of Australia's area of irrigated cotton (92%), rice (100%), cereals other than rice (88%), pasture (for dairy and other livestock, 67%), grapes (58%) and fruit and nuts (53%) were grown in the Basin. Total agricultural water consumption in the MDB is influenced by changes in water consumed by these crops and pasture.

WATER USE BY INDUSTRIES AND HOUSEHOLDS

The allocation of water to competing users in Australia's economy and society (e.g. Agriculture, other industries and households) presents a significant planning issue for resource managers. This becomes especially relevant during droughts when contingency plans are formed (e.g. MDB dry inflow contingency planning, see Appendix). To reliably underpin the trade-offs which arise during water planning, data are required on the volume of water used, and the value of that water use to society and industries.

Industries (including Agriculture) and households in the MDB accounted for more than half (52%) of Australia's total water consumption in 2004–05.

The following section examines water consumption by industries and households in the MDB, and presents comparisons with state and Australia-level water consumption.

Agriculture

Agriculture is a large user of water (in 2004–05 accounting for 83% of all industry and household water consumption in the MDB), but consumption varies across different agricultural activities. In 2005–06, agricultural water consumption in the MDB was 7,720 GL, accounting for 66% of total agricultural water consumption in Australia (table 3.1). The major agricultural water users in the MDB were: cotton (1,574 GL), dairy farming (1,287 GL), pasture for livestock (excluding dairy, 1,284 GL) and rice (1,252 GL). These crops and pasture collectively accounted for 70% of all agricultural water consumption in the MDB. The MDB accounted for all irrigated water consumption in Australia for rice (100%), and the vast majority for cotton (91%), cereals other than rice (88%) and grapes (81%).

3.1 WATER CONSUMPTION, by agricultural commodity—2005–06

	MDB	*Aust.*	*MDB as a proportion of Aust.*
	GL	GL	%
Dairy farming(a)	1 287	1 893	68
Pasture for other livestock(b)	1 284	2 042	63
Rice	1 252	1 253	100
Cereals (excl. rice)	782	894	88
Cotton	1 574	1 735	91
Grapes	515	633	81
Fruit (excl. grapes)	413	630	66
Vegetables	152	431	35
Other agriculture(c)	461	2 178	21
Total Agriculture(d)	**7 720**	**11 689**	**66**

(a) Includes irrigated pasture for grazing, hay and seed; livestock drinking; and shed washdown.
(b) Includes irrigated pasture for grazing, hay and seed.
(c) Includes other broadacre crops, nurseries, livestock (other than dairy) drinking.
(d) Components may not add to total due to rounding.
Source: Water use on Australian Farms (cat. no. 4618.0); ABS data available on request, Agricultural Census, 2005–06

Agriculture continued

Some irrigated agricultural crops are confined to relatively small areas of the MDB, others are more widely distributed (see table 3.2). This pattern of agricultural activity affects spatial patterns of water consumption. In 2005–06, 72% of water used for growing cotton was in New South Wales compared with 28% in Queensland (table 3.3). Almost all water consumption for rice (99%) occurred in New South Wales. The majority of water for dairy farming was consumed in Victoria (82%). Water used for growing grapes, fruit and nuts (hereafter referred to as fruit), and vegetables was more evenly distributed between New South Wales, Victoria and South Australia.

3.2 IRRIGATED AREA, by agricultural commodity and Basin state—Murray-Darling Basin—2005–06

	NSW/ACT		VIC.		QLD		SA		TOTAL MDB(a)	
	Area	*Proportion of total MDB*	*Area*	*Proportion of total MDB*	*Area*	*Proportion of total MDB*	*Area*	*Proportion of total MDB*	*Area*	*Proportion of total MDB*
	'000 ha	%	'000 ha	%	'000 ha	%	'000 ha	%	'000 ha	%
Pasture for dairy farming(b)	40	15	226	82	3	1	7	3	276	100
Pasture for other livestock(b)	243	55	174	40	15	3	8	2	441	100
Rice	101	99	1	1	—	—	—	—	102	100
Cereals (excl. rice)	252	77	39	12	37	11	2	—	329	100
Cotton	169	68	—	—	78	32	—	—	247	100
Grapes	39	37	33	32	1	1	32	30	106	100
Fruit (excl. grapes)	24	32	32	43	5	6	14	19	75	100
Vegetables	13	40	8	24	4	13	8	24	32	100
Other agriculture(c)	32	71	9	19	4	8	1	2	46	100
Total Agriculture(a)	**913**	**55**	**522**	**32**	**147**	**9**	**71**	**4**	**1 654**	**100**

— nil or rounded to zero (including null cells)

(a) Components may not add to total due to rounding.

(b) Includes irrigated pasture for grazing, hay and seed.

(c) Includes other broadacre crops, nurseries, livestock (other than dairy) drinking.

Source: Water use on Australian farms 2005–06; ABS data available on request, Agricultural Census, 2005–06

3.3 WATER CONSUMPTION, by agricultural commodity and Basin state—Murray-Darling Basin—2005–06

	NSW/ACT		VIC.		QLD		SA		TOTAL MDB(a)	
	Volume	*Proportion of total MDB*	*Volume*	*Proportion of total MDB*	*Volume*	*Proportion of total MDB*	*Volume*	*Proportion of total MDB*	*Volume*	*Proportion of total MDB*
	GL	%	GL	%	GL	%	GL	%	GL	%
Dairy farming(b)	167	13	1 057	82	9	1	54	4	1 287	100
Pasture for other livestock(c)	678	53	521	41	51	4	33	3	1 284	100
Rice	1 239	99	13	1	—	—	—	—	1 252	100
Cereals (excl. rice)	617	79	84	11	77	10	4	1	782	100
Cotton	1 128	72	—	—	447	28	—	—	1 574	100
Grapes	178	35	180	35	3	1	154	30	515	100
Fruit (excl. grapes)	125	30	165	40	7	2	116	28	413	100
Vegetables	59	39	37	24	10	7	45	30	152	100
Other agriculture(d)	295	64	79	17	66	14	20	4	461	100
Total Agriculture(a)	**4 487**	**58**	**2 136**	**28**	**671**	**9**	**426**	**6**	**7 720**	**100**

— nil or rounded to zero (including null cells)

(a) Components may not add to total due to rounding.

(b) Includes: irrigated pasture for grazing, hay and seed; livestock drinking; and, shed washdown.

(c) Includes irrigated pasture for grazing, hay and seed.

(d) Includes other broadacre crops, nurseries, livestock (other than dairy) drinking.

Source: Source: Water use on Australian farms 2005–06; ABS data available on request, Agricultural Census, 2005–06

Electricity and gas

Water is an essential production input for the Electricity and gas industry. Water is used for cooling processes during electricity generation within coal or natural gas power stations. This is an example of consumptive water use by the Electricity and gas industry. Water is also used non-consumptively (in-stream use) during hydro-electricity generation when water is extracted from a storage facility, then immediately discharged after passing through generating turbines. In the Snowy Mountains region of the MDB, water is diverted from outside the Basin via several storage dams, and then discharged into the MDB through a series of tunnels, dams and generating stations (Snowy Hydro 2007).

In 2004–05, approximately 3% of Australia's electricity and 33% of the nation's hydro-electricity was generated in the MDB. Hydro-electricity represented the bulk of the Basin's generated electricity. Approximately 15,900 GL of water was used (non-consumptively) in the MDB to generate 5,209 GWh of hydro-electricity (tables 3.4 and 3.5). The volume of water used in the MDB represented 27% of Australia's hydro-electricity (in-stream) water use. Two-thirds of the water used was in New South Wales, and one-third in Victoria.

3.4 HYDRO-ELECTRICITY GENERATORS' IN-STREAM WATER USE, by Basin state—2004–05

	GL
New South Wales	10 271
Victoria	5 581
Queensland	—
South Australia	—
Murray-Darling Basin	***15 852***
Australia	**57 867**

— nil or rounded to zero (including null cells)

Source: ABS data available on request, Water Account

3.5 ELECTRICITY GENERATED—2004–05

	GWh
Hydro-electricity	
Murray-Darling Basin	5 209
Australia	15 991
Total electricity - Australia	**194 471**

Source: ABS data available on request, Water Account.

Water supply industry

Minimising losses from water storage and delivery infrastructure is a fundamental aspect of national and MDB-specific water policies (see Appendix). The effectiveness of such policies can be assessed by evaluating whether the share of the entire economy's water consumption represented by water losses reduces over time.

Apart from Agriculture, the largest source of industry and household water consumption in the MDB was water lost or unaccounted for during delivery from water supply sources to end-users (accounting for 13% of total water consumption in the MDB). Water losses can result from evaporation, channel seepage, pipe leakage or bursts, mains flushing, and water meter errors. The standard water accounting convention, according to the System of Environmental and Economic Accounting for Water (UN 2006), is to attribute this consumption to the water supply industry. This industry includes both urban and irrigation water suppliers.

In 2004–05, water consumption by the water supply industry in the MDB (1,246 GL) accounted for 60% of Australia's total water supply industry consumption. This is because four of the five largest irrigation water suppliers in Australia (by delivery volume) operate in the MDB (ANCID 2007). Irrigation water suppliers in Australia lose more water (23% of total distributed water) than urban suppliers (12%) (ABS 2006a).

Most water consumption by the water supply industry in the MDB occurred in Victoria (53%) and New South Wales (39%) (table 3.6).

3.6 WATER SUPPLY INDUSTRY WATER CONSUMPTION, by state/territory—2004–05

	WATER CONSUMPTION		MDB WATER CONSUMPTION AS A PROPORTION OF	
	MDB	*Total state/Aust.*	*Total MDB*	*Total state/Aust.*
	GL	GL	%	%
New South Wales	486	631	39	77
Victoria	657	793	53	83
Queensland	83	426	7	20
South Australia	15	71	1	21
Australian Capital Territory	5	5	—	100
Total	**1 246**	(a) **2 083**	**100**	(a) **60**

— nil or rounded to zero (including null cells)

(a) Includes water consumption by WA, Tas. and NT.

Source: ABS data available on request, Water Account

Mining

Water is important for mining operations to facilitate the transport, flotation, grinding and separation of minerals (Norgate & Lovel 2004), as well as dust suppression. Water consumption by Mining in the MDB represented an insignificant proportion of MDB water consumption (0.2%) in 2004–05. As a proportion of all water consumption by the Mining industry, the MDB had a relatively minor contribution (5% or 20 GL). Of this, most (78%) occurred in the New South Wales section of the Basin (table 3.7). Of the businesses engaged in Mining in the MDB, metal ore mining businesses consumed the most water.

3.7 MINING WATER CONSUMPTION, by state/territory—2004–05

	WATER CONSUMPTION		MDB WATER CONSUMPTION AS A PROPORTION OF	
	MDB	*Total state/Aust.*	*Total MDB*	*Total state/Aust.*
	GL	GL	%	%
New South Wales	16	63	78	25
Victoria	2	32	11	7
Queensland	2	83	9	2
South Australia	—	19	1	2
Australian Capital Territory	—	—	1	100
Total(a)	**20**	(b)**413**	**100**	(b)**5**

— nil or rounded to zero (including null cells)
(a) Components may not add to total due to rounding
(b) Includes water consumption by WA, Tas. and NT.
Source: ABS data available on request, Water Account

Manufacturing

Water is used in Manufacturing for a variety of purposes including cooling, cleaning, as a solvent, and as a food or beverage constituent. The types of manufacturing businesses which use the highest volumes of water in the MDB include pulp and paper mills, abattoirs and other food manufacturing, dairy factories and breweries. Like Mining, water consumption by Manufacturing in the MDB was an insignificant proportion of overall MDB water consumption (0.6%) in 2004–05. Compared with Australia, MDB Manufacturing water consumption was also relatively minor (9%). Most occurred in the New South Wales (56%) and Victoria (28%) sections of the MDB (table 3.8).

3.8 MANUFACTURING WATER CONSUMPTION, by state/territory—2004–05

	WATER CONSUMPTION		MDB WATER CONSUMPTION AS A PROPORTION OF	
	MDB	*Total state/Aust.*	*Total MDB*	*Total state/Aust.*
	GL	GL	%	%
New South Wales	30	126	56	24
Victoria	15	114	28	13
Queensland	5	158	9	3
South Australia	3	55	5	5
Australian Capital Territory	1	1	1	100
Total(a)	**53**	(b)**589**	**100**	(b)**9**

(a) Components may not add to total due to rounding.
(b) Includes water consumption by WA, Tas. and NT.
Source: ABS data available on request, Water Account

Other industries

Water is also important for other industries operating in the MDB. These include, but are not limited to: local, state and commonwealth governments, service industries, restaurants, motels, schools and hospitals. Water is used for activities such as irrigating parks, gardens and sporting fields, for fire fighting, filling swimming pools and laundry operation. When describing water consumption, collectively these are referred to as "Other industries".

Although the quantity of water consumption by each of the "Other industries" cannot be disaggregated due to data quality issues, collectively these industries accounted for 1.6% of the total water consumption in the MDB in 2004–05.

Households

Households accounted for only 2% of MDB water consumption in 2004–05. Household water consumption in the MDB (189 GL) accounted for 9% of water consumption by all Australian households in 2004–05 (table 3.9). This is consistent with the proportion of total population living in the MDB (10% in 2006).

The majority of MDB household water consumption was in New South Wales (36%), followed by Victoria (28%), and the Australian Capital Territory (16%), which reflects the population distribution of the MDB (see Chapter 2). However, per capita water consumption varied across the Basin states and was highest in Queensland (119 kilolitres/person), and lowest in New South Wales (88 kilolitres/person) (table 3.10).

3.9 HOUSEHOLD WATER CONSUMPTION, by state/territory— 2004–05

	WATER CONSUMPTION		MDB WATER CONSUMPTION AS A PROPORTION OF	
	MDB	*Total state/Aust.*	*Total MDB*	*Total state/Aust.*
	GL	GL	%	%
New South Wales	68	573	36	12
Victoria	52	405	28	13
Queensland	26	493	14	5
South Australia	11	144	6	8
Australian Capital Territory	31	31	16	100
Total(a)	**189**	(b)**2 108**	**100**	(b)**9**

(a) Components may not add to total due to rounding
(b) Includes water consumption by WA, Tas. and NT.
Source: ABS data available on request, Water Account

3.10 HOUSEHOLD WATER CONSUMPTION, per household and per capita—2004–05

	Water consumption (GL)	*kL/household*	*kL/capita*
Murray-Darling Basin			
New South Wales	68	227	88
Victoria	52	233	91
Queensland	26	314	119
South Australia	11	253	101
Australian Capital Territory	31	252	96
Total(a)	189	244	94
Australia	**2 108**	**268**	**103**

(a) Components may not add to total due to rounding.
Source: Australian Demographic Statistics, Dec 2005 (cat. no. 3101.0); ABS data available on request, Water Account

AGRICULTURAL WATER CONSUMPTION

This section of the chapter provides a detailed analysis of Agricultural water consumption in the MDB and covers four topics:

- water sources used for agricultural activity;
- changes in agricultural water consumption over time;
- regional agricultural water consumption; and
- irrigation practices in the MDB.

Water Sources

The source of water used for agricultural production is of interest to policy makers and water resource managers (see Appendix). Issues that are of particular interest include:

- whether water sources (e.g. groundwater) are being overused relative to the volume of available water;
- the location of high and low levels of surface or groundwater consumption;
- change in the levels of surface and groundwater consumption, and change in the ratio of surface to groundwater consumption;
- the degree of water connectivity between surface and groundwater systems; and,
- the replacement of existing sources (e.g. surface or groundwater) with the use of alternative or 'new' water sources (e.g. recycled water).

SURFACE AND GROUNDWATER SOURCES

In 2005–06, the majority of water consumption by the Agriculture industry in the MDB originated from two main sources: surface water (6,499 GL) and groundwater (1,069 GL) (table 3.11). Combined, these two sources accounted for 98% of all water consumed for agricultural production in the Basin: 84% surface water, 14% groundwater. Other sources accounting for the remaining 2% of water consumption included recycled or reused water from off-farm sources and reticulated mains supply.

Although 14% of all agricultural water consumption inside the MDB was sourced from groundwater, areas outside the MDB were more reliant on groundwater, with 33% of water consumption originating from this source.

As shown in table 1.9 the long-term average annual run-off (23,609 GL) and deep drainage (9,719 GL) produce the long-term average annual water availability in the MDB of 33,328 GL. In 2005–06, Agriculture water consumption was 7,720 GL (table 3.11), or 23% of the long-term water availability in the MDB. Nation-wide, agricultural water consumption (11,689 GL) represents 3% of Australia's long-term water availability (413,264 GL).

As a proportion of the long-term average annual run-off in the MDB (table 1.9), surface water consumption by Agriculture represented 28% in 2005–06. In contrast, groundwater consumption (1,069 GL) represented 11% of the long-term average annual deep drainage.

3.11 AGRICULTURAL WATER CONSUMPTION, by source—Murray-Darling Basin—2005–06

	SURFACE WATER		GROUNDWATER		OTHER SOURCES(a)		TOTAL WATER CONSUMPTION	
		Proportion of total water consumption		*Proportion of total water consumption*		*Proportion of total water consumption*		*Proportion of total water consumption*
	GL	%	GL	%	GL	%	GL	%
Murray-Darling Basin								
New South Wales	3 680	82	762	17	44	1	4 486	100
Victoria	1 923	90	151	7	62	3	2 136	100
Queensland	550	82	109	16	12	2	671	100
South Australia	345	81	47	11	34	8	426	100
Australian Capital Territory	1	87	—	3	—	10	1	100
Total	***6 499***	***84***	***1 069***	***14***	***152***	***2***	***7 720***	***100***
Balance of Australia	2 498	63	1 323	33	148	4	3 969	100
Australia	**8 997**	**77**	**2 392**	**20**	**300**	**3**	**11 689**	**100**

— nil or rounded to zero (including null cells)
(a) Includes recycled/reuse water and town or country reticulated mains supply.

Source: Water use on Australian farms, 2005–06 (cat. no. 4618.0)

Water Sources continued

LOCATION OF SURFACE AND GROUNDWATER USE

In 2005–06, the majority of surface water consumption by the Agriculture industry in the MDB was in New South Wales (57%) and Victoria (30%). Over 70% of the 1,069 GL of groundwater consumption in the MDB occurred in New South Wales (table 3.12). A relatively low volume of groundwater (150 GL or 14%) was extracted for consumption by the Agriculture industry in the Victoria section of the Basin.

3.12 AGRICULTURAL WATER CONSUMPTION, by source and Basin state—Murray-Darling Basin—2005–06

	SURFACE WATER		GROUNDWATER	
	Water consumption	*Proportion of MDB*	*Water consumption*	*Proportion of MDB*
	GL	%	GL	%
New South Wales	3 680	57	762	71
Victoria	1 923	30	151	14
Queensland	550	8	109	10
South Australia	345	5	47	4
Australian Capital Territory	1	—	—	—
Murray-Darling Basin(a)	**6 499**	**100**	**1 069**	**100**

— nil or rounded to zero (including null cells)
(a) Components may not add to total due to rounding.
Source: Water use on Australian farms, 2005–06 (cat. no. 4618.0)

River basin scale measurement of water use from surface and groundwater sources is important for water management and planning agencies, because water management plans and water resource assessments commonly report at this level. Of the approximately 6,500 GL sourced from surface water in the MDB in 2005–06, most was from the Murrumbidgee (1,446 GL), Murray-Riverina (850 GL), Loddon (643 GL) and

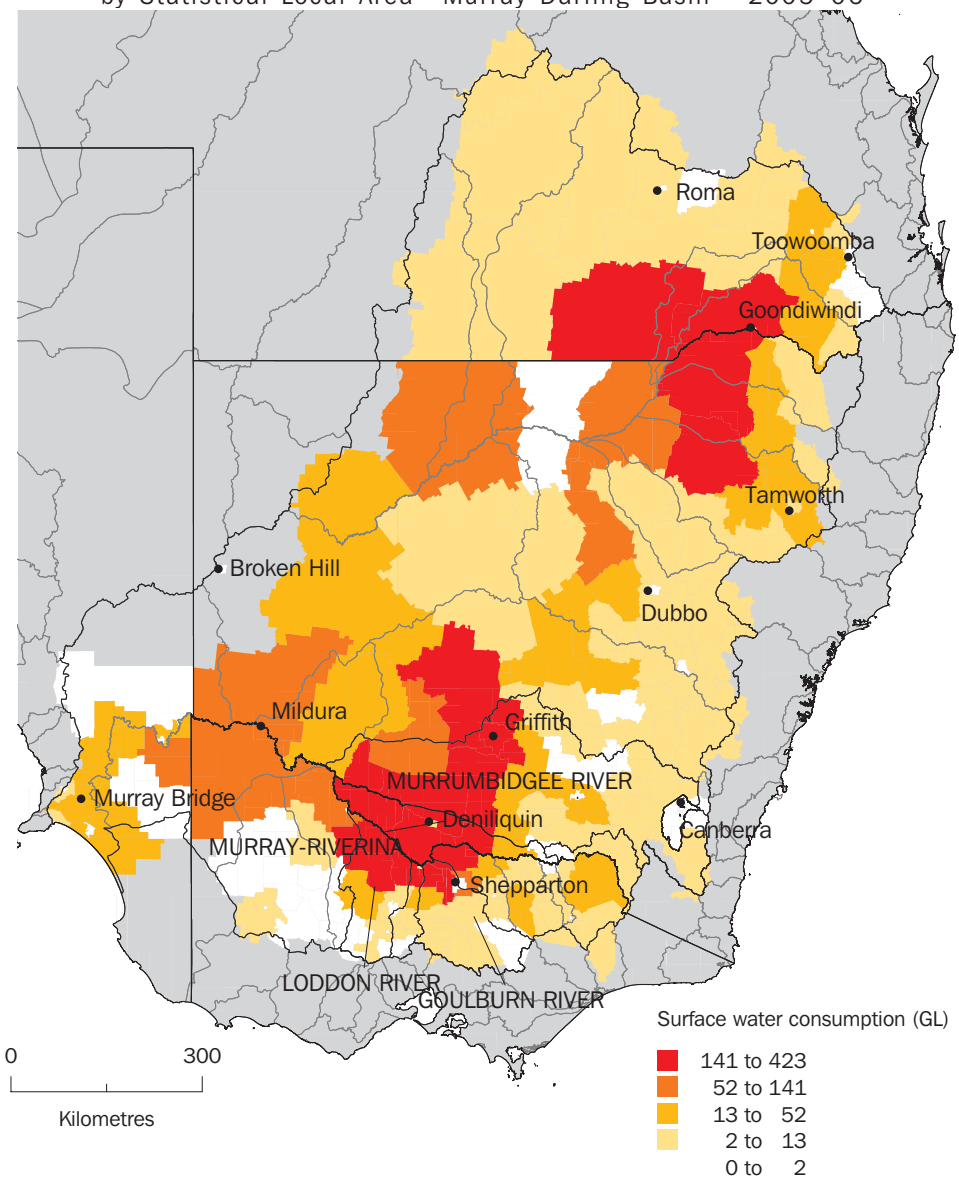
Water Sources continued

LOCATION OF SURFACE AND GROUNDWATER USE *continued*

Goulburn (417 GL) river basins (table 3.14). These are also the basins with the highest total agricultural water consumption.

Map 3.13 illustrates the volumes of surface water used for agricultural production in MDB Statistical Local Areas (SLAs, see map E.2 in the Explanatory Notes) in 2005–06. The data was sourced from the ABS Agricultural Census. This level of geography has been used to provide a more detailed picture of the distribution of surface water consumption relative to river basins in the MDB. The pattern demonstrates that in 2005–06, surface water was consumed in most Basin SLAs, and that the highest quantities of water consumption were in SLAs in the southern and northern MDB.

3.13 AGRICULTURAL SURFACE WATER CONSUMPTION IN RIVER BASINS, by Statistical Local Area—Murray-Darling Basin – 2005–06



Source: ABS data available on request, ABS Agricultural Census 2005–06, Geoscience Australia 2004

Water Sources continued

LOCATION OF SURFACE AND GROUNDWATER USE *continued*

In 2005–06, groundwater accounted for 14% (or 1,069 GL) of agricultural water consumption in the MDB. Most of the water sourced from groundwater in the Basin occurred in the Murrumbidgee (218 GL), Namoi (185 GL) and Lachlan (144 GL) river basins (table 3.14). Groundwater was a more important water source to farmers in the Namoi and Lachlan river basins than other river basins (contributing 41% and 38% of total water consumption respectively). Within these river basins, groundwater consumption was spread across the Namoi river basin SLAs, while for the Murrumbidgee and Lachlan river basins, most groundwater consumption occurred in the SLAs located in the lower regions (see map 3.15 sourced from the 2005–06 Agricultural Census).

3.14 AGRICULTURAL WATER CONSUMPTION IN SELECTED RIVER BASINS, by source—Murray-Darling Basin—2005–06

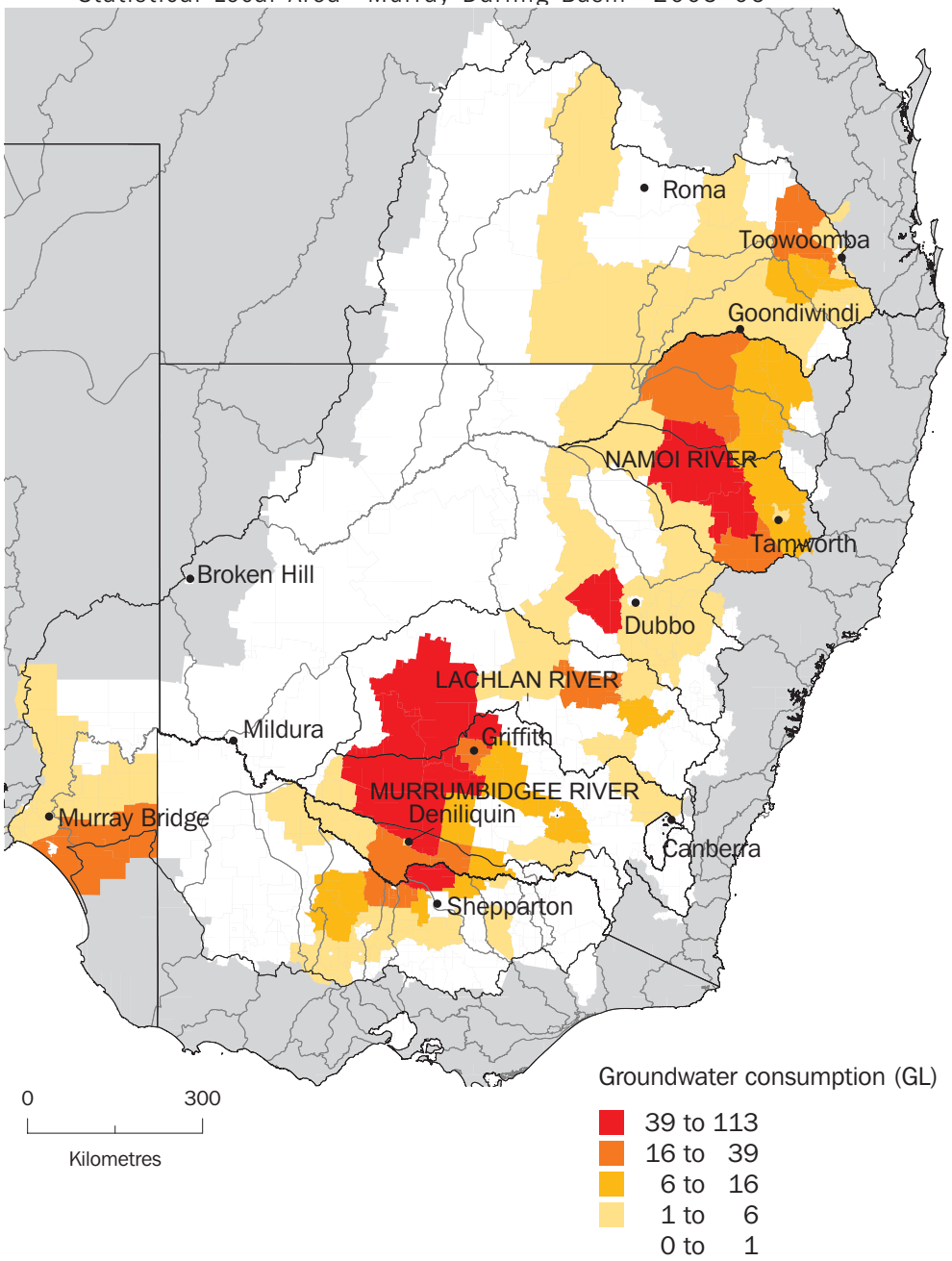
	SURFACE WATER		GROUNDWATER		OTHER SOURCES(a)		TOTAL WATER CONSUMPTION	
	Volume	*Proportion of total water consumption*	*Volume*	*Proportion of total water consumption*	*Volume*	*Proportion of total water consumption*	*Volume*	*Proportion of total water consumption*
	GL	%	GL	%	GL	%	GL	%
Murrumbidgee	1 446	86	218	13	14	1	1 678	100
Murray-Riverina	850	90	91	10	5	1	946	100
Loddon	643	95	25	4	13	2	681	100
Broken	399	85	58	12	12	2	470	100
Goulburn	417	90	31	7	16	3	464	100
Namoi	260	57	185	41	12	3	456	100
Condamine-Culgoa	335	76	99	22	7	2	441	100
Lachlan river	233	61	144	38	2	1	380	100
Macquarie-Bogan	180	73	66	27	1	—	246	100
Other river basins	1 735	89	153	8	70	4	1 959	100
Murray-Darling Basin(b)	**6 499**	**84**	**1 069**	**14**	**152**	**2**	**7 720**	**100**

— nil or rounded to zero (including null cells)

(a) Includes recycled/reuse water and town or country reticulated mains supply.

(b) Components may not add to total due to rounding.

3.15 AGRICULTURAL GROUNDWATER CONSUMPTION IN RIVER BASINS, by Statistical Local Area—Murray-Darling Basin—2005–06



Water Sources continued

CHANGE IN WATER SOURCES

Comparable agricultural surface and groundwater consumption data are not available for the MDB before 2005–06. However, as table 3.16 shows, of the total state surface and groundwater consumption, the MDB section of New South Wales accounts for 94% of both sources. Therefore, assessing the change in surface and groundwater consumption in New South Wales between 2004–05 and 2005–06 would be indicative of the change in the New South Wales section of the MDB. In other states (Victoria, Queensland and South Australia), the proportion of surface and groundwater consumption in the MDB as a proportion of the total state, are lower. Therefore, assessing the change in surface and groundwater consumption in those states is less indicative of the change in the MDB section of each respective state.

Water Sources continued

CHANGE IN WATER SOURCES *continued*

3.16 AGRICULTURAL WATER CONSUMPTION, by source—2005–06

	SURFACE WATER			GROUNDWATER		
	MDB	*Total state/territory*	*MDB as a proportion of total state/territory*	*MDB*	*Total state/territory*	*MDB as a proportion of total state/territory*
	GL	GL	%	GL	GL	%
New South Wales	3 680	3 921	94	762	810	94
Victoria	1 923	2 254	85	151	297	51
Queensland	550	1 853	30	109	674	16
South Australia	345	448	77	47	459	10
Australian Capital Territory	1	1	100	—	—	—

— nil or rounded to zero (including null cells)

Source: ABS data available on request, Agricultural Census, 2005–06

The change in surface and groundwater consumption in New South Wales from 2004–05 to 2005–06 is shown in table 3.17. The volume of groundwater extracted by farmers decreased from almost 950 GL (25% of total water consumption) in 2004–05 to 810 GL (or 17%) in 2005–06. The decrease in groundwater used as a water source coincides with an increase in surface water consumption; from almost 2,800 GL (73% of total water consumption) to over 3,920 GL (or 82%).

One hypothesis for this trend is when more water is available for use from surface water storages (e.g. as in 2005–06, see graph 3.18) farmers use less groundwater for agricultural purposes. Conversely, when less surface water is available as a result of lower allocations induced by reduced water storage, (for example, in 2004–05), more groundwater is used. Although the data to support this hypothesis are limited, it would be expected that for 2006–07, when surface water storages were very low in the MDB, there may be some increase in the use of groundwater by farmers. Data which would enable this comparison are expected to be available in *Water Use on Australian farms, 2006–07* (ABS cat. no. 4618.0) in the near future.

3.17 AGRICULTURAL WATER CONSUMPTION IN NEW SOUTH WALES, by source—2004–05 and 2005–06(a)

	2004–05			2005–06		
	Surface water	*Groundwater*	*Total water consumption*(b)	*Surface water*	*Groundwater*	*Total water consumption*(b)
Volume (GL)	2 797	949	3 810	3 921	810	4 795
Proportion of total water consumption (%)	73	25	100	82	17	100

(a) Care should be taken when comparing volumetric water source data between years, due to changes in statistical methodologies, changes in survey frames, and sampling error. Climatic conditions should also be taken into account. Percentages should provide a more indicative estimate.

(b) Includes other sources.

Source: Water Use on Australian Farms, 2004–05 and 2005–06, (cat. no. 4618.0)

CHANGE IN AGRICULTURAL WATER USE OVER TIME

The volume of water used by different agricultural crops and pastures varies from year to year for a number of reasons. These include:

- level of rainfall;
- volume of water available for allocation during an irrigation season;
- technological improvements in irrigation infrastructure;
- water trading;
- input costs (e.g. water, petrol, fertiliser etc.); and
- commodity prices.

When water availability is high, for example, when water storage is elevated, high water allocations (or some equivalent) are typically announced by water management authorities and farmers decide how to use the available water. For example, cropping farmers might choose to plant relatively large areas of annual crops like rice and cotton which require more water per unit area.

When water availability is low, water management authorities announce lower allocations (or some equivalent) and irrigators are faced with decisions about how to manage the limited water resource. Cropping farmers might choose to switch from crops that typically use more water (e.g. rice - 12 ML/ha in 2005–06, see table 3.22) to alternatives which use relatively less (for example, cereals other than rice - 2 ML/ha). Alternatively, they might decide to trade some or all of their allocation and/or not sow a crop.

When there is low water availability, farmers with perennial plantings like fruit and grapes stand to lose not only their annual crop, but their assets of trees or vines if they decide not to irrigate. If their water allocation at the beginning of an irrigation season is insufficient to produce a grape or fruit crop, they may choose to purchase additional water or sacrifice their harvest to preserve their trees or vines.

Pasture and cereals are also irrigated to feed livestock, either from direct grazing or through hay/silage production. When relatively less water is available and adequate pasture or cereals cannot be grown to sustain livestock, farmers may need to purchase additional livestock feed, sell their livestock, or agist them elsewhere which has additional costs.

Technical efficiency refers to the economic value added for a given amount of water. For irrigators, technical efficiency is influenced by factors like wastage, evaporation, and production technologies (The Treasury: Roberts, Mitchell & Douglas 2006). To improve the technical efficiency of on-farm irrigation, improvements in technology, infrastructure and water management practices are required. A change in technical efficiency can be measured through monitoring water application rates over time, and taking account of climatic conditions (e.g. rainfall). This can be supplemented through assessing the irrigator uptake of more efficient technologies and practices (see 'Irrigation practices' section later in this chapter).

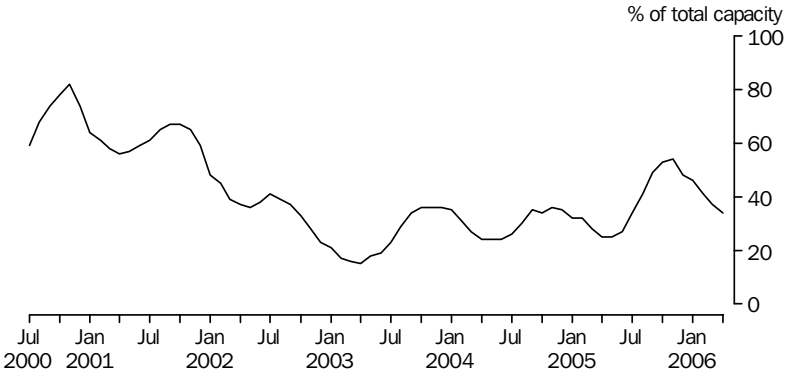
The following section examines water availability and the related change in water consumption, irrigated area and application rates by different crops and pasture between 2000–01 and 2005–06. As an indicator of surface water availability, water storage in large dams situated within the MDB has been plotted over the same period for comparison with water consumption change. Rainfall anomalies from 2000–01 to 2005–06 have been presented in Chapter 1.

Water storage in the MDB, July 2000 – June 2006

Large dams are defined as dams with a crest or wall height of greater than 15 metres, or as dams with a dam wall height of greater than 10 metres while also meeting another size criteria e.g. having a crest more than 500 metres in length; creating a reservoir of no less than 1,000 ML; the ability to deal with a flood discharge of no less than 2,000 cubic metres per second; or being of unusual design (ANCOLD 2008). Using this definition there are 105 large dams in the MDB (see map E.3 in the Explanatory Notes) with a storage capacity of 24,365 GL.

As shown in graph 3.18, water storage in large dams located in the MDB was relatively high between July 2000 and December 2001 (greater than 50% for this 18 month period). From January 2002, the combined storage level in large dams in the MDB did not increase above 50% except for a brief period in late 2005. There is a pattern of increased storage in the winter and spring months of almost every year. However, the amplitude and duration of water storage increase varies, and this impacts on the volume in storage. It is difficult to determine the relative impacts on storage of evaporation, water use and water transfer for management purposes between large dams.

3.18 WATER STORAGE (a), Murray-Darling Basin—July 2000 to June 2006



(a) In large dams.

Source: ABS data available on request, Water Account

Crop irrigation in the MDB

IRRIGATED PASTURE FOR DAIRY AND OTHER LIVESTOCK

Irrigated pasture uses more water than any other crop or pasture grown throughout Australia (3,800 GL or 36% of water used for irrigating crops or pasture in 2005–06, see *Water Use on Australian Farms 2005–06*, ABS cat. no. 4618.0). The MDB grew 67% of Australia's irrigated pasture (by area) in 2005–06. In addition, irrigated pasture consumed more water (2,537 GL) than any irrigated crop or pasture in the MDB. Irrigated pasture in the MDB is mainly used for grazing livestock (1,981 GL) and cutting for hay or silage (531 GL).

The area of irrigated pasture fluctuates from year to year. For example, the area of irrigated pasture in the MDB decreased from 760,000 ha in 2000–01, to 551,000 ha in 2002–03, and increased to 718,000 ha in 2005–06 (table 3.21).

In 2005–06, the Dairy industry accounted for 39% of the total irrigated area of pasture in the MDB. Water was used by dairy farmers for irrigating pasture for grazing, hay/silage and seed production, livestock drinking, and dairy shed washdown - in total 1,287 GL, or 17% of MDB agricultural water consumption (table 3.20). A similar quantity of water (1,284 GL) was used to irrigate pasture for other livestock in 2005–06, and accounted for 17% of the total agricultural water consumption in the MDB.

Dairy farming water consumption fluctuates to some degree from year to year. For example, water consumption decreased from 1,693 GL in 2000–01 to 1,227 GL in 2002–03 (table 3.20). From 2002–03 to 2005–06 the volume of water consumption did not reach the 2000–01 level. The proportion of agricultural water used for dairy farming in the MDB fluctuated between 15%–19% over the period from 2000–01 to 2005–06 (table 3.20). This was relatively less than for annual crops like rice (9%–23%), cotton (17%–26%) and cereals other than rice (7%–17%).

Between 2000–01 and 2005–06, the variation in water consumption by pasture for other livestock, (and the proportion of agricultural water used), exhibited a similar pattern to dairy farming.

Water was irrigated onto pasture with an application rate of 3.5 ML/ha, less than the average rate for all crops/pasture (4.5 ML/ha) in 2005–06 (table 3.22). This rate was lower than in 2000–01 (4.2 ML/ha).

COTTON

The MDB grew about 92% of Australia's irrigated cotton (by area) in 2005–06. In addition, cotton was consistently the crop with the highest water consumption in the MDB from 2000–01 to 2005–06. Cotton water consumption was almost 1,600 GL in 2005–06 (table 2.20).

Cotton water consumption fluctuates significantly from year to year, and the area of crop grown is dependent on water availability (see graph 3.19). In 2000–01, when water storage was relatively high in large dams servicing cotton growing areas in northern New South Wales and southern Queensland, the area of irrigated cotton (405,000 ha, table 3.21), volume of water consumption (2,599 GL, table 3.20), and proportion of agricultural water consumption in the MDB (25%) were all high. In 2003–04, when there was lower water storage, less irrigated cotton was planted (174,000 ha), a lower volume of water was consumed (1,186 GL), and the proportion of agricultural water

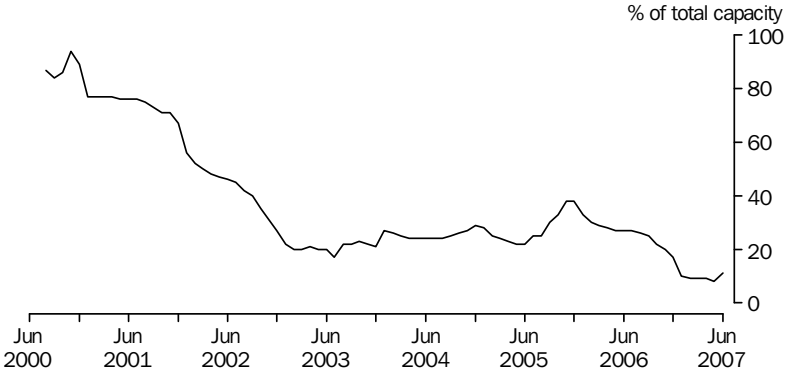
Crop irrigation in the MDB continued

COTTON *continued*

consumption accounted for by this crop dropped to 17%. Within large dams servicing cotton growing areas, the lowest water storage levels in the seven years to June 2007 were recorded in the six months between January and June 2007 (graph 3.19). This indicates that water consumption, area irrigated, and production were very low in 2006–07.

Water was irrigated onto cotton at a rate of 6.4 ML/ha in 2005–06, the second highest application rate of the major irrigated crops and pasture (table 3.22). This rate was lower than for the previous two years when the highest rates were recorded (6.8 ML/ha). As outlined above, in 2003–04, water availability was very low. Because there was less rainfall to supplement irrigated cotton, more irrigation water was required.

3.19 WATER STORAGE IN LARGE DAMS (a), Cotton growing regions—Murray-Darling Basin—2000–2007



(a) Large dams servicing cotton growing regions.

Source: ABS data avaialble on request, Water Account

RICE AND OTHER CEREALS

In 2005–06, all of Australia's rice and the vast majority (88%) of other irrigated cereals (hereafter referred to as 'cereals') were grown in the MDB. Between 2000–01 and 2005–06, more water was consumed by rice and cereal crops than by fruit, grapes or vegetables, but less than by pasture or cotton (table 3.20).

The volume of water applied to rice and cereals fluctuated significantly during the 2000–01 to 2005–06 period. The pattern of water consumption for both crops between 2000–01 and 2005–06 coincided with the change in water availability over the same period. When there was more water stored in large dams (e.g. in 2000–01, graph 3.18), water consumption for rice was higher relative to other years (table 3.20). However, when water availability was restricted, rice water consumption decreased. The opposite trend applies to irrigated cereals i.e. when water availability was restricted (e.g. 2002–03), water consumption was relatively higher than in years when water storage was high (e.g. 2000–01). This suggests there is crop substitution by irrigators depending on relative application rates (rice 12–14 ML/ha, cereals 2–3 ML/ha) and water availability from season to season.

Irrigation application rates of cereals appear to have decreased slightly from 2000–01 to 2005–06 (table 3.22). Of the major crops and pasture irrigated, cereals are irrigated with

Crop irrigation in the MDB continued

RICE AND OTHER CEREALS *continued*

the lowest application rate. By contrast, rice requires the highest application rate of water. Since 2002–03, rice farmers have significantly reduced the application rate of that crop from 14.1 ML/ha to 12.3 ML/ha in 2005–06.

GRAPES

The MDB grew the majority of Australia's irrigated grapes - 58% of Australia's irrigated area of grapes, in 2005–06. Grape growing consumed 515 GL of water in 2005–06 (table 3.20). From 2000–01 to 2005–06 significantly less water was irrigated onto grapes than onto pasture, cotton, rice or cereals, but more than for fruit or vegetables.

Being a perennial crop, the volume of water applied to grapes tends not to fluctuate from year to year to the extent of annual crops such as rice, cotton or cereals. The proportion of water used to grow grapes in the MDB compared to other agricultural commodities increased slightly between 2000–01 and 2005–06, from 4% to 7% of MDB agricultural water consumption. The volume of water applied (469 to 515 GL), gradually increased between 2000–01 and 2005–06 in the MDB (table 3.20). This is consistent with the increase in area of irrigated grapes over the same period (84,000 to 106,000 ha, table 3.21).

The irrigation application rate for grapes was relatively consistent between 2000–01 and 2004–05 (at around 5.5 ML/ha), however it decreased to 4.9 ML/ha in 2005–06. This application rate was lower than for rice, cotton and fruit, but higher than for cereals and pasture (table 3.22).

FRUIT

The MDB grew just over half of Australia's irrigated fruit - 53% of Australia's irrigated area, in 2005–06. Irrigated fruit consumed 413 GL of water in 2005–06, and between 2000–01 and 2005–06 consumed less water than most crops except vegetables (table 3.20).

Like grapes, irrigated fruit crops are perennial therefore require relatively regular annual volumes of water to sustain production. The proportion of water used by fruit in the MDB compared to other agricultural commodities remained relatively constant (approximately 5% of MDB agricultural water consumption) between 2000–01 and 2005–06. The area of irrigated fruit (59,000 to 75,000 ha, table 3.21), and volume of water applied (372 to 413 GL, table 3.20) increased over this period.

The fruit irrigation application rate, ranging from 5.5 to 6.5 ML/ha, was more variable than that for grapes between 2000–01 and 2005–06 (table 3.22). This application rate was higher than for each major crop and pasture in the MDB except rice and cotton.

VEGETABLES

The MDB grew about 28% of Australia's area of irrigated vegetable crops in 2005–06. In the MDB, vegetables use less water than all of the major crops and pastures, just 2–3% of all agricultural water consumption between 2000–01 and 2005–06 (table 3.20).

In the MDB, the area of irrigated vegetables, and volume of water applied, both decreased slightly from 37,000 ha and 166 GL in 2000–01 to 32,000 ha and 152 GL in 2005–06 (tables 3.20 and 3.21).

Crop irrigation in the MDB continued

VEGETABLES *continued*

The irrigation application rate for vegetables was reasonably consistent, ranging between 4.3 and 4.9 ML/ha in the 2000–01 to 2005–06 period. These application rates are similar to the 2005–06 average application rate for all irrigated crops and pasture in the MDB (4.5 ML/ha, table 3.22).

OTHER CROPS AND LIVESTOCK

Other agriculture includes agricultural activities like the irrigation of other broadacre crops (e.g. oilseeds) and plant nurseries, the watering of livestock, and the washdown of stock enclosures, for example, piggeries. Dairy shed washdown and dairy livestock watering are excluded from this category, and instead are included within dairy farming. The quantity of water consumption by other agriculture is substantial and ranged from 460 GL to 596 GL in the period from 2000–01 to 2005–06 (table 3.20). The decrease observed in 2002–03 relative to other years reflects changes in livestock numbers.

3.20 WATER CONSUMPTION, by agricultural commodity—Murray-Darling Basin—2000–01 to 2005–06

	2000–01(a)	*2001–02*(a)	*2002–03*	*2003–04*	*2004–05*	*2005–06*
Water consumption (GL)						
Dairy farming(b)	1 693	1 546	1 227	1 319	1 277	1 287
Pasture for other livestock(c)	1 534	1 425	1 116	1 230	1 094	1 284
Rice	2 418	1 978	615	814	619	1 252
Cereals (excl. rice)	751	1 015	1 230	876	844	782
Cotton	2 599	2 581	1 428	1 186	1 743	1 574
Grapes	469	479	492	489	510	515
Fruit (excl. grapes)	372	389	424	382	399	413
Vegetables	166	152	143	194	152	152
Other agriculture(d)	514	504	475	596	564	460
Total Agriculture(e)	**10 516**	**10 069**	**7 150**	**7 087**	**7 204**	**7 720**
Proportion of total Agriculture water consumption (%)						
Dairy farming(b)	16	15	17	19	18	17
Pasture for other livestock(c)	15	14	16	17	15	17
Rice	23	20	9	11	9	16
Cereals (excl. rice)	7	10	17	12	12	10
Cotton	25	26	20	17	24	20
Grapes	4	5	7	7	7	7
Fruit (excl. grapes)	4	4	6	5	6	5
Vegetables	2	2	2	3	2	2
Other agriculture(d)	5	5	7	8	8	6
Total Agriculture(e)	**100**	**100**	**100**	**100**	**100**	**100**

(a) The 2000–01 and 2001–02 data are experimental estimates. Only the irrigated area of each commodity was directly collected from the census or survey (see Explanatory Notes).
(b) Includes: irrigated pasture for grazing, hay and seed; livestock drinking; and, shed washdown.
(c) Includes irrigated pasture for grazing, hay and seed.
(d) Includes other broadacre crops, nurseries, livestock (other than dairy) drinking, and piggery washdown.
(e) Components may not add to total due to rounding.

Crop irrigation in the MDB continued

OTHER CROPS AND LIVESTOCK *continued*

3.21 AREA IRRIGATED, by agricultural commodity—Murray-Darling Basin—2000–01 to 2005–06

	2000–01	*2001–02*	*2002–03*	*2003–04*	*2004–05*	*2005–06*
Pasture for dairy and other livestock farming(a)	760	707	551	669	703	717
Rice	178	145	44	65	51	102
Cereals (excl. rice)	260	354	416	340	324	329
Cotton	405	394	218	174	258	247
Grapes	84	86	89	87	92	106
Fruit (excl. grapes)	59	62	74	59	63	75
Vegetables	37	35	31	40	35	32
Other agriculture(b)	41	34	43	67	62	46
Total Agriculture(c)	**1 824**	**1 817**	**1 466**	**1 501**	**1 588**	**1 654**

(a) Includes: irrigated pasture for grazing, hay and seed.
(b) Includes other broadacre crops, nurseries.
(c) Components may not add to total due to rounding.
Source: Source: ABS data available on request, Agricultural Census, 2000–01 and 2005–06; Agricultural Surveys 2001–02 to 2004–05

3.22 IRRIGATION APPLICATION RATES, by crops and pasture—Murray-Darling Basin—2000–01 to 2005–06

	2000–01(a)	*2001–02*(a)	*2002–03*	*2003–04*	*2004–05*	*2005–06*
	ML/ha	ML/ha	ML/ha	ML/ha	ML/ha	ML/ha
Pasture for dairy and other livestock farming(b)	4.2	4.1	4.2	3.8	3.3	3.5
Rice	13.6	13.6	14.1	12.4	12.1	12.3
Cereals (excl. rice)	2.9	2.9	3.0	2.6	2.6	2.4
Cotton	6.4	6.6	6.5	6.8	6.8	6.4
Grapes	5.6	5.6	5.5	5.6	5.5	4.9
Fruit (excl. grapes)	6.3	6.3	5.7	6.5	6.3	5.5
Vegetables	4.5	4.4	4.6	4.9	4.3	4.7
Total crops and pasture	**5.5**	**5.3**	**4.6**	**4.5**	**4.3**	**4.5**

(a) The 2000–01 and 2001–02 data are experimental estimates. Refer to Explanatory Notes.
(b) Includes irrigated pasture for grazing, hay and seed.

Source: ABS data available on request, Agricultural Census, 2000–01 and 2005–06; Agricultural Surveys 2001–02 to 2004–05

REGIONAL WATER USE

The MDB is made up of 26 river basins (see map 1.2 in Chapter 1). River basins have topographically-formed catchment boundaries, and have been used in previous Australian water use assessments, such as the *1985 Review of Australia's Water Resources and Water Use* (AWRC 1987). Some organisations (e.g. Murray-Darling Basin Commission and Bureau of Rural Sciences) disseminate water data by river basin, for example, Water Audit Monitoring reports and National Landscape Water Balance reports and mapping.

The majority of agricultural water consumption in the MDB occurs in only a few river basins. In 2005–06, the ten river basins (of the 26) with the highest water consumption in the MDB accounted for 83% of MDB agricultural water consumption (table 3.23). This pattern reflects the distribution of specific irrigated crop and pasture areas throughout the MDB. The largest single contributing river basin is the Murrumbidgee, comprising 22% of the total MDB agricultural water consumption in 2005–06.

3.23 AGRICULTURAL WATER CONSUMPTION IN SELECTED RIVER BASINS—Murray-Darling Basin—2005–06

	Water consumption	*Proportion of MDB*
	GL	%
Murrumbidgee river	1 678	22
Murray-Riverina	946	12
Loddon river	681	9
Broken river	470	6
Goulburn river	464	6
Namoi river	456	6
Condamine-Culgoa rivers	441	6
Border rivers	433	6
Mallee	433	6
Lachlan river	380	5
Other MDB river basins	1 339	17
Murray-Darling Basin(a)	**7 721**	**100**

(a) Components may not add to total due to rounding
Source: ABS data available on request, Agricultural Census, 2005–06

Irrigated agricultural activities, and resulting water consumption, vary across different regions in the MDB. The following sections examine regions of the MDB that have high water consumption.

Southern New South Wales region of the MDB

In 2005–06 in the Murrumbidgee river basin, rice consumed the most water (45% of total agricultural water consumption), followed by other cereals (21%) and pasture for other livestock (15%). This pattern was similar in the Murray-Riverina basin where rice consumed the most water (43%). Pasture for other livestock (27%) and dairy farming (14%) were also significant agricultural water users (table 3.24) in this river basin.

Southern New South Wales region of the MDB continued

3.24 WATER CONSUMPTION, by agricultural commodity–selected southern New South Wales river basins—2005–06

	Murrumbidgee		Murray-Riverina	
	Volume	*Proportion of total Agriculture*	*Volume*	*Proportion of total Agriculture*
	GL	%	GL	%
Dairy farming(a)	10	1	135	14
Pasture for other livestock(b)	244	15	256	27
Rice	762	45	407	43
Cereals (excl. rice)	345	21	107	11
Grapes	93	6	6	1
Fruit (excl. grapes)	60	4	9	1
Vegetables	31	2	7	1
Other agriculture(c)	133	7	19	2
Total Agriculture(d)	**1 678**	**100**	**946**	**100**

(a) Includes: irrigated pasture for grazing, hay and seed; livestock drinking; and, shed washdown.
(b) Includes irrigated pasture for grazing, hay and seed.
(c) Includes cotton, other broadacre crops, nurseries, livestock (other than dairy) drinking.
(d) Components may not add to total due to rounding.
Source: ABS data available on request, Agricultural Census, 2005–06

Northern Victorian region of the MDB

In 2005–06, in the Victorian section of the southern MDB, dairy farming consumed the most water (53% to 65% of total agricultural water consumption in the Goulburn, Broken, Loddon and Campaspe river basins), followed by pasture for other livestock (21% to 32%, table 3.25).

3.25 WATER CONSUMPTION, by agricultural commodity—selected northern Victorian river basins—2005–06

	Loddon		Broken		Goulburn		Campaspe	
	Volume	*Proportion of total Agriculture*	*Volume*	*Proportion of total Agriculture*	*Volume*	*Proportion of total Agriculture*	*Volume*	*Proportion of total Agriculture*
	GL	%	GL	%	GL	%	GL	%
Dairy farming(a)	360	53	287	61	300	65	78	58
Pasture for other livestock(b)	220	32	124	26	98	21	33	24
Cereals (excl. rice)	46	7	12	2	9	2	7	5
Grapes	2	—	1	—	5	1	1	1
Fruit (excl. grapes)	23	3	37	8	20	4	1	1
Vegetables	9	1	1	—	8	2	8	6
Other agriculture(c)	21	3	9	2	24	5	6	4
Total Agriculture(d)	**681**	**100**	**470**	**100**	**464**	**100**	**134**	**100**

— nil or rounded to zero (including null cells)
(a) Includes:irrigated pasture for grazing, hay and seed; livestock drinking; and shed washdown.
(b) Includes irrigated pasture for grazing, hay and seed.
(c) Includes rice, other broadacre crops, nurseries, livestock (other than dairy) drinking.
(d) Components may not add to total due to rounding.
Source: ABS data available on request, Agricultural Census, 2005–06

South western Murray-Darling Basin

In 2005–06, in the Mallee and Lower Murray river basins (located in the 'Riverland' region of South Australia and north west Victoria), horticultural crops were the major water users. Grapes (50% and 39% respectively of total agricultural water consumption), fruit (31% and 18%) and dairy farming (3% and 17%) accounted for the majority of water consumption (table 3.26).

3.26 WATER CONSUMPTION, by agricultural commodity—selected lower Murray-Darling river basins—2005–06

	Mallee		Lower Murray River	
	Volume	*Proportion of total Agriculture*	*Volume*	*Proportion of total Agriculture*
	GL	%	GL	%
Dairy farming(a)	15	3	39	17
Pasture for other livestock(b)	14	3	23	11
Cereals (excl. rice)	3	1	3	2
Grapes	218	50	81	39
Fruit (excl. grapes)	133	31	39	18
Vegetables	38	9	14	7
Other agriculture(c)	11	2	12	6
Total Agriculture(d)	**433**	**100**	**211**	**100**

(a) Includes irrigated pasture for grazing, hay and seed; livestock drinking; and, shed washdown.
(b) Includes irrigated pasture for grazing, hay and seed.
(c) Includes other broadacre crops, nurseries, livestock (other than dairy) drinking, and piggery washdown.
(d) Components may not add to total due to rounding.
Source: ABS data available on request, Agricultural Census, 2005–06

Northern Murray-Darling Basin

In the northern MDB, cotton was the predominant agricultural water user in 2005–06. Cotton consumed the most agricultural water in the Border Rivers (81% of total agricultural water consumption), Condamine-Culgoa (63%), Gwydir (87%), and Namoi (74%) river basins. Water was also used to a limited degree for irrigating cereals other than rice, mainly in the Condamine-Culgoa (14%), Namoi (10%) and Border Rivers (5%) basins (table 3.27).

3.27 WATER CONSUMPTION, by agricultural commodity–selected northern Murray-Darling river basins—2005–06

	Namoi		Condamine-Culgoa		Border Rivers		Gwydir	
	Volume	*Proportion of total Agriculture*	*Volume*	*Proportion of total Agriculture*	*Volume*	*Proportion of total Agriculture*	*Volume*	*Proportion of total Agriculture*
	GL	%	GL	%	GL	%	GL	%
Dairy farming(a)	7	2	9	2	np	—	np	—
Pasture for other livestock(b)	35	8	34	8	26	6	np	np
Cereals (excl. rice)	47	10	62	14	23	5	11	3
Cotton	337	74	278	63	351	81	276	87
Grapes	np	—	2	—	np	—	np	—
Fruit (excl. grapes)	—	—	3	1	5	1	np	np
Vegetables	np	—	5	1	5	1	np	—
Other agriculture(c)	30	7	48	11	23	5	11	5
Total Agriculture(d)	**456**	**100**	**441**	**100**	**433**	**100**	**317**	**100**

— nil or rounded to zero (including null cells)

np not available for publication but included in totals where applicable, unless otherwise indicated

(a) Includes: irrigated pasture for grazing, hay and seed; livestock drinking; and, shed washdown.

(b) Includes irrigated pasture for grazing, hay and seed.

(c) Includes other broadacre crops, nurseries, livestock (other than dairy) drinking.

(d) Components may not add to total due to rounding.

Source: ABS data available on request, Agricultural Census, 2005–06

IRRIGATION PRACTICES

The following section describes a variety of irrigation management practices that irrigators in the MDB employed in 2004–05, using data from the ABS Natural Resource Management Survey. For further detail on MDB NRM regions, refer to Chapter 5, and map 5.1.

Irrigation occurred on approximately one-third (16,600) of farms within MDB Natural Resource Management (NRM) regions in 2004–05 (table 3.28). Most irrigated farms in the MDB were located in the Goulburn Broken, South Australia (SA) Murray Darling Basin, Murrumbidgee, North Central, Mallee and Murray NRM regions (map 3.29). Each region contained more than 1,500 irrigated farms. More than 70% of MDB irrigating farms were located within those regions.

More than 50% of farms in the Lower Murray Darling, Mallee, Goulburn Broken and SA Murray Darling Basin NRM regions were irrigated. There were very few irrigating farms in the Australian Capital Territory, South West (QLD), Western, Maranoa Balonne and Wimmera regions.

3.28 IRRIGATED AND NON-IRRIGATED FARMS, by NRM region—Murray-Darling Basin—2004–05

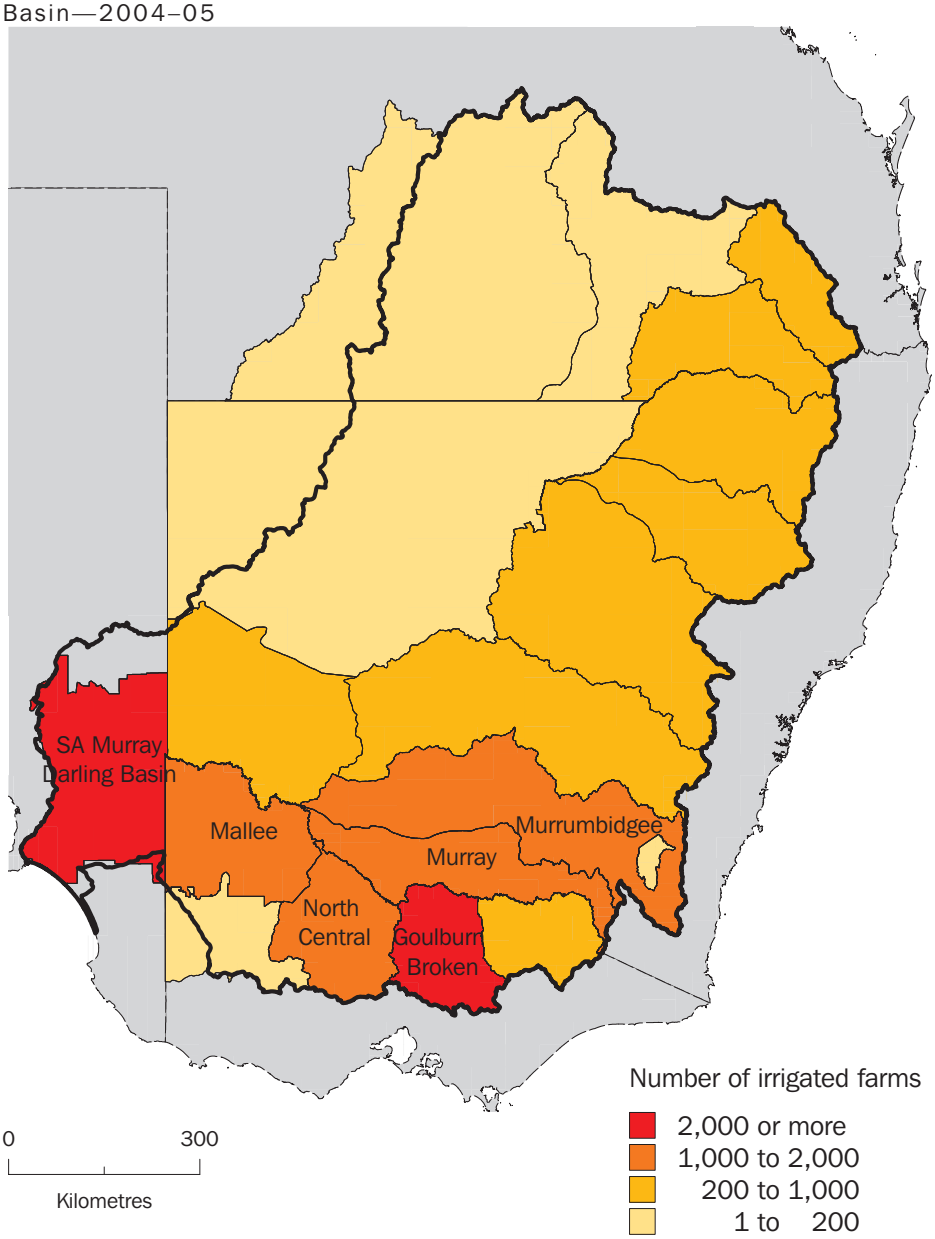
	Irrigated farms	*Proportion of total farms*	*Non-irrigated farms*	*Proportion of total farms*	*Total farms*(a)
	No.	%	No.	%	No.
Border rivers/Gwydir	300	13	2 200	87	2 600
Central West	700	13	4 700	87	5 500
Lachlan	500	9	5 000	91	5 500
Lower Murray Darling	400	62	300	38	700
Murray	1 500	48	1 600	52	3 000
Murrumbidgee	1 900	35	3 600	65	5 500
Namoi	500	19	2 300	81	2 900
Western	100	9	700	91	800
Goulburn Broken	2 700	53	2 400	47	5 000
Mallee	1 700	61	1 100	39	2 900
North Central	1 900	41	2 700	59	4 500
North East	700	33	1 500	67	2 200
Wimmera	200	7	2 100	93	2 300
Border rivers	400	41	600	59	1 000
Condamine	800	24	2 600	76	3 400
Maranoa Balonne	100	7	1 300	93	1 400
South West	—	4	500	96	500
SA Murray Darling Basin	2 200	53	1 900	47	4 100
ACT	—	15	100	85	100
Murray-Darling Basin(a)	**16 600**	**31**	**37 300**	**69**	**53 900**

— nil or rounded to zero (including null cells)

(a) Components may not add to total due to rounding.

Source: ABS data available on request, Natural Resource Management Survey 2004–05

3.29 LOCATION OF IRRIGATED FARMS, by NRM region—Murray-Darling Basin—2004–05



IRRIGATION PRACTICES *continued*

Irrigation management practices are the subject of strong interest for policy makers and water resource managers in the MDB (see Appendix). Improvements to on-farm water savings is a central part of the 2007 National Plan for Water Security (DEWHA 2007b). Through *Drought assistance and Exceptional Circumstances* support programs (see Chapter 4), several measures are available for farmers located within the MDB (DAFF 2007a). These include grants for activities related to:

- improving on-farm water management practices to increase water use efficiency;
- mitigating the effect of reduced water allocations; and
- maximising production from the water that is available.

It should be noted when analysing the data outlined below that several factors could affect these results. For example, water availability or drought could affect various regions of the MDB differently, thereby influencing irrigation practices. Further, the

IRRIGATION PRACTICES *continued*

trade of water may be more feasible in some irrigation areas than others due to infrastructure or regulations. Also, the targeting of NRM funding may have been more intense in some regions compared to others, affecting the uptake of more efficient water use technologies by irrigators. Finally, by their nature, some water management practices might be implemented less frequently than others. Therefore, if irrigators implemented some practices before the reference period, the change to that practice would not have been reported for that year.

Approximately two-thirds of irrigators in the MDB changed their water management practices during 2004–05 (table 3.30). In 2004–05, the most common changes to irrigation practices in the MDB (as a proportion of total MDB irrigated farms) were:

- adopting more efficient irrigation techniques (35%);
- undertaking more efficient irrigation scheduling (27%);
- reducing area under irrigation (20%);
- laser levelling (17%); and
- purchasing extra irrigation water (16%).

The least commonly adopted irrigation management practices included: improving the quality of water run-off (3% of irrigated farms) and installing piping or covering open channels (7%).

3.30 CHANGES TO IRRIGATION PRACTICES, by irrigated farms—Murray-Darling Basin—2004–05

	Number of irrigated farms	*Proportion of total irrigated farms*
	no.	%
Did not change practices	5 900	36
Changed	10 700	64
Reduced the area under irrigation	3 300	20
Increased the area under irrigation	1 300	8
Adopted more efficient irrigation techniques	5 800	35
Adopted more efficient irrigation scheduling	4 500	27
Purchased extra irrigation water	2 700	16
Sold irrigation water	1 300	8
Installed piping and/or covered open channels to reduce water loss	1 200	7
Laser levelled areas to improve water management	2 800	17
Introduced reused or recycled irrigation water	1 800	11
Improved quality of water runoff	600	3
Installed soil moisture sensors	1 500	9
Other	500	3
Total irrigated farms(a)	**16 600**	**100**

(a) Total irrigators who changed practices does not equal the sum of the types of changes made, as farmers could report more than one type of change.

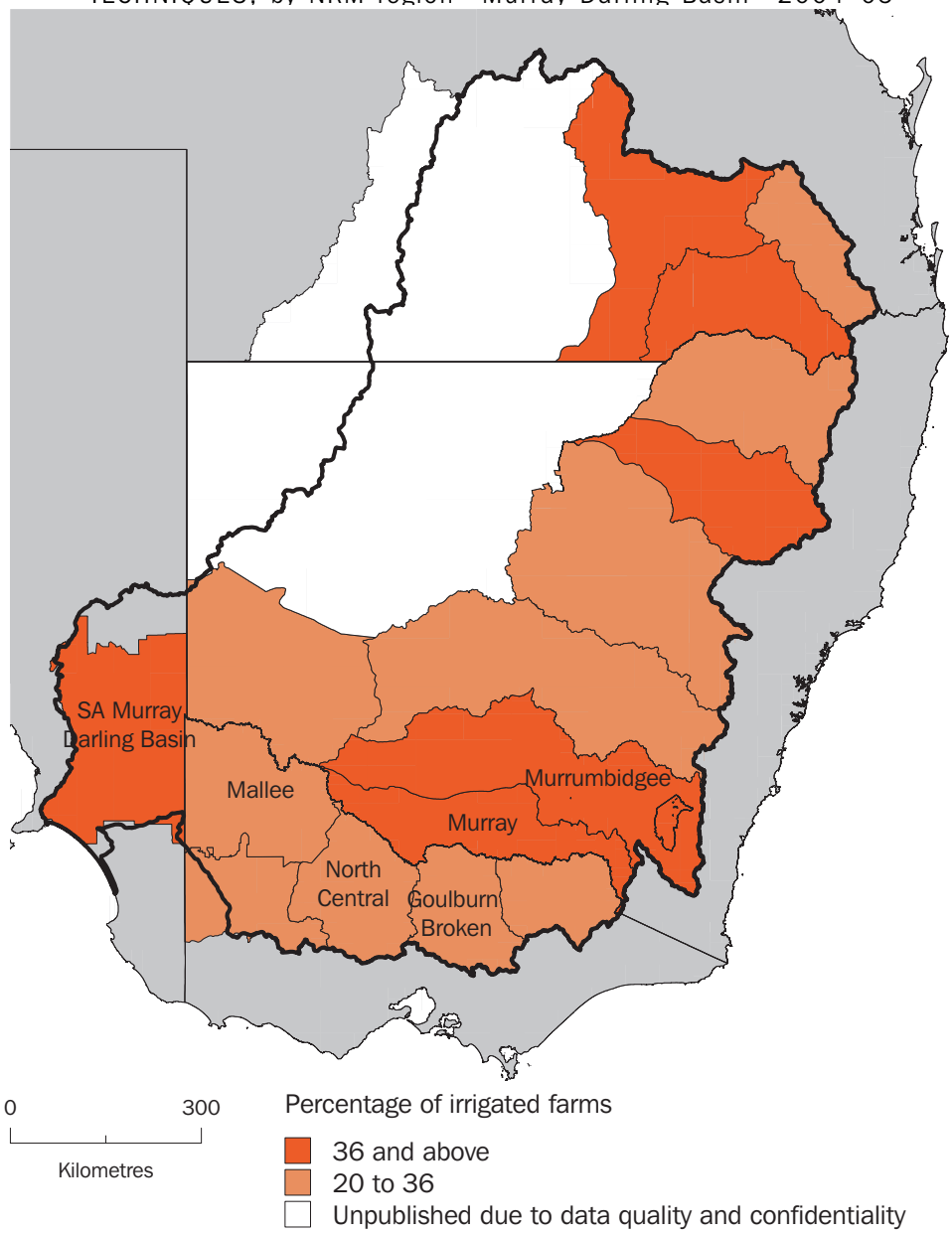
Source: ABS data available on request, Natural Resource Management Survey 2004-05

The following maps show the proportion of farms undertaking a range of irrigation practices for 2004–05. As there were significantly more irrigated farms (>1,500) in the Goulburn Broken, SA Murray Darling Basin, Murrumbidgee, North Central, Mallee and Murray NRM regions (table 3.28 above), the majority of this analysis will focus on these six NRM regions. Due to data quality and confidentiality concerns, the data have been presented in ranges, and as a proportion of the total irrigated farms in NRM regions.

IRRIGATION PRACTICES *continued*

In 2004–05, of the six NRM regions with more than 1,500 irrigated farms, 36% or more of the total irrigated farms in the Murray, Murrumbidgee and SA Murray Darling Basin NRM regions changed to more efficient irrigation techniques (map 3.31). These techniques were less commonly adopted by farms in the Goulburn Broken, North Central and Mallee NRM regions.

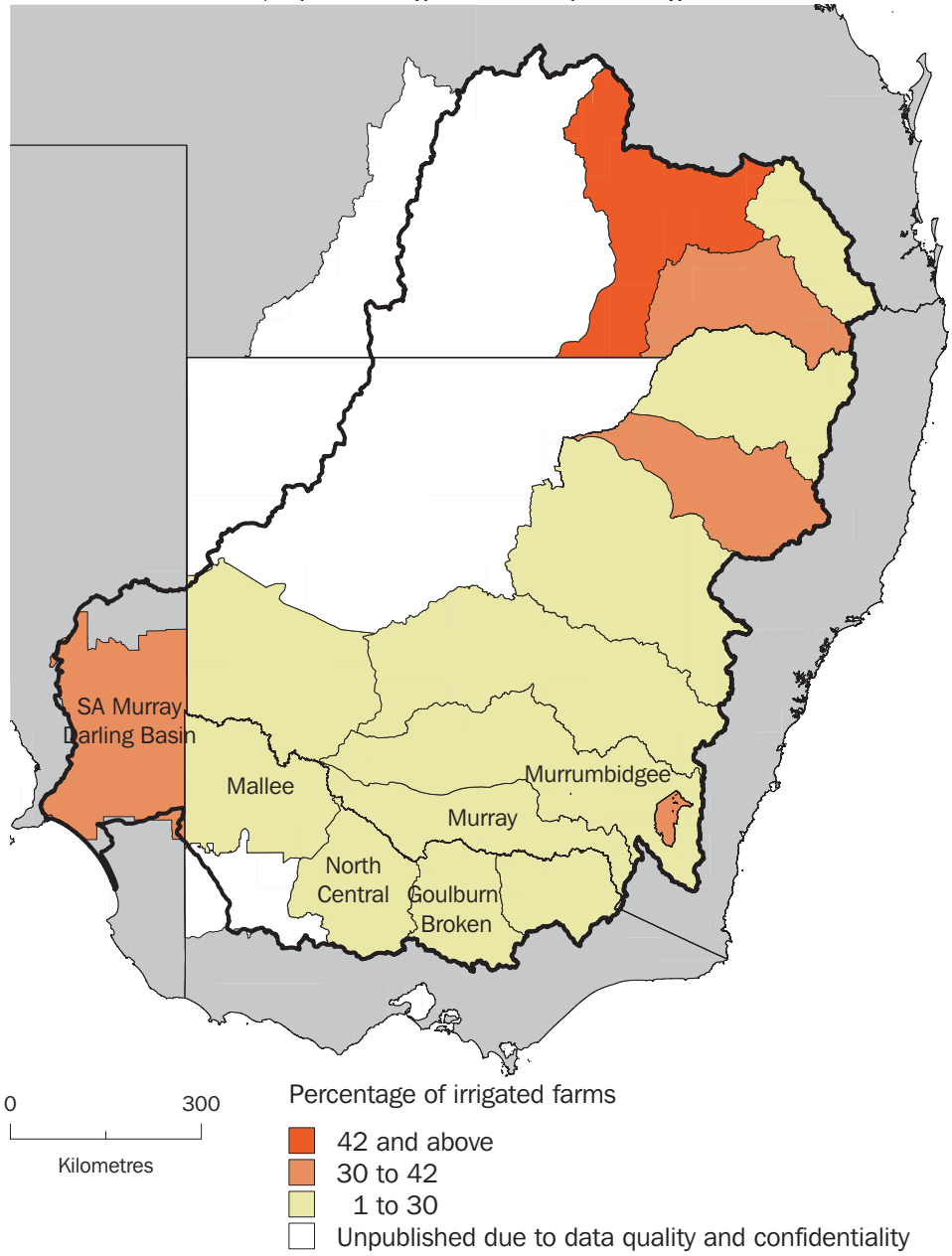
3.31 FARMS THAT CHANGED TO MORE EFFICIENT IRRIGATION TECHNIQUES, by NRM region—Murray-Darling Basin—2004–05



IRRIGATION PRACTICES *continued*

In 2004–05, of the six NRM regions with more than 1,500 irrigated farms, SA Murray Darling Basin had a higher proportion of farms that changed to more efficient irrigation scheduling (30 to 42%) than in the other five NRM regions (map 3.32).

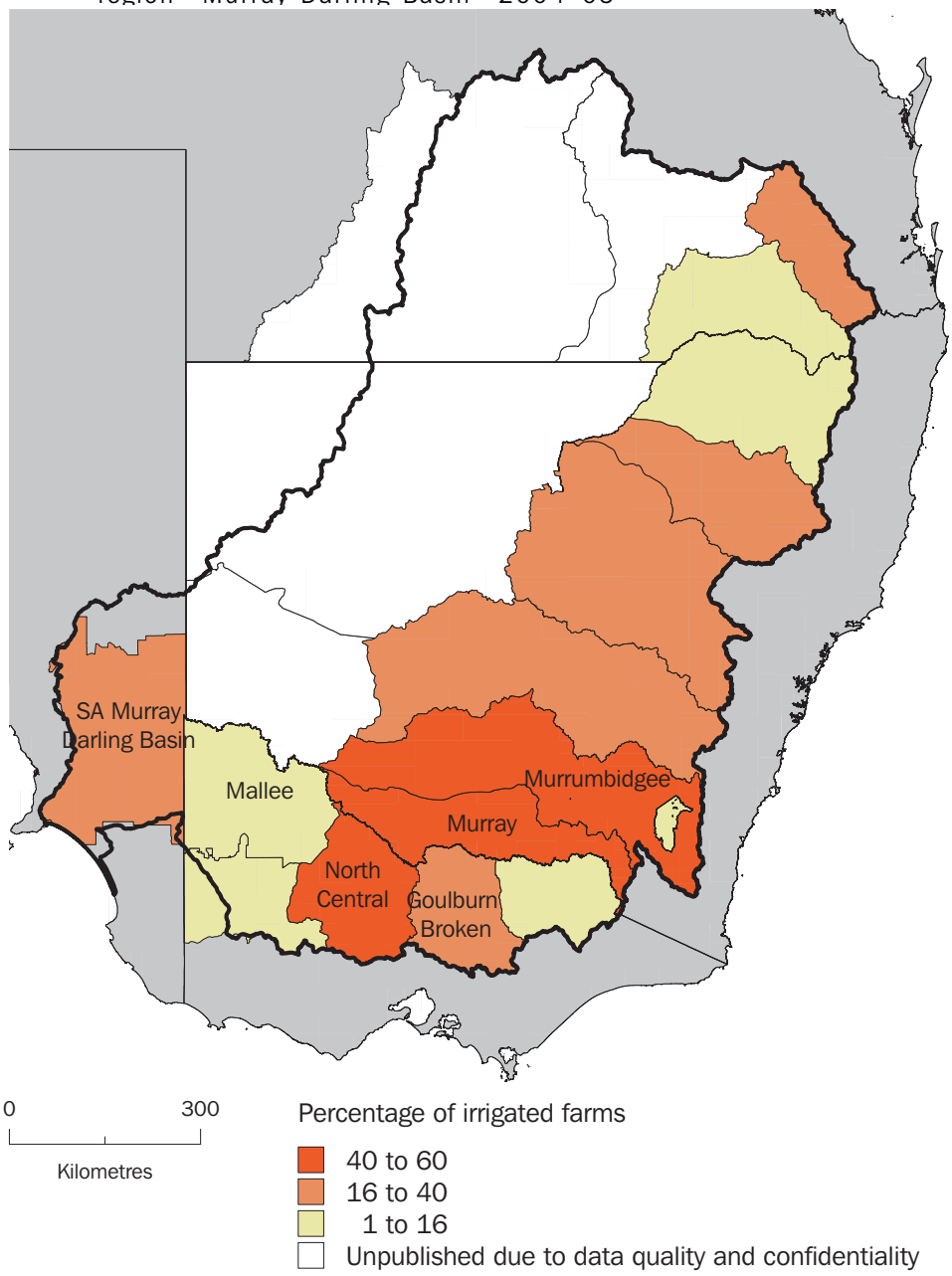
3.32 FARMS THAT CHANGED TO MORE EFFICIENT IRRIGATION SCHEDULING, by NRM region—Murray-Darling Basin—2004–05



IRRIGATION PRACTICES *continued*

In 2004–05, of the six NRM regions with more than 1,500 irrigated farms, the reduction of irrigation area was more commonly undertaken by irrigated farms in the Murray, North Central and Murrumbidgee NRM regions (between 40% and 60% of total irrigated farms). This change to irrigation practices was less commonly carried out in SA Murray Darling Basin and Goulburn Broken, and least in the Mallee (map 3.33).

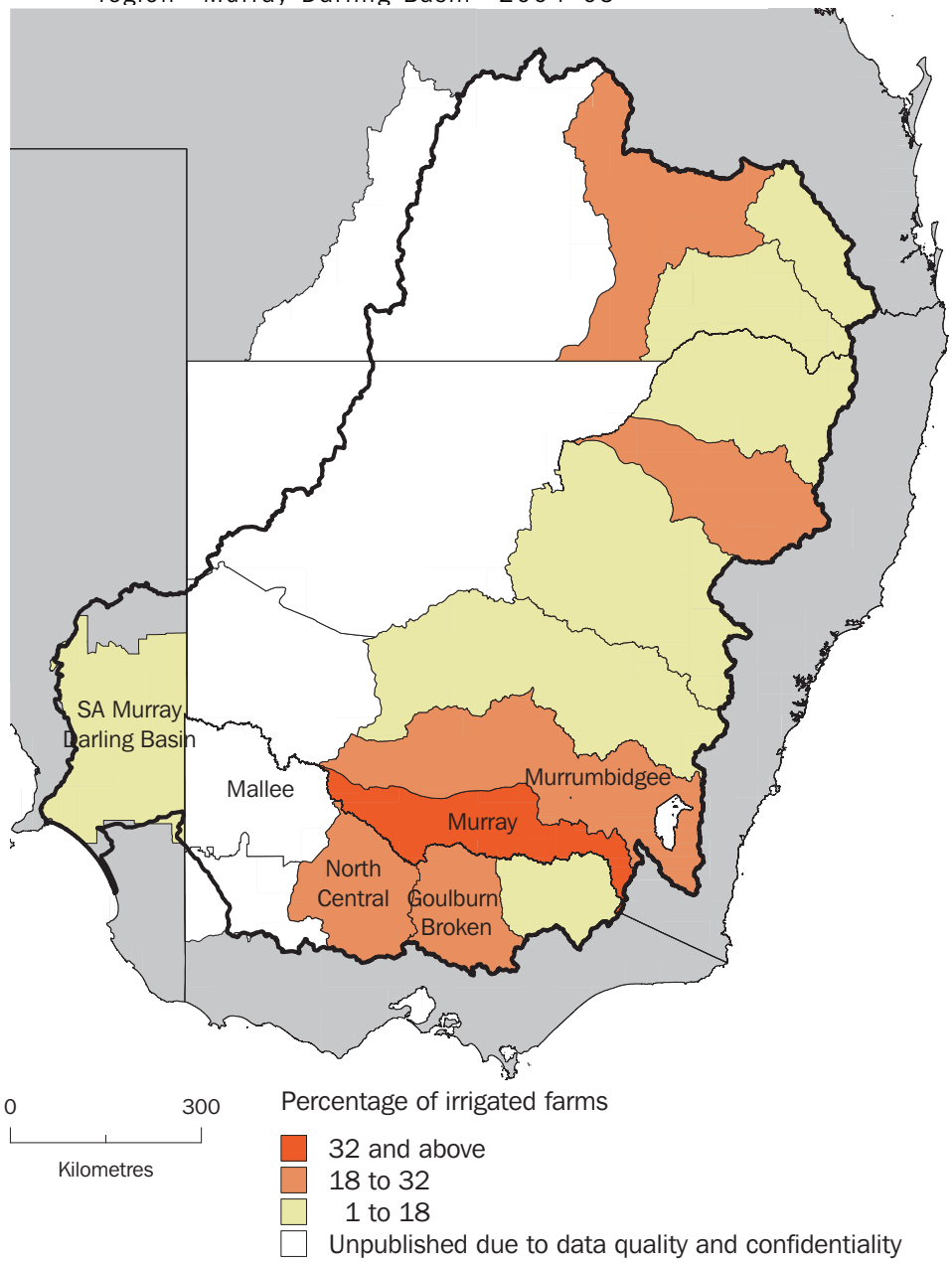
3.33 FARMS THAT REDUCED THE AREA UNDER IRRIGATION, by NRM region—Murray-Darling Basin—2004–05



IRRIGATION PRACTICES *continued*

In 2004–05, a higher proportion of irrigated farms (32% or more) in the Murray NRM region changed their irrigation practices by laser levelling than the other NRM regions with more than 1,500 irrigated farms: Murrumbidgee, Goulburn Broken, North Central and SA Murray Darling Basin (map 3.34).

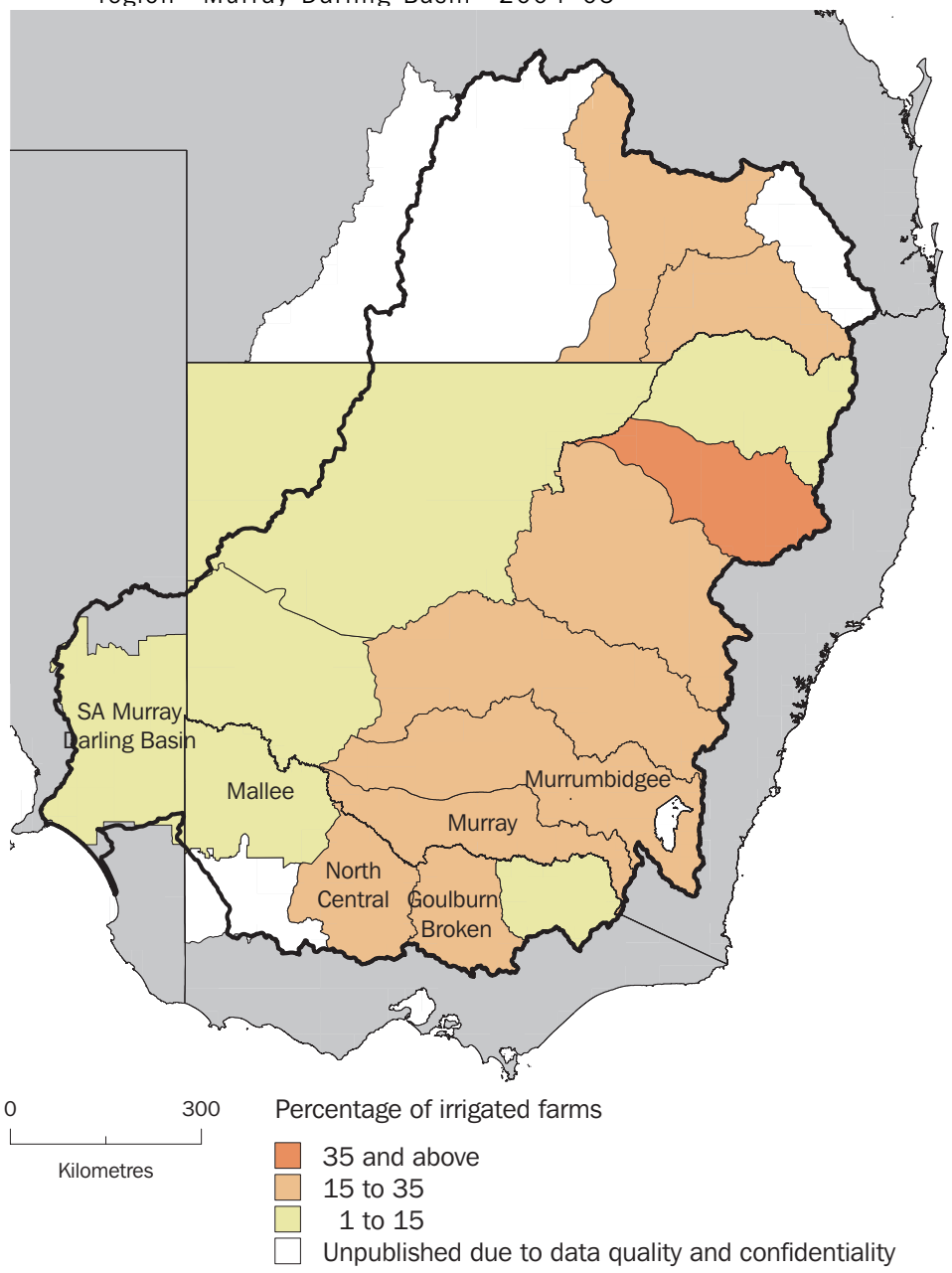
3.34 FARMS THAT CHANGED LASER LEVELLING PRACTICES, by NRM region—Murray-Darling Basin—2004–05



IRRIGATION PRACTICES *continued*

In 2004–05, of the six NRM regions with more than 1,500 irrigated farms, purchasing additional irrigation water was more commonly undertaken (15% to 35%) in the south east of the MDB in the Murray, Murrumbidgee, North Central and Goulburn Broken NRM regions. Relatively few irrigated farms (1% to 15%) purchased extra water in the south west MDB - within the SA Murray Darling Basin and Mallee NRM regions (map 3.35).

3.35 FARMS THAT PURCHASED ADDITIONAL IRRIGATION WATER, by NRM region—Murray-Darling Basin—2004–05



FOR MORE INFORMATION . . .

INTERNET **www.abs.gov.au** the ABS website is the best place for data from our publications and information about the ABS.

INFORMATION AND REFERRAL SERVICE

Our consultants can help you access the full range of information published by the ABS that is available free of charge from our website. Information tailored to your needs can also be requested as a 'user pays' service. Specialists are on hand to help you with analytical or methodological advice.

PHONE 1300 135 070

EMAIL client.services@abs.gov.au

FAX 1300 135 211

POST Client Services, ABS, GPO Box 796, Sydney NSW 2001

FREE ACCESS TO STATISTICS

All statistics on the ABS website can be downloaded free of charge.

WEB ADDRESS www.abs.gov.au