

Australia's water supply, consumption and regulation

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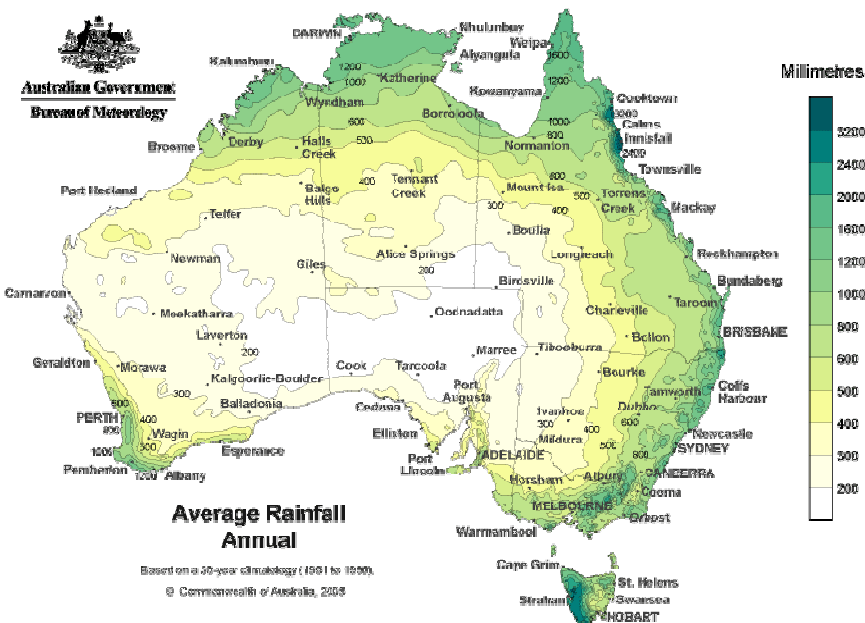
Key points

- Australia's annual rainfall (our main water supply) is highly variable. Climate research indicates the north is getting wetter and the south drier.
- About two thirds of our distributed water goes to agriculture (mainly irrigation), 10% to households and 10% to water and sewerage services.
- Australia's water management system faces significant, increasingly urgent, reform challenges including the establishment of effective national planning, co-ordination, ownership and market trading arrangements.

Water supplies

Australia is often referred to as the 'driest continent on earth'. While much of the interior is certainly very dry, our coastal regions and river systems generally have adequate water, except during times of drought. Most of arable Australia has a mean annual rainfall of 600 to 1500mm, which is a comparable range to Europe or the US. Australia differs however, in that our annual rainfall variability is greater and therefore our floods and droughts tend to be much worse. This is partly due to the Pacific Ocean weather cycles known as 'El Niño' and 'La Niña' (the Southern Oscillation), which affect annual temperatures and rainfalls across much of Australia. Records from 1892 to 2005 for example, show that inflows to the Murray River (the southeast's largest and most intensively developed) varied from an annual high of over 30,000GL down to 1,675GL, with just 610GL recorded in 2006, the lowest annual inflow on record. In the case of the Murray, it appears that on top of the extended drought, large bushfires in its alpine catchment area in 2003 have also decreased recent inflows, since regenerating forests absorb far more water than established ones.

Average annual rainfall, 1961-1990

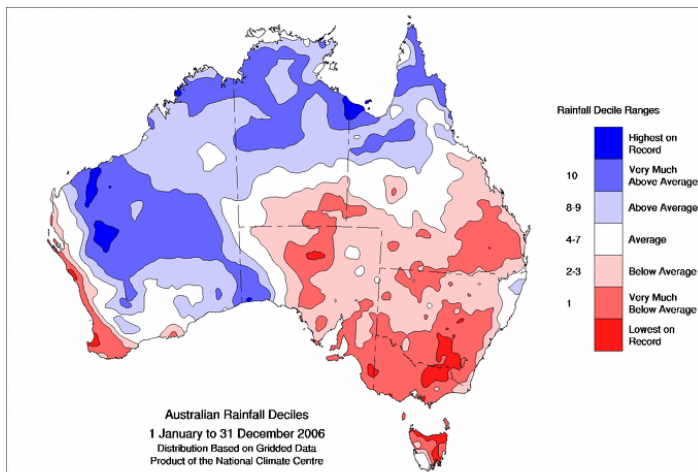


Source: Bureau of Meteorology (BOM).

Australia also has some large groundwater reserves, such as the Great Artesian Basin, which stretches under Qld, NSW, NT and SA. Underground water volumes are notoriously difficult to estimate. Some known groundwater reserves are in remote locations, while others have high salinity levels that make them difficult to utilise. The Australian Water Association estimates the annual national sustainable groundwater yield is around 29,000GL, 8,000GL of which is highly saline.¹ Nationally, only around 4% of distributed water consumption comes from groundwater sources (32% of water used in WA).

While very long-term weather patterns can be difficult to pinpoint, Australia has suffered nation-wide extended drought periods approximately every 50 years since European settlement (1840s, 1890s, 1930s and 2000s). The Bureau of Meteorology has noted that over the past 50 years, national rainfall data have indicated increasing annual rainfall over northeast Australia and decreasing rainfall over the southeast. Annual rainfall patterns in 2006 continued this long-term trend (see map to left). Sparsely developed northern Australia already receives around 60% of the nation's annual water run-off, compared with only 6% flowing into the heavily developed Murray-Darling Basin river system.

Annual rainfall deciles, 2006



Source: BOM, *Annual Australian Climate Statement 2006*.

run-off of 242,779GL. Of that, we extracted 79,784GL from the environment, 62,445GL of which was later returned as 'in-stream' regulated discharge (mainly from hydro-electric power generation). Water storage levels dropped by 10% over that year, to around 47% of storage capacity. A year later, national water storage levels were even more depleted, going into an extremely dry 2007. The Murray-Darling Basin Commission is now expecting that key public water storage facilities including the "Hume and Dartmouth dams and Lake Victoria are likely to be empty by April or May". Elsewhere, many cities and urban areas are tightening household water restrictions, some up to the highest level of restrictions available.²

Looking forward, these trends toward a wetter northwest and a drier southeast look likely to continue. Tim Flannery and other scientists predict the effect of this will be reduced rainfall across eastern Australia "until a semi-permanent el-Niño-like state is induced". Estimates at the more pessimistic end of the spectrum indicate that, as a result, average water inflows to the all-important Murray-Darling Basin could fall by up to 20% by 2030 and 45% by 2070. In addition, global climate change is likely to increase the annual variability range within these long-term trends.

Even in dry years, only a small proportion of our annual rainfall is collected and consumed. The most recent data on Australia's total water resources and usage are for 2004-05, a relatively dry year, in which many agricultural regions were drought declared (some for several years already). In that year, an estimated 2.8mn GL of rainfall fell, with a

Water consumption

By international standards, Australia has very high levels of managed water consumption per capita, third only to Canada and the US. This is due to our relatively small population combined with a large, irrigation-intensive agriculture sector. Our domestic (household) water use per capita is lower than Canada, the US and New Zealand (see graph below).

Total Australian water consumption in 2004-05 was 18,767GL, 14% less than in 2000-01, a year of much higher rainfall. This amounted to 22% of large dam storage capacity but 47% of the stored water available at the time. Annual water consumption fluctuates greatly depending on rainfall and available water supplies, but the long-term trend has been a steady increase in total water consumption due to a combination of population growth, economic growth, rising living standards, changing technologies and changing industry practices.

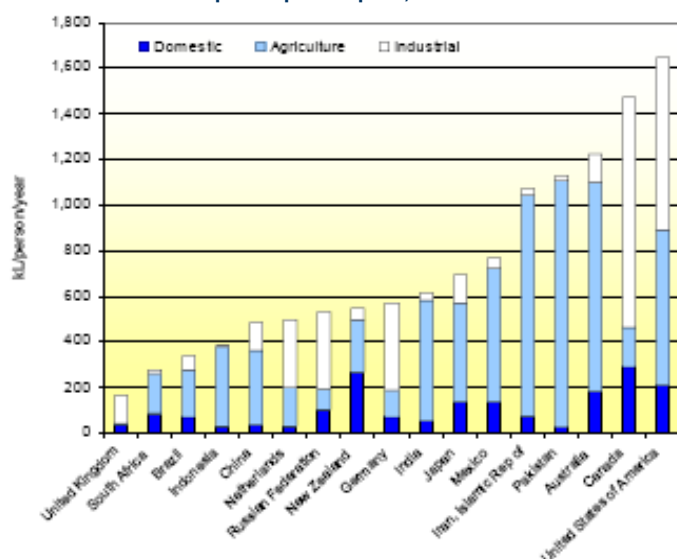
Around two-thirds of total water consumption is used directly in agriculture and 11% goes to each of households and water, sewerage and drainage. Although large, our services and manufacturing industries directly consume less than 9% of our water. This distribution is why drought relief, water restrictions, water policy and water reform tend to concentrate on agriculture and households rather than on other sectors.

¹ Estimate based on 2000-01 data. Australian Water Association, *Industry Facts*.

² ABS; BOM; CSIRO; Agriculture and Food Policy Reference Group; T. Flannery; Murray-Darling Basin Commission.

While agriculture's direct share of water consumption may seem high relative to its share of GDP and exports (see table below), it must be remembered that most agricultural production is 'primary'. That is, it is a key input into downstream 'secondary' industries (e.g. food, beverages and textiles manufacturing). Agricultural produce (and hence the water it embodies) is also consumed by all households as food. This means that net (direct and indirect) water consumption by non-agricultural industries tends to be somewhat understated by these raw data.

Water consumption per capita, selected countries



Source: Food and Agriculture Organisation of the United Nations (FAO), AQUASTAT database, 2005, cited in Marsden Jacob 2006.

Taking this into account, the CSIRO and the University of Sydney have estimated the 'water intensity' (net managed water use per dollar of final demand) of 135 industry sectors. They found that even when calculated on an input-output basis, agriculture sectors have far higher net water intensity ratings than mining, manufacturing or service industries. The next highest sectors were food, beverages and aluminium manufacturing. Among service sectors, hospitality had the highest water intensity rating, but this was still well below the agriculture and food sectors.

Following from this, they concluded that "the prices consumers pay for primary production items do not reflect the full value of the natural resources embodied in their production chains. This physical reality is reflected in the current debate on national water resources reform, with calls for consumption-based pricing".³ These results should not be interpreted as a criticism of agriculture or its water use. Rather, they give an insight into the extent to which national pricing structures arguably undervalue water as a scarce natural resource.

Direct water consumption by industries and households

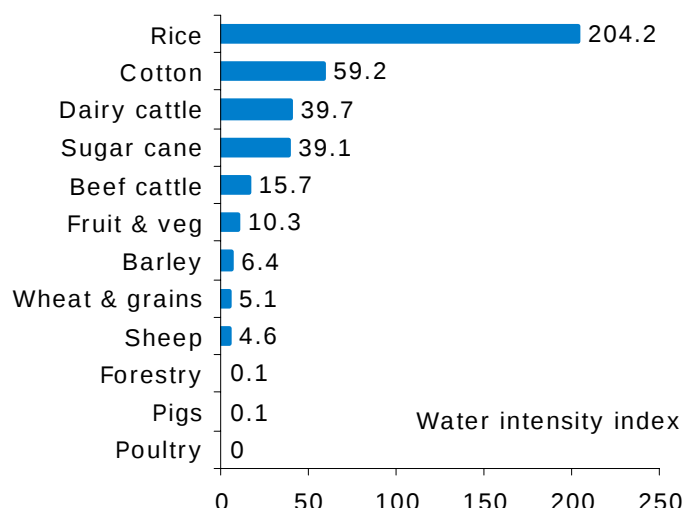
	2000-01		2004-05			
	GL	% of water	GL	% of water	% of GDP	% of exports
Agriculture	14,989	69.1	12,191	65.0	3.2	6.1
Forestry, fishing & ag. services	44	0.2	51	0.3	0.3	0.5
Mining	321	1.5	413	2.2	5.0	26.7
Manufacturing	549	2.5	589	3.1	13.5	43.9
Electricity & gas	255	1.2	271	1.4	2.7	0.0
Water supply, sewerage & drainage	2,165	10.0	2,083	11.1		
Other industries (services ex utilities)	1,102	5.1	1,059	5.6	75.2	22.8
Households	2,278	10.5	2,108	11.2	na	na
Total industries and households	21,703	100.0	18,767	100.0	\$711.2bn	\$153.6bn

Source: ABS 4610.0, *Water Account 2004-05*; ABS 5206.0, *National Accounts*.

Agriculture

Water consumption in agriculture reflects the size of each sector as well as the water intensity of different agricultural products — that is, the amount of water needed to produce the output. Thus cotton, one of Australia's smaller but more water-intensive crops, consumed more water than the far larger, but less thirsty, grain-growing sector in 2004-05. Products that require more water are generally produced in naturally wetter regions (e.g. sugar in Qld and dairy in Victoria and Tasmania) or in low-cost irrigation regions (e.g. cotton and rice in some Murray-Darling irrigation zones). In 2004-05, dairy farming consumed the most water (18.7% of agricultural water consumption), followed by pasture grown for livestock other than dairy (mainly cattle and sheep) (15.8%), cotton (14.9%), sugar (10.4%) and all grains other than rice (9.5%) (see table below).

³ CSIRO and University of Sydney 2006, *Balancing Act*.

Water intensity in agriculture varies significantly

Source: CSIRO and University of Sydney 2006, *Balancing Act*.

Among Australian agriculture sectors, rice is the single most water-intensive product, relative to the value of its output. Even in good years, rice is a very small crop, since it is only sown to the extent that adequate low-cost water allocations are available. Fruit and vegetables also require large amounts of water, but their high dollar value gives them a much lower 'water intensity' rating (see graph to left).

In contrast, Australia's more traditional and widespread broadacre crops (primarily wheat) and livestock grazing use relatively low amounts of water in proportion to the value of their output. On the other hand, they tend to require a greater area of land and/or other resources to support production. Grain-fed cattle, poultry and pig production also have low 'water intensity' scores, due to intensive indoor production processes that rely on commercial feed supplies and other inputs rather than on the vagaries of the local weather.

When calculated against the value of production, the water intensity of each sector will vary from year to year, depending on net water consumption, production yields and prices (see table below for 2004-05 values). Water intensity can be improved through various technologies and farming techniques, but significant differences across sectors will always exist, due to the natural water requirements of each crop or product.

Agricultural water consumption and gross value of farm production, 2004-05

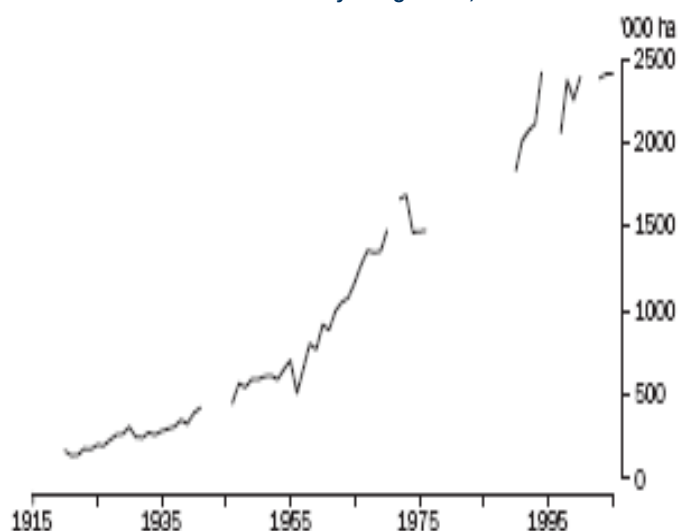
Agriculture sector	Water consumption ML	Water consumption % of agriculture	Gross value of farm production \$m	ML per \$m produced
Dairy	2,275,603	18.6	3,194*	712.5
Vegetables	455,373	3.7	2,134	213.4
Sugar	1,269,012	10.4	980	1,294.9
Fruit	647,662	5.3	2,770	233.8
Grapes	717,047	5.9	1,271	564.2
Cotton	1,821,509	14.9	1,222	1,490.6
Rice	630,872	5.2	101	6,246.3
Livestock	1,035,474	8.5	14,630#	202.6
Pasture (ex dairy)	1,927,892	15.8		
Grains (ex rice)	1,162,268	9.5		
Other agriculture	248,659	2.0	2,335	106.5
TOTAL	12,191,372	100	35,894	339.6

* Farm gate value of milk production. # Value of all livestock slaughterings, live exports, wool and products excluding milk.

Sources: ABS 4610.0 *Water account 2004-05*; ABARE, *Commodities Quarterly*, Dec 2006.

An interesting indicator of longer term trends in agricultural water use is the five-fold increase in the total land area supplied by irrigation over the last 50 years, from less than 500,000 ha in 1955 to almost 2.5 mn ha in 2005 (see graph below). Irrigation methods have become more water-efficient over the years, however 62% of all irrigated land was still being surface irrigated (that is, controlled flooding of paddocks and fields) in 2004-05, rather than using a more water-efficient drip system (9% of irrigated land area) or a sprinkler system (28%).

Total land area serviced by irrigation, 1920 to 2005



Source: ABS 4610.0, *Water Account 2004-05* (data incomplete).

Irrigation is used to produce some of our most valuable crops. The Business Council of Australia has estimated that “half of Australia's agricultural value is produced using 12% of our irrigated water supplies”. Around 70% of all irrigated production draws water from the Murray-Darling river system, which is currently experiencing record low water levels due to drought and bushfire. This has prompted loud calls for urgent water reform and even for the relocation of some irrigation agriculture activities to wetter regions to the north.⁴

These differences in water use characteristics across Australian agriculture will increase in significance as the volume and distribution of our national water supplies alter, and as we (very slowly) move toward more market-oriented national water allocation and trading systems. In simple terms, the sectors with the greatest reliance on cheap, reliable water will be the most vulnerable to changes in water supply and/or pricing.

Non-agricultural industries (mining, manufacturing, energy and services)

Looking at non-agricultural industries, mining, manufacturing, energy and services consume small proportions of water relative to their output (although they do, of course, use high proportions of other inputs instead). As in agriculture, water ‘intensity’ varies considerably across individual mining, manufacturing and services sectors.

In mining, bauxite mining has the highest water intensity rating, but the much larger coal mining sector uses more water overall — 117,803 ML in 2004-05, 5% of which came from recycled sources. Brown coal has a higher water intensity rating than black coal due to differing mining techniques and requirements. All metals except bauxite have relatively low ratings on the CSIRO water intensity scale.

The CSIRO water intensity ratings for the various agriculture and mining sectors tend to be reflected in their corresponding downstream manufacturing sectors. Thus food, beverages, paper, aluminium (the main product of bauxite) and other metals manufacturing tend to have higher water intensity ratings and to consume more water overall than more elaborately transformed manufactures such as clothing, machinery or printed products. Manufacturing as a whole directly consumes remarkably little water however, at only 3% of the total.

Water use by the energy sector can be deceptive. The electricity industry extracts very large amounts of water from the environment (over 60,000GL in 2004-05), but 99% of this is returned to the environment by hydroelectric power plants and/or re-used by other industries. Direct water consumption by energy utilities (and their water intensity ratings) is therefore relatively low. Water intensity is higher for electricity than for gas due to the water consumed in electricity generation, mainly for plant cooling, maintenance and related processes.

Despite growing in output, value and employment, the services sector *decreased* its water consumption by 3.9% between 2000-01 and 2004-05. Services (excluding utilities) took around 5% of direct water consumption in 2004-05. CSIRO water intensity scores indicate that, as might logically be expected, hospitality was the thirstiest services sector, but at a level far below the thirstier agriculture, mining or manufacturing sectors.⁵

Households

Australian households reduced their water consumption per person between 2000-01 and 2004-05 in all states and territories except Tasmania. Considerable variation remains between locations. Nationally, we used 103KL of distributed household water per capita in 2004-05, 11.7% less than in 2000-01. In urban areas, household water consumption appears to be lower again. The WSAA estimates that urban household water consumption per capita was 84KL in 2004-05, or 15% lower than in 2000-01. The WSAA attributed this saving to: 2005's water restrictions in Sydney and Brisbane; increased water awareness nationally; greater uptake of water-efficient household appliances and devices; and “the introduction of pricing structures that penalise high water users”.⁶

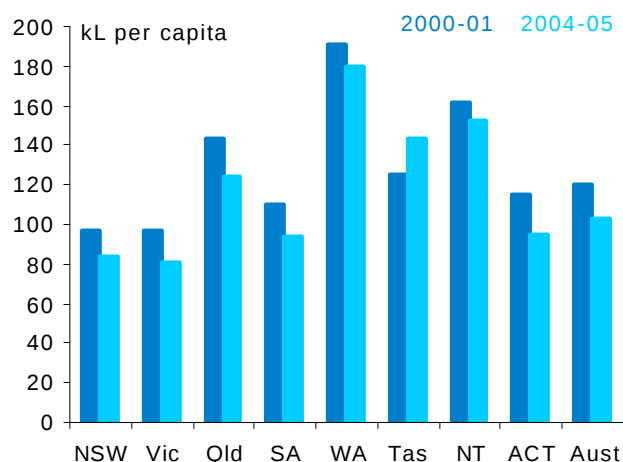
⁴ Business Council of Australia 2006, *Water Under Pressure*; Agriculture and Food Policy Reference Group 2006.

⁵ ABS 4610.0 *Water Account 2004-05*; CSIRO and University of Sydney 2006, *Balancing Act*.

⁶ Water Services Association of Australia (WSAA) 2005.

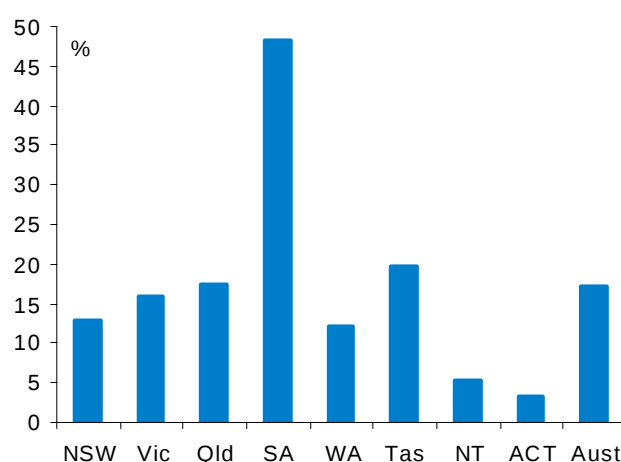
Urban household water consumption will no doubt reduce further in 2007 as more severe household water restrictions take effect in many cities and towns across the country. Better water awareness and protracted drought have also seen the re-appearance of household rainwater tanks in urban areas, with many local councils now actively encouraging their installation, even in inner metropolitan localities where once they were banned.

Household distributed water consumption per capita



Source: ABS 4610.0, *Water account 2004-05*.

Households with a rainwater tank, 2004



Source: ABS 4610.0, *Water account 2004-05*.

Water recycling

Only 2.3% of the water we consume comes from recycled sources. Most of this is used by the forestry industry to water timber plantations. The services sector is the next biggest user of recycled water, at around 6% of its consumption. Among households, less than 1% of distributed water comes from recycled sources. These data do not include on-site water recycling such as grey water systems (or less sophisticated 'buckets on the garden' measures), which always increase in popularity when household water restrictions are imposed in more locations and/or for longer periods.

Water extracted, returned to the environment and recycled by industries and households, 2004-05

Sector	Total extracted ML (1)	In-stream ML (2)	Regulated discharge ML (3)	Consumption ML	Re-used % (4)
Agriculture	11,911,447	-	-	12,191,372	2.3
Forestry, fishing & ag. services	419,157	385,158	385,159	51,481	33.9
Mining	601,306	183,406	226,748	413,266	1.7
Manufacturing	587,470	-	109,875	589,333	2.2
Electricity & gas	60,286,554	59,867,227	59,924,125	271,220	2.2
Water supply, sewerage & drainage	13,204,338	-	1,808,832	2,083,043	1.8
Other industries (services ex utilities)	998,779	-	-	1,059,400	5.7
Households	2,106,496	-	-	2,108,263	0.6
Environment flows	1,005,277	-	-	-	-
Total	91,120,824	60,435,791	62,454,739	18,767,379	2.3

(1) Self-extracted plus distributed water. (2) Self-extracted water used in-stream. (3) Water used in-stream or discharged after use. (4) Proportion of net water consumed that comes from waste & drainage water, excluding 'on-site' recycling.

Source: ABS 4610.0, *Water Account 2004-05*.

As many governments around Australia already recognise, there is clearly room for more widespread adoption of water recycling technologies by industries and households. To date, Australian households (as memorably demonstrated in Toowoomba in 2006) have shown strong resistance to accepting reticulated recycled water supplies, due to perceptions that this would involve drinking sewerage. State governments in Victoria and Qld are, nevertheless, pushing ahead with plans to construct major water recycling infrastructure for industrial (Victoria) and household (Qld, pending a state referendum) use. In NSW and WA, state governments have indicated an interest in desalination plants instead of recycling facilities to meet future urban water demand.

While the technology for water recycling and desalination is essentially similar — filters to remove salt and impurities from the water — desalination is the more expensive option due to the additional filters and energy required to remove the larger amounts of salt. In both cases however, one of the more significant cost variables is transport, since new piping and pumping infrastructure are required to transfer the waste and/or water from source to treatment to distribution. As an example, feasibility studies by Sydney Water indicate that desalination might actually be a cheaper option for Sydney (at \$2,510 capital cost plus \$165mn annual operating costs for 500ML per day) than potable recycling (\$3,845mn capital costs plus \$175mn annual operating costs) due to long transfer distances (and therefore higher costs) for recycling. In this case, Sydney Water found that “although desalination has a higher treatment cost, this is more than offset by the higher infrastructure maintenance costs and pumping costs of the Indirect Potable Recycling project”. In other studies, CSIRO and CoPS have calculated that desalination for a medium to large city becomes feasible at water prices of between \$1.00 and 1.50 per KL, which puts Sydney’s current household water prices of \$1.20 to \$1.48 per KL well within the feasibility range.⁷

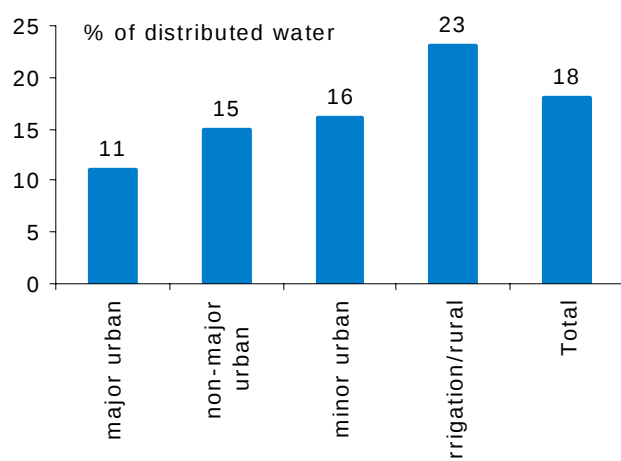
Another form of water recycling is water that is used by industry and households and subsequently returned to the environment, with or without treatment. This can be in the form of in-stream discharges, such as the water flowing into and out of hydroelectric and other energy generators, or regulated discharges from sewerage and drainage systems or directly from industry. Some extracted water is also set aside for regulated environmental flows in sensitive locations. Appropriate environmental flows have been the subject of protracted inter-government negotiations. They remain contentious in regional areas, particularly during long drought periods.

Water wastage — how much water is ‘lost’ in distribution?

Disturbingly, an estimated 18% of our total distributed water supply (over 2,000GL) was wasted through ‘distribution losses’ (leaks, evaporation and unaccounted losses) in 2004-05. This was a *greater* proportion than in 2000-01 (16%), indicating a deterioration in water distribution infrastructure over this period. Losses were greatest in rural irrigation areas (23%) and minor urban areas (16%) but even in major urban centres, 11% of our water was lost in distribution. Water losses across states tend to reflect the location of irrigation areas, which are concentrated around the Murray-Darling Basin.

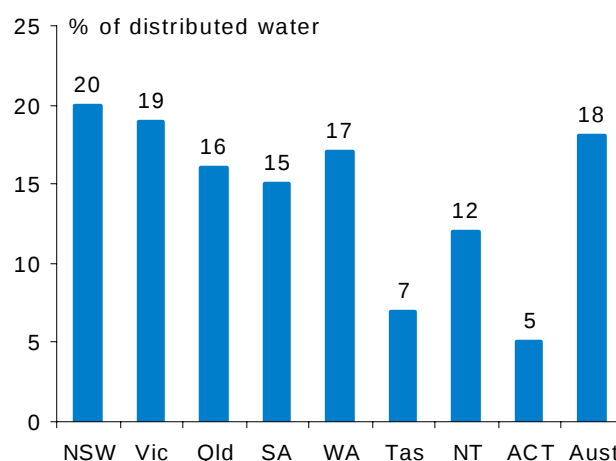
In irrigation areas, older, open water channels with high rates of evaporation are a major source of water loss. In urban areas, leakage from ageing water and drainage infrastructure is the main culprit. The WSAA claims urban water supply leakage rates are improving, with a fall in its ‘Infrastructure Leakage Index’ (which measures water leakage and loss by urban water providers) from 1.9 in 2002-03 to 1.3 in 2004-05.⁸ In all locations, significant amounts of water are also lost through unavoidable evaporation from public storage dams. All of this ‘lost’ water is ultimately returned to the environment, albeit indirectly and unintendedly.

Water distribution losses by location, 2004-05



Source: ABS 4610.0, *Water account 2004-05*.

Water distribution losses by state, 2004-05



Source: ABS 4610.0, *Water account 2004-05*.

⁷ Sydney Water and CSIRO/CoPS cited in BCA 2006, pp. 32-5.

⁸ Water Services Association of Australia 2005.

Water regulation and management

Australia's water regulation and management is highly disjointed, with responsibilities spread across all three levels of government — federal, state and local. Constitutionally, the right to control and use all water resources is vested in the states. There are currently 340 separate surface water management areas plus 367 groundwater management areas nationally, each with its own water management plan and allocation system. Even water systems that are physically connected are often managed by different local water authorities. Various government agencies also have direct water policy and regulatory responsibilities relating to issues such as the environment and health. All of this makes for a complex and rather uncoordinated water management system, without agreed accounting standards, planning methods or measures of 'sustainable' water levels and yields.

The National Water Initiative is currently the key process for moving toward a nationally consistent water management system. It commenced in 2004, based on earlier Council of Australian Governments (COAG) agreements on water reform (dating back to at least 1994), and is overseen by the National Water Commission. The National Water Initiative aims to better standardise and coordinate national water management but not necessarily to centralise or federalise it. Indeed, in line with good regulatory practice, one of its stated goals is to ensure "as far as possible, the roles of water resource management, standard setting and regulatory enforcement and service provision continue to be separated institutionally" (clause 74).

Various aspects of water management have been examined by a multitude of committees, taskforces and commissions, each producing a set of useful findings and recommendations. However, unlike other key infrastructure sectors such as energy and transport, progress on implementing national water reform at a practical level has been glacial. Indeed, the Business Council of Australia recently went so far as to conclude that "Australia's water problems are a direct result of a poorly planned and managed water system that has conspired to turn a sufficient supply of water at the source to scarcity for end-users".⁹ While the sufficiency of our water supplies is hotly debated, the need for regulatory reform — and especially market reform — is acknowledged at all levels.

Water access — entitlements and allocations

Access to water for agricultural and other purposes is controlled through a complex system of permanent entitlements and temporary allocations. These are regulated by state and territory governments, with significant variations in institutional and regulatory arrangements across jurisdictions. National harmonisation of these entitlements is one of the goals of the National Water Initiative, although progress to date has been slow.

Although the terminology varies across states and territories, in broad terms:

- **Water access entitlements** (including water licences, water rights and bulk water rights) give their owners a permanent, legally recognised right to access a specified amount of water from a specified water source (ground and/or surface water) each year, subject to annual availability and restrictions. Water entitlements can be attached to a land title or held as a separate property right. Water entitlements can vary greatly in their size, security level and conditions, from very large, high security entitlements for urban water authorities to small, low security entitlements for small landholders near seasonal water sources. Older agricultural water entitlements may be still tied to the relevant land title. The National Water Initiative aims to separate all water entitlements from land titles so that they can be owned, valued and traded separately.
- **Water allocations** specify exactly how much water each owner of a water access entitlement can have each year. In NSW, Victoria and Qld, water allocations for all regulated water sources and water management areas (such as the Murray-Darling rivers) are announced at the start of the year (1 July). They are expressed in terms of a percentage of the water entitlement volume. The allocation can be below, equal to or above the entitlement volume, and can be amended at any time during the year as water availability changes. In other states, the water allocation is bundled with the access entitlement, such that the annual allocation volume equals the entitlement volume. Separate restriction orders are then imposed on the actual allocation volume when water flows or supplies become low. In Tasmania, agreed 'cease-to-take thresholds' mean that individual allocation volumes are reduced with stream flows on a seasonal, monthly or even weekly basis.¹⁰

The latest data for national water entitlements and allocations are for 2004-05, a reasonably typical recent year. These data include only water extracted from regulated sources and not unregulated self-extractions (e.g. from Tasmania's many unregulated rivers and streams). In that year, all states and territories except NSW and Victoria were able to allocate full water entitlements (see table below).

⁹ BCA 2006, *Water under pressure*.

¹⁰ ABS 4610.0.55.003, *Water access entitlements, allocations and trading 2004-05*; ACIL Tasman 2005.

Water access entitlements and allocations, 2004-05

	Total entitlements no.	Surface water entitlements ML	Ground water entitlements ML	Total entitlements ML	Allocated volume ML (%)
NSW (1)	118,110	10,644,024	2,657,827	13,301,851	9,798,575 (74%)
Vic	25,514	5,827,960	852,374	6,680,334	4,733,845 (71%)
Qld (2)	48,591	3,488,495	908,986	4,397,481	na (na)
SA (3)	10,399	789,057	854,296	1,660,584	1,660,584 (100%)
WA	17,513	902,500	1,644,143	2,546,643	2,546,643 (100%)
Tas (4)	3,110	1,038,419	-	1,038,419	1,038,419 (100%)
NT	166	59,832	80,127	139,959	139,959 (100%)
ACT (5)	153	64,154	660	66,150	66,150 (100%)
Australia	223,556	22,814,441	6,998,412	29,831,421	na (na)

(1) NSW allocated volume equals maximum available volume. (2) Excludes 1,931 water licences without a volumetric entitlement in Qld. Allocated volumes are not available for Qld. (3) Total entitlements for SA includes 734 entitlements of 17,232ML that are combined surface and groundwater entitlements (4) Excludes Hydro Tasmania, which holds a Special Water Licence of 13 mn ML per year (Australia's single largest water licence), almost all of which is returned to the environment. (5) Total entitlements for the ACT includes 12 entitlements of 1,336ML that are combined surface and groundwater entitlements Source: ABS 4610.0.55.003, *Water access entitlements, allocations and trading 2004-05*.

In 2005-06 and 2006-07, water allocations have been significantly lower than in 2004-05, particularly in irrigation water management areas through Qld, NSW, Victoria and SA. Allocation percentages vary across water management areas and for different types of water entitlement holders (e.g. 'high security' vs 'general' or 'low security' entitlement holders). 2006-07 allocations have fallen to as low as 15% for 'general security' water entitlement holders in some locations. Temporary reductions in annual water allocations are not generally compensated by water authorities. Charges for the full water entitlement (rather than just for the fraction actually allocated) still apply in some water management areas but not in others. Partial rebates for water transport costs are available to eligible water entitlement holders in some locations and 'exceptional circumstances' drought assistance packages are available to eligible farmers in official drought declared areas.¹¹

Water entitlements for urban water providers are generally accorded permanent or 'high security' status, such that the full entitlement is available for allocation. In the absence of market-based or user-pays pricing, water rationing in urban areas is handled by government-imposed water restrictions for households and businesses. Many cities and towns around Australia have now been subject to urban water restrictions for several years. Water restriction levels are defined and imposed by state and territory governments in stages (up to 6 stages) that are triggered by changes in urban water storage levels. Victoria has also imposed permanent water-saving regulations since 2005. Households and businesses that breach local water restrictions can be prosecuted and fined. The number and definition of urban water restriction stages are not standardised across Australia.

Water markets and trading

Theoretically, water can be traded in Australia on a permanent (trade in water entitlements) or temporary (trade in water allocations) basis. In practice, both forms of trading are extremely limited. Only around 4% of water rights (7% of total water consumption) were traded in 2004-05. 1,756 transactions for permanent water rights (water entitlements) took place. This included water entitlements that changed ownership as a result of a land sale (that is, water rights attached to or sold with a property). Another 13,088 temporary water allocations were also traded. Only 46 permanent and 368 temporary water rights were traded interstate, with most of these going from Victoria to NSW or SA. Most of the remaining trades took place within water management areas rather than between them.¹² Most but not all of these water transactions were for agricultural purposes — several golf courses, for example, have purchased local water entitlements in order to gain cheaper, more reliable water.

The National Water Initiative aims to create effective national markets for both permanent and temporary water rights with "the widest possible geographic scope and not restricted to within catchment areas". In order to do this, certain barriers to trade need to be first addressed including:

- excess water entitlements in over-allocated water management areas;
- legally consistent, enforceable and secure water entitlements across all states and territories, including legally secure entitlements for environmental water flows;
- nationally consistent water accounting and data collection systems across all water management areas; and

¹¹ See Economics@ANZ 2006, *Impact of the drought 2006-07*; Murray-Darling Basin Commission; Murrumbidgee Water.

¹² ABS 4610.0.55.003, *Water access entitlements, allocations and trading 2004-05*.

- compatible wholesale water pricing structures for urban and rural water entitlement holders so that trade in both permanent and temporary allocations can occur more freely between the two categories (enabling, for example, irrigation water entitlement owners to sell their entitlement or allocation to urban water suppliers).

These measures are aimed largely at establishing an effective and efficient wholesale water market. Other measures and policy changes would subsequently be needed to improve the efficiency of retail water markets, such as devising more market-oriented water pricing systems while still allowing for equity of access to water as an essential service for all people and households (e.g. introducing seasonal or peak prices or sliding price scales based on actual water volumes consumed). This process is under way, but urban water pricing is not yet flexible enough to adequately 'ration' water when needed — hence the need to impose water restrictions in urban areas.

Urban retail water prices are set at different rates and different scales across Australia (supplied and billed by 387 water supply entities), with varying degrees of user-pricing. Most suppliers charge a service fee to cover infrastructure costs, plus a price per volume consumed. Many areas have a flat price per KL or a two-tier volume pricing structure only. In Tasmania, urban water rates are still based on land values rather than on the volume consumed. Prices per KL also vary greatly across Australia, at up to \$1.48/KL for households in Sydney (rising to \$1.85 in 2008-09) but lower in other cities, with an average capital city price of around \$1.00/KL. Prices in regional cities and towns are generally much lower; for example, \$0.62/KL in Bendigo and \$0.40/KL in Shepparton. Compared with other countries, our urban household water prices are similar to the US but much lower than in Europe. The National Water Commission is reviewing retail water pricing structures across Australia, with a view to encouraging a greater reliance on user-pays pricing (that is, prices based on the actual water volume consumed) and eventually, pricing that better reflects local or seasonal supply constraints.¹³

Objectives for future regulatory reform

The National Water Initiative aims to achieve "a nationally compatible market, regulatory and planning based system of managing surface and groundwater resources for rural and urban use that optimises economic, social and environmental outcomes". It has 10 stated objectives relating to water entitlements, planning, environmental management, over-allocations, barriers to trading, risk management, accounting, efficiency, adjustment and connectivity of water management systems. Of these objectives, a National Water Commission 'stakeholder reference group' has identified the following common goals as requiring urgent action:

- establish a robust, secure and consistent national system of water entitlements;
- promote interstate water trading;
- improve the security of environmental water flow entitlements;
- introduce nationally consistent water accounting, metering, reporting and data sharing;
- address water over-allocation and over-use;
- improve water planning in urban areas; and
- accelerate the adoption of water recycling and improve water efficiency in urban and rural areas.¹⁴

In the current extended drought environment, perhaps the most pressing of these issues is dealing with systemic water over-allocations. The National Water Commission estimates that as of 2005, 1% of Australia's 340 surface water management areas and 5% of 367 groundwater management areas were 'over-allocated' (that is, over 100% of sustainable water levels were permanently allocated for extraction and consumption), while another 13% of surface water and 23% of groundwater areas were 'highly developed' (that is, 70-100% of sustainable water was allocated), putting them at greater risk of temporary over-allocation during dry periods.¹⁵ Correcting these over-allocations is an important pre-requisite to ensuring the future security of all remaining water entitlements and allocated environmental flows. Some permanent over-allocations (in the form of water entitlements) may therefore need to be bought back by governments for environmental and other purposes.

¹³ ABS 4610.0, *Water Account 2004-05*; BCA 2006, pp. 35-6.

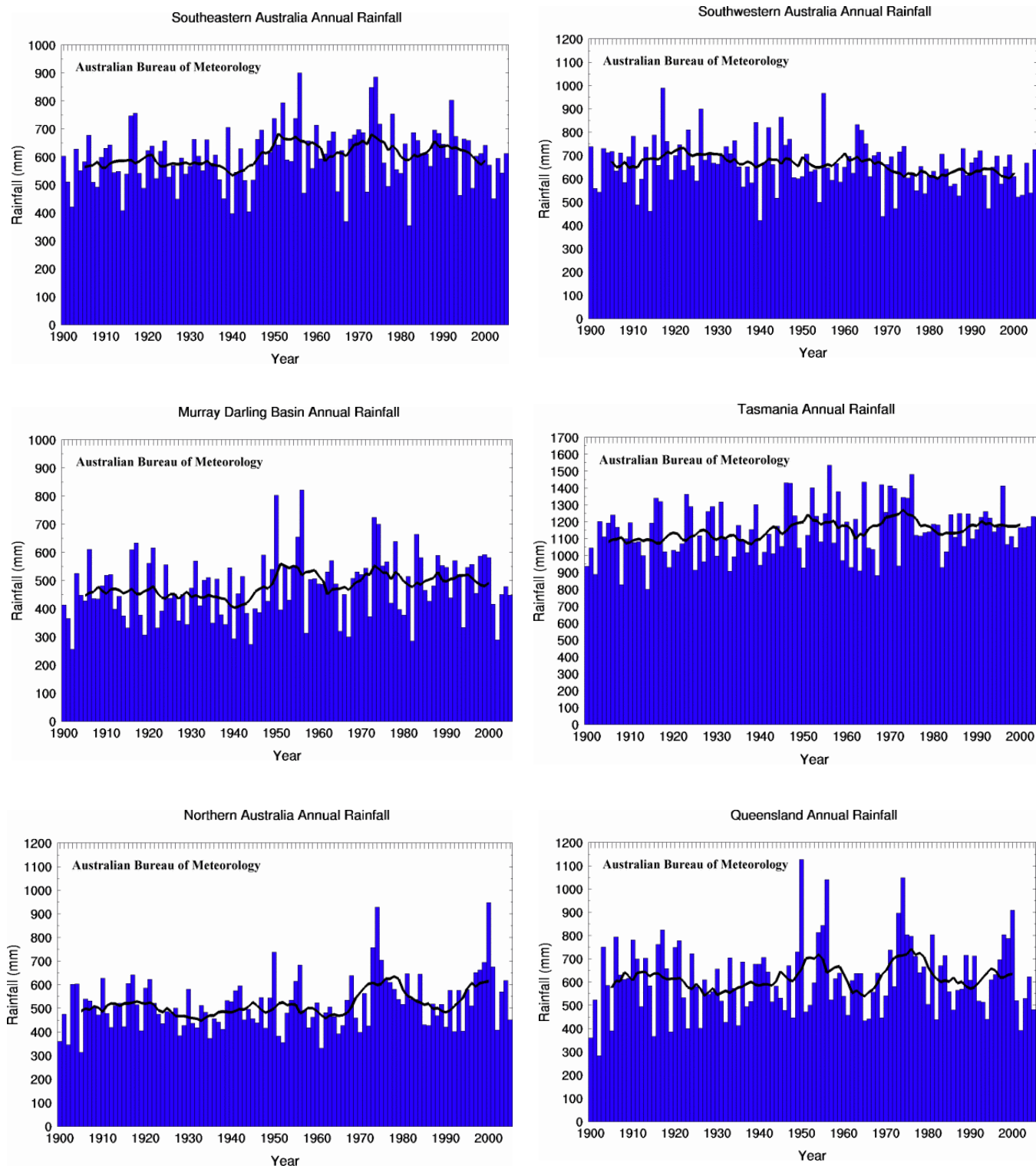
¹⁴ COAG 2004; National Water Commission 2006, "Peak groups identify common goals for water reform", Media Release.

¹⁵ National Water Commission 2006, *Australian Water Resources 2005; a baseline assessment of water resources for the National Water Initiative*.

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Long term annual rainfall, 1900 to 2005, selected regions



Source: Bureau of Meteorology, http://www.bom.gov.au/cgi-bin/silo/reg/cli_chg/timeseries.cgi

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