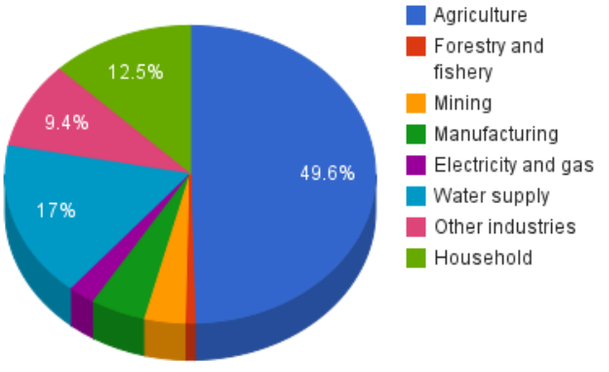
Urban Water Supply and Use

Water scarcity is a serious issue facing Australia's major cities. Australia is a highly urbanised country (89 per cent of the population lives in towns and cities), and urban populations are expected to grow rapidly over the next 40 years. Many urban areas draw heavily on finite water supplies. This pressure is anticipated to increase due to population growth, but also due to urban regions and their water catchment areas becoming increasingly hotter and dryer because of climate change. The implications of climate change are decreased rainfall and increased evaporation, leading to an overall reduction in runoff into dams. The impacts of climate change on urban water resources are expected to be felt most severely in southern and eastern Australia, its most heavily urbanised regions. Thus, planning for our water future is a necessary and, in many cases, urgent task.

Figure 1: Australian water consumption by sector, 2008-09.
(Source: Australian Bureau of Statistics, Water Account Australia 2008-09).



Australia's water resources are most plentiful in areas where population is sparse. Tasmania and the regions north of the Tropic of Capricorn receive in excess of 50 per cent of the nation's divertible water, but contain a small proportion of the population. By comparison, approximately 65 per cent of the nation's population live in the coastal regions of Victoria, New South Wales and Queensland, an aggregate area which receives 23 per cent of the nation's divertible water. With climate change predicted to aggravate water shortages in major population centres due to increased duration and frequency of droughts, the security of urban water supplies is of paramount importance.

Household water use in Australia

In 2008-09, households used 12.5 per cent of the water consumed in Australia (see Figure 1) or 1,768 GL, a decrease of 16 per cent from 2004-05. The majority of households receive their water from mains supply and a growing number supplement this with rainwater tanks. A large proportion of household water is used for purposes other than human consumption such as watering gardens, washing cars and other household activities. Outdoor water use is the major form of household water use.

Units of water measurement:

- 1 Kilolitre (KL) = 1,000 litres
- 1 Megalitre (ML) = 1,000,000 litres
- 1 Gigalitre (GL) = 1,000,000,000 litres

Ninety-three per cent of Australians have access to a reticulated water supply and 90 per cent have a connection to reticulated sewage. A reticulated water system refers to a piped water system, such as a town supply. In the capital cities, 99 per cent of households are connected to mains or town supply. Total household water use in 2008-09 was:

- New South Wales 536 GL
- Victoria 342 GL
- Western Australia 326 GL
- Queensland 308 GL
- Northern Territory 154 GL
- South Australia 122 GL
- Tasmania 69 GL
- Australian Capital Territory 27 GL

In 2010, 26 per cent of households sourced water from rainwater tanks, up from approximately 17 per cent of households in 2004. South Australian households lead this trend, with 49 per cent of households having a rainwater tank. Victorian and Queensland households have also increased rainwater tank usage to 30 per cent and 36 per cent respectively.

Predicted urban water consumption increases

Figure 2 below illustrates how Australian urban water requirements may change over the next 40 years. The three predictions are based on Australian Bureau of Statistics projected population changes until the year 2056, with Prediction B considered the most likely, and Prediction A the least likely. Under predictions A, B, and C the Australian population is anticipated to increase to 45.5 million, 35.5 million, and 31 million respectively by 2056. Commensurate to these population predictions will be increased demand for urban water in Australia per annum: 1,612 GL, 1,147 GL and 961 GL respectively for these three scenarios by 2056.

The gap between the volume of water supplied in 2009 and demand in 2026 is anticipated to be 737 GL, 631 GL and 581 GL for predictions A, B, and C respectively. Therefore, under a conservative population growth estimate, 581 GL of water will be required per year within 14 years, in addition to the 1,500 GL currently used in urban areas. This means urban water managers need to be actively planning to ensure they can deliver sufficient water to meet the future water needs of urban populations.

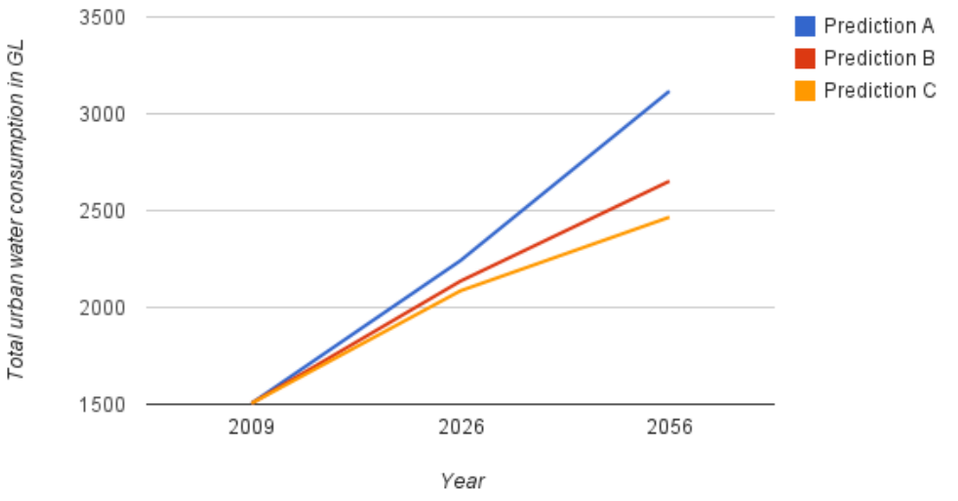
Governments are responsible for water collection, storage, treatment, distribution and waste-water management in all of Australia's states and territories, typically through state-owned utilities. Water security in urban areas is typically achieved by focusing on either water demand or water supply management.

Demand management for urban water security

Demand management means reducing the amount of water needed to perform the same functions, for example, improving the water efficiency of taps and showers or changing the water use habits of people. Education programs, rebates, incentives and water restrictions are some of the main demand management approaches employed by governments to reduce water use.

Over the last twenty years urban water consumption has increased overall while decreasing per person. This has been achieved predominantly through demand management approaches. For example, in 2004-05, Australian householders used an average of 103 KL per person, compared to 120 KL per person in 2000-01. This reduction has

Figure 2: Projected urban water consumption increases for Australia
(Source: WSAA Occasional Paper 25, July 2010).



been achieved through water pricing reforms, education programs and technological changes such as water efficient washing machines and dual flush toilets. The reduction in per capita water use has allowed the populations of the major urban areas to increase without the need for new water storages. Nevertheless, predicted trends in population growth and the implications of climate change mean that overall water consumption in all the main urban centres will increase.

Water supply and management in Australia's major cities

Supply management means increasing the supply of water. This can be done in a variety of ways. Harvesting rain water, stormwater and recycling household water for uses such as toilet flushing or watering the garden are ways of replacing drinking water supplied from catchments. These options have potential to reduce water use by 50 per cent without loss of quality of life. Neighbourhood and regional scale recycling plants can also provide an alternative supply of water. Other options include dams and desalination plants. However, dams affect natural river ecosystems and do not solve the problem of future changes in rainfall patterns. Desalination plants (removing salts from sea water) are energy intensive and, unless they are powered by renewable energy, will contribute to climate change and ultimately to further water shortage in the Australian urban areas. Another problem is the high cost of modernising urban water infrastructure, not only is it expensive to add additional pipes to carry recycled water, but the works can also be disruptive in highly urbanised areas.

Australian cities typically depend on water stored in dams as the primary urban water source. This tendency makes the cities vulnerable to drought, and the prospect of climate change increasing the frequency and duration of drought has led decision-makers to explore and invest in other options to augment urban supplies.

The situation in each of Australia's capital cities is as follows:

- Sydney: Rainfall in the Sydney region is higher in volume but less frequent than in other metropolitan areas. Sydney stores more water per head of population in storage dams than most other cities in the world; the total storage being 2,863 GL, with the Warragamba Dam holding just over 70 per cent of that total storage volume. Due to ongoing concerns over the capacity of the dams to fulfill Sydney's water needs, recycling and conservation strategies have been implemented to increase the volume of water available. In 2009-10, approximately 36 GL of recycled water was used in the Sydney area, with an aim of 70 GL by 2015, which would equate to 12 per cent of Sydney's water needs. Additional to these plans has been the commissioning of the Kurnell desalination plant, which became operational in January 2010. Kurnell is powered by renewable energy from the Capital Wind Farm in Bungendore and can supply 250 ML of drinking water a day.
- Melbourne: Most of Melbourne's drinking water comes from pristine Mountain Ash forests in the Yarra Ranges that have been closed to public access for almost 100 years. These water storages have a total capacity of 1,773 GL. Ongoing drought since 1998, and concerns over the long-term security of Melbourne's water supplies, led the Victorian Government in 2004 to unveil a comprehensive plan with 110 water saving initiatives to secure future water supplies. In 2005, permanent water saving rules were introduced with penalties for non-compliance (e.g. restrictions on manual watering). Additionally, in 2007 the Victorian Government introduced plans to further diversify water supplies. These included a desalination plant in Wonthaggi which can produce 150 gl per year, or 33 per cent of Melbourne's water needs. The Victorian and Commonwealth governments are investing $2 billion in modernising irrigation systems in northern Victoria. As part of this program, a pipeline connecting the northern irrigation regions has been built which can supply 75 GL of water to Melbourne per year, and is held as a drought reserve in Lake Eildon.
- Brisbane: Floods in February 2009 ended what had been the worst drought in the last 100 years in Brisbane. The drought prompted water managers in southeast Queensland to investigate alternative water supply options to storage dams, which had fallen below 20 per cent of their total storage volume of 2,220 GL. Desalination and the use of recycled water were considered to be two of the most viable options. These have included the western corridor recycled water project, producing 230 ML of recycled water per day. This water is pumped

through a 200 kilometre network of pipes, primarily for cooling coal-fired power stations, and can provide water to agricultural users, as well as delivering water into the Wivenhoe Dam for the water needs of Brisbane. The Tugun desalination plant was completed in February 2009 and is capable of producing 125 ML per day. The plant was put into standby mode in December 2010 following widespread rain in the region which replenished dam levels. Tugun will remain on standby until water storage levels fall below 60 per cent.

- Adelaide: Adelaide extracts water from two sources: the River Murray and the Mt Lofty Ranges catchment within the Adelaide Hills. It has been projected that water demand in the city will exceed supply within 20 years without measures to increase water supply. In drought years the Murray provides up to 90 per cent of urban water in South Australia. This means the city relies on good river management practices in upstream states. High salinity levels in water drawn from the Murray, however, is a significant problem. The South Australian Government's strategy has three key goals: (1) to better manage existing resources; (2) to encourage responsible water use; and (3) to develop additional water supplies. Desalination features prominently in Adelaide's water management strategies. The Port Stanvac desalination plant will provide Adelaide with 135 ML of water per day, with output expected to increase to 270 ML per day in 2012, approximately 50 per cent of Adelaide's water needs. The strategy aims to ensure a security of supply of high quality water until 2025 and beyond.
- Perth: Perth's water comes from two major sources: surface water from storage reservoirs on rivers in the Darling Range and groundwater pumped from huge natural reservoirs. Perth's dam can hold up to 605 GL, or 25-45 per cent of its water needs, while groundwater supplies between 35-50 per cent. Climate change is expected to have a severe impact on Perth's water supplies. Since the mid-20th century, diminishing winter rainfall has led to annual inflows dropping by 50 per cent. Flows into the Stirling Dam catchment are predicted to drop by 31 per cent by 2050. In 2006, the Perth Sea-water Desalination Plant in Kwinana was commissioned to supply Perth 17 per cent of its water needs. It was the first plant in the world to use electricity generated from a wind farm to avoid the use of fossil fuels and their climate change impacts.

National policy

In 2004, the Council of Australian Governments (COAG) agreed on the National Water Initiative as a national blueprint for water reform. The Initiative includes objectives to improve water planning and over-allocated water systems, and to develop better and more efficient water management in urban areas. In the same year, the National Water Commission was established under the National Water Commission Act 2004 as an independent statutory body to drive the national water reform agenda. In 2006, a National Water Summit was held to discuss means of dealing with drought and the over-extraction of water from Australian rivers. The Summit ordered emergency work to protect urban water supplies. In March 2008, then Prime Minister Kevin Rudd announced that the states had agreed to establish a new basin-wide plan for the Murray-Darling Basin. Under the plan, the Australian Government will have the power to set a new sustainable cap on water extraction. In addition, the Government announced a commitment of $50 million to purchase water entitlements in the basin, which will help reduce the extent of overuse of water, allowing more water to flow to the environment. These measures, although a preliminary step only, are of vital importance for the protection of Adelaide's water supply because it is situated at the end of the Murray River system.

The Australian Government Water Fund was a $2 billion program to invest in water infrastructure, improved water management and better practices in the stewardship of Australia's scarce water resources. The Fund has three programs: Raising National Water Standards; Water Smart Australia Programme; and the Community Water Grants Programme. The Water Efficiency Labelling Scheme aims to decrease water consumption through labelling all showerheads, washing machines, toilets, dishwashers, urinals and some types of taps according to water efficiency.

A challenge for Australia during the 21st Century will be to deliver water to towns and cities that is affordable, socially acceptable, yet does not impose a significant environmental burden.

Useful sources

Australian Bureau of Meteorology
http://www.bom.gov.au/water/?ftr
The Bureau of Meteorology (BOM) has the responsibility for compiling and disseminating water information across Australia, in particular explore the National Water Account 2010, a comprehensive and user friendly online resource containing information relating to eight nationally significant water management regions.

Australian Bureau of Statistics, (2006). *Water Account for Australia 2008-09,*
http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/4610.02008-09?OpenDocument
This ABS publication, released in November 2010, provides the latest information on water supply and use in Australia for 2008-09.

Australia State of the Environment (SOE) Report (2006), "Human Settlements",
http://www.environment.gov.au/soe/2006/publications/report/pubs/soe-2006-report-chapters-1-3.pdf
The latest SOE report documents serious issues facing major Australian cities, including issues relating to the management of urban water resources.

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