

2.19 Managing water in Australia's biggest cities

In order to ensure that reliable supplies of safe water are available for use now and into the future, we all need to use water more **sustainably**. Careful management of our existing supplies and reductions in our consumption will help to achieve this. We also need to remember that people are not the only living creatures on the planet. The interests of all living organisms need to be considered if the natural environment is to be protected for the future.

Source 1 The Warragamba Dam near Sydney is one of the largest domestic water supply dams in the world. It supplies 80 per cent of Sydney's water.



Ensuring reliable water supplies in Australian cities

Over 60 per cent of Australia's population lives in one of our five largest cities – Adelaide, Brisbane, Melbourne, Perth and Sydney – all of which are home to more than a million people. The sites of these cities were chosen in large part because of their reliable rainfall and access to fresh water from neighbouring rivers. However, all of these cities have now outgrown their original water supplies. Large dams have been built to provide a permanent water supply for large towns and cities, but population growth and drought have put enormous pressure on these reserves. As a result, many Australian cities are now looking at a number of strategies to reduce their water usage and ensure they have access to reliable supplies into the future. Some of these options are discussed here.

Option 1: Build more dams

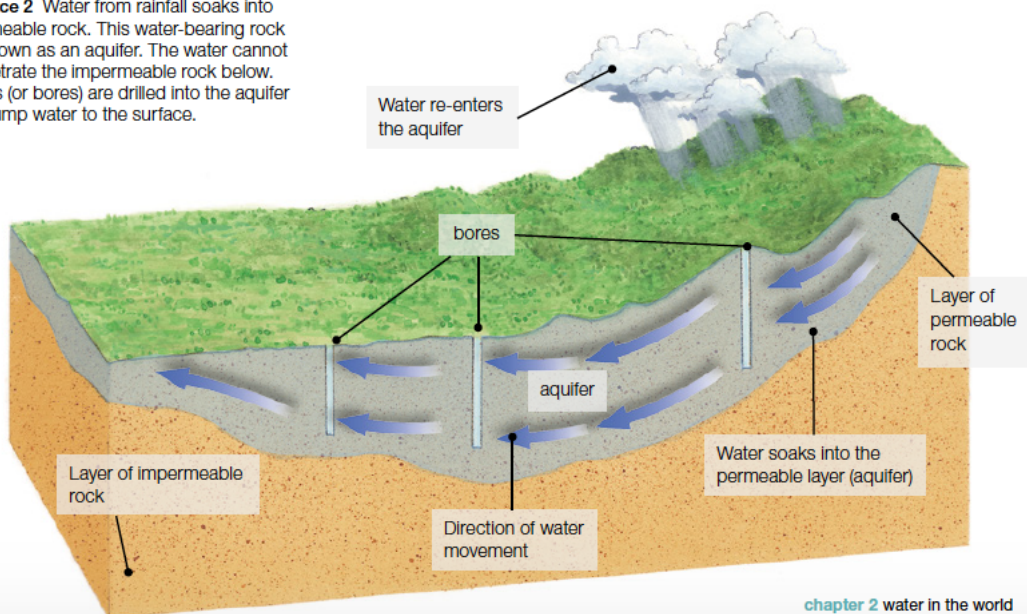
Across Australia, governments are thinking about building more dams to create a reliable water supply for our growing population. Dams can also be used to create hydroelectric power when water let through the dam wall turns a turbine to create electricity.

Option 2: Use underground water reserves

Drilling water bores is a common method used on Australian farms for supplying water for irrigation and animals. Many Australian cities have started to use this method to add to their freshwater supplies. Deep holes, called bores, are drilled down into a layer of rock under the ground that holds water. This layer of rock is called an **aquifer**. The water is then pumped to the surface (see Source 2). It is also possible to replace the water in the aquifers during wet periods by pumping the water back underground. In this way, aquifers operate as underground dams. In Western Australia scientists are trialling a method of treating storm water (rainwater that falls on the hard surfaces of a city, such as roofs and roads) and using it to recharge the aquifers that supply much of Perth's water.

There are large aquifers in many areas of Australia, including beneath Melbourne. Often this water has a high mineral content and must be treated before it can be used for drinking and other household uses. This water could be used for industrial purposes, such as to clean machinery and irrigate crops. This would allow drinking water, currently used for these other purposes, to be added to the city's water supplies. This idea of using lower-quality water for non-domestic purposes has been considered in many Australian cities.

Source 2 Water from rainfall soaks into permeable rock. This water-bearing rock is known as an aquifer. The water cannot penetrate the impermeable rock below. Wells (or bores) are drilled into the aquifer to pump water to the surface.



Option 3: Build desalination plants

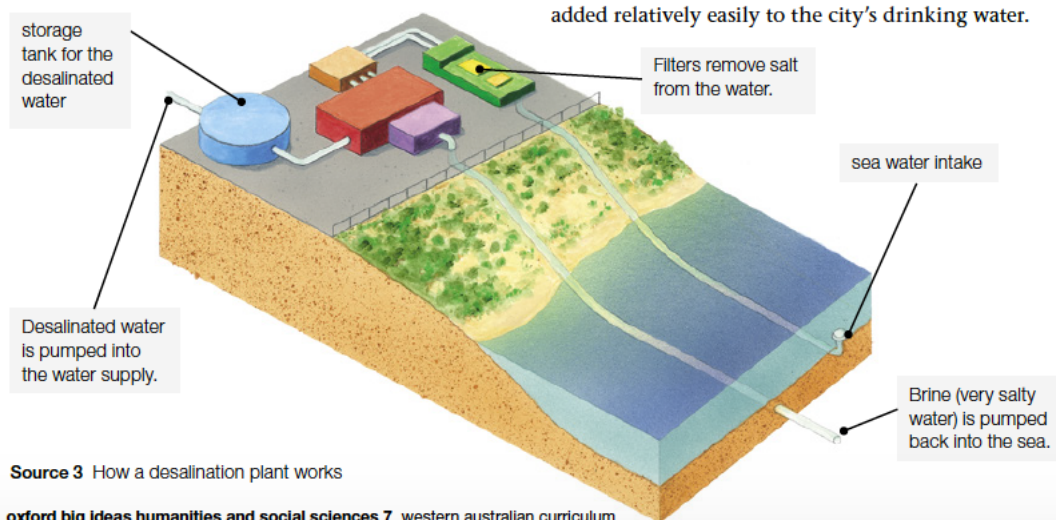
Desalination plants treat sea water to remove from it the salt and other impurities (see Source 3). This process, known as reverse osmosis, turns sea water into fresh water for drinking. As Australia has easy access to a vast supply of sea water, desalination plants are an attractive option for many cities.

There are three main reasons why there are not more of them already:

- Desalination plants cost a lot of money, making the water they produce expensive. The Perth desalination plant, opened in 2006, cost \$387 million to build and adds about \$44 a year to every consumer's water bills.
- Desalination plants use a lot of electricity. It has been estimated that the Sydney desalination plant uses as much electricity as 120 000 households. A new power plant had to be built to run it, adding to the cost.
- Desalination plants can damage the environment. They release highly concentrated salt water (brine) back into the ocean, which can harm marine animals.

Option 4: Build water pipelines

Perhaps the simplest method of ensuring a reliable water supply is to move water from areas that have a surplus. This already happens in most Australian cities. Rainwater is collected in catchments in the hills and forests close to cities and piped to treatment plants and then to water users.



Source 3 How a desalination plant works



Source 4 In some parts of Australia, such as the Eastern Goldfields region of Western Australia, water has to be piped in from other areas. This pipeline carries water from Perth to Kalgoorlie.

One proposal currently involves piping water not just hundreds of kilometres but thousands. For many years, there has been an idea to pipe water from the Fitzroy River in the Kimberley region in north-western Western Australia to the city of Perth. This pipeline would need to be 3700 kilometres long. The cost of transporting water this far through steel pipes is much greater than other options, such as desalination plants, and so this method is unlikely to be used in the near future. It will also cause environmental problems at the source of the water and would require large amounts of energy to build and operate.

Option 5: Capture and store storm water

Storm water is collected in pipes and gutters and discharged in the sea or rivers. Rainwater tanks capture this fresh water but cities have not been designed to collect this water on a large scale.

In Adelaide, there is a plan to capture this water through existing pipes and treat it in the current water-treatment facilities. In this way, it could be added relatively easily to the city's drinking water.

Option 6: Recycle and treat waste-water and sewage

Water that leaves our homes is generally unsuitable to be used again. In using the water to clean clothes, dishes and ourselves and to flush toilets we have polluted the water. This water (known as waste-water or sewage) is usually piped to a treatment plant where it is cleaned and purified and then released back into rivers and bays. In some places, notably Singapore and Windhoek (see 2C Rich task) in Namibia, this water is added to rainwater and piped back into homes and to other water users.



Source 5 At this plant in Singapore, waste-water (sewage) is processed and then used in industry or blended with rainwater for use in homes.

keyconcept: Sustainability

In trying to use our resources sustainably, we sometimes have to change our attitudes and behaviours. While many Australians believe that we should use less water or use water from different sources, it can be difficult to convince people to change.

In 2012 the Western Australian Government successfully completed a trial of the Groundwater Replenishment Scheme and set a goal to deliver the project officially by the end of 2016. This scheme involves treating waste-water using a number of methods so that it meets drinking water standards. It is then injected as groundwater where it continues to be cleansed naturally. The water is removed later and treated again before it is used as drinking water. The project has the capacity to recharge 14 billion litres of water into groundwater supplies.

One of the great benefits of storing drinking water as groundwater is that groundwater supplies are not affected by changes in climate the same way dams or rivers might be. As Australia continues to experience a dryer climate, increased groundwater supplies could help Western Australians by reducing the need for rainfall for drinking water, and by sustainably recycling water rather than wasting it.

While some people might not like the idea of drinking wastewater, recycled water is an important addition to our water supply and is actually very clean once it has been treated. For more information on the key concept of sustainability, refer to page 9 of 'The geography toolkit'.

Check your learning 2.19

Remember and understand

- 1 In your own words, describe what a sustainable resource is.
- 2 List five different ways that governments might investigate to find extra water resources for growing cities.
- 3 When a new dam is built across a river, what problems are caused for people and wildlife upstream from the dam?
- 4 How can aquifers be used to provide and to store water?
- 5 What are the advantages and disadvantages of desalination?
- 6 Where does the water that you use at home come from? Where does it go when you are finished using it?

Apply and analyse

- 7 Why doesn't Perth pipe water from wet places in Western Australia?

Evaluate and create

- 8 Complete the following activities:
 - a Research Perth's current water supply. Which of the water supply methods described here does it currently use?
 - b Which of these methods do you believe should be used to add to this water supply?
 - c What impacts would these new methods of water supply have on the natural environment and the cost of water?