Can water banking guard against a future 'Day Zero'?

By Declan Page and Joanne Vanderzalm, CSIRO

AS the water count down continues to 'Day Zero' in regional centres in New South Wales and Queensland, how can science provide greater water security into the future?

Outback councils are rushing to put emergency water measures in place for Australian towns at risk of running out of water. After more than a decade since the end of the millennium drought, water security is still an unresolved challenge for many rural communities.

Regional towns such as Warwick, Stanthorpe, Tenterfield, Walcha and Goulburn, are deemed at high risk of running out of water within six months, if it doesn't rain soon. This has been termed 'Day Zero' after a similar water crisis occurred in Cape Town in 2017. 'Day Zero' is a shorthand reference for the day where municipal water supplies would largely be switched off and residents would have to queue for their daily ration of water.

With the spotlight now turned on Australia, our researchers are investigating how water supply security can be supported through considering not just 'supply' and 'demand' but also new options for 'storage'.

There is no single solution to water security problems. Instead, we need a diverse portfolio of sustainable solutions, and these may differ across regional centres.

What is water banking?

There are options available to increase water security for regional towns that are yet to be fully explored. One of these is 'banking water' in aquifers.

Water banking, also known as Managed Aquifer Recharge (MAR), is the purposeful recharge of water into aquifers for subsequent recovery and use. Water banking is the broad term for various methods to recharge aquifers with available water. Importantly, available water from numerous sources, such as flood water, urban stormwater, treated sewage, desalinated water and groundwater from another aquifer, can be stored when it is in excess until it's required for use. The appropriate MAR method is largely governed by the hydrogeological conditions at the point of recharge.

Water banking can increase water security to help regional towns cope with drought and provide a storage role in producing fit-for-purpose water supplies.

Water banking works well in conjunction with traditional water supplies such as reservoirs, where storage capacity is increased by storing water in both reservoirs and aquifers when rivers are flowing.

Water banking in Ophthalmia Dam

An example of this is Ophthalmia Dam, in the Pilbara in Australia's north west. Constructed in 1981, the dam was part of a conjunctive storage scheme built to support mining operations and the local community. A separate MAR system, using infiltration basins, was constructed downstream of the dam but was not used because leakage through the floor of the dam itself was so effective in recharging the aquifer, according to the WA Department of Water's 2009 Newman Water Reserve drinking water source protection plan.

New water supplies such as seawater desalination plants or water recycling plants can be developed with water banks.

These water treatment plants are most efficient when operated at a constant rate, and water can be banked during wetter periods when immediate demand is low.

The key is to ensure storage capacity is sufficient to augment supply during times of stress, such as drought, in addition to balancing seasonal demand for water supply.

Recharge through the floor of Ophthalmia Dam, in the Pilbara in Australia's north west, effectively recharges the aquifer.
(PHOTO: Pilbara Development Commission)

Groundwater sampling at a salt lake in the Murray-Darling Basin to test for iron levels.

Reducing demand on water supply systems during times of stress

Water banking currently makes only a small contribution to water resources development in Australia, estimated at about 400 gigalitres a year, by Peter Dillon in Australian Progress in Managed Aquifer Recharge and the Water Banking Frontier. That is less than 10 per cent of the estimated 5000 gigalitres a year of national groundwater use, according to hydrologists Nikki Harrington and Peter Cook, in Groundwater in Australia.

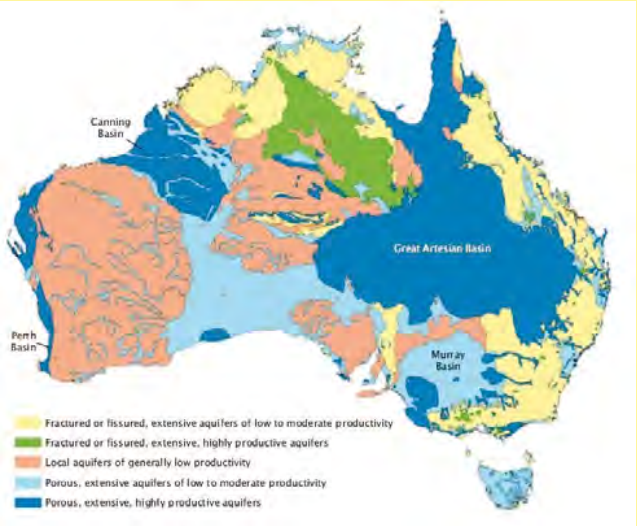
The role of water banking for regional towns has the potential to reduce demand on current water supply systems and the environment during times of stress, such as drought and growing demand.

At the same time, it is generally acknowledged that the potential role for water banking has not been fully realised across Australia. By 2019, a range of water banking schemes had been developed in concentrated pockets across Australia, including Adelaide (20 GL/year urban stormwater), Perth (20 GL/year treated wastewater) and some rural areas (e.g. Burdekin Delta 45 GL/year) (Figure 1).

There are potential opportunities for water banking to be explored in townships facing Day Zero.

FIGURE 1: The types of Managed Aquifer Recharge schemes and where they are used across Australia

FIGURE 2: Under the surface – the green and blue areas are aquifers that may have good opportunities for water banking, noting that further investigation is needed to manage water quality



Source: Groundwater in Australia, by N Harrington and P Cook, 2014, National Centre for Groundwater Research and Training, Australia.

Keys to success

Each town needs to be investigated individually and the potential for a portfolio of technologies (e.g. diversification of water supply sources, water banking, increasing surface storage), to be carefully evaluated. For water banking to be successful and sustainable five key components are needed:

- A water source available for allocation to recharge, which may be seasonal, such as rivers that flood, treated wastewater, urban stormwater or even desalinated water.
- An aquifer capable of storing and recovering the water.
- A strategy around water use. Traditionally water has been recharged and withdrawn every year on a seasonal basis, but a strategic, longer-term storage is recommended for water security in regional towns.
- Capacity to harvest and treat the water for recharge, if needed, such as for treated wastewater or urban stormwater.
- The ability to manage the water banking system, requiring someone to oversee the recharge operations and water quality considerations in management of the scheme.

But unlike other technological solutions such as desalination, water banking requires careful research and investigation and supportive policy. For this reason, the uptake and growth of water banking has been slower than expected to date, which can be attributed to several key factors:

- Need for research to evaluate feasibility;
- Unknowns in costs compared with alternatives;
- Poor understanding of aquifers;
- Regulatory barriers; and,
- Lack of sustainable demonstration sites.

Water banking using recycled water will be an important growth area over the next five to 10 years. There could also be potential to store seasonally available river flood water for townships and develop a strategic storage.

In this way, regional towns could increase their water security so that they are better prepared for future droughts. ■