Potential network savings from rainwater and greywater systems in New Zealand

Much of New Zealand's water supply infrastructure is under strain. Rainwater harvesting and greywater reuse could help to alleviate that burden, but only by a limited amount, and the financial costs could be high.

NEW ZEALAND has the fastest-growing population among the OECD countries we commonly compare ourselves with, and there is a housing boom in the main population centres. Considering just affordable homes – a smaller part of the construction industry – the government is planning 100,000 new buildings over the next decade. Given our ageing reticulation systems and that new water sources are becoming scarce or more costly to secure, there is a pressing need to expand and/or improve our water supply infrastructure.

Rainwater harvesting systems catch rainwater on rooftops, while greywater is the wastewater taken from baths, showers and hand basins and, in some cases, from laundries. Greywater is typically reused after filtration/treatment for outdoor uses or toilet flushing.

BRANZ and other research organisations have studied the role that rainwater and greywater systems could play.

Rainwater harvesting in commercial buildings

BRANZ monitored eight commercial buildings with rainwater harvesting systems during 2015/16. Rainwater use ranged from 45–1,147 kL per month in summer and 22–1,039 kL per month in winter. Annual rainwater use ranged from 309–23,525 kL/year – 23,525 kL is the equivalent of around nine Olympic swimming pools.

Non-potable, non-contact end uses (such as flushing toilets and urinals) made up 23%

of the average total water use (Figure 1). Assuming that all this non-potable water could be sourced from rainwater, this indicates a potential average saving of 23% of water from the water network. Water for non-potable uses does not have to be treated to the quality of drinking water. That means there is a saving for the water service provider in the energy and financial cost of both treating and transporting the water. There is also a saving for the commercial building owner through a reduction in their volumetric water charge.

Non-potable uses were extrapolated for the building stock and projected to 2066 for Canterbury, Auckland, Wellington and the Bay of Plenty. This enables an indication of the potential volumetric savings to the network under different scenarios in 50 years' time.

Researchers modelled three scenarios based on the proportion of new builds and existing buildings that installed rainwater harvesting systems:

- Low uptake – 10% of new builds.
- Medium uptake – 20% of new builds and 10% of existing buildings.
- High uptake – 30% of new builds and 20% of existing builds.

Two water supply scenarios were modelled:

- Where an optimistic demand was met – this assumes that 23% of total building water use can be met with rainwater and/or greywater and is not taken from the network.
- Where the regional average supply (observed supply) was met – this recognises that the volume of non-potable demand that is actually able to be supplied varies by region.

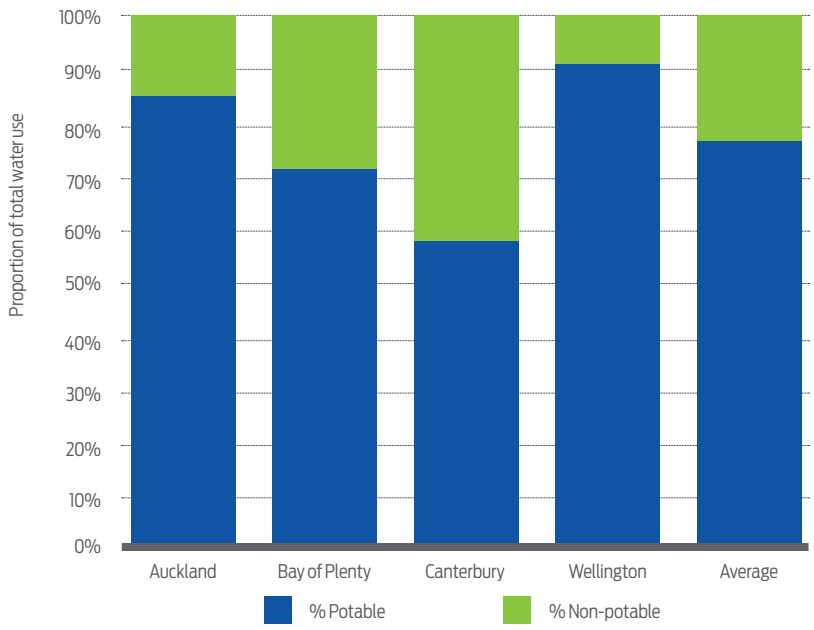

Figure 1. Annual proportion of potable and non-potable water in the BRANZ case study commercial buildings by region.

Under an optimistic supply scenario:

- a low uptake is estimated to save 109,859–585,814 kL/year
- a medium uptake is estimated to save 235,462–1.5 million kL/year
- a high uptake is estimated to save 580,782–3.6 million kL/year.

When the observed supply scenario is used:

- for the low uptake scenario, the forecast savings across all four regions ranged from 199,743 kL/year in the Bay of Plenty region to 925,170 kL/year in the Canterbury region
- for the medium uptake scenario, volumes saved ranged from 428,112 kL/year in the Bay of Plenty region to 2.6 million kL/year in the Canterbury region
- for the high uptake scenario, volumes ranged from 1 million kL/year in the Bay of Plenty region to 6.2 million kL/year in the Canterbury region.

When compared to the forecasted water demand in 2066, the volumes of potential water that can be saved under the optimistic and observed scenarios are comparatively low.

Other rainwater harvesting studies

Other investigations have also found that rainwater harvesting can only meet a portion of the demand. They also found that the financial cost can be higher than other water supply options.

A report commissioned by Greater Wellington Regional Council compared savings from reduced water charges with the cost of installing rainwater systems for outdoor usage and toilet flushing. It modelled a range of household sizes, roof areas and tank sizes. The average cost for installing systems with 5,000 L and 10,000 L tanks for a quarter of Wellington City properties was $153 million. The average total savings over 5 years would be $10.7 million. Tank systems would not pay for themselves through reduced water charges under the current charging regime.

The study commented that, while rainwater tanks can provide water supply in a civil defence emergency, space can be very limited in cities and tank installations can be difficult and expensive.

Another report by the same researchers (Harrison and Grierson) looked at the contribution rainwater tanks could make during dry summers. The model assumed a two-person household with a 100 m^2 roof collection area and a 5,000 litre tank. The finding was that rainwater would meet 17% of demand. If a quarter of households had these tanks, it would reduce water demand in Wellington City by 4.25%.

In 2015, Auckland's Watercare looked at the potential for rainwater tanks to provide water in Auckland compared to taking more water from the Waikato River. The researchers modelled different scenarios. Under the scenario with the best results, rainwater would provide up to 16% of forecast demand during a drought and 35% at the peak level of service. The cost of building this system was estimated to be four times higher than taking water from the river, and the river could provide for 100% of the forecast demand.

While rainwater/greywater systems can contribute to a reduction in network demand, they are unlikely to replace traditional water sources.

More information

Fact sheet 1 *Rainwater harvesting systems in New Zealand houses*

Fact sheet 2 *Greywater reuse systems in New Zealand houses*

Fact sheet 3 *Rainwater harvesting in non-residential buildings*

Fact sheet 4 *Water quality in New Zealand rainwater harvesting systems*

Fact sheet 5 *Benefits of rainwater and greywater systems in New Zealand houses*

Fact sheet 6 *What is holding back rainwater and greywater systems in New Zealand?*

Beban, J., Stewart, C., Johnston, D. M. & Cousins, W. J. (2013). *A study of the role of rainwater tanks as an emergency water source for the Wellington region following a major earthquake on the Wellington Fault.* GNS Science Report 2013/16. Wellington, New Zealand: Institute of Geological and Nuclear Sciences Ltd.

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