

An ideal and sustainable water supply

Dr Peter Coombes of the University of Newcastle in Australia, heads a research team in the area of rainwater quality. Following a decade of research into the quality of rainwater collected from roofs, Dr Coombes has identified the **potential for rainwater to be utilised far more extensively** than many government regulators are recommending. In fact Dr Coombes' research reinforces the view of many Australians, that **rainwater is an ideal supply for our water requirements**.

Stan Abbott is the Director of the Roof Water Research Centre and a Senior Lecturer in Microbiology & Communicable Disease at Massey University in Wellington, New Zealand. Stan's research highlights the **importance of incorporating good design features into rainwater harvesting systems**.

Highlights from research

Dr Peter Coombes

Whilst there are large losses of water in water catchment systems such as dams, **rainwater tanks harvest water efficiently** during droughts and reduce demand on water supply reservoirs. There is **more rainfall in urban areas** and **minimal water is lost** from the roof to the tank.

Rainwater tanks complement mains water supply infrastructure. Rainwater tanks are underutilized if water is only used for irrigation. **Maximum benefit occurs when rainwater is used for indoor + outdoor uses**.

The quality of rainwater is ensured by a **natural treatment chain** in the tank that reduces the presence of bacterial and metal contaminants. Bacteria, organics and chemicals form flocs that become biofilms on surfaces or settle to the bottom of the tanks to the sludge. **The processes of flocculation, settlement and biofilms in tanks act to improve the quality of rainwater**. The majority of bacteria in rainwater tanks are harmless and from the environment.

The quality of rainwater are acceptable for hot water, toilet, laundry and outdoor uses. The rainwater treatment chain was confirmed, AND the **use of rainwater reduced mains water demand by 54%**.

Water quality monitoring has shown **effective pasteurization of rainwater in hot water systems**. Rainwater used in hot water systems set at $>52^{\circ}\text{C}$ was **compliant with Australia drinking water standards**. Hot water systems pasteurize water removing bacteria.

Separation of the first flush of rainwater from the roof and gutters **will improve tank water quality**.

Rainwater tanks **reduced stormwater volumetric discharges** by 39%.

Cost of rainwater varied from \$0.3 kL to a benefit of \$0.39 kL (**considerably less than mains water**).

Extensive analysis of literature and research revealed that **health concerns about rainwater tanks was significantly overstated**. You are more likely

to contract illness from drinking mains water compared to rainwater.

Stan Abbott

The **risk of disease arising from roof-collected rainwater consumption can be low, providing** that the water is visibly clear, has little taste or smell and, most importantly, **the storage and collection of rainwater is via a properly maintained tank and roof catchment system.**

Studies have often shown deficiencies in the use of rainwater catchment systems and components cited include: lack of maintenance; inadequate disinfection of the water; poorly designed delivery systems and storage tanks; and, failure to adopt physical measures to safeguard the water against microbiological contamination.

A range of enteric pathogens has been found in roof-collected rainwater including Salmonella, Campylobacter, Giardia and Cryptosporidium. The likely sources of these pathogens were faecal material deposited by birds, frogs, rodents and possums, and dead animals and insects, either in the gutters or in the water tank itself.

Rainwater users can reduce their risks of disease from contaminated rainwater consumption by **regular maintenance** and using a **well-designed system.**

Regular maintenance should include:

- Keeping roof catchments clean and clear of moss, lichen, debris and leaves;
- Cutting back trees and branches that overhang roofs;
- Regular inspections and, if necessary, cleaning of gutters;
- Cleaning gutter and tank inlets and screens every 3–4 months;
- Disinfecting the supply, if tank contamination is apparent;
- Inspecting tanks annually and cleaning them out if necessary; and
- Testing the water periodically.

Good design features should include:

- A clean, impervious roof made from non-toxic material;
- The absence of lead flashings or lead-based paints;
- A coarse filter and first flush device to intercept water entering tank and gutter guards / screens;
- Wire mesh (screens) to cover all tank inlets;
- A covered and light-proof tank;
- Tank taps or draw-off pipes that are at least 100mm above the tank floor (Alternatively, a floating arm draw-off valve);
- A tank floor which slopes towards the sump and washout pipe; and
- A well-covered manhole for easy access and inspection.

Other research

Roof-collected rainwater can be made safe and potable so that it complies with strict international drinking water standards (Waller & Inman, 1982; Gould & McPherson, 1987). This is especially true when measures such as tank cleaning and the use of first flush diverters and coarse rainwater filters are undertaken.

In South Australia 42% of residents mostly drink rainwater in preference to their mains water without any apparent effect on the incidence of gastrointestinal illness (Heyworth et al. 1998). To investigate the relationship between tank rainwater consumption and gastroenteritis in South Australia, a prevalence survey of 9,500 four year-old children was undertaken and this was followed up with a longitudinal cohort study of gastroenteritis among 1000 four to six-year-old children, selected on the basis of their tank rainwater consumption (Heyworth, 2001). This study found that in South Australia, children drinking tank rainwater were not at a greater risk of gastroenteritis than children drinking public mains water. In fact, the data suggest that those children drinking treated public mains water were at

an increased risk of gastroenteritis.
