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Alternative Urban Water Supplies – Discussion Paper Feedback

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I have reviewed the submission by Rain Harvesting Pty Ltd to the Victorian Government's discussion paper *Alternative Urban Water Supplies*. I fully support this submission and the recommendation that mandatory use of rainwater must be underpinned by a set of minimum standards for all rainwater catchments and tank installations.

While the use of alternative water sources such as roof-collected rainwater can be part of the solution to diminishing water resources, they do however, have the potential to introduce new health threats such as waterborne diseases from contaminated water sources. The risk of contamination of roof water supplies can be minimised by modern approaches to water management. Therefore, for public health and safety, it is paramount that standards are in place to ensure the consistent installation of safe, simple and effective rainwater collection and storage systems for the continuous supply of high quality potable water.

In New Zealand more than 10% of the population (~380,000) depends on roof-collected rainwater systems for their drinking water, especially in rural areas that are not served by municipal town water supplies. Roof-collected rainwater consumption is also popular because the general public has the perception that rainwater is "pure" and safe to drink. The latest Ministry of Health data published in the *Annual Review of the Microbiological and Chemical Quality of Drinking-Water in New Zealand*, show that there are currently 368 (16.7%) registered rainwater supplies in New Zealand. Of these registered supplies, serving 25 or more people at for at least 60 days per year, 73.4% are school water supplies. Roof-collected rainwater supplies serving fewer than 25 people are unregistered and classed as private or individual dwelling supplies.

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. However, a number of national and international studies have shown that the microbiological quality of roof-collected rainwater is usually poor and often fails to meet national and international drinking water standards. These studies include our own case-control studies and microbiological surveys of the drinking water quality of roof-collected rainwater that we are currently conducting throughout New Zealand.

We have frequently found deficiencies in the use of rainwater catchment systems and components by roof water users including:

- Lack of maintenance
- Inadequate disinfection of the water
- Poorly designed delivery systems and storage tanks
- 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.

In a recently completed study of 450 roof-collected rainwater samples from private dwellings in the lower half of the North Island in New Zealand, we found more 30% of the samples were heavily contaminated with faecal indicator organisms and we noticed a strong correlation between contamination levels and poorly designed delivery systems and/ or storage tanks. Conversely, we found a significantly large number of samples with low to zero microbial levels from roof water supplies where basic physical measures, such as rain heads (debris screens) and first flush diverters, had been incorporated into the downpipes connected to the storage tanks.

New Zealand Ministry of Health data published in the *Annual Review of the Microbiological and Chemical Quality of Drinking-Water in New Zealand* showed that only 6.5% of all the registered rainwater supplies complied with the *Drinking-Water Standards for New Zealand* and of the schools that rely on roof-collected rainwater alone for their drinking water, only 8.9% of supplies complied with the standards, while 41.5% were non-compliant and 49.6% were not monitored. Reasons for non-compliance included *Escherichia coli* transgressions, inadequate sampling, analysis not conducted by an approved laboratory, and importantly, failure to carry out corrective action or inappropriate corrective action. Failure to carry out corrective action included lack of maintenance as well as inadequate physical measures for protecting the supply from contamination.

Despite the fact that relatively few disease outbreaks linked with roof-collected rainwater have been reported worldwide, the indications are that there could be under-reporting of illnesses associated with contaminated roof-collected rainwater. The lack of reports linking communicable disease outbreaks to roof-collected rainwater may in part be due to the fact that while rainwater use is extensive, most systems serve individual households of only a few persons. Therefore, residents experiencing

sporadic gastrointestinal illnesses are less likely to seek medical attention unless the illnesses are severe and/or life-threatening. Furthermore, contaminated rainwater is more likely to be a source of sporadic disease episodes in these households because of possible immunity in a proportion of those exposed, and asymptomatic infection in others. Visitors or persons who have not consumed roof-collected rainwater previously could be especially at risk from waterborne diseases if the water supply is contaminated with pathogenic organisms.

While there will always be some risk of gastrointestinal illnesses to consumers from roof-collected rainwater supplies that are contaminated, a variety of products and systems are now available for reducing, and in some cases even eliminating, microbial contamination of stored roof water. I therefore support Rain Harvesting's recommendation that roof-collected rainwater be used for both internal and external use provided that the collection and storage of the rainwater is via a properly maintained roof catchment and tank system. As mentioned earlier, a large number of people in New Zealand depend on roof-collected rainwater systems for their drinking water and food preparation, especially in rural areas that are not served by municipal town water supplies. For example on Waiheke Island 97% of the population (7,500 – 8,000) receive their drinking water from roof-runoff serving about 4,500 dwellings (6,000 tanks) to both commercial and private water supplies.

At the *Roof Water Research Centre* at Massey University in Wellington we have been evaluating and researching a number of products designed for safe roof water collection and storage. The purpose of this research is to establish which products and systems are especially effective in safeguarding roof-collected rainwater against contamination. The work involves an extensive microbiological analysis of spiked and unspiked roof-collected rainwater samples collected during a range of meteorological events. This includes the determination of sedimentation rates as well as the retention and reduction times of organisms in rainwater storage tanks and the usefulness of 1st order kinetics for studying indicator organism die-off rates. Since October 2005 we have analysed approximately 1300 samples over 22 meteorological events. While the comprehensive results of these stage one trials will only be presented and published later this year, I can report here that so far we have found quite spectacular results in the quality of the rainwater in the storage tanks linked to first flush diverters. Counts of *Total coliforms* and *Escherichia coli* in excess of 2,000 organisms per 100 ml are frequently found in the first flush diverter water samples (drainage/waste-water) during or after rainfall events but the tanks linked to the first flush diverters repeatedly yield zero counts for both indicator organisms at all sampling levels in the tanks.

Based on the extensive Roof Water Research Projects we have been performing at Massey University and having reviewed the submission by Rain Harvesting Pty Ltd, I concur with their submission that minimum standards for all rainwater catchments and tank installations “.....should be based on common sense, practical experience and emerging research. New and innovative technologies should be adoptedand include appropriate equipment and design to minimise risk”. I believe the ten essential components of rain harvesting systems (see Rain Harvesting submission page 13) are prudent, practical and possible steps for the safe collection and storage of roof water.

As highlighted in the Discussion Paper, roof-collected rainwater represents a good quality, low risk water source provided certain common sense precautions and control measures are implemented in the design and installation of the collection systems and a good maintenance program is applied. The maintenance program should include I believe, periodic testing of the water because the supply may need to be disinfected, filtered and/or boiled, depending especially on the microbiological quality of the stored roof-collected rainwater. Water quality monitoring results can also indicate if the roof water collection components and maintenance programs are satisfactory. The frequency and timing of the water samples needs to be considered, perhaps as part of a compliance guidance for “potable water” requirements of private rainwater supplies.

Roof water paper presentations / publications (S.E.Abbott):

- 12/03/04: ***Microbiological Health Risks of Roof-Collected Rainwater***. NZ Institute of Environmental Health Conference, Napier, New Zealand.
- 23/03/04: Online publication ***Roof Water Safety***. <http://www.waternz.co.nz>
- 20/05/04: ***Microbiological Health Risks of Roof-Collected Rainwater***. Water & Wastes in New Zealand. May; 26-27.
- 13/06/04 ***Roof-Collected Rainwater Health Risks***. New Zealand Planning Quarterly. 153; 4-6.
- 27/01/05: Online publication of DCC public lecture ***Rainwater supplies fail drinking standards*** <http://www.stuff.co.nz>
- 31/01/05: ***The hidden microbiological perils of roof-collected rainwater*** in ESR’s Water and Health (pages 2-3).
- 04/02/05: Online publication ***Rainwater tanks often host to harmful bugs***. www.waternz.co.nz
- 20/06/05: ***Roof Water Supplies. In Guidelines for Drinking Water Quality Management for New Zealand***. Ministry of Health, Wellington.
- 10/04/06 ***Water collection tanks and safe household water***. Public Information Brochure for the Ministry of Health (Code 10148). Wellington.

Page 13 minimum installation standards
Page 15 Essential components
Pages 18-20 first flush diverters

Refs – Stan
Annual Review
DWSNZ 2005
Guidelines 2005
Stans's napier paper
Tank brochure