Rainwater harvesting

A survey of South Australian rural communities found that 82% use rainwater as their primary source of drinking water (Heyworth et al 1998). However, the Community Housing and Infrastructure Needs Survey of Indigneous communities in 1999 showed that only 9% of communities use rainwater as their primary source (ABS 1999). Whilst the data is not a direct comparison, it does indicate that rainwater tanks are not common in remote Indigenous communities.

This Bush Tech sets out to explain some of the issues that are important to consider when installing rainwater tanks for drinking water.

Background

The majority of Indigenous communities rely on groundwater for their water needs. Groundwater is generally not preferred by consumers because it has low palatability and high levels of salts which cause scaling to infrastructure. Encouraging Indigneous people in remote areas to use rainwater as their main drinking water source would be beneficial based on conservation and the recognition that there are limited fresh water resources in Australia.

Many Indigenous communities have expressed a need for dual water supply systems – a bore supply for general domestic needs such as flushing the toilet and washing, supplemented by a rainwater supply for drinking. A dual supply system would reduce costs and support sustainability. Costs would be reduced because sophisticated and expensive water treatment technologies to treat large volumes of groundwater to drinking water quality standard for all household uses would not be necessary. A dual water supply would also support sustainability by reducing the demand on the groundwater supply.

There is plenty of information available on harvesting rainwater. This brief explains additional information about how to install a suitable rainwater harvesting system for arid regions. This information is based on the first part of a three-part research project on rainwater tanks at Mutitjulu conducted by CAT and the Australian Cooperative Research Centre for Water Quality and Treatment.

Assessing the needs

Harsh environmental conditions in arid regions, such as very fine dust, extreme heat and torrential downpours of rain followed by long periods without rain, make it important to carefully consider approaches to rainwater harvesting.

There is evidence that many remote Indigenous communities once relied on rainwater tanks. However these old tanks are now relics which serve to provide some evidence of what can happen to tanks which are not maintained. Steel tanks for example have been rusted out, downpipes have been broken off and often the tops of the tanks are damaged because the tanks have been used as a swimming pool or as a jungle gym. So, what kind of system is robust enough to sustain this environment?

Rainwater tank infrastructure is fairly standard. The following points contain suggestions and tips to make the infrastructure as robust as possible.

The rainwater tank –

Polyethylene ('poly') tanks are preferred because they are robust and easy to fix should they spring a leak.

The storage tank should be above-ground rather than underground. Above ground tanks are less susceptible to contamination[1].

Install a light-coloured poly tank rather than a dark coloured tank[2]. The higher count is probably due to the heat absorbed by the dark colour creating a warm microenvironment for bacteria to grow in.

Locate the tank on the southern side of the house[3].

Pipes

Keep the inlet pipes from being exposed. Underground connection pipes have worked well in Indigenous communities.

Guide the overflow underground and away from the house into a gravel pit to help prevent any excess water from pooling.

Round-section downpipes do not make as much noise as square pipes.

Interceptors

Interceptors are recommended to catch the first rainfall after a dry period because it can carry contamination from the roof into the tank. Installing a 'first flush'device or other interceptor will prevent this water from entering the collection tank. This 'first flush' water can be stored separately and used for garden watering.

The first flush device needs to have the capacity to collect sufficient

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water to be functional. For an adequate first flush, the roof needs 2mm of rainfall over the whole roof area to effectively wash dust and contamination off the catchment area (Wade 1998). For example, for a roof area of 100 square metres the amount of water to be captured as 'first flush'would be 200 litres.

Some communities have put a number of interceptors on the one building to divert enough water to be effective. These interceptors need to be emptied after each rain. Self-emptying interceptors are available but have not lasted well.

A sediment or settling tank prior to the collection tank which can catch all the first flush on communities can serve as an effective interceptor[4]. Inside the sediment tank should be a baffle so that all the debris is forced to the bottom of the settling tank. The overflow from the settling tank can then fill the collection tanks. One benefit of this design is that the sediment tank can be emptied after a number of rains, saving more water. Less maintenance is required as it is not imperative to empty the first flush device after every rain.

Guttering

The guttering should be wide, ideally a minimum of 100 mm diameter. The width is necessary to cope with the volumes of water during torrential rain.

Semi-circular guttering is recommended. These gutters are commonly known as 'self cleaning' gutters. The self-cleaning description is misleading because they do not self-clean they are merely more efficient at moving debris from inside the gutter than conventional square shaped gutters. In the square shaped gutters, leaves, dust and debris can catch onto the corners of the gutters and block up the flow way.

"Gutter guard" generally does not work very well in remote communities. The guard often breaks and catches debris. There are some alternatives which attach to the downpipe and separate debris from the water flow[5].

Seal the system

The system needs to be insect-proof. Water provides a suitable breeding ground for mosquitoes in particular. Recently, Murray Valley Encephalitis has been detected in the central desert so it is important to keep the system insect–proof. Mesh over all inlets and outlets can keep all insects out. Mesh should be stainless steel and robust. Many plastic mesh outlet plugs have fallen out or broken because they are not strong.

Seal the water tanks so that insects, small animals, birds and sunlight can not enter (this will also help minimise the growth of algae)

Choices

Whilst this design makes the system as robust and low maintenance as possible, it is not maintenance-free. Ongoing maintenance includes regularly cleaning the gutters to remove leaves, animal or bird remains, dust and other debris. The settling tank should be emptied out regularly.

Challenges

Health is always a concern for people drinking rainwater. While there are many water borne diseases which can make people very sick, the best way to look after the water is to keep the catchment clean. Many monitoring tests have been completed on rainwater and bacteria which can cause gastroenteritis are frequently found, such as Shigella, Camphylobacter, Salmonella and E.coli (Simmons et al 2001). It is important to maintain the tank and catchment area to reduce the possibility of any adverse health effects.

Future directions

Additional information:

"Guidance on the use of rainwater tanks" (1998) by David A Cunliffe, National Environmental Health Forum Monographs, Water Series No 3. South Australian Health Commission.

References

Heyworth, J.S. (in press) A Diary Study Of Gastroenteritis And Tank Rainwater Consumption In Young Children In South Australia, Department of Public Health, University of Western Australia.

Simmons, G., Hope, V., Lewis, G., Whitmore, J.,Gao, W. (2001) Contamination of potable roof-collected rainwater in Auckland, New Zealand, Water Resources Vol 35, No 6, pp1518-1524.

Wade, R. (1999) Sustainable Water from Rain Harvesting, Environmental Conservation Planning and Consultancy PtyLtd, Oxenford, Australia, www.sustainable-water.com

1 Human Services, Public Health Division, Victoria

2 Nganampa Health completed a survey of rainwater tanks in the Anangu Pitjantjatjara Lands. It was found that the water in tanks which were dark in colour had higher bacterial growth than water from light coloured tanks.

3 Nganampa Health completed a survey of rainwater tanks in the Anangu Pitjantjatjara Lands. It was found that tanks located on the southern side had lower bacterial counts than houses located on the northern side

4 Appreciation to Peter Burg for his ideas and comments on the settling tank.

5 Leaf beater systems - www.sustainablewater.com

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Rainwater tank design at Mutitjulu showing a 500l settling tank which serves as a large interceptor prior to large storage tanks.