Roofwater harvesting

This Action Sheet is about harvesting the rain that falls on your roof. Rainwater harvesting is an easy way to improve security in water supplies. People have been doing it for a long, long time. For many generations in Uganda, rain that falls on trees has been collected using folded banana leaves as gutters. Now, people all over Africa are collecting and storing the rain that falls on their roofs to use at home. This Action Sheet will help you decide whether it's worth collecting roofwater where you live, and know how to make sure that it is safe to drink.

Where can rainwater harvesting help?

Rainwater harvesting can help to increase the supply of good water in areas where it is hard to get groundwater out with wells and pumps, in areas where there is little or no surface water for all or part of the year, or where the surface water is of poor quality.

It is easiest to harvest rainwater where there is regular rainfall to keep the tank topped up. However, in many parts of Africa rainfall varies a lot throughout the year. In this case, people may need to work together to make rules about water conservation to get through the dry season.

Rainwater tank. Image: Sarah Watson, PACE

How much rainwater can we collect?

With rainwater harvesting, you can think small or you can think big. Rainwater harvesting can help supply water for individual households, for communities working together, or for schools or hospitals. The amount of water you can collect depends firstly on the rainfall in your area, secondly, on the surface area from which you are able to collect rainwater, and thirdly, on how much you can afford to spend on building and maintaining the rainwater harvesting system.

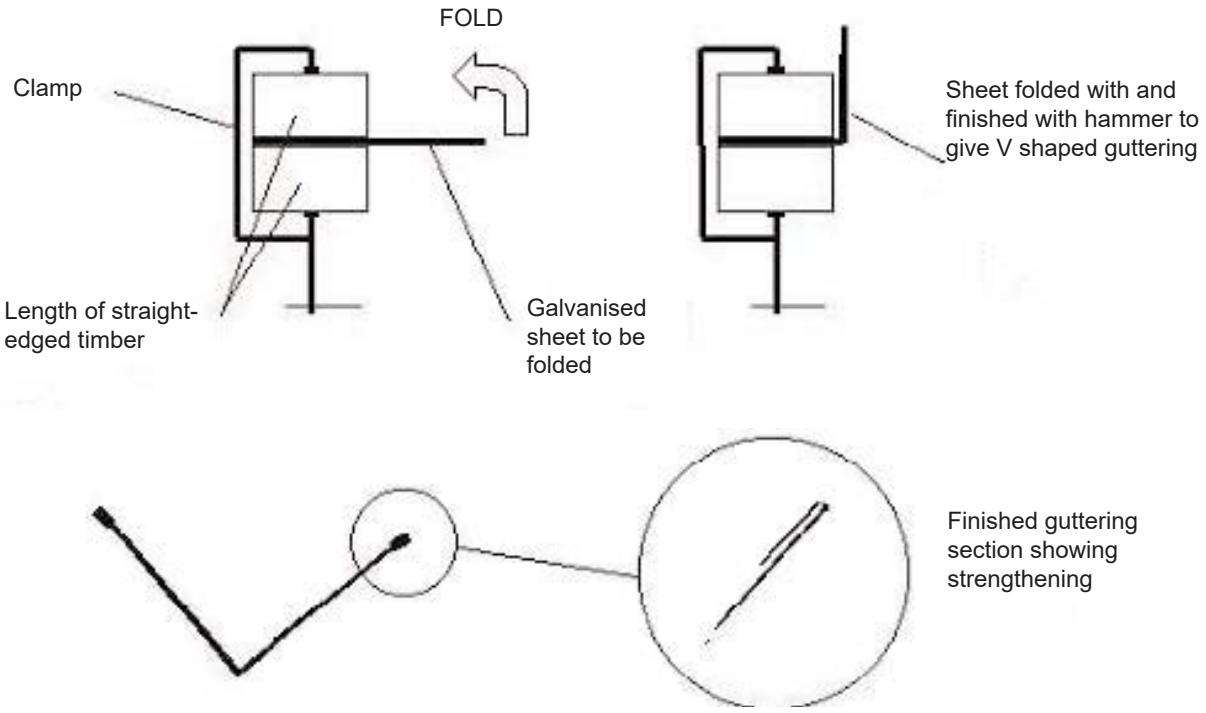
The simplest option is to collect water from the roof of your house. Every square metre of roof can collect up to one litre of water for every 1mm of rain that falls. The water that is actually collected will be between 0.5 and 0.9 of a litre of water, because some will evaporate, be spilt or get blown away by the wind. If people are able to work together to improve their water supply, rainwater can be collected in larger quantities from the roofs of larger building or from rocky hillsides (see Action Sheet 15). Technical help from an engineer may be required for this scale of project.

What can rainwater be used for?

Rainwater can be collected to use at home for washing, gardening, and if kept clean, for drinking. There are also many ways in which farmers in dry areas can harvest rainwater to help irrigate their crops and provide water for their livestock (see Action Sheet 45).

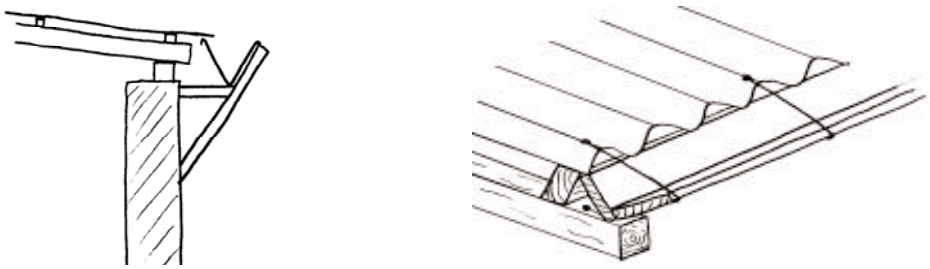
How do you collect rainwater from a roof?
Warning: Do not collect water from lead-painted surfaces. The lead can be dissolved in the water, which would poison your family.

It is easiest to collect water from a tiled or corrugated iron roof, which should be clean. You can also collect water from tightly thatched or palm-leafed surfaces, but these may be harder to clean so the water may need more treatment to make it safe to drink.
To collect rainwater from a roof, you need to make a gutter around the eaves. A gutter can be made of 22 gauge galvanised mild steel sheeting, bent to form a V in a clamp. The outer edge can be strengthened by bending it 90 in a clamp and then hammering it flat.



Making a gutter with a strengthened edge. Image: Practical Action

The gutter can then be stitched to the roof with galvanised wire or supported by a wooden structure, so that it runs along the eaves of the house.



Alternative ways to attach a V-shaped gutter. Images: ITDG

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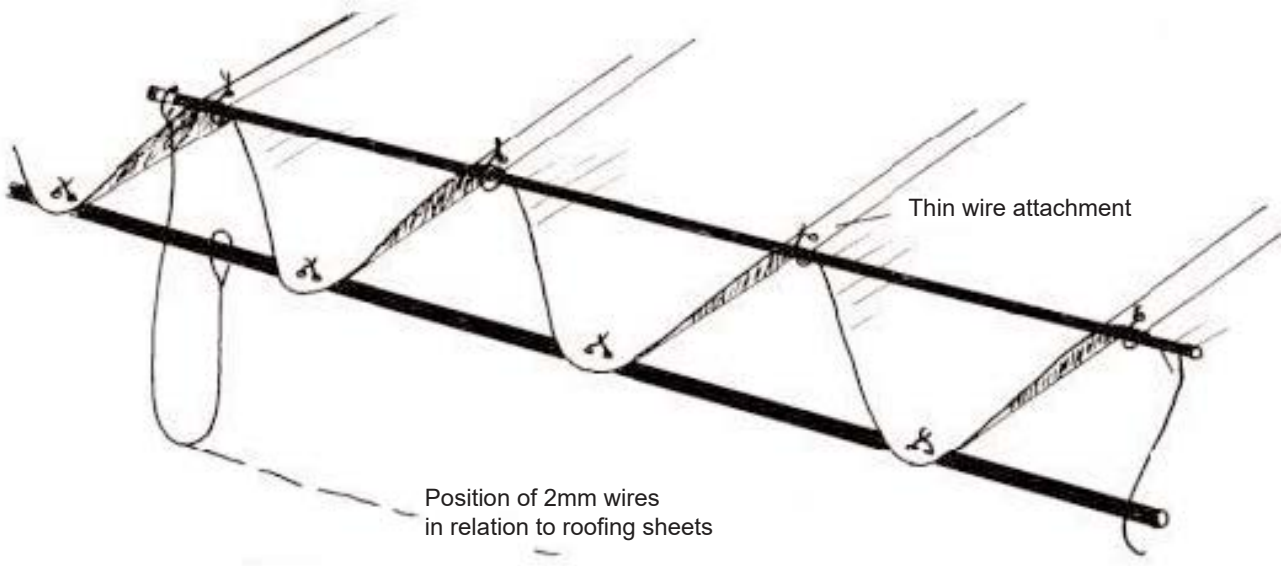
A cheaper option for the gutter material is a strip of waterproof cloth or plastic sheeting, folded into a pouch. “Waterproof shade cloth” is a good material to use, as it is resistant to degradation by the sun and has a longer life than ordinary plastic sheeting. The edges of the cloth are reinforced by stitching them down with strong nylon thread, and then inserting a 2mm wire along the length of the edge. The wired edges are then attached to holes drilled in the edge of the roof with 1mm wire, to make a hanging pouch. A sloped gutter can also be made in this way by cutting the cloth wider at one end (eg. 60cm), tapering it to a narrower end (eg. 40cm) at the other.



Gutter pouch of waterproof shade-cloth attached to corrugations. Image: Peter Morgan, Aquamor)

How do you store your ‘crop’ of rain?

Water collected from the roof of a house can be stored in an oil drum. However, it may be worth building a bigger tank so that you can store more water. These are ideas that people have developed around Africa:

- Oil drums welded together to make a long vertical or horizontal tank
- Basket tanks based on bamboo structures covered in mortar
- Corrugated galvanised mild steel sheeting bent and welded or bolted into a cylinder, coated with sand/cement mortar.

It is important to ensure that mosquitoes are kept out of the tank. An improperly sealed tank would greatly increase the risk of malaria for your family. Also, the tank must be kept dark so that algae do not grow in the water.

Roofwater tank Image: Sarah Watson, PACE

For larger systems collecting water from a school or hospital roof, or a rocky slope, water should be stored in a ferro-cement or brick tank or cistern (underground) (See Action Sheets 21 and 22). Calculating the size of the storage tank depends on how many people you are aiming to supply, the size of the area from which you plan to collect rain, and how much the rainfall varies through the year. For example, if there are long periods without rain, you ideally need a bigger tank to get you through the dry season. People interested in developing a larger scale rainwater harvesting system should consult sources of further information and get advice from a relevant NGO.

Roofwater cistern Image: PACE

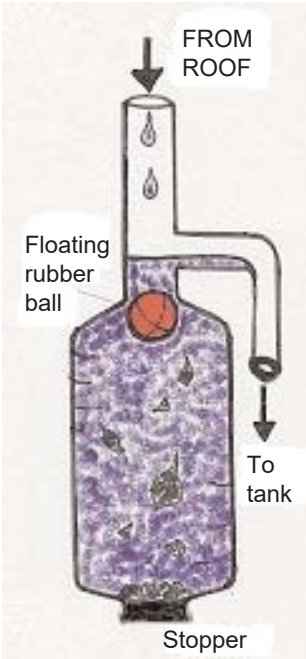
How can we make sure the rainwater is safe to drink?

Unless there is a lot of pollution from man-made sources of smoke (especially industrial sources like factories), then rainwater is very clean. However, if you are using rainwater to increase supplies of drinking water, it is important to keep the water in a clean and protected place. Otherwise, people may get ill from drinking it.

To make sure the water in the storage tank is clean, the system used to collect the water needs to stop the 'foul flush' or 'first flush'. This is the water from the first rain that washes solid objects like leaves, twigs, bird droppings and dirt off the roof into the storage container.

If rainfall is predictable and someone is always near-by, the simplest option is to have a system that allows you to swivel the inlet pipe away from the storage tank at the beginning of the rain. The foul flush water (the first five litres or so) can still be collected and used for watering plants or given to animals. The disadvantage is that someone needs to remember to go outside and move the pipe.

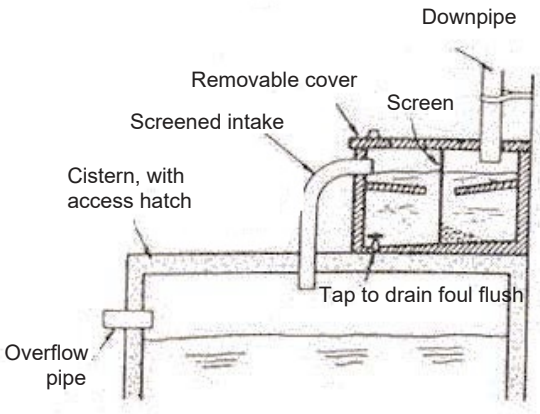
Another simple alternative is extending the down-pipe below the level of entry to the tank so that the first rainwater collects in the lower section of the pipe before it starts to flow into the storage tank. This could be blocked off with a floating rubber ball as shown here.



First flush removal system. Image: Based on Smet and Van Wijk, 2002

You could also build a foul flush box, as shown in the diagram to right. The water from the foul flush box or extended down-pipe can also be collected and used for watering plants or given to animals.

To ensure good quality drinking water, a filter can also be part of the system. The filter should not block easily and should be easy to clean. The simplest type of filter to use is a tilting section of cloth or fine mos uito mesh on an angled frame across the entrance to the storage tank. It needs to tilt so that water running across it cleans it off.



Foul flush box. Image: ITDG Technical Brief

To investigate more design options for clean and safe rainwater harvest systems, consult the sources listed below. See Action sheets 23-25R on water treatment methods for more ways to make sure that water is safe to drink.

Acknowledgements
This Action Sheet was compiled by Nancy Gladstone and is based on ITDG's Technical Brief on Rainwater Harvesting (http://www.itdg.org/docs/technical_information_service/rainwater_harvesting.pdf) and on Peter Morgan's webpage on Rainwater Harvesting in Zimbabwe (http://aquamor.tripod.com/page3.htm), and has been reviewed by Jo Smet (Senior Programme Officer), and Ingeborg Krukkert (Information Specialist) at IRC International Water and Sanitation Centre.

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More information

International Rainwater Harvesting Alliance www.irha-h2o.org

IRC - International Water and Sanitation Centre https://www.ircwash.org/node/86756/
Water Aid www.wateraid.org

WaterAid factsheet on rainwater harvesting
IRC International Water and Sanitation Centre list of on-line resources on rainwater harvesting
www.irc.nl/page/14666

Rainwater Catchment Systems for Domestic Supply, J. Gould, and E. Nissen-Petersen, IT Publications, 1999. Available at Practical Action (ITDG) Resource Centres or from www.developmentbookshop.com

The Rainwater Harvesting CD , H. Hartung, Margraf Publishers, 2002 Available by emailing: info@margraf-verlag.de or HansFHartung@aol.com

Rainwater Harvesting - The collection of rainfall and runoff in rural areas , A. Pacey and A. Cullis ITDG Publishing, 2002 (available from www.developmentbookshop.com

Small Community Water Supplies: Technology, people and partnership, J. Smet and C. van Wijk (Eds), 2002 (Available from IRC)

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