Low-cost rainwater harvesting

by Dai Rees

The Development Technology Unit of Warwick University aims to research and promote technologies appropriate for practical use in the Third World. The Unit has recently developed three small jars (between 500 and 750 litres) for rainwater storage. Their aim was to develop a number of safe, low-cost alternatives for rainwater storage.

The research work was carried out at Kyera Farm, a training centre for organic farming near Mbarara, Uganda. Three sample tanks were developed at the farm and then ten tanks were built in the nearby village of Kyera. A study is now under way to look at the benefits that such small tanks can bring to the users.

Indications from a similar study in western Uganda show that up to 70% or 80% of household water needs can be met with small rainwater jars. Rainwater harvesting works best when rainfall is fairly regular through the year.

Water supply from the rain

Rainwater harvesting, or collection, is common in many parts of the world. Water is usually captured from the roof of a house and used for drinking, cooking, washing clothes, personal hygiene, watering plants and animals, and numerous other uses. Typical traditional methods of catching the water vary from small buckets to large tanks. Old oil drums are commonly seen outside homes in Uganda using short lengths of home-made guttering to catch the water.

Small jars are useful in areas where there is a good distribution of rain throughout the year, with two rainy seasons. The householder may still have to collect water from the traditional water source during the drier periods, but for much of the year, the family members will have water at the home. This can save a significant amount of time and effort in water collecting.

The brick jar

The brick jar was developed to make use of this common local building material. The jar is made from a simple brick cylinder. A tap brings water out at the right height for a jerry can. The cover is made from ferro-cement mortar and a filter basin is used as described for the ferro-cement jar. It is a good idea to include some reinforcements in the brickwork, such as bands of wire.

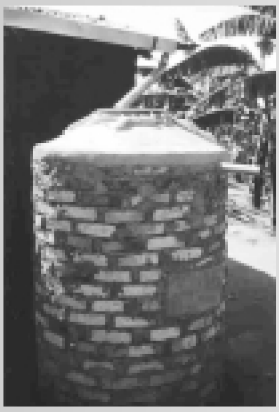


Photo: Vince Whitehead

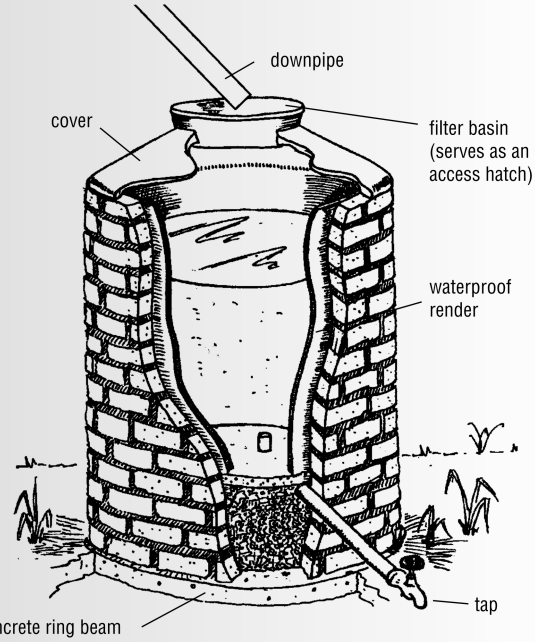


Photo: Corel

Costs

This table shows the approximate costs of the different jars:

Type	Size (litres)	Cost (£)	Cost ($)
Brick jar	750	£33	$50
Ferro-cement jar	500	£28	$42
Plastic tube jar	600	£20	$30

Costs of gutters are not included.

A study in Kabarole District, Uganda, during the dry season, showed that with just twelve rainy days in two months, a family of five could obtain 60% of all their household water from the tank – a total of 118 jerry cans (of 20 litres each). If their traditional water source was 500 metres away, in two months they would save nearly 50 hours of their time by using the water tank.

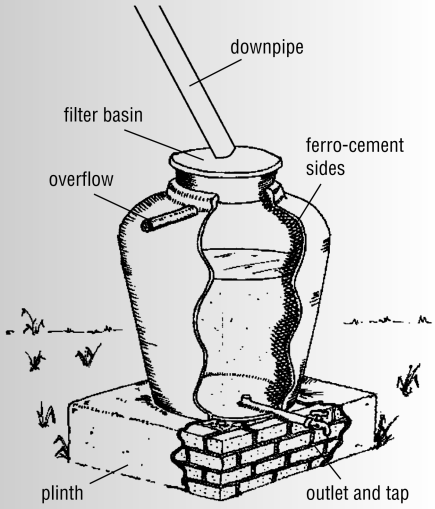
The quality of water from a rainwater system is an important concern. Usually, if water is filtered as it enters the tank and stored in dark conditions, then the quality of the water will be good and will improve with time. It is also recommended that during the first five minutes of heavy rainfall after a dry spell, this water is discarded by pushing the downpipe aside. All openings should be covered with mosquito mesh to prevent mosquitoes from breeding in the tank. Given good rainfall, one side of the roof of a typical dwelling will provide sufficient collection area to provide the household needs of an average family.

Local production

Local masons were involved as fully as possible so that they could share their knowledge with the project team, and also learn about the new designs. It was hoped that the masons would then go on to build other jars in the area and would also be able to maintain the systems already built. A good pool of skilled masons was found in the area. Three tanks were designed, each using slightly different techniques and materials.

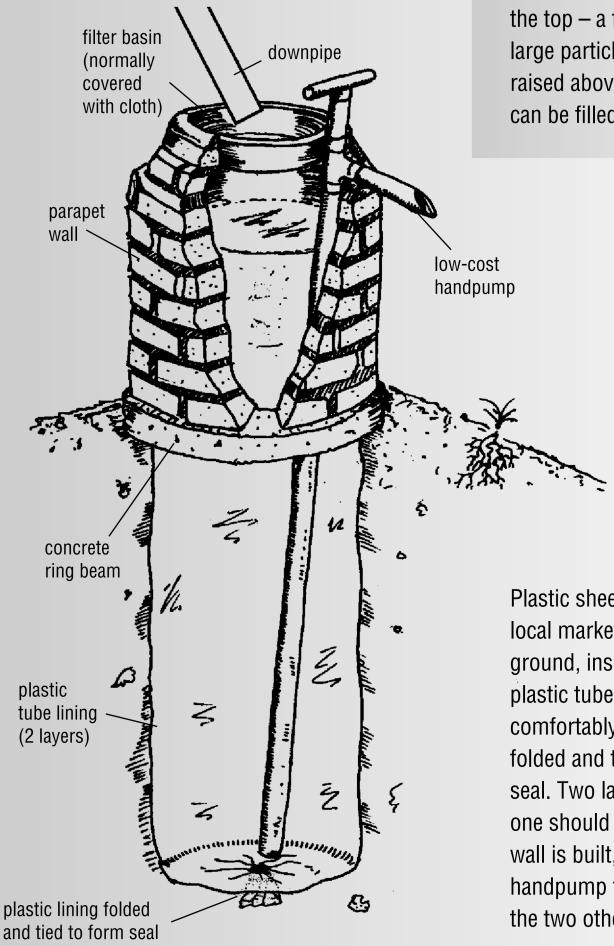
Galvanised iron sheet gutters and downpipes are available in Mbarara town and these were used on all the jars

The ferro-cement jar



This design is already well known. The technology involves using chicken wire sandwiched between layers of cement mortar. A shaped mould is made from sacks and filled with sawdust. The mould is then plastered with sand/cement paste in a ratio of 3:1. This is then covered with ½" chicken wire and given a second coat of mortar. A tap and overflow are fitted and a plastic basin used to form the opening at the top – a filter is fitted here to remove large particles from the water. The jar is raised above the ground so that jerry cans can be filled easily from the tap.

The plastic tube tank



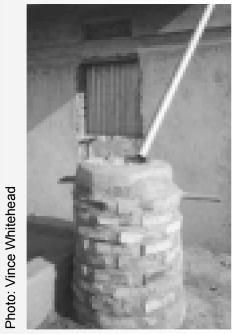


Photo: Vince Whitehead

Plastic sheet in tube form is available in the local marketplace. A hole is dug in the ground, inside which the largest size of the plastic tube sheeting available can sit comfortably. The end of the plastic tube is folded and tied several times to form the seal. Two layers of plastic are used in case one should puncture. A surrounding brick wall is built, an overflow and low-cost handpump fitted and a basin used, as with the two other examples.

that were built under the project. Alternative gutter systems can be used, of course (for example: bamboo).

Future work

Already masons are building these new jars for individuals in the area. A local women's group has approached Kyera Farm staff with a request to build a number of jars. The local farmers group which benefited from the initial jars has received a flood of new members specifically interested in building these jars.

Readers who would like detailed construction plans, either on paper or by e-mail, should contact the DTU (see below).

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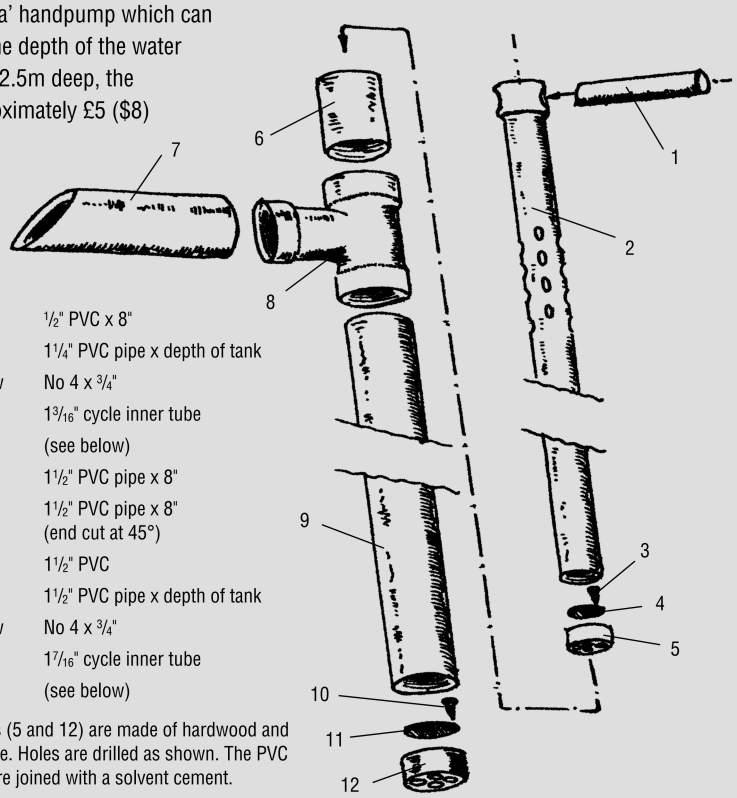
Handpumps

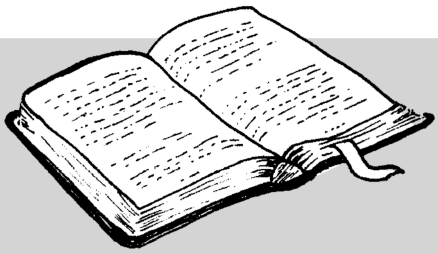
A number of low-cost handpump designs were also developed for pumping water from below ground tanks. Full details, including costs, can be obtained from the DTU. The sketch shows the 'enhanced inertia' handpump which can be made to fit the depth of the water tank. For a tank 2.5m deep, the parts cost approximately £5 ($8) in Uganda.



1	handle	½" PVC x 8"
2	central tube	1¼" PVC pipe x depth of tank
3	flap valve screw	No 4 x ¾"
4	flap valve	1 3/16" cycle inner tube
5	central inlet	(see below)
6	top tube	1½" PVC pipe x 8"
7	outlet	1½" PVC pipe x 8" (end cut at 45°)
8	tee	1½" PVC
9	rising main	1½" PVC pipe x depth of tank
10	flap valve screw	No 4 x ¾"
11	flap valve	1 7/16" cycle inner tube
12	main inlet	(see below)

The two inlet valves (5 and 12) are made of hardwood and are turned on a lathe. Holes are drilled as shown. The PVC fittings and pipes are joined with a solvent cement.

BIBLE STUDY



Stewardship: using the resources we are given

by Rose Robinson

Read Matthew 25:14-30

A man is going on a journey, so he asks his servants to care for his property while he is away.

• *What guides him in how he distributes his money? (verse 15)*

The servants with five and two talents use what they have been given and double them, but the servant with one talent buries it in the ground.

• *Why does this servant not use the talent he was given?*

The master judges the servant on his own words. If he knew that his master harvests where he hasn't sown, he should have banked the money so that he could have given it back with interest. This servant was given very little. He also chose not to use what he was given. He is judged by his attitude in choosing to ignore what he is given – even though it is very little in comparison to what the other servants receive. His master calls him a wicked, lazy servant and he is thrown out into the darkness.

The two servants who used what they'd been given well, go to be with the master and share his happiness. Because they were faithful with a few things, they are put in charge of many things.

• *To whom does the earth and everything in it belong? (Exodus 9:29; Deuteronomy 10:14; Psalm 24:1, 2)*

Everything that we have comes from God. He trusts us to care for what he gives us (Genesis 2:15; Genesis 9:3) and to use it well (1 Peter 4:10).

• *What has God given you and how are you using it?*

Rose Robinson worked with MOPAWI in Honduras for four years as a Tearfund International Personnel Worker.