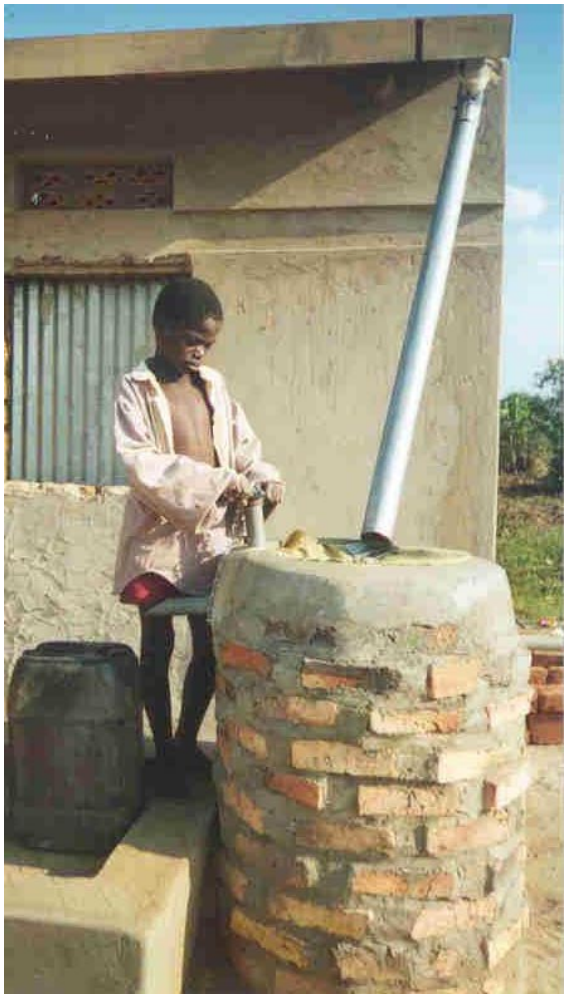
DTU Technical Release Series **TR-RWH08**

Plastic Tube Tanks

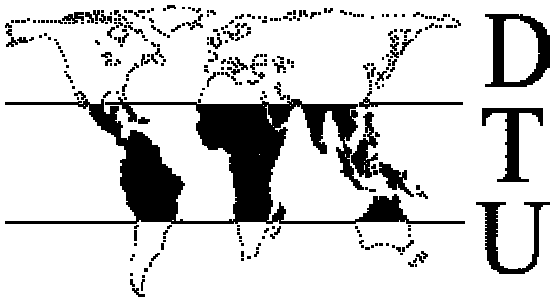
Instructions for manufacture

(Based on the construction of a plastic tube tank at Kyera Farm, Mbarara, Uganda)



Prepared by Dai Rees and Vince Whitehead

Development Technology Unit
School of Engineering
University of Warwick
Coventry CV4 7AL
Tel: +44 (0)1203 522339
Fax: +44 (0)1203 418922
dgr@eng.warwick.ac.uk
www.eng.warwick.ac.uk/DTU/



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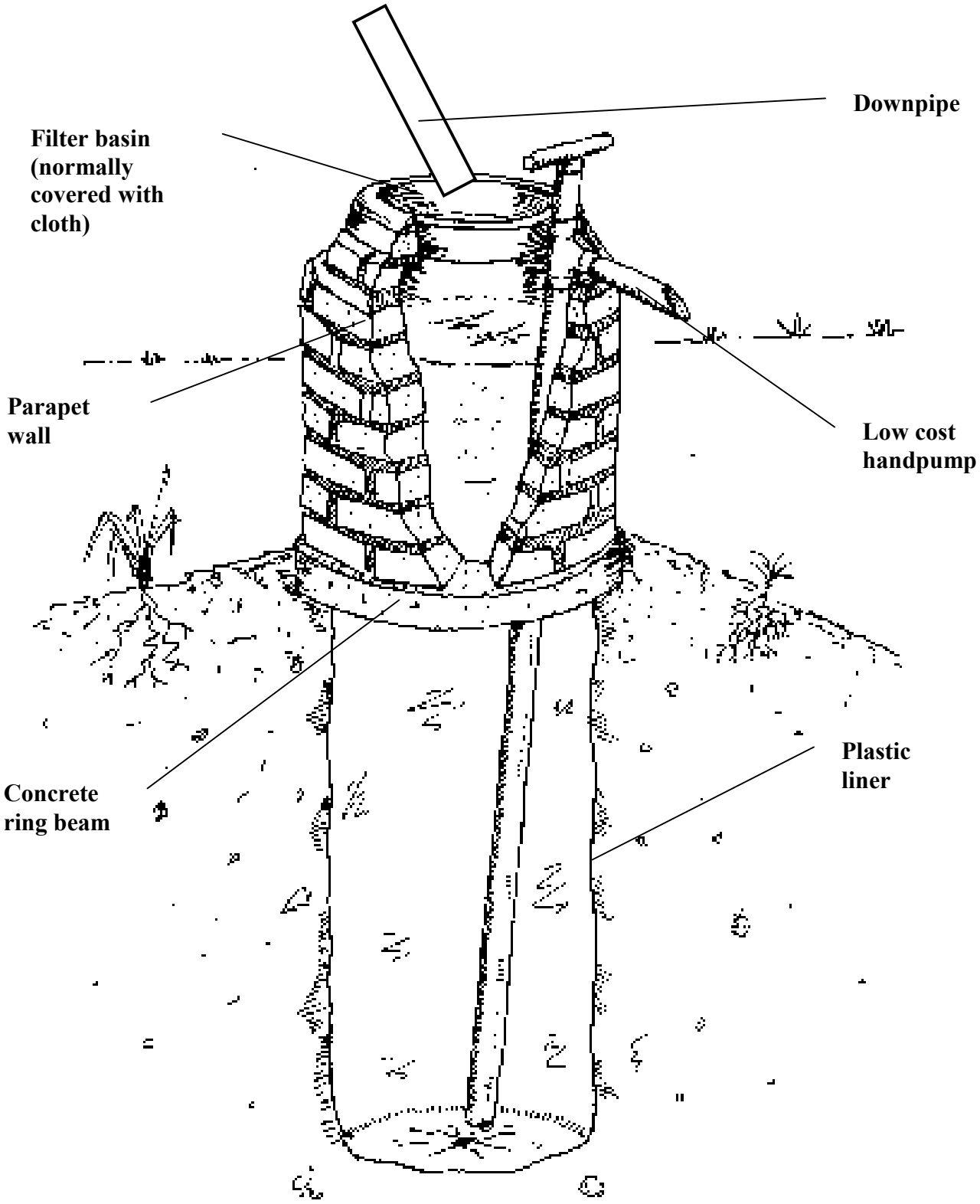
Downpipe
Filter basin (normally covered with cloth)
Parapet wall
Low cost handpump
Concrete ring beam
Plastic liner

Introduction

This manual gives guidelines for the manufacture of a 600ltr plastic tube tank, which is based on a tank built at Kyera Farm, Mbarara, Uganda during June and July 2000.
The availability of plastic tubes from local markets is quite wide spread and of very low cost and it has been the reason behind the development of this option for rainwater storage. This tube is the largest that was found at the time.
The tank consists of a brick top section (parapet), which incorporates the inlet basin and handpump and the lower section plastic tube, which sits in a ground excavation.

1. Advantages and disadvantages of the Plastic tube tank

Pro**s:**

- Very low cost compared with other similar sized tanks.
- Low manufacture time.
- Low material requirements.
- Low maintenance.
- Small repairs are easily carried out.

Cons:

- Not suitable for unstable soils or rocky ground.
- The tank diameter is limited to the availability of plastic tube size.
- Replacement of the liner requires the removal of the handpump and top two courses of bricks.

2. Tank specifications

Table 1 gives the specifications for the tanks main features:

Table 1 Tank specification

Tank internal diameter	0.55m
Tank external diameter	0.75m
Tank depth	2.5m (1.5m excavation + 1m parapet wall)
Tank capacity	Approximately 600 litres
Tank lining	Plastic tube (two tubes)
Water extraction	Direct action low cost handpump
Top	PVC Basin

3. Material and labour requirements

Table 2 Material and labour requirements for the various components

	Unit	Ring beam	Parapet	Cover	Lining	Water extraction	Totals
Cement	kg	3	20	10			33
Sand	kg	6	100	30			136
Aggregate <50mm	kg	20					20
Bricks	no		100	15			115
"Harold" handpump	no					1	1
PVC Pipe 1.25"	m		0.3				0.3
0.87 flat plastic tube	m				6		6
Basin (medium size PVC)	no			1			1
Labour (skilled)	days						1
Labour (unskilled)	days						2

4. Tools and equipment required

- Spade or shovel
- Hoe
- Large crowbar
- Spirit level (600mm) (or plumb bob)
- Bucket
- Trowels
- masons

5. Tank Costing

Table 3 Tank costing

Item	Unit	No reqd	Unit cost (UGS)	Total (UGS)	Total US$	Total £
Cement	kg	33	300	9900	6.60	4.46
Sand	kg	136	20	2720	1.81	1.23
Aggregate <50mm	kg	20	25	500	0.33	0.23
Bricks	no	115	42	4830	3.22	2.18
Harold pump	no	1	15000	15000	10.00	6.76
PVC Pipe 1.25"	m	0.3	1667	500.1	0.33	0.23
0.87 flat plastic tube	m	6	1000	6000	4.00	2.70
Basin	no	1	1000	1000	0.67	0.45
Labour (skilled)	days	1	5000	5000	3.33	2.25
Labour (unskilled)	days	2	3000	6000	4.00	2.70
			Material costs	40450	26.97	18.22
			Total costs (incl. labour)	51450	34.30	23.18
			Cost per litre storage	67	0.04	0.03
			Cost per litre storage (incl. labour)	85	0.06	0.04

Notes

1. Some transport costs are included (i.e. for sand, aggregates and bricks)
2. Cost of bucket slab not included

6. Site selection

It is important to select the right site for the tank so that it will remain a reliable source of water for years to come.
Some pointers for what constitutes a good site are given below:

- Close enough to the dwelling to avoid long lengths of guttering and downpipe (some suggest siting the tank mid way along the length of a building to reduce gutter size– this is fine if water from one side of the building only will be fed into the tank)
- Reasonably flat where possible – otherwise the ground will have to be levelled before marking out
- Away from trees – the roots of trees can puncture the plastic tube
- Away from areas where animals will wander – fence off if needed
- Away from areas where surface water will gather (i.e. depressions)
- Not so close to the dwelling that the foundations are undermined
- Somewhere convenient for extracting water e.g. close to the kitchen area
- There should be no large stones, bedrock or sheet rock close to the surface, and one should be sure that the groundwater table in the area is several meters below the bottom of the tank. This information can often be gleaned from locals who may have tried digging wells or pit latrines, sinking boreholes or digging garbage pits.

7. Manufacturing procedure for the tank

- After finding a suitable location for the tank level the ground to provide a circular area whose diameter is about 1m.
- Place a stake in the centre of the area and mark out an inner and outer circle using a piece of string and a nail. The radii of these are 27cm and 39cm respectively.
- Carefully excavate between the two diameters to a depth of 12cm.
- Fill this with a concrete mix of 4:2:1 (aggregate: sand: cement), cover with damp grass/leaves and leave for two days.
- Using a large crowbar and hoe dig out the soil within the concrete ring to a depth of 1.5m, as shown in Figures 1 and 2, making sure the sides are vertical, check this with a spirit level or plumb line. Trim the trench sides with a machete to obtain a good trench with perpendicular sides.

Figure 1 Excavating the tank

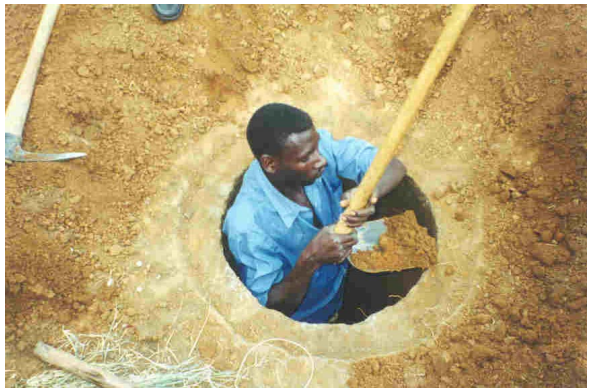

Figure 2 Removing soil during excavation of the tank

Build up a brick parapet on top of the concrete ring so that the internal diameter is the same as the inner diameter of the ring i.e. 54cm, to a height of 1m. Use a mortar mix of 5:1 (sand: cement) see Figure 3. On the top course fit in a Ø1 ½"PVC pipe (or nearest size available) 30cm long to act as an over flow.

Figure 3 Checking the diameter of the parapet wall

- Fill any deep voids on the inside of the parapet with mortar.
- Cut off a length of plastic tube 3.5m long and bunch up one end for 12cm and tie around tightly with string as shown in Figure 4. Fold over to 10cm and tie/tape up in the same way, repeat this a third time.
- Cut of a second length of plastic tube and repeat the folding and tying procedures then insert on tube inside the other.

Figure 4 Showing the end of the plastic tube tied and folded over

- Carefully push the tubes down inside the tank making sure that the plastic is not torn on the brickwork.
- Pour in at least 20 litres of water inside to make sure that the tube is sitting snugly at the bottom of the pit.
- Slit the plastic tube down to the height of the parapet and fold over so that the plastic sits on the top course of bricks as shown in Figure 5. Temporarily use loose bricks to hold the plastic in place.

Figure 5 The plastic is folded over on top of the parapet prior to the next course of bricks

- On top of the plastic build up two more courses of bricks which are smaller in diameter than the parapet wall, the top course will hold the basin in position.

- Using a short length Ø1 ½"PVC pipe at the outlet to simulate the handpumps rising main, check that the basin will fit in the top of the tank and that they do not obstruct each other.
- Render the outside of the top course of bricks as shown in Figure 6 with the basin in position. Making sure that the basin fits snugly but can be removed later.

Figure 6 Applying render to the top course with the basin in situ, notice the gap left for the handpump

Make up the handpump as described in the "Manual for direct action handpumps for use with rainwater harvest tanks", DTU Technical Release No TR-RWH09.

- Remove the basin and carefully insert the handpump in to the tank, being careful not to tear the plastic tube with the bottom of the rising main, use mortar to secure this in to place and leave to cure.
- Make a series of about twenty holes in the bottom of the basin using a hot nail or a drill (Ø6mm) for the rain to enter the tank. Fill the basin with aggregate (about 20mm) to about one third full.
- Cut out a square section of clean cloth that will cover the basin and have sufficient to overhang down the sides, then tie around the sides of the basin with string or rubber inner tube strip to hold the cloth in place.
- Lower the basin in to the tank.
- Fix the appropriate gutter to the roof and place the downpipe directly on to the cloth.

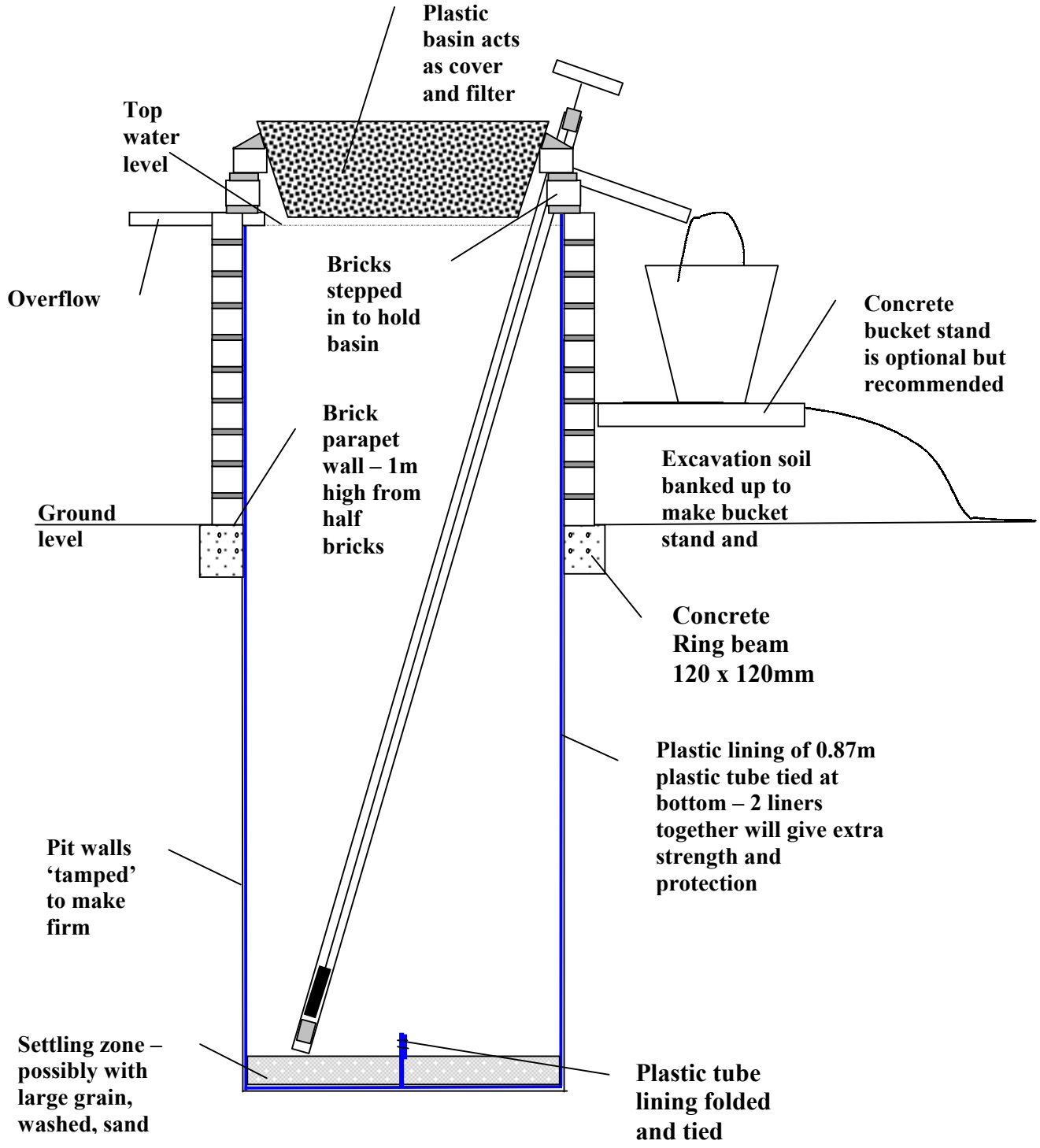

Diagram of the plastic tube tank