Case study 2

Underground brick dome tank, Sri Lanka

Background

This is another RWH system, as with the previous case study, which was developed by the CWSSP programme in Sri Lanka (see Case Study 1 for more detail). The tank, a 5m3 underground brick built tank, is based loosely on the design of the Chinese below ground biogas tank. Indeed, the Sri Lankan engineer who designed the system had studied for some years in China. This is a good example of cross fertilisation of technologies across cultures, as well as the application of appropriate technology.

Again, this system was introduced due to the difficulties faced in bringing water to this community in a conventional manner. There was a lot of opposition to the RWH technology in the area at first, as it was a technology

which was not widely known in the. Now, after 2 years using the rainwater falling on her roof, Mrs. Emsayakar, of Batalahena Village near the town Matara, sees things very differently.

The alternative offered by CWSSP was a handpump per 10 households. This still means walking to collect water. Mrs. Emsayakar joked that they can still use the handpump of their neighbours when they wish. She has not, however, had to do so yet as the harvested water meet all the needs of the family of 5, as long as they conserve water carefully. She also said, however, that she would prefer a piped / pumped supply which would mean that they could use as much water as they wish.

Technical detail

The tank

The tank is a $5m^3$ below ground cylindrical brick construction based on the design of a Chinese biogas digester (see Figure 1 below). It has a diameter of 2.5m and a height of 1.3m to the base of the cover. The cover is a constructed using a clever brick dome design which can be left open to provide access.

Water extraction is either by bucket, by handpump (more detail later) or by gravity through a pipe / tap arrangement where the topography and ground conditions are suitable. The cost of the tank is in the region of Rps.6,500 (UK100). The construction details given to local masons are given below.

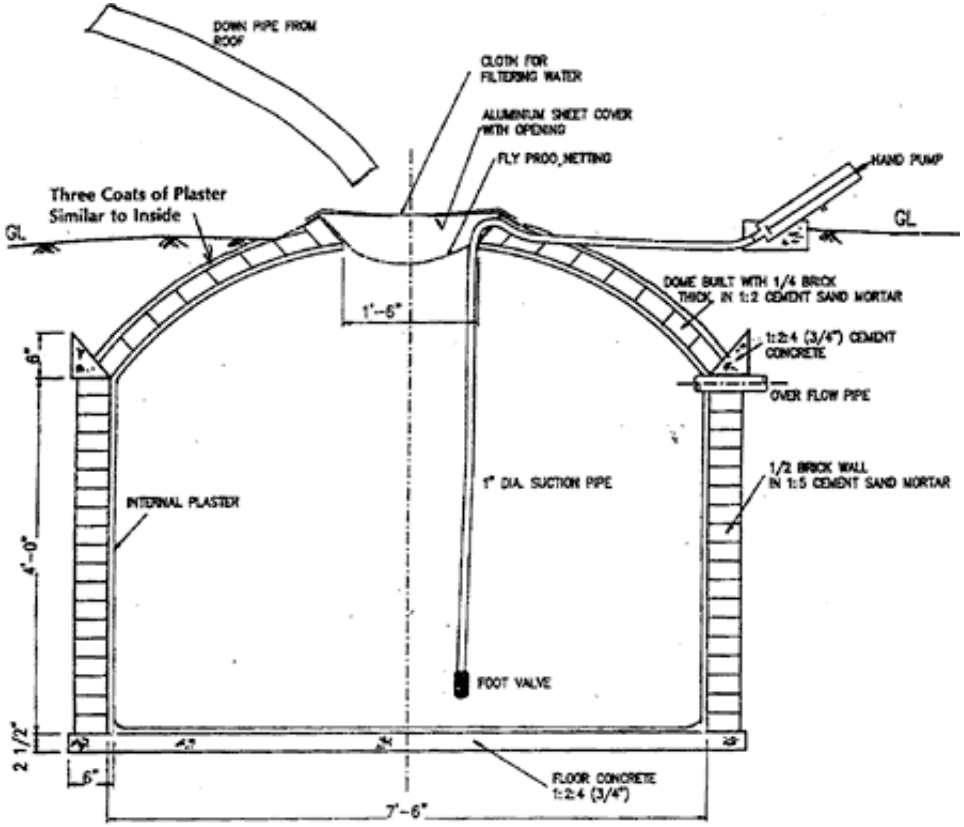

Figure 1 detail drawing of the Sri Lankan brick dome tank

The Sri Lanka Brick Dome Tank Construction details

1. Find suitable site
2. Dig pit 0.5m larger than the tank diameter
3. Plant an iron rod in the centre of the pit, making sure it is vertical.
4. Construct concrete base.
5. Start constructing walls using wire from iron rod to maintain the radius.
6. Once walls are complete backfill the gap between wall and pit with sand.
7. Make concrete ring beam to the shape shown. No reinforcing is required. Fit overflow pipe at this point if required.
8. Prepare two wooden sticks one end an L shape and the other a V shape. The length of the stick is 2/3 that of the internal diameter of the tank.
9. Keeping the L shaped end of the stick to top of the tank wall, place the V end against the iron rod and wrap string or wire around the rod to support the stick.
10. Start to build the dome shaped roof of the tank with dry bricks.
11. To start, stick the first brick to the lintel with mortar and support it with

the first stick.

12. For the second brick, stick this to the lintel and the first brick and support it with the second stick.
13. Push the third brick into place (with mortar) next to the second brick and move the second stick to hold the third brick.
14. Continue the process as with brick 3 until the first course is almost complete.
15. The final key brick should be shaped to fit tightly allowing for the mortar.
16. Remove the sticks once the first course is complete.
17. Continue in this fashion for the subsequent courses.
18. The dome mouth is constructed in a similar way, but using the bricks length-ways.
19. Plaster the outside of the dome, then plaster the inside of the dome.
20. Plaster the inside of the tank.
21. Plaster the floor o the tank
22. Cure the tank by wetting for 7 10 days. Fill the gradually starting on day 7, filling at a rate of approximately 300mm per day.

Water proofing can be added to the mortar. This can be specialist additive or

liquid dishwashing soap.

Water extraction is performed, at this sight, by two methods. A tap is fitted which allows water to flow by gravity from the tank, as shown if Figure 2. The second option is a simple handpump which has been developed, as part of the CWSSP programme, for use with below ground tanks. The pump is known as the Tamana pump, after the Pacific island on which its predecessor was originally observed.

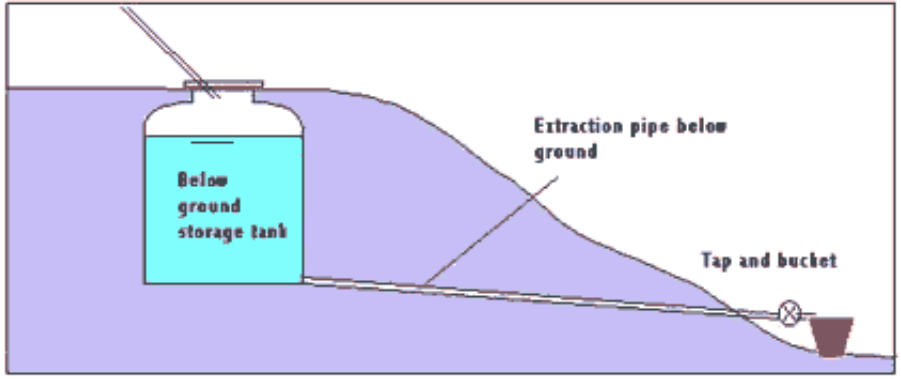

Figure 2 Water is fed by gravity from the tank when the conditions are favourable

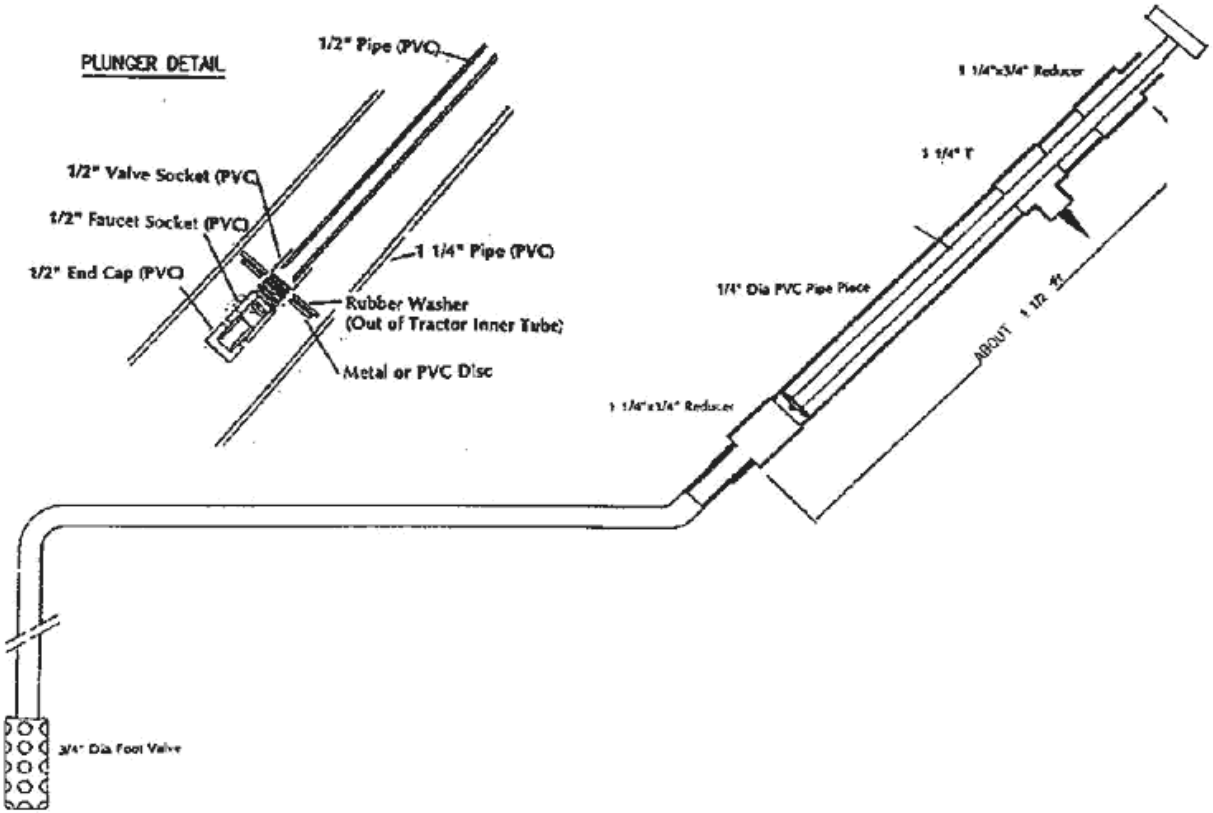

Figure 3 The Tamana pump design drawings

The Tamana pump is designed to be very low cost, approximately UK5, using only locally available PVC fittings and rubber from a tractor inner tube. The location of the pump is shown in Figure 1 and technical details of the pump are shown in figure 3. This particular pump was fitted by the owners son, a mechanic, who has fitted many of these pumps for other community members. The pump has been brought via a " PVC pipe to the kitchen of the house.

Figure 4 photo the Tamana pump installed at Batalahena (click on text to see photo)

The first flush system is quite simple the inlet chamber has a hole in its bottom, which is plugged with a bottle. When the bottle is removed water is allowed to flow away from the tank (See figure 5). The inlet chamber leads otherwise to a pre-filter chamber which contains layers of stone, charcoal and

sand. The owner has experienced some problems with infestations of ants in this chamber. The inlet pipe to the tank has a protective mosquito mesh to stop mosquitoes entering and breeding in the tank.

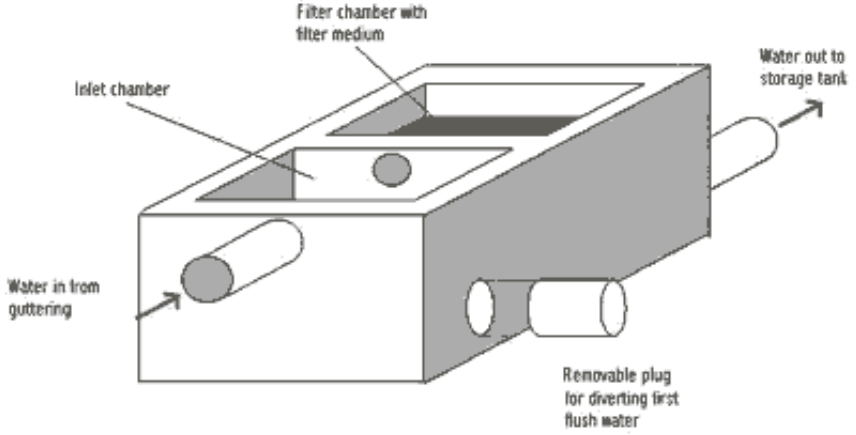

Figure 5 first flush system

Catchment area

The catchment area is the roof of the dwelling. This is a pitched roof of

pantiles. Only one side of the roof is used. The other side is actually used to supply water for a neighbours tank which is situated at the other side of the house. The guttering is a factory manufactured U section type fitted to a facia board with specialist clips. The cost of the guttering is 1000 Rps. (UK15.50). There is only about 8m of guttering for the 28m^2 of catchment surface.

Photos (click on text to see)

Below ground tank - photo 1

Below ground tank - photo 2

User pattern

Average annual rainfall is 2600mm with a bimodal rainfall pattern and a dry season which lasts for 3 months. When properly managed the water collected can last throughout the dry period, with occasional trips to the nearby well for washing water. The average consumption rate for the whole family is about 75 litres per day but this is reduced during the dry season. The water is used for all domestic applications and there is no anxiety about the quality of the water, as is seen often where rainwater is used.

Item	Unit	Unit cost	Quantity	Cost (SL Rupees)
Cement	bag	310	8.5	2635
Sand	m^3	1700	0.4	680
" Metal bar	m^3	4000	0.1	400
Brick	Number	2.10	800	1680
Padlo cement	kg	100	0.5	50
Skilled labour	days	250	4	1000

Unskilled labour	days	150	12	1800
			Total	**8245**
The unskilled labour is often provided by the recipient hence reducing the cost of the tank.				

Many thanks to Deva Hapugoda (Consultant Engineer), Tanuja Ariyananda (LRHF) and members of CWSSP Programme for their valuable contributions.

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