

DIVISION OF WATER TECHNOLOGY
CSIR
APPROPRIATE TECHNOLOGY PROGRAMME

TECHNICAL GUIDE

**How to build a small
ferro-cement water tank**



To be distributed together with the video:
How to build a small ferro-cement water tank

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SA DEPARTMENT OF NATIONAL HEALTH AND POPULATION DEVELOPMENT

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Division of Water Technology

C S I R

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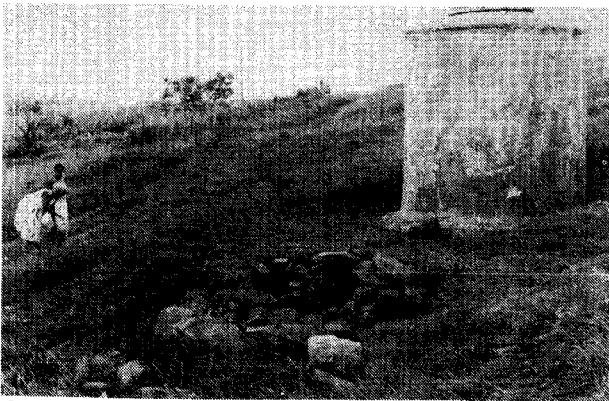
This guide will help you to build a small water tank which can be used to store spring water, rainwater or water pumped from a stream or dam (Photo 1).



1

Small water tanks can be constructed from many different materials such as corrugated iron, bricks or masonry, or even steel plates or plastic.

Ferro-cement techniques are relatively cheap, easy to learn and need only materials which are readily available in most areas (Photos 2, 3).



2



3

To build a five thousand litre tank you will need the following materials:

| | QUANTITY | APPROX. PRICE Rand 1988 |
|----------------------------|--------------------|----------------------------|
| Cement | 10 bags | 90 |
| Coarse sand | 1 m ³ | 30 |
| Small stones | 0.3 m ³ | 15 |
| Chicken mesh 50/1200 mm | 12 m | 30 |
| Fencing wire 3.15 mm diam. | 10 kg | 30 |
| Binding wire 1.25 mm diam. | 0.5 kg | 5 |
| | | 200 |

Additionally, collect some wooden planks, flat iron sheets or cardboard sheets and flat iron or cardboard strips.

You will need a mould which can be hired from one of the organizations listed below:

WORLD VISION

Private Bag X1023, Botha's Hill 3660,
Natal Tel. (031) 777-1105

PO Box 36, Wynberg 7824, Cape Tel.
(021) 71-5737, 71-5353

PO Box 23135, Diasland 6009 (Port Eliza-
beth) Tel. (041) 2-11975/6

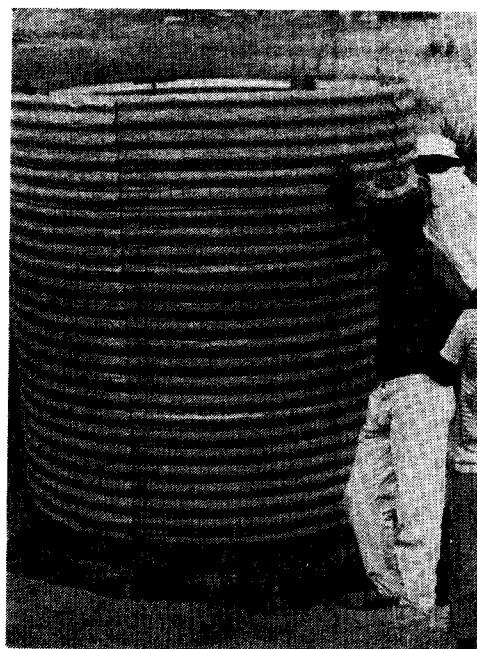
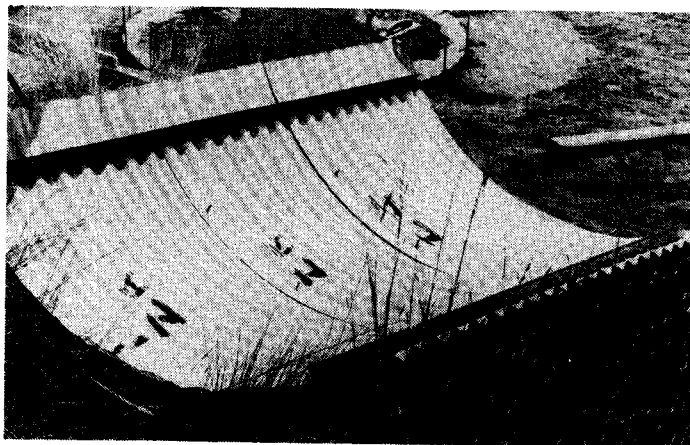
PO Box 1101, Florida 1710 (Johannes-
burg) Tel. (011) 42-3999

THE VALLEY TRUST

PO Box 33, Botha's Hill, Natal 3660
Tel. (031) 777-1930

SPRING MINISTRIES — Mr Paul Dell
(for KaNgwane and Gazankulu area)
PO Box 467, White River 1240
Tel. (01311) 3-3153.

You can also build the mould by following the instructions given in a separate technical guide on "How to build a mould for a ferro-cement water tank" (Photos 4, 5)



If the tank is to be used to store spring water, you will need a few nylon pipe fittings and a plastic pipe made of black polyethylene:

| | QUANTITY | APPROX. PRICE Rand 1988 |
|-----------------------------|----------|----------------------------|
| Nylon elbows 40 mm diam. | 3 | 3 |
| Nylon couplings 40 mm diam. | 3 | 3 |
| PVC pipe 40 mm diam. | 5 m | 10 |
| | | 16 |

To build the standpipe, you will need the following materials:

| | QUANTITY | APPROX. PRICE Rand 1988 |
|---|----------|----------------------------|
| A tap 12 mm (1/2 inch) | 1 | 20 |
| Galvanized steel elbow 12 mm | 1 | 3 |
| Galvanized steel pipe 12 mm threaded at one end | 0.7 m | 2 |
| Nylon fittings: | | |
| Elbow coupling 25 mm | 1 | 1 |
| Reducing coupling 40 x 25 mm | 1 | 1 |
| Short pieces of PVC pipes 25, 32 mm PVC pipe 40 mm as long as needed from the tank to the standpipe | | — |

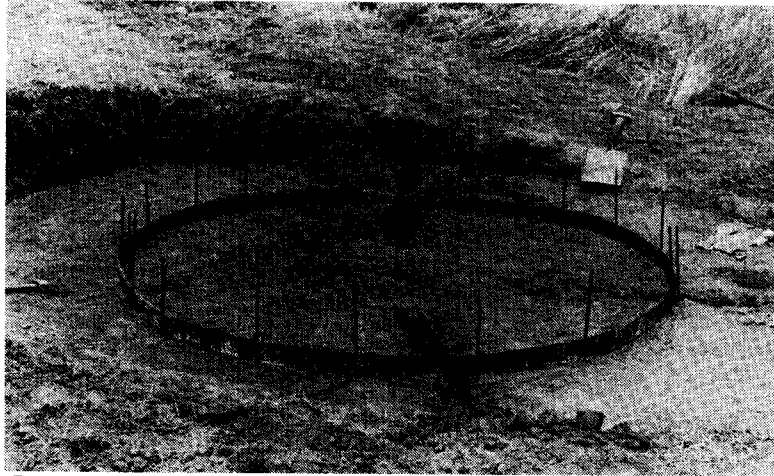
The place chosen for the reservoir should be levelled and the loose top soil removed until firm ground is reached (Photo 6).



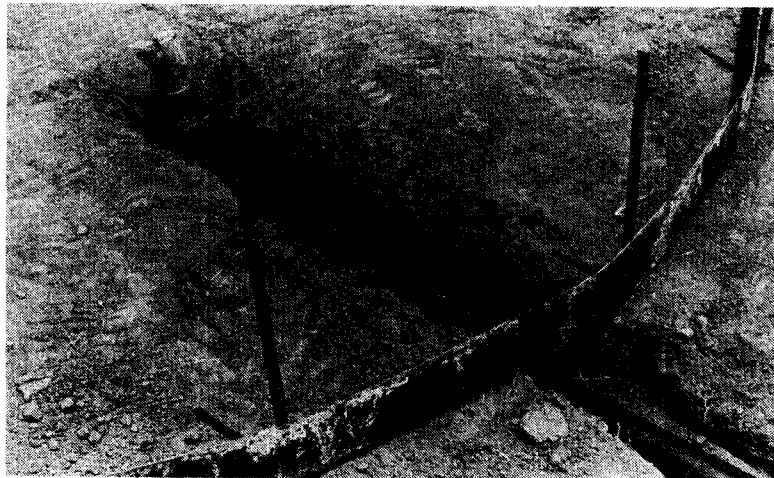
6

First a foundation 150 to 200 mm thick is laid. To achieve a neat appearance the following method can be used.

Start by putting a peg in the centre of the excavation. Using a piece of string or thin wire, a circle is drawn with the diameter of 2,20 metre. Next, several steel or wooden pegs are put along the circle. Flat iron is then attached to the stakes to form the shuttering (Photos 7 and 8).



7



8

The shuttering can also be made using a cardboard strip supported by stones, or alternatively, simply place large stones forming a circle at least 2,2 m in diameter.

For a spring water or river water storage tank, the inlet pipe should be cast into the foundation so that the pipe can later be buried. Dig a shallow trench under the shuttering and lay a piece of pipe (approximately 2 m long) in the trench so that its end will protrude into the tank. An elbow is used at one end of the pipe and a coupling at the other end. The outlet pipe and the overflow pipe can also be cast into the foundation in the same way (Photo 8).

Pieces of paper are put into the ends of pipes to prevent concrete entering accidentally.

The concrete mixture is prepared from one part of cement, two parts of sand and three parts of stone. If there are no stones available, mix one part of cement with three parts of sand. Use a bucket or similar container to measure the volumes (Photo 9).



9

Sand and stones must be clean, free from grass, clay or silt. Mixing must be done properly until all the pile is one colour of grey. Keep adding clean water to achieve a stiff but workable mixture.

The base slab should be about 15 cm thick (Photos 10, 11).

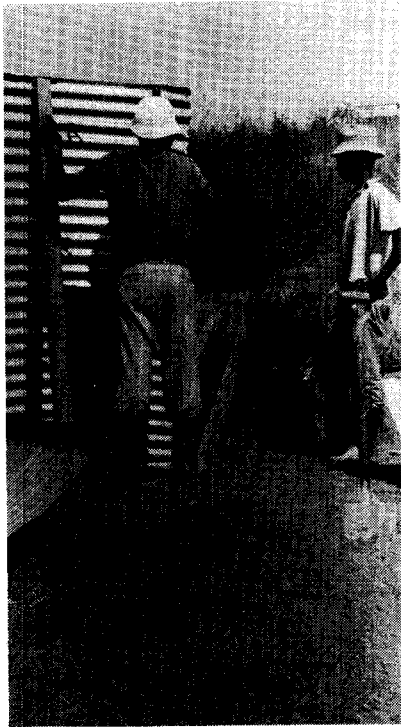


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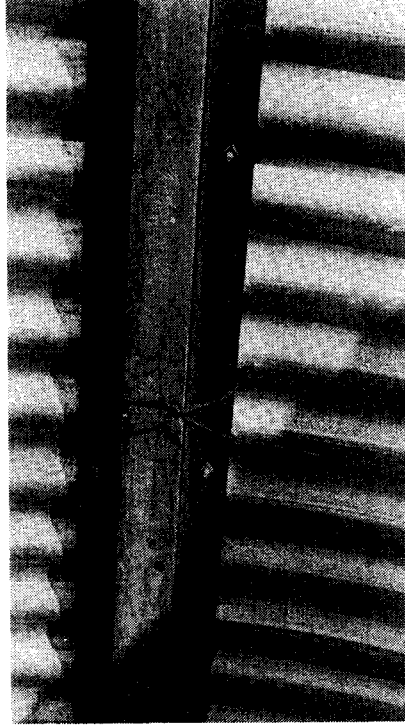


11

You can now start with the preparation of the mould. First the corrugated iron sections must be joined using pieces of binding wire (Photos 12, 13, 14).



12



13



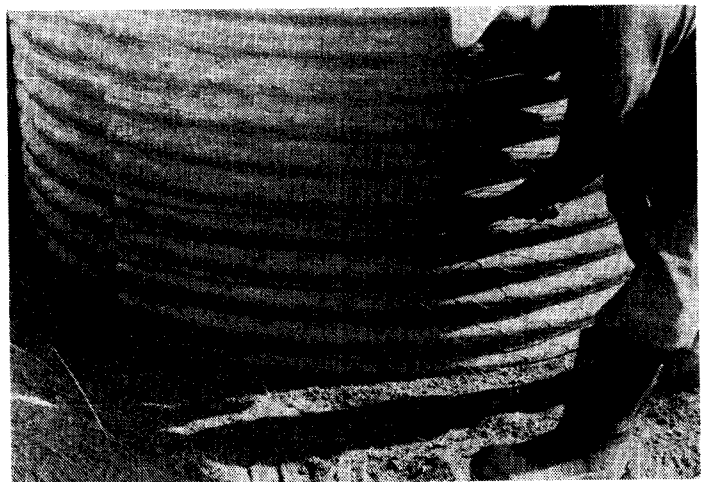
14

Next, chicken mesh or diamond fencing mesh is wound around the framework so that the ends overlap each other (Photo 15).

Then, the fencing wire is wrapped around the mould to form the reinforcing for the tank (Photo 16). The spacing of the wire loops should be approximately 8 cm, which is the spacing of the corrugations of the shuttering.



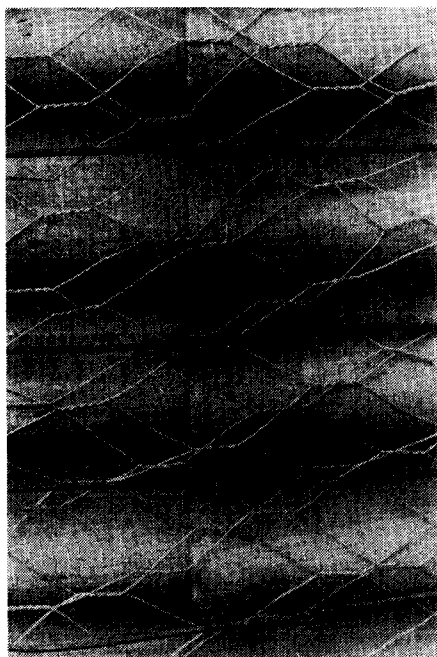
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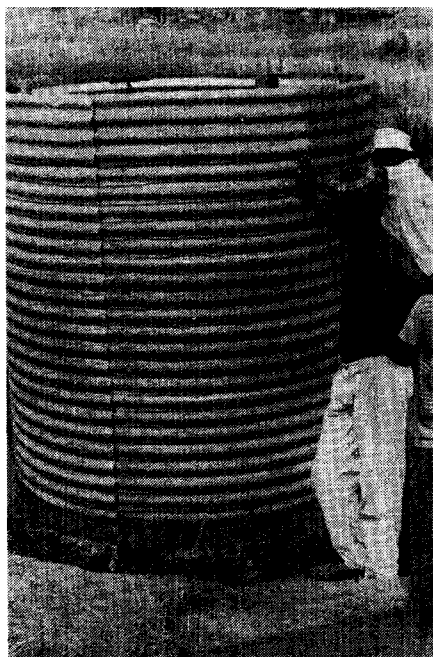
16

The wire is fixed to the chicken mesh with binding wire (Photo 17).

The concrete foundation should be cured for at least three days which means it is kept moist all the time. After this the mould can be placed on the base slab (Photo 18).



17



18

The mixture for mortar should be one part of cement and three parts of clean building sand. It is very important to mix the cement and sand properly.

Do not use too much water because it will reduce the strength of mortar and cause cracks when it shrinks (Photo 19).



19

Plastering starts from the bottom and it should be finished within half an hour of mixing the mortar. The layer of mortar is about one centimetre thick. Plastering should start in the morning and two to three hours after the first layer is completed, the second layer can be applied. The third layer is done the next day (Photos 20, 21, 22).



20



21

After two days the mould can be dismantled. This should be done carefully because the concrete is still not completely hard.

The mould should be cleaned properly after dismantling so that it can be used for the next tank (Photo 23).



22

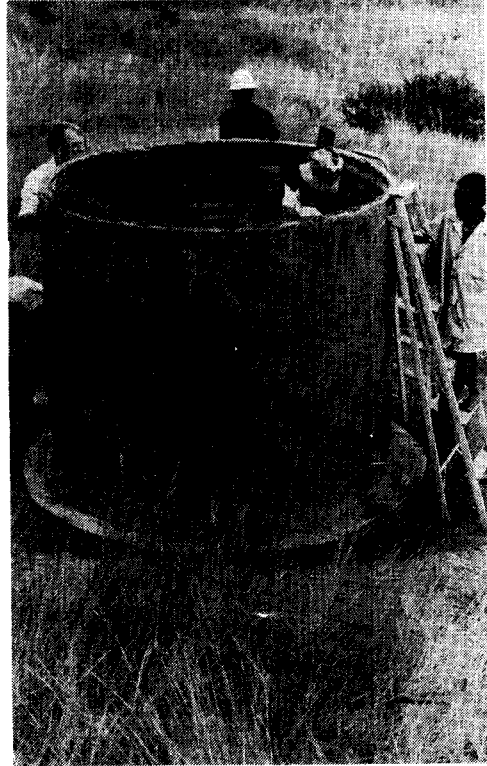


23

Now, the mortar can be applied on the inside surface of the wall and it should be completed in one operation. A thin layer should also be put on the floor and a collar formed on the joint between the wall and the floor (Photo 24, 25, 26).



24



25

At the top of the tank, the inside layer must form a ledge which is needed to support the shuttering for the lid (Photo 27).



26



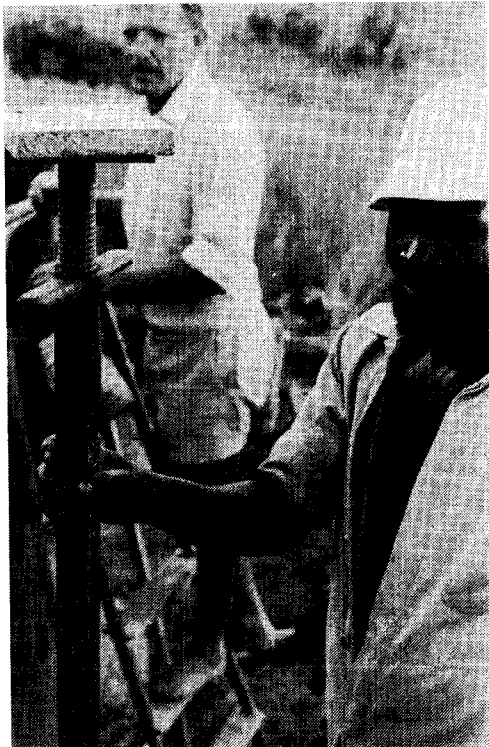
27

Finally, give a smooth finish to the surface (Photo 28).



28

Now the preparations can start for the construction of the roof. Here, a two-inch pipe is used in the centre to support the shuttering. A jack is mounted on top of the pipe. This makes it easier to dismantle the shuttering after the roof is finished (Photos 29, 30). Alternatively, a wooden pole standing on bricks or flat stones to adjust the height can be used.



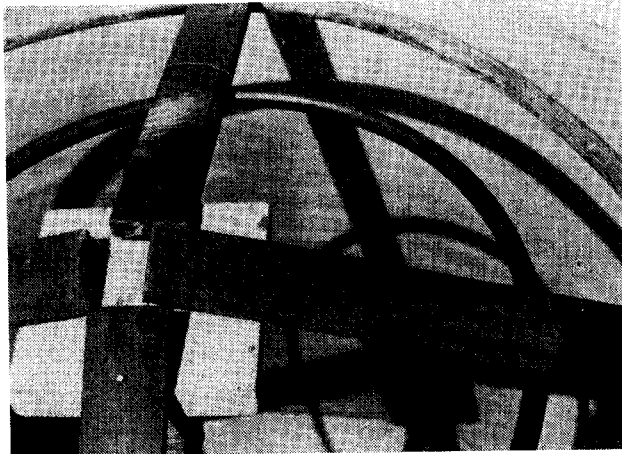
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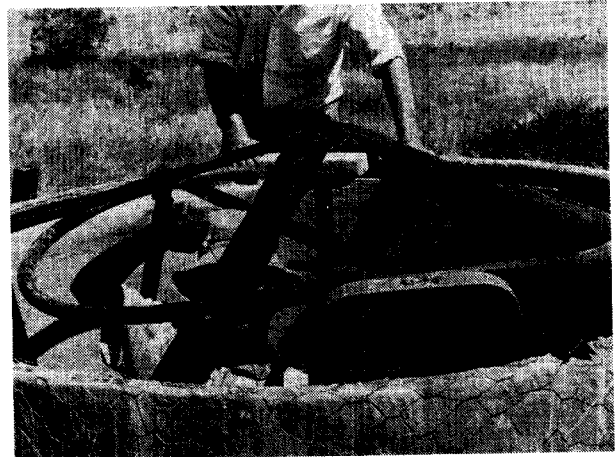
30

Supporting planks are rested with one end on the ledge at the top of the tank and the other on a piece of square plank placed on top of the jack (or pole).

Two rings made of twenty-five millimetre plastic pipe are attached to these planks at equal spacing between the edge and centre of the tank. Shorter planks are then placed between the main supporting planks, with one end resting on the tank ledge, and the rest supported by the pipes. Two shorter planks between each two main supporting planks should be sufficient (Photos 31, 32).

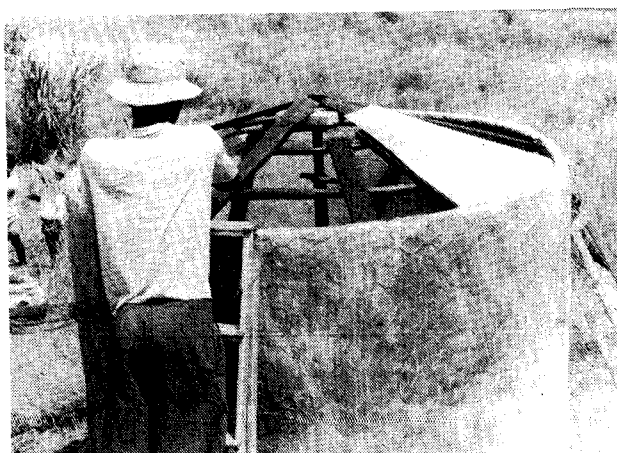


31



32

The framework is now covered with pre-cut flat iron sheets. Materials other than iron can also be used for example: plywood or thick cardboard covered with plastic foil (Photos 33, 34).



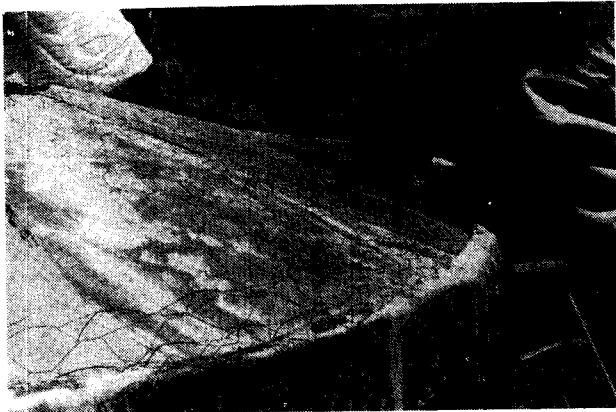
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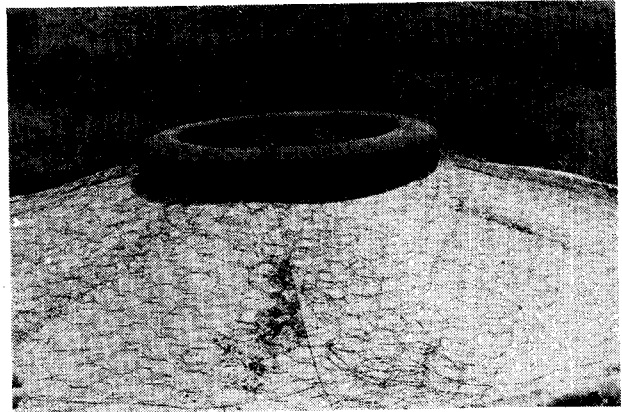
34

The mesh sticking out from the wall is now bent down to overlap the mesh placed on top of the shuttering (Photo 35).

Place an old car tyre in the centre of the shuttering to make a form for an access manhole which should be at least 50 cm in diameter (Photo 36).



35



36

The mortar used for plastering the roof is the same as that used for the foundation slab which is one part of cement, two parts of sand and three parts of stone. If you don't have enough stones, use sand instead making a mixture of one part of cement and four parts of sand (Photos 37, 38).



37



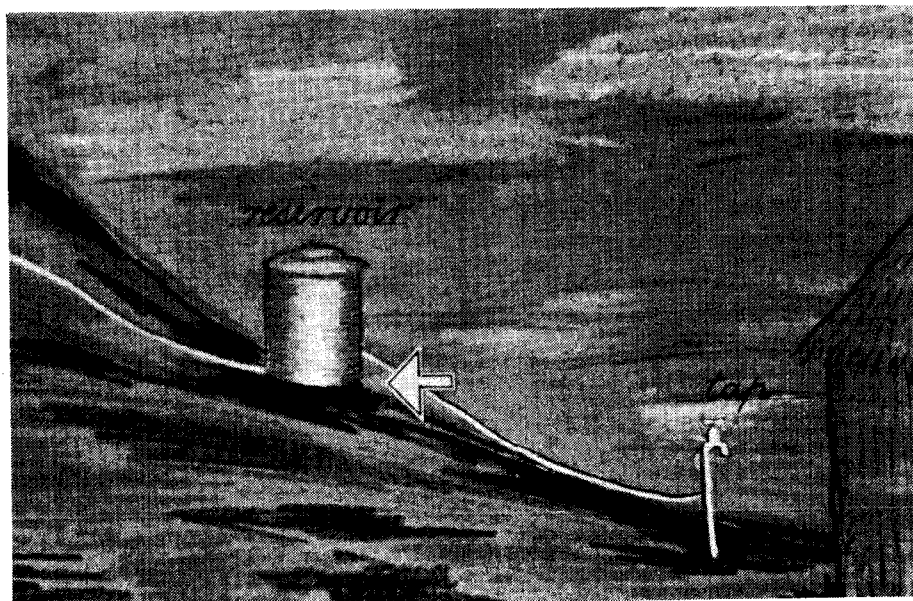
38

It is very important to cure the roof and walls by keeping them moist for at least three days or even better, for one week. The roof can be covered with empty cement bags to prevent drying too quickly (Photo 39).



39

In the meanwhile, preparations can be made to build the standpipe. First, the right location for the tap must be found. It is important that the tap is lower than the bottom of the reservoir, so the distance between the tank and the standpipe depends on how steeply the ground slopes (Photo 40).



40

Now, the trench can be dug and the pipe placed in it (Photos 41, 42, 43).



41



42

The pipe is 40 mm in diameter and is connected with a plastic fitting to the outlet of the tank (Photo 44).

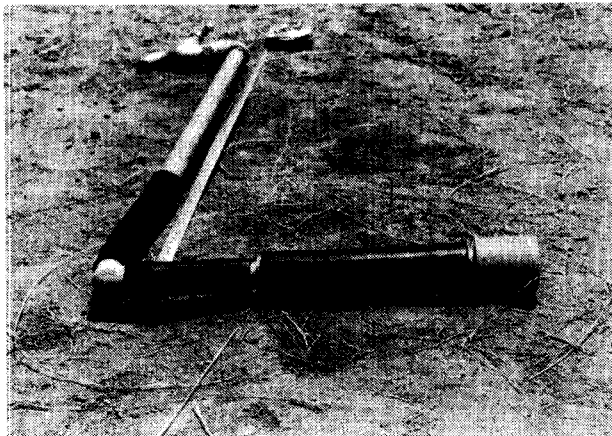


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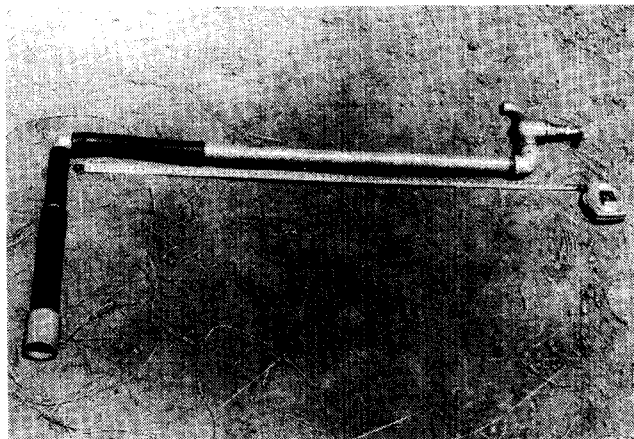


44

The standpipe is made of a piece of galvanized steel pipe about 60-70 cm long and 12 millimetres or half an inch in diameter. Nylon fittings and short pieces of PVC pipes are used to reduce the diameter from 40 to 12 millimetres (Photos 45, 46).



45



46

Now, the standpipe can be connected to the outlet pipe. Use a standard 25 litre container to measure the height of the tap (Photos 47, 48).



47



48

A slab under the tap will prevent water collecting around the base of the standpipe (Photos 49, 50).



49



50

After curing the concrete roof for at least three days, the shuttering can be dismantled. The jack is lowered and removed together with the pipe and other parts of the shuttering. Remember that instead of using the metal pipe and jack you can also use a wooden pole to support the shuttering in the centre. To remove the pole, you can use a hammer to knock it out (Photos 51,52).



51

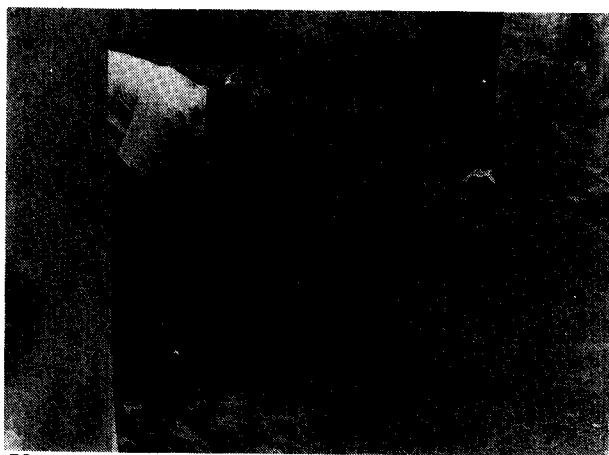


52

All the pipework inside the tank should be completed at this stage as well. The overflow pipe should be extended up to a level just below the top of the wall and preferably attached to the wall by plastering it in place. The inlet pipe could similarly be extended to the same level as the outlet pipe.

The water supply pipe from a spring, stream or other source can now be connected to the inlet of the tank (Photo 53).

The overflow pipe should be extended to divert the water away from the tank (Photo 54). A drinking trough for cattle could later be constructed at the overflow if desired.



53

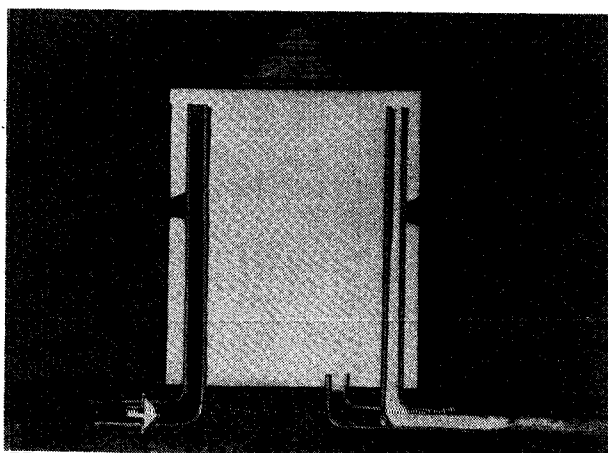


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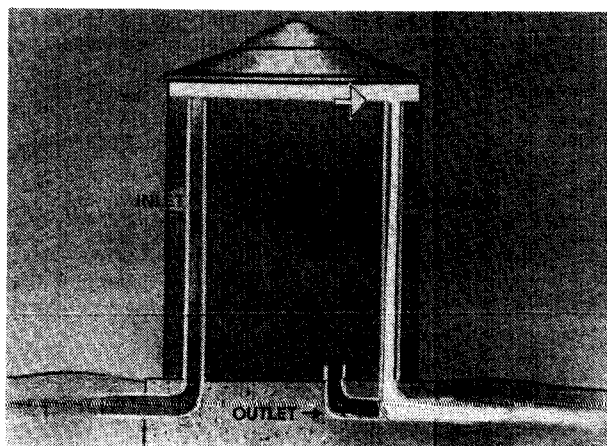
When in use, the water storage tank operates as follows:

Inside the tank, two vertical pipes for the inlet and the overflow are fixed to connections on the floor. The pipes are of equal height: the inlet is on the left and the overflow on the right. Water from the spring flows continuously through the inlet pipe into the tank (Photo 55).

The highest level to which the tank can be filled is the level of the overflow pipe (Photo 56).



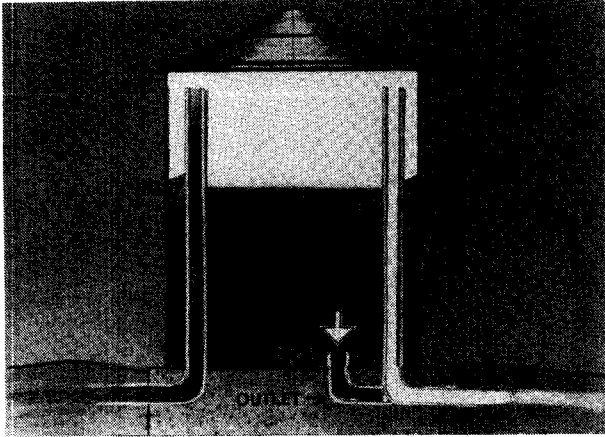
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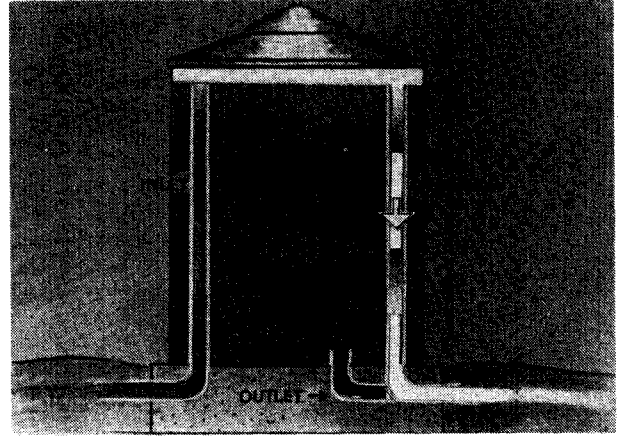
56

Now, the water can be drawn from the outlet (Photo 57).

When the tap is closed, all the incoming water firstly fills the tank and then flows through the overflow pipe away from the tank. This water can be used in a vegetable garden, for cattle, or for washing clothes if desired (Photo 58).

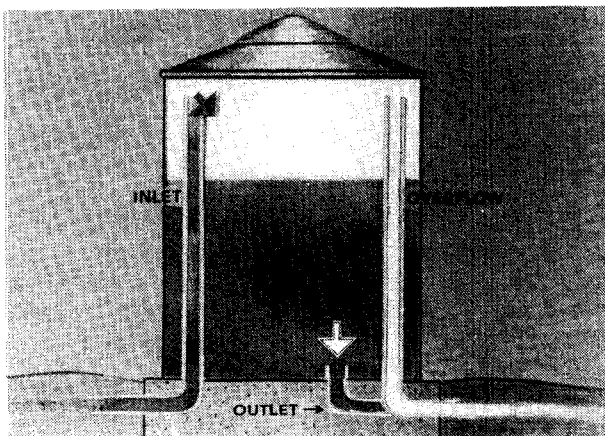


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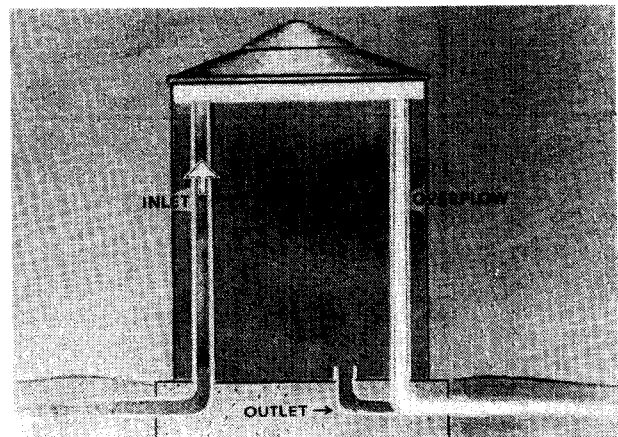


58

If there are many people using the tap at the same time, the water level in the tank drops, but then rises again as water flows in from the spring, stream or other source (Photos 59, 60).



59



60

The construction of the reservoir is now complete and the tank should be covered with a lid. The cover slab is made from precast concrete reinforced with wire (Photo 61). This lid is cast on the ground using a concrete mix the same as was used for the roof. Wire reinforcing must be used and the lid should be cured for at least five days before lifting.

In some cases the whole roof is cast as a flat lid on the ground, using a wire reinforcing grid. After a week it is lifted and placed on the tank.



61

It is quite easy to own a water tank like this if you all get together and build it as shown in this technical guide and the film. This will help ensure a better and healthier life for you and your community.



62



63