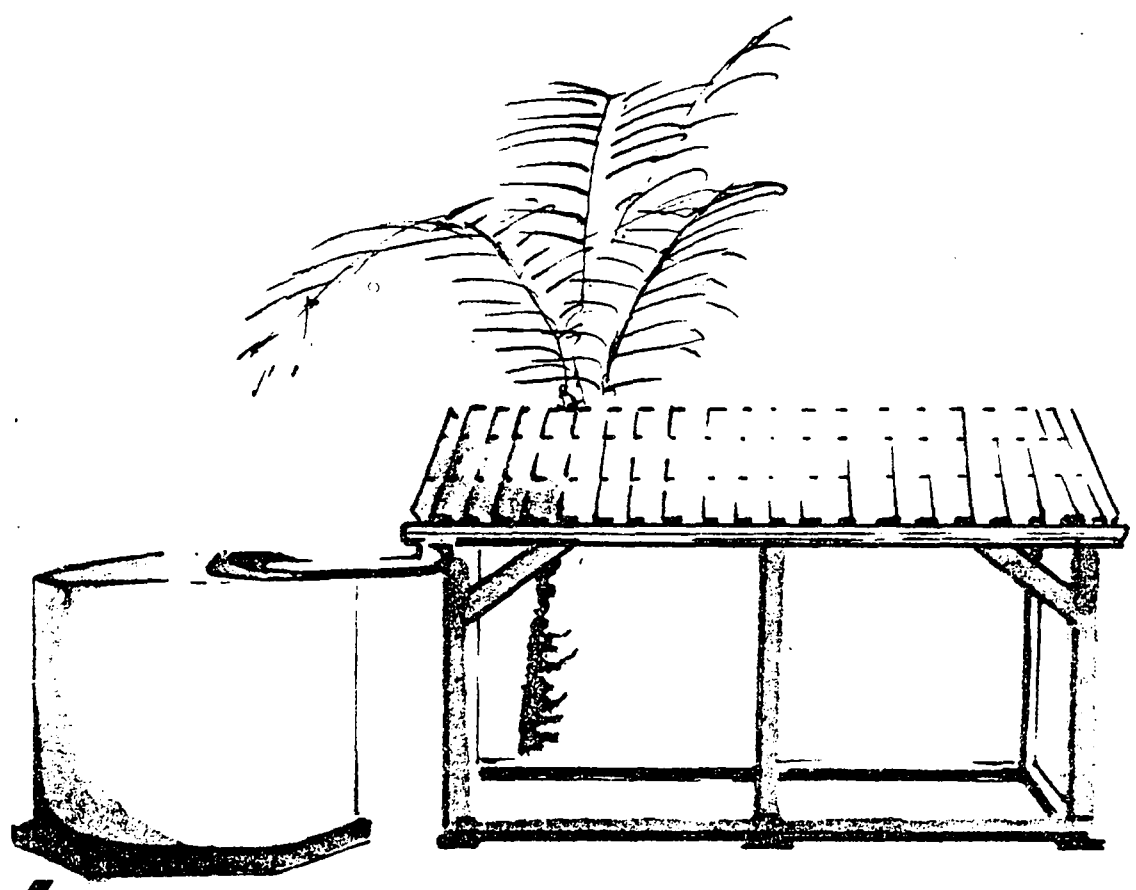


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Building Ferro Cement Water Tanks In Tuvalu.



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GUIDE TO BUILDING FERRO CEMENT WATER TANKS IN TUVALU

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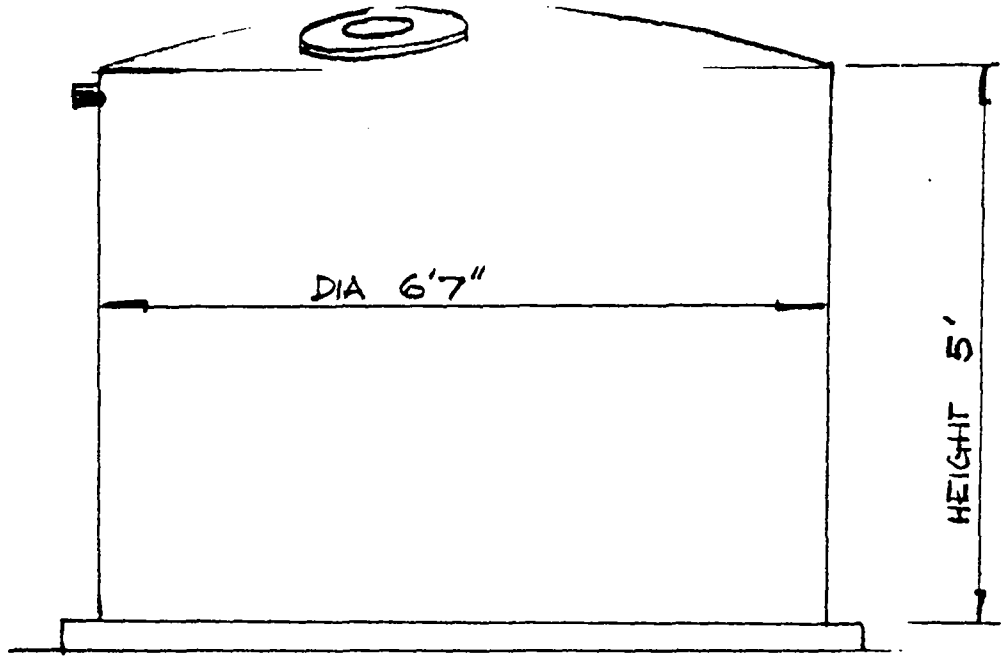
Save the Children®

TUVALU FIELD OFFICE
FUNAFUTI, TUVALU.

1982

GENERAL PROJECT INFORMATION.

TANK SIZE



HEIGHT 5'
DIAMETER 6' 7"
CIRCUMFERENCE 21'
VOLUME 1060 gallons

MATERIALS

CEMENT 450 Kg - 9 x 50 Kg Bags
CHICKEN WIRE 75 ft.
TIE WIRE 600 ft.

MATERIALS: The quality of the tanks built for this project relies on the quality of the materials and workmanship.

CEMENT: Make sure cement is stored in a secure dry place. Cement must be sifted to remove any hard lumps.

SAND: Do not use fine white sand or sand from the beach. Use coarse large grain sand. Collect the sand and store it so rain can wash through it. Protect the sand from any possible contamination from chickens or other animals.

Sand must be sifted to remove any roots or stones.

GRAVEL: Gravel must be clean. Collect gravel and let rain water wash through it for at least one month before using it. Remove any roots or large rocks by sifting.

Try to collect gravel and sand well before starting the construction of a tank. This will allow time for rain to wash out the materials to remove corrosive salts.

CHICKEN WIRE & TIE WIRE:

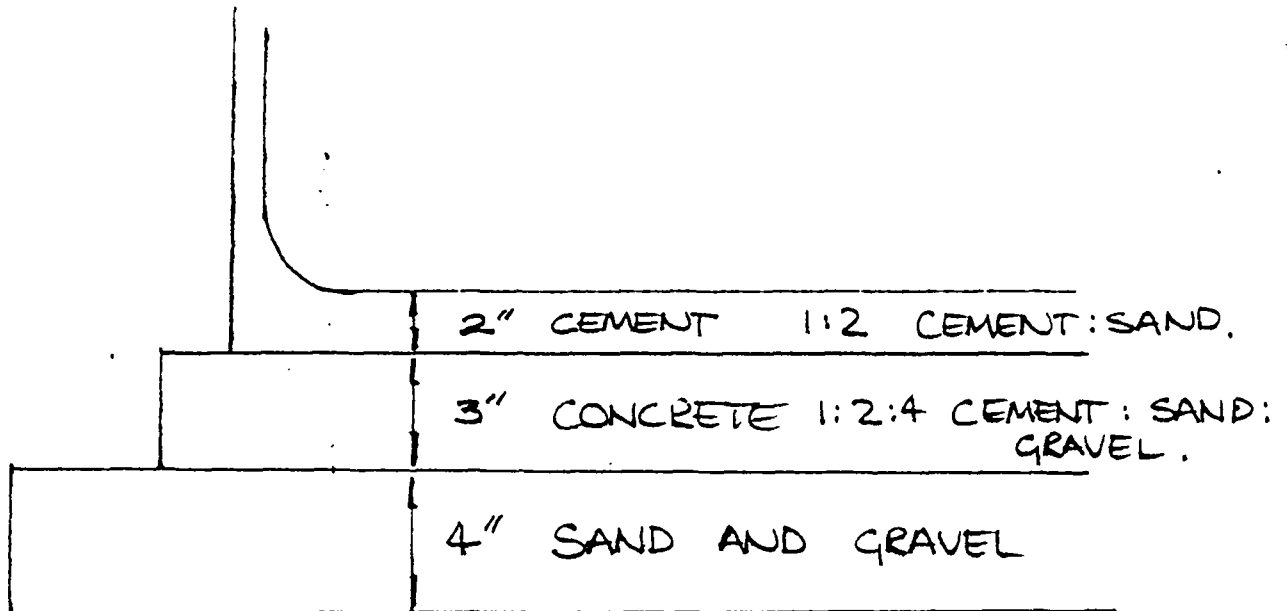
Store in secure dry place. Before using the wire, brush off any white powder which may form on the surface. Use a scrubbing brush for this, not a wire brush, as you may remove the galvanized coating.

SITE: Before starting construction of the tank check the site as follows:

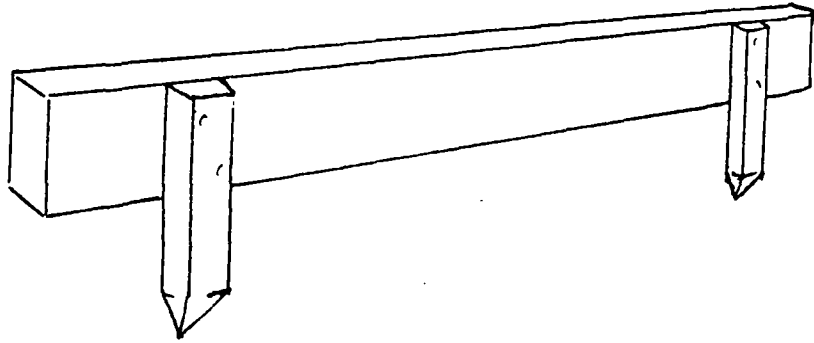
1. Land boundary-make sure the tank is within the household's land area.
2. Make sure there is room for the catchment.
3. Keep tanks well away from pit or water sealed latrines. (at least 12')
4. Ask householder if a rubbish pit has been dug anywhere near site. Remove any rubbish and fill with sand and gravel.
5. Position tanks away from large trees.
6. Remove any rotting tree stumps from the site and fill with sand and gravel.

FOUNDATION:

1. After selecting the site mark out a circle 9ft. in diameter.
2. Dig out soil to a depth of 6".
3. Remove any roots or rubbish.
4. Fill with 4" layer of sand and gravel.
5. Maximum gravel size should be 1".
6. Do not use large rocks or large flat stones.
7. Pour water over the sand and gravel so sand washes into spaces between gravel.
8. Beat down the sand and gravel using heavy block of wood.

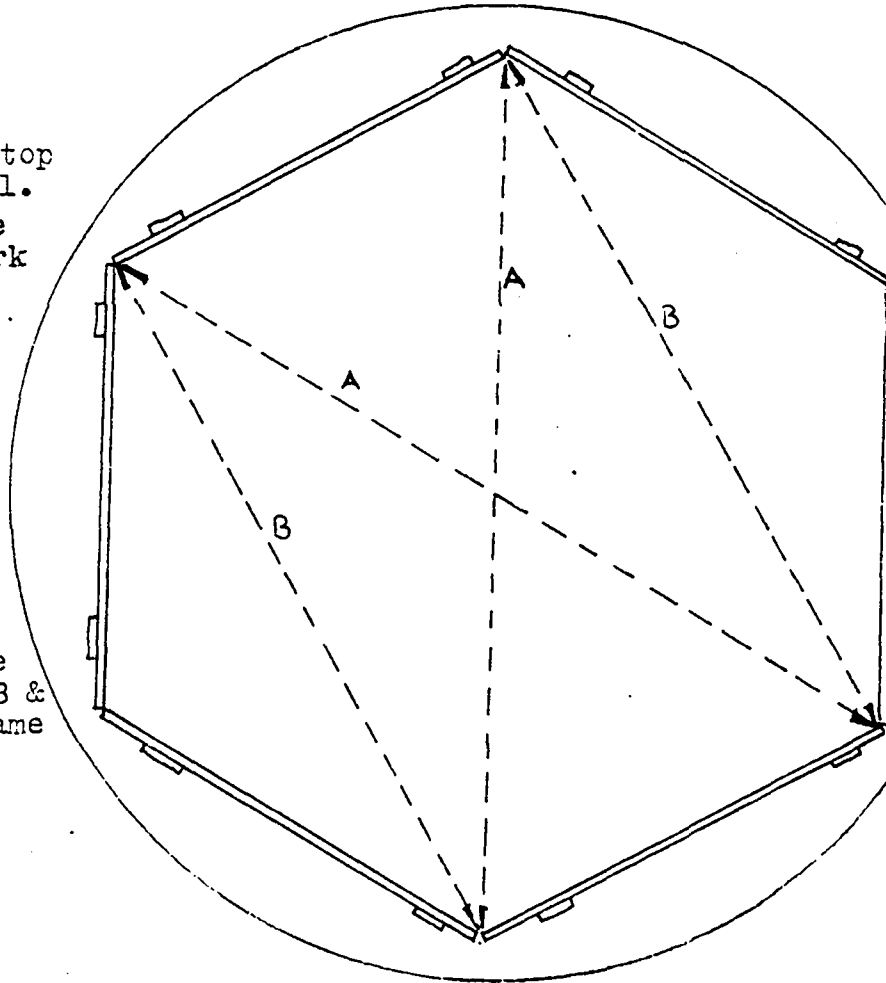


9. Formwork for Foundation is made of 6 pieces of timber 4' long x 4" x 2". Nail 2 stakes on each length to hold steady when pouring concrete.

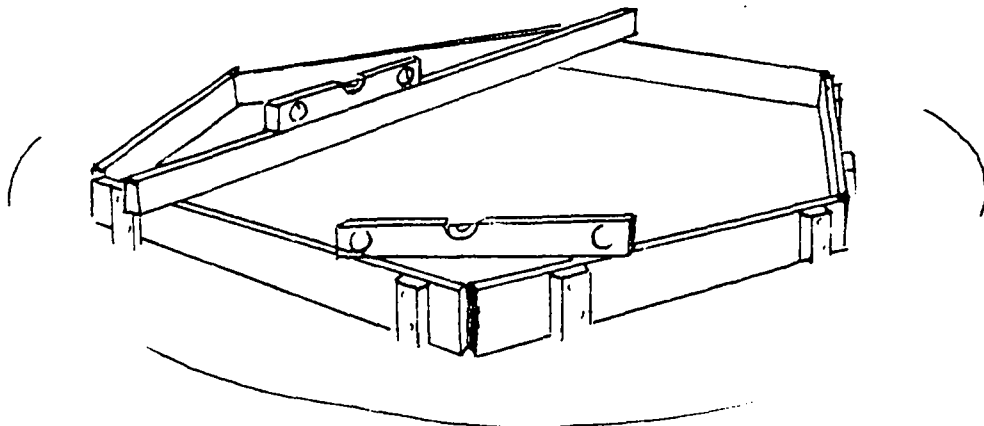


10. Position the formwork on top of the gravel. Check to see that formwork is true by using a measuring tape.

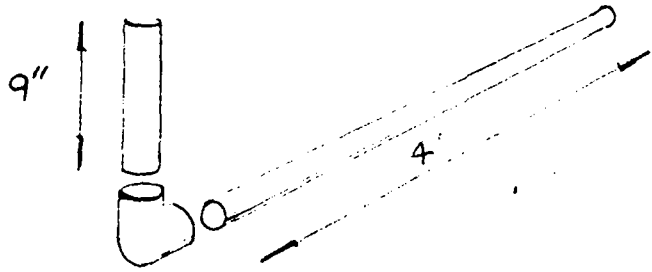
Adjust the formwork until distances A & A (see diagram) are the same length and B & B are the same length.



11. Using Spirit level check to see that formwork is level.

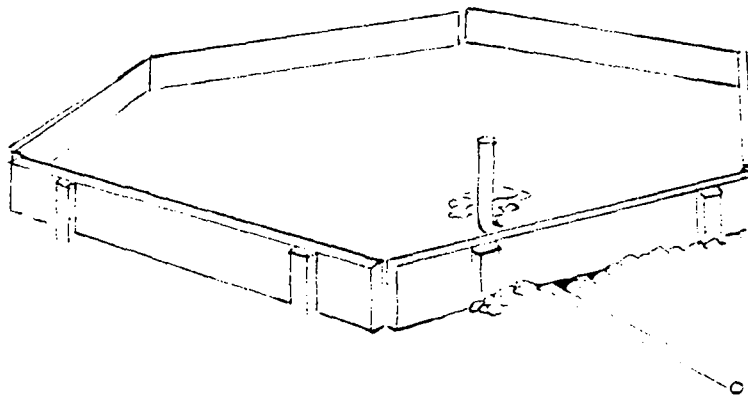


12. Cut 2 lengths of PVC Pipe one 4 ft long and one 9" long. Join them together using an elbow joint and PVC Pipe Cement.



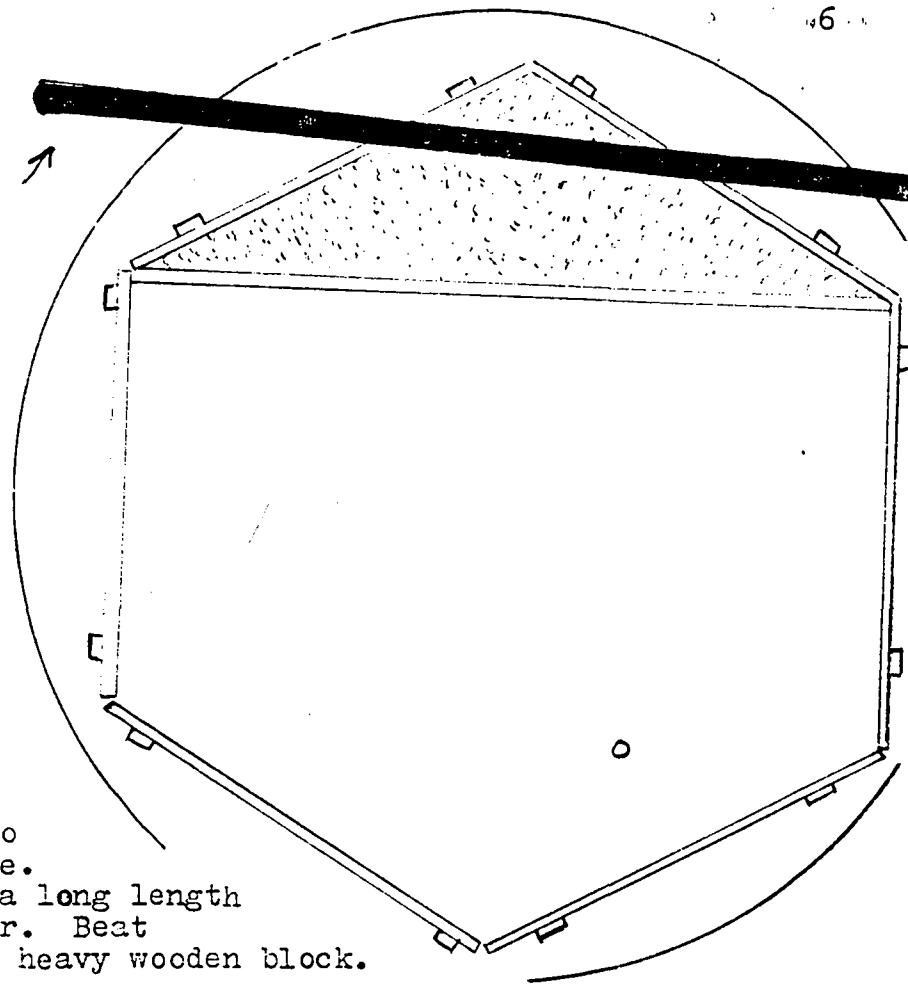
Apply PVC cement to both surfaces to be joined. Push the pipes together and hold tightly for 45 seconds.

13. Place the Pipe under the wooden formwork about 2" down in the sand and gravel.



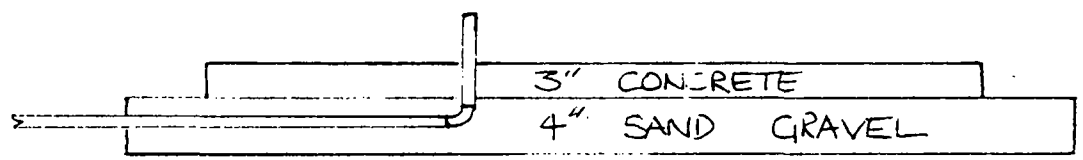
14. Mix concrete. 1 Bucket cement, 2 Buckets sand, 4 Buckets gravel.
Make sure sand is sifted and clean.
Gravel size should be no more than $\frac{3}{4}$ ".
Sift gravel through sifter made from chicken wire.
15. Mix on clean mixing board.
16. Make sure cement sand and gravel are well mixed before adding water.
17. Use clean water only. NEVER USE SEAWATER.
18. Add water to get a stiff mix which will give a smooth surface. Check by patting with shovel.

19. TIMBER
USED FOR
LEVELLING
CONCRETE



Pour concrete into one area at a time. Screed off using a long length of straight timber. Beat cement down using heavy wooden block.

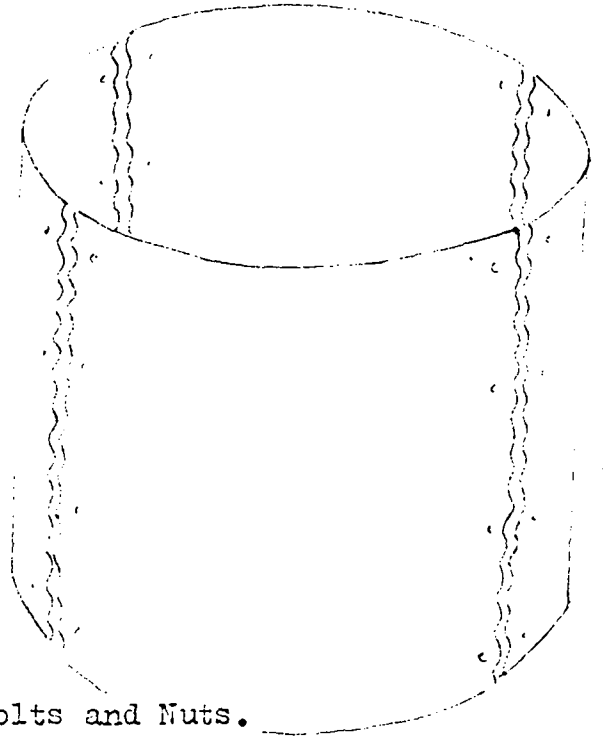
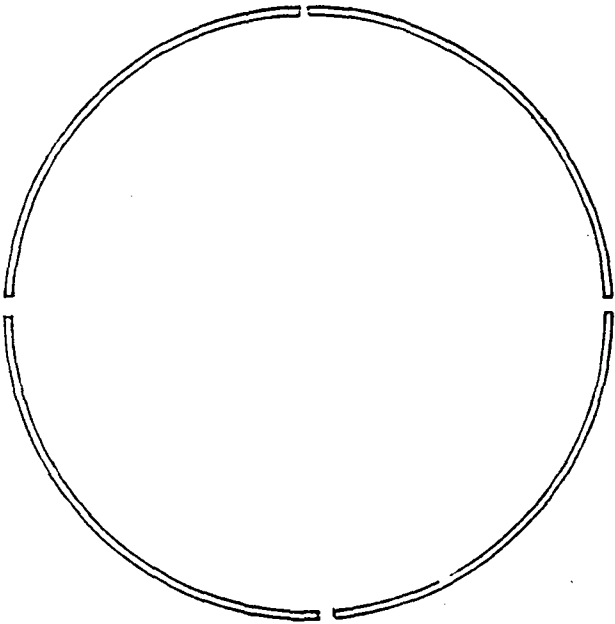
20. The concrete should be 3" thick.



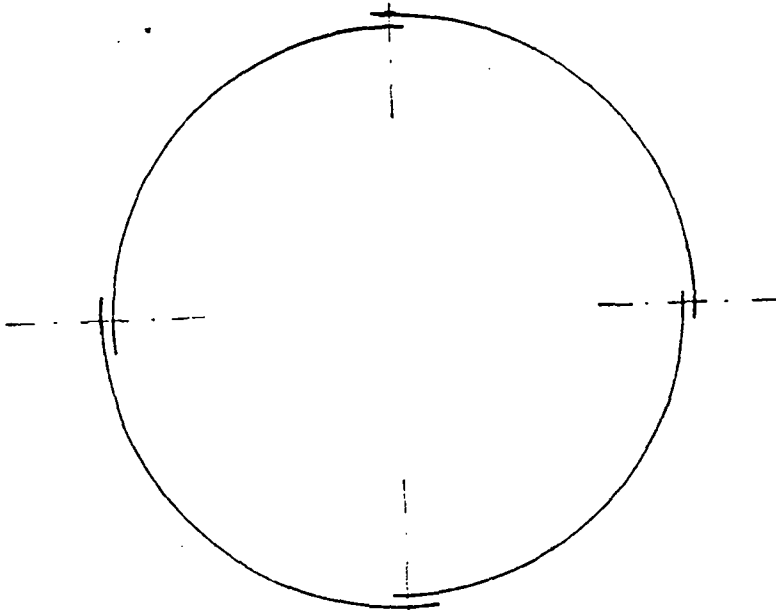
- 21. Fill all formwork. Beat down and level off surface with a length of timber.
- 22. Cover with Black plastic and keep damp for 4 days after.
- 23. Remove formwork after 4 days and buildup gravel around edge
- 24. Base should take 2 50kg bags of cement.
- 25. Leave base for at least 9 days before continuing construction.

FORMER

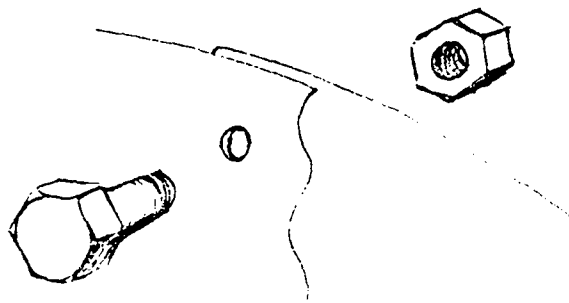
1. The former is made from corrugated galvanized sheets. Its made in 4 sections.



2. Its held together with 16 Bolts and Nuts.



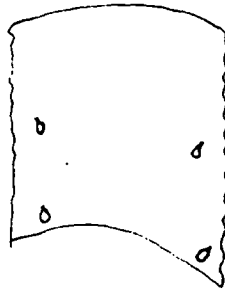
3. Where the sheets overlap nuts and bolts are secured through pre-drilled holes. The nuts on the outside, bolts inside.



4. Before the former is put together make sure it's clean. If any dents appear use a hammer to straighten them out.
5. Assemble former on concrete base.
6. Make sure nuts and bolts are clean and well greased.
7. Bolts should not stand out. Cut the bolts with a hacksaw if they are too long.

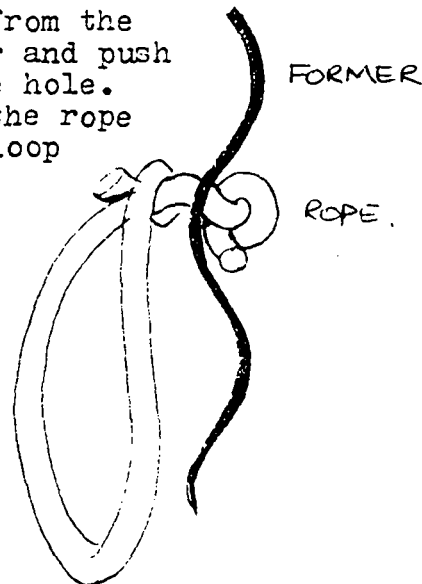


8. Tighten up each nut and bolt, then undo it half a turn so it can be easily removed.
9. To help in handling the sheets, put 4 ropes in each corner.



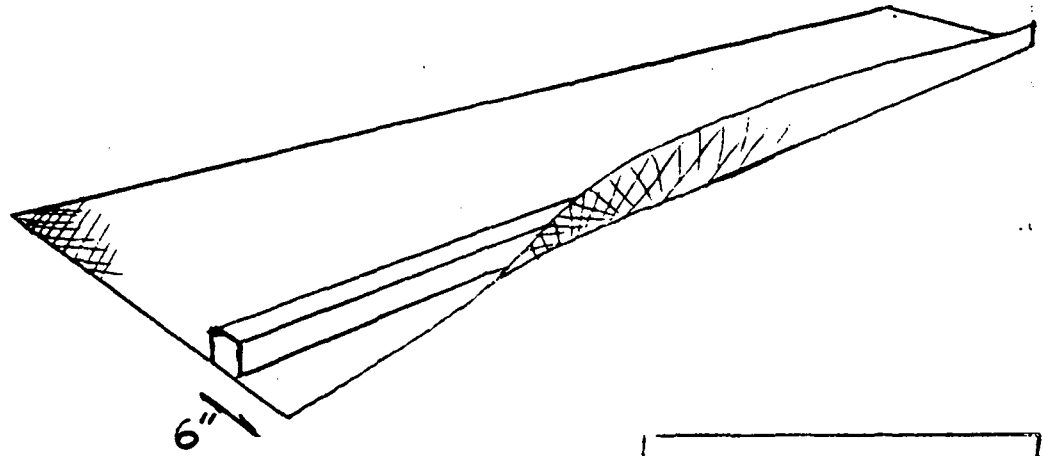
10. Wipe over the outside of the Former using an oil soaked rag. Use old tractor oil if possible.
11. Cover any large holes or seams with strips of thick Black Plastic.

Drill a hole 10" from the edge of the former and push a rope through the hole. A knot will stop the rope coming out and a loop will make a good handle to pull on when removing the former.

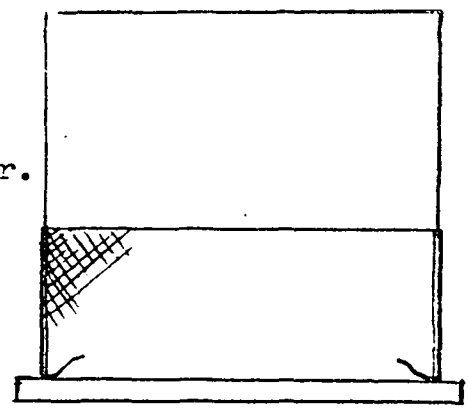


REINFORCING WIRE

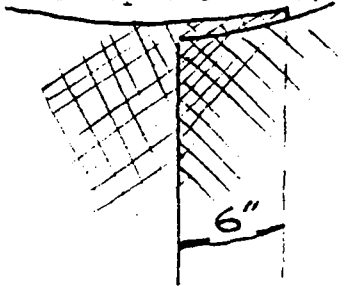
1. Measure out a 22ft length of chicken wire. This should go around the former and overlap at least 6".
2. Clean the chicken wire with a stiff brush to remove any white powder which forms on the galvanized surface.
3. Using a long length of timber bend one side of the wire at right angles 6" from a long edge.



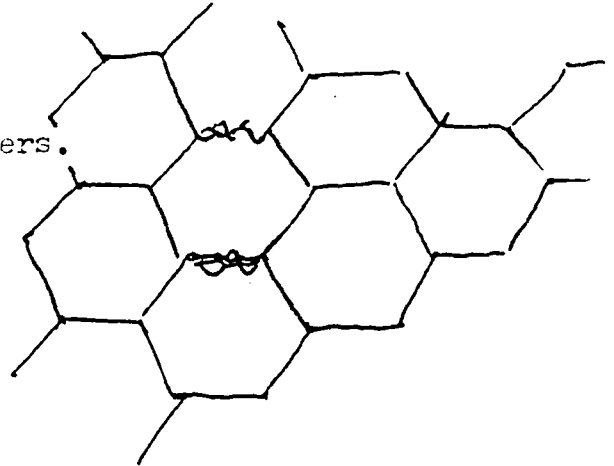
4. Tuck this 6" fold under the former.



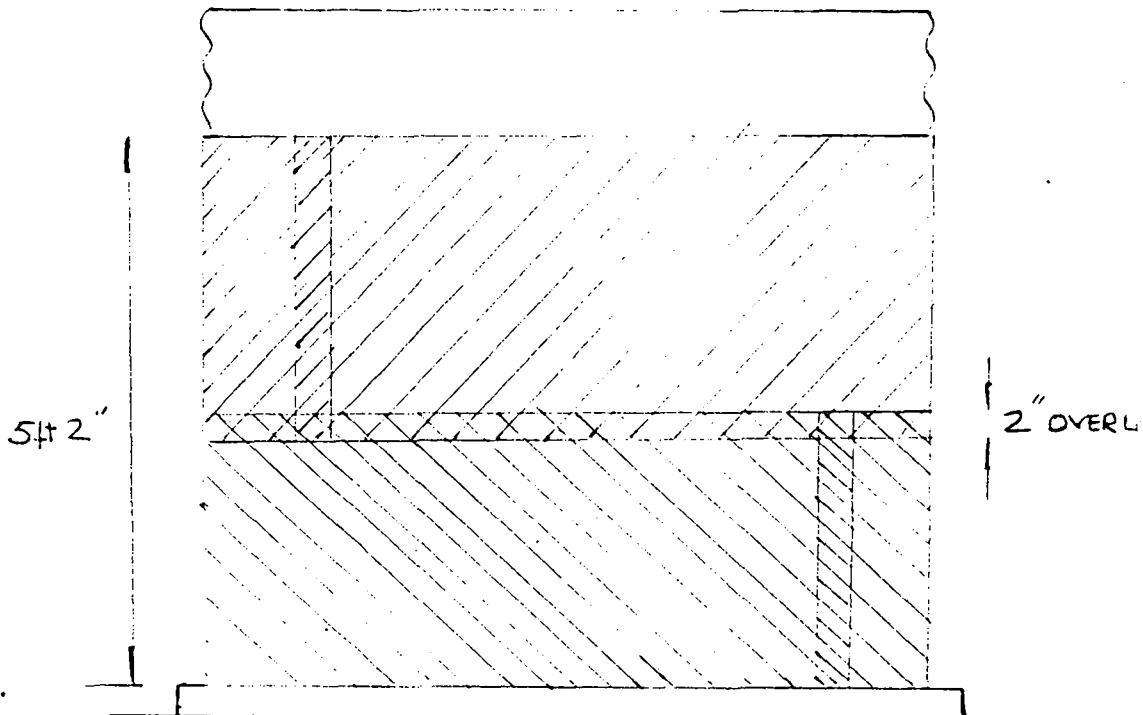
5. Tie up the 6" overlap,



using long nose pliers.

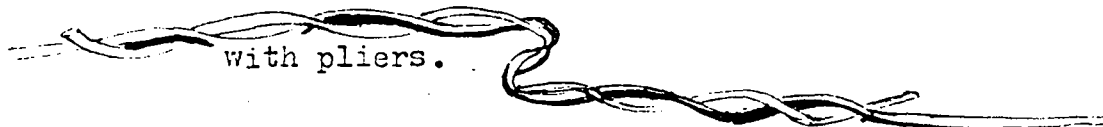


6. Take another 22' length of chicken wire and brush off any oxide powder.
7. Wrap this second length tightly around the former above the first length and overlapping by 2".



8. Make sure the 6" overlapping ends of the 2 lengths of chicken wire are spaced well apart.
9. Using the straight galvanized tie wire wrap 2 wires in each corrugation for the first 6 1 wire in each corrugation to the top 2 wires in top corrugation. Leave 2" of chicken wire clear at the top.
10. Start at the base and work to the top. Join the wire by overlapping kinking.

with pliers.



12. Pull the tie wire so it lies flat

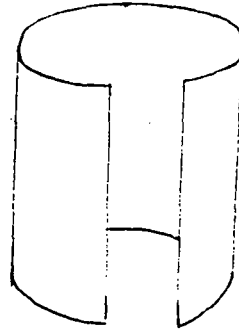
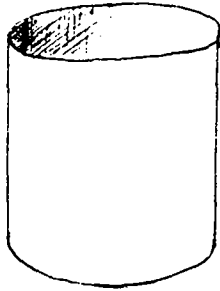


13. If wire stands out from the former, "tweak" the wire with pliers to pull it tight.

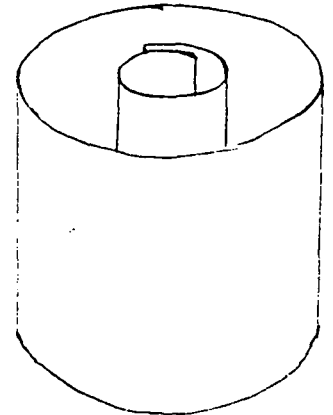
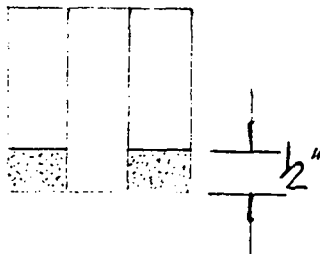
14. Check the former is equally placed on the foundation.

OVERFLOW

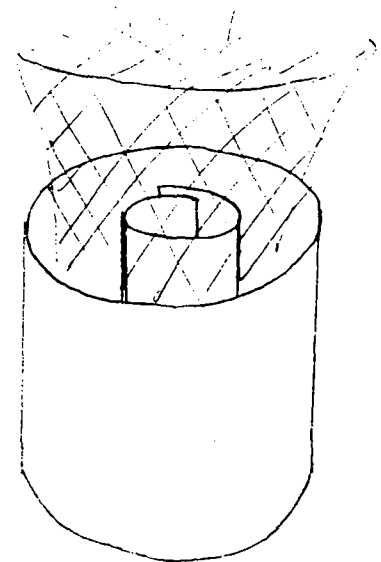
1. Make an overflow pipe from cement and chicken wire.
2. Take 2 sweetened condensed milk tins and cut it down one side.
Cut both ends out of one, cut **one** end of the other.



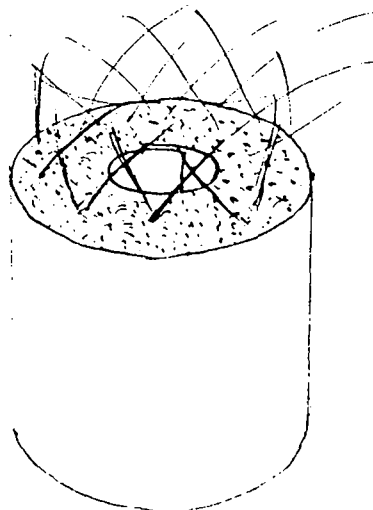
3. Put the tins together as shown.



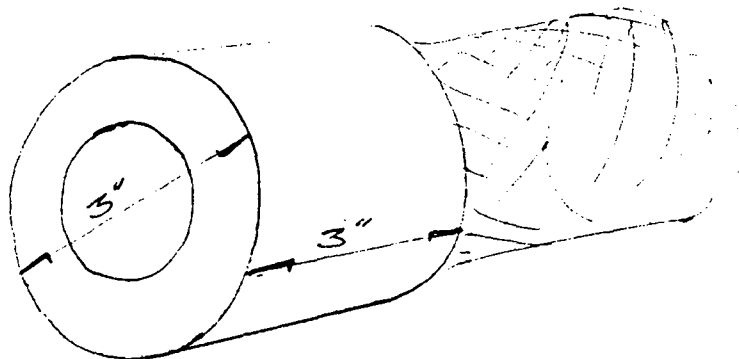
4. Put $\frac{1}{2}$ " layer of cement in the base of the tin.
5. Cut a length of chicken wire about 8" wide x 12" long. Roll this up & place in the tin mould.



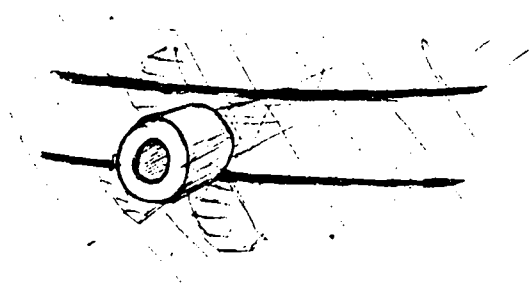
6. Fill up with cement.



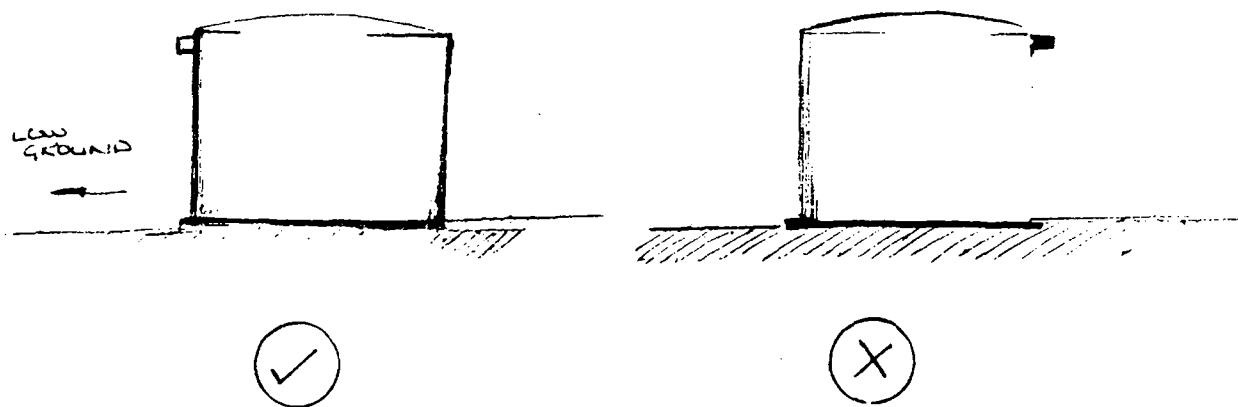
7. Leave the mould for about 12 hours then cut off the outer tin and remove the inner tin.
8. The overflow should look like this



9. Tie the overflow onto the wire around the former. It should be just below the top hoop wire.



10. Make sure the overflow wire is securely tied into the former wire.
11. The overflow should point to any low ground to help drainage.

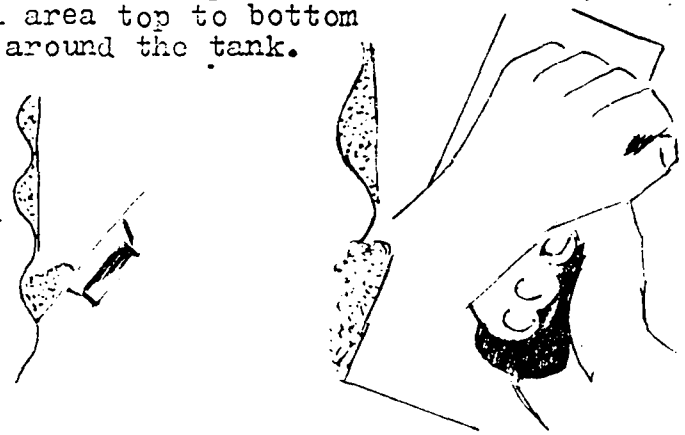


PLASTERING OUTSIDE

1. Check position of former on base.
2. 5 or 6 people can work on plastering the tank, with 2 or 3 people mixing cement.
3. Each plasterer should have a steel float, wooden board to carry cement and wooden board to catch any cement dropped.
4. Materials: - Cement sifted
 sand sifted, washed coarse sand.
 water clean rain water.

Mix: 1 cement : 2 sand : 1/2 water using bucket measure.

5. First measure out sand and cement and mix when dry on a clean mixing board.
Add water until a stiff mix is obtained.
Turn the mix from one end of the board to the other and feel for any lumps.
Good mixing is very important. Keep cement-mix covered with Black Plastic to stop it drying out quickly.
6. Plastering is done in two layers.
The first layer is to fill in the corrugations.
Work from the top. It's important to force cement onto the former so wires are well covered.
Use both hands on the trowel to apply pressure.
Work at an even pace around the tank; don't plaster one small area top to bottom
Work around the tank.

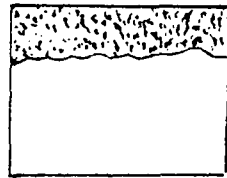
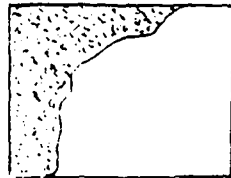


Working the trowel towards plaster already on the former may cause plaster to fall.
Work away from plaster already on former.
Plaster more than 30 minutes old will become hard to use so don't use old plaster. Don't use plaster which has fallen on the earth around the tank only use plaster which falls on the board.
Plaster to the 5' corrugation leaving 2" of chicken wire clear.
Ensure the overflow pipe is well plastered into the wall.

7. When the former is covered with plaster use the Spackler to give the plaster surface a ruff finish. Mix used in spackler is 1 cement 1 sand and enough water to make a thick runny mix.
8. Cover the tank with Black plastic and keep the top of the tank shaded.
9. Make sure all tools are cleaned.
10. Leave tank for at least 3 hours before applying second plaster layer.

This layer should be at least 5 mm thick. Plaster as before from top to bottom working around the tank evenly.

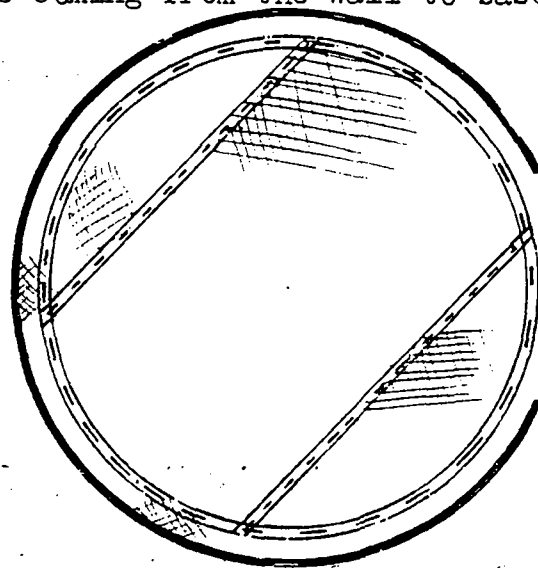
11. Using a wooden float smooth out the surface of the plaster. Fill in any dents with more plaster.
12. Using a steel float, smooth out this surface. Do not add water to the float. Check for any loose cement. If loose cement is found, remove it and replaster.
13. Paint the surface with cement slurry.
14. Cover tank with black plastic.
15. Clean up all tools and mixing boards.
16. Leave tank for at least 2 days. Keep damp by covering with water each day after initial curing.



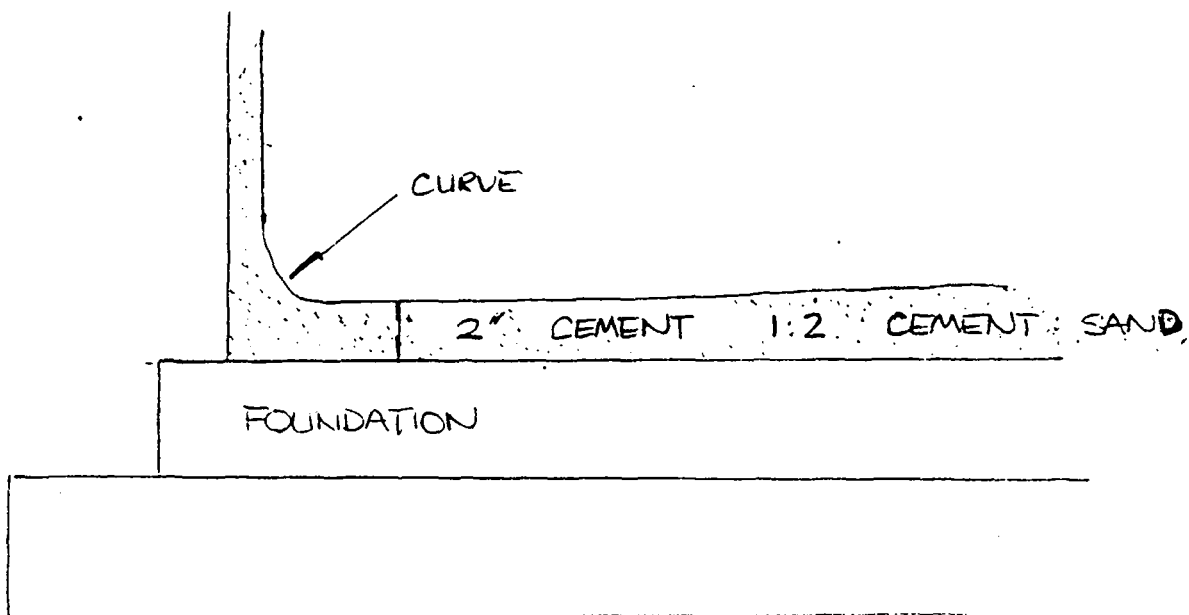
Plaster at an even pace around the tank.

PLASTERING INSIDE

1. Former must be left inside tank for at least 2 days.
Using ladders get inside the tank. Undo the bolts holding the former together. Undo them evenly not one at a time. Using the ropes, gently pull the former sheets away from the walls and lift out of the tank. Clean the former sheets.
2. Brush off any loose cement on the inside tank wall and sweep out the tank floor. Plug the open end of plastic pipe in the floor to prevent it getting blocked by falling cement.
3. Reinforce the tank floor with chicken wire
Tie wire tightly into the wire coming from the wall to base joint.
4. 4 people can work inside the tank.
5. Mix cement as before 1:2 and place on a board in the centre of the tank.
Also mix up some cement slurry.
6. The inside is plastered with 2 layers. The first to fill in the corrugations.
7. Before applying the cement plaster paint the area you are about to work on with cement slurry.



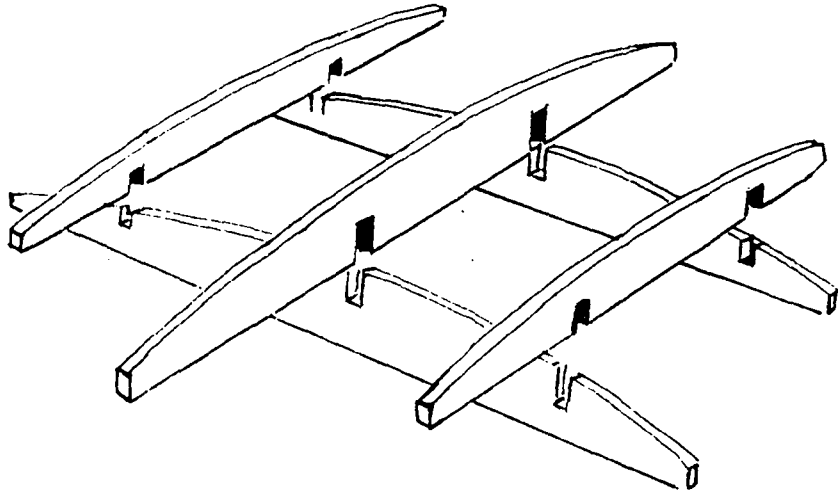
8. Start plastering from the top using the same technique described earlier. Remember use both hands on the steel float to apply pressure.
9. Any cement dropped should be worked into the floor of the tank.
10. Cut out the wire inside the overflow and tie it back so all wires are covered with cement. When the inside is plastered apply a spackle layer to give a rough finish.
11. After about 3 hours apply the second coat of plaster. This should be about 5mm. thick.
12. Level off surface with wooden float filling in any low spots.
13. Paint the walls with slurry.
14. Using a steel float smooth out the slurry. This should give a shiny smooth finish.
15. Now put a 2" layer of cement in the bottom of the tank. Build up a curve between the floor and the walls using a glass bottle or steel trowel. Paint slurry around plastic pipe before laying cement.



16. Paint floor and curve between floor and wall with cement slurry, and smooth off with steel float.

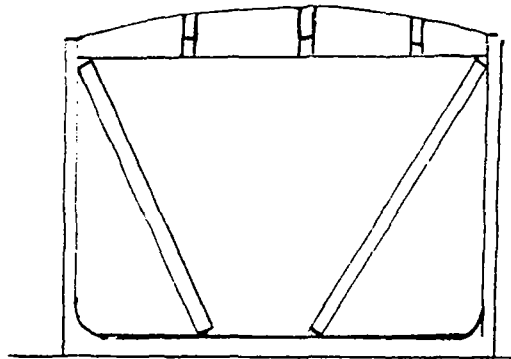
ROOF

1. Put the roof formwork together.

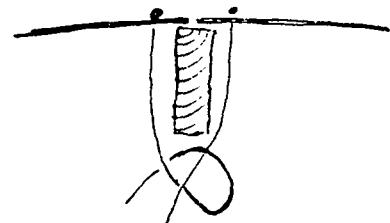
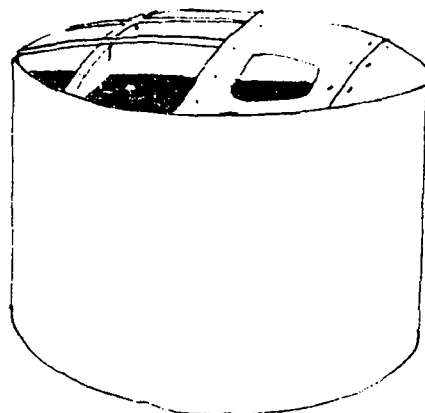


EACH JOINT SHOULD BE NUMBERED.

2. Put the formwork inside the tank and support on 4 wooden posts. Make sure the formwork is level with the top of the walls.

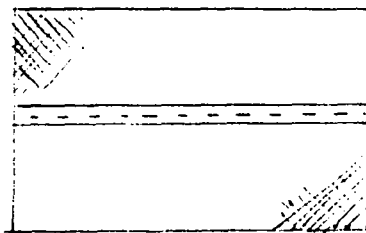


3. Decide where the access hole should go. It should be as close to the catchment as possible. Lay the steel sheets onto the wooden frame. Cover the steel with black plastic.

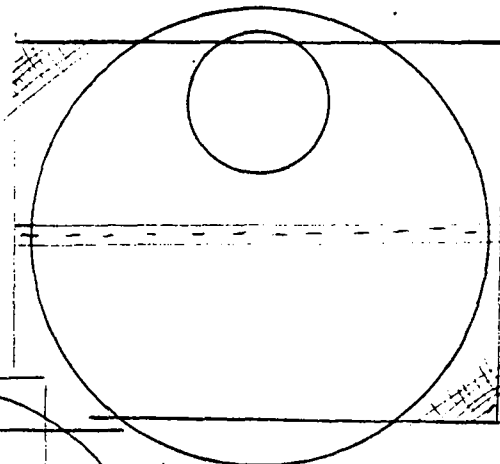


Tie the sheets down with string ties around the timber formwork.

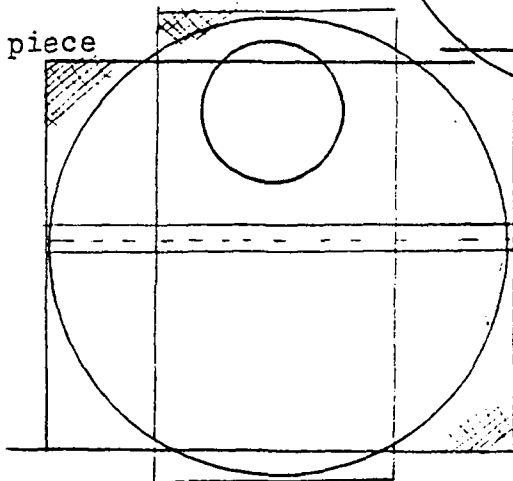
4. Cut 3 lengths of chicken wire 6' 7" long. Brush the wire to remove any white powder. Join 2 lengths together with a 2" overlap.



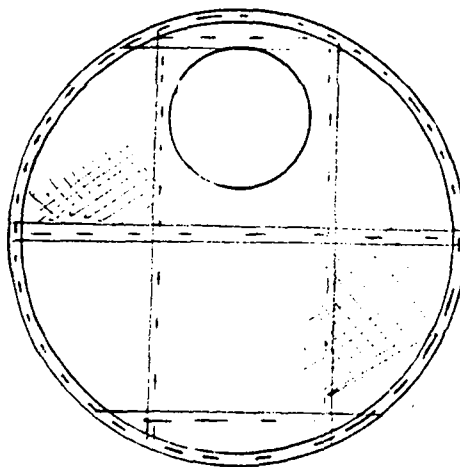
5. Position the 2 pieces on the formwork.



6. Add the third piece

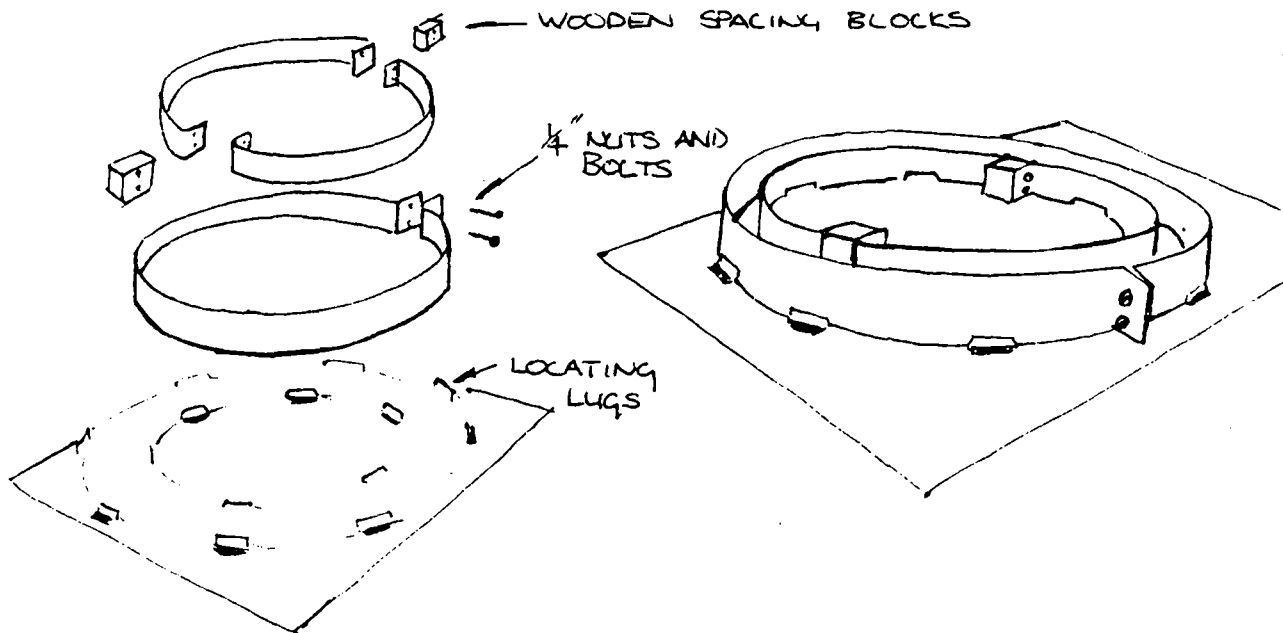


7. Join the chicken wire from the top of the walls to the roof wire. Join by twisting with long nose pliers every 3" spacing.

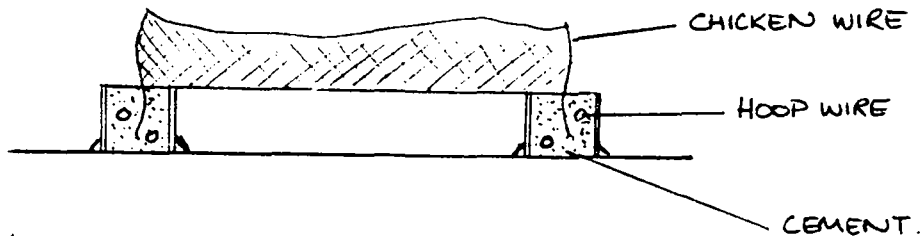


Collar:

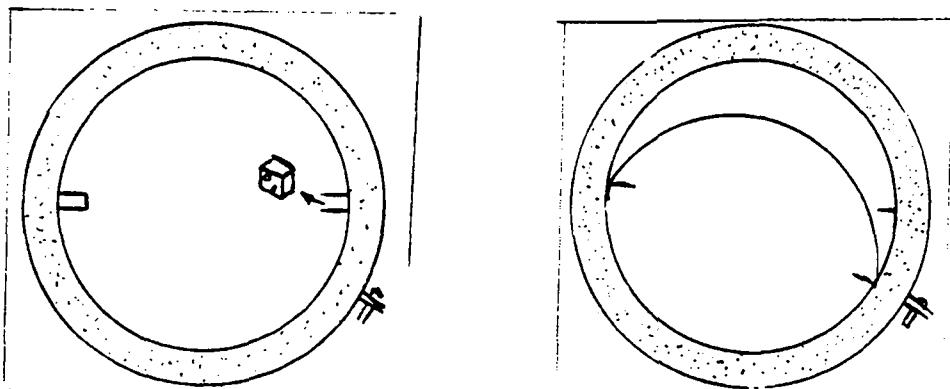
8. Using the formwork supplied, make a collar 23" in Diameter x 2" wide x 2" thick.



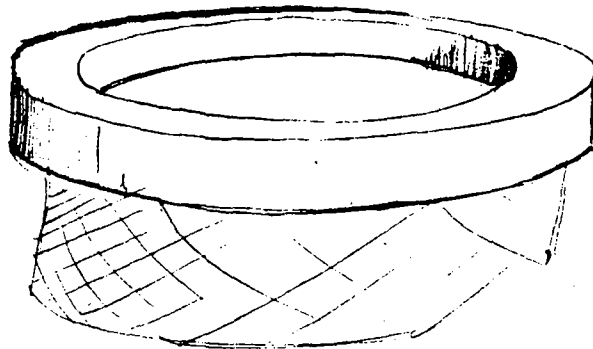
9. Assemble the collar formwork as shown.
10. Fill in the area between the 2 circles with a 2" layer of cement mix 1:2. Also add 2 hoop wires and a ring of chicken wire.



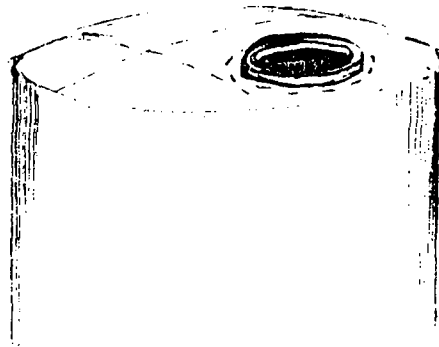
11. Make sure the cement is forced well into the formwork and around the chicken wire.
12. Leave the collar for 2 days before removing formwork.
13. Take out the 2 wooden spacing blocks first.



14. Gently take out the inner steel ring.
15. Now take off the outer ring and remove cement collar.
16. Collar should look like this.

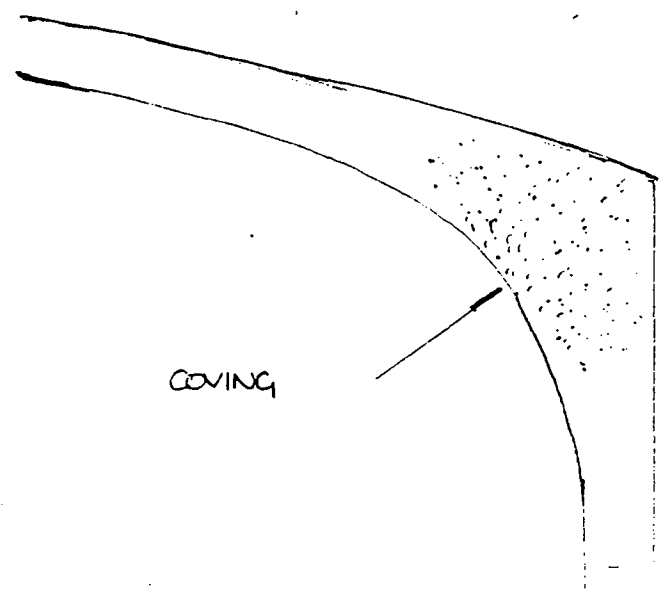


17. Position collar over access hole on roof formwork and join chicken wire firmly together.



18. Chicken wire should lie flat on formwork. Apply tension to wire to make it lie flat if required by tweaking with long nose pliers.
19. Plaster the roof using cement sand mix 1:2.
20. Paint the top edge of the wall before applying cement with slurry to ensure a good roof wall joint.

- 21. Thickness of cement on roof should be 1½". Check this by using a nail and measuring the thickness.
- 22. Vibrate the roof formwork so cement works its way into the chicken wire. This also brings out any air bubbles in the cement. This will make plastering the inside of the roof unnecessary.
- 23. While plastering, lift the chicken wire with long nose plier so cement gets under the wire.
- 24. Paint slurry around base of collar and make sure the collar is firmly plastered into the roof.
- 25. Use wooden floats to get a smooth level finish.
- 26. Cover the roof and leave for at least 3 days, keeping damp.
- 27. Remove the formwork from the inside by untying the strings holding the steel in place. Next take out the 4 support posts and gently pull out the timber frames and metal sheets. Take care when passing the material out through the collar hole. Remember the formwork must last a long time. Remove all the plastic sheeting.
- 28. Paint the joint between wall and roof with slurry and plaster a coving between the two of at least 4" radius.



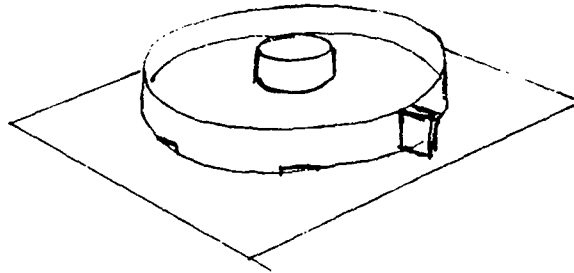
NOTE.

It is very important to cover the tank with black plastic or wet copra sacks for at least 4 weeks after construction. keep the tank damp by applying water every few days to the outside and inside surfaces. Do not use sea water for this keep tank shaded from direct sunlight for 6 weeks after construction using mats or coconut leaves.

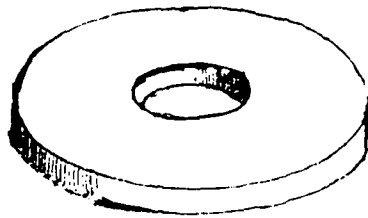
After 3 weeks a 6" layer of water should be put inside the tank. After 4 weeks the tank can be connected to the catchment and filling can start. Fill the tank slowly over a period of 3

NEVER FILL THE TANKS UP QUICKLY.

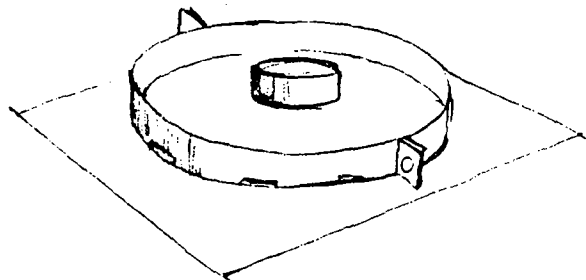
29. Check all wires in roof are covered with cement plaster. Cover any wires you can see.
30. Paint inside the tank, the roof walls and floor, and paint the outside of the roof.
31. Cover the tank with plastic for 4 weeks keeping damp with water.
32. A lid to fit the collar can be made using the collar formwork. First assemble the formwork as shown placing a tin can in the centre.



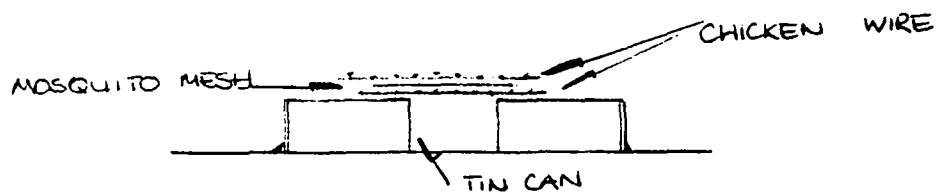
Fill the formwork with a 1" layer of cement. Reinforce with any scrap pieces of chicken wire. Leave for 1 day before removing formwork.



Now reassemble formwork with smaller ring leaving out the spacing blocks. Place a tin can at the centre. Fill with cement.



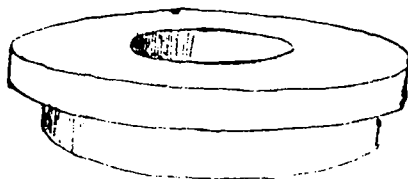
Place a piece of chicken wire over the hole made by the tin can then add a layer of mosquito mesh over the chicken wire. Add another layer of chicken wire over the mesh.



Make sure the chicken wire is tucked into the cement.

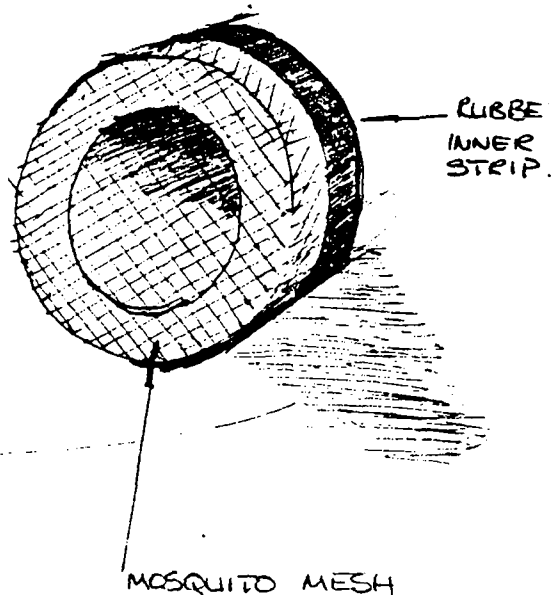
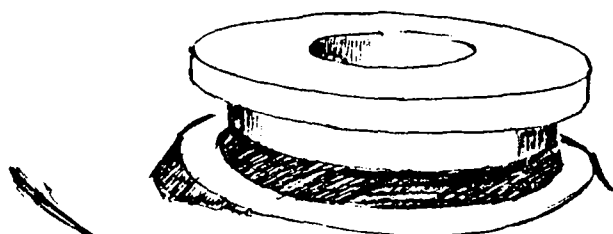


Now place the larger cement disc on top of this while the lower cement is wet. Paint the top disc with slurry to make a good join between top and bottom discs. Leave for 24 hours before removing formwork. Lid should look like this:



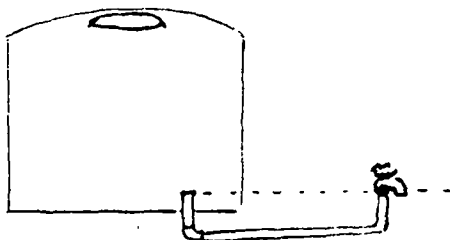
It should fit tightly into the collar.

Also cover overflow with mosquito mesh to prevent insects entering tank.



TAP CONNECTION

1. Select a position for the tap. 20 ft length of $\frac{1}{2}$ " PVC pipe is allowed for each household with 3 elbow joints and a brass tap with FVC connection. The tap must be securely mounted to withstand any knocks. Also the PVC pipe must be kept shaded as it will crack in direct sunlight.
2. The height of the tap must be at the same level as the top of the pipe inside the tank.



3. People should be able to get a bucket under the tap so you may have to dig out an area of ground so you have 18" clear under the tap. Line this area with gravel to assist draining.
4. Secure all joints between pipes and elbows with PVC Solvent cement carefully following instructions given on the glue tin.
5. Tighten the tap onto its plastic fitting before joining to the PVC Pipe. Make sure tap is in a vertical position.

CATCHMENT

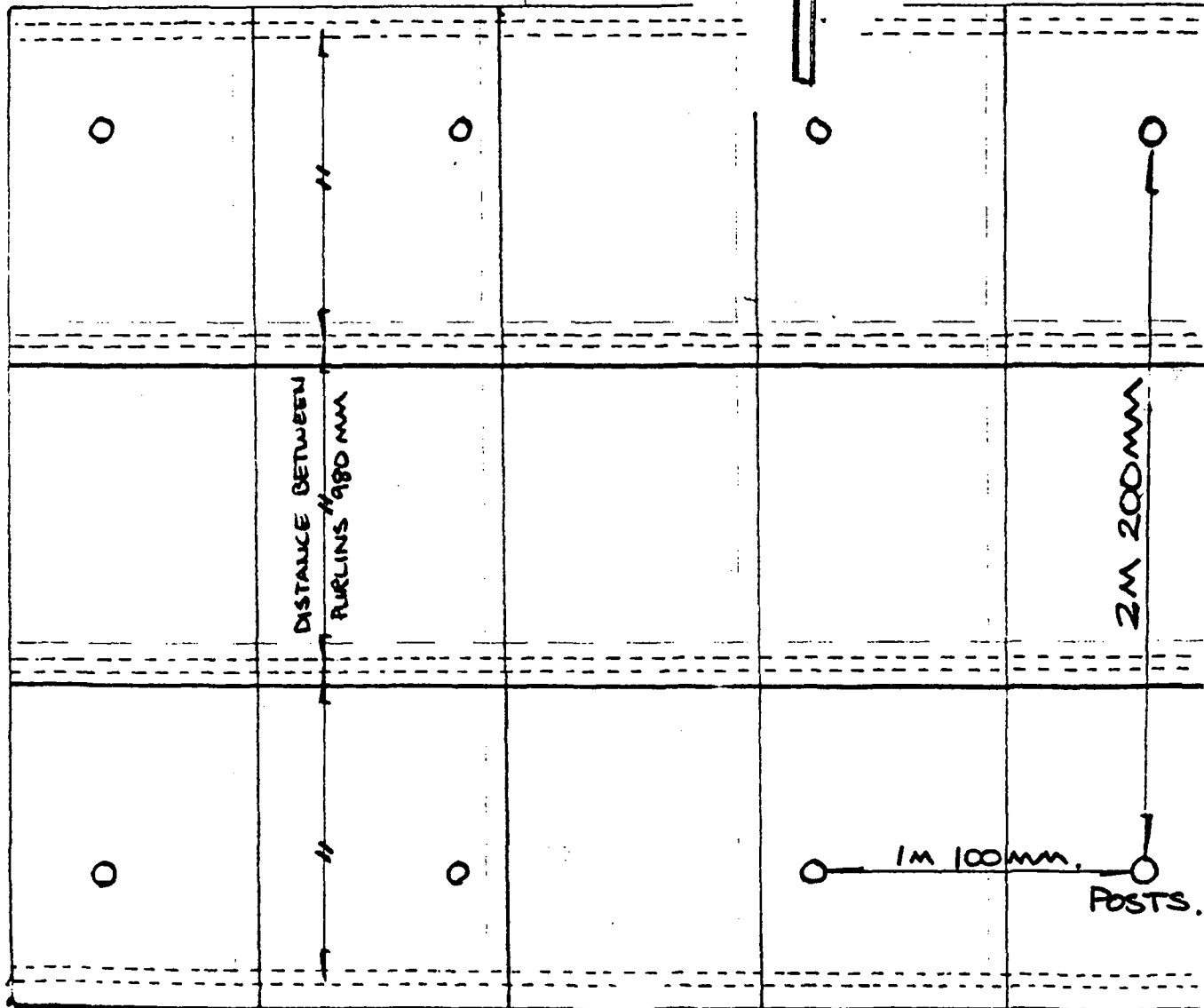
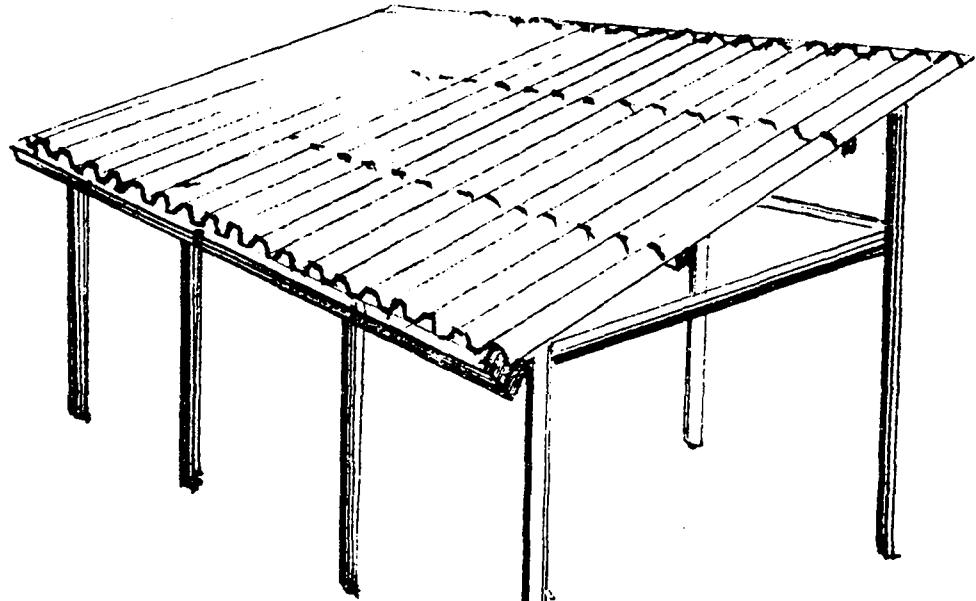
GENERAL INFORMATION

Number of tiles - 15

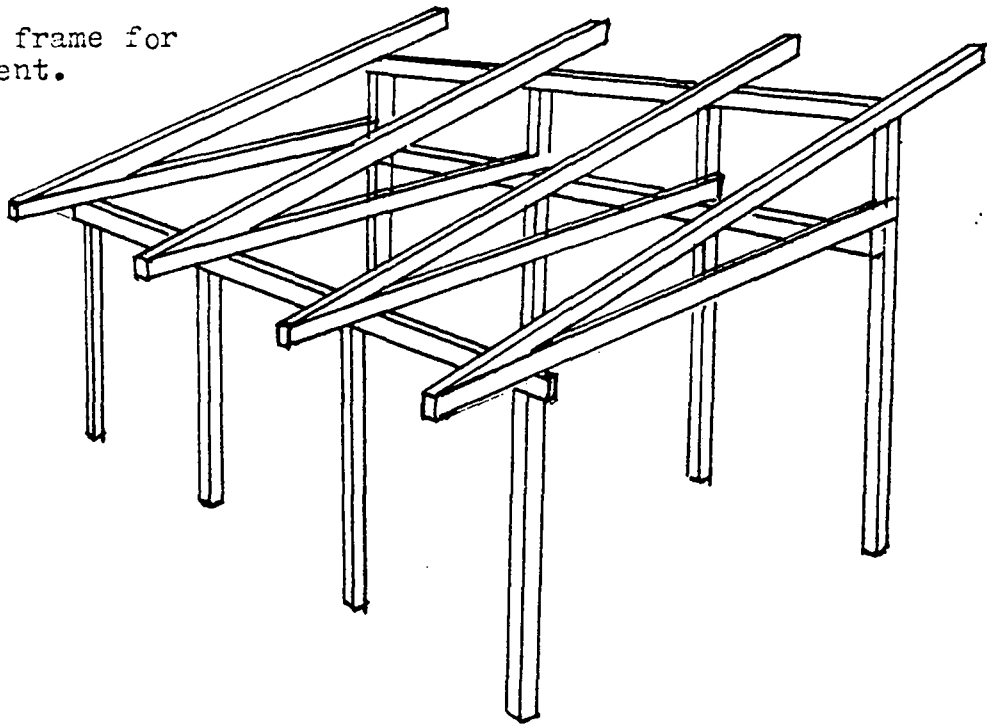
Quantity of cement - 150 Kg. - 3 bags

Overall size - 3m 900mm x 3m 100mm

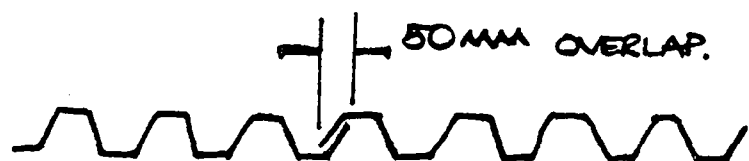
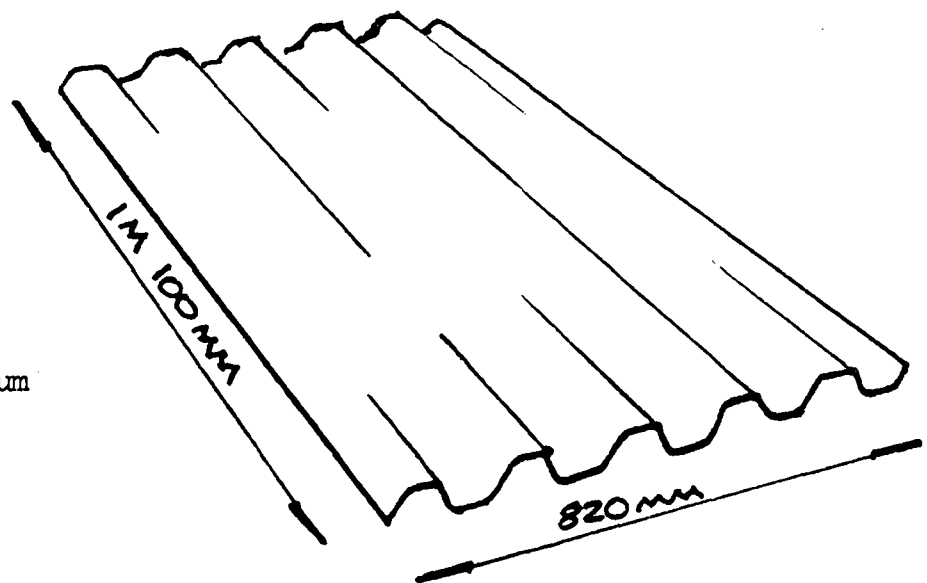
Area - 12 sq. meters.

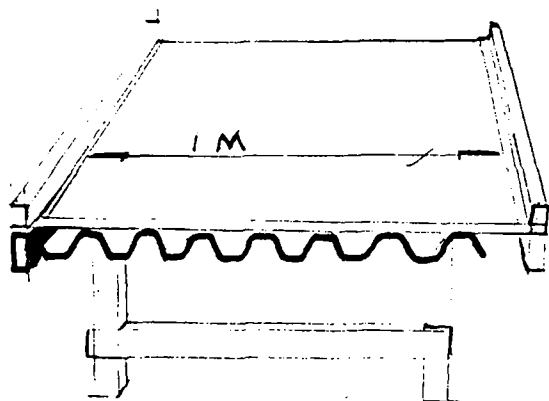


Timber frame for
Catchment.



Tile details
using Aluminium
Former.





Using the Aluminium formers the sheet making table must be changed. The width of the sheet must be increased. Using a plane or a saw cut the thin plywood framing so the distance between the frames is 1m.

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