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TERESIA KAVUJA
Kericho

MACHAKOS DIOCESE

INTERNATIONAL REFERENCE CENTRE
FOR COMMUNITY WATER SUPPLY AND
SANITATION (IRC)

RAIN WATER TANK PROGRAMME

A description of a Self-reliant Programme.



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MACHAKOS DIOCESE RAIN WATER-TANK PROGRAMME

1. INTRODUCTION.

In 1983, the Water Programme of the Development Office of the Catholic Diocese of Machakos (then under A. C. Thiadens) introduced a newly designed watertank for roof catchments. Soon after this introduction the interest of the people of Machakos District in this tank was so enormous, that the idea developed into a programme which could offer 3 different tanksizes (4000, 5400 and 13,500 Litres). The first 1500 small and medium sized rain watertanks were subsidized by one-quarter through a grant of a foreign donor while the beneficiary paid the rest. This number of tanks was built within 3 years. It was both the technical design as well as the method of implementation which made this programme a success.

This booklet outlines this design (chapter 2) and the implementation method (chapter 3). It also gives details of the materials needed (chapter 4) and the building process (chapter 5). This chapter is both in English and Kiswahili. After concluding remarks (chapter 6) the drawings of the two types of tanks are given.

At the moment, the programme is financially self-reliant: the beneficiary pays for everything. Tanks are built all over the Machakos District and in almost all locations trained artisans are available. Every month approximately 60 tanks are built, worth Kshs. 100,000/-! Up to now approx. 2500 families in the District have their own watersource: clean water and within their home-stead.

The need for these tanks is still there, not only in the Machakos District. Hopefully other organizations (some of which have already shown interest in this unique programme like the Diocese of Nakuru and of Kisii and Plan International) can benefit from the experience, gained in Machakos District as summarized in this booklet.

December, 1987

L.P.M. de Vrees,
Water Engineer,
CATHOLIC DIOCESE OF MACHAKOS.

2. DESIGN.

The tanks are meant for storing rain water, harvested from a corrugated iron sheet roof of a small family home. With an average rainfall of 500mm per year divided over two rain seasons (March - May and October - December) and a roof catchment of 20m² approximately 5000 litres can be stored per season. There are 2 sizes of rain water tanks for households: 4000 litres (1.85m high) and 5400 litres (2.55m high). With a dry period of 120 days between the rainseasons resp. 33 litres and 45 litres can be consumed from these tanks every day before the next rains will refill the tank.

The tank is cylindrical shaped and made out of concrete, reinforced with barbed wire. The mould (shuttering) consists of corrugated iron sheets (24 Gauge), half circular bent. The bending is done by a machine which is available in every main industrial area (For example, this can be done in Machakos Town). Two bent sheets of 3m (or three of 2m) are joined with bolts and nuts to form a ring. The inner ring has a diameter of 1.65m, the outer ring has a diameter of 1.89m. Different sizes of sheets are available in Kenya; the most convenient are the sheets with a length of 3m and a width of 0.85m. Then the 4000 litres tank can be made with 2 rings on top of each other, plus an extra 15cm in the third ring. The 5400 litres tank consists of 3 rings.

The reason to use corrugated sheets instead of flat sheets, is because of the formstiffness it creates in the radial direction due to its corrugation. A fairly thin metal sheet can be used and it doesn't require any extra reinforcement such as steel strips. Thus, the mould becomes cheap, light and easy to transport, compared to other moulds. If carefully used, the mould can be used to build upto 50 tanks. In practise they are used 25 times.

In order to reduce the temperature - tension in the concrete (cracks), the outlet pipe inside the tank is raised with 2.5cm through a nipple so, always some water is left behind to cool the concrete. This way, also a dead storage is created where sediments can settle, for instants when one forgets to disconnect the gutters during the first shower after a dry season.

The same technology of corrugated moulds is used for a tank with a larger diameter (2.6m) to form a tank of 13,500 litres. The mould is made out of 6 sheets of 3m. length. For this tanksize the reinforcement consists of barbed wire and round bars. This tank is suitable for institutions - like schools and dispensaries.

Both designs are widely used in water projects to store the (night) flow or to break the pressure in the pipeline. Then, an extra outlet is made as a washout.

3. DESCRIPTION OF THE WATER-TANK PROGRAMME

3.1. Implementation Method.

In Machakos District, the percentage of people who have access to clean drinking water within a reasonable distance, is far below the average for Kenya. Unfortunately, most people live not very near water-sources or in areas where relatively cheap and easy to maintain gravity supplies can serve them. However, the number of people who have one of their buildings covered with corrugated sheets is enormous. Therefore, in 1983, a roof catchment programme was started under the Water programme of the Development Office of the Catholic Diocese of Machakos.

The approach of this Development Office is to educate people towards self-reliance. This calls for adapting the kind of development-approach that encourages maximum participation of the marginalised communities. Within the water tank programme this approach resulted in building the small and medium sized tanks only for group members (women groups, agricultural groups, special water tank groups etc.) Such a group had to fulfill a number of conditions like:

- paying for at least 3 water tanks before a Diocese artisan could move in;
- providing a person who can be trained as a water-tank artisan by the Diocese artisan; *The there were men only but today its women who have the skills*
- providing all local materials like sand, aggregate and hardcore;
- providing food and accomodation for the Diocese artisan.

The other necessary materials are bought and delivered by the programme. In the beginning, the prices of the tanks were sponsored with Kshs. 400/- for each tank of 4000 or 5400 litres and every new group received a 4000 litres tank free of charge, to be build at a communal point (meeting hall, Asst. Chief's Office, Co-operative shop, school, church, dispensary etc).

Ususally, after a short period, more people got interested by seeing these tanks and started to make efforts to join the group or to form a new group. It was this effect of spreading which had made the programme grow extensively.

So, the advantages for building concrete rain water tanks for groups are:

1. The members can help financing each others tanks by contributing a monthly fee. For example, a group of 50 members contributing Kshs. 50/- per month, raises a total of Kshs. 2500/-, enabling them to build two tanks. Thus, in a period of 25 months, all members are served.
2. Group members can help each other in collecting the local materials and assisting the artisan building the tank.
3. It is economical to build more tanks at the same time in one area.
4. It becomes worthy to train a local person, chosen by the group, as a water tank artisan.

The close co-operation between the group and the Diocese artisan ensures progress and quality of the work. If the artisan delays the work or delivers bad quality, the group will report to the Diocese, since they are not eager to provide him with food and accomodation. If the group delays in assisting the artisan or in providing the local materials, the artisan will report to the Diocese, since he is paid per tank, not per day.

After building approx. 1500 small and medium sized tanks the money from the donor, to subsidize this programme, got finished. Since then (Sept. 1986) the prices for the tanks were raised up to approximately the real cost and no more free tanks were given. The prices then became Kshs. 1,600/- and Kshs. 1,900/- for the 4000 litres and the 5400 litres tank respectively excluding Kshs. 100/- application fee. The 13,500 litres tank costs Kshs. 5,300/-, approx. Kshs. 900/- above the real costs. The small profit made on these tanks is meant for coping with unforeseen costs like repairs, high transportcosts to remote areas for the smaller tanks etc.

Unexpectedly, the number of applications for the tanks didn't drop despite the withdrawel of the subsidy: every month the people of the District still pay for 60 tanks! (approx. Kshs. 100,000/-). Now, individuals also can order a tank. They have to pay Kshs. 100/- application fee for each tank and sometimes to wait longer untill more people in their area apply for a tank; this helps to keep the transport cost of the artisan and the materials as low as possible.)

The next and last step in the development of the programme is to hand it over to the communities, in order to make not only the programme but also the communities self-reliant in this aspect. In almost every location, trained artisans are working (approx. 60 altogether) and many groups are aware of the programme. This awareness is also created through the other programmes of the Development Office (i.e. Women, Public health, SALU and Adult Literacy - Programme). The new approach is to sell the mould to anybody or any group who is interested, together with a list of names and addresses of trained artisans and this description of the programme. These persons or groups can hire the mould out and even start a kind of hardware - shop where they sell materials, needed for the rain water tanks.

3.2. Organisational structure

When the programme started in 1983, information about the programme was put on stencil and handed out to all groups the Development Office had contact with. Also information was given during workshops of the other programmes of the Development Office. The same method is still used whenever changes in the programme occur.

The procedure is as follows:

1. A group has to fill in an application form on which they mention how many tanks they want to build. Application fee is Kshs. 100/- for each each group (or individual)
2. They pay the money for the tank(s) (in instalments) to the Development Office.
3. They start preparing the site, collecting the local materials and organizing the assistance of the artisan.
4. They make arrangements with the Water-tank Co-ordinator when and where to deliver the materials.
5. Arrangements are made to collect a mould from a nearby place by the group or by sending it with the rest of the materials.
6. An artisan is sent to the new site. (normally they report back at the Office after finishing a number of tanks).
7. Materials are ordered at a local hardware supplier and delivered to the site (together with materials for other tanks in the same area or on the same route)
8. During construction of the tank, a local person is trained to build the tanks by the Diocese artisan. After assisting in construction of 3 tanks, he is allowed to build tanks himself.
9. After completion of the tank, the owner signs the completion form which is with artisan.
10. The artisan brings the completion-form to the Office and receives new instructions.
11. All data like: name of the group (owner), date of payment, receipt number, amount paid, date of delivery materials, name of artisan, date of completion, salary of artisan and his signature are filled in on a progress - control sheet.
12. New moulds to replace old ones or to extend to other areas are ordered by the Office.

4. LIST OF MATERIALS AND TOOLS

4.1. Materials

ITEM	UNIT	Size (litres)			Unit Price Kshs. (1987)
		4000	5400	13500	
Cement	bags	9	11	28	83
Waterproof cement	kg	1	1	3	40
Welded mesh sheets (8'x4', 6mm-150mm)	nr	2	2	-	70
Barbed wire 16G	m	160	200	-	0.60
Barbed wire 12 ½ G	m	-	-	200	1.25
Reinforcement bars 6mm	m	-	-	252	2
Bailing wire	kg	-	-	3	15
Fittings (nipple, socket, elbow) ½"	nr	1	1	-	100
Fittings (nipple, socket, elbow) ¾"	nr	-	-	1	110
G.I. pipe, threaded ½"	m	0.6	06	-	25
G.I. pipe, threaded ¾"	m	-	-	0.6	30
Nails, 2"/3"	kg	3	3	3	10
Timbers, 6"x1"	m	20	20	40	6.7
Timber, 3"x2"	m	30	30	20	6.7
Poles, 2.55m*	nr	-	-	8	18
Local materials:					
Sand	tons	2	3	5	-
Aggregate ½"	tons	2	3	5	-
Hardcore	tons	1.5	1.5	3	-
Labour	days	7	7	9	-
Mould, 4 sheets 24G diam. 1.65m*	nr	1	1	-	1300
Mould, 6 sheets 24G diam. 2.6m*	nr	-	-	1	1850

*Items which can be re-used.

4.2. Tools

Shovel	Sand sieve	Plier
Jembe/Mattock	Chisel	Measuring tape
Mason's trowel	Hammer	Spirit level
Woodfloat	Sisal twine	Karais
Steel trowel	Plumb bob	

4.3 Prices of the rain water tanks

As explained before, the local materials and the assistance for the Diocese artisan should be provided by the owner of the tank.

The timber can be used approximately 10 times, if carefully used. The mould, on average, is worn out after building 25 tanks, so depreciation-value is approx Kshs. 50/- per small tank and Kshs. 75/- per larger tank.

The Diocese artisan receives Kshs. 200/- for the 4000 litres tank, Kshs. 250/- for the 5400 litres tank and Kshs. 400/- for the 13,500 litres tank. Busfare is only refunded when the artisan goes to a new area. Transport cost of the materials depends of course on the distance. In Machakos District, an average of Kshs. 100/- per 10 bags of cement can be used.

Overhead costs (Kshs. 100/- per tank) are used to pay the water tank co-ordinator's salary. This brings the prices for the tank to Kshs. 1660/- for the 4000 litres tank, Kshs. 1905/- for the 5400 litres tank and Kshs. 4400/- for the 13,500 litres tank. The profit made on the 13,500 litres tank is used to cope with small deficit on the smallest tank and unforeseen costs, like repairs of tanks, extra high transport costs to remote area's etc.

5. BUILDING PROCESS STEP BY STEP

5.1. Tank size 4000 and 5400 litres.

Dig a circular hole of 0.3m deep and a diameter of 2.25m. Fill this hole with the hardcore (By the owner)

Day 1: Sprinkle water over the hardcore. Put a concrete cover on top with a thickness of 2.5cm and a diameter of 2.5m. Use cement - sand - aggregate (volume proportion) 1:2:4. Use the solded wire to sieve the sand. Place the welded mesh sheet on the concrete floor. Cut the pieces, stretched out of the floor and use them to cover the whole floor with the reinforcement. Put the outlet pipe in place (nipple - elbow - 2ft G.I pipe-socket-tap). Pour concrete mixture 1:2:4 on top of the reinforcement, up to a level of 12.5cm above the reinforcement. (So, the total thickness, of the floor is 15cm). Make sure that the floor is level (Use timber and spirit level).

Labour: 20 workman hours. Use 1 ½ bags of cement.

Day 2: Install the mould on top of the floor. The inside diameter is 1.65m. Put in the first turn of barbed wire. Don't cut the wire. Fill the space between the moulds with concrete mixture 1:3:3 up to 7.5cm from the bottom. Put in the second turn of barbed wire and fill again with concrete. Continue up to the top of the first ring, making 12 turns with the barbed wire.

Labour: 6 workman hours. Use 1½bags of cement.

Day 3: Remove the mould from the first ring and install it on top. Put in the barbed wire in turns and after each turn (12 turns totally) put in the concrete mixture 1:3:3.

Labour 6 workman hours. Use 1 ½ bags of cement.

Day 4: Remove the mould from the second ring and install it on top. Put in the barbed wire and fill the space with concrete - mixture 1:3:3. For the 4000 litres tank, only 2 turns of barbed wire are needed and a height of 15cm. concrete. For the 5400 litres tank, 8 turns of barbed wire and the whole height of the mould (0.85m) are needed.

Labour: 3 - 6 workman hours. Use ¼- 1 ½ bags of cement.

Day 5: Remove the mould. Make a hole at the top of the wall for the overflow. Make the inside of the tank wet. Plaster the inside of the tank roughly with cement-sand mixture 1:3. Plaster again with cement/waterproof - sand mixture 1:2. Make a final coating with pure cement and water.

Labour: 20 workman hours. Use 2 bags of cement.

Day 6: Fix shuttering for the roof. Put in place the welded mesh - sheet for reinforcement. Make the roof slab out of a mixture of 1:2:4. The roof should be 7.5cm - 9cm thick. Keep a place for man-hole-cover and inlet drain pipe. Make a concrete man-hole-cover (slightly bigger than the

gap in the roof: 0.6 x 0.6m), using a piece of the welded mesh or barbed wire as reinforcement and handle.

Labour: 20 workman hours. Use 1 bag of cement.

Day 7: Plaster outside of the tank with a mixture of 1:4. Construct a water point around the tap.

Labour: 10 workman hours. Use 2 bags of cement.

Day 8 - 20: Pour water on inside and outside of the tank, at least 3 times a day for proper curing (done by the owner).

Day 14: Remove the roof shuttering and clean the tank. Connect the gutters from the roof with the tank-inlet.

If everything is well planned, an artisan can build two tanks at one time. Of course slight alterations in the process are possible, depending on the experience of the artisan. For instance, some artisan find it easier to make double turns with the barbed wire (so, 6 double turns with a distance of 15cm between the turns) in stead of 12 single turns in the first and second ring.

5.2. Tank size 13,500 Litres

Dig a circular hole of 0.3m deep and a diameter of 3m. Fill this hole with the hardcore (By the owner).

Day 1: Sprinkle water over the hardcore. Put a concrete cover on top with a thickness of 2.5cm and a diameter of 3m. Use cement - sand - aggregate (volume proportion) 1:2:4. Use the solded wire to sieve the sand. Place the round bars on top of the floor, according to the drawing (space between the bars is 15cm). Use bailing wire to connect the bars. Put the outlet pipe in place (nipple - elbow - 2ft G.I. pipe - socket - tap). Pour concrete mixture 1:2:4 on top of the reinforcement, up to a level of 12.5cm above the reinforcement. (so, the total thickness of the floor is 15cm). Make sure that the floor is level. (Use timber and spirit level).

Labour: 35 workman - hours. Use 3 bags of cement.

Day 2: Install the mould on top of the floor. The inside diameter is 2.6m. Put in the first turn of round bar. Fill the space between the mould with concrete-mixture 1:3:3, up to 7.5cm from the bottom. Put in the first turn of barbed wire. Don't cut the wire. Fill the space again with concrete up to another 7.5cm. Put in round bar again and continue this process up to the end of the mould (6 turns round bar, 6 turns barbed wire 12½G)

Labour: 8 workman hours. Use 3 bags of cement.

- Day 3:** Remove the mould from the first ring and install it on top. Put in one turn of round bar. Fill up with concrete mixture 1:3:3 up to 7.5cm. Use barbed wire (8 turns) up to the top of the mould.
Labour: 8 workman hours. Use 3 bags of cement.
- Day 4:** Remove the mould from the second ring and install it on top. For the third ring, make 6 turns with the barbed wire (every 15cm one turn)
Labour: 8 workman hours. Use 3 bags of cement.
- Day 5:** Remove the mould. Make a hole at the top of the wall for the overflow. Make the inside of the tank wet. Plaster the inside of the tank roughly with cement - sand mixture 1:3.
Labour: 20 workman hours. Use 2 bags of cement.
- Day 6:** Plaster inside of the tank with cement/water proof - sand mixture 1:2. Make a final coating with pure cement and water.
Labour: 15 workman hours. Use 3 bags of cement.
- Day 7:** Fix the shuttering for the roof. Place the round bars (distance 15cm). Connect them with bailing wire. Keep a place open for man-hole-cover and inlet for drain pipe.
Labour: 20 workman hours.
- Day 8:** Make the roof slab out of a mixture of 1:2:4. The roof should be 10cm thick. Make a concrete man-hole cover (slightly bigger than the gap in the roof 0.6 x 0.6m) using reinforcement.
Labour: 20 workman hours. Use 4 bags of cement.
- Day 9:** Plaster outside of the tank with a mixture of 1:4. Construct a water point around the tap.
Labour: 20 workman hours. Use 5 bags of cement.
- Day 10-23:** Pour water on inside and outside of the tank at least 3 times a day (by the owner) for proper curing.
- Day 16:** Remove the roof shuttering and clean the tank. Connect the gutters from the roof with the tank-inlet.

5. NAMNA YA KUJENGA

5.1. Kipimo cha Tangi 4000 na 5400 Litres

Chimba shimo urefu wa 0.3m na upana 2.25m halafu lijaze mawe hilo shimo (kazi ya mwenye tangi).

Siku ya 1:

Mwagilia maji hayo mawe halafu weka concrete kiasi cha 2.5cm (Concrete iwe vipimo simiti: changarawe: Kokoto 1:2:4). Hakikisha ya kwamba umechunga changarawe ukitumia kichungu. Kisha wekelea wire mesh juu ya hii concrete.

Unaweza kukata zile sehemu za wire mesh zinazotokeza nche ya kipimo cha shimo ukazitumia kujaza kwenye mapengo kuakikisha sakafu yote imefunikwa na wire mesh. Weka mfereji wa kutegea maji (yaani niple, elbow, 2ft G.I. socket na tap). Mwaga concrete juu ya wire mesh (kipimo 1:2:4) hadi ifike 12.5cm juu ya wire mesh. Sakafu yote sasa itakuwa na kipimo cha 15cm. Hakikisha yakuwa sakafu iko temparari level. Tumia mbao laini na maji-miti (spirit level) kuhakikisha hivi. Kazi yote hii itakubidi utumie mfuko 1½ wa simiti.

Siku ya 2:

Weka mabati (mould) juu ya sakafu, upana wa upande wa ndani ni 1.65cm. Weka mzunguko wa kwanza wa seng'eng'e na usiikate. Jaza concrete (1:3:3) katikati ya mabati (mould) hadi 7.5cm kutoka chini. (KUMBUKA KWAMBA NAFASI ILIOKO KATIKATI YA MABATI LAZIMA IWE 12.5cm). Weka mzunguko wa pili wa seng'eng'e halafu jaza concrete tena. Endelea hivyo hadi mwisho wa mabati. Yote utakuwa umeweka mizunguko 12 ya seng'eng'e na kutumia mfuko 1½ wa simiti.

Siku ya 3:

Ondoa mabati halafu yawekelee juu ya concrete uliyoweka jana. Endelea kuzungusha seng'eng'e kila mara ukiweka concrete kama vile awali. Ukimaliza utakuwa umefanya mizunguko 12 na mfuko 1½ wa simiti.

Siku ya 4:

Yaondoe tena mabati kisha yawekelee juu. Zungusha seng'eng'e na kuweka concrete. Kama tangi ni ya kipimo cha 4,000 litres utahitaji mizunguko 2 tu ya seng'eng'e na concrete hadi 15cm. Kama ni ya kipimo cha 5400 litres utahitaji mizunguko minane na kujaza concrete hadi mwisho wa mabati. Simiti utakuwa umetumia mfuko kati ya ¼ na 1 ½

Siku ya 5:

Toa mabati kisha toboa shimo ya kuweka mfereji wa kutoa maji yakijaa. Hakikisha umemwagilia maji upande wa ndani wa tangi yako. Piga plaster ya kwanza upande wa ndani (simiti: changarawe ziwe 1:3). Piga plaster ya pile ukitumia simiti inayozuia maji (simiti: changarawe ziwe vipimo 1:2) Mwishowe fanya plaster ya simiti na maji pekee. Utakuwa ushatumia mifuko 2 ya simiti.

Siku ya 6:

Weka mbao za kushikilia paa halafu weka wire mesh tena (welded mesh). Tengeneza paa kwa concrete kipimo cha 1:2:4. Paa itakuwa na concrete upana 7.5cm - 9cm. Wacha nafasi ya kuwekelea kifuniko kwa paa, mahali pa kuangalilia au kuingilia mtu, na mahali pa kuingiza maji. Utakuwa umetumia mfuko 1 wa simiti.

Siku ya 7:

Piga plaster nche ya tangi yako kwa kipimo 1:4 kisha tengeneza paali pa kuchotea maji.

Siku ya 8 - 20:

Kuwa ukimwagilia maji, ndani na nje mara tatu kwa siku au jaza tanki baada ya kutoa mbao.

Siku ya 14:

Toa mbao halafu safisha tangi yako. Shikanisha gutters kutoka paa la nyumba hadi kwa tangi. Kukiwa na mpango mzuri fundi mmoja anaweza kutengeneza tangi mbili kwa mara moja. *Bila shaka kunaweza kuwa na mabadiliko kidogo kidogo kutengemea ujuzi wa fundi mwenyewe.

5.2. Kipimo cha Tangi 13,500 Litres

Chimba shimo mviringo yenye upana wa 3m na urefu 0.3m kwenda chini halafu lijazé mawe (kazi ya mwenye tangi)

Siku ya 1:

Mwagilia mawe maji kisha weka concrete kiasi cha 2.5cm vipimo vya concrete viwe 1:2:4 na uhakikishe umetumia kichungi kuchunga changarawe. Wekelea vyuma kama inavyoonyeshwa kwa picha. Vyuma viwe vimeachana kwa 15cm. Hakikisha sakafu ni level kwa kutumia spirit level. Kisha mwaga concrete juu ya vyuma hadi 12.5cm kipimo cha 1:2:4. Sakafu yote itakuwa na kipimo cha 15cm. Hakikisha sakafu (floor) iko level. (Utakuwa umetumia simiti mifuko 3).

Siku ya 2:

Weka mabati (upana wa ndani ni 2.6m). Weka mzunguko mmoja wa vyuma kisha jaza nafasi iliyo katikati ya mabati (12.5cm) na concrete kipimo 1:3:3 hadi 7.5cm kwenda juu. Zungusha seng'eng'e (na usikate). Jaza tena concrete hadi 7.5cm kwenda juu. Weka tena vyuma (mzunguko mmoja) halafu jaza concrete kama hapo mbele na uendeleo hivyo hadi mwisho wa mabati. (Utakuwa na mizunguko 6 ya seng'eng'e na 6 ya vyuma tayari). Utakuwa umetumia mifuko 3 ya simiti.

Siku ya 3:

Toa mabati kisha yaweke juu na uzungusho chuma mare moja. Jaza concrete 1:3:3 hadi 7.5cm kwenda juu. Weka mizunguko 8 ya seng'eng'e hadi mwisho wa mabati, kisha jaza concrete hadi mwisho wa mabati. Utakuwa umetumia mifuko 3 ya simiti.

Siku ya 4:

Toa mabati tena yaweke juu. Zungusha seng'eng'e mzunguko mmoja kila 15cm hadi mwisho. Utakuwa umefanya mizunguko 6, na kutumia mifuko 3 ya simiti.

Siku ya 5:

Toa mabati na utoboe shimo juu ya kuweka mfereji wa kumwaga maji yanapojaa.

Piga plaster ya kwanza upande wa ndani ukitumia kipimo cha 1:3. Utahitaji mifuko 2 ya simiti.

Siku ya 6:

Piga plaster upande wa ndani mara ya pili ukitumia kipimo cha 1:2. Tumia simiti ya kuzuia maji (water proof cement). Piga plaster ya mwisho ukitumia simiti na maji peke yake. Utahitaji mifuko 3 ya simiti.

Siku ya 7:

Weka mbao za kutengeneza paa (roof). Weka vyuma zikiachana na 15cm kisha ziunganishe na bailing wire (kama inavyoonyeshwa kwa picha). Wacha sehemu ya kutengeneza shimo la kuingilia na pia sehemu ya kuingizia maji.

Siku ya 8:

Weka concrete kipimo cha 1:2:4. Paa itakuwa kiasi cha 10cm. Tengeneza kifuniko cha shimo la kuingilia ukitumia concrete na vyuma. (Kipimo cha shimo ni 0.6 x 0.6m). Hakikisha kuwa kifuniko ni kikubwa kidogo kushinda shimo ili kisitumbukie ndani. Utakuwa tayari ushatumia mifuko 4 ya simiti.

Siku ya 9:

Piga plaster upande wa nje ukitumia kipimo cha 1:4. Tengeneza pahali pa kuchotea maji. Utakuwa umetumia mifuko 5 ya simiti.

Siku ya 10-23:

Mwagilia tangi yako maji, ndani na nje, mara tatu kwa siku, au jaza maji ndani ya tangi baada ya kutoa mbao.

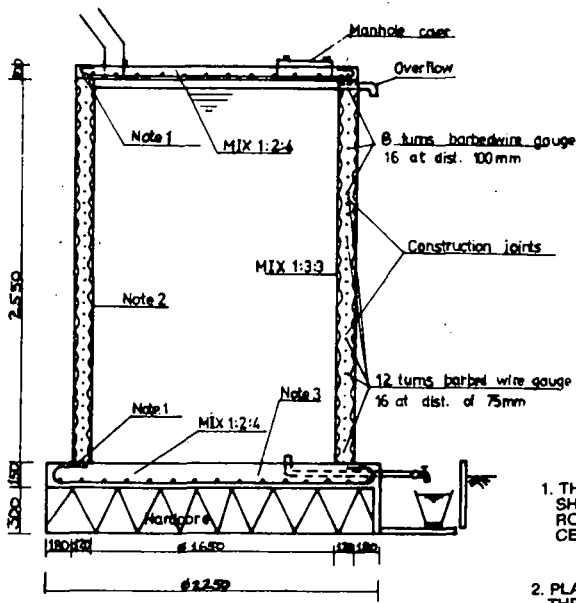
Siku ya 16:

Toa mbao na uisafishe tangi. Weka gutter kuunganisha paa la nyumba na tangi yako.

6. CONCLUDING REMARKS

As mentioned before, contacts with groups were in the beginning established through existing groups under the Development Office of the Catholic Diocese. These contacts (through group leaders and area Co-ordinators) are for a great part responsible for the success of the programme in such a short time. Some groups have contact with the Development Office since 1975 when the Development Office started with an Adult Literacy programme, since this programme was established as people's priority need after a community survey in 1974/75. A number of spring - off projects from the Adult Literacy activities were eventually consolidated into full operational programmes in response to demands from the grassroot communities (e.g. Water 1976, Women 1978, Co-operatives 1978, Primary Health Care 1978, Leadership Training 1979, Agriculture 1980 etc). All these programmes are now under the Development Education Programme (DEP) in the Diocese and they use the participatory development approach (sometimes known as DELTA - method, DEP approach or Psychosocial method). More information about the DEP programme is available at the Diocese.

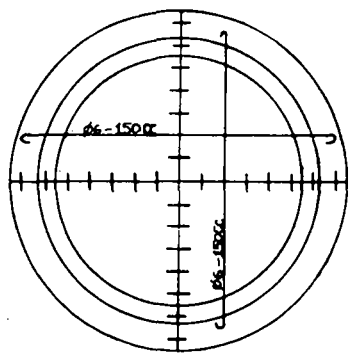
We are ready to provide any possible assistance to those who may want to try this programme out (from self-help groups to non-governmental and government organizations). We know what we have accomplished is not perfect and we call upon others to share their experiences as to how this piece of innovation can be improved.



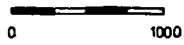
BILL OF QUANTITIES	
CEMENT	11 BAGS
SAND	3 TONS
AGGREGATE (1/2")	3 TONS
HARDCORE	1.5 TONS
18 GIBARBED WIRE 200M	
WATERPROOF CEMENT 1KG	
OUTLET PIPE & FITTINGS 1/2"	1 SET
TIMBER 6"x1"	20M
TIMBER 3"x2"	30M
NAILS 2" & 3"	3KGS
WELDED MESH 8"x4'	2 SHEETS

NOTES

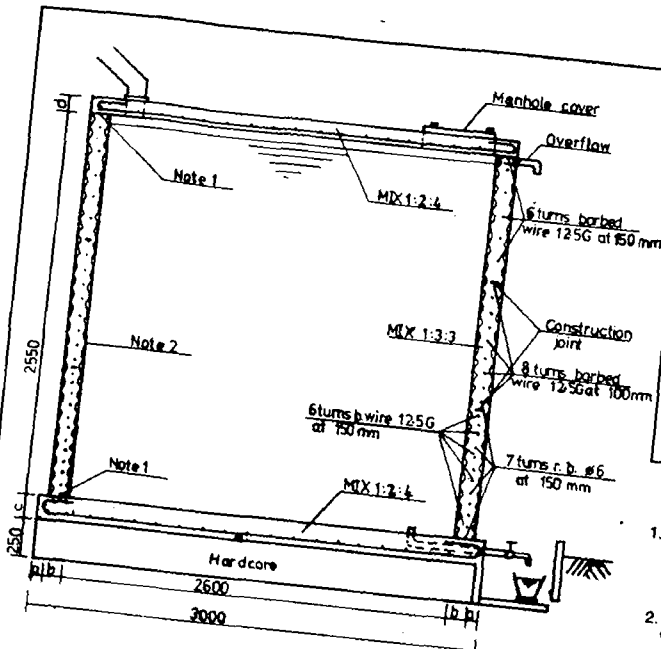
1. THE WALL REINFORCEMENT SHOULD NOT BE JOINED TO THE ROOF AND FLOOR REINFORCEMENT
2. PLASTER INSIDE IN THE THREE COATS
 1st COAT MIX 1:3
 2nd COAT MIX 1:2 WITH WATER PROOF CEMENT
 3rd COAT OF NEIL
3. INCASE BLACK COTTON SOIL FLOOR SLAB TO BE EXTRA REINFORCED IN THE TOP LAYER. INCASE GOOD SOIL CONDITIONS FLOOR REINFORCEMENT NOT NEEDED.



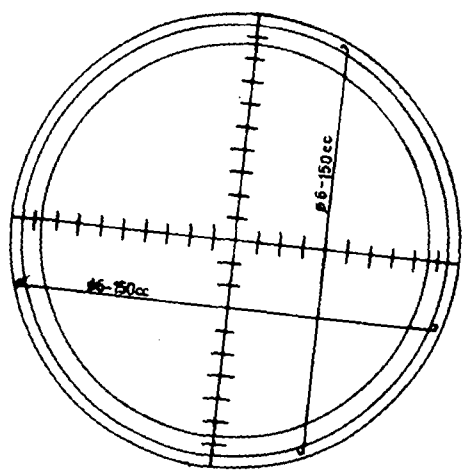
BAR SCHEDULE
ROOF AND FLOOR SLAB



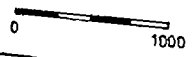
MACHAKOS DIOCESE
RAIN WATERTANK
MADE WITH CORRUGATED IRON MOULD
VOLUME 5400LTS. (1200 GALS.)
DESIGNED A.C. THIADENS
DIMENSIONS IN MILLIMETRES



a=75 b=125 c=150 d=100



BAR SCHEDULE
ROOF AND FLOOR SLABS



BILL OF QUANTITIES	
CEMENT	28 BAGS
SAND	5 TONS
AGGREGATE (1/2")	5 TONS
HARDCORE	3 TONS
R.B. #6	21 LENGTHS
WATERPROOF CEMENT	3 KGS
OUTLET PIPE	
FITTINGS 3/4"	1 SET
TIMBER 6"x1"	40M
TIMBER 3"x2"	20M
SHUTTERING POLES	
NAILS 2" & 3"	2.6M 8 NOS
12.5G BARBED WIRE	3KGS
	200M

- NOTES**
1. THE WALL REINFORCEMENT SHALL NOT BE JOINED TO THE ROOF AND FLOOR REINFORCEMENT
 2. PLASTER INSIDE IN THREE COATS:
1st COAT MIX 1:3
2nd COAT MIX 1:2 WITH WATERPROOF CEMENT
3rd COAT OF NEIL
 3. INCASE BLACK COTTON SOIL FLOOR SLAB TO BE EXTRA REINFORCED IN TOP LAYER.

MACHAKOS DIOCESE
RAIN WATERTANK
MADE WITH CORRUGATED IRON MOULD
VOLUME 13,500 LTS. (3000 GALS)
DESIGNED A.C. THIADENS
DIMMENSIONS IN MILLIMETRES