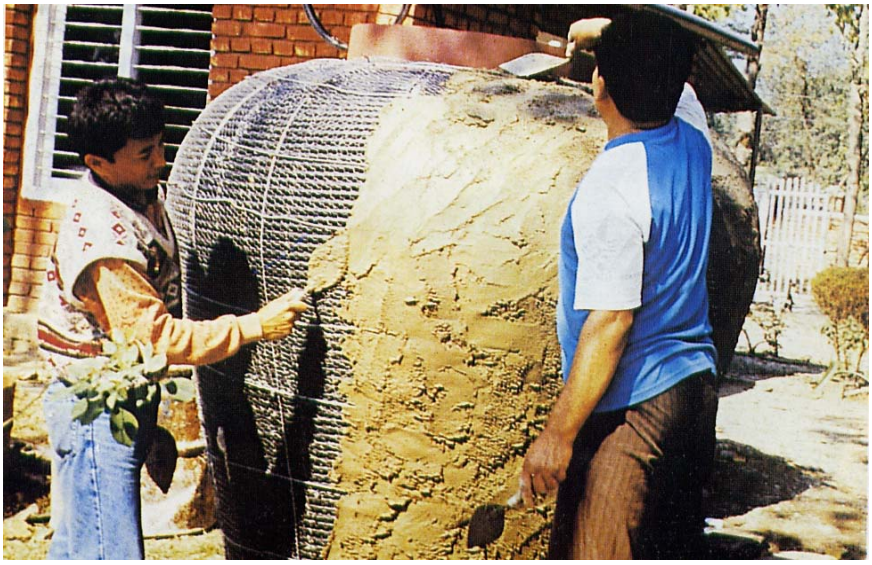
RURAL WATER SUPPLY AND SANITATION
FUND DEVELOPMENT BOARD

Guidelines

For

Ferro-cement Rainwater Harvesting Jar

(Design and Estimate)



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ACKNOWLEDGEMENT

First edition

This Guideline has been prepared by Mr. Dhruva Majagaiyan, DED during his tenure in the technical division as Chief of the Division. The RWSSFDB would like to extend thanks to Mr. Majagaiyan for his incredible contribution to prepare the guideline.

It is known that the RWSSP (FINNIDA) guideline for rainwater harvesting system has been referred in preparation of this guideline. Therefore, we would like to extend our precious acknowledgement to RWSSP (FINNIDA) as well.

We hope that this guideline will help to those who are involving in design and estimate of rain water harvesting system.

Thank you.

Technical Division

RWSSFDB, Lazimpat

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RAINWATER HARVESTING

Introduction

In many parts of the world rainwater is being used as the only source of domestic water supply. Rainwater as a source of water supply to meet the domestic drinking water needs is not a new concept. Rainwater is being used as water supply sources traditionally all over the world. Depletion of available quantity of water in the ground water sources and surface water sources is the major problem of the day. Ground water supply system or gravity water supply system may not be applicable or effective everywhere. Moreover, in some ground water sources are being identified as contaminated with Arsenic. So, this technology needs to be revived in the present context of water scarcity. Rainwater harvesting is being used and studied over the various part of the world and proven as reliable, dependable and safe source of water for drinking water supply. The main principle of the rainwater is collecting water in period of rainfall, store the water and use water in need. This system is applicable in the areas where scarcity of drinking water considering its quantity as well as quality and no other alternate sources.

Rainwater can be collected from rooftop, platform catchments harvesting, hill slope catchments or through watershed management. In India Rural development work on rain water started in 1965, and there since organization like UNICEF and SWAJAL are involved with others in researches and implementation of rain water harvesting system.

In case of Nepal, FINNIDA among with few other organizations had started developing roof top rainwater harvesting system quite successfully since 1996, with Ferro cement jars as cost effective new technology. The cost effectiveness for the Ferro jars are found more in 6 m3 designs when tested by FINNIDA to presently adopted 2 m3 designs. The FINNADA model of Ferro-cement jar adopted in this manual follows Technical Design based on Dr. Reissner's theory, to check the hoop tension resistance, and the water tightness of the jar. The Jars are made-up of thin walled reinforced concrete commonly constructed out of cement mortar and reinforced with closely spaced layers of wire mesh and some reinforcement bars called Ferro cement.

The rainwater harvesting may be of two types:

a. Centralized system
b. Individual system

In centralized system, the rainwater collection and storage is centralized and then arranged to distribute. It needs a large catchments area, storage tank and some treatment system depending on the nature of catchments area.

In the individual system, rainwater is collected and stored for every household separately and used. The individual rainwater harvesting is more popular, cost effective and reliable in the rural water supply system.

The main construction components of individual rainwater harvesting system are:

a. Catchments
b. Collection Vessel (Jar)

a. Catchments:

Catchment is the surface area that is used to collect the rainwater. The catchments in use are roof type and ground type. In roof type catchments, roof of a building is used to collect the rainwater whereas in ground type catchments, a paved or suitable platform is used to collect the rainwater. Roof type catchments is appropriate and popularly being used for rural rainwater harvesting systems in Nepal. Roofing materials used are Corrugated Galvanized Iron (CGI) sheets but it may be cement concrete or roofing tiles or slate roofs for safe catchments. There is less chance of fecal contamination over roof surface. The dust and any waste maters over roof surface is to be flushed outside from a waste carrying pipe arrangement before collection starts into the jar at every frequency of rain.

b. Collection Vessel (Jar):

Collection Vessel (Jar) is the vessel for storing the collected rainwater. Collection Jar contains inlet (mouth of Jar) for storing the collected rainwater from catchments and outlet to draw water from jar for water supply. Jar may be of any shape and size depending upon the design. Construction materials of the jar may be any kind i.e. masonry, RCC or ferro-cement. Ferro-cement jars are most economic for rural water supply system. The standard designs for the jars are available for 2 m3 and 6 m3 capacity.

Rainwater Harvesting Scheme Selection Criteria

1. The scheme should be proposed for the households which do not have any feasible gravity flow system or they are dependent on heavily arsenic contaminated groundwater sources.
2. Present consumption of water should be less than 10 liters per capita per day.
3. Time saving after scheme should be more than 2 hr. per household.
4. BCR should be > 1.5
5. Maximum number of households will be 100.

Rainwater Harvesting Scheme Working Approach

1. Scheme will be proposed for the construction of 2 Jars of 2 m3 or 1 jar of 6 m3 capacity (depending on the choice of owner) per household having CGI sheet roof and one Jar of 2 m3 capacity and 22 sheets (6' long) of CGI (26 SWG) sheet for the households having thatched roof.
2. Community cash contribution:
    a. 10% of hardware cost as up-front cash
    b. 4% of total scheme cost as O & M Fund
    c. O & M Fund will be utilized as revolving fund for the construction of additional jars within the community.
3. Community Kind contribution:
    a. All local materials collection and transportation (similar to the Board rules in other schemes)
    b. All unskilled labour (similar to the Board rules in other schemes)
4. Other software components (WTSS, SRLF, HSE, training etc.) will be same as other schemes of Fund Board
5. VMW's role will be to undertake the extension of Jars construction after completion of Implementation phase of the scheme according to the need of the community

RWSSFDB Scheme Cycle for Rainwater Harvesting Scheme

Pre Development Phase (Existing FB Scheme Cycle)

Submission of Pre-feasibility report, Site appraisal, Selection of Rainwater Harvesting scheme based on the scheme eligibility criteria of Fund Board. Process for the selection of scheme should be followed as other schemes and especially considered for the scheme where no other alternate sources

Development Phase (6-8 month)

Community preparation: Mass meeting, Water source/resource mapping, Health /socio economic survey, awareness and sanitation trainings and other related software activities CAP (A1-A14), as conducted in Development Phase software programs

Implementation Phase (6-10 month)

Steps to make rainwater collection system:

A) Construction Part

1. Construction works followed as per construction manual for Rainwater Harvesting Jars of RWSSFDB.

B) Software Part

2. RWSSFDB A1-A14 activities as per manual.
3. Rain water construction trainings for CT, VMW
4. WUSC training for management, maintenance and extension of the scheme.

Design Factors/ Criteria for Rainwater Harvesting Systems

It has been already proved that the rainwater harvesting system is being accepted as an alternate source of drinking water supply system. Since, the system is proposed for the water scarce area, only the demand for the drinking purpose is considered in design. The sizing of the jar is done for storage of the area is obtained for a period of non rainfall duration. For design of the catchments area the rainfall data of the area is obtained for a period say 10 years. There is the debate whether to consider the minimum or average rainfall for design consideration but in country like Nepal where the rainfall character is random, better to consider the average rainfall. From the rainfall precipitation data and the character of catchments materials the area of catchments is designed.

Principle of Design

Design of the rainwater harvesting system mainly depends upon the rainfall characteristics of the area. The rainfall data that can be obtained from Department of Hydrology is as in table below.

Typical Rainfall Data

Month	Rainfall (mm)				
	1985	1986	1987	1988	1990
May	210	215	185	215	185
June	623	610	590	630	575
July	834	775	850	846	792
August	862	810	820	860	805
September	536	520	513	540	499
October	162	150	175	160	140
November	12	15	9	14	9
December	14	15	11	14	11
January	33	30	29	31	28
February	30	35	38	35	25
March	43	41	36	29	38
April	3.6	3	0	2	1

Data for different parts of Nepal for a year

Region	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
MidWest	**Surkhet**	24	32	38	20	62	242	424	380	170	56	4	16	**1468**
West	**Syangja**	23	44	42	163	344	599	756	658	430	165	18	11	**3253**
Central	**KTM**	15	18	34	50	97	272	371	297	163	69	5	8	**1399**
East	**Dhankuta**	14	13	20	66	114	199	256	131	105	75	11	10	**1014**
FarWest	**Dipayal**	14	33	109	44	107	168	372	279	46	8	3	27	**1210**
North	**Jomsom**	7	9	20	15	8	26	43	38	32	31	16	3	**248**

The above table shows that the rainwater harvesting may not be applicable in the Northern part of Nepal as the total annual rainfall is very low.

A study shows household size of rural areas of Nepal is 6 in average and a family with 6 members uses 3 GAGROS of water in a day for drinking and cooking purpose. 1 GAGRO equals 15 ltr. of water. So, total water consumption is 45 ltr. which is less than 10 lpcd. It is recommended to have 10-15 lpcd of water for drinking purpose by GON. Total demand for deferent time period is tabulated below:

Water Demand

Population (No)	Demand (lpcd)	Total Water Demand (litre						Remarks
		Day	15 Days	Month	3 Months	6 Months	Year	
6	10	60	900	1800	5400	108000	21600	
6	15	90	1350	2700	8100	16200	32400	
10	10	100	1500	3000	9000	18000	36000	
10	15	150	2250	4500	13500	27000	54000	

Roof area of a house in rural area of Nepal is about 30 Sq. M. to 45 Sq.M. in general. Considering roof area of 30 Sq.M. applicable for the rainwater harvesting system.

Amount of water available for collection is calculated using the following formula:

Available Water (m3) = Avg. Rainfall (Mtr) x Catchments Area (m^2) x Coefficient
= Avg. Rainfall (Mtr) x Catchments Area (m^2) x 0.7

Coefficient is depended of the Catchments. If the catchment is of CGI sheet roofing then the coefficient is considered as 0.7 and for tile roofing it is considered as 0.6.

Amount of Water Collected

Month	Average Rainfall mm	Catchment Area Sq.M.	Volume Available litre	Water Demand litre
May	114	30	2394	1800
June	199	30	4179	1800
July	256	30	5376	1800
August	131	30	2751	1800
September	105	30	2205	1800
October	75	30	1575	1800
November	11	30	231	1800
December	10	30	210	1800
January	14	30	294	1800
February	13	30	273	1800
March	20	30	420	1800
April	66	30	1386	1800

Here we can see the water demand is met for 5 months fully from the rainfall. For another two months rainwater is quite deficit, but for highlighted five months totally deficit. So the jar should be sized for storing water for this period.

If the amount of water available should be increased for these period, we should provide the larger area of the catchments. So catchments may also be designed for rainwater harvesting.

The total amount of water is not available for collection for drinking purpose as the water for first some minutes should be allowed to flush the catchments.

Sizing of Jar

Jar should be sized to hold the required deficit water for the period of the dry season. In the above example of demand and Supply, water should be stored for five months. As we have water required for five month is 9000 ltr. so size of jar needed is 9 m^3

Area of Catchments

Area of Catchments may be calculated as require for the collection of required quantity of water. It can be done as follows:

Say Rainfall = 10 mm
Water Demand = 1800 ltr.
Coefficient = 0.7

So,

Area of Catchment = Water Demand (m3) / {Rainfall (Mtr) x Convenient}

= 1.8/0.01*0.7
= 258 Sq.m.

Which is very high for considering a roof catchment of a building. So in general jar is sized for storing water as much as required for dry season.

Cost Analysis

For A Single Household (Including roofing)

Description	Unit	Number	Quantity	Rate*	Amount	Remarks
Catchment Say 30 Sq.m.						
CGI Sheet (2'6" x 6')	Pc.	1.00	22.0			
HDPE Pipe 90mm dia 2.5 kg/cm^2	Mtr.	1.00	10.00			
HDPE Pipe 63mm dia 4 kg/cm^2	Mtr.	1.00	7.50			
HDPE Pipe 40mm dia 6 kg/cm^2	Mtr.	1.00	10.00			
Nails	Kg.	1.00	0.20			
GI Strip Clamps	Pc.	1.00	10.00			
Ferro-cement Jar (2 m^3 - 1 no.)						
Cement	Bag	1.00	4.00			
Sand	M^3	1.00	0.40			
Aggregate	M^3	1.00	0.05			
Chicken Wire Mesh	Mtr.	1.00	16.00			
GI Plain Wire 3.5mm	Kg.	1.00	6.00			
Binding Wire	Kg.	1.00	0.30			
GI Binding Wire	Kg.	1.00	2.00			
Tap With Locking System	Pc.	1.00	1.00			
GI Nipple ½" dia 9" long	Pc.	1.00	1.00			
GI Nipple 1" dia 9" long	Pc.	1.00	1.00			
GI Socket 1/2" dia	Pc.	1.00	1.00			
Jar cover	Pc.	1.00	1.00			
Mosquito Net (Nylon)	Mtr.	1.00	1.00			
Plastic Sheet	Mtr.	1.00	5.50			
Thread seal Tape	Pc.	1.00	1.00			
Cement Paint	Kg.	1.00	2.00			
Nails	Kg.	1.00	0.20			
Rod 6 mm dia.	Kg.	1.00	0.20			
				Total=		

* Rate will be adopted as per market rate.
Board Contribution: **Rs. ……..(Cash) (…….%)**
Users contribution: Rs. ……..(Cash) and Rs. ……(Kind) **Total: Rs. ……. (…….%)**

For A Single Household (Excluding roofing)

Description	Unit	Number	Quantity	Rate*	Amount	Remarks
Catchment Say 30 Sq.M.						
HDPE Pipe 90mm dia 2.5 kg/cm^2	Mtr.	1.00	10.00			
HDPE Pipe 63mm dia 4 kg/cm^2	Mtr.	1.00	7.50			
HDPE Pipe 40mm dia 6 kg/cm^2	Mtr.	1.00	10.00			
Nails	Kg.	1.00	0.20			
GI Strip Clamps	Pc.	1.00	10.00			
Ferro-cement Jar (2 m^3 - 2 nos.)						
Cement	Bag	2.00	4.00			
Sand	M^3	2.00	0.40			
Aggregate	M^3	2.00	0.05			
Chicken Wire Mesh	Mtr.	2.00	16.00			
GI Plain Wire 3.5mm	Kg.	2.00	6.00			
Binding Wire	Kg.	2.00	0.30			
GI Binding Wire	Kg.	2.00	2.00			
Tap With Locking System	Pc.	2.00	1.00			
GI Nipple 1/2" dia 9" long	Pc.	2.00	1.00			
GI Nipple 1" dia 9" long	Pc.	2.00	1.00			
GI Socket 1/2" dia	Pc.	2.00	1.00			
Jar cover	Pc.	2.00	1.00			
Mosquito Net (Nylon)	Mtr.	2.00	1.00			
Plastic Sheet	Mtr.	2.00	5.50			
Teflon Tap	Pc.	2.00	1.00			
Cement Paint	Kg.	2.00	2.00			
Nails	Kg.	2.00	0.20			
Rod 6mm dia.	Kg.	2.00	0.20			
				Total =		

* Rate will be adopted as per market rate.

Board Contribution: **Rs. ……(Cash) (…….%)**

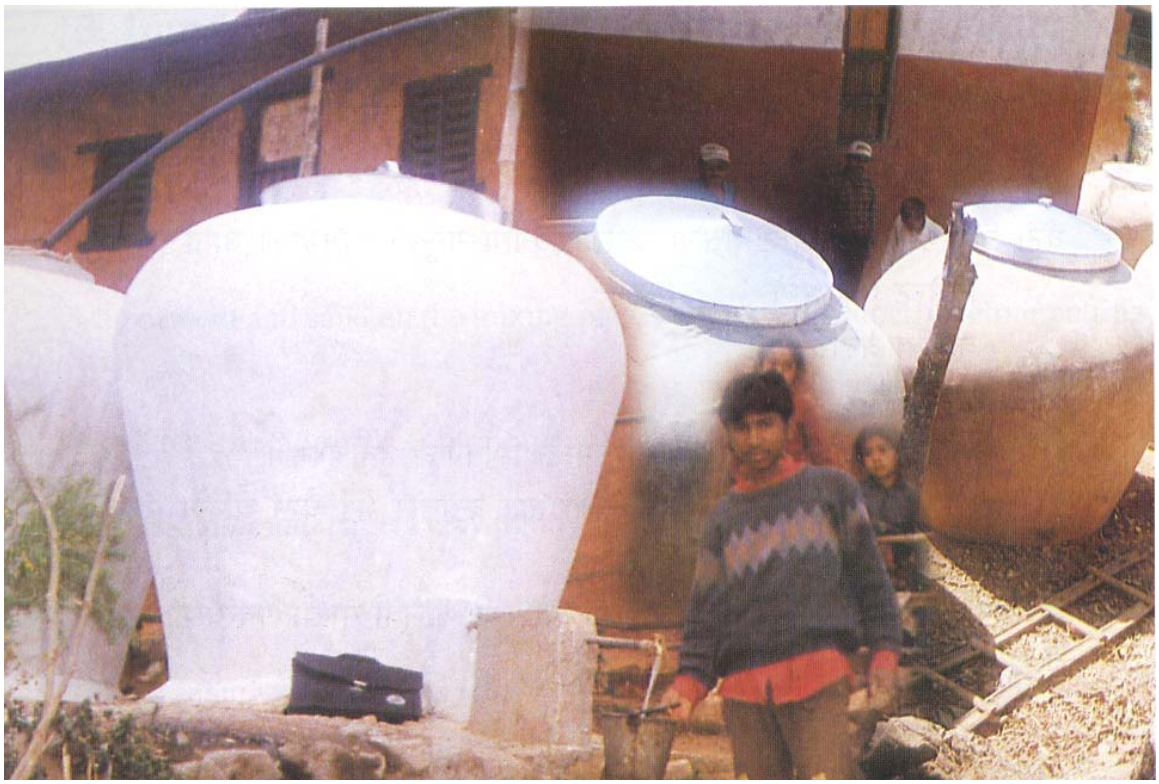
Users contribution: Rs. ……..(Cash) and Rs. ……(Kind) **Total: Rs. ……. (…….%)**

Construction of Rainwater harvesting system

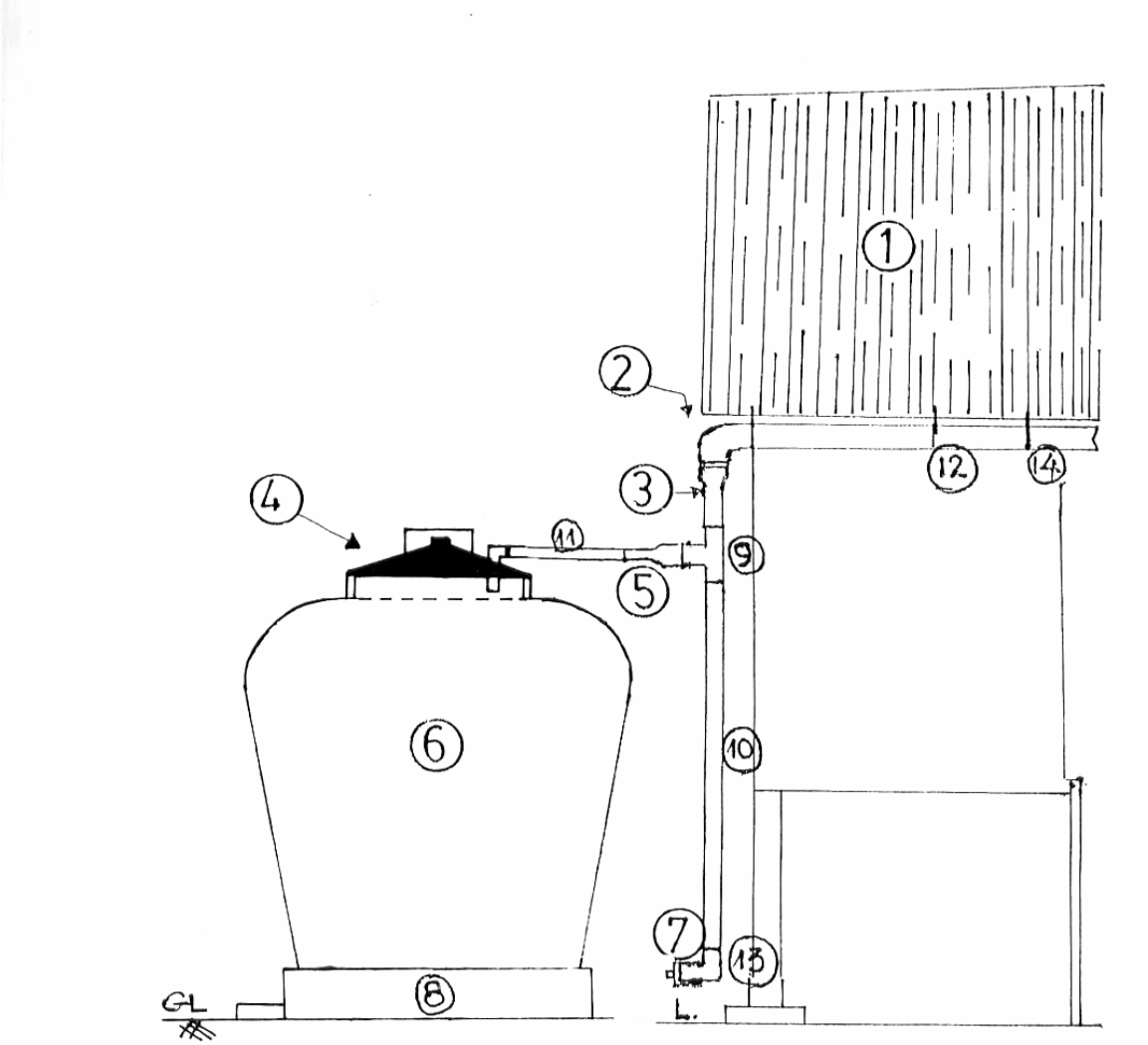
Construction of Catchments

Considering the roof type catchments, the roof of the building itself is the catchments of the system. Roof should be of CGI Sheet, Tiles or Concrete for collection of safer water. Many of the buildings of rural area have these roofing so no problem about catchments. But if the roof is of other materials then should be analyzed in detail for guaranteed draw of safer water. The roof may be changed in the case.

Gutter for channeling water is another important component of the catchments. Simply GI sheet gutter or HDPE pipe gutter may be used. HDPE Pipe gutter is made from 90mm dia. pipe of 2.5 kg/cm2 pressure class. A slot along the pipe length is cut out and one side of the pipe will be plugged for use as gutter. The pipe gutter is then connected with 63 mm dia. pipe up to the ground level for drain out water. A 40mm dia. pipe will be branched from the 63 mm dia. pipe just above level of the mouth of jar and extended up to the mouth of the jar.



RAINWATER JAR WITH GUTTER

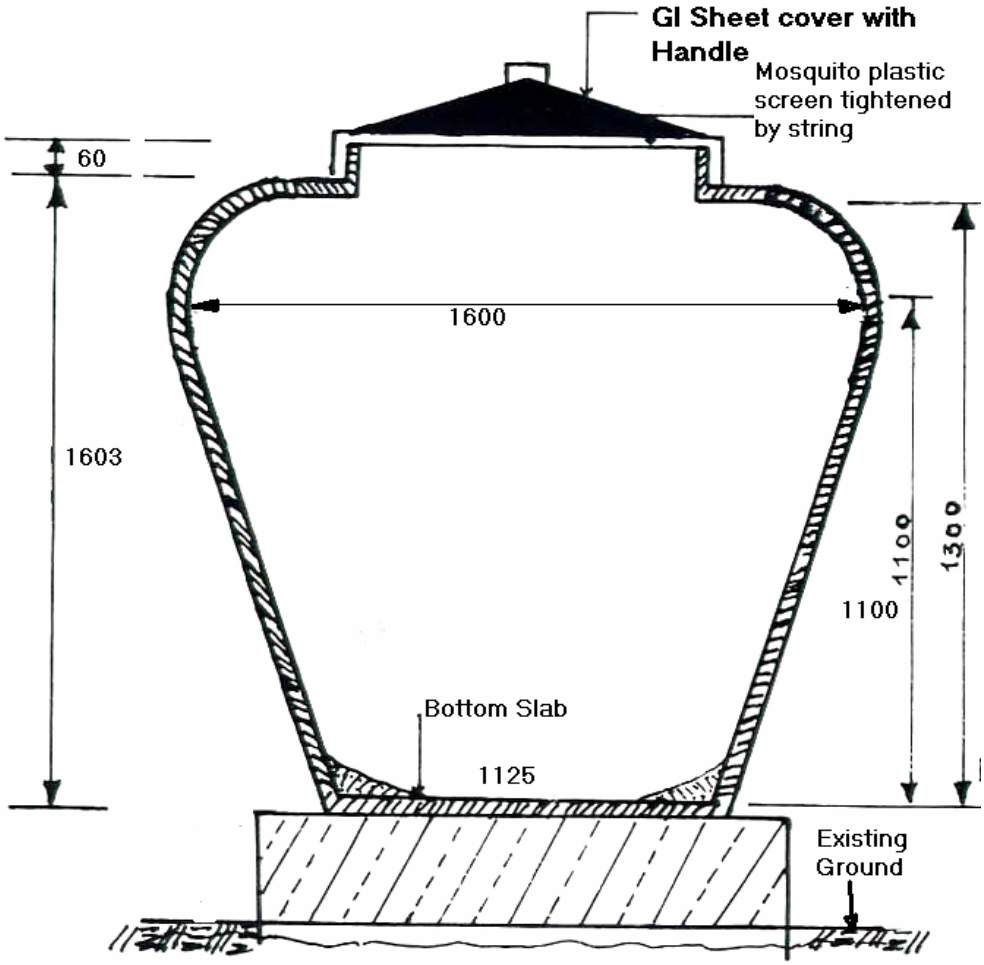


1. CGI sheet /Slate Roofing
2. 90 mm ø HDP Elbow
3. 90 X 63 mm ø HDP Reducer
4. Jar Cover
5. 63 X 40 mm ø HDP Reducer
6. Jar Body
7. HDP End cap / Wooden Plug
8. Jar Base
9. 63 mm ø HDP Tee
10. 63 mm ø HDP Pipe
11. 40 mm ø HDP Pipe
12. 90 mm ø HDP Pipe
13. 63 mm ø HDP Elbow
14. Metal Gutter clamp

Construction of Jar

As said earlier the jar may be of any shape, size or of any materials as per need of the system or user. The ferro-cement RVT as specified in gravity water supply system may also be used in this system, but another type of ferro-cement tank of 2000 ltr. capacity is tested and found economic for the use in rainwater harvesting system. It is of typical shape with lower dia. at base increasing as go up with small mouth at the end. It looks like a traditional vessel "*GHAMPO*" widely used in rural areas. Considering the fact that the space occupied by several numbers of 2 m^3 jars, a single 6 m^3 jar can also be used to fulfill household demand.

This typical design of the jar was tested by various organizations worldwide and in Nepal also and found economic and well serving for the purpose. Jar size of 2 m^3 is found economically effective of this shape, so practiced to construct the size of 2 m^3 in general. Instead of constructing several 2 m3 jars in courtyard a 6 m^3 can also be constructed and standard design is available. The construction details and the materials required are listed in the respective headings ahead.



2 m^3 Jar

Construction materials required

Construction materials required for construction of the 2 m^3 and 6 m^3. Jars are listed below:

Sr. No.	Materials	Quantity	
		2 m3	6 m3
1.	Cement	4 bags	14 bags
2.	Sand	0.4 m^3	1.71 m^3
3.	Aggregate (6mm)	0.05 m^3	0.52 m^3
4.	Chicken Wire Mesh (22 gauge- 90 cm wide)	16 Mtr.	32.07 Mtr.
5.	GI Plain Wire 3.5mm dia	6 kg.	25 kg.
6.	Binding Wire	0.3 kg.	2.89 kg.
7.	Tap with locking System	1 Pc.	1 Pc.
8.	GI Nipple ½" dia 9" long with 6mm rod welded	1 Pc.	-
9.	GI Nipple ½" dia 4" long	-	1 Pc
10.	GI Nipple 1" dia 4" long with 6mm rod welded	1 Pc.	1 Pc.
11.	GI Socket ½" dia	1 Pc.	1 Pc.
12.	GI End cap 1" dia.	1 Pc.	1 Pc.
13.	GI Tee ½"	-	1 Pc.
14.	GI pipe ½" both side threaded	-	0.40 m.
15.	GI pipe 1" both side threaded	-	1.5 m.
16.	Jar Cover	1 Pc.	1 Pc.
16.	Mosquito Net (Nylon)	1 mtr.	1 mtr.
17.	Plastic Sheet	5.5 mtr.	6 mtr.
18.	Thread seal tape	1 Pc.	1 Pc.
19.	Cement Paint/Snowcem	2 kg.	3.45 kg.
20.	Nails 3"	0.2 kg.	0.5 kg.
21.	Rod 6mm dia	0.2 kg.	-
22.	8 mm dia. TOR Steel	-	25.23 kg.
23.	Water proofing compound	-	3 kg.
List of Materials required for Gutter			
24.	HDPE Pipe 90mm dia (2.5kg/cm2)	10 Mtr.(Approx.)	10 Mtr.(Approx.)
25.	HDPE Pipe 63mm dia (4 kg/cm2)	7.5 Mtr.(Approx.)	7.5 Mtr.(Approx.)
26.	HDPE Pipe 40mm dia (6kg/cm2)	10 Mtr.(Approx.)	10 Mtr.(Approx.)
27.	Roofing nails (4" long)	0.2 Kg.	0.2 Kg.
28.	GI Strip Clamps	10 Pc.	10 Pc.
List of Materials for Jar mold (HDP pipe form work) (for up to 100 Jars)			
29.	HDP pipe 20 mm ¢/10 kgf	400 m	-
30.	HDP pipe 32 mm ¢/6 kgf	-	500 m
31.	Iron lip mold (Outer/Inner)	1 set	1 set
32.	Bottom slab mold	1 set	1 set
33.	Jar body mold	1 set	1 set
34.	Binding wire Galvanized	2 kg.	5 kg.

List of Tools, Required for Construction of Rainwater harvesting scheme (for up to 100 Jars).

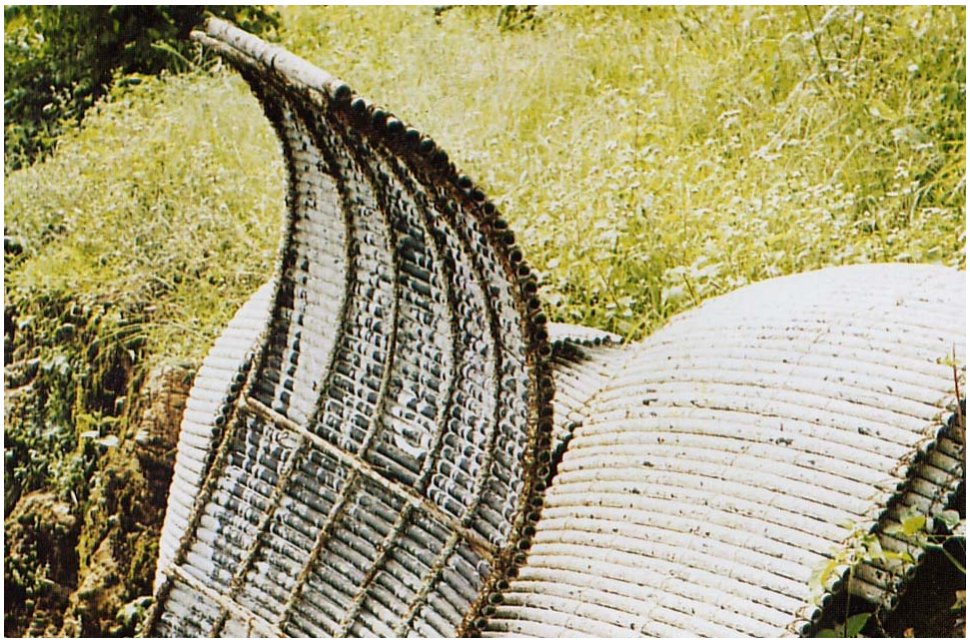
Sr. No.	Tools	Quantity
1.	Heating Plate 6"	1 No.
2.	Teflon cover 7" x 7"	1 Pc.
3.	Thermocrome	1 Pc.
4.	Kerosene Blow Torch	1 Pc.
5.	Geberite knife	1 Pc.
6.	Pipe Wrench 14"	2 Pc
7.	Hacksaw Frame	1 Set
8.	Hacksaw Blade	12 Pc.
9.	Combination pliers-8"	1 Pc.
10.	Shovel	2 Pc.
11.	Steel Pan	2 Pc.
12.	Stone Cutter Hammer	2 Pc.
13.	Trowels, Building	2 Pc.
14.	Trowels, Pointing	2 Pc.
15.	Trowels, Finishing	2 Pc.
16.	Paint Brush	1 Pc.
17.	Measuring Tape (3m)	1 Pc.
18.	Carpenter's Saw	1 Pc.
19.	Steel Scissors	1 Pc.
20.	Sand Sieve Set (1.3mx0.85mx2mm) mesh	1 Pc.
21.	PVC Tarpolin (12' X 12')	1 Pc.

Manpower Requirement for Construction

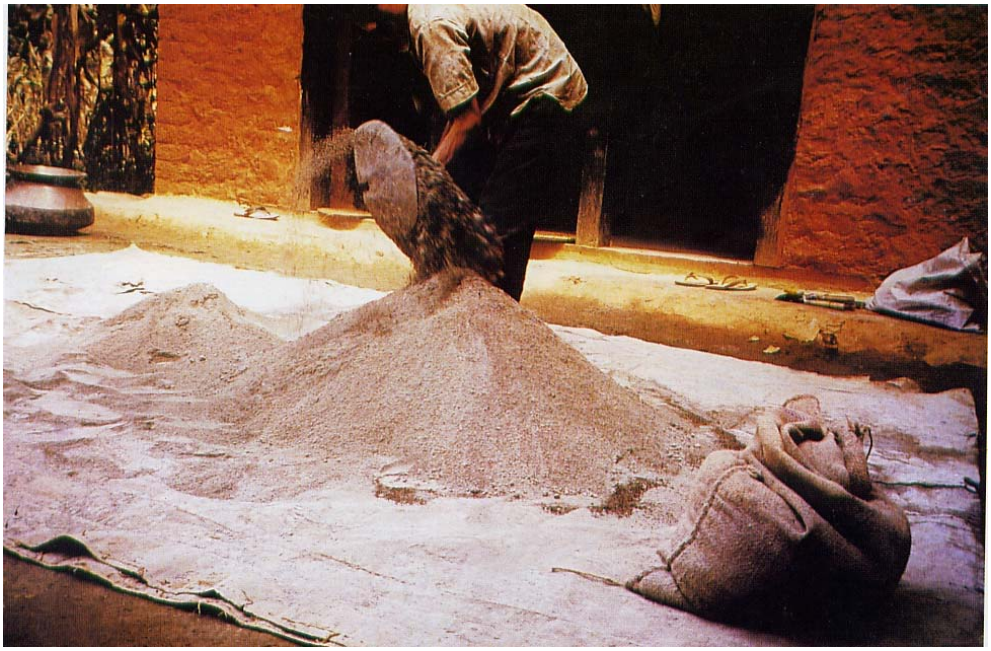
Description	Skilled Labour		Unskilled Labour	
	2 m^3	**6 m^3**	**2 m^3**	**6 m^3**
Ferro-cement Jar	7 MD	17.9 MD	7 MD	22.7 MD
Pipe Gutter	0.5 MD	1 MD	0.5 MD	1 MD
Preparation of Formwork	6 MD	8 MD	8 MD	10 MD

Construction Procedures

1. Prepare mould by wrapping 20 mm HDP pipe around the fabricated steel frame as given in picture below:



2. Prepare cement mortar for base slab by mixing cement and coarse sand in 1:2.5 ratio.



3. Make ground level, place sand layer and plastic sheet at the top.
4. Place the base slab mould on the leveled ground over the plastic sheet.
5. Place 16 nos. 3.5 mm (10 SWG) GI wires diagonally as shown in picture below.
6. Place the prepared mortar inside the base slab mould and compact properly.
7. Cure base slab at least for 3 days.

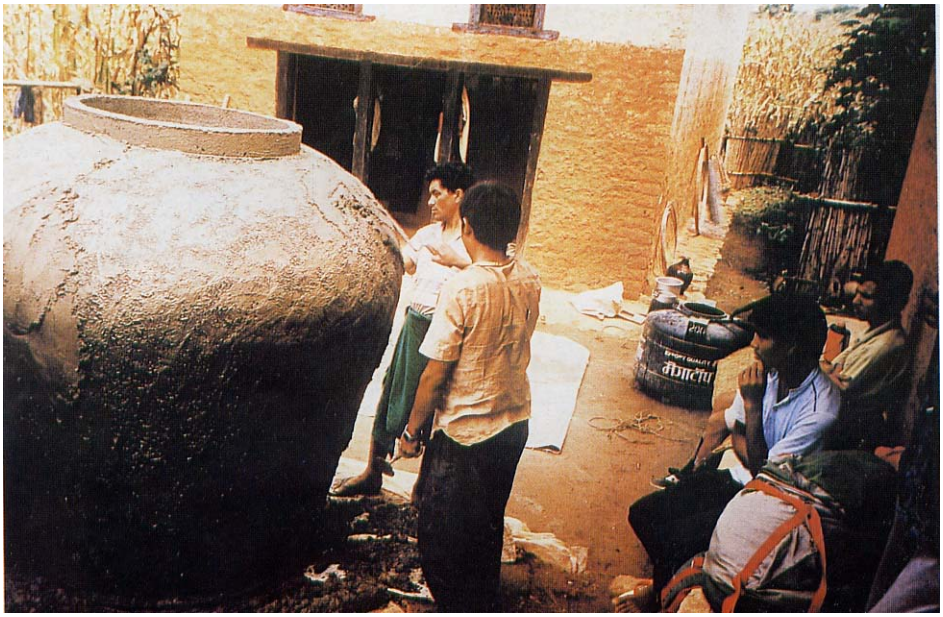
8. Place mould panels and fix the mould on the base slab after 3 days of curing.

9. Fix 22 SWG chicken wire mesh and 10 SWG GI wire around the mould. For 6 m^3 Jars place vertical bars 8 mm ¢ instead of 10 SWG wires.

10. Apply first coat of plaster 12.5 mm thick (1:2.5 cement sand) with rough surface.

11. Fix the lip mould after application of first coat of outer plaster and fill up the lip with same cement sand mortar.

12. Again apply 13 mm plaster as second coat with same cement sand mortar making smooth surface.



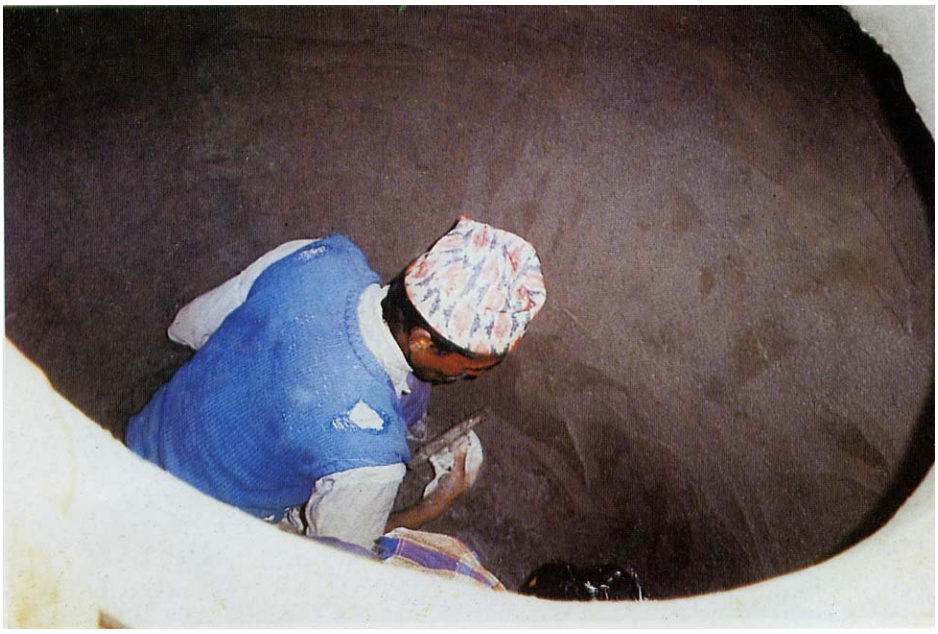
13. Properly cure after initial setting of cement at least for 7 days.

14. Remove the Jar mould from inside after completion of outer second coat plaster.

15. Clean the inside surface of the Jar with water after removing the mould.

16. Place the fittings and fixtures on the Jar wall for outlet and washout.

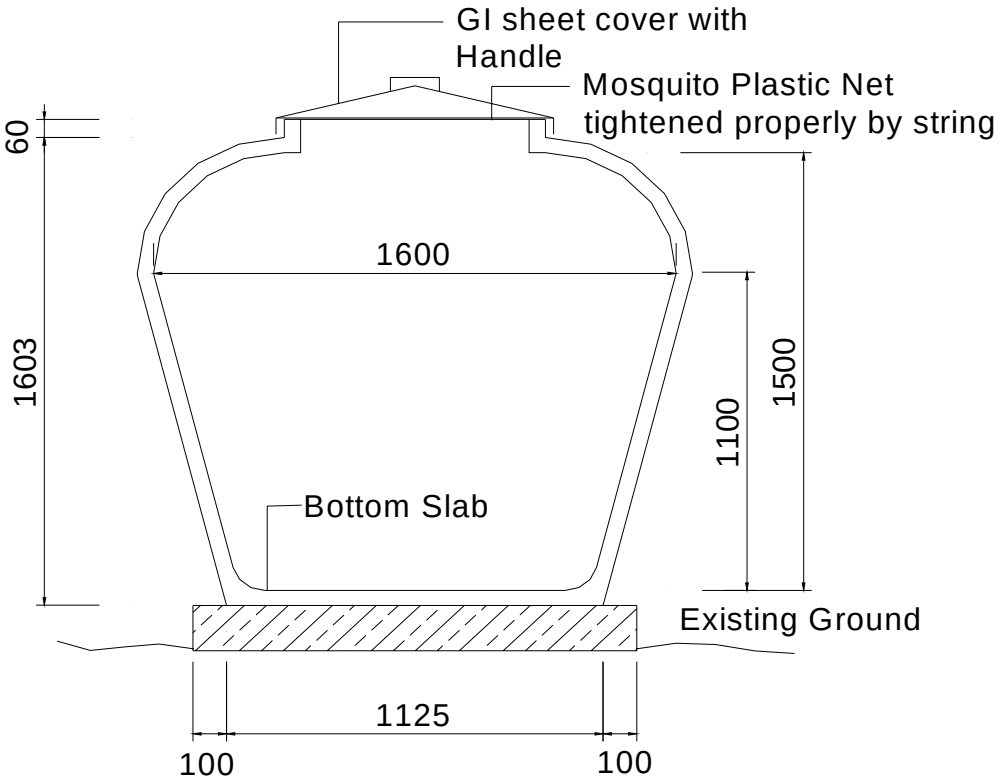
17. Now plaster the inside surface of the Jar with 1:2.5 cement sand mortar with smooth surface including cement punning.

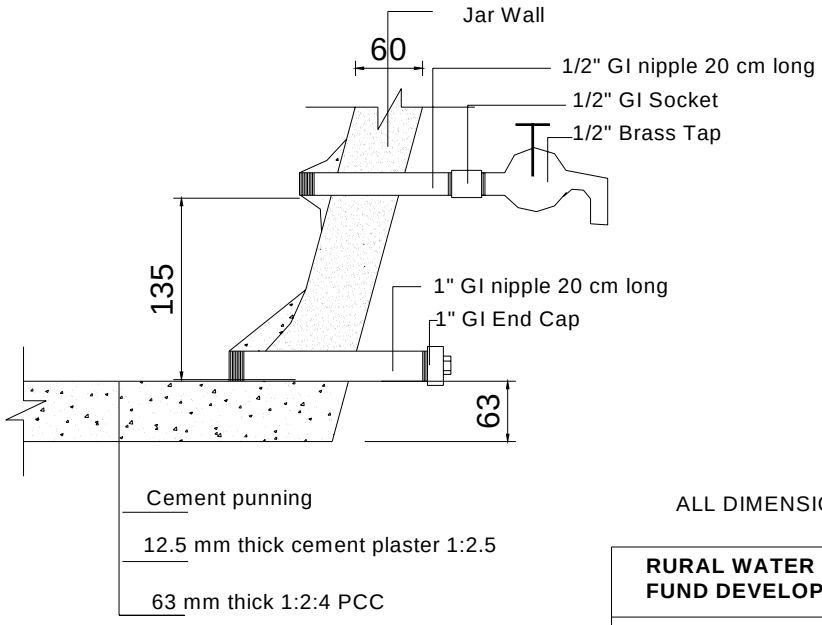


Special Tips for Rainwater Jar Construction:

1. Cement Sand mortar should be made properly in 1:2.5 ratio.
2. Sand to be used must be free from mud, dust and other organic materials.
3. Mix cement and sand on the mixing plate in dry stage before putting water into it.
4. Level the ground surface, put some sand over it while making base plate.
5. Do not tight mold panels very tightly to each other while assembling the mold.
6. Cover the whole jar with plastic immediately after completing the plaster work.
7. Do not remove the mold panels from the jar until two days after completion of external plaster.
8. After removing the mold, inside of the jar should be cleaned properly.
9. Curing should be done at least for seven days after the jar is made. Outside of the jar should be covered with wet jute bags and water be filled up to the tap level inside the jar, for proper curing.

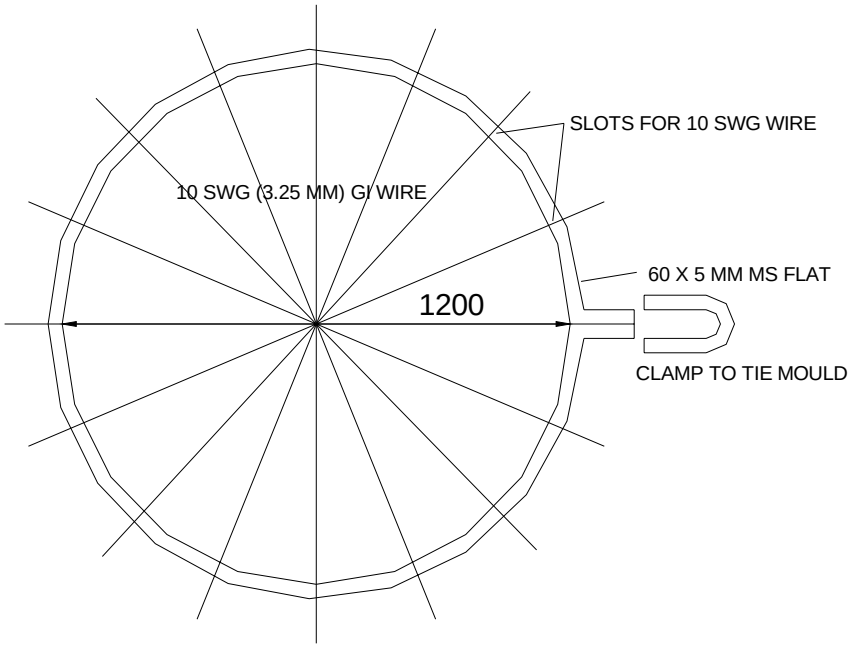
STANDARD DRAWINGS



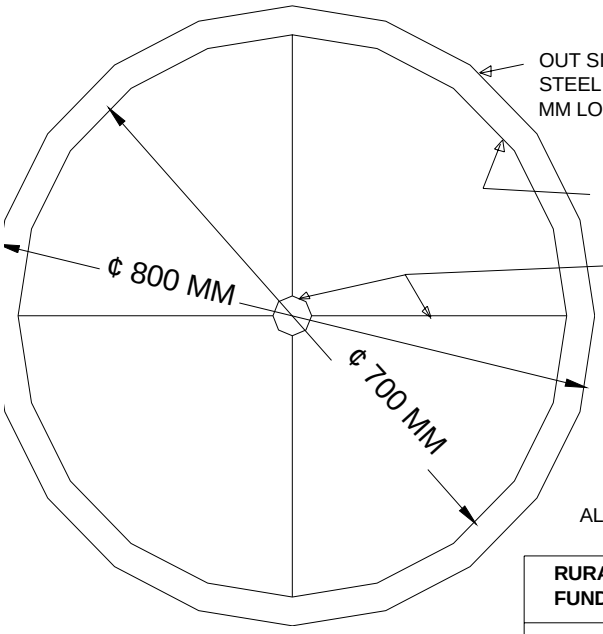


ALL DIMENSIONS ARE IN MM.

RURAL WATER SUPPLY AND SANITATION FUND DEVELOPMENT BOARD (RWSSFDB)		
2000 Ltr. Rain Water Jar (RWH002)		
TYPICAL JAR SECTION		DRG. NO. 01
SCALE: NOT TO SCALE	APRIL 2004	



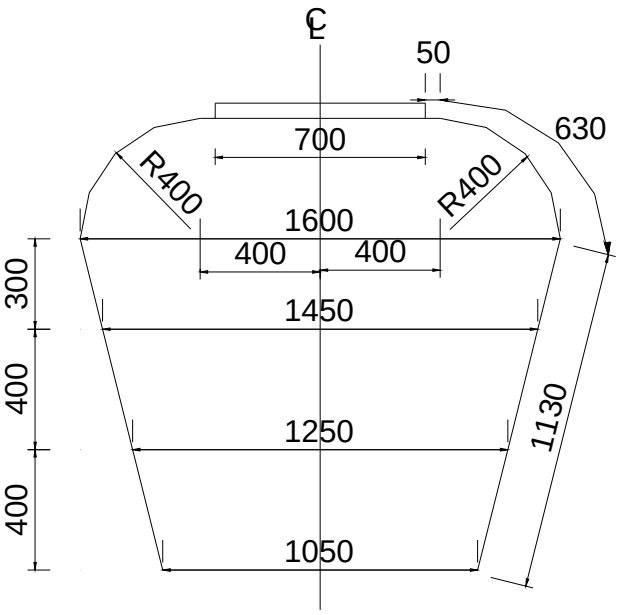
BOTTOM SLAB MOULD



JAR LIP MOULD

ALL DIMENSIONS ARE IN MM.

RURAL WATER SUPPLY AND SANITATION FUND DEVELOPMENT BOARD (RWSSFDB)		
2000 Ltr. Rain Water Jar (RWH002)		
BASE AND LIP MOULD		DRG. NO. 02
SCALE: NOT TO SCALE	APRIL 2004	

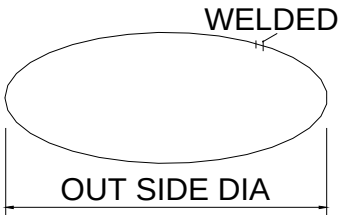


JAR MOULD OUTLINE DIA.

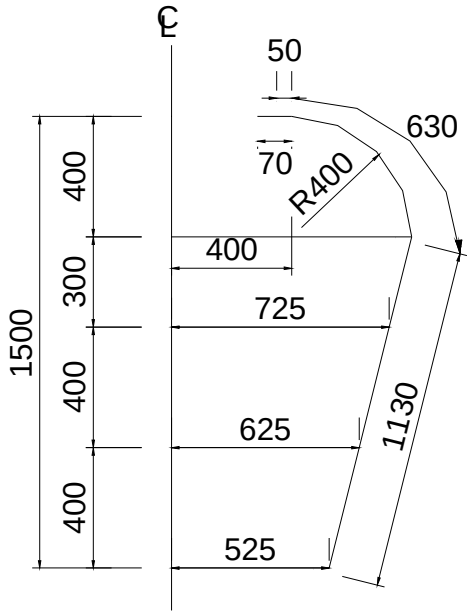
HOOP BAR DIA AND LENGTH

1. ¢ = 0.70 m L = 2.25 m
2. ¢ = 1.60 m L = 5.08 m
3. ¢ = 1.45 m L = 4.60 m
4. ¢ = 1.25 m L = 3.98 m
5. ¢ = 1.05 m L = 3.35 m

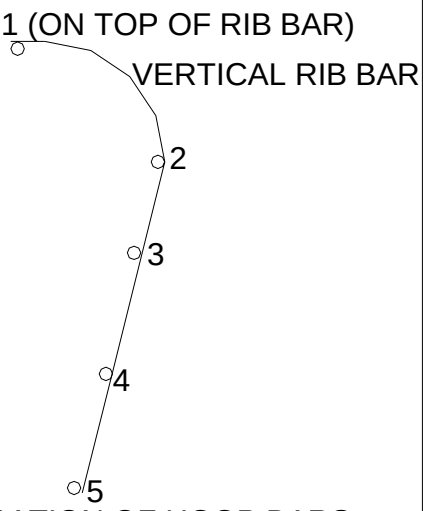
LENGTH INCLUDES 0.05 M OVERLAP



HOOP BARS



RIB BAR DIMENSION

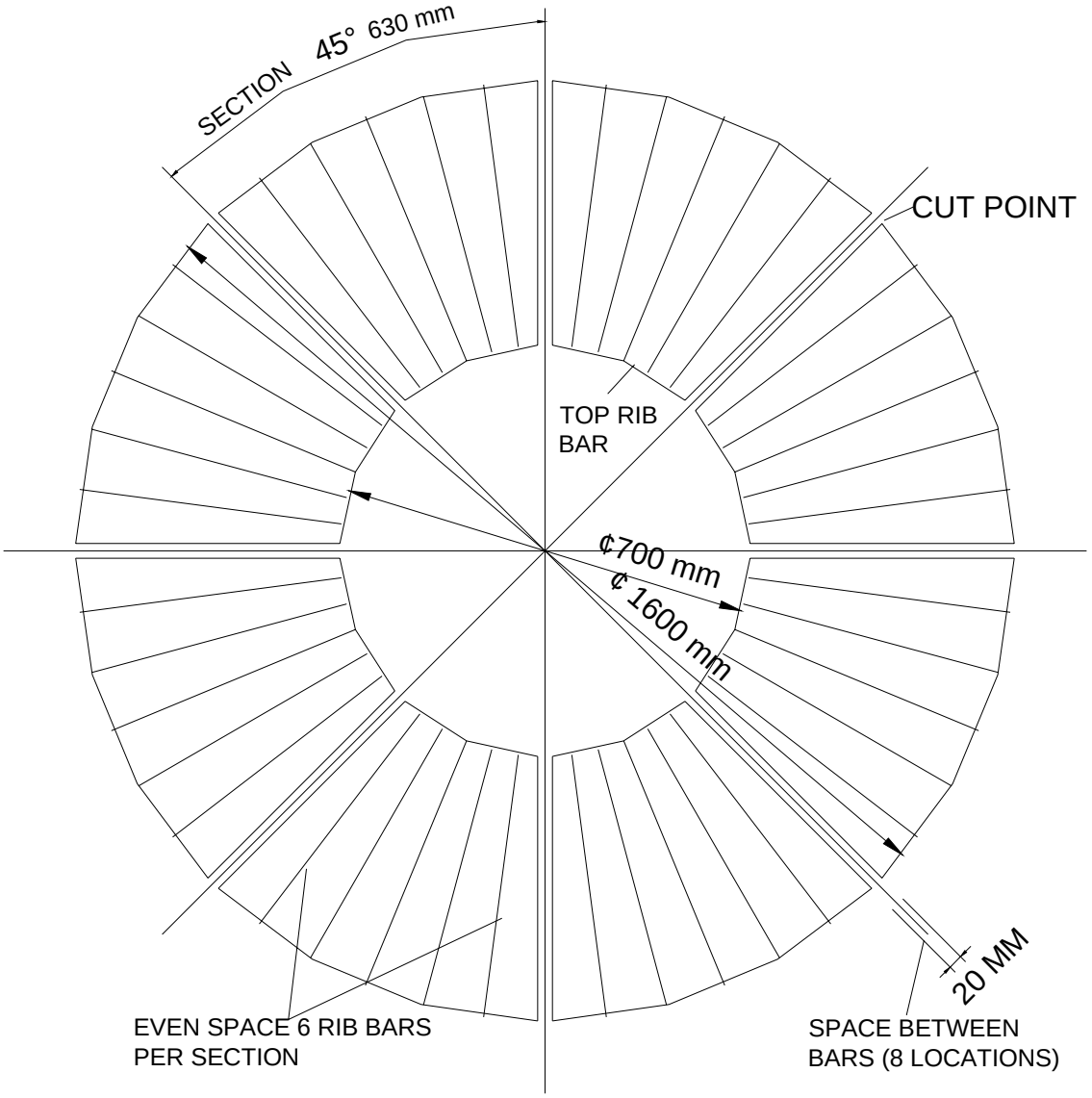


LOCATION OF HOOP BARS

ALL BARS ARE 8 MM ¢ STEEL

ALL DIMENSIONS ARE IN MM.

RURAL WATER SUPPLY AND SANITATION FUND DEVELOPMENT BOARD (RWSSFDB)		
2000 Ltr. Rain Water Jar (RWH002)		
DETAILED DIMENSION OF STEEL BARS IN FRAME		DRG. NO. 03
SCALE: NOT TO SCALE	APRIL 2004	



STEEL MOULD TOP VIEW

ALL DIMENSIONS ARE IN MM.

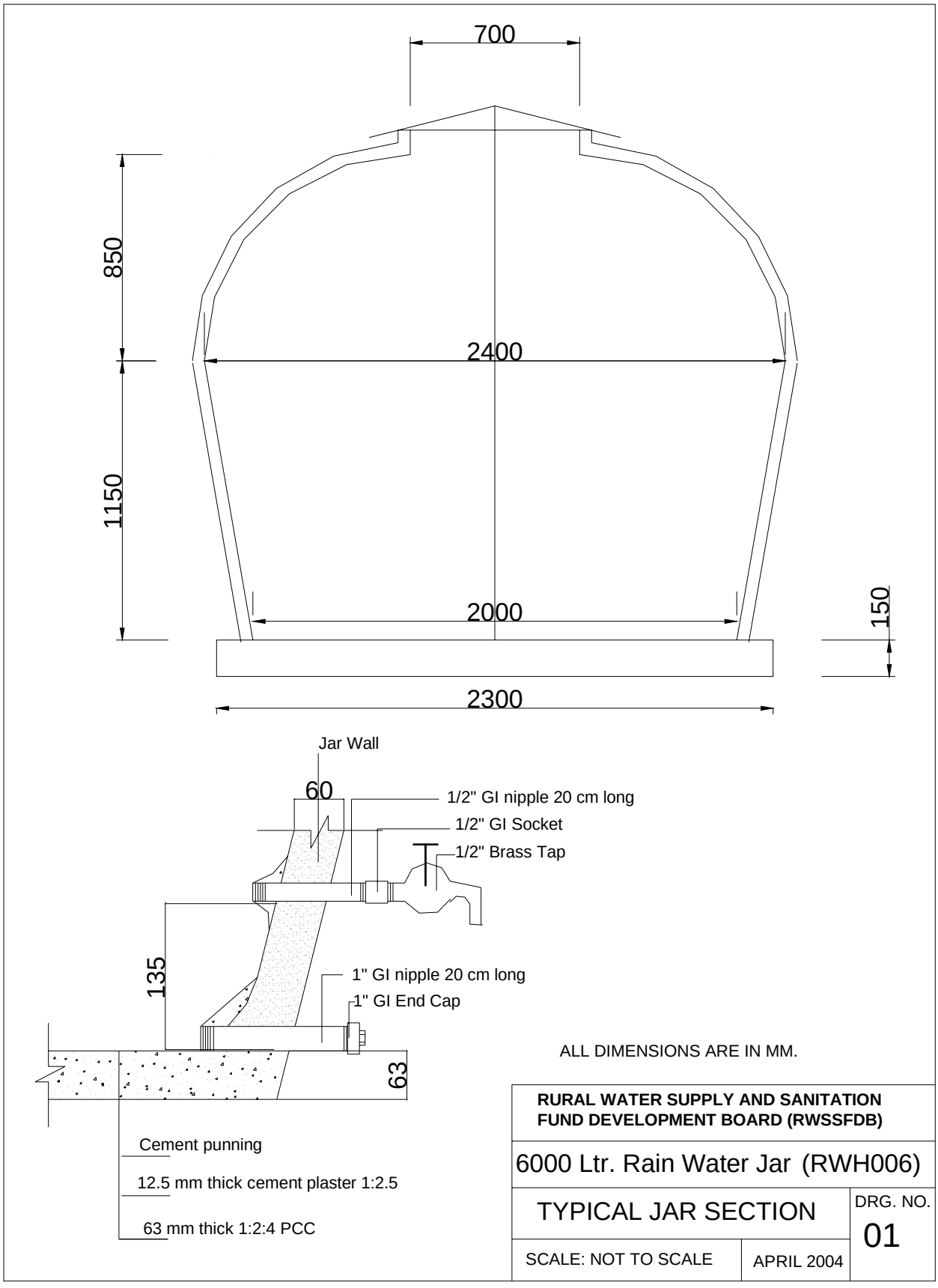
BAR LIST

RIB BARS 1.83 m X 48 pc. = 87.84 m

HOOP BARS

1. L = 2.25 m
2. L = 5.08 m
3. L = 4.60 m
4. L = 3.98 m
5. L = 3.35 m

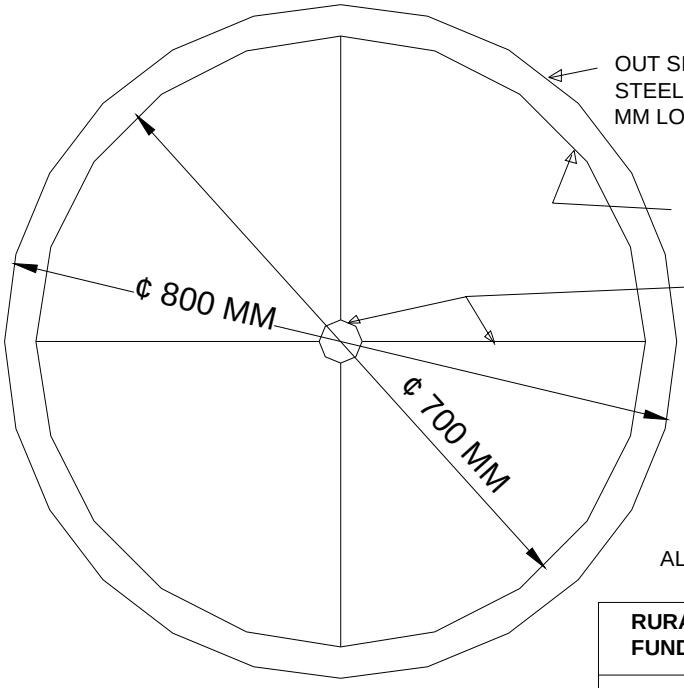
RURAL WATER SUPPLY AND SANITATION FUND DEVELOPMENT BOARD (RWSSFDB)		
2000 Ltr. Rain Water Jar (RWH002)		
DETAILED DIMENSION OF STEEL BARS IN FRAME		DRG. NO. 04
SCALE: NOT TO SCALE	APRIL 2004	



ALL DIMENSIONS ARE IN MM.

RURAL WATER SUPPLY AND SANITATION FUND DEVELOPMENT BOARD (RWSSFDB)		
6000 Ltr. Rain Water Jar (RWH006)		
TYPICAL JAR SECTION		DRG. NO. 01
SCALE: NOT TO SCALE	APRIL 2004	

BOTTOM SLAB DETAIL

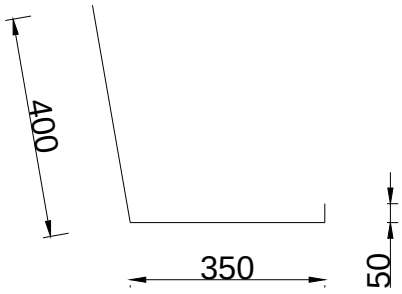


ALL DIMENSIONS ARE IN MM.

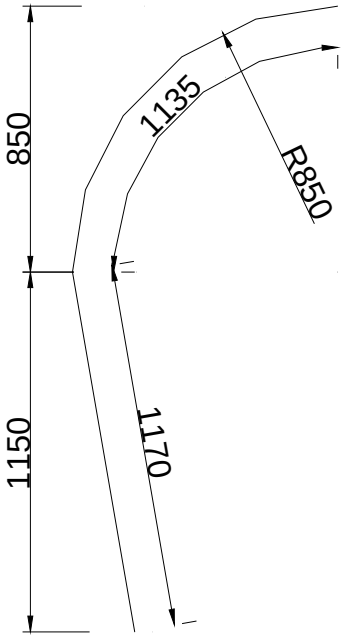
JAR LIP MOULD

RURAL WATER SUPPLY AND SANITATION FUND DEVELOPMENT BOARD (RWSSFDB)		
6000 Ltr. Rain Water Jar (RWH006)		
BASE AND LIP MOULD		DRG. NO. 02
SCALE: NOT TO SCALE	APRIL 2004	

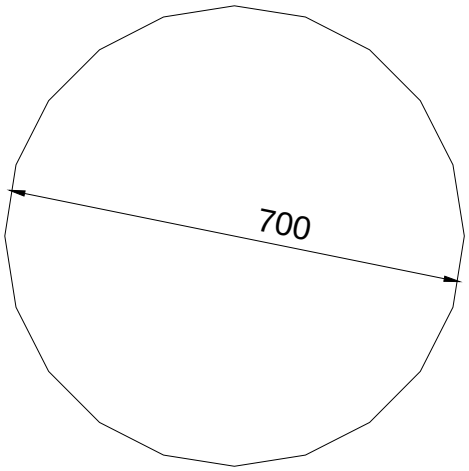
REINFORCEMENT DETAILS



BAR -1 (800 MM LONG @380 MM C/C)



BAR -2 (2400 MM LONG @380 MM C/C)



BAR -3 (2500 MM LONG)

BAR NO. 1, 2 AND 3 ARE 8 MM¢ TOR STEEL

OTHER REINFORCEMENTS:

1. 10 SWG GI WIRE @ 50 MM C/C UP TO INCLINED PORTION (i.e. 1.15 m.)
2. 10 SWG GI WIRE @ 80 MM C/C ON DOME PORTION
3. CHICKEN WIRE MESH 22 SWG DOUBLE LAYER FOR WALL PORTION
4. CHICKEN WIRE MESH 22 SWG SINGLE LAYER ON DOME PORTION

ALL DIMENSIONS ARE IN MM.

RURAL WATER SUPPLY AND SANITATION FUND DEVELOPMENT BOARD (RWSSFDB)		
6000 Ltr. Rain Water Jar (RWH006)		
REINFORCEMENT DETAIL		DRG. NO. 03
SCALE: NOT TO SCALE	APRIL 2004	