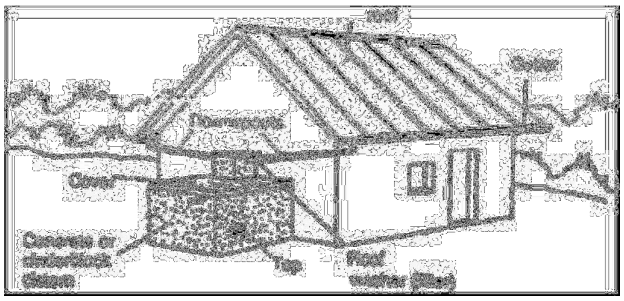
ROOF WATER HARVESTING

Rain water harvesting is the accumulating and storing of rainwater for reuse before it reaches the aquifer. It has been used to provide drinking water, water for livestock, water for irrigation, as well as other typical uses. The method of rain water harvesting has been into practice since ancient times. It is as far the best possible way to conserve water and awaken the society towards the importance of water. The method is simple and cost effective too. It is especially beneficial in the areas, which faces the scarcity of water.



During the monsoons, lots of water goes waste into the gutters. And this is when Rain water Harvesting proves to be the most effective way to conserve water. We can collect the rain water into the tanks and prevent it from flowing into drains and being wasted. It is practiced on a large scale in metropolitan cities. Rain water harvesting comprises of storage of water and water recharging through the technical process. Communities in the face of adversity have revived or created new water harvesting systems. They have made check dams, johads, and other structures to harvest every drop of drain. Some of them have even harvested rooftop runoffs. In many places these efforts have withstood the effects of recurring drought.

Rainwater harvesting from rooftop catchments

Rooftop Rain Water Harvesting is the technique through which rain water is captured from the roof catchments and stored in reservoirs. Harvested rain water can be stored in sub-surface ground water reservoir by adopting artificial recharge techniques to meet the household needs through storage in tanks. The main objective of rooftop rain water harvesting is to make water available for future use. Capturing and storing rain water for use is particularly important in dry land, hilly, urban and coastal areas. Rainwater harvesting usually involves collecting water from cleaner surfaces, such as roofs. There are several reasons for harvesting rainwater today including: low-cost irrigation, domestic water supply, water and soil conservation, aquifer recharge, and flood control. It is also desirable to use rain because of the high quality and softness of the water and the relative absence of contaminates such as disinfection byproducts (chlorinated hydrocarbons), endocrine disrupting compounds (antibiotics and hormones), heavy metals, agricultural chemicals and chlorine resistant microbes that are increasingly appearing in our ground and tap water. Rainwater collection systems are cost effective and easy to maintain by the average homeowner and are easier to install and use than wells or surface ponds.

Technical Description

A rainwater harvesting system consists of three basic elements: a collection area, a conveyance system, and storage facilities. The collection area in most cases is the roof

of a house or a building. The effective roof area and the material used in constructing the roof influence the efficiency of collection and the water quality.

A conveyance system usually consists of gutters or pipes that deliver rainwater falling on the rooftop to cisterns or other storage vessels. Both drainpipes and roof surfaces should be constructed of chemically inert materials such as wood, plastic, aluminum, or fiberglass, in order to avoid adverse effects on water quality.

The water ultimately is stored in a storage tank or cistern, which should also be constructed of an inert material. Reinforced concrete, fiberglass, or stainless steel are suitable materials. Storage tanks may be constructed as part of the building, or may be built as a separate unit located some distance away from the building.

A rainwater harvesting system comprises components of various stages - transporting rainwater through pipes or drains, filtration, and storage in tanks for reuse or recharge. The common components of a rainwater harvesting system involved in these stages are illustrated here.

1. **Catchments:** The catchment of a water harvesting system is the surface which directly receives the rainfall and provides water to the system. It can be a paved area like a terrace or courtyard of a building, or an unpaved area like a lawn or open ground. A roof made of reinforced cement concrete (RCC), galvanised iron or corrugated sheets can also be used for water harvesting.
2. **Coarse mesh** at the roof to prevent the passage of debris
3. **Gutters:** Channels all around the edge of a sloping roof to collect and transport rainwater to the storage tank. Gutters can be semi-circular or rectangular and could be made using:

- Locally available material such as plain galvanised iron sheet (20 to 22 gauge), folded to required shapes.
- Semi-circular gutters of PVC material can be readily prepared by cutting those pipes into two equal semi-circular channels.
- Bamboo or betel trunks cut vertically in half.

The size of the gutter should be according to the flow during the highest intensity rain. It is advisable to make them 10 to 15 per cent oversize.

Gutters need to be supported so they do not sag or fall off when loaded with water. The way in which gutters are fixed depends on the construction of the house; it is possible to fix iron or timber brackets into the walls, but for houses having wider eaves, some method of attachment to the rafters is necessary.

4. **Conduits:** Conduits are pipelines or drains that carry rainwater from the catchment or rooftop area to the harvesting system. Conduits can be of any material like polyvinyl chloride (PVC) or galvanized iron (GI), materials that are commonly available.
5. **First-flushing:** A first flush device is a valve that ensures that runoff from the first spell of rain is flushed out and does not enter the system. This needs to

be done since the first spell of rain carries a relatively larger amount of pollutants from the air and catchment surface

6. **Filter:** The filter is used to remove suspended pollutants from rainwater collected over roof. A filter unit is a chamber filled with filtering media such as fibre, coarse sand and gravel layers to remove debris and dirt from water before it enters the storage tank or recharge structure. Charcoal can be added for additional filtration.
   i) **Charcoal water filter:** A simple charcoal filter can be made in a drum or an earthen pot. The filter is made of gravel, sand and charcoal, all of which are easily available.
   ii) **Sand filters:** Sand filters have commonly available sand as filter media. Sand filters are easy and inexpensive to construct. These filters can be employed for treatment of water to effectively remove turbidity (suspended particles like silt and clay), colour and microorganisms.

   In a simple sand filter that can be constructed domestically, the top layer comprises coarse sand followed by a 5-10 mm layer of gravel followed by another 5-25 cm layer of gravel and boulders.
7. **Storage facility:** There are various options available for the construction of these tanks with respect to the shape, size and the material of construction. **Shape:** Cylindrical, rectangular and square.

   Material of construction: Reinforced cement concrete, (RCC), ferro cement, masonry, plastic (polyethylene) or metal (galvanised iron) sheets are commonly used.

   Position of tank: Depending on space availability these tanks could be constructed above ground, partly underground or fully underground. Some maintenance measures like cleaning and disinfection are required to ensure the quality of water stored in the container.
8. **Maintenance**
   - Before collecting water the roof, gutters and tank should be cleaned
   - Let the first 2-3 rains flow out through the first flush system
   - Remember to clean the tank once in a year
   - Replace the filtering agents every year
   - Keep the tank and surroundings clean and hygienic
   - Apply white cement on the tank every year
   - Make sure that sunlight does not pass through the manhole to prevent algae growth
   - Remember to preserve water and use it judiciously

Advantages

- Rainwater harvesting provides a source of water at the point where it is needed. It is owner operated and managed.

- It provides an essential reserve in times of emergency and/or breakdown of public water supply systems, particularly during natural disasters.
- The construction of a rooftop rainwater catchment system is simple, and local people can easily be trained to build one, minimizing its cost.
- The technology is flexible. The systems can be built to meet almost any requirements. Poor households can start with a single small tank and add more when they can afford them.
- It can improve the engineering of building foundations when cisterns are built as part of the substructure of the buildings, as in the case of mandatory cisterns.
- The physical and chemical properties of rainwater may be superior to those of groundwater or surface waters that may have been subjected to pollution, sometimes from unknown sources.
- Running costs are low.
- Construction, operation, and maintenance are not labor-intensive.

ESTIMATE FOR FERRO CEMENT WATER TANK, Capacity – 1,00,000 Litres

No.	Description of Works	Qty	Unit	Rate	Amount
1	Clearing the Tank Site	93.2449	C.um	2.25	209.80
2	Excavation in hard soil for foundation	55.4711	C.um	211.50	11732.14
3	RCC 1:4:8 using 20 mm broken stone below base slab	3.6725	C.um	5007.68	18390.90
4	Steel reinforcement for floor concrete and pillar	4.4877	Qtl	6057.48	27183.90
5	Floor concreting in R.C.C. 1:11/2:3 using 20 mm broken stone including form work and excluding reinforcement	6.5948	C.um	6783.64	44737.08
6	R.C.C. 1:11/2:3 using 20 mm broken stone for central pillar with formwork but excluding reinforcement	0.1052	C.um	12179.63	1281.83
7	Making steel cage for wall dome and filter chamber with 8 mm & 6 mm bars including supply of material and labour	4.1535	Qtl	9357.48	38866.35
8	Supply and winding with 1 layer of 10 gauge, 50 mm x 50 mm welded mesh over the steel cage including material and labour	60.3087	Sq.m	246.55	14869.12
9	Supplying and winding with three layers of 24 guage, 12.5 x 12.5 mm Gl chicken mesh around the cylindrical steel cage, including material and labour	63.2535	Sq.m	173.10	10949.17
10	Supplying and winding with two	53.1674	Sq.m	150.60	8007.01

	layers of 24 guage, 12.5 x 12.5 mm Gl chicken mesh for dome and filer chamber including material and labour				
11	Plastering with C M 1:2.5, 24 mm thick each on both sides of tank wall applied in layers and finished smooth with cement flushing coat including material and labour	106.017	Sq.m	398.61	42260.21
12	Plastering with CM 1:3, 15 mm thick each on both sides of dome and filter chamber applied in layers and finished smooth with cement flushing coast including material and labour	105.047	Sq.m	230.11	24172.71
13	Plastering tank floor by applying one coat of neat cement slurry and then with CM 1:3, 15 mm thick, mixed with water proofing compound and finished with cement flushing coat.	50.1729	Sq.m	246.08	12346.55
14	Cement washing 2 coats	105.532	Sq.m	44.40	1171.11
15	Providing roof water collection and conveyance system, filter, material, first flush and drainage system including material and labour	LS			15000.00
16	Supplying and erecting of 1 HP Pump, OH tank and pumping main including materials, electrification and labour	LS			20000.00
17	Scaffolding, Water, Cleaning, Writing etc.	LS			4983.00
	Sub Total				**296161**
	Design Estimate and implementation charges @2.5%				7404
	Total				**303565**
	Service tax @ 12.36% of labour part				11256
	KVAT @ 4%				12143
	KWWE @ 4%				3036
	Total				**330000**

Note : Quantities have been rounded off to four digits. Amount is arrived by computer by multiplying the actual quantity (without rounding of) with rate and hence a slight difference may be observed if the rounded of quality is used for multiplication