RWH System Components

C-WAS
Center for Water and Sanitation

CEPT UNIVERSITY

RWH System Components

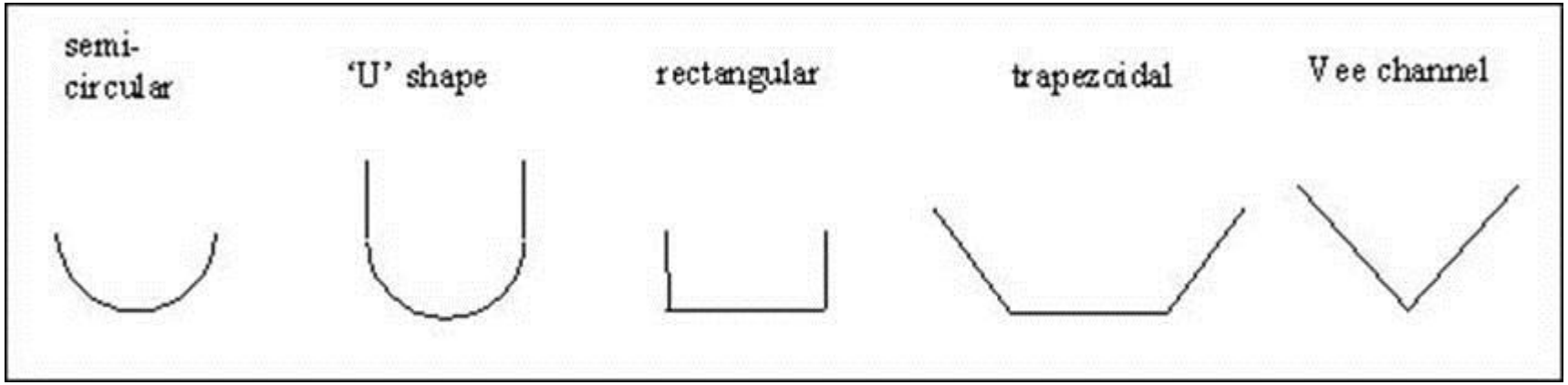
Catchment Area/Roof:

- The catchment of a water harvesting system is the surface which directly receives the rainfall and provides water to the system.
- 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.
- Coarse mesh at the roof to prevent the passage of debris.

RWH System Components

Conveyance systems Gutters:

- Channels all around the edge of a sloping roof to collect and transport rainwater to the storage tank.
- Shape of Gutters:



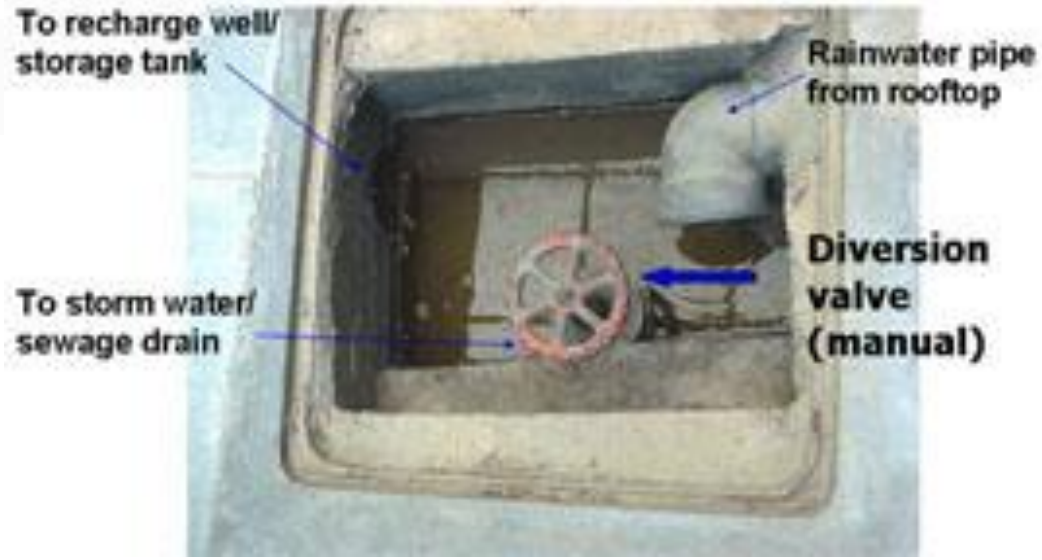
- The size of the gutter should be according to the flow during the highest intensity rain. It is advisable to make them 10 to 15 per cent oversize.

- Gutters need to be supported so they do not sag or fall off when loaded with water.

RWH System Components

First flush:

- 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.



Source: http://cseindia.org/node/1147#catchment

RWH System Components

Filters:

- Filters are 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.

Selection of a filter depends on followings:

1. Type of catchment
2. Amount of silt load
3. Quality of runoff
4. Purpose of storage
5. Type of recharge structure

Source: http://cseindia.org/node/1147#catchment

RWH System Components

Storage system

- Generally, Two basic types of storage system:
  - Underground tank or storage vessel
  - Ground tank or storage vessel
- A variety of materials and different shapes of the vessels available for the storage of rainwater
- The choice of the system will depend on several technical and economic considerations like, space availability, materials and skill available, costs of buying a new tank or construction on site, ground conditions, local traditions for water storage etc.

Design of Storage Tank

The volume of the storage tank can be determined by the following factors:

- Number of persons in the household
- Per capita water requirement
- Average annual rainfall
- Period of water scarcity
- Type and size of the catchment

Dry season demand versus supply approach

In this approach there are three options for determining the volume of storage:

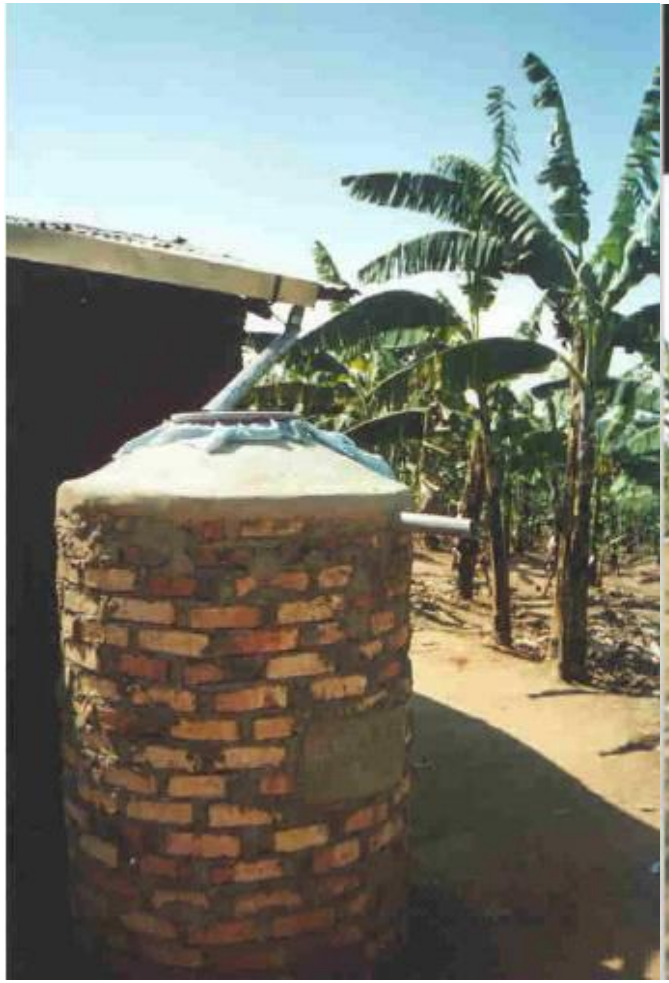
- Matching the capacity of the tank to the area of the roof
- Matching the capacity of the tank to the quantity of water required by its users
- Choosing a tank size that is appropriate in terms of costs, resources and construction methods

Type of storage system

Source: http://www.sswm.info/category/implementation-tools/water-sources/hardware/precipitation-harvesting/rainwater-harvesting-u

Type of storage system

RWH Brick Jars - Uganda

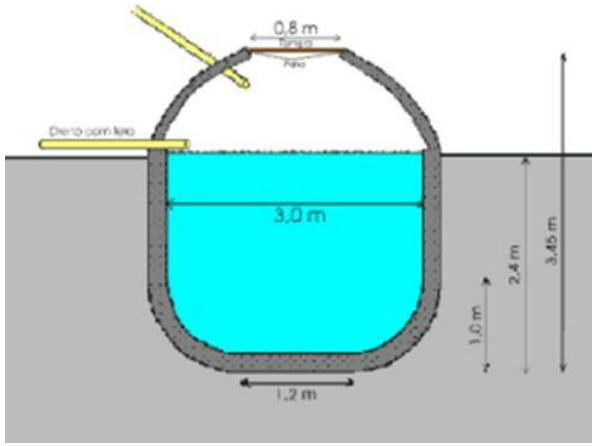


Source: Rees and Whitehead (2000), DTU, University of Warwick, UK

Ferro-cement jar for rainwater collection - Uganda

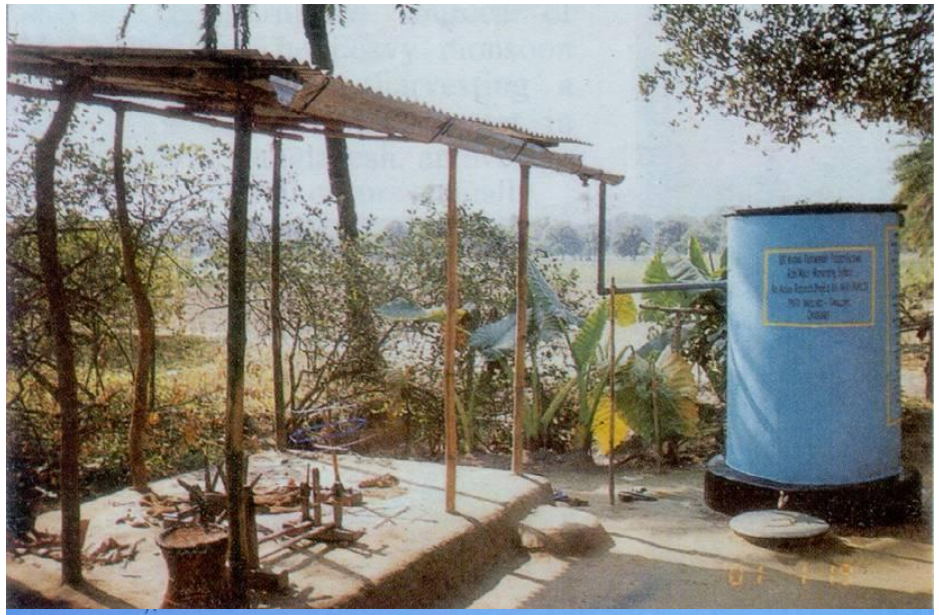
Source: DTU, University of Warwick (September 2000)

Underground lime and bricks cistern



Source: Course on Rainwater harvesting, Unesco-IHE

Type of storage system



Polyethylene Tank

A wooden water tank in Hawaii, USA

Design considerations for Rooftop catchment systems

- The material of the catchment surfaces must be non-toxic and not contain substances which impair water quality.
- Roof surfaces should be smooth, hard and dense since they are easy to clean and are less likely to be damaged and shed materials into water
- Precautions are required to prevent the entry of contaminants into the storage tanks.

  - No overhanging tree should be left near the roof
  - The nesting of the birds on the roof should be prevented
  -A first flush bypass such as detachable downpipe should be installed
- All gutter ends should be fitted with a wire mesh screen to keep out leaves, etc.
- The storage tank should have a tight-fitting roof that excludes light, a manhole cover and a flushing pipe at the base of the tank.
- The design of the tank should allow for thorough scrubbing of the inner walls and floor or tank bottom. A sloped bottom and a provision of a sump and a drain are useful for collection and discharge of settled grit and sediment.
- Taps/faucets should be installed at 10 cm above the base of the tank as this allows any debris entering the tank to settle on the bottom where it remains undisturbed, will not affect the quality of water.

How much water we can harvest from One roof in Bhuj

Illustration:

For a building with a flat roof of size 5 m x 8 m in Bhuj

Average annual rainfall of Bhuj is 330 mm

- Roof Area (A) = 5 x 8 = 40 m^2
- Average annual rainfall (R) = 400 mm = 0.33 m
- Total annual volume of rainfall over the roof = A * R

  = 40 m^2 x 0.33 m

  = 13.2 m^3 = 13,200 litres
- If 70% of the total rainfall is effectively harvested,

  Volume of water harvested = 13,200 x 0.7

  = 9240 litres
- Average water availability = 9240 / 365 ~ 25 litres/ day

How much water we can harvest from One roof in Bhuj

Roof Area in Sqmt	Water can be harvested (Liters/day)	Roof Area in Sqmt	Water can be harvested (Liters/day)
10	6	70	44
15	9	80	51
20	13	90	57
25	16	100	63
30	19	125	79
35	22	150	95
40	25	175	111
45	28	200	127
50	32	250	158
60	38	300	190

How much storage required for Rain Water Harvest ?

Catchment Area (m2)

X

Amount of rainfall (mm)

=

Volume of water received (Litres)

Calculation Example:

Terrace area: 60 sq.m.

Average annual rainfall: 800mm (0.300m)

Water harvesting potential: Terrace area x Avg. Annual Rainfall

= 60 X 0.300 = 18 cu m (18,000 litres)

For a runoff coefficient of 0.7 for roof surface; Harvestable Rainwater = 12,600 litres annually

Drinking water requirement of a family

Family members: 5

Water required/person/day: 5 litres ; Number of days in a year: 365

Total water required = 5 X 5X 365= 9,125 litres

Add 25% for additional = 11,000 litres annually consumption

Source-A people's manual on RWH, Janhit foundation

Excess of 1600 litres harvested rainwater can be recharged into the ground through wells and tube/bore wells

Maintenance requirement

Annually:

- Keep all catchments neat and clean
- Drain and clean storage tanks thoroughly before every monsoon
- Change the filter media every year
- Remove algae from the roof tiles and asbestos sheets before the monsoon
- Repair cracks in ferrocement tanks

Regular maintenance:

- Clean open drains /conveyance system and gutters regularly by removing deposits of sand and gravel

Precautions:

- Don't allow contaminated water to flow into system
- Put iron/nylon mesh/fine cloth on inlet and outlet pipes and chambers to prevent solid debris from getting into the system
- Make available a layer of soil beneath the recharge structure to ensure natural filtration
- Do not let water stagnate in the collection chamber since this will slow down the recharge of water