

COLLECTION OF RAIN WATER ON ROOF TOP FOR RAIN WATER HARVESTING

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ABSTRACT-Rainwater 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 given to water. Rainwater collected from the roofs of houses, tents and local institutions, can make an important contribution to the availability of drinking water. Water collected from the ground, sometimes from areas which are especially prepared for this purpose, is called Storm water harvesting . In some cases, rainwater may be the only available, or economical, water source. Rainwater harvesting systems can be simple to construct from inexpensive local materials, and are potentially successful in most habitable locations. Roof rainwater can be of good quality and may not require treatment before consumption. Although some rooftop materials may produce rainwater that is harmful to human health, it can be useful in flushing toilets, washing clothes, watering the garden and washing cars; these uses alone halve the amount of water used by a typical home.

INDEX TERM- catchment area , filtration, storage of rainwater, pipes, bottom tanks

INTRODUCTION

Rainwater harvesting is a technology used to collect, convey and store rain for later use from relatively clean surfaces such as a roof, land surface or rock catchment. The water is generally stored in a rainwater tank or directed to recharge groundwater. Rainwater infiltration is another aspect of rainwater harvesting playing an important role in storm water management and in the replenishment of the groundwater levels. Rainwater harvesting has been practiced for over 4,000 years throughout the world, traditionally in arid and semi-arid areas, and has provided drinking water, domestic water and water for livestock and small irrigation. Today, rainwater harvesting has gained much on significance as a modern, water-saving and simple technology. The practice of collecting rainwater from rainfall events can be classified into two broad categories: land-based and roof-based. Land-based rainwater harvesting occurs when runoff from land surfaces is collected in furrow dikes, ponds, tanks and reservoirs. Roof-based rainwater harvesting refers to collecting rainwater runoff from roof surfaces which usually provides a much cleaner source of water that can be also used for drinking.

APPLICATION AREAS

Rainwater harvesting systems can be installed in both new and existing buildings and harvested rainwater used for different applications that do not require drinking water quality such as toilet flushing, garden watering, irrigation, cleaning and laundry washing. Harvested rainwater is also used in many parts of the world as a drinking water source. As rainwater is very soft there is also less consumption of washing and cleaning powder. With rainwater harvesting, the savings in potable water could amount up to 50% of the total household consumption.

CRITERIA FOR SELECTION OF RAINWATER HARVESTING TECHNOLOGIES

Several factors should be considered when selecting rainwater harvesting systems for domestic use:

- Type and size of catchment area
- Local rainfall data and weather patterns
- Length of the drought period
- Alternative water sources
- Cost of the rainwater harvesting system.
- When rainwater harvesting is mainly considered for irrigation, several factors should be taken into consideration. These include:

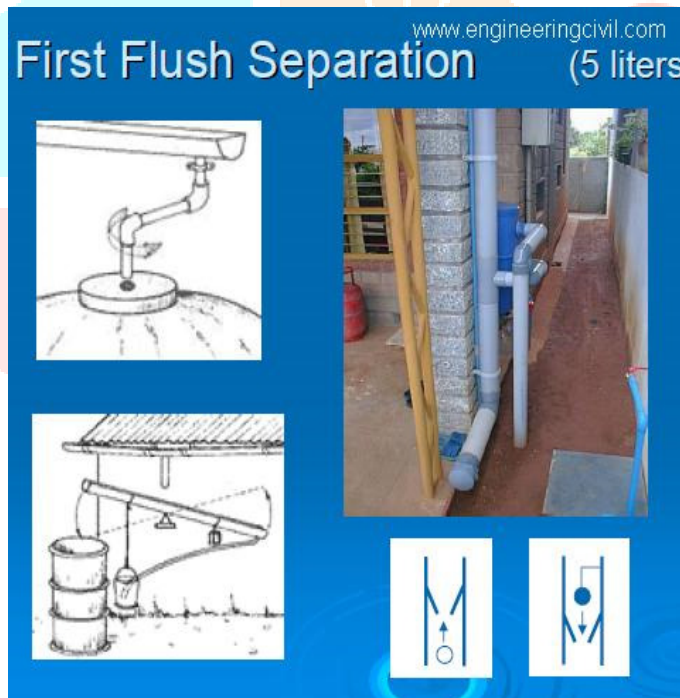
- Rainfall amounts, intensities, and evapo-transpiration rates .
- Soil infiltration rate, water holding capacity, fertility and depth of soil .
- Crop characteristics such as water requirement and length of growing period .
- Hydrogeology of the site .

OBJECTIVES

- To meet the increasing demand of water.
- To Control Wastage of Rain Water.
- To avoid the flooding of roads.
- To make the Unit Independent for Water Consumption.

BENEFITS OF RAINWATER HARVESTING

- Rainwater is a relatively clean and free source of water .
- Rainwater harvesting provides a source of water at the point where it is needed .
- It is socially acceptable and environmentally responsible .
- It promotes self-sufficiency and conserves water resources .
- Rainwater is friendly to landscape plants and gardens .
- It reduces storm water runoff and non-point source pollution .



- It uses simple, flexible technologies that are easy to maintain .
- Offers potential cost savings especially with rising water costs .
- Provides safe water for human consumption after proper treatment .
- Low running costs

PONENTS OF ROOFTOP SYSTEM

Fig-: Component of roof top system

CATCHMENT

The surface that receives rainfall directly is the catchment of rainwater harvesting system. It may be terrace, courtyard, or paved or unpaved open ground. The terrace may be flat RCC/stone roof or sloping roof. Therefore the catchment is the area, which actually contributes rainwater to the harvesting system.

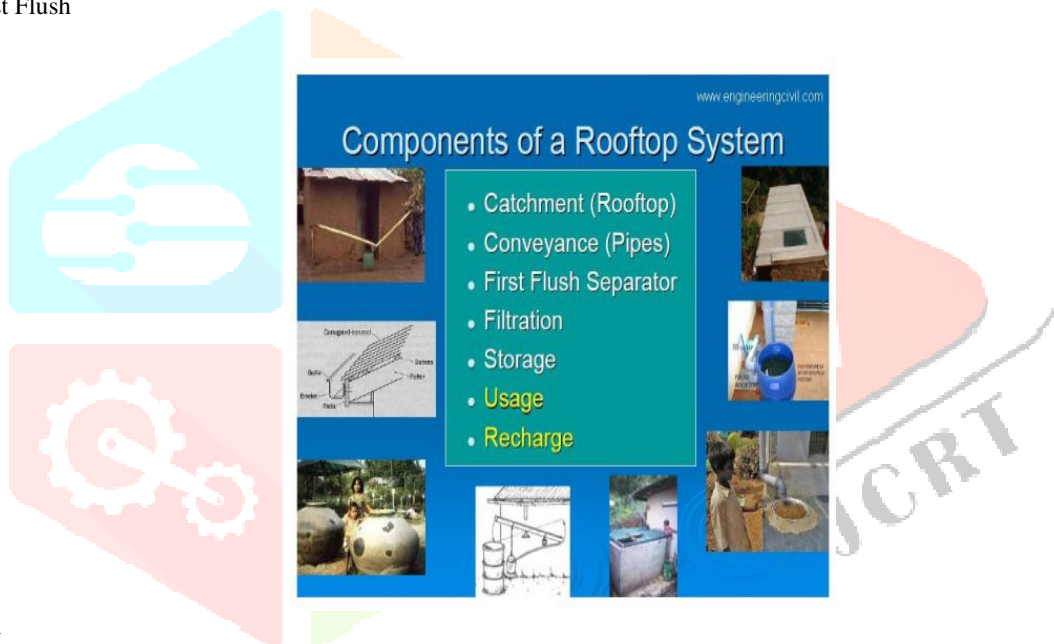
CONVEYANCE (PIPE)

Rainwater from rooftop should be carried through down take water pipes or drains to storage/harvesting system. Water pipes should be UV resistant (ISI HDPE/PVC pipes) of required capacity. Water from sloping roofs could be caught through gutters and down take pipe. At terraces, mouth of the each drain should have wire mesh to restrict floating material.

FIRST FLUSH

First flush is a device used to flush off the water received in first shower. The first shower of rains needs to be flushed-off to avoid contaminating storable rechargeable water by the probable contaminants of the atmosphere and the catchment roof. It will also help in cleaning of silt and other material deposited on roof during dry seasons Provisions of first rain separator should be made at outlet of each drainpipe.

Fig:- First Flush



FILTER

Filters are used for treatment of water to effectively remove turbidity, colour and microorganisms. After first flushing of rainfall, water should pass through filters or directly stored in tank and filter before use. A gravel, sand and 'netlon' mesh , Pressure filter is designed and placed on top of the storage tank or near the tank depending upon the use.

Pressure Sand Filter

Pressure sand filter consists of a pressure vessel-this could be either vertical or horizontal-fitted with a set of frontal pipe work and valves, graded silica quartz sand supported by layers of graded under bed consisting of pebbles and gravels, a top distributor to distribute the incoming water uniformly throughout the cross section of the filter, and an under drain system to collect filtered water.

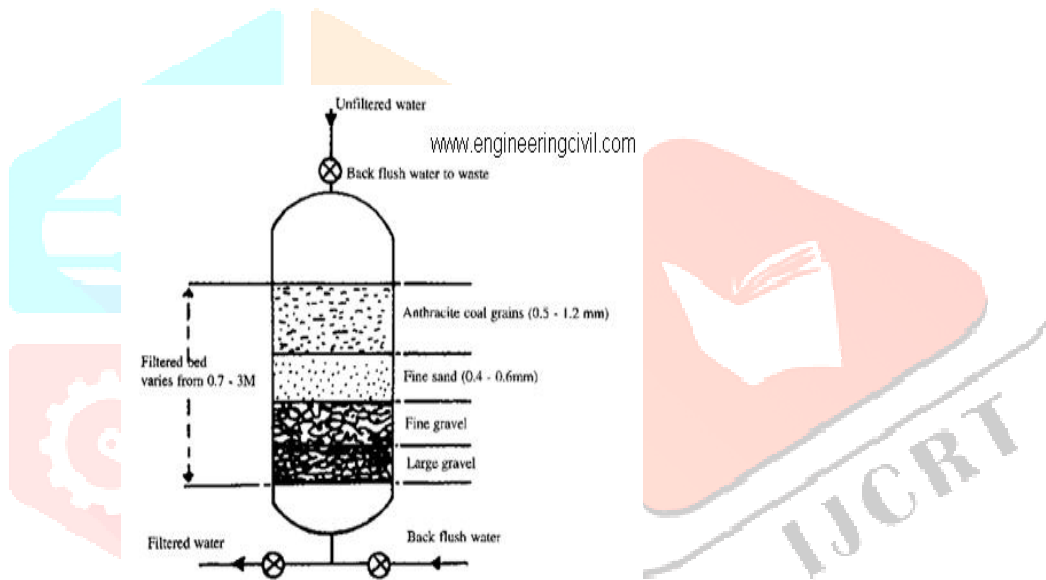
Raw water flows down wards through the filter bed and as the suspended matter- which has usually been treated by addition of a coagulant like alum- is retained on the sand surface and between the sand grains immediately below the surface. There is steady rise in the loss of head as the filter process continues and the flow reduces once the pressure drop across the filter is excessive.

- Technology: Mechanical filtration
- Material: Stainless steel

STORAGE

It is used to store the water that is collected from the roof through filter. For small scale water storage plastic buckets, jerry cans, clay or cement jars, ceramic jars, drums may be used. For larger quantities of water, the system will require a bigger tank with cylindrical or rectangular or square in shape constructed with Ferro cement or cement rings or plain cement concrete or reinforced cement concrete or brick or stone etc. The storage tank is provided with a cover on the top to avoid the contamination of water from external sources. The storage tank is provided with pipe fixtures at appropriate places to draw the water to clean the tank & to dispose of extra water.

RAINWATER USE



- Intermittent – in situations with one long rainy season when all water demands are met by rainwater. During the dry season, water is collected from other sources.
- Occasional – water is stored for only a few days in a small container. This is suitable when there is a uniform rainfall pattern with very few days without rain and when a reliable alternative water source is available.
- Partial – rainwater is used throughout the year but the ‘harvest’ is not sufficient for all domestic demands. For example, rainwater is used for drinking and cooking, while for other domestic uses (e.g. bathing and laundry) water from other sources is used.
- Full – for the whole year, all water for all domestic purposes comes from rainwater. In such cases, there is usually no alternative water source other than rainwater, and the available water should be well managed, with enough storage to bridge the dry period.

SUSTAINABILITY

Rainwater harvesting is one of the most promising alternatives for supplying water in the face of increasing water scarcity and escalating demand. The pressure on water supplies, increased environmental impact from large projects and deteriorating water quality, constrain the ability to meet the demand for freshwater from traditional sources. Rainwater harvesting presents an opportunity for the augmentation of water supplies allowing at the same time for self-reliance and sustainability.

ECONOMIC EFFICIENCY

Valid data on the economic efficiency of rainwater harvesting systems is not possible. Dependent on the regional conditions (water and wastewater prices, available subsidies), the amortization period may vary between 10 and 20 years. However, it should be taken into consideration that for the major investment (storage and pipe work) a period of use of several decades is expected.

COSTS The associated costs of a rainwater harvesting system are for installation, operation and maintenance. Of the costs for installation, the storage tank represents the largest investment which can vary between 30 and 45% of the total cost of the system dependent on system size. A pump, a pressure controller and fittings in addition to plumber's labor represent other major costs of the investment.

WATER TREATMENT AND SAFE STORAGE

- Boiling, thermal microbial deactivation.
- Solar Water Disinfection (SODIS), UV radiation microbial deactivation.
- Safe Water System, sodium hypochlorite disinfection combined with safe water storage
- NaDCC (sodium dichloroisocyanurate) dosing, chlorine disinfection.
- Ceramic filters, filter usually impregnated with silver for its bactericide and viricide properties.
- Biosand filters, mechanical and biological filtration through a sand bed.
- Flocculation and disinfection systems, particle removal through flocculation Combined with disinfection.

CONCLUSION

The contour maps obtained from contour survey shows that the slope of the ground is towards the NE of the WaghGuruji School, hence collection and storage tank can be provided in NE zone. The rooftop water collection can be used to fulfil the daily drinking demand. By installing given rain water harvesting system every year huge amount of water will be saved and huge expenditures on procurement of water will be reduced.

The huge amount of precipitation occurring on the ground can be harvested and utilized for different purposes, if proper collection system is provided. As so many parts of the world facing the problems of water crises, one must understand the importance of water, and should make optimum use of water and adopt efficient methods of collecting and saving the rainwater. The procedure adopted in this study is proven to be costly as per the cost analysis, very easy as per methodology and very efficient as per the discharge calculated.

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