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Rain Water Harvesting Needs & Uses

AkhileshwariAnant, BhumikaSahu, PoojaAgrawal, PoonamSinha, Bhumika Das

U.G. Students, Department of Civil Engineering,Central College of Engineering and Management,Kabir Nagar Raipur (C.G.) India

Assistant Professor, Department of Civil Engineering,Central College of Engineering and Management,Kabir Nagar Raipur (C.G.) India

ABSTRACT: Till about thirty years back, the areas around our homes and offices used to be unpaved and the rain falling on these areas would percolate into the soil and remain there for being drawn through shallow open wells. With the proliferation of flat complexes, not only have these areas been paved and percolation of rainwater into the soil almost totally stopped, the quantity of water drawn from the soil below has increased manifold. Consequently open wells and not - so - deep bore wells started drying up. The reason is that no sincere attempt is made to replenish the ground water table with rainwater during the monsoon. The Rainwater harvesting is the simple collection or storing of water through scientific techniques from the areas where the rain falls. It involves utilization of rain water for the domestic or the agricultural purpose. 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. People usually make complaints about the lack 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.

KEYWORDS: Rainwater harvesting, unpaved, percolation drains.

I. INTRODUCTION

Millions of people throughout the world do not have access to clean water for domestic purposes. In many parts of the world conventional piped water is either absent, unreliable or too expensive. One of the biggest challenges of the 21st century is to overcome the growing water shortage. Rainwater harvesting (RWH) has thus regained its importance as a valuable alternative or supplementary water resource, along with more conventional water supply technologies. Much actual or potential water shortages can be relieved if rainwater harvesting is practised more widely. Rainwater harvesting is a simple low-cost technique that requires minimum specific expertise or knowledge and offers many benefits. Collected rainwater can supplement other water sources when they become scarce or are of low quality like brackish groundwater or polluted surface water in the rainy season. It also provides a good alternative and replacement in times of drought or when the water table drops and wells go dry. One should, however, realise that rainfall itself cannot be managed. Particularly in arid or semi-arid areas, the prevailing climatic conditions make it of crucial importance to use the limited amount of rainfall as efficiently as possible. The collected rainwater is a valuable supplement that would otherwise be lost by surface run-off or evaporation. During the past decade, RWH has been actively reintroduced by local organisations as an option for increasing access to water in currently underserved areas (rural or urban). Unfortunately decision-makers, planners, engineers and builders often overlook this action. The reason that RWH is rarely considered is often simply due to lack of information on feasibility both technical and otherwise.

During the past decade the technology has, however, quickly regained popularity as users realise the benefits of a relatively clean, reliable and affordable water source at home. In many areas RWH has now been introduced as part of an integrated water supply, where the town water supply is unreliable, or where local water sources dry up for a part of the year. But RWH can also be introduced as the sole water source for communities or households. The technology is flexible and adaptable to a very wide variety of conditions. It strives to give practical guidance for households, CBOs, NGOs, local government staff and extension workers in designing and applying the right systems, methods and techniques for harvesting rainwater on a small scale (varying from 500 – 60,000 litres). It explains the principles and components of a rooftop rainwater system for collecting and storing rainwater.

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II. NEED FOR RAINWATER HARVESTING

A) Need for rainwater harvesting

Due to pollution of both groundwater and surface waters, and the overall increased demand for water resources due to population growth, many communities all over the world are approaching the limits of their traditional water resources. Therefore they have to turn to alternative or 'new' resources like rainwater harvesting (RWH).

B)Reasons for rainwater harvesting

The reasons for collecting and using rainwater for domestic use are plentiful and varied:

a) Increasing water needs/demands
b) Variations in water availability
c) Advantage of collection and storage near the place of use
d) Quality of water supplies

C) Advantages and disadvantages

When considering the possibility of using rainwater catchment systems for domestic supply, it is important to consider both the advantages and disadvantages and to compare these with other available options. RWH is a popular household option as the water source is close by, convenient and requires a minimum of energy to collect.

III. SCIENCE OF WATER HARVESTING

In scientific terms, water harvesting refers to collection and storage of rainwater and also other activities aimed at harvesting surface and groundwater, prevention of losses through evaporation and seepage.

IV. BASIC PRINCIPLES OF RAIN WATER HARVESTING

A) Definition

Water harvesting in its broadest sense can be defined as the collection of run-off rainwater for domestic water supply, agriculture and environmental management. Water harvesting systems, which harvest runoff from roofs or ground surfaces fall under the term rainwater harvesting.

B) Basic principles of rainwater harvesting

a) Catchment surface
The catchment of a water harvesting system is the surface that receives rainfall directly and drains the water to the system. Surface water is, however, in most cases not suitable for drinking purposes since the water quality is not good enough.

b) Delivery system
The delivery system from the rooftop catchment usually consists of gutters hanging from the sides of the roof sloping towards a downpipe and tank. This delivery system or guttering is used to transport the rainwater from the roof to the storage reservoir. Rainwater harvesting for domestic usage tank if the gutter and downpipe system is properly fitted and maintained.

C) Storage reservoirs

The water storage tank usually represents the biggest capital investment element of a domestic RWH system. For storing larger quantities of water the system will usually require a tank above or below the ground.

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V. COST OF INSTALLATION

Estimated average cost of installing a Water Harvesting System for:
A) **An individual house** of average area of 300-500 m2, the average cost will be around Rs. 20,000- 25,000.
B) **An apartment building**, the cost will be less since the many people will share the cost. . The cost will be around 60 to 70 thousand.
C)**A colony**, the cost will be much less. For instance, around 36 recharge wells were installed at the cost of 8 lakh, which is around Rs 500-600 per house.
D) **An institution** with campus, the cost was around 4 lac.

VI. WATER QUALITY ASPECT

A) Protecting water quality
In rural areas rainwater is generally unpolluted and pure before reaching the ground. It is also in these areas that rainwater from roof catchments is most commonly used for drinking.

B) Filters
The quality of water can be much improved if debris is kept out of the system. To accomplish this filters and separators can be added to a rainwater harvesting system at the inlet, outlet or both.

C) First-flush
The primary purpose of a first-flush diverter is to take the first flow of rainwater from the roof and divert it away from your storage reservoir.

VII. USAGE AND MAINTAINENCE

THE FOLLOWING TIMETABLE OF MAINTENANCE MANAGEMENT REQUIREMENTS GIVES A BASIS FOR MONITORING CHECKS:

a) During rainy season
b) End of dry season
c) Year round

A) Regular maintenance

a) Roof surfaces and gutters have to be kept free of bird droppings. Gutters and inflow filters must be regularly cleared of leaves and other rubbish.
b) The mosquito screening on the overflow pipe should be checked regularly during the rainy season and renewed if necessary.

B) **Infrequent and annual tasks**
The following annual or infrequent tasks for which technical assistance may be required are important for the maintenance of the RWH system:

a) At the end of the dry season, when the tank is empty, any leaks that have been noticed should be repaired.
b) The roof surface, gutters, supporting brackets and inflow pipes need to be checked and repaired if necessary.

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VIII. DESIGNING A RAIN WATER HARVESTING SYSTEM

The main consideration in designing a rainwater harvesting system is to size the volume of the storage tank correctly.

Five steps to be followed in designing a RWH system:

Step I. Determine the total amount of required and available rainwater

Step II. Design your catchment area

Step III. Design your delivery system

Step IV. Determine the necessary size of your storage reservoir

Step V. Select suitable design of storage reservoir

Gutters must be properly sized and correctly connected around the whole roof area. When high intensity rainfall occurs, gutters need to be fitted with so-called splash guards to prevent overshooting water losses. Splash guards consist of a long strip of sheet metal 30 cm wide, bent at an angle and hung over the edge of the roof about 2-3 cm to ensure all run-off for the roof enters the gutter. The splash guard is connected to the roof and the lower half is hung vertically down from the edge of the roof. During intensive rainfall, large quantities of run-off can be lost due to gutter overflow and spillage if gutters are too small. To avoid overflow during heavy

rains, it makes sense to create a greater gutter capacity. For large roofs, such as on community buildings and schools, the 14 × 14 cm V-shaped design with a cross-sectional area of 98 cm2 is suitable for roof sections up to 50 m long and 8 m wide (400 m2).When gutters are installed with a steeper gradient than 1:100 (1cm vertical drop over 100 cm horizontal distance) and used together with splash guards, V-shaped gutters can cope with heavy rains without large amounts of loss. A gradient of 1:100 ensures steady water flow and less chance of gutter blockage from leaves or other debris. Downpipes, which connect the gutters to the storage reservoir, should have similar dimensions to the gutters.

The following tables give some examples of guttering systems. The guttering requirement for a typical household roof of 60 m2 is shown in table A.

Table A: Examples for guttering systems

Section	Roof size	Slope	Cross sectional area	Gutter sizes
Square	40-100 m2	0.3-0.5%	70 cm2	7 × 10 cm
Rounded	40-60 m2	0.3-0.5%	63 cm2	125 mm bore **[?]**
45° V-shaped	Not specified	1.0%	1) 113 cm2	15 cm on each side

IX. EXPERIMENTAL RESULTS

(a) (b) (c)

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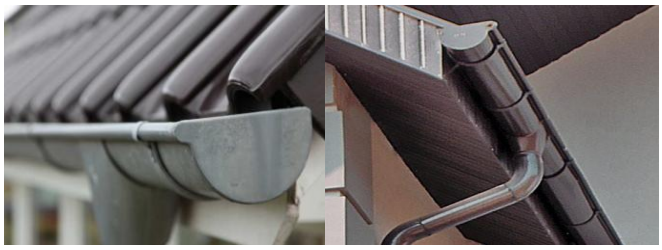
(d) (e)

(a) Rain water Harvesting System (b) Storage of rain water (c) Basic componentsof rain water harvesting(d)Connecting a gutter (e)Connecting a gutter

(a) (b) (c)



(d) (e)

(a) Connecting a gutter (b) Vessel used for small scale waterstorage (c) Vessel used for small scale water storage (d) Type of gutter (e)Type of gutter

(a) (b) (c)

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(d)

(a)Type of gutter (b) Typeof gutter (c) Filter bed (d) Remove debris from gutter regularly

X.CONCLUSION

Rain water is a clean, in expensive and readily available source of water even in desert area substantial amount of rain water are being collected, stored and used for variety of purpose including drinking water. Consider that is very useful process during rainy season and during scarcity of water, by doing this process we can safe water for domestic purpose, drinking purpose and for future use.it is very simple and affordable process. With the decreasing availability of water, rain water harvesting is the best option. After study on rainwater collection, storage and re-use systems, it is our belief that this is a viable and economically sound method for water collection and use. With inevitable upcoming scarcities in this seemingly abundant resource, it is also a sustainable and sensible solution for the future. A rain water collection and storage system is investigated, focusing on water quality at various points: from roof runoff to an underground concrete system. A sand filtration system (designed to improve water quality) is built and then tested. The result is complete removal of suspended solid.

The effectiveness of rain water harvesting system lies in its ability to meet the site requirements and end use preferences. Though simple, these systems are site specific and need to be details out before implementation. With decrease in availability of water, rain water harvesting presents the best option for times to come.

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