

## RESEARCH REPORT

# Paradigm Shift in Water Management: Rain Water Harvesting

Gupta Piyush

Assistant Professor, Department of Chemistry, SRM University, NCR Campus, Modinagar, India  
Email: piyushg.1977@gmail.com

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**ABSTRACT**

This paper proposes rainwater harvesting system and need of it in the present arena. The design and construction of rain water harvesting system along with its applications are also presented. In today's world human beings are running a race of development. But in this development they are losing some of the precious gift gifted to him by nature. Water is one of those precious gifts. The quantity and quality of water is adversely affected by global warming, pollution etc. Water is depleting at a higher rate where there is no surface water, where groundwater is deep water or inaccessible due to hard ground conditions. The most appropriate alternative of this condition is the collection of rainwater, called 'Rainwater harvesting'. Rainwater harvesting can be used as a partial solution to augment other sources, which may also not be available in the required quantities.

**Key words:** Rainwater harvesting, Water resources, Paradigm shift

**INTRODUCTION**

India has been notorious of being poor in its management of water resources. The demand for water is already outstripping the supply. Majority of the population in the cities today are groundwater dependent. In spite of the municipal water supply, it is not surprising to find people using private tube wells to supplement their daily water needs. As a result, the groundwater table is falling at an alarming rate. Extraction of groundwater is being done unplanned and uncontrolled thus this has resulted in hydrological imbalance, deterioration in water quality, rise in energy requirements for pumping (IS, 1172). Water is essential for farming but often is taken for granted. Yet in many parts of the world water resources are already scarce and are likely to become even scarcer as a result of climate change.

Rain Water Harvesting, is an age-old system of collection of rainwater for future use. It is a process of collecting and storing rainwater that falls on a catchment surface (typically a roof, although almost any external surface could be suitable) for use, independent from, or supplemental to the mains water supply. It is type of a mini-scale project that collects and stores water using structural measure for domestic and production purpose. Buildings under construction present the ideal opportunity to install a RWH system-or it can be added to existing structure. It can simply be created by diverting roof gutters into a storage tank or water butt, or it can be more complex involving pumped storage, filters and UV treatment for use on ready-to-eat crops. There are various ways through which rainwater can be captured:

- capturing run-off from rooftops
- capturing run-off from local catchments
- capturing seasonal flood water from local streams
- conserving water through watershed management

The water captured can be utilized for various purposes like irrigation, domestic chores, industrial utilization, drinking purpose etc. The RWH would prove to be miracle for mankind.

### **NEED FOR RAIN-WATER HARVESTING**

All water resources, surface water and groundwater originate from rainwater. Uneven distribution of rainfall all over the world has direct relationship with variations in the availability of water resources (IWA, 2004). Major parts of our country have been facing continuous failure of monsoon and consequent deficit of rainfall over the last few year and increasing population has led to the use of ground water has increased drastically leading to constant depletion of ground water level causing the wells and tube wells to dry up. In some places, excessive heat waves during summer create a situation similar to drought. It is imperative to take adequate measures to meet the drinking water needs of the people in the country besides irrigation and domestic needs. Rainwater harvesting is enjoying a revival in popularity for

two reasons: its inherently superior quality and an interest in reducing consumption of treated water. Rainwater has long been valued for its purity and softness. It is slightly acidic, and is free from disinfectant by-products, salts, minerals, and other natural and man-made contaminants. Furthermore, rainwater harvesting is valued as a water conservation tool to reduce demand on more traditional water supply sources (CWSA, 2005).

### **ADVANTAGES OF RAINWATER HARVESTING**

The technique was later developed to cover the collection of run off for agricultural purposes and installation of large reservoirs that are used to regulate flooding, in some developed countries such as Japan (Mooyoung, 2004; Kim et al., 2007). It helps to meet the increasing demand for water.

1. It reduces the runoff which chokes storm drains and to avoid flooding of roads.
2. It provides self-sufficiency to your water supply and to supplement domestic water requirement during summer and drought conditions.
3. Reduces soil erosion in urban areas.
4. In saline or coastal areas, rainwater provides good quality water and when recharged to ground water, it reduces salinity and helps in maintaining balance between the fresh-saline water interfaces.
5. In Islands, due to limited extent of fresh water aquifers, rainwater harvesting is the most preferred source of water for domestic use.
6. In desert, where rainfall is low, rainwater harvesting has been providing relief to people.

### **CONSTRUCTION AND DESIGN OF RAINWATER HARVESTING SYSTEM**

The first step of the construction project is to make a plan drawing. The plan drawing considers the location of the downspout and the amount of space available (Kumar, 2003)). Each system must include the tank, the first flush and the overflow.



Fig. 1. Rainwater harvesting model

The basic components of rainwater harvesting system are:

### 1. Roof Catchment

The roof of the house is used as the catchment for collecting the rainwater. Roofs made of corrugated iron sheet, asbestos sheet, tiles or concrete can be utilized as such for harvesting the rainwater (Hasse, 2003). But thatched roofs are not suitable as it gives some colour to water and also the water carries pieces of roof material (such as palm leaves).

### 2. Gutters

Gutters are channels fixed to the edges of roof all around to collect and transport the rainwater from the roof to the storage tank. Gutters can be prepared in semi-circular and rectangular shapes. Locally available material such as plain galvanized iron sheet can be easily folded to required shapes to prepare semi-circular and rectangular gutters. Semi-circular gutters of PVC material can be readily prepared by cutting the PVC pipes into two equal semi-circular channels. Bamboo poles can also be used.

### 3. Downpipe

Down pipe is the pipe, which carries the rainwater from the gutters to the storage tank. Down pipe is joined with the gutters at one end, and the other end is connected to the filter unit of the storage tank. PVC or GI pipes of diameter 50-75 mm (2-3inch) are commonly used for down-pipe.

### 4. First Flush Pipe

Debris, dirt and dust collect on the roofs during non-rainy periods. When the first rains arrive, this unwanted material will be washed into the storage tank. This causes contamination of water collected in the storage tank thereby rendering it unfit for drinking and cooking purposes. Therefore, a first flush system is incorporated to dispose off the water from 'first rain' so that it does not enter the tank. There are two such simple systems. One is based on a simple manually operated arrangement, whereby, the down pipe is moved away from the tank inlet and replaced again once the first flush water has been disposed. In another simple and semi-automatic system, a separate vertical pipe is fixed to the down pipe with a valve provided below the "T" junction. After the first

rain is washed out through first flush pipe, the valve is closed to allow the water to enter the down pipe and reach the storage tank.

### 5. Filter Unit

The filter unit is a container or chamber filled with filter media such as coarse sand, charcoal, coconut fibre, pebbles and gravels to remove the debris and dirt from water that enters the tank. The container is provided with a perforated bottom to allow the passage of water. The filter unit is placed over the storage tank.

### 6. Storage Tank

Storage tank is used to store the water that is collected from the Rooftops. Common vessels used for small scale water storage are plastic bowls, buckets, jerry cans, clay or ceramic jars, cement jars, old oil drums etc. For storing larger quantities of water the system will usually require a bigger tank with sufficient strength and durability.

### 7. Collection Pit

A small pit is dug in the ground, beneath the tap of the storage tank and constructed in brick masonry to make a chamber, so that a vessel could be conveniently placed beneath the tap for collecting water from the storage tank. A small hole is left at the bottom of the chamber, to allow the excess water to drain-out without stagnation. Size of collection pit shall be 60 cm x 60 cm x 60 cm.

## APPLICATIONS OF RAINWATER HARVESTING SYSTEM

RWH system is very beneficiary for human beings as it performs task of both environment and water saving. It can be installed both in urban as well rural areas with difference in construction as well as material to be utilised (Pacey A. and Cullis A., 1986). It has various applications in different fields. In domestic use it can be utilised to perform domestic chores, watering plants or can be fitted for drinking after filtration. It can be used in different agriculture sector like Livestock Sector, Pigs and Poultry Sector, Arable Farming Sector,

Protected Cropping Sector etc. It also has application in industrial sector as well (Critchley and Reij, 1989).

## CONCLUSION

It is no denying that sustaining and recharging the groundwater along with judicious use of the limited fresh water resources is the need of the hour. If sufficient measures are not taken up immediately, we will face a crisis which will be detrimental to the very survival of mankind. The rainwater harvesting system is a logical step towards water conservation. A planned approach is needed in order to fully utilise the potential of rainwater to adequately meet our water requirements. The quality of harvested rainwater depends substantially on environmental sanitation, disposal and management of waste. Water quality of harvested rain needs to be monitored over time. Testing and disinfection needs to form part of monitoring operations on regular basis. Hence, an equal and positive thrust is needed in developing and encouraging both the types of water harvesting systems. We have to catch water in every possible way and every possible place it falls and safeguard this precious gift of nature.

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