

Rain Water Harvesting Techniques

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ABSTRACT: *Our most valuable natural resource is water, which most of us take for granted. We are more conscious of the significance of water to our existence, as well as its scarcity. Humans need water for a variety of reasons. Water covers the majority of the earth's surface (about 71 percent). Only 1% of the total quantity of water accessible on the earth's surface is fresh and drinkable water, with 97 percent being salty water, 2% being ice and glaciers, and 1% being clean and potable water. In terms of average annual rainfall, India is one of the world's wealthiest countries. It's hard to believe, but Cherapunji, which receives 11000 mm of yearly rainfall, yet has a significant drinking water scarcity. This paper discusses the overview of rain water harvesting, techniques of rain water harvesting, component of rain water harvesting and advantages of rain water harvesting. Though India's average annual rainfall is 1170 mm, it may be as low as 100 mm in the deserts of western India. As a result, rainwater gathering methods are required to meet the water need.*

KEYWORDS: *Barrels, Collecting, Effective, Rain water, Wet System*

1. INTRODUCTION

India is a country in the developing world. Water demand is growing day by day as a result of greater industrialization and urbanization, as well as a rise in population. India's rainfall is erratic at best (Musz-Pomorska et al., 2020). The majority of it is concentrated over a few months of the year, and the majority of it flows away, resulting in inadequate ground water recharge. There is a huge geographical mismatch in the available water resources and the demand for water. As a result, it is becoming essential to transport water from farther away, increasing the expense of

transportation (Muriu-Ng'ang'a et al., 2017). It's also a widespread observation that the subsurface water table is dwindling as a result of unregulated water extraction. Maharashtra is a state in India that spans 307,713 square kilometers and has a population of 82 million people(Taylor et al., 2021). Over half of the population lives in rural areas where water scarcity is an issue. Due to declining water tables, poor water quality, and expensive operating and maintenance costs, traditional sources such as open wells, bore wells, and piped water supplies have failed. Every year, a large volume of water that falls on terraces is lost, and it all ends up in storm water drains. Rainwater collection has the potential to help solve water shortages(Taylor et al., 2021).

The technique of collecting rainwater straight directly the skies and refreshing it in the soil to avoid water levels from dropping, or keeping it in a public or underground water tank, is known as rainwater harvesting(Mahmood et al., 2020). It is ideally suitable in history's circumstances for the below reason. It is the most scientific and cost-effective method for replenishing groundwater and restoring the water table.

- It enhances the water purity for agriculture and domestic use.
- It generates natural soft water that is devoid of soluble mineral, chloride, mercury, and other harmful elements(Gupta & Kumar, 2012).
- It might be performed on a personal as well as a group level. Instead of depending on the governments or others municipal authorities to meet our water requirements, we might be identity in this way (Kumar Gola et al., 2021).

1.1 Techniques of rain water harvesting:

- Barrels of rain:

It is the greatest simple and price-saving way of rainwater gathering, particularly at home. It is where barrels or water tanks are positioned underneath the rooftop guttering system's downspouts(Gola et al., 2020). The water is then poured into the tanks through a funnel. The tank may be linked to your present plumbing system to

supply backup water or to a pipe for drip irrigation. The usage of barrels or tanks is good since they can hold a large volume of water(Singh, 2020).

- The Drying System:

It's comparable to the barrel method, but the dry system makes use of a bigger storage container (Abbasian Dehkordi et al., 2020). Typically, the container is a few meters away from the house. The gutter has been rebuilt to direct water to the huge storage tank. It is a simple and inexpensive strategy to execute, yet it reaps substantial benefits.

- Wet System:

It's a completely different method from the dry system. Water will always be present in the collecting pipes here(Khan et al., 2020). This is due to the fact that they will be located beneath. Many collecting pipes are linked to a building's downspouts and routed into an underground storage tank in the wet system. To prevent leaking into the earth, the pipes must be secure and carefully maintained(Gola & Gupta, 2019).

- Green Roof:

This harvesting technique does not need the use of storage tanks. The water is piped directly to the garden rather than being stored in a reservoir. The procedure will need the installation of a drainage system on a building's roof that will go directly to the backyard. It's a system that requires very little upkeep (Mian & Kumar, 2019).

- Harvesting surface runoff:

Rainwater is collected as surface runoff and stored for later use in this approach. The flow of minor creeks and streams may be diverted into surface or subsurface reservoirs to store surface water. It can offer water for agriculture, animals, and ordinary household usage(Kumar Gola et al., 2021). In metropolitan settings, surface runoff collection is the best option.

- Recharge of groundwater:

Groundwater recharging is a hydrological mechanism in which water moves downwards from ground water to petroleum. The most typical route for groundwater to infiltrate a stratum is via recharging. The aquifer also functions as a mechanism of distribution. Using artificial recharge methods, the excess precipitation may subsequently be utilized to replenish the groundwater aquifer.

1.2 Advantages of rain water harvesting:

- **Minor Water Beaks:**

Rainwater collection systems are inexpensive, generate high-quality water, minimize the need for wells, and are easy to operate because they are not utilized for eating, heating, or similar sensitive functions. The total expenses of setting up harvest technologies are much cheaper than other purification or boosting operations. The expense of replenishing a subterranean reservoir is also less than that of replenishing a surface reservoir.

- **Benefit to the environment:**

It is environmentally beneficial to store water underground. Rainwater collection has several environmental advantages. It helps to alleviate the pressure on drainage systems by funneling runoff into enormous tanks for recycling, reducing the effect of floods. Because no land is sacrificed for storing and no human evacuation is required, freshwater is not instantaneously subjected to evaporate and pollution. It also helps to reduce the likelihood of rivers drying up.

- **Reduces erosion and floods in the vicinity of structures:**

It reduces soil degradation and flood threats in urban areas by collecting rainwater and managing wastewater flow. In the case of a rainfall, most structures with rainfall collecting equipment have a built-in collecting area on top of the rooftop that can collect large volumes of water.

- **Irrigation equipment that is sufficient:**

Rainwater collecting allows for the collection of large amounts of water and the reduction of drought-related effects. The bulk of rooftops provide the necessary platform for collecting rainwater. Rainwater is suitable for watering since it is usually free of harmful contaminants.

- Groundwater demand is reduced.

One significant benefit is that it increases aquifer production, resulting in higher freshwater supplies and lower need for drinkable freshwater. It is critical, especially in locations where water levels are low.

- Easy to Maintain:

The use of a rainwater collecting system has a number of benefits for the society. Firstly and foremost, stormwater collection helps us to better use a power resources. It is necessary to do so because freshwater is not readily renewable, and it reduces waste. Rainwater collecting systems are based on straightforward technology. Their install and operating costs are much lower than those of water purification or pumping systems. Maintenance takes very little time and effort. The end result is a gathering of liquid that may be utilized in a variety of ways, especially if it hasn't been purified.

1.3 Component of rain water harvesting:

- *Catchments:*

A catchment area is the region that immediately absorbs It collects rainwater and feeds it into the system. It might be a tiled region, like the terrace or patio of a structure, or an empty region, like a grass or empty field. On a roof made of cemented cemented cement, galvanised iron, or perforated sheets, water collection is also possible.

- *Gutter system:*

Rainfall is gathered and delivered to a holding tank by tunnels that ring the sloping roof's edge. Gutters are commonly made locally out of basic 25 mm sheets and are quasi

or rectangular in shape. Gutters must be maintained to avoid drooping or falling off when they are full with water. The technique by which gutters are fastened is largely dictated by the construction of the home; most gutters are secured to the wall utilizing metal or wooden bracket.

- *Ductwork:*

Rainwater is transported from a collection or roof region to a rainwater collection system through tubes, which are pipelines or drains. Polyvinyl acetate or galvanised iron are often used in the construction of pipes (GI).

- *Initial flushing:*

An initial flushing device is a device that ensures that the initial period of rain is washed out of the holding tanks, bringing more pollutants through the air and collecting surface.

- *Filters:*

Wastewater gathered from the roof is filtered through the filter to remove trapped pollutants. Charcoal water filters, sand filters, horizontal roughing filters, and slow sand filters are some of the most often used industrial filters.

- *Structures must be recharged:*

Rainwater harvesting may also be utilized to replenish groundwater aquifers by using appropriate structures such as dugwells, borewells, Ditches for recharging and pits for recharging. There are several recharging topologies to choose from, some of which enhance water percolation through soil layers at lesser depths, while others transport water to deeper depths where it meets groundwater. In many cases, existing structures such as wells, trenches, and tankers may be adapted to act as recharge structures, eliminating the need for new ones. Dug well charging and derelict tubes well recharge are 2 of the handful commonly used recharge systems.

- *Storage space:*

There are many alternatives for the building of these tanks in terms of design, size, construction material, and tank placement: - Cylindrical, square, and rectangular shapes are available. Reinforced cement concrete (RCC), masonry, Ferrocement, and other building materials are used. Tank placement: Depending on available land space, these tanks might be built above ground, partially underground, or completely underground. To guarantee the quality of the water contained in the container, several maintenance actions such as disinfection and cleaning are necessary. If it is chosen to utilize collected water to replenish an underground aquifer or reservoir, some of the buildings listed below will be utilised.

2. DISCUSSION

A groundwater collecting systems, sometimes referred to as a rainwater collection systems or a stormwater collection scheme, collects and retains freshwater for human consumption. Rainwater collection systems range from simple rain buckets to more complex structures with pump, containers, and purification processes. Nonpotable rainwater can be utilized to water plants, flush toilets, clean cars, and even launder clothes, and it can be sanitised for human consumption. Rainwater collection systems might give freshwater to homes and companies throughout dry periods, relieving the burden on municipal systems.

Given that rainfall is irregular and only a small fraction of global rainfall is easily accessible for human use, rainfall harvesting might be an effective technique of collecting that precious commodity. Instead of soaking into the soil, majority of the rain on structures, rooftops, highways, and similar artificial hardscape in cities is directed into storm sewers for disposal. Impervious surfaces cause urban floods and polluted unusable groundwater that is redirected far from consumable water sources in many areas. Local groundwater may be depleted during dry months, and many communities struggle to fulfill demand for drinkable water on a continuous foundation. Rainfall collecting for non - potable uses like horticulture and washing reduces both overall fresh water consumption and the strain on drainage infrastructures. In major

cities, this reduction in demand and availability of drinkable renewed water is considerable. Although many communities promote and even fund rain tubs and other rainfall gathering devices, certain places, notably in the Southwest, Rainwater is viewed as a groundwater rights issue problem and impose limits on its use.

Rain barrels and other building practice rainwater collection methods are the most rudimentary. Rain gutters feed into a tank through pipes. These facilities, referred to as "dry systems," do not keep any liquid in the pipelines after it has stopped pouring, keeping mosquito and other parasites from breeding. "Wet networks" are required when the tubing cannot be designed to flow straight into the tanks. In circumstances when the tanks are positioned significant long way away from the collection surfaces or wherein they are a series of containers to supply a large number of buildings, pipes from the gutter flow below and then up via a raise into the container. Such systems are often pressured to prevent stagnant water from accumulating in lengthy lines of pipes.

Insect-proof pipes and other holes are ensured in well-designed rainwater collecting systems, particularly in wet systems. Furthermore, wire mesh screen coverings on all tank inlets may assist keep debris out of the tank. Nontoxic materials should be used on collection surfaces (mostly roofs), Lead-based coatings and membrane must be eliminated, and containers would be constructed from nontoxic, noncorrosive components. Make that the container outflow faucets or draw-off pipelines are at minimum 10 cm (4 inches) beyond the bottom to avoid pulling out any sediment that might have collected in the water supply. Although some systems have a sludge-removal pit motor and a washing pipe, all systems need have their interior surfaces cleaned on a regular basis. Catchments should also be maintained free dirt, fungus, epiphytic, and other strewn about Pruning tree stems that drape over catchments is recommended. Gutters, tank inlet, and screen washing on a regular basis, as well as an annual tank check, are required for optimal operation. Water should ideally be tested on a regular basis to keep track of its purity.

3. CONCLUSION

Water is a need for survival. Everyone understands that water shortage would become a severe concern if we do not harness existing water sources and utilize them sparingly and with care. There can be no alternative for water, regardless of how quickly science advances in all sectors. As a result, a variety of water collection techniques must be used. Every drop of water that falls on the earth's surface must be collected by both government organizations and individuals. Each individual must collect raindrops falling on his roof, allotment, or farm and recharge them underground in order to do this. The current research looked at two different types of roof top water harvesting: urban and rural. Rooftop rainwater collection may also be used for different types of buildings. In reality, rainwater collection systems can cover all of India's basic drinking and cooking demands.

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