# Water Conservation: Resource for Future

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**ABSTRACT:**
In order to solve the worldwide water issue and ensure that our planet has a sustainable future, water conservation is essential. This chapter emphasises the importance of water conservation and provides crucial tactics that may be used to efficiently save water supplies. The chapter also highlights the significance of both individual and group efforts in accomplishing water conservation objectives, as well as the potential advantages for the environment and human welfare. We can contribute to a future that is more resilient and water-secure by implementing water-saving strategies and encouraging responsible water management.

**KEYWORDS:**

Conservation, Filter, Rainwater, Recharging, Runoff, Soil, Water.

## I. INTRODUCTION

Water has to be protected since it is one of the most valuable and necessary resources. The measures listed below may be used to save water. On most soil types, run-off results in significant water loss that may be decreased by allowing the majority of the water to permeate the soil. Contour cultivation, terrace framing, water spreading, chemical treatment, or enhanced water-storage systems may all be used to accomplish this. Contour cultivation in nooks and crannies throughout the slopes, little furrows and ridges capture rainwater and give it more time to infiltrate. The capability for storing water in terracing built on deep soils is substantial. For improved penetration, stored runoff on mild slopes is dispersed across a wide region. Conservation-bench terracing. This technique entails building a number of benches to collect runoff water. Lagoon levelling or channeling are used to disperse water.

In channelings, a sequence of vertically spaced diversions is used to regulate the water flow. Small depressions are excavated during lagoon levelling to provide temporary water storage. When applied to typical irrigated soil, they seem to boost the water absorption rates. By giving water more time to soak into the soil, surface crop residues, tillage, mulch, animal residues, etc. aid in preventing run-off. When applied to sodic soils, chemical conditioners like gypsum ($CaSO_4.2H_2O$) increase soil permeability and decrease runoff. HPAN (hydrolyzed polyacrylonitrile) is another helpful conditioner. Water-storage facilities built by individual farmers, such as farm ponds, dugouts, etc., may be helpful measures for water conservation by reducing runoff.

**2. Reducing Evaporation Losses**: In humid areas, this is especially important. Placed below the soil's surface, horizontal barriers made of asphalt enhance water availability and boost crop output by 35–40%. While less effective on loamy sand soils, this is more successful on sandy soil. It has been claimed that a co-polymer of starch and acrylonitrile known as super slumper may absorb water up to 1400 times its weight. Sandalwood soils have been proven to benefit from the chemical.

**3. Soil Water Storage**: When the soil is sufficiently saturated, water is stored in the root zone in humus-rich areas. Water may be made accessible for the crop produced the next season by leaving the land fallow for one growing season.

4. **Reducing Irrigation Losses:** Using lined or covered canals to decrease seepage and watering in the early morning or late evening to minimise evaporation losses are two ways to reduce irrigation losses. Growing hybrid crop types with lower water needs and salt tolerance Using drip irrigation and sprinkler irrigation to save water by 30–50%. Water conservation helps. Treated wastewater may be used for fertiliser irrigation. Reusing grey water from washing machines, bathtubs, and other appliances to water gardens, wash vehicles, or clear roads helps save freshwater. As water consumption increases, the user must pay a correspondingly larger cost. This promotes consumer conservation of water consumption.

## II. DISCUSSION

### Rainwater Harvesting

Although the phrase rainwater harvesting is often used nowadays, India has always practiced water conservation. Techniques for collecting water have been refined and perfected for millennia [1]–[3]. Percolation is a natural process that replenishes groundwater supplies. But because of indiscriminate building and fast urbanization, the amount of exposed soil surface has significantly decreased, which has limited precipitation infiltration and depleted the groundwater supply. The technique of enhancing rainwater's natural filtration into an underground formation via some artificial means is known as rainwater harvesting. Rainwater Harvesting is the conscious gathering and storage of rainwater to meet water needs for drinking, home use, and irrigation [4]–[6].

### Why should we collect rainwater?

To stop the fall of the ground water table and increase it. Improve aquifer water quality; save monsoon runoff of surface water; lessen soil erosion; and instill a culture of water conservation. The following surfaces may be used to collect rainwater:

**Rooftops**: If there are existing structures with impermeable roofs, the catchment area is basically free to use and they provide at the point of consumption. The runoff may be efficiently collected in both paved and unpaved places, such as open fields, parks, highways, pavements, and other open spaces. The ability to gather water from a broader area is the primary benefit of utilising the earth as a collecting surface. In regions with little rainfall, this is especially useful.

**Swimming Pools**: The capacity for storing rainwater in lakes, tanks, and ponds is enormous. The collected rainfall may be utilised to replenish groundwater aquifers in addition to meeting the city's water needs.

**Drains for Storm Water**: Most residential colonies have a well-organized network of drains for storm water. These are an easy and affordable way to collect rainwater if kept correctly.

### Types of Harvesting System

Broadly rainwater can be harvested for two purposes

- **a.** Roof top rain water harvesting (RTRWH).
- **b.** Charged into the soil for withdrawal later (groundwater recharging).
- **c.** Roof top rain water harvesting (RTRWH).

It is a technique for collecting rainwater at its source. Rooftop harvesting is collecting rainwater from a building's or home's roof by turning it into a catchment. It may be either directed to an artificial recharge system or kept in a tank. If correctly used, this approach is less costly, extremely successful, and contributes to raising the local area's ground water level. Components of Roof top Rainwater harvesting system. The system mainly constitutes of following sub components: Catchment, Coarse mesh, Gutters, Conduits or Conveyance.

- **a.** Transportation.
- **b.** First flush.
- **c.** Filter.
- **d.** Storage.
- **e.** Supply unit.

The system mainly constitutes of following sub components:

- **a.** Catchment.
- **b.** Coarse mesh.
- **c.** Gutters.
- **d.** Conduits

### Catchments

A water harvesting system's catchment is the surface that absorbs rainfall directly and supplies water to the system. It may be a paved area, such as a building's terrace or courtyard, or an unpaved area, such as a lawn or open space. Water may also be collected from a roof constructed of corrugated sheets, galvanized iron, or reinforced cement concrete (RCC). There is coarse mesh at the roof's corners to stop debris from entering. A sloping roof's edge channels for collecting and directing rainfall to a storage tank. Semi-circular gutters of PVC material can be easily prepared by cutting those pipes into two equal semi-circular channels. Gutters can be rectangular or semi-circular and could be made using: Locally available material, such as plain galvanized iron sheet (20 to 22 gauge), folded to required shapes. trunks of betel or bamboo, divided vertically. The gutter's size should be determined by the amount of water that flows during the heaviest downpour. It is recommended to enlarge them by 10% to 15%. Gutters must be supported so that when they are filled with water, they do not droop or fall off. The manner gutters are fastened depends on how the house was built; although iron or wooden brackets may be installed into the walls of homes with larger eaves, a means of connection to the rafters is required for these homes [7]–[9].

**Conveyance or Conduits**

Pipelines or drains known as conduits are used to transport rainwater from rooftops or catchments to rainwater collecting systems. Conduits may be made of any material, including readily accessible ones like galvanised iron (GI) and polyvinyl chloride (PVC).

**First-Flushing**

A valve known as a first flush device makes sure that runoff from the first downpour is flushed out and does not enter the system. This is necessary because the initial downpour tends to carry a disproportionately higher concentration of air and catchment surface contaminants.

**Filtration or Purification**

Rainwater collected over roofs is filtered to eliminate suspended contaminants. A filter unit is a chamber that filters water before it enters a storage tank or recharges a structure using filtering material like fibre, coarse sand, and gravel layers. The inclusion of charcoal may increase filtering. A simple charcoal filter may be created in an earthen pot or a drum. Gravel, sand, and charcoal are the main components of the filter, all of which are readily accessible. Sand is a popular filter medium used in sand filters. Sand filters are simple and affordable to build. In order to successfully remove turbidity suspended particles like silt and clay, colour, and microbes from water, these filters may be used. In an easy-to-build sand filter, the top layer is coarse sand, followed by a layer of gravel that is 5 to 10 mm thick and then another layer of sand that is 5 to 25 cm thick boulders and gravel.

Storage or sump: An area for collecting and storing filtered water that has been collected via the filter channel from the tank. Regarding design, size, and construction material, there are many possibilities accessible for the building of these tanks. Shapes include square, rectangles, and cylinders. Material of construction. Commonly utilised materials include reinforced cement concrete (RCC), ferrocement, masonry, plastic (polyethylene), and metal (galvanised iron) sheets. Position of tank. Depending on available space, these tanks may be built above ground, partially underground, or entirely underground. To guarantee the quality of the water held in the container, several upkeep procedures like cleaning and disinfection are necessary. Different types of structures may be used to replenish ground water aquifers, ensuring that precipitation percolates into the ground rather than draining away from the surface. The following recharging techniques are often employed:

- **a.** Recharging of bore wells
- **b.** Recharging of dug wells.
- **c.** Recharge pits
- **d.** Recharge Trenches
- **e.** Soak ways or Recharge Shafts
- **f.** Percolation Tanks

**a) Recharging of bore wells**

Rainwater collected on the building's roof is sent to a settlement or filter tank through drainpipes. Filtered water is transferred to bore wells after settlement to replenish deep aquifers. Bore wells that have been abandoned may also be recharged. Based on the catchment area, rainfall intensity, and recharge rate stated in the design parameters, the best settlement tank/filtration tank capacity may be created [10]. Entry of floating debris and silt should be prevented during recharge since it might choke the recharge structure. To prevent contamination, the first one or two showers should be cleaned off using a rain separator. This is crucial, thus every precaution should be made to guarantee that it has been completed.

**b) Recharge pits**

Recharge pits are tiny pits that may be rectangular, square, or circular in form. The pit's top can be covered with perforated coverings, and the pit is enclosed by a brick or stone masonry wall with weep holes spaced periodically. Filter media need to be positioned at the pit's bottom. The catchment area, intensity of the rainfall, and rate of soil recharging may all be used to determine the pit's capacity. Depending on the depth of the underlying strata, the pit's typical dimensions range from 1 to 2 metres in width to 2 to 3 metres in depth. Small dwellings and shallow aquifers may be recharged in these holes.

**c) soak away or recharge shaft**

In areas where the top layer of soil is alluvial or less permeable, soak away or recharge shafts are supplied. These are 30 cm dia. drilled holes that may reach depths of 10 to 15 m, depending on the thickness of the pervious layer. To avoid the collapse of the vertical sidewalls, the bore should be lined with PVC/MS pipe that has slots or perforations. To capture runoff before it passes through the soak away filters, a sump of the necessary size is built at the top of the soakaway. Filter media should be placed in the sump.

d) **Recharging of dug well**

A dug well may serve as a structure for recharging. Rainwater is collected on the roof and sent to wells that have been excavated. Regular cleaning and desalting of dug wells is necessary to increase the rate of recharge. One option is to employ the recommended filtering technique for bore well recharge.

e) **Fill the trenches with dirt.**

A recharging trench is provided when the top impermeable layer of soil is shallow. Digging a hole in the ground and filling it with porous objects like pebbles, rocks, or brickbats are the two steps involved. It is often made to collect surface runoff. Bore wells may be inserted into the trench as recharge shafts to increase percolation. The length of the trench is determined by the expected amount of runoff. This method is suitable for use with playgrounds, parks, roadside drains, and modest homes. The recharging trench may be between 1 and 1.5 metres in depth and breadth.

f) **Percolation tanks**

Percolation tanks are man-made surface water bodies that submerge an area of land with enough permeability to allow for enough percolation to rehydrate the ground water. These may be constructed at large campuses where there is accessible land and suitable terrain. Water from the roof and surface runoff may both be directed to this tank. To increase the ground water, water that has built up in the tank percolates through the solid. The water that has been kept may be consumed raw or used for gardening. Gardens, open areas, and green belts along the sides of roadways in metropolitan areas should all have percolation tanks.

## III. CONCLUSION

Given the growing water shortage and environmental damage, water conservation is a vital issue. We can lessen the negative effects of water shortage and ensure a sustainable water future for future generations by putting different conservation techniques into practise. The need of implementing water-saving practises at the individual, community, and industrial levels is emphasised in this conclusion. Sustainable water management requires actions including decreasing water waste, installing effective irrigation systems, encouraging rainwater gathering, and increasing public awareness of water conservation. By taking these steps, you can protect freshwater habitats, sustain ecological harmony, and guarantee a steady supply of water for home, industrial, and agricultural usage. Additionally, investing in water conservation strategies may have a positive impact on the economy via lower water bills, increased agricultural output, and less stress on water infrastructure. Due to the fact that water shortage is anticipated to worsen in many areas, water conservation is essential for coping with the effects of climate change.

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