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Rain water harvesting: A sustainable approach to water management

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Abstract

A conventional rain water harvesting pond, though could meet the water requirement for some of the purposes, has failed to sustain its utility and people have filled it up to have a land surface to be utilized for other purpose. With introduction of water supply system, people are deriving more economic benefit by using the land area obtained for other purposes by filling up their old ponds. With more and more numbers of ponds getting converted to land, adverse impact on hydrological system is now becoming visible, as flood and drought both are increasing at an alarming rate. To derive its hydrological benefit along with others, a rain water harvesting system has been designed to have benefits from its multiple applications coupled with scientific management of the available water. This has been designed in a way that people can derive its benefit in a sustainable manner. The system is named as Sustainable Approach of Rain Water Management. Irrigation through recirculation, microclimate moderation, runoff reduction and groundwater recharge are some of the benefits that this pond system can provide.

Keywords: Water scarcity, runoff coefficient, pitched roof, flat roof, rainwater yield

Introduction

Freshwater scarcity is a serious problem throughout the world for both urban and rural communities. It has now become very difficult to meet the water demand of very rapidly growing population. Along with this industrial development also need large quantity of water (Rupesh *et al.*, 2005). Currently, 69% of all water withdrawn for human use is soaked up by agriculture, whereas industry account for 23% and domestic sector account for about 8%. The global averages vary a great deal between different region of the world like Asia, Africa, and Europe. Our country uses, nearly 83% of total available fresh water supply for agriculture and remaining for all other purposes. The best solution to over come water scarcity problem is to tap the groundwater resources but very rapid depletion in the groundwater table has been observed from last five decades due to over tapping. Presently, the proper management of groundwater resources is urgently required through advance water conservation and harvesting systems. Instead of developing big water systems, we people are going for smaller harvesting systems to work at the root level. The main source of fresh water is rainwater. The rainwater collected can be used directly for lawns, toilets etc. It can also be used for drinking purposes after proper treatment. The most valuable aspect could be its use directly to recharge groundwater, by adopting a simple technique called Rainwater Harvesting (RWH). It means making use of each and every drop of rain water to recharge the groundwater table. The objective of present study is to reduce run-off losses that result in the rise of water table by recharging. By using this, the problem of flooding, can also be minimize. The significance of the project for general public is to provide safe drinking water, irrigation water, and control on urban floods and reduce over loading of water/wastewater treatment plants. The most important aspect is the increase in water table which is reducing day by day due to very rapid urbanization and industrialization

Rainwater Harvesting

Rain water harvesting can be classified based on time such as, traditional and modern methods Traditional method were used in past time for the collection of rainwater such as Kunds in thar desert, temple tanks method. Modern methods are divided into two categories of artificial recharge and rainwater harvesting.

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Artificial recharge could be done by adopting pit method, Absorption well method, well cum bore method and Recharge trench cum injection well method. Modern scientific methods for recharging of groundwater by rainwater could be applied on individual houses and grouped houses. Individual houses can be design for rainwater harvesting with the Percolation pit, Bore well with settling tank, Open well and Percolation pit with bore method. This study has been done by using the bore well method. In this method both recharging as well as utilization of rainwater is done. It requires less space as compared to open well for installation of rainwater harvesting system. In this method, rainwater falling of the terrace of building is collected through pipes and then diverted to bore well which work as a settlement and filter tank. A percolation pit has been provided in the near by area to divert excess flow of rainwater. Rainwater harvesting is a simple strategy by which rainfall is gathered and stored for future usage. The process involves collection and storage of rainwater with help of artificially designed systems, that runs off natural or man-made catchment areas e.g. rooftop, compounds, rocky surface, hill slopes or artificially repaired impervious/semi-pervious land surface. The collected rainwater from surfaces on which rain falls may be filtered, stored and utilized in different ways or directly used for recharge purposes. Rainwater Harvesting is unrestricted from any kind of impurity, with relatively less storage cost and no maintenance cost involved except for periodical cleaning. With depleting groundwater levels and fluctuating climate conditions, this measure can go a long way to help mitigate the adverse effects rising water scarcity. Reserving rainwater can help recharge local aquifers, reduce urban flooding and most notably, ensure water availability in water-scarce zones.

Advantages of implementing rain-water harvesting

Reduced Water Bills

Rainwater harvesting systems are cost-effective, provide high-quality water, lessens dependence on wells and are considerably easy to maintain since they are not utilized for drinking, cooking or other sensitive uses. The all-around expenditures used in setting up harvesting methods are much cheaper compared to other purifying or pumping means. The cost of recharge to the subsurface reservoir is also lower than the surface reservoirs.

Ecological benefit

Storing water underground is environment-friendly. The ecological benefits of rainwater harvesting are immense. It minimizes the impacts of flooding by funneling the off water into large tanks for recycling and helps reduce the load placed upon drainage systems. No land is wasted for storage purpose and no population displacement is implicated therefore, groundwater is not directly exposed to evaporation and pollution. Additionally, it helps minimize the possibility of rivers drying up.

Reduces erosion and flooding around buildings

It reduces soil erosion and flood hazards by collecting rainwater and reducing the flow of stormwater to prevent urban flooding. Most buildings that utilize rainwater harvesting systems have a built-in catchment area on top of the roof, which has a capacity of collecting large volumes of water in case of rainstorms.

An adequate means for Irrigation purpose

Harvesting rainwater allows the collection of large amounts of water and mitigates the effects of drought. Most rooftops provide the necessary platform for collecting water. Rainwater is mostly free from harmful chemicals, which makes it suitable for irrigation purposes.

Reduces demand on Ground Water

Another vital benefit is that it increases the productivity of aquifer resulting in the rise of groundwater levels and reduces the need for potable water. It is extremely essential, particularly in areas with low water levels.

There are two major techniques of rainwater harvesting.

1. Surface runoff harvesting

In this method, rainwater flows away as surface runoff and can be stored for future use. Surface water can be stored by diverting the flow of small creeks and streams into reservoirs on the surface or underground. It can provide water for farming, for cattle and also for general domestic use. Surface runoff harvesting is most suitable in urban areas.

Rooftop rainwater/storm runoff can be harvested in urban areas through:

- Recharge Pit
- Recharge Trench
- Tubewell
- Recharge Well

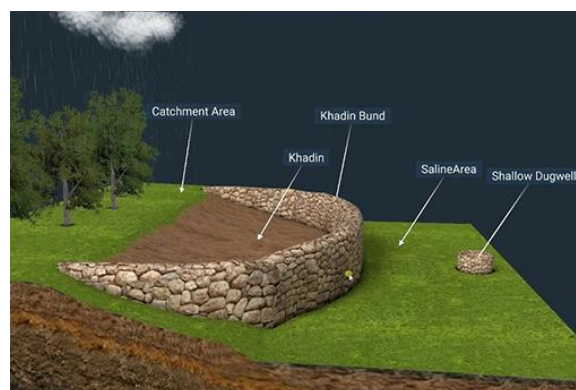
2. Groundwater recharge

Groundwater recharge is a hydrologic process where water moves downward from surface water to groundwater. Recharge is the primary method through which water enters an aquifer. The aquifer also serves as a distribution system. The surplus rainwater can then be used to recharge groundwater aquifer through artificial recharge techniques.

Rainwater in rural areas can be harvested through:

- Gully Plug
- Contour Bund
- Dugwell Recharge
- Percolation Tank
- Check Dam/Cement Plug/Nala Bund
- Recharge Shaft

Although rainwater harvesting measure is deemed to be a desirable concept since the last few years, it is rarely being implemented in rural India. Different regions of the country practiced a variety of rainwater harvesting and artificial recharge methods. Some ancient rainwater harvesting methods followed in India which includes Madakas, Ahar Pynes, Surangas, Taankas, etc.



Conclusions

Rainwater harvesting is a cost effective method of conserving water there by solving the water crisis. The Indian town planners and civil authorities need to make rainwater harvesting compulsory in all new structures. Typically, this will save up to 50% domestic water consumption. The conservation of fresh water resources must be therefore required to improved world. Wide to ensure that clean drinking water does not become a luxury product.

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