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RAIN WATER HARVESTING

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ABSTRACT

Rainwater Harvesting is the accumulating and storing, of rainwater for reuse, before it reaches the aquifer. It has been used to provide drinking water, water for livestock, water for irrigation, as well as other typical uses given to water. Rainwater collected from the roofs of houses, tents and local institutions, can make an important contribution to the availability of drinking water.

Water collected from the ground, sometimes from areas which are especially prepared for this purpose, is called Storm water harvesting. In some cases, rainwater may be the only available, or economical, water source. Rainwater harvesting systems can be simple to construct from inexpensive local materials, and are potentially successful in most habitable locations.

Roof rainwater can be of good quality and may not require treatment before consumption. Although some rooftop materials may produce rainwater that is harmful to human health, it can be useful in flushing toilets, washing clothes, watering the garden and washing cars; these uses alone halve the amount of water used by a typical home. Household rainfall catchment systems are appropriate in areas with an average rainfall greater than 200 mm (7.9 in) per year, and no other accessible water sources (Skinner and Cotton, 1992). Overflow from rainwater harvesting tank systems can be used to refill aquifers in a process called groundwater recharge , though this is a related process, it must not be confused with Rainwater harvesting.

I. BASIC CONFIGURATION

Rainwater harvesting systems channel rainwater that falls on to a roof into storage via a system of gutters and pipes. The first flush of rainwater after a dry season should be allowed to run to waste as it will be contaminated with dust, bird droppings etc. Roof gutters should have sufficient incline to avoid standing water. They must be strong enough, and large enough to carry peak flows. Storage tanks should be covered to prevent mosquito breeding and to reduce evaporation losses, contamination and algal growth. Rainwater harvesting systems require regular maintenance and cleaning to keep the system hygienic.

II. AROUND THE WORLD

Currently in China and Brazil, rooftop rainwater harvesting is being practiced for providing drinking water, domestic water, water for livestock, water for small irrigation and a way to replenish ground water levels. Gansu province in China and semi-arid north east Brazil have the largest rooftop rainwater harvesting projects ongoing.

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In Rajasthan, India rainwater harvesting has traditionally been practiced by the people of the Thar Desert.

In Bermuda, the law requires all new construction to include rainwater harvesting adequate for the residents. The U.S. Virgin Islands have a similar law.

In the Indus Valley Civilization, Elephant Caves and Kanheri Caves in Mumbai rainwater harvesting alone has been used to supply in their water requirements.

In Senegal and Guinea-Bissau, the houses of the Diol -people are frequently equipped with homebrew rainwater harvesters made from local, organic materials.

In the United Kingdom water butts are often found in domestic gardens to collect rainwater which is then used to water the garden. However, the British government's Code For Sustainable Homes encourages fitting large underground tanks to new-build homes to collect rainwater for flushing toilets, washing clothes, watering the garden and washing cars. This reduces by 50% the amount of mains water used by the home.

In the of Myanmar , the groundwater is saline and communities rely on mud-lined rainwater ponds to meet their drinking water needs throughout the dry season. Some of these ponds are centuries old and are treated with great reverence and respect.

Until 2009 in Colorado , water rights laws almost completely restricted rainwater harvesting; a property owner who captured rainwater was deemed to be stealing it from those who have rights to take water from the watershed. Now, residential well owners that meet certain criteria may obtain a permit to install a rooftop precipitation collection system. Up to 10 large scale pilot studies may also be permitted).The main factor in persuading the Colorado Legislature to change the law was a 2007 study that found that in an average year, 97% of the precipitation that fell in Douglas County, in the southern suburbs of Denver, never reached a stream-it was used by plants or evaporated on the ground. In Colorado you cannot even drill a water well unless you have at least 35 acres. In New Mexico, rainwater catchment is mandatory for new dwellings in Santa Fe .

In Australia rainwater harvesting is typically used to supplement the reticulated mains supply. In south east Queensland, households that harvested rainwater doubled each year from 2005 to 2008, reaching 40% penetration at that time (White, 2009 (PhD).

III. NEED FOR WATER HARVESTING

The scarcity of water is a well-known fact. In spite of higher average annual rainfall in India (1,170 mm, 46 inches) as compared to the global average (800 mm, 32 inches) it does not have sufficient water. Most of the rain falling on the surface tends to flow away rapidly, leaving very little for the recharge of groundwater. As a result, most parts of India experience lack of water even for domestic uses. Surface water sources fail to meet the rising demands of water supply in urban areas, groundwater reserves are being tapped and over-exploited resulting into decline in groundwater levels and deterioration of groundwater quality. This precarious situation needs to be rectified by immediately recharging the depleted aquifers. Hence, the need for implementation of measures to ensure that rain falling over a region is tapped as fully as possible through water harvesting, either by recharging it into the groundwater aquifers or storing it for direct use.

IV. 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 and all other hydrological studies and engineering inventions, aimed at conservation and efficient utilization of the limited water endowment of physiographic unit such as a watershed. Rain is a primary source of water for all of us.

There are two main techniques of rainwater harvesting:

Storage of rainwater on surface for future use.

- Recharge to groundwater.
- Directly collected rainwater can be stored for direct use or can be recharged into the groundwater.

All the secondary sources of water like rivers, lakes and groundwater are entirely dependent on rain as a primary source.

The term water harvesting is understood to encompass a wide range of concerns, including rainwater collection with both rooftop and surface runoff catchment, rainwater storage in small tanks and large-scale artificial

reservoirs, groundwater recharge, and also protection of water sources against pollution. The objective of water harvesting in India differs between urban and rural areas. In urban areas, emphasis is put on increasing groundwater recharge and managing storm water. On the other hand, in rural areas securing water is more crucial. There the aim is to provide water for drinking and farming, especially for life-saving irrigation, and to increase groundwater recharge.

Rooftop / Runoff Rainwater Harvesting for Artificial Recharge to Ground Water

Water harvesting is the deliberate collection and storage of rainwater that runs off on natural or manmade catchment areas. Catchment includes rooftops, compounds, rocky surface or hill slopes or artificially prepared impervious/ semi-pervious land surface. The amount of water harvested depends on the frequency and intensity of rainfall, catchment characteristics, water demands and how much runoff occurs and how quickly or how easy it is for the water to infiltrate through the subsoil and percolate down to recharge the aquifers. Moreover, in urban areas, adequate space for surface storage is not available, water levels are deep enough to accommodate additional rainwater to recharge the aquifers, rooftop and runoff rainwater harvesting is ideal solution to solve the water supply problems.

V. ADVANTAGES OF RAINWATER HARVESTING

1. To meet the ever increasing demand for water. Water harvesting to recharge the groundwater enhances the availability of groundwater at specific place and time and thus assures a continuous and reliable access to groundwater.
2. To reduce the runoff which chokes storm drains and to avoid flooding of roads.
3. To reduce groundwater pollution and to improve the quality of groundwater through dilution when recharged to groundwater thereby providing high quality water, soft and low in minerals.
4. Provides self-sufficiency to your water supply and to supplement domestic water requirement during summer and drought conditions.
5. It reduces the rate of power consumption for pumping of groundwater. For every 1 m rise in water level, there is a saving of 0.4 KWH of electricity.
6. Reduces soil erosion in urban areas
7. The rooftop rainwater harvesting is less expensive, easy to construct, operate and maintain.
8. 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
9. In Islands, due to limited extent of fresh water aquifers, rainwater harvesting is the most preferred source of water for domestic use.
10. In desert, where rainfall is low, rainwater harvesting has been providing relief to people.

VI. CONCLUSION

Based upon our prototype testing results, we conclude that a sand filtration system will effectively eliminate all suspended solids and therefore improve the quality of stored rainwater at the Van Asperdt-Boesjes residence.

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Because organic particles are removed from rainwater by the sand filter before entering the cistern, the potential for bacterial growth is drastically diminished. Such a filtration system could be easily implemented into the current design and will result in significant water quality improvements.

It should be mentioned however, that the elimination of suspended solids does not equate to water portability. To meet EPA standards for safe drinking, water samples should be tested by a certified laboratory. Many owners of rainwater harvesting systems use chlorine, ozone, or UV purification to ensure that their drinking water is free of pathogens.

This case study allowed us to learn about water supply on two very different scales. At the community scale, EWEB's Hayden Bridge facility embraces water in a technical manner with a huge supply flume that runs directly through the building's second floor landing. On a residential scale, the house at Moonshadow Drive celebrates water in an artistic manner with streams of rainwater falling over granite boulders. There is also an HVAC intake in the cistern that provides cooler air to the house, and an acoustic connection (through vents) to the water dripping into the cistern. By using water as an organizing principle, the owners of these two buildings of very different scale have found a way to address their environmental control needs and make the architecture special at the same time.

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