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Rain Water Harvesting: Benefit, Need of Rain Water Harvesting in Future Use of Farmer, Component and Process of Rooftop Rain Water Harvesting

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INTRODUCTION

For the survival of any living beings on earth, water is one of the most important resources as much as food and air. It plays a major role is development of communities, economic and social activities. Unfortunately, not much attention is given for the conservation of this precious resource. India is a land of versatile weather where inconsistency in rain is quite frequently experienced. Due to rapid urbanization, industrialization and infrastructure development the demand of water scarcity arises in ecosystem. Ecosystem is adversely affected due to exploitation of the water resource especially by rapid growth of population. So, in order to have a backup plan for water requirements, a system has to be developed to conserve storm water that could be help in solving most of the water scarcity issues. Owing to the excess use of ground water through over pumping, the level of ground water at various locations has been drastically decreasing. In case if this issue is not addressed then the future generations may have to face a challenge of water scarcity. The major source of potable water is rainfall. Hence, if rainwater is harvested then the water scarcity issues can be altogether decreased and even eliminated. It is well known fact that the collection and storage of rain water is being practiced since many centuries. Rain water harvesting is a technique through which the rain water is captured, stored and reused for various purposes. Various studies have suggested to use harvested storm water for domestic and land-scape purpose. An advanced modified technique of decentralized water management that combines grey water recycling and rainwater management for densely populated city is examined by. This study reports a satisfactory outcome with better water resource management. Similarly several other studies have suggested the importance of adopting rainwater harvesting technique either in small scale (individual dwelling) or for large scale (city/town) levels. A rooftop rainwater harvesting system that consists of various elements for conveying storm water through pipes or drains after collecting from catchment area into storage tanks.

During the course of first rain event the storm water will be flushed out of the system to stop contaminants entering the storage tank. Based on the water reuse application some RWH systems also incorporate filters (especially sand, gravel and charcoal filters) to ensure effective pre-treatment technique. Even though the RWH technique has gained rapid popularity, estimating/designing the storage tank volume for collecting the rooftop stormwater has always been a challenging task. Hence the rooftop rainwater harvesting technique will be more effective in heavy rain intensity regions with well distributed rainfall over the years. Because of vast rooftop area the public institutions will be a focal point to have effective RTRWH system. Generally, they have a significant rooftop area with single managing system with sufficient financial assistance that will favour towards easy implementation of RWH system. Additionally, being the larger administration, it also establishes the trust over rainwater harvesting technique to locals and other organizations. However, a very little initiative and research is reported over the government building on rooftop rainwater harvesting potential especially at University/Institution level. Water scarcity, pollution in water bodies, access to clean drinking water, threat to water dependent ecology, erratic rainfall and climate change are pressing issues around water management. Several government schemes and policies, non-governmental organisations and private companies work to address these water issues.

Rain water harvesting is the technique of collection, filtration and storage of rainwater at surface or in subsurface aquifers, before it is lost as surface run-off, such that the collected water can be harvested in the time of need.

The government has embankment on a campaign for preserving water and is promoting rainwater harvesting across the state. As per directions of chief minister Yogi Adityanath, rooftop water harvesting has to be set up in government and semi government building in six major cities, including Meerut, Bareilly, Lucknow, Prayagraj, Gorakhpur and Jhansi. A government spokesman said that the Jal Jeevan Mission section of the minor irrigation department has been entrusted with the responsibility of coordinating this project.

He said Rooftop rain water harvesting facility has to be installed at 2,19,376 government and semi government building in these six cities. Out of these, work is in progress at 2,07,876 building while it has already been completed in 11,500 building. In rural areas, water harvesting facilities are being installed at both private and public places under MNREGA. This includes setting up of rooftop rain water harvesting systems at government school, digging ponds and recharging pits in a beneficiary farmers field.

The spokesperson said- The campaign for compulsory installation of rooftop rain water harvesting system in all government and semi government building in metropolitan cities is going on at war-footing. Executive engineers have been designated as nodal officers at the district level to monitor the progress in the implementation of the action plan.

Where to install rooftop rainwater harvesting system?

RRWHS can be installed in any building having a roof area, and space to store rainwater in a tank or recharge your own borewell as groundwater. Government offices, institutions, industries, apartments buildings, bungalows, etc., can install rainwater harvesting systems. Schools can also be a great setting for installing rainwater harvesting systems, as it will meet water needs for students' and staff, and also inculcate practical learning about water conservation and environment among students.

Guidelines for construction of Rain / Roof top water harvesting Structures:

1. Recharge structures should be designed and constructed in

favourable geological conditions i.e., permeable soils followed by murram etc. The structures should not be taken up in impervious clayey soils, rock and steep sloped areas.

2. Recharge structures should be preferred for recharging to depleted aquifers with deep water table. They should not be taken up in the shallow water table areas. The depth to water level should be not less than 5 to 6 meters in post-monsoon period.
3. Recharge structures should be taken up with unpolluted surface water only. Adequate precautions should be taken to prevent entry of polluted urban surface runoff water, sewerage water into recharge structures.
4. Recharge structures should be planned and taken up in over exploited and critical areas experiencing intensive ground water development for various uses.
5. All existing kuntas and tanks in and around the urban agglomeration areas are to be protected against encroachments and should be converted as percolation ponds and tanks. The polluted drainage and other industrial pollutants should not be allowed to let into these tanks.
6. Ground water recharge through shafts is preferable in steep slope areas.

Each Components of a rooftop rainwater harvesting system is explained below:

1. **Roof:** The roof of any building is an important catchment area, which is a surface on which rainwater falls and it can be directed to storage or for shallow aquifer recharge. The roof can be sloping or flat, and it is important to check that the finishing materials or paint used on the roof is non-toxic and does not contain mercury. Before the first rains, it is important to clean the roof thoroughly to avoid dirt and other impurities from mixing with rainwater.
2. **Pipes**: Rainwater can be brought down from the roof through pipes. The size of pipes can be decided as per rainfall intensity and roof area. For aesthetic purposes, sometimes people use rain chains instead of pipes. These chains direct the water flow from roof to floor, reduce splashing and create a good visual as water flowers down.
3. **First rain separator:** The first rain of the monsoon season is not stored because the dirt and organic matter mixes with water and such water can create contamination in storage tank. So, the first rain separator removes this water, and subsequent rainwater can be collected.
4. **Filter system:** A filter is needed to prevent stones, leaves, dust and other particles from entering storage tanks or recharge pits. It can be (i) ready filter cartridge available from several manufacturers – to be mounted a few feet above ground on the pipeline bringing water from the roof or (ii) a set of filter chambers usually constructed underground with input from the roof water pipe and output to the storage of borewell.
5. **Storage**: The capacity of a storage tank can be designed based on space availability, needs and usage. If the water is to be used for drinking purposes, the tank can be smaller than if the intended use is for non-drinking purposes.
6. **Recharge and excess outlet:** Once the storage tank is filled, the overflow can be directed to recharge groundwater.

Maintenance

1. Check the terrace areas for any major spillage of oil, chemicals or garbage and clean it particularly at the beginning of the

monsoon season and then every few months.

2. Using the first rain separator (FRS), water from initial two rain showers should be drained off. Then close the cap of the FRS for subsequent rains, so the water flows from roof through the filter to the tank or recharge as per design.
3. Lid of the storage tank should be kept closed all the time, and water stored inside should not be exposed to sunlight.
4. If rainwater is being stored and used, then regular water quality tests will have to be done to ensure drinking water standards, and perform treatment if necessary.
5. Storage tank should be cleaned once a year especially before the monsoon season.
6. Filter media aggregates or filter cartridges should be cleaned as per their maintenance routine.
7. Stored rainwater can be disinfected by chlorination or boiling water before use.

Benefits of Roof Water Harvesting

- Save money on water bills by using your own water source
- Watering for your garden
- No wasting money on water tankers
- No water shortage due to water cuts
- 24 hours water supply with no need to depend on water timings
- Recover your installation cost within 2-3 years due to savings in water bills – this can be considerably less depending on the water demands of your building.
- Savings of up to 200 liters of water per family in the society per day
- Helps the environment through giving back to the water supply.

ADVANTAGES OF RAINWATER HARVESTING:

1. Recharge to groundwater and built up in ground water levels.
2. Rejuvenation of dried-up wells.
3. Improvement in the yields of wells.
4. Improvement in the quality of ground water through dilution.
5. Helps in reducing inundation of roads and flood hazards.
6. Save future generations from water scarcity problem.
7. Reduce power Consumption.
8. Collection of roof top water in to a sump and recharge pit facilitates direct use of rainwater apart from recharge to ground water. This helps in reducing the water bill and huge investments on purchase of water through tankers in scarcity areas.
9. The structures recommended for rainwater harvesting area simple, economical and echo- friendly.

NEED FOR ROOF TOP RAINWATER HARVESTING:

1. To meet the ever-increasing demand for water
2. To reduce the runoff which chokes storm water drains
3. To avoid flooding of roads
4. To augment ground water storage
5. To reduce the soil erosion
6. To supplement domestic water requirement during crisis
7. To improve the quality of ground water

CONCLUSION

Precipitation plays a vital role is deciding the efficiency of the RWHS. The cost of implementation is incomparable with rainwater harvesting methodology for providing sufficient good quality water is a social responsibility and public institution is a better place to start off with. It is underlying fact that the RWHS has its merits and demerits as other technological alternatives. From the cost estimation of implementing RWHS it is clear that the payback period is about 13 years. Eventually the cost of the RWHS is directly depended on storage capacity hence a structured approach is essential before implementation. The majority of designed

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storage tanks may effectively fulfil the water demand for two to three months. Under such scenarios, RWHS could be justified with incurring construction cost when compared with existing system. In case of low rainfall, the RWHS cannot pass through scrutiny of economic benefit for the present study area. Meanwhile the University can also plan to capture the ground water runoff and store it in open lake/pond. The present ground terrain and existing pond within the campus will be beneficial for this approach. Further such RWH initiative should be supported by incentive from the government to encourage various sectors to take it further. Policies, water pricing and promotional activities should be practically and effectively designed before implementation. The future work includes a detailed survey of water demand based on particular activities, since it will guide to increase the efficiency of the system and complete cost estimation. Hence RTRWH is a simple, economical technique that is socially accepted and environmentally sustainable.