IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022

# Rain Water Harvesting and Its Uses

Arun Kumar Pipersenia, Assistant Professor
Department of Civil Engineering, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India
Email id- apipersenia@yahoo.com

***ABSTRACT:*** ***Water was among the most extensively used chemicals on our world. All of our everyday activities need the use of water. In most urban locations, water supply is frequently in short supply relative to demand. Because surface water is inadequate to meet our requirements, we must depend on underground water. As a consequence of expanding urbanization, rainwater penetrating into the groundwater has dropped substantially, and groundwater flow has diminished. In this instance, an alternative source is important to balance the demand-supply imbalance. Rainwater, the purest sort of water, would be an immediate source to replace the present water supply by "gathering water wherever it falls." Rainwater harvesting is the practice of collecting and storing rainwater in a systematic and controlled manner for future use.In this paper we discussed about the advantages and disadvantages of rain water harvesting with different technique. The future scope of this study is to understanding the whole scenario of water harvesting.***

***KEYWORDS:*** ***Groundwater, Roof, Rainwater, Storage, System.***

## 1. INTRODUCTION

Rain water harvesting is a method or plan for collecting rainwater and properly storing it for future use. Water may be collected and stored from a variety of surfaces and platforms. The water is mainly collected from roofs and other paved areas in most circumstances. Rainwater harvesting is regarded as a very dependable method of water conservation. This method has been around a long time and has been used since ancient times. This traditional technique of flood control has become fairly popular in recent years. It is critical in minimizing the consumption of potable water while increasing the reliance on rainfall. Harvesting rainwater, in basic terms, involves using every drop to replenish the groundwater by simple

ISSN PRINT 2319 1775 Online 2320 7876
*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022

directing it to a well or under the earth (Anand, 2019; Chandrika Kota et al., 2020; Madara & Namango, 2016).

Surprisingly, India barely consumes 10-20% of its yearly rainfall. Only a little amount of rainwater infiltrates and reaches the groundwater aquifers when it rains. This means that the vast bulk of the rain falls down the drain and into the ocean. In addition, due to a lack of suitable storage facilities, water must be allowed to flow back to the ocean in order to avoid folding and breaching. Not to mention the uncontrolled usage of bore wells, which are fast increasing in number and depth, posing a serious danger to our country's groundwater supplies. The greatest way to combat the worldwide danger of groundwater depletion is to capture every drop of precipitation and use it to artificially replenish the water tables (Khan et al., 2012).

Water reuse in urban contexts includes rooftop rainwater catchment, rainwater collection in pavement and unpaved areas, and water saving in paved and unpaved areas. Large-scale rainwater harvesting using open ponds, lakes, and tanks, for example (Garg et al., 2012).

### *1.1. Rainwater Harvesting Benefits*

Harvesting may be done using infrastructure in both residential and commercial areas. Storage tanks are one of the easiest methods to store water from the collection. The collected water is normally routed to water tanks, cisterns, or ponds in most circumstances. In most cases, the water is saved for later use. The ideal place to collect rainwater is on a building's roof. There are a slew of benefits to doing so (Khan et al., 2012).

Any community may benefit from the deployment of a rainwater collecting system. First of all, and foremost, the gathering allows for a more efficient and effective use of energy resources. It is critical since potable water is seldom renewable, resulting in waste. Water collecting systems are based on basic approaches that are extremely straightforward to maintain. In comparison to alternative purifying or pumping processes, the total costs of setting up harvesting systems are substantially lower. Its upkeep is also cost-effective since it does not need large sums of money

ISSN PRINT 2319 1775 Online 2320 7876
*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022

(Alwan et al., 2019; Guhey & Mukherjee, 2012; Gupta & Kumar, 2012; Mume & Kemal, 2014).

### *1.2. Reducing Water Bills in an Inaccurate Manner*

Freshwater that has been collected and preserved for non-drinking reasons may be utilized in a variety of ways. It will lower one's utility expenses right away. It's appropriate for both home and industrial buildings.

### *1.3. Irrigation-Friendly*

Harvesting permits vast volumes of water to be collected. The preponderance of roofs provide the necessary platform for collecting rainwater. Rainwater is ideal for irrigation since it is often free of harmful contaminants (Choudhary et al., 2019; El-Nahry A, 2015; Kabbashi et al., 2020; Sivanappan, 2006).

### *1.4. Lessen the demand for groundwater*

Another significant benefit is that it lowers the need for potable water. It's crucial, particularly in locations where water levels are low. These are just a few of the many benefits of rainwater collections (Agrawal et al., 2019).

### *1.5. Rainwater harvesting is required*

Water harvesting is the process of gathering rainfall directly from the sky and storing it for later consumption or recharging groundwater.

- As water becomes scarce, achieving self-sufficiency to meet water demands is becoming more important.
- The urban pump station is under immense strain in order to meet the demands of an ever-increasing population.
- Groundwater is depleting and becoming contaminated.
- Soil erosion caused by uncontrolled runoff.
- Health risks associated with consuming dirty water.

### *1.6. Rainwater Harvesting Has Its Drawbacks*

This approach has a number of disadvantages in addition to its benefits:

ISSN PRINT 2319 1775 Online 2320 7876
*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022

- Unpredictable Rainfall - Rainfall volume is difficult to anticipate. Rainfall may be limited at times, with little or no rainfall, therefore relying solely on this resource is impossible.
- Not Good for All Places — this approach is only suitable for areas with a lot of rain.
- Expensive — Depending on the size and technical level of the system, a rainwater collecting system may spend anywhere from $200 to $2000. Given the high initial expenditure, it may not be repaid if you are unable to utilize the system due to unpredictable or limited rainfall (Gola et al., 2019).
- Expensive Maintenance - Another disadvantage is the high expense of routine maintenance. Because these harvesting systems are susceptible to rodents, mosquitoes, algae development, insects, and reptiles, they need a lot of upkeep. They could become a potential source for a variety of animals and insects if they are neglected or badly managed, resulting in additional difficulties (Laurie et al., 2017).
- Storage Restrictions - The collecting facilities may put various limitations on the amount of precipitation you may utilize. In the event of severe rain, the collecting system would not be able to store all of the water, and the water may eventually flow into sewers or rivers (Sharma et al., 2019).

## 2. DISCUSSION

### *2.1. Rainwater Harvesting System:*

A rainwater harvesting scheme, also known as a rainwater collecting system or a rainwater catchment system, gathers and stores precipitation for human use. Simple finished with an oil rubbed to more complicated constructions with engines, tanks, and purifying systems are all examples of rainwater gathering systems. The no potable water may be used to irrigate gardens, flush toilets, wash automobiles, and even wash clothing, and it can be cleaned for human use. With water shortage a major issue in many densely populated areas, rainwater collecting systems may provide water to families and businesses during dry seasons, reducing the strain on municipal systems.

ISSN PRINT 2319 1775 Online 2320 7876
*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022

Rainwater harvesting may be an effective way of gathering that valuable resource, particularly that rainfall is intermittent and only a tiny percentage of environment. The external is readily accessible for human use. Almost all of the rainwater on homes, buildings, roads, and other surface landscaping in cities is channelled into storm drains for disposal rather than percolating into the soil. In many regions, impermeable surfaces induce urban floods and produce polluted waste water that is diverted away the potable water sources. Local groundwater may be depleted during dry months, and many communities struggle to fulfil demand for drinkable water on a constant basis. Rainwater collection for no potable use, such as gardening and laundry, decreases both the quantity of total fresh water consumed and the burden on storm water infrastructure. In major cities, this reduction in demand and availability of drinkable fresh water is considerable. Although many communities promote and even fund rain water and other rainwater gathering devices, certain places, notably in the Southwest, see rainwater catchment as a water rights problem and impose limits on its use.

### *2.1.1. Design recommendations*

No-pressurized rainwater collection devices, such like rain barrels, where pipes flow from downspouts into a tank, are the most basic. Known as "dry systems," these buildings do not retain any water in the conduits after it stops raining, preventing mosquito and other insects from developing. When the pipework cannot be arranged to flow directly into the tanks, "wet systems" are required. Pipes from either the gutter run efficiently and then up via a riser into the tank in situations where the containers are placed some distance from the collecting surfaces or when there are a sequence of tanks to service a lot of buildings. Such installations 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), with lead-based paints and coverings being avoided, and tanks should be built of nontoxic and chemically stable materials. To prevent drawing out any gunk that may have developed in the water supply, make

ISSN PRINT 2319 1775 Online 2320 7876
*Research paper* © 2012 IJFANS. All Rights Reserved, **UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022**

sure the tank output taps of draw-off tubing are at least 3 - 4 cm (4 inches) far above tank bottom. Although some systems contain a sump pump and a washout line to remove sludge, all systems need have their interior surfaces cleaned on a regular basis.

Catchments should also be maintained free of dirt, moss, mosses, and other detritus. Tree branches that dangle over the catchment areas should be pruned. Cleaning gutters, tank inlets, etc. screens on a regular basis, as well as an annual tank check, are required for optimal operation. To keep track of the water's quality, it should be tested on a regular basis.

### *2.1.2. Quality*

Rainwater gathers dust and chemicals as it falls down through the atmosphere, mixing with both insoluble and soluble components from the places on which it drops. Plants, fungus, and other organic items, as well as inorganic particles such dissolving minerals, chemicals, chemicals, or water-soluble paints, may all be contaminants. Rainwater collected from dirty surface runoffs is not safe for drinking or cooking, despite the fact that it does not just need to have a high degree of cleanliness for garden or irrigation activities. Ground water in the storm water storage reservoir may be improved by separating the initial flush of rainfall from the roof, downspouts, and other gathering surfaces.

If the rainwater is to be used in the home, it is now being cleansed. To remove microbes, organic debris, and substances that form films on interfaces or fall to the bottom of both the tanks as sludge, flocculation, settling, and biofilm skimming may be utilized. To bind tiny suspended particles into bulk materials that can be recovered by settling and filtering, a liquid alumina solution may be added to the entering raw water. The drinking water is then free of undesirable colour, turbidity (cloudiness), and aluminium. If the water is meant for potable use, it may be disinfected using solar water purification or treated with chloride and perhaps other chemicals to destroy pathogenic organisms. Potassium permanganate, calcium carbonate, and fluoride are some of the other chemicals used to purify water.

### *2.2. Rainwater Harvesting Techniques*

ISSN PRINT 2319 1775 Online 2320 7876
*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022

Rainwater may be collected in a variety of ways, depends on a few criteria. The following are a few examples of frequent methods:

- *Rain barrels are number one.*

It is the most humble and cost-effective way of rainwater gathering, particularly at home. It is where buckets or water tanks are positioned underneath the rooftop guttering system's downspouts. 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 soaker hoses. The usage of barrel or tanks is good since they can hold a large volume of water (Meenu et al., 2019).

- *The Drying System*

It's comparable to the barrel method, but the dry system makes use of a bigger storage container. Typically, the container is a few centimetres 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 (Ashraful & Islam, 2015; Bhosale et al., 2020; Manju & Raja, 2019; Murgor et al., 2013).

- *Wet System*

It's a completely different method from the dried system. Water will always be present in the collecting pipes here. 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.

- *Green Roof*

This harvesting technique doesn't need use of pumping stations. The water is piped directly to the garden rather than being stored in a reservoir. The procedure will need the installation of a sewer system on a building's roof that will go directly to the backyard. It's a system that requires very little upkeep. These are a handful of the most common rainwater gathering technologies used in many houses (Azis et al., 2019; Jain et al., 2019; Nimje & Wayal, 2019; Rowe, 2011).

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022

## 3. CONCLUSION

Rainwater storage aids in replenishing aquifers. It aids in the prevention of urban floods caused by excessive rainfall. In agricultural areas, the stored water may be utilized for irrigation. The water may be utilized on a daily basis and can help municipalities and cities save money on their water costs. Rainfall in India is unpredictable and variable throughout the year. In addition, certain portions of India, such as Rajasthan, have water shortages during the dry season. Water may be saved and utilised during the dry season with the use of rainwater gathering systems. Because rainwater collection delays runoff and allows it to soak into the soil, it enriches the soil with nutrients and maintains it healthy. This is critical, since the need for food is growing by the minute. Every second, 200,000,000 gallons of water are utilized to produce food for our globe.

## REFERENCES

Agrawal, T., Agrawal, A. K., & Singh, S. K. (2019). An efficient key-accumulation cryptosystem for cloud. *International Journal of Engineering and Advanced Technology*.

Alwan, K. K., Ali Al-Kubaisi, M. S., & Al-Ansari, N. (2019). Validity of Existing Rain Water Harvesting Dams within Part of Western Desert, Iraq. *Engineering*. https://doi.org/10.4236/eng.2019.1112055

Anand, V. (2019). Photovoltaic actuated induction motor for driving electric vehicle. *International Journal of Engineering and Advanced Technology*, *8*(6 Special Issue 3), 1612–1614. https://doi.org/10.35940/ijeat.F1298.0986S319

Ashraful, A., & Islam, M. (2015). A Study on Rain Water Harvesting and Comparative Cost Analysis with Withdrawal of Underground Water around Gazipur City. *Journal of Environmental Science and Natural Resources*. https://doi.org/10.3329/jesnr.v8i1.24678

Azis, S. U., Nugroho, A. M., & Nikita, N. (2019). Konservasi dengan rain water harvesting system sebagai solusi efektif bagi bangunan sekolah. *Jurnal Pengelolaan Lingkungan Berkelanjutan (Journal of Environmental*

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022

*Sustainability Management)*. https://doi.org/10.36813/jplb.3.1.258-271

Bhosale, M., Ukhalkar, P., & Kadam, D. M. (2020). Smart Rain Water Harvesting System (SRWHS) Using IoT Enabled Smart Kit for Better Tracking and Management in Pune City. In *Allana Inst of Management Sciences, Pune*.

Chandrika Kota, V. S. P., Annepu, C. R., Dusarlapudi, K., Sreelatha, E., & Tiruvuri, C. S. (2020). Smart approach of harvesting rainwater and monitoring using IoT. *Journal of Advanced Research in Dynamical and Control Systems*. https://doi.org/10.5373/JARDCS/V12I2/S202010011

Choudhary, P., Dwivedi, R. K., & Umang. (2019). A novel framework for prioritizing emergency vehicles through queueing theory. *International Journal of Engineering and Advanced Technology*.

El-Nahry A, R. A. (2015). Rain Water Harvesting Using GIS and RS for Agriculture Development in Northern Western Coast, Egypt. *Journal of Geography & Natural Disasters*. https://doi.org/10.4172/2167-0587.1000141

Garg, N., Jain, A. K., Ansari, A., Sharma, A., Singh, J., & Chugh, T. (2012). Dimorphism of maxillary and mandibular canine teeth in establishing sex identity. *Indian Journal of Forensic Medicine and Toxicology*.

Gola, K. K., Dhingra, M., & Rathore, R. (2019). Modified version of playfair technique to enhance the security of plaintext and key using rectangular and substitution matrix. *International Journal of Engineering and Advanced Technology*.

Guhey, R., & Mukherjee, A. (2012). Impact analysis of rain water harvesting and artificial recharge on Karstic Chandi limestone aquifer of Boriyakhurd micro watershed, Raipur, Chhattisgarh. *International Journal of Earth Sciences and Engineering*.

Gupta, P., & Kumar, A. (2012). Fluoride levels of bottled and tap water sources in Agra City, India. *Fluoride*.

Jain, V., Goyal, M., & Pahwa, M. S. (2019). Modeling the relationship of consumer engagement and brand trust on social media purchase intention-a confirmatory

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022

factor experimental technique. *International Journal of Engineering and Advanced Technology*. https://doi.org/10.35940/ijeat.F1163.0986S319

Kabbashi, N. A., Jami, M. S., Abdurahman, N. H., & Puad, N. I. M. (2020). Rainwater harvesting quality assessment and evaluation: IIUM case study. *IIUM Engineering Journal*. https://doi.org/10.31436/iiumej.v21i1.1139

Khan, M. K., Haroon, A., Hanif, S. A., & Husain, M. (2012). A study of pattern of fatal head injury at J.N.M.C. hospital, Aligarh. *Indian Journal of Forensic Medicine and Toxicology*.

Laurie, S. M., Nhlabatsi, N., Ngobeni, H. M., & Tjale, S. S. (2017). The Effect of In-Field Rain Water Harvesting on Orange-Fleshed Sweet Potato Biomass and Yield. *Journal of Agricultural Science*. https://doi.org/10.5539/jas.v9n10p1

Madara, D. S., & Namango, S. S. (2016). Potential of Roof Rain Water Harvesting at an Industrial Setup. *Journal of Environment and Earth Science*.

Manju, P., & Raja, S. (2019). Authorship Pattern of Rain Water Harvesting Research Management Publications. *Library Progress (International)*. https://doi.org/10.5958/2320-317x.2019.00003.5

Meenu, Andeep Kumar, S., Panchal, V. K., & Kumar, R. (2019). Evolution of new integrated haze removal algorithm based on haze line. *International Journal of Engineering and Advanced Technology*. https://doi.org/10.35940/ijeat.E7084.088619

Mume, J., & Kemal, A. (2014). Factor Affecting Rain-Water-Harvesting Technology Adoption and Farmers Practices against Drought and Water Shortage in Eastern Hararghe Low Land, Ethiopia. *International Journal of Agricultural Science, Research and Technology in Extension and Education Systems*.

Murgor, F. A., Owino, J. O., Cheserek, G. J., Saina, C. K., Author, C., & Cheserek, G. J. (2013). Factors Influencing Farmers ' Decisions to Adapt Rain Water Harvesting Techniques in Keiyo District , Kenya. *Journal of Emerging Trends in Economics and Management Sciences*.

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  **UGC CARE Listed ( Group -I) Journal Volume 11, Iss 12, Dec 2022**

Nimje, J. J., & Wayal, A. S. (2019). Improvement in ground water quantity using rain water harvesting system in coastal area. *Journal of Critical Reviews*. https://doi.org/10.22159/jcr.06.06.32

Rowe, M. P. (2011). Rain water harvesting in Bermuda. *Journal of the American Water Resources Association*. https://doi.org/10.1111/j.1752-1688.2011.00563.x

Sharma, A., Sharma, M. K., & Dwivedi, R. K. (2019). Hybrid neuro-fuzzy classification algorithm for social network. *International Journal of Engineering and Advanced Technology*. https://doi.org/10.35940/ijeat.F8537.088619

Sivanappan, R. K. (2006). Rain Water Harvesting , Conservation and Management Strategies for Urban and Rural Sectors. *Rainwater Harvesting and Water Management*.