

Rain Water Harvesting: A Lifeline for Human Well-Being

Mr. R.L.Nibe¹ Mr.M.S.Sutar² Mr.A.S.Wani³ Mr.K.Tambe⁴ Mr.S.K.Sonawane⁵

^{1,2,3,4,5}Department of Chemical Engineering

^{1,2,3,4,5}Pravara Rural Engineering College, Loni (Ahmednagar) Maharashtra

Abstract— Today India is facing the shortage of water, water is a more than often been seen as a cause for social conflicts protests, demonstration and road blockades. Water is an essential element of life. Life impossible without this precious gift of nature. One of the biggest challenge of 21st century is to overcome the growing the water shortage. Rain water harvesting is helpful to various types of artificial recharge techniques, operation, maintenance, reducing soil erosion also in improving the quality of ground water. The collection of rainwater is the most important and economical aspect.

Key words: RWH, Rain Water Harvesting

I. INTRODUCTION

The concept of rainwater harvesting involves “tapping the rainwater where it falls” major portion of rainwater falls on earth surface run’s off into streams and rivers. The technique of rainwater harvesting involves collecting rain from roofs, plain sloping surfaces. In urban areas the roof top rainwater can be conserved & used for recharge of ground water. Rainwater harvesting has been used throughout history as a water conservation measure. Particularly in regions where other water resource are scare or difficult to access.

A simple and effective way to increase usable water supply and to decrease demand an ever stressed freshwater resource is rainwater harvesting. The most efficient & cheapest way of conserving rainwater at agricultural farm. The farmers are not aware of rainwater management for storage and ground water recharge. The major constraints identified for conservation and management of water & soil in area includes lack of technical knowledge & poor economic status of farmers. The agriculture is total dependent on rain. The type & amount of rainfall is such that is the vegetation is disturbed large scale erosion could ensure.

Urban centers in India are facing an ironical situation with regard to water today. The shortage of ground water is more pronounced due to urbanization and limited open areas available for recharge of ground water.

Water is more than often been seen as a cause for social conflicts, protests, demonstrations & road blockades. researchers and policy makers have shown renewed interest in water use strategies due to rising water demand. Increase interest in conservation and increased regularly emphasis on reducing storm water runoff volumes and associated pollutants loads. Water forms the lifeline of any society. Water is essential for the environment, food security and sustainable development. India has long tradition of water harvesting many of the traditional water harvesting system have either fallen it to disuse due to variety of physical, social, economic, cultural& political factor which have caused their deterioration.

Rainwater harvesting is a system by which, the rainwater that collect on the roofs and the area around the

building is directed into open wells through a filter tank or into percolation chamber, built specifically for this purpose.

Water is also being obtained through desalination artificial rain by cloud seeding etc. In some or the developed countries the shortage of water even for drinking purpose is perpetual phenomenon throughout the world. Countries like In India it is used only once before being disposed. The never ending exchange of water from the atmosphere to the oceans& back again is known as the “hydrologic cycle”. Water is essential for life & plats a major role in creating earth’s climate. Rainwater harvesting is life line for well-being.

Water is an essential elements of life. Life on this planet is impossible without this precious gift of nature. Due to irrational cutting of trees the environment balance of the nature has been disturbed leaving the pollution has been increasing rapidly to this since plants absorb Co2 and release oxygen since the number of tress on earth is been decreasing due to increased deforestation there are no trees to absorb Co2 in the atmosphere is increased leading to rise in temp of earth and effects like global warming. Trees collect cloud together and increase the rainfall since there are no trees or few trees in the rainfall has been gradually decrease over the years water provides no work be it household chores or be it any process in industry or agriculture work is impossible without water but we do not understand the value of this gift of nature we waste much of water by our even though there is high rainfall in the monsoon season in Mumbai the city faces acute shortage of water in the summer do any of us have ever think of this problem. The reason much of the water is been wasted and it drained away into sea since no water is not arrested and percolate into the group ground the water which should have percolated into ground and increase the ground water level goes into the ocean as result the region of Mumbai which having highest rainfall in Maharashtra suffer the problem of acute shortage of water in summer season. The best option which can show these problems is rainwater harvesting there are various methods to collect rainwater they are

- Rain barrels
- Wet system
- Dry system

II. ARTIFICIAL RECHARGE TECHNIQUES

- Conservation & storage of excess surface of water for future requirements since this requirement often change within a season or a period.
- To arrest sea water ingress.
- To improve the vegetation cover & reduce flood hazard.
- To improve the quality of existing ground water through dilution.
- To reduce power consumption.

A. Domestic:

One of the biggest challenges of the 21st century is to overcome the growing the water shortage. People collect and store rainwater in buckets, tanks, ponds & wells. This collecting rainwater can be used for multiple purposes ranging from irrigating crops to washing cooking & drinking. The rainwater harvesting is a simple low cost technique that requires minimum specific expertise of knowledge & offers many benefits.

B. Various types of harvesting water:-

- Capturing run-off from rooftops.
- Capturing run-off from local catchments.
- Capturing seasonal flood water from local stream.
- Conserving water through watershed management

C. Glossary of terms:

- 1) Bore well: small diameter wells, which are generally deeper than open wells.
- 2) Ground water: the water retained in the intergranular pores of soil OR fissures of rock below the water table is called ground water
- 3) Artificial recharge: any man made scheme OR facility that adds water to an aquifer is artificial recharge system.
- 4) Open wells: some as dug well. These wells where kept open in earlier days for manual withdrawal of water. Today with electrical OR diesel petrol pumps, They can be fully covered.
- 5) Recharge: the process of surface water joining the ground water aquifer.

D. Programmable:

There are currently no federal regulations governing rain water harvesting for non potable use and policies and regulations enacted at state and local levels vary widely from one location to another regulation are particularly fragmented regard water conservation.

E. Water Resources:

Water resources are limited and highly variable the judicious use of these resources is essential agriculture is the main occupation of people of almost all the states of India the rate of irrigation water has gained importance in overall of water for irrigation purposes is the main problem of cultivation hilly states.

F. Rainwater Harvesting and Ecosystem Services:

Rainwater harvesting is often an intervention intended to augment provisioning series of environment for human well being provisioning services of environment as defined in millennium Ecosystem assessment include environmental services such as improved safe water supplies.

G. Cultural ecosystem services and rainwater harvesting:

Water has strong cultural and religious values these values are critical for human spiritual well being and are recognized as having an essential role in societal interactions. Water flows in the landscape and effects of rainwater harvesting: Rainfall is the main source of freshwater in all land based ecosystem whether natural of managed by human from arid deserts to humid tropical rainforest the of water through ecosystem shapes the

characteristics fauna and flora as well as soil system rainwater harvesting is principally the management of these two partitioning points in water flow.

H. Need for Rain Water Harvesting:-

Major parts of our country have been facing continuous failure of monsoon and consequent deficit of rainfall over the last few years. Also due to ever increasing population of India the use of ground water has increased drastically leading to constant depletion of ground water level causing the wells and tube wells to dry up. In some places excessive heat waves during summer create situation and domestic need out of 8760 hour in year; most of the rain in India falls in just 100 hours.

III. RAIN WATER HARVESTING AND UTILIZATION:-

The rain water collected can be stored for direct use of can be recharged into the ground water to improve the quality of ground water and rise in the water levels in wells and bore wells that are drying up as well as reduce the soil erosion as the surface runoff is reduced rainwater harvesting is an ideal solution to water problem in area having in adequate water resource and helpful in mitigation of the effect of drought and attainment of drought proofing, Even Cherrapunji, India which receives about 11,000mm of rainfall annually, suffers from acute shortage of drinking water. This is because the rain water is not conserved and is allowed to drain away. Thus it does not matter as to how much rain falls at a place if it is not captured or harvested there for use. This highlights the need to implement measures to ensure that the rain falling over a region is tapped as fully as possible through water harvesting either by recharging it into the ground water aquifers or storing it for direct use.

A. Technical:

In many areas, state or local regulations restrict the use of cross connections with mechanical backflow prevention and require that the municipal supply be used to fill small day tank or to partially refill cisterns directly in cross connection configuration the municipal water feed is directly plumbed to the same water distribution system fed by harvesting system. The water conservation performance of active system is significantly better than that of passive system due to two primary factor storage volumes & delivery system the potential for water conservation varies significantly with factors such as climate, land use and development type.

B. Operation & maintenance:

Active system have similar basic maintenance requirements to passive systems namely debris removers and filter maintenance because active system are larger and typically include more components, some additional maintenance may be depending on design for example most active system includes some type of filtration device or capability up stream of points of connection of collection system to cisterns. Inspection and maintenance schedules vary depending on type of system and intended use of harvested water the table below provides guidance on basic maintenance requirements for cistern systems.

Table shows suggested maintenance procedures for rainwater harvesting system.

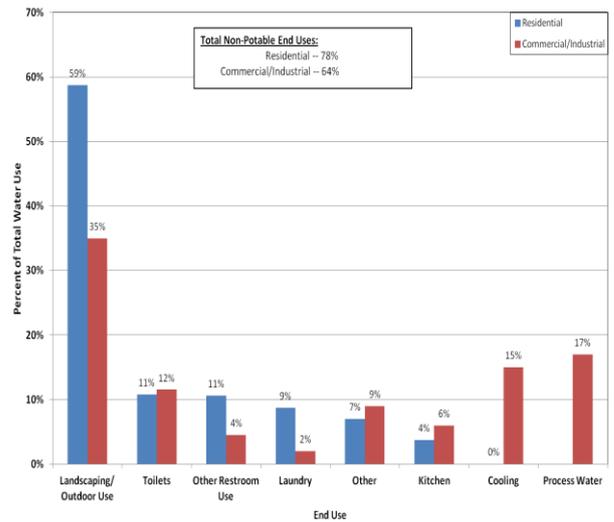
Activity	Frequency
----------	-----------

1) Keep gutters & downspouts free of leaves & other debris	O-twice a year
2) Inspect & clean pre-screening inlet filtration devices & first flush diverters	O-four times year
3) Inspect & clean storage tank lids, paying special attention to vents & screens on inflow & outflow spigots check mosquito screens & path holes or gaps immediately	O-once a year
4) Inspect condition of overflow pipes overflow filter path & or secondary runoff reduction practices.	O-once a year
5) Inspect tank for sediment build up	I-every third year
6) Clear overhanging vegetation & trees over roofs surface	I-every third year
7) Check integrity of backflow preventer	I-every third year
8) Inspect structural integrity of tank pump pipe & electrical system	I-every third year
9) Replace damaged or defective system components	I-every third year
Key : O-owner I- qualified third party inspector	

IV. PREDICTABILITY

The efficiency of rainwater harvesting system for conserving water depends largely on the ability to balance water demand with water supply provided by regional precipitation. The ability of rainwater harvesting system to meet water demand using the supply of available rain water is typically expressed in terms of satisfaction & reliability satisfaction refers to the percent of water demand meet or projected to meet by the harvesting system over the entire period analyzed reliability refers to the percentage of individual time units in the time period analyzed that the imposed water demand are entirely met by the system. Regional climate conditions often play a significant role in determining the reliability of the particular system design. The American water association (AWWA) estimation total per capita water use at 172 gallons per capita per day (gpcd) with 101gpcd coming from outdoor uses, 69.3gpcd coming from indoor uses & 1.7gpcd from unknown or identified indoor or outdoor use. Residential indoor uses & their respective percentage of total indoor use 69.3gpcd are estimated to be showers (16.8%) clothes washers (21.7%) dishwasher (1.4%) toilets (26.7%) baths (1.7%) leaks (13.7%) and other domestic uses (2.2%) (AWW1999) of these, toilets & clothes washers have been suggested as ideal potable demand replacement using either reclaimed grey water or harvested rainwater which could supply up to a total of approximately 48.3% of the total typical demand. National & international codes until the fall of 2010 neither the national uniform plumbing codes (UPC) or international plumbing code (IPC) directly addressed rainwater harvesting in their potable or storm water section (kloss 2008, traugott 2007, ecker, 2007).

End Uses as a Percent of Total Water Use



1-Residential end uses based on AWWA (1999)

2- Commercial/ industrial end user based on pacific institute (2003)

Definition & typology of rainwater harvesting system

Rainwater harvesting consist of a wide range of technologies used to collect, store & provide water with the particular & human activities.

V. REDUCING SOIL EROSION

Rain fed areas also confronted with the problems of land degradation through soil erosion watershed management intervention through water harvesting is often synonymous with soil and water conservation. They act both to harvest rainfall and to conserve soil and water as mean of increasing farm productivity. The available evidence reveals that soil loss is reduced by about 0.82 tons per year due to intervention in the water shed in India.

VI. IMPROVEMENT IN THE QUALITY OF GROUND WATER

- Rise in the water levels in well and bore wells that are drying up.
- Mitigation of the effects of drought and attainment of drought proofing.
- An ideal solution to water problems in areas having in adequate water resources.
- Reduction in soil erosion as the surface runoff is reduced.
- Decrease in the choking of storm water drain and flooding of roads.
- Saving of energy to lift ground water.

VII. SUMMERY

- 1) Rainfall, ecosystem, and human well-being rainwater harvesting is the collective terms for a wide variety of interventions to use rainfall through collection & storage, either in soil or in manmade dams, tanks or containers bridging dry spells and droughts. The effect is increased retention of water in landscape enabling management& use of water for multiple purpose.
- 2) Rain water harvesting create synergies by upgrading rain fed agriculture & enhancing productive landscapes farms are undisputedly the most important provides

nearly 60% of global food value on 72% of harvested land the variable rainfall also result in poor crop water availability reducing rain fed yields to 25-50% of potential yields often less than 1 ton cereal per hectare in south Asia .

- 3) Enabling the benefits of rainwater harvesting the extensive intervention of rainwater harvesting in India a governments & communities jointly make efforts in enabling policies & legislation together with cost sharing & subsidies for rain water harvesting interventions.

VIII. CONCLUSION

The collection of rainwater as a water source has on increasingly bright future. Previous study of its application has suffered because most work has been done in isolation from other often similar endeavors however very recently renewed emphasis is being put on the topic by researchers and it is now clear that rainwater collection is unique area of applied science that incorporates a wide range of fields among which are reservoir theory hydrology design construction water treatment environmental pollution history archaeology & economics.

REFERENCES

- [1] Deusdedit Kibassa, *Indigenous Rain Water Harvesting Practices for Climate Adaptation and Food Security in Dry Areas: The Case of Bahi District*, African Technology policy studies Network, 2013, Pp-1-19.
- [2] American Rainwater Catchment Systems Association (ARCSA)/American Society of Plumbing Engineers (ASPE). *Rainwater Catchment Design and Installation Standards*. Austin, TX. October 2008.
- [3] ABCMAC. 2006. *Workshop Recommendations about Cistern Water Quality*. Petrolina/Brazil, 2006.
- [4] Ariyabandu, R.D.S. 2001. *Rainwater Jar Programme in North East Thailand*. DTU, UK
- [5] Bahi District Council, BDC, (2008) *Bahi District Profile*, Bahi, Dodoma
- [6] Amruthavarshini- by A.R. Shiva Kumar BBMP, *Brochure BDA Documents*, 2011 BDA's initiative to conserve a great heritage DH News Service 04-10-2011
- [7] Beijing water authority, annual, *Beijing water resources bulletin 1999-2008* Beijing bureau of statistics, 2009. Beijing statistical yearbook 2009.
- [8] R. N. Athavale, "Water harvesting and sustainable supply in India," Centre for Environment Education, Ahmedabad, India, 2003
- [9] Barton, T. *Rainwater Harvesting in Turkana: water case study*. Practical Action Consulting website last accessed January 2009