Review on Rain Water Harvesting Using Roof Top

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Abstract- *The rate in which India population is increasing day by day, it is said that India will surely replace China from its number 1 position of the most densely populated countries of the world after 20-30 years. Rainwater is essential for life and play major role in creating earth's climate. By modifying land use, the proportion of the different pathway as like- Evaporation, Percolation and run off change. The change ground rainwater accessibility, both for people, simulated and regular sources, thus these will prompt, high rate of utilization of most significant common asset of Rainwater resulting in growth of weights on the allowed fresh rainwater resources.*

Keywords- Rainwater harvesting (RWH), Roof Top, Filter.

I. INTRODUCTION

Water is essential for all life and used in many different ways, It is also a part of the larger ecosystem in which the reproduction of the bio diversity depends. Fresh water scarcity is not limited to the arid climate regions only, but in areas with good supply the access of safe water is becoming critical problem. Lack of water is caused by low water storage capacity, low infiltration, larger inter annual and annual fluctuations of precipitation (due to monsoonic rains) and high evaporation demand.

Rainwater is the most essential need for nature and people. Be that as it may, as human populace expands, society is confronting difficult issues identified with rainwater amount and quality. The worldwide group now recognizes a rainwater emergency: the UN has pronounced 2005 – 2015 the decade of rainwater and a large portion of the Millennium Development Goals concentrate on rainwater; the extent of individuals without practical access to safe drinking rainwater and essential sanitation. Groundrainwater is an important resource for humans. Globally groundrainwater provides 50% of current potable rainwater supplies, 40% of the demand for self-supplied industry and 20% of irrigation rainwater. In India, where 15% of the world's population lives groundrainwater accounts for over 80% of domestic rainwater use in rural areas, and 55 – 60% of the Indian population (about 620 million people) is directly or indirectly dependent on groundrainwater for its livelihood. Subsequent to the expanded utilization of groundrainwater in India, a large number of individuals have been lifted out of destitution (Kemper 2007).

Regardless of and as a result of the significance of groundrainwater, abuse and debasement of groundrainwater supplies is a difficult issue in India, and groundrainwater tables are quickly falling in various states. This is most suitable solution for increasing the ground rainwater table from RAIN WATER HARVASTING (RWH) .Rainwater harvesting (RWH), a customary catchment improvement instrument in South Asia, gathers and stores spillover that falls amid the substantial deluges in the Indian rainstorm season , permitting time for the put away rainwater to recharge pit shallow ground rainwater aquifers.

II. ROOF TOP WATER HARVESTING

Rain rainwater may be harvested in areas, having rainfall of considerable intensity, spread over the larger part of the year e.g. the Himalayan areas, northeastern states, Andaman Nicobar, Lakshadweep islands and southern parts of Kerela and Tamil Nadu. This is an ideal solutionof rainwater problem where there is inadequate groundrainwater supply and surface sources are either lacking or insignificant. Rain rainwater is bacteriologically pure, free from organic matterand soft in nature. In this system, just rooftop top is the catchment The material should be of galvanized iron sheets (G.I.), aluminum, mud tiles, asbestos or cement. If there should arise an occurrence of covering rooftop, it might be secured with rainwaterproof LDPE sheeting. For harvesting of rainwater, a channel is given (Gutter) along the edge of the rooftop. It is settled with a delicate incline towards down pipe, which is implied with the expectation of complimentary stream of rainwater to the capacity tank. This might be comprised of G.I. sheet, wood, bamboo or whatever other locally accessible material. The down pipe should be no less than 100 mm breadth and be given a 20 network wire screen at the channel to counteract dry leaves and different trash from entering it. Amid the time of no rain, dust, feathered creature droppings and so on gather on the rooftop. These are washed off with the main rains and enter the capacity tank to defile the rainwater. This can be prevented by two methods:

(a) Simple diversion of foul rainwater
(b) Installation of foul flush system.

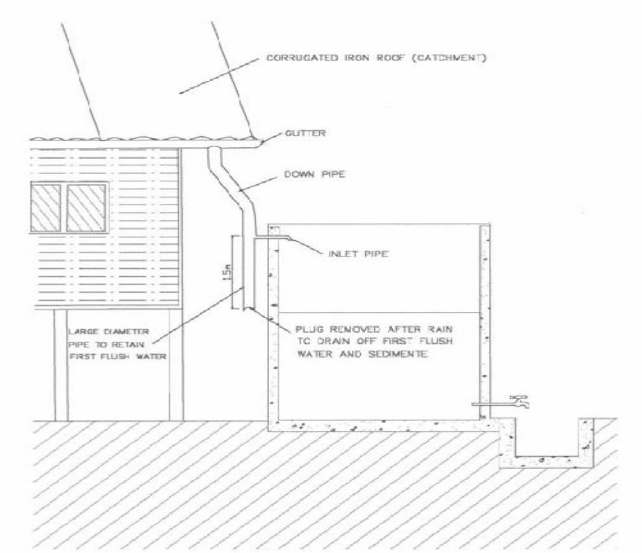

Figure 1:Typical Roof Top Harvesting Structure

III. ADVANTAGES / DISADVANTAGES OF RWH

Advantages

i. One of the appropriate options for augmenting ground rainwater recharge/storage in urban areas, where natural recharge has been considerably reduced due to increased urban activities and not much land is available for implementing any other artificial recharge measure. In rural areas roof top rainwater harvesting can supplement the domestic requirements.
ii. Rainwater spillover which generally moves through sewers and tempest depletes and is squandered. can be harvested and used.
iii. Helps in reducing the frequent drainage congestion in urban areas where fast rate of urbanization has reduced availability of open surfaces.
iv. Recharging of aquifers with harvested rainwater improves the quality of ground rainwater through dilution .
v. The harnessed rainwater can be used when required at the time and place of lack.
vi. The structures required for harvesting are simple, economical and Eco-friendly.
vii. In seaside zones over extraction of ground rainwater lead s to saline rainwater entrance. Hence, energizing of ground rainwater aquifer in such territories controls saline rainwater entrance.

Disadvantages

i. The catchment area and storage capacity of a system are relatively small. There is a great variation in weather. During a prolonged drought, the storage tank may dry up.
ii. Maintenance of rainwater harvesting systems, and the quality of collected rainwater, can be difficult for users.
iii. Extensive development of rainwater harvesting systems may reduce the income of public rainwater systems.
iv. Rainwater harvesting systems are often not part of the building code and lack clear guidelines for users/developers to follow.
v. Rainwater utilization has not been recognized as an alternative of rainwater supplysystem by the public sector.
vi. Governments typically do not include rainwater utilization in their rainwater management policies, and citizens do not demand rainwater utilization in their communities.

IV. COMPONNTS OF RWH SYSTEM

A rainrainwater harvesting system comprises of components for - transporting rainrainwater through pipes or drains, filtration, and tanks for storage of harvested rainwater. The common components of a rainrainwater harvesting system are:-

A. Catchments:

A rooftop top catchment system has three primary parts, specifically, a rooftop, a guttering and first flush device and a capacity tank.

a) Roof:

In this system, just housetop top is the catchment as showed up in Fig. The material should be of blended iron sheets ,aluminum, mud tiles, asbestos or concrete. In the occasion of covering housetop, it may be co vered with rainwaterproof LDPE sheeting. The housetop should be smooth. made of non-perilous material enough broad to fill the tank with the open precipitation condition s. Existing highest points of houses and open structures can be used for a housetop top catchment system. Every so often created or additional roofed structures can be produced.

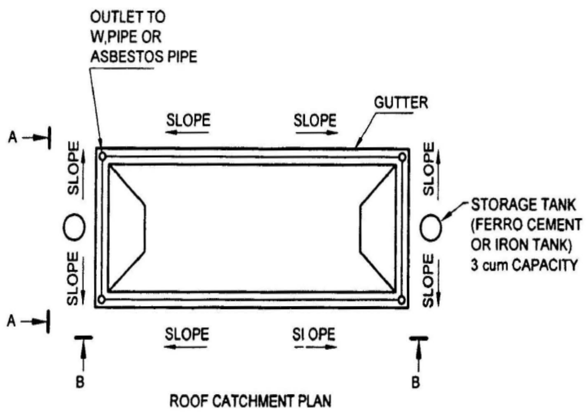

Fig 2: Roof Catchment Plan

The surface which straightforwardly gets the precipitation and gives rainwater to the system is called catchment range. It can be a cleared range like a porch or patio of a building, or an unpaved territory like a garden or open ground. A rooftop made of reinforced cement concrete (RCC), galvanized iron or ridged sheets can likewise be utilized for rainwater harvesting.

B. Guttering

Guttering is intended to protect the building by harvesting the rainwater running of the roof and direct it, via a downpipe, to the storage tank . Drain is given along the edge of the rooftop. It is settled with a tender slant towards downpipe. which is implied with the expectation of complimentary stream of rainwater to the capacity tank . This might be comprised of G.I. sheet, wood. bamboo or some other locally accessible material. The downpipe utilized should be no less than 100mrn distance across and be furnished with a 20 network wire screen at the bay to forestall dry leaves and different trash from entering it. The drain size might be worked out utilizing any standard formula of hydraulics.

C. Conduits:

Conductors are pipelines or channels that carry rainwater from the catchment or housetop zone to the harvesting system. Courses can be of any material such as polyvinyl chloride (PVC) or galvanized iron (GI), materials that are generally accessible.

D. First-flushing:

A first flush device is a valve which guarantees flushing out of first spell of rain far from the capacity tank that conveys a moderately bigger measure of contaminations from the air and catchment floor.

E. Filter:

The channel is utilized to expel suspended toxins from rainwater gathered over rooftop. A channel unit is a chamber loaded with sifting media, for example, fiber, coarse sand and rock layers to expel garbage and soil from rainwater before it enters the capacity tank or recharge structure.

F. Recharge structures:

In alluvial and hard shake regions, there are a great many wells which have either gone dry alternately whose rainwater levels have declined extensively. These can be energized specifically with housetop keep running off. Rainwater that is gathered on the housetop of the building is redirected by drainpipes to a settlement or filtration tank, from which it streams into the energize well(borewell or dugwell). In the event that a tubewell is utilized for reviving, then the packaging (external channel) should ideally be an opened or punctured pipe with the goal that more surface zone is accessible for the rainwater to permeate. Adding to a borewell would expand its energizing limit (creating is the procedure where rainwater or air is constrained into the well under weight to extricate the dirt strata encompassing the drag to make it more penetrable). In the event that a dugwell is utilized for recharge, the well covering should have openings (sob gaps) at consistent interims to permit drainage of rainwater through the sides. Dugwells should be secured to forestall mosquito reproducing and passage of leaves and trash. The base of energize wells should be desilted every year to keep up the admission limit.

V. STUDIES ON RWH GLOBALLY&IN INDIA

Today due to rising population & Economical growth rate, demands for the surface rainwater is increasing exponentially. Rain water reaping is by all accounts an impeccable trade for surface and ground rainwater as later is worried with the increasing expense and in addition ecological issues. Consequently, rainwater harvesting is a practical and generally lesser complex method for dealing with our restricted assets guaranteeing supported long term supply of rainwater to the group. In order to fight with the rainwater scarcity, many countries started harvesting rain. Significant players are Germany (Biggest harvesting system in Germany is at Frankfurt Airport, harvesting rainwater from tops of the new terminal which has a huge catchment range of 26,800 m2), Singapore (as normal yearly precipitation of Singapore is 2400 mm, which is high and most appropriate for rainwater harvesting application), Tokyo (as RWH system holds rainwater which can be used for crisis rainwater requests for seismic debacle), and so on.

Today, only 2.5 per cent of the entire world's rainwater is fresh, which is fit for human consumption, agriculture and industry. In several parts of the world, however, rainwater is being used at a much faster rate than can be refilled by rainfall. In 2025, the per capita rainwater availability in India will be reduced to 1500 cubic meters from 5000 in 1950. The United Nations cautions that this lack of freshrainwater could be the most genuine obstruction to delivering enough sustenance for a developing world populace, decreasing neediness and ensuring nature. Thus the rainwater shortage will be a basic issue on the off chance that it is not treated now in its shelled nut stage. Contrasting figures of rainwater scarcity in world between two timeline (1999 & 2025) are shown in the fig. 2 & fig 3. Some of the major city where rainwater harvesting has already implemented is Delhi (Centre for Science and Environment's (CSE) designs sixteen model projects in Delhi to setup rainrainwater harvesting structures in different colonies and institutions), Bangalore (Rainrainwater harvesting at Escorts-Mahle-Goetze, Designed by S Vishwanath, Rainwater club, http://www.rainrainwaterharvesting.org/People/innovators-urban.htm#svis), Indore (Indore Municipal Corporation (IMC) has announced a rebate of 6 per cent on property tax for those who have implemented the rainwater harvesting work in their house/bungalow/building). Source : The above photographs was the result shown in the website: http://www.rainrainwaterharvesting.org/crisis/Crisis_Scarcity.htm.

Studies by Vasudevan et al. (2001) reported no significant differences in chemical quality with roof material and design of roof, gutter and storage types. Uba and Aghogho (2000) and Polkowska et al. (2002) found pH of roof runoff within acceptable limits. Runoff from a wood shingle roof had a pH lower than that of rainwater (Chang et al. 2004) Roughness and cracks of wooden shingle, trap water which enable timber rotting organisms to penetrate deeper into timber, plants to develop and natural topic to decay, and as a consequence additional H+ ions are released due to weathering and disintegration of organic matter. This makes the care and maintenance of wood shingle very important with respect to quality of roof runoff. Zobrist et al. (2000) detected cat IOns like sodium, potassium and calcium, and anions like chlorides, sulphates and nitrates in all samples, and among the cat ions, sodium and calcium had the highest concentration. The greatest increase of macro ion concentration during passage over roof surface was found for potassium and sodium (Forster 1998).

The differences within roofs clearly indicated that the ions originated from roof material; fibrous cement having greater calcium, and concrete tiles having greater potassium and calcium were susceptible to weathering, whereas dry deposition was of minor importance. But roof contribution of acidic ions like sulphates and nitrates was different, and they were transported by deposition. Study by Zobrist et al. (2000) found that a tile roof acted as a slight source of suspended atoms and alkalinity, and weathering of a gravel roof produced calcium and alkalinity. The high particle load found in a zinc roof was attributed to its strong weathering in grouping with smooth surface that has low resistance to particle wash off (Forster 1996).

Another study was conducted by Forster (1998) to study the influence of location as good as to uncover seasonal behaviour of pollutants in runoff. Differences in concentrations of ions like NH4+ and Cl deposited via atmosphere could be observed with change of season, and roofs receivmg local emission showed elevated attention of suspended particles.

Influence of antecedent dry time, precipitation intensity and roughness of material in the concentration profile of suspended solids and inorganic ions was also studied by Forster (1999). Typical run-off profile started with a high pollutant load and showed a decreasing trend while a modification was found when rain intensities were low and surfaces rough. Suspended solid concentration for tar felt showed an increase within the course of an event. Gromaire et al. (1998) also found a good linear relationship between suspended solid concentration from roof runoff and the following rain event characteristics, viz. dry weather duration, depth and length of rain. LE. Gould (1984) has discussed bacteriological evaluation (complete coli type, faecal coli type and faecal streptococci) from roof tank water.

Accepted water quality standards of Botswana is also tabulated. Generally high quality of properly stored rainwater is seen. Periodic chlorination is the most economic solution as suggested by the author. However the factors which will determine whether a water source is used or not are more likely to be related to taste, color and odour, rather than necessarily directly to quality as stated in the paper.

Ghayoumian .J et .al (2006) paid Special attention to artificial groundwater recharge in water resource management in arid and semi-arid regions. Parameters considered in the selection of groundwater artificial recharge locations were diverse and complex. In their study, factors such as: slope, infiltration rate, depth to groundwater, quality of alluvial sediments and land use were considered, to determine the areas most suitable for groundwater recharge in a coastal aquifer in the Gavbandi Drainage Basin in the southern part of Iran. Thematic layers for the above parameters were prepared, classified, weighted and integrated in a GIS environment by the means of Boolean and Fuzzy logic. To determine the relationships between geomorphological units and the appropriate sites for groundwater artificial recharge, land-use and geomorphological maps were developed from satellite images. The results of their study indicate that about 12% of the study area is considered as appropriate and 8% moderately appropriate sites for artificial groundwater recharge. The relationship between geomorphology and appropriate areas for groundwater recharge indicate that the majority of these areas are located on alluvial fans and pediment units. At the reconnaissance stage these geomorphological units can be considered as appropriate sites for artificial recharge in regions with similar characteristics. Sturm.M et.al in their paper entitled Rainwater Harvesting as an Alternative Water.

United Nations Environment Programme (Mati et al. 2006) conducted a study to determine if RWH technologies can be mapped at continental and country scales. The project utilized a number of GIS data sets including rainfall, land use, land slope, and population density to identify four major commonly adaptable RWH technologies: roof top RWH, surface runoff collection from open surfaces into pans/ponds, flood flow storages and sand/sub-surface dams and in-situ RWH.

Mondal and Singh (2004) conducted a study of unconfined aquifer response in terms of rise in water level due to precipitation; a rapid and cost-effective procedure is evolved in hard rock terrain. Cross correlation of rise in water level and precipitation is established. The entire area is classified into various zones depending on variability in coefficient of correlation. Thus, most favorable zone for artificial recharge is delineated with the help of correlation coefficients.

Venkatesh and Jose (2007) conducted a rainfall study on the coastal and its adjoining areas in Karnataka State. The statistical analyses conducted included cluster analysis and analysis of variance. The study revealed that there exist three distinct zones of rainfall regimes in the study area, namely,Coastal zone, Transition zone and Malanad zone. It is observed that, the maximum rainfall occurs on the windward side ahead of the geographical peak. Further, mean monthly rainfall distribution over the zones has been depicted to enable agricultural planning in the study area.

Sreekanth et al. (2009) used a prediction model to forecast ground water level at Maheshwaram watershed, Hyderabad, India. The model efficiency and accuracy were measured based on the root mean square error (RMSE) and coefficient of determination (R2). The model provided the best fit and the predicted trend followed the observed data closely (RMSE = 4.50 and R2 = 0.93).

VI. CONCLUSION

The effective management of water resources demands a holistic approach linking social and economic development with protection of natural ecosystem. The size of the water tank required to fulfill the drinking and cooking water demand of a family from RWH from rooftop area of different sizes, as expressed by mathematical equations is exclusively for area of study. In this work an overiew of Rain water harvesting with respect to Roof top methd present and work globaaly and in india on RWH. In future work we can perform this work on that land where water problem exist.

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