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RAIN WATER HARVESTING: A LITERATURE REVIEW

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Abstract - About 70 percent of the earth is water. Despite this, if the people living in the remaining 30 percent area are facing its shortage, then it is necessary to know the reasons behind it. Merely knowing these reasons by a few sections of the people is not going to change anything because the existence of water element in nature is going to be constant. If there is a shortage of water in 30 percent of the area, it does not mean that it is getting destroyed from there. Rather, it means that somehow it is getting from there in 70 percent part. The scope of human life is in 30 percent of the earth, it is a serious and shameful thing for the human being to let the water go somewhere else, not caring about it and getting into trouble himself. The sources of water are on the surface, the ground and the sky, and any disturbance from anywhere in this range can affect a very large area. But such disturbances can be fettered only when 30 percent of the people have an intuitive understanding of these disturbances. Along with development, increasing demand for water like other resources is a normal process. Due to increase in population, urbanization, change in living habits etc., the pressure on groundwater is increasing, whose effect is clearly visible in many areas in the form of decline in groundwater level and quality. The availability of water in any region of India depends on the geographical conditions and the amount of rainwater there. But, in this period of development, rapid changes are being made in the geographical structures, the resources are increasing rapidly. Consumption/utility and extinction of various water resources have changed the dimensions of water availability. Now the effect of all ecological dimensions on the water is becoming important. On the other hand, the word pollution has become common to all the areas. Along with the development, some of the relevant effects of the industrial revolution at the global level are constantly taking a formidable form in the form of pollution. Due to this the scope of pollution of water of wells, ponds, rivers, even ground water sources are increasing day by day. The considerable concern is being expressed about the pollution of large parts of the water in these circumstances.

***Key Words*:** Groundwater, Urbanization, Water resources, Population, Conservation, Climate change.

1. INTRODUCTION

Water has the potential to influence the development of any country. The lack of clean water can put a question mark on the existence of entire human life. At present, the water problem is taking a formidable form in front of the whole world. About 25 percent of the world's population is facing a lack of safe (potable) water. In such circumstances, water management is taking the form of a serious international issue on which positive initiative and proper action is becoming imperative. There is an estimate in the world scenario that if the gravity of the situation is not handled in time, then the third world war may not happen for oil or land, but for water. To deal with this menace, every individual, society and country will have to take accountability at their own level from now on. A great deal of support can be found in this noble work by making efforts to change the thinking of the person using positive emotions. The use of high technologies is an effective way of efficient management of available water resources.

Apart from this, public participation (individual and social level) can play an important role. But the question of how to correct such a role has been emerging as a debatable and more important point. Discussions take place on these points in the forums of high professional organizations and learned people, but there is a need to make direct access of people to them with ease and seriousness. Because, without this, it seems like a very difficult task to create emotional awareness among people about water management. As a result of these realizations, as a simple remedy, this work was started. During its creation, many useful points have been included for the general public. So that this work becomes a close ally of the people.

2. LITERATURE REVIEW:

Su et al. (2009): Rainwater harvesting system is an effective choice to conserve water resource, but its capability in effected by demand of water and temporary distribution of rainwater. It has been obvious that the natural rainfall is a continuous process and having its own characteristics and hence it can be explained the probabilistic features of rainfall and its relationship with the supply lacking and design storage capacity of water conservation system.This technical paper discusses with the methods and process of design capacity assessment and its storage capacity. Consequently, a model has been developed to evaluate intensity of rainfall and results obtained were used in futuristic calculation of design storage capacity and the deficit in water supply. The city of Taipei adopted such model as a study are for the purpose of analysis and demonstration for water demand and deficit with design storage capacity relationship.

Farreny et al. (2011) For urban area rainwater harvesting systems, building roofs plays an important role in collecting the rainfall. This technical paper elaborates about the quantitative and qualitative data of roof top storm water collected within the premises of building roofs in an urban area weather environment. This technical paper aims at roof selection criteria to enhance the quality and availability of rainwater. Roofs were selected and monitored for certain period of time for the estimation of runoff volume collected at the rooftop. Collection of roof top runoff volume were different for different kind of roofs depending upon its slope's roughness and flatness.Results so found have significant impact on local governments and urban planners for the redesign of building and subsequently, for sustainable rainwater conservation management.

Ward et al. (2012) Sustainable water management tool kit proves water conservation system as an integral part with the feasibility of potential water conservation scenario. This technical paper aims at the results of longitudinal empirical performance assessment of rain water harvesting system which is located in an office building in the United Kingdom. Moreover, it compares the real time performance with the calculated performances recommended by the British Standards Institute between the Intermediate (Simple calculations) and Detailed (Simulation based) approaches. However, for full life cost data analysis, extra cost details on maintenance and operation is required to perform potential and significant cost saving.

Welderufael et al. (2013) Natural stream flow which occurs from substantial amount of rainfall are intercepted by many water concerned human activities, Rain water harvesting techniques is one of them which involves collection of runoff for the different purpose of the community. Due to increased consumption of water resources in the country, an issue of concern arises for water availability to preserve the ecosystem. To resolve the problem of water scarcity due to excessive use of water runoff, many techniques was adopted in Central South Africa. In this process, small scale formers have adopted the objectives of collecting and preserving the rain water for crop production.

Thomas et al. (2014) United States had adopted a fairly different system for water conservation of runoff. The country adopted the electronic survey system to facilitate the community towards good practices of collecting rain water runoff developed by American Rainwater Catchment System (ARCSA). All the members of ARCSA responded to the survey and about 2700 Rain Water Harvesting Systems across the country have observed in surrounding area. All the exercises was setup regarding the harvesting rain water, its treatment techniques and quality of water testing methods. All the respondents reported about the harvesting water uses which implies the rainwater for irrigation as well as potable use purpose. As a whole, the survey renders the data about non-potable rain water harvesting techniques in the United States and this practice also used for future water conservation techniques research.

Yosef & Asmamaw D. K. (2015) Ethiopia region is largely dependent on rainfall and rain-based agriculture has been widely adopted for many centuries. Therefore, rainfall constitute an important component of the weather for improvement in agricultural productivity. Acute weather conditions and seasonal variation of functional weather elements imparts adverse impact on productivity because crop productivity is controlled mainly by rainfall. With the growing weather circumstances, rainfall is a must factor for agricultural schemes and its management. In order to counter such a problem, efforts by capable Ethiopia government and local communicating have adopted various water conservation techniques.

Various rain water harvesting techniques has been done up to a remarkable effect on soil moisture enhancement, surface runoff and groundwater recharge. Consequently, improvement in cultivation of crops which helps in reduction of risks and possesses positive benefits towards ecosystem. As a whole, water conservation techniques helps in management of water scarcity, agricultural progress and water resource management.

Adham et al. (2016) Water conservation techniques has been widely applied in dry and semi-dry zones to minimize the danger from drought. Due to scarcity of water resources with increasing demand of water, an assessment and waking parttern of rain water harvesting system becomes of utmost importance.This technical paper aims at developing a simple and effective water conservation system at a catchment area to calculate and customize the overall effectiveness of rain water harvesting within design and management criteria. This model

was adopted to analyze rainfall data for 1980-2004 within 25 sub-catchment of watershed area of Wadi Oum Zessar (South Eastern Tunisia). This study stresses on the performance of rain water harvesting system for all seasons of the year (i.e., Summer, Wet, and Winter). This study also shows impact on advantages of long-term water harvesting system and improvement on understanding of hydrological processes within rain water harvesting system and also renders the solutions for water conservation techniques performances.

Roman et al. (2017) Many cities having combined sewer overflow has to counter the urban storm water with the priority. Many of the advanced approaches are now being proposed to resolve the problem. Current research in information technology are now providing cost-effective techniques to receive the best performance of traditional rainfall water infrastructure through the regular monitoring approach. This technical paper elaborates the regular monitoring and evaluation approach which may be applied for traditional rainwater harvesting system in New York City to enhance performance by least discharge to the combined sewer during rainfall water, reducing water use for irrigation of local vegetation and optimization of health. To achieve this objective, a hydrologic and hydraulic model was developed for a planned and designed rainwater harvesting system to explore multiple potential scenarios prior to the systems actual construction.

Lopes et al. (2017) Urban water system across the world is having increasing and variable water scarcity, increase in demand, basic infrastructure deficit, uncertainly being produced by climate change. Rainwater harvesting systems presents the hopeful alternative for water supply system flexibility and capacity increase of water demand. This technical paper aims all the purpose of demand of non potable water and the size of tank in which the rainfall water is received which are helpful for assessment of performance. The efficiency of Rainwater harvesting systems highlights the usefulness of the water supply and demand mechanism towards the economic assessment.

Traboulsi & Traboulsi (2017) The problem of water scarcity and domestic water demand increase becomes more severe over last decades in lebnan and various countries in the middle east region. This issue rises due to population and other economic growth. Rainwater harvesting system proves cost effective, safe and reliable alternative source for docetic source, but uncomfortable and impractical aspects which rates high cost and space requirement for its construction makes this concept not currently adopted in rural and urban areas. This technical paper emphasizes of a purely new water conservation method which may be conveniently adopted in both village and city area. In this method, Rainwater is collected and stored directly into the taken installed in the roof area of the building and it is not necessary to collect such storm water in ground and underground tanks. This method is popularly adopted in Lebanon by which very helpful in recharging the rainwater and eventually saving a lot of amounts of electrical energy which are required for pumping of water from the ground water. It is quite evident that the runoff received from rainwater is not holded on coastal area and thereby reducing the rate of infiltration in the underground surface which may ultimately lead to the ocean.

Kisakye & Van der Bruggen (2018) Climate alternation possesses acute uncertainties toward water accessibility within the rural communities which are facing the scarcity of water already. The rainwater harvesting technique becomes a major strategy for safe drinking water availability in Uganda. However, water conservation capacity has unknown effects of climate changes. Thus, this technical paper evaluates the water-saving and impact of climate changes on water security using water conservation technique for Kabrole district, Uganda. This process also assesses the effects of rainfall during rainy season for saving of water and its security and also calculate the scarcity of water.

Braga et al. (2018). All the cities along with the district of Columbia (DC) facing the problem of combined sewer overflows to manage stormwater flow through the combined sewerage system. Rainwater harvesting system with advancement technique is a modern logistic approach to balance the stormwater and having the feasibility to reduce the issue of combined overflow and to enhance the conservation of water. The rainwater harvesting system adopts regular monitoring and controlling techniques to save or release the water from a rain water harvesting structure. This implies the efficiency of RWH system to get the benefits of wet weather flow from two firehouses installed in DC. Monitoring data's were collected on regular basis for the period of three years for RHW system which were installed systems were emphatic for net weather flow as well as average discharge and harvesting rates are more than 95% . The results propound that if executed to a large scale, Rainwater harvesting system would be a significant tool in impressive management of stormwater flow.

Freni & Liuzzo (2019) Water conservation systems have several advantages being an improved optional water supply remedial solution, within dry and semi-dry areas. Urban areas having risk of flood can be benefited by this system. This technical paper summarises the potential of rainwater harvesting system with reduction of water consumption and in addition to this, efficiency of retention of rainfall water in flood-prone residential communities. The aim of the technical paper was to evaluate the reliability of water conservation system keeping in view of surface runoff retention. Eventually, the performance of rainwater harvesting system to supply stored water for cleaning of water closets in more than stored 400 single family homes in a residential area of Sicily

(Southern Italy) was evaluated. For this study, area with high susceptibility of flooding was selected. Results so obtained shows that potential rainwater harvesting system installation was made within the flood risk areas which is highly concerned to rainfall amount.

Yannopoulos et al. (2019). In the present scenario, Available sources of water demand counters utmost pressure because of demographic, economic, social issues, environmental losses, change of climate and technology changes to the world level. It is obvious that rainwater harvesting being as a conventional method has the capacity to recharge the surface and groundwater resources in the vicinity of inadequate supply of water. In recent years, all the countries have adopted the updated concept of rainwater harvesting to meet the rise in water demand and at the same time tracing out the volume, frequency and peak of runoff in the city area. All these factors evaluate the present circumstances and the exposure for the forthcoming development of such method globally.

This technical paper aiming at all the examination of present condition rainwater harvesting as an additional and alternative source of water to meet the water demand and to solve the issues of water scarcity across the different countries of the world. In short, the paper emphasizes the following:

Reasons behind the scarcity of water.

A brief description of the past development in rainwater harvesting method.

The rainwater harvesting concept overviews.

The collective effort to expand interest in rain water harvesting.

The remuneration, scope and objectives for exposures of the rainwater harvesting techniques in different countries globally.

Santos et al. (2020). In order to improve the capacity and efficiency of water consumption, the use of non-potable water for pavement washing, toilet clearing, cultivation and others is the effective strategy which is being adopted. For such situation, the design and analysis of rainwater harvesting system may be made by applying recent or historical records for the future projections of the rain water harvesting systems to be developed. The technical paper includes the study of the rainwater harvesting system in the area of Portugal Southern Europe. The main objective was to evaluate the impact of climate change on these water conservation systems and for this purpose daily simulation using the projected rainfall data was taken into account. It has been observed that there were no appreciable changes in water conservation system performance in the concerned areas.

Tamagnone et al. (2020). Various strategies and measurers are adopted to counter the anthropic and climate change effects on drought prone area. This technical studies, exercise the potential of beneficial rainwater harvesting techniques to be adopted as feasible solutions for flood control measures. This study also summaries the hydraulic performance of catchment for rainwater harvesting peak flow reduction and volume reduction on the field. This study also analyses the basic hydraulic capacity of the various techniques and close look at the high performance of the water conservation techniques where extreme precipitation occurs. Moreover, this study also presents the rainfall runoff model for water conservation issues. Al through a few limitations, this study has the emphatic feature of very high-resolution topography which may be ultimately taken as input for rain water harvesting and conservation system. The outcome of the study also motivates the stakeholder to adopt increasing the use of rain water harvesting system keeping in view to control the flood hazard situation and land degradation that minimizes the draught and semi drought area.

Zhang et al. (2021). Rainwater harvesting systems along with the drip irrigation system are frequently adopted water conservation techniques as curtaining farming and husbandry sustainability in dryland areas of northwest china, however, above mentioned techniques are having benefits as well as drawbacks of their own. According to a meta-analysis conducted on various study cases of four regions of northwest China, it has been evaluated for fruits yield, soil water storages and efficiency of water stored. It is shown that 38.5% of fruits yield (by weight) are currently produced in northwest china. In addition to this also drip irrigation helps in improving yield of fruits which increase by 53.3% or even more so the rainwater harvesting system helps by 19.1% improvement. Further later studies shows that rainwater harvesting system increases o-2 m soil water retention by 13.7 also, the method of drip irrigation system, increase the water use efficiency by 17.2%.

This technical paper enlightens the prouder ability of integrating rainwater harvesting and drip irrigation system for enhancement of water conservation, its productivity, preserving land degradation and desertification as well as reducing poverty in drought prone area.

3. CONCLUSIONS

The government is spending lakhs and crores of rupees on the construction of rainwater harvesting and conservation. But this is also equal to zero in hundred percent in our country, otherwise in a city like Delhi where there is a shortage of water for about nine to ten months, there is water-logging, traffic jams, jams of drains when there is little rain and due to all the problems like road sinking, the common people have to face always.

In such a situation, people can at least make their lives happy by making rainwater accessible again inside through rainwater harvesting, not only can we get rid of our water problem but also make good use of water to the society by the thought

water is life that even though can give. And by saving the people from the scarcity of water, one can avoid the problems in future.

We can save all this through the national level panchayat, village-level groundwater harvesting conservation and management movement. If that would be a movement, which will increase the groundwater, will maintain the soil fertility, which will increase the agricultural production, and take the country to the pinnacle of progress. It is our humble request to every citizen of the country to take forward the slogan of this sacred groundwater conservation, conservation movement and establish India as a developed country.

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