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Study of Rooftop Rain Water Harvesting

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Abstract: ***Water is the most prime resource on the earth which cannot be created like other resources. The population of India is increasing at such a rate that it is said that the India which replace China from its number one position of most populated country in the world. We need water in our day – to- day life for various activities. The increasing population may cause high consumption of most precious natural resource i.e., water which creates pressure on the augmentation of water resources. This increasing consumption of water for domestic, irrigation and industrial purpose may cause depletion of ground water resources. The depletion of ground water results in lowering of levels of underground water levels which creates the necessity of conserving groundwater resources. The main purpose of conservation of ground water is to use the water efficiently and to decrease the wastage of water. In order to conserve the water, to meet the problem of depletion of ground water resources and to fulfil the daily demand of water in urban areas it is necessary to invent alternative method of artificial recharge which proves to be effective in cost and is easier from technical point of view. Rooftop rain water harvesting is one of the alternative technique which can be used for collecting and storing the rain water on the surface or under the surface which can further be use at the time of scarcity. This paper discusses the rainwater harvesting method of artificial recharge of water.***
Keywords: ***Rooftop rainwater harvesting, augmentation of water resource, depletion of ground water***

I. INTRODUCTION

The major portion of rainwater that falls on the earth surface run-off into the stream or river and finally meet into the sea. The technique of rainwater harvesting involves the collection of rain water from the catchment area and storing it on the surface or sub-surface. This stored water can be use directly or can be use to enhance the ground water resources depending on the condition. Construction of small barriers across small streams to collect and store water is also consider as water harvesting.

Collection of rainwater from the rooftops to fulfil the various needs is popular in many parts of India. The general practise of rooftop rainwater harvesting is collecting the rainwater from rooftop in the large basin which is kept below the edge of the roof. This water can fulfil the urgent domestic need. This large basin is made up of iron sheet or cement concrete or bricks. The rainwater from the rooftop is collected with the help of drain pipes which are fixed at the edges of roof.

This practise becomes popular because of its effective cost and collection and storage of rainwater in the tank which is constructed underground. The rainwater harvesting practises vary widely with sizes, types of construction, material use for construction and method for collecting and storing the water.

II. ADVANTAGES OF ROOFTOP RAINWATER HARVESTING

Among all the various techniques of water harvesting, harvesting of water from roof top have following advantages.

1) Rainwater harvesting is an ideal solution for minimizing the pressure of declining of underground water levels.
2) Rainwater runoff which becomes wasted because of flowing through sewers or storm drains can be successfully harvested and utilized.
3) Rainwater is soft in nature, free from organic matter and bacteria.
4) It minimises the danger of flooding of roads.
5) The structures which are required for rainwater harvesting are much more easy, economical and eco-friendly.
6) It improves the quality of ground water by the process of dilution.
7) Losses from rooftop rainwater harvesting are very less as compared to other water harvesting techniques.

III. COMPONENTS OF ROOFTOP RAINWATER HARVESTING

Rooftop rainwater harvesting comprises of following components: -

1) Roof catchment
2) Drain pipe
3) Gutters

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4) Down pipe
5) First flush pipe
6) Filter unit
7) Storage tank
8) Collection sump
9) Pump unit

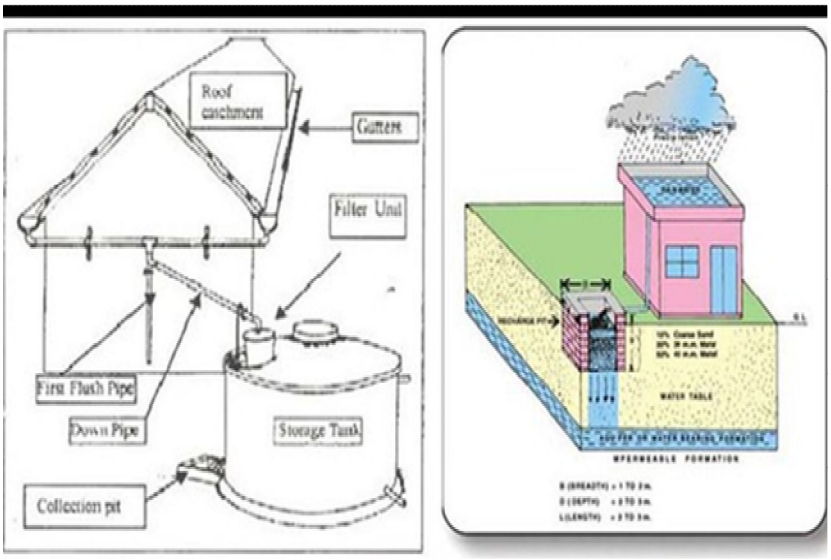


Fig no. 1- Components of rooftop rainwater harvesting

A. Roof catchment

The roofs of the buildings are use as a catchment for collecting rainwater.

B. Drain pipe

The drain pipes are use to drain of the rain water to the storm drain. They are provided as per the building code requirement.

C. Gutters

Gutters are the channels which are provided all around the edges of the roof to collect and transport the rain water to the storage tank.

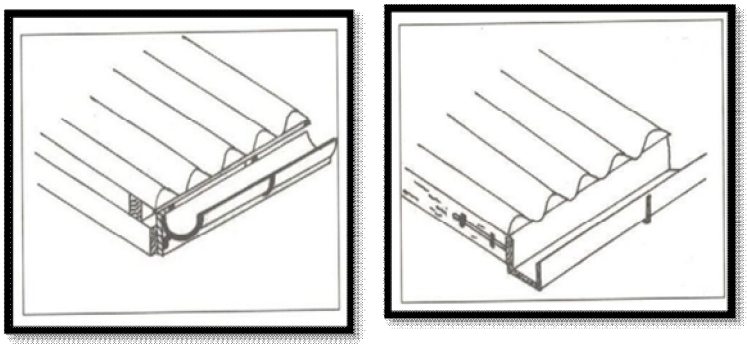


Fig 2. – Semi-circular and rectangular gutters

D. Down pipe

These are the pipes whose one end is connected to the gutters and other end is connected to the filter unit which is installed to the storage tank.

It is used to transport rainwater from gutters to storage tank.

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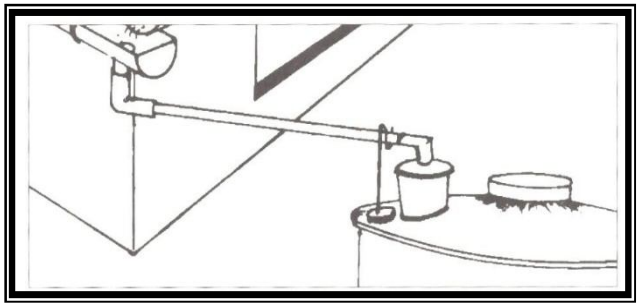


Fig 3. – Arrangement of down pipe

E. First flush pipe

These pipes are provided to remove debris, dirt, dried leaves and dust which is collected on the roof in non-rainy period, which flows with the rain water when the first rain arrives.

If this unwanted material enters into the storage tank it will contaminate the whole water in the tank.

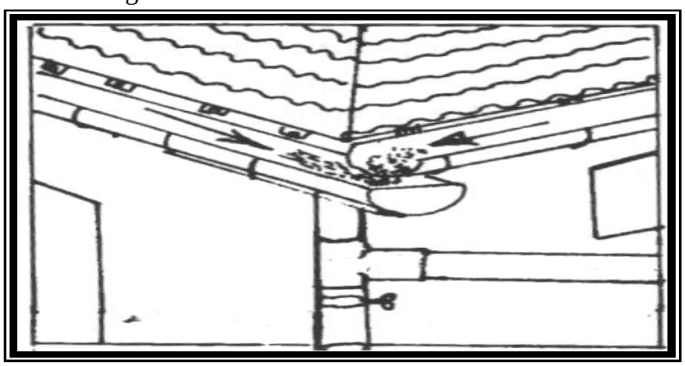


Fig 4. – First flush pipe

F. Filter units

Filtration is the most important method in purification of water. This method includes the process of removal of suspended and colloidal impurities that are present in water. This process allows water to pass through the filter units. Filters are classified into two main categories- slow sand filter, rapid sand filter.

G. Storage tanks

Storage tanks are used to store the rain water which is collected from the rooftops.

H. Collection sump

A small pit is generally dug below the ground so that storage tank is conveniently placed below the ground to collect and store rain water.

I. Pump unit

Hand pump or power pump is provided so as to lift water for the use.

IV. DATA REQUIRED FOR PLANNING OF RAINWATER HARVESTING SYSTEM

1) *Amount of rainfall*- Total amount of rainfall = total water available x area
2) *Rainfall distribution*- The practicability of rainwater harvesting in an area is determined from rainfall pattern and the total rainfall in the area.
3) *Intensity of rainfall*- Peak flow to be harvested by rainwater harvesting is decided by the maximum intensity of rainfall which occurs in short duration of time.
4) *Surface area*- It is necessary to estimate total surface area accurately for planning the scheme. The size of roof forming the catchment will decide the range of roof top rainwater harvesting system.

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5) *Storage capacity*- Analysis of storage requirement of water is required as the storage tank is the most expensive component of rainwater harvesting.
6) *Daily demand*- This factor has most important impact on harvesting scheme.
7) *Number of users*- This will have great influence on the design of rain water harvesting scheme.
8) *Cost*- Main factor which should be consider at time of designing harvesting system.

V. LIETATURE REVIEW

1) Artificial ground water recharge with special reference to India (Amartya Kumar Bhattacharya Associate Professor, department of applied mechanics, Bengal engineering and Science University)- This paper discusses the various issued involved in artificial ground water recharge.
2) Artificial ground water recharge field study: site characterization and test results (prof. Pratima Patel, Dr. M. D. Desai)- Authers have established the correlation between radius of bore well and depth of previous strata with capacity of borehole or which are adopted at site and gives satisfactory results.
3) Design and analysis of rooftop rainwater harvesting system for Y. C. C. E. campus (Preeti P. Shiras, Nikhil A. Maske, civil engineering department, Assistant Professor, Nagpur Institute of Technology, Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur, Maharashtra)- The technical aspect of this paper is rainwater harvesting collected from rooftop which is considered to be catchment areas from Institutes departmental building at Y. C.C. E Campus.
4) Review on design of rooftop rainwater harvesting in Nimgaon village- a case study of Junnar Tahsil (Dr. P. D. Sabale, Prof. S. J. Yadav, department of civil engineering, Anantrao college of engineering and research, Pune, India) -. This project is adopted for conserving the most important natural source on the earth.
5) A review of artificial ground water recharge in India: Debu Mukherjee (Assistant Professor, department of civil engineering, Batanagar Institute of engineering management and science)- This paper discusses various issues involved in the artificial recharge of groundwater.
6) A study of ground water problem, Artificial recharge techniques in Musunuru (M. Sai Sudheer Reddy, N. Sandeep Kumar, K. Venkatesh department of civil engineering Koneru Lakshmaiah Education foundation, Vaddeswaram, A. P.)- This study explains the demand and consumption of water and estimates the water budget in Musunuru village. In this study the study chooses the low budget soak pit method with materials like a reused plastic drum and locally available construction materials in Musunuru.

VI. CONCLUSIONS

Rooftop rainwater harvesting proves to be very efficient, cost-effective and eco- friendly. It nearly fulfils all the water demands. It also has many environmental benefits. Rainwater harvesting is very beneficial as it helps to improve ground water quality, minimizes erosion of soil and decreases the pollution of ground water. It helps in augmenting ground water table. The main aim of rooftop rain water harvesting is to collect and store the rainwater which becomes wastage by runoff into the streams, rivers or storm drains and store the rainwater into the storage tank so that the water can be effectively available for future use. Collection and storage of rainwater is particularly important in dry lands, hilly regions and urban areas.

VII. ACKNOWLEDGMENT

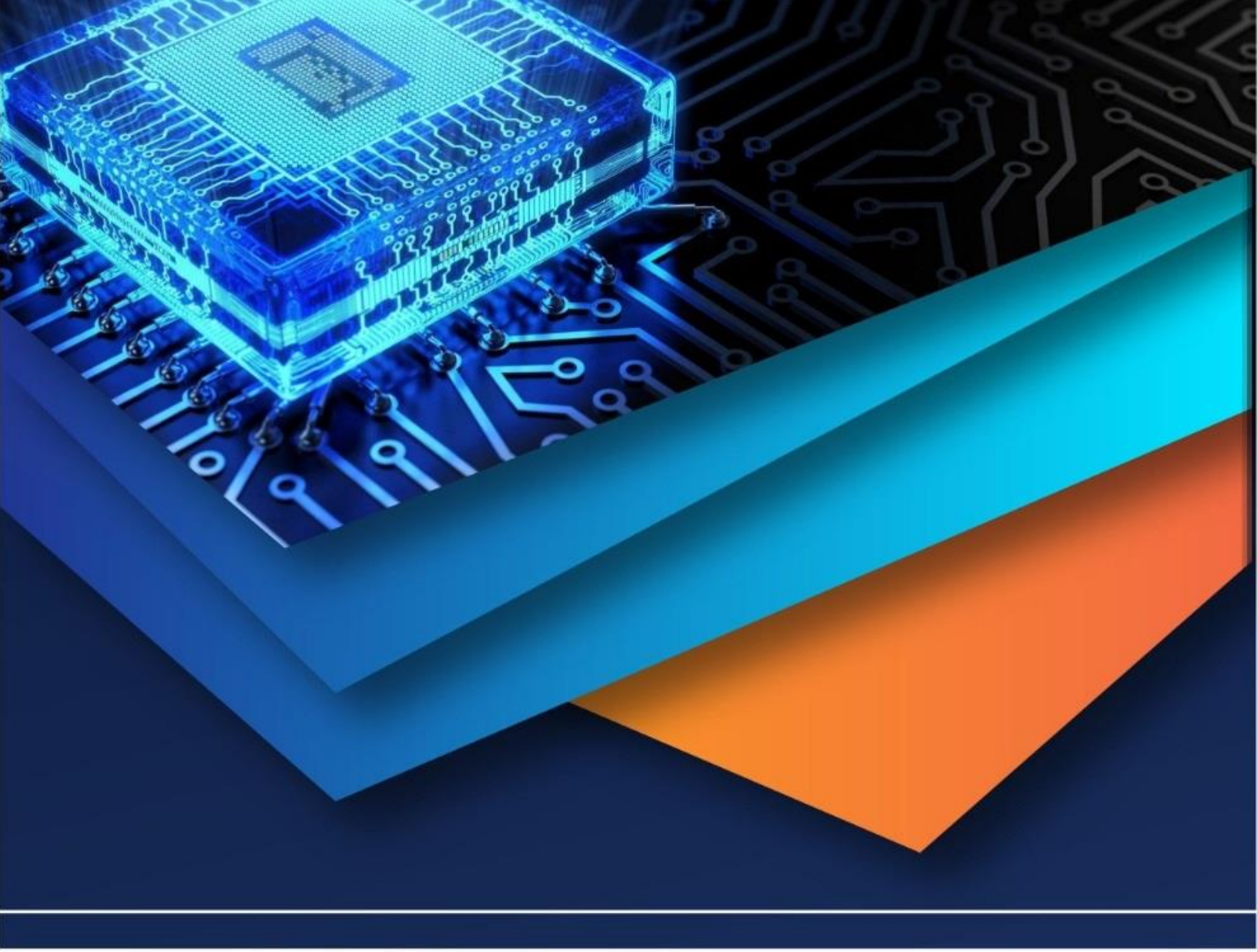
I am highly thankful to my guide for their support and guidance. I feel wholehearted grateful for the constant support and guidance given by them.

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