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Design of rainwater harvesting system in RRCE campus

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ABSTRACT

Rainwater harvesting system is mainly the process or a phenomenon of collection and conservation of rainwater from various techniques where the rainwater is the main source for the process of harvesting. Here we mainly consider the rooftop rainwater harvesting system for the collection of rainwater from roof or top of the buildings of Rajarajeswari College of Engineering campus. The study and implementation of the technique of rooftop rainwater harvesting system in RRCE campus mainly fulfill the needs and also resolves the issue of scarcity of water in all seasons by equivalent supply of collected and stored water for future needs. Also groundwater recharge could be done in efficient way. By implementation of this technique, water source will be increased up to 1420 meter cube in the campus which also intern could be used for construction works as well as maintenance of the good gardening works in the campus. Thus we can say it mainly fulfill the needs of scarcity of water and also mainly recharge groundwater.

Keywords— Roof top Rainwater harvesting system, Total station Surveying, Design considerations

1. INTRODUCTION

Rooftop rainwater harvesting system is nothing but the process or the technique of collection of the rainwater from the rooftop or catchment surface of the building and intern transferring this water into the storage tank through pipes from the gutters that are attached at the ends of the roof catchment. Also by the adoption of the rain water harvesting system techniques, the recharge of groundwater could also be take intensively done, that is by the method of groundwater recharge technique. The water scarcity could be mainly avoided and also the demands could be easily fulfilled by the adoption of this technique of rainwater harvesting especially in the college campus and in the school building for the required construction works and gardening maintenance. The amount of required supply of water could be easily provided or demands of water could be fulfilled. For this process of installation of rooftop rainwater

harvesting system we mainly required the area of catchment and also the necessary data of rainfall that maybe annual rainfall data and also the area of Rajarajeswari college campus that we are going to deal with, for its process of installation of rainwater harvesting systems.

Rajarajeswari College of Engineering campus is educational campus which has vast area of around 36855.425meter square which mainly has 2425 students studying in the campus. And there is main criteria To serve the requirement of water without any shortage or scarcity of water fulfillment. so the study here mainly is based on the design of rooftop rainwater harvesting system for the RRCE campus in order to overcome scarcity of water during dry seasons.

This study mainly gives us the objectives like:

- Estimation of rainwater harvesting potential of the catchment area of the overall campus.
- Total demand of water by the students, staffs including technical and non-technical staffs during regular working days and also during holidays or non-working days could be estimated.
- Also, the rooftop rainwater harvesting system could be designed. suitable for the college campus.

2. STUDY AREA

Study area the campus of Rajarajeswari College of Engineering is located near Ramohalli cross, kumbalagodu, Mysore Road, that is in the Bangalore city mainly in Karnataka state, India. As we observed there is a good rainfall during the monsoon seasons which mainly Comforts the installation of this design into the campus building in this area region. Here our College campus mainly consists of five different blocks that are like girls hostel, boys hostel, PG block, main building, canteen. These blocks could be used as the area of catchment for the collection of rainwater by the designing of rooftop rainwater harvesting system. So here in the figure we can absorb the study area or the top view of the campus of RRCE(fig 3).

3. METHODOLOGY

Here for the purpose of the study we mainly require the data of the annual rainfall of the campus area. The data of rainfall is been collected from the "Gandhi Krishi Vignana Kendra"(GKVK) which is the University of Agricultural sciences, located on the Bangalore Hyderabad highway.

- ❖ Then we have the brief stepwise series of action or procedures that are mainly adopted for our design regarding the rooftop rainwater harvesting system of the RRCE Campus.
- ❖ Total station serving is being done using total station equipments in order to perform the horizontal and vertical measurements with reference to the grid system for the calculation of the catchment area.
- ❖ using total station equipment we mainly carry out following surveys like :slope staking, building corner, intersections, projection of points, project layout construction, levellings, etc.
- ❖ Water harvesting potential is been estimated.
- ❖ Discharge of water is been calculated.
- ❖ Based on demand, the area of catchment to be selected for the design of rooftop rainwater harvesting system.
- ❖ Design calculations are to be carried out further.

4. MODELLING

Preparation of the Miniature model of RRCE campus main building. (BLOCK A). For the process of better understanding and clear exhibition purpose the Miniature model of the RRCE main building has been made using sun board. The materials involved and also the commodities involved in the purpose of making this Miniature model are has listed below:

Sun board, Plaster of pairs. Cutters, Rulers, Paints, are been mainly utilized for the creation or making of the Miniature model making purpose.

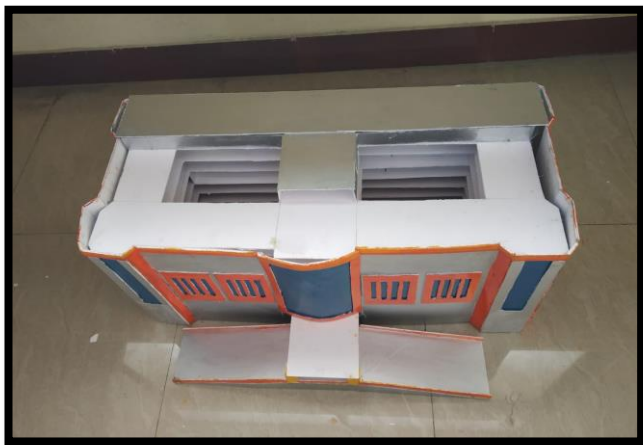


Fig 1 : MINIATURE MODEL OF RRCE MAIN BUILDING



Fig 2: RRCE MAIN BUILDING

4. DESIGN CALCULATIONS AND RESULT

4.1 Design Of Rooftop Rainwater Harvesting System

Amount of rainfall = 916 mm

Area of catchment = 8516sqm

Number of persons = 2425

Volume of water collected = Roof area * Total annual rainfall

* Efficiency factor * Runoff coefficient = 499288 liters

The tank capacity has to be designed for dry period = 245 days

Water requirement for 2425 persons for dry season

= 45.5 ML

4.2 Design of Rapid Sand Filter

- Q = 499288 litrs = 49.3 MLD
- Total filtered water required per day = 51.272 ML/Day
- The filter water required / hr= 2.18 ML/hr.
- The area of filter required=436sq
- B = 8.5m and L = 12.82m
- Adopt 4 filter units, each of (8.5m X 12.8m)
 - Assuming that 4% of filtered water is required for washing the filter, everyday.
 - Assuming that 0.5 hour is lost every day in washing the filter.
 - Assuming that the rate of the filtration to be 500 litrs/hr/sqm.
 - Assuming length of filtered length (L) is 1.5 times the width of the filter bed (B) and 4 units are provided.

4.3 Design of Storage Tank

NAME OF RRCE BUILDINGS	STRENGTH
BOYS HOSTEL	173
GIRLS HOSTEL	221
RRCE MAIN BUILDING	2120

- Strength of RRCE Campus = 2425
- Roof top area = 8516.8 meter sq.
- Average annual rainfall = 916mm
- Maximum amount of rainfall that can be harvested= 4960184.3 liters
- The tank capacity has to be designed for dry period = 245 days
- Water requirement for 2425 people for dry season = 1188250
- Seeping safety factor = 20%
- The tank should be built for = 1420000 liters
- Tank size= 1420 meter cube
- Out of which 50% shall be meet with bore well water
- Therefore water remaining = 710 meter cube
- Area = 710/10
- Diameter (d) = 9.5m And Assume depth = 10m
- Maximum amount of rainfall that can be harvested from roof top = (Area of roof top)x(annual rain fall in meter)x(runoff coefficient obtained)x(constant coefficient)



Fig:3 Google Map showing RRCE Campus.
(Source: www.googlemap.com)

5. CONCLUSION

Hence, conclusion can be made saying that this study mainly Aimed on the designing of the rooftop rainwater harvesting structures for the campus of Rajarajeshwari College of Engineering by the adoption and installation of the system or structure the water source could be increased by 1420 met cube that is of 14 2000 lits of water that mainly facilitates in fulfilling the water needs demands for various utilizations in the campus area.

The design of Roof top rainwater harvesting systems is been carried or its adoption are been done since ancient times. The technique is simple but it very much fulfill done is or demand of the scarcity of water. Hence the adoption and installation of this technique of Design of Roof top Rain water harvesting system place a vital role in fulfilling the demands of water requirements and needs.

6. REFERENCES

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4.4 Design of Under Drainage System

- Area of perforations = 0.217sqm
- Area of each lateral = 0.435sqm
- Area of manifold= 0.868sqm
- Diameter of the manifold= 1.05m
- Assuming spacing between lateral = 15cm
- Total no of laterals = 12.82/0.15
- Total no of laterals on both sides = 85 no
- Length of lateral = 3.725m
- Area of I perforation = 0.000132sqm
- Total no of perforations = 10 no's
- Area of lateral = 0.002sqm
- Diameter of the lateral = 0.041m
- Discharge = 0.8cumecs
- Velocity = 6.89 m/sec



Fig 4: TOTAL STATION SURVEYING OF RRCE CAMPUS