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RAIN WATER HARVESTING (RWH) AT B.I.T CAMPUS GIDA GORAKHPUR – (A CASE STUDY)

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ABSTRACT

The rainwater harvesting locally collects and stores rainfall through different technology, for future use to meet the demands of human consumption or human activities. However, rainwater harvesting has much wider perspectives, in particular, if it is considered in relation to its role in supporting ecosystem goods and services. An integrated planning for Rooftop Rain Water Harvesting system for different institutes in the premises an educational complex is done. The main objectives of the study are to estimate the rooftop rain water harvesting potential of all buildings, planning and designing the roof top rain water harvesting system, the conveyance system and the groundwater recharge system. The cost estimation of different components of roof top rain water harvesting project for each zone is done. The annual equivalent capital cost is estimated with and without the cost of ground water recharge structure.

Keywords : Runoff, ground water recharge structure, rain water harvesting, rooftop rain water.

I. INTRODUCTION

Concept of Rain Water Harvesting he rainwater harvesting consists of a wide range of technologies used to collect, store and provide water with the particular aim of meeting demand for water by humans and/or human activities, which is explained schematically in Figure-1. These technologies can be divided into two main areas depending on source of water collected; namely, the in situ and the exsit types of rainwater harvesting, respectively.

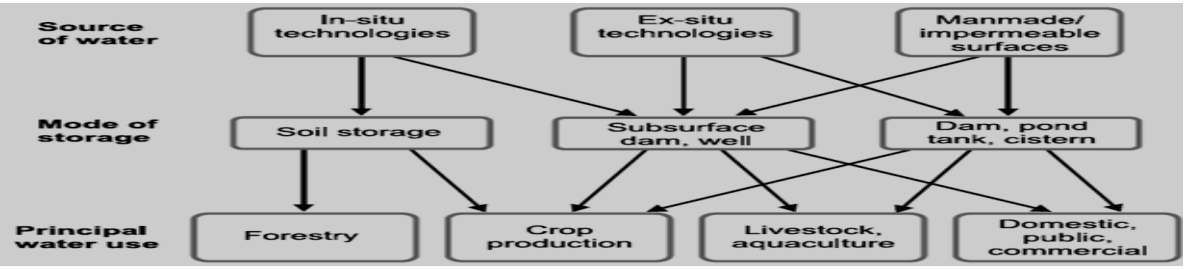

Figure 1 :"Schematic Diagram showing the rain water harvesting technologies based on source of water and water storage type"

II. NEED FOR RAINWATER HARVESTING

Due to over population and higher usage levels of water the surface sources are being over stressed which has led to boring of tube wells at individual as well as at local government's level. The replenishment of ground water (GW) is drastically reduced due to paving of open areas. Indiscriminate exploitation of GW results in lowering of ground water table (GWT) rendering many bore-wells dry. To overcome this situation bore wells are drilled to greater depths. This further lowers the GWT and in some areas this leads to higher concentration of hazardous chemicals such as fluorides, nitrates and arsenic. In coastal areas, over exploitation of GW results in seawater intrusion thereby rendering GW bodies' saline. In rural areas also, government policies on subsidized power supply for agricultural pumps and piped water supply through bore wells are resulting into decline in GWT. The solution to all these problems is to replenish GW bodies with rainwater by manmade means.

III. OBJECTIVES OF THE STUDY

- Analysis of present water use at BIT Campus
- Problems with current system
- Goals, constraints and regulations
- Feasibility of rainwater collection system with recommendations

IV. METHODOLOGY

4.1 Rationing Method (RM):

The Rationing method (RM) distributes stored rainwater to target public in such a way that the rainwater tank is able to service water requirement to maximum period of time. This can be done by limiting the amount of use of water demand per person.

4.2 Rapid Depletion Method (RDM):

In Rapid Depletion method, there is no restriction on the use of harvested rainwater by consumer. Consumer is allowed to use the preserved rain water up to their maximum requirement, resulting in less number of days of utilization of preserved water.

4.3 Determination of the Collection Surface:

The total catchment area will be calculating in this step and for that we will collect data related to all building of the campus.

4.4 Calculation of the Volume of Rainfall:

To ensure a year-round water supply, the catchment area and storage capacity must be sized to meet water demand through the longest expected interval without rain. If the rainwater harvesting system is intended to be the sole water source, the designer must seize the system to accommodate the longest anticipated time without rain, or otherwise plan for another water source, such as well backup or hauled water. Also, rainfall from high-

intensity, short duration rainfall events may be lost to overflow from storage tanks or splash out from the gutters.

V. STUDY AREA

As discussed earlier in the section of introduction – importance of rainwater harvesting at BIT campus Gida Gorakhpur, we clearly came to know the all the advantages which we can draw out by implementing this small but highly efficient technique in the campus. Thus to increase the potential, benefits of this system and draw maximum advantages from it, we need to have large rooftop areas which will be going to act as catchment areas. More the catchment areas more will be the surface runoff and thus more will be the amount of harvested water. Therefore as much as possible, we have included and considered all the major buildings having large rooftop areas. Hence, study areas includes all educational building, hostels, Given below a satellite picture, showing majority of the buildings considered for rainwater harvesting system at BIT campus.

VI. DATA COLLECTION

6.1 Rainfall Data Collection

Table-1: Monthly Rainfall Data of Gorakhpur

Months	**Rainfall (mm)**
January	15.1
February	24.9
March	16
April	16
May	40.6
June	237.4
July	386.4

August	393.9
September	211.5
October	67.7
November	8.7
December	7.2
Total	1422.40

6.2 Determination of Catchment Area:-

The rooftop surface area is nothing but the catchment area which receives rainfall. Catchment areas of the different buildings are measured. This measurement was done manually with the help of reinforced fiber tape which is the simplest technique known as tape survey. Before using the tape, tape was checked for any zero error and also length of the tape was also carefully checked for its accuracy. Given below the table for calculated the rooftop areas of all the buildings suited inside the campus.

Table-2: Calculation of Rooftop Area of All Building

Serial No.	Name of Building	Rooftop Catchment Area **(m^2)**
1.	Hostel Building	1692
2.	Main Building	4386
3.	B-tech Building	966
4.	ITI and Diploma Building	966
5.	Total	8010

6.3 Hydrological Analysis:

On the basis of experimental evidence, Mr. H. Darcy, a French scientist enunciated in 1865, a law governing the rate of flow (i.e. the discharge) through the soils. According to him, this **Discharge Was Directly Proportional to Head Loss (H)** and the area of cross- section (A) of the soil, and inversely proportional to the length of the soil sample (L). In other words,

[Q α (H/L) . A] **{Q=Runoff}**

Q = Runoff Here, H/L represents the head loss or hydraulic gradient (I), K is the co-efficient of permeability Hence, finally,

[Q=K.I.A]

Similarly, based on the above principle, water harvesting potential of the catchment area was calculated. The total amount of water that is received from rainfall over an area is called the rainwater legacy of that area and the amount that can be effectively harvested is called the water harvesting potential. The formula for calculation for harvesting potential or volume of water received or runoff produced or harvesting capacity is given as :-

Harvesting potential or Volume of water Received (m^3)= Area of Catchment (m^2) X Amount of rainfall (mm) X Runoff coefficient

Table-3: Value of Runoff Coefficient (K)

Type of Catchment	**Coefficient**
Roof Catchment	
Tiles	0.8-0.9
Corrugated metal sheets	0.7-0.9
Ground surface covering	
Concrete	0.6-0.8
Brick pavement	0.5-0.6
Untreated ground catchments	
Soil on slopes less than 10 per cent	0.0-0.3
Rocky natural catchments	0.2-0.5

6.4 Computation of Volume of Runoff per Year:-

As we know the formula for runoff discharge from the reference is

Volume of water Received (m^3)= Area of Catchment (m^2) X Amount of rainfall (mm)

Total roof area of hostel was calculated = 1692 m2

Average annual rainfall at BIT campus =1422.40mm/year = 1.42m/year

Total volume of surface runoff water suppose to be collected =1692 x 1.42 = 2402.64m3/year

Table-4: Showing Rainfall & Discharge of Hostel Building Monthly At BIT Campus

Serial No.	**Months**	**Rainfall (mm)**	**Discharge (m3)**
1.	January	15.1	25.54
2.	February	24.9	42.13
3.	March	16	27.07
4.	April	16	27.07

5.	May	40.6	68.69
6.	June	237.4	401.68
7.	July	386.4	653.78
8.	August	393.9	666.47
9.	September	211.5	357.85
10.	October	67.7	114.54
11.	November	8.7	14.72
12.	December	7.2	12.18
	Total	1422.40	2411.72

Chart-1: Showing amount of Rainfall collected in throughout the year

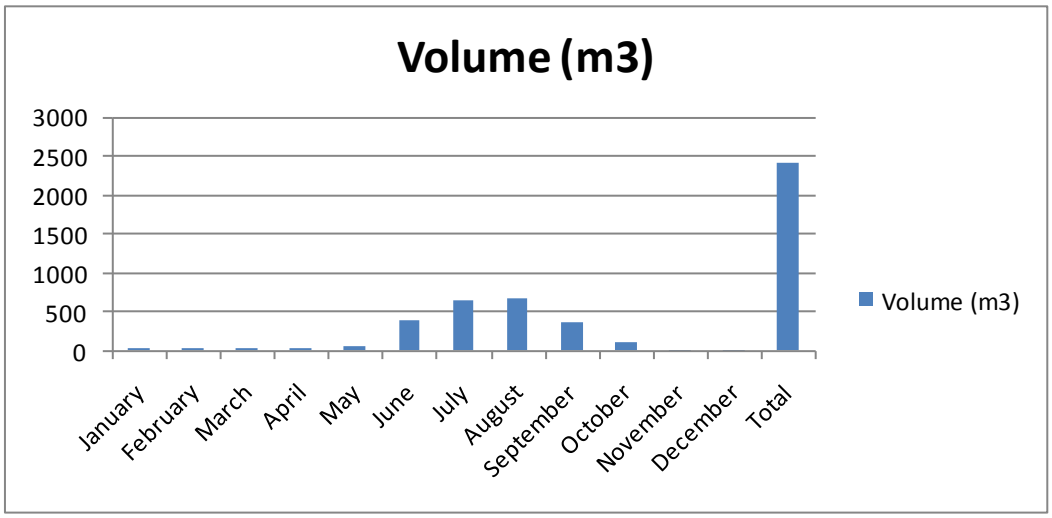

Chart-2: Showing volume of water collected from rainfall throughout the year

VII. SUMMARY AND CONCLUSION:-

Campus detailing was done under this project and we have details below:-

- Average annual rainfall ranges between 700-800 mm/year
- Total catchment area = 8010.00 m2
- Total quantity of rainfall = 10236.77 m3

Hence it was finally concluded that implementation of RAINWATER HARVESTING PROJECT to the campus of B.I.T. By implementation in water harvesting project in B.I.T campus we can make little noble cause for rain water conservation which will be beneficial to the students of campus. It may also helpful to the campus. Our campus will become an example to others for rain water harvesting and if our campus would apply this than surely it will be in benefit. This paper fulfilled with all aspect of improving the water scarcity problem in the B.I.T campus by implementing ancient old technique of rainwater Harvesting.

REFERENCES

[1.] Maharastra – A Case Study", Journal of Applied Hydrology, ISSN 0971-670N, VOL. XXIII, No. 1 & 2.

[2.] 2) Gould, J. and Nissen-Petersen, E. (1999), "Rainwater Catchment Systems for Domestic Supply", Intermediate Technology Development Group (I.T.D.G.) Publication.

[3.] 3) S. K. Garg, "Hydrology and runoff computation, Irrigation Engineering & Hydraulic Structure" Table 7.31 1987, pg. 674.

[4.] 4) V. Jothiprakash and Madnar V. Sathe (2009), "Evaluation of Rainwater Harvesting Methods and Structures Using Analytical Hierarchy Process for a Large Scale Industrial Area", JWRAP, VOL. No. VI, PP. 427 to 438.

[5.] 5) R. N. Athawale (2003), "Water Harvesting and Sustainable Supply in India", Centre for Environment Education1) K. Venugopal and N. Ghosh (2010), "Rooftop Rainwater Harvesting at CWPRS, Pune;, Ahmedabad, India.

[6.] 6) Website Searched:

[7.] http://rainwater.sustainablesources.com/

[8.] http://www.harvestingrainwater.com/books/volume1/

[9.] http://wiki.iricen.gov.in/doku/lib/exe/fetch.php?media=iricen_books:rain_water_harvesting.pdf

[10.] http://www.rainwaterharvesting.org

[11.] http://www.tn.gov.in/dtp/rainwater.htm

[12.] http://www.aboutrainwater harvesting.com