

Quantitative Analysis of RWH System For Engineering Buildings With The Help of GIS

Nilesh H. Gaikar¹, Varun N. Karmarkar², Aditya B. Kalbhor³, Shubham R. Raison⁴

^{1, 2, 3, 4} Dept of Civil Engineering

^{1, 2, 3, 4} PVPIT Bavdhan Pune, Maharashtra.

Abstract- Rainwater harvesting plays a vital role in reducing soil erosion and water conservation. This study aims to cater the water scarcity by implementing rain water harvesting system, to model & analyze rainwater harvesting in our college area to fulfill water requirement. The data is been collected from P.V.P.I.T college so to analysis the daily requirement of water as well as annually so as to analyze the annual expenditure on water. The aim of this research is for identifying rainwater harvesting using GIS in Institutional Building in JSPM Narhe, Pune region. To augment the propose rain water harvesting structure the knowledge base can suitable to modified as and when required on the basis of other expert knowledge.

Keywords- Benefit cost ratio, Estimation and costing, Geographic information system (GIS), Rainwater harvesting (RWH), Site suitability for rainwater harvesting.

I. INTRODUCTION

The concept of rainwater harvesting involves "Tapping The Rainwater Where It Falls". A major portion of rainwater that falls on the earth's surface runs off into streams and rivers and finally into the sea. An average of 8-12 percent of the total rainfall recharge only is considered to recharge the aquifers. The technique of rainwater harvesting involves collecting the rain from localized catchment surfaces such as roofs, plain/sloping surfaces etc. either for direct use to or to augment the ground water resources depending on local conditions.

This approach requires connecting the outlet pipe from the rooftop to divert the water to either existing wells/ tube wells/ bore well or specially designed tank. The urban housing complexes or institutional buildings have a large roof area and can be utilizing for harvesting roof top rainwater to recharge aquifer in urban areas.

II. LITERATURE REVIEW

1) Aditya Morey (Apr-2016)

Over the years of the rising population practices that increase demand of water supply have growing industries and the expansion of agricultural. Monsoon is still the main hope and the source of our agriculture. Therefore, the water saving became need time. Rainwater harvesting is a way to capture rain water at the time of the downpour, store the water above the ground or download the underground water and use later. As the groundwater resources are depleting, is the only way the rainwater harvesting to solve the water problem. Rainwater will be useful not only, the demand of water supply, but also help to improve the quantity and quality of water.

2) Tulinave Burton Mwamila (2016)

There are socio-technological challenges towards extension of the application of rainwater harvesting (RWH) practices in developing countries. An attempt to address this was done using the Mnyundo Primary School, Tanzania, as a study area for evaluating the technical, economic, and social challenges of RWH practices.

3) Dr. Sanjay D. Gaikwad (Jan-2015)

Present research deals with the application of GIS in rainwater harvesting through case study of Quepem tehsil of Goa. An attempt is made to elaborate the application of RS and GIS in the field of identification mapping of impervious surfaces and roof top area as potential sites for water harvesting using tassal-cap transformation (Kauth and Thomas 1976, Cris and Cicone 1984).

4) Garima Dadhich (Apr 2016)

For properly Digitizing the Roof area of any building, some parameters need to be determined in order to get maximum benefit. Google Earth is used to determine the view or the area with proper resolution. The resolution should not be too high to cover the building which have small area and should not be too low to cover large building. The ARC GIS tool is used to convert raster file into vector file for calculating the area. Then the amount of rainwater and the Tank capacity is calculated to collect the water.

III. ROOF TOP RAINWATER HARVESTING

The runoff from the terrace of the college building is channelized into three recharge wells located at three different locations, each measuring 1m x 1m x 2m. All the rooftop rainwater outlets, except that from the tutorial block, discharge into storm water drains and then to recharge the structures. In the tutorial block, a network of the pipes linked through the chambers to take the rainwater to recharge wells. To facilitate the groundwater recharge, all structures are provided with 15m deep bore wells of 150mm diameter. Layer of bricks filled inside the recharge wells ensures the proper filtration of harvested water.

Estimating and costing of project:

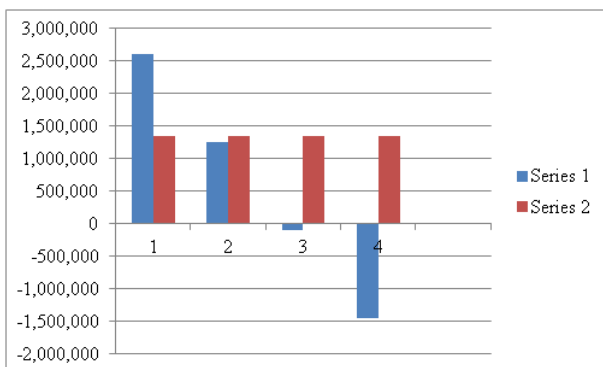
Sr. NO.	ITEM	AMOUNT (in Rs)
1	Excavation	38700
2	PCC	749898.64
3	RCC	1354604.27
4	Steel Reinforcement Bar cutting, Bending Cranking and Binding Steel Bars in Position	238767.09
5	Centering, Shuttering (Both execution and dismantling)	14950
6	Pipes	3080
7	Contingencies = 5%	120000
8	Contractors Profit = 10%	240000
9	Net Total	2760000

Total amount of RWH system = Rs 2760000
 Total amount to be spent on water every year = Rs 1350000

Break even analysis =
 Total amount to be spent on construction / amount spent on consumption of water per year.

= 2.04 years.

IV. COST BENEFIT ANALYSIS



Series 1- Capital investment on project.
 Series 2-Annual expenditure on water.

V. CONCLUSION

As we compare both the cost we get to know that the initial cost for construction is more as compared to expenses in a year of construction. But in later years we see the actual profit as after recovery cost is been totally covered in two years and we utilize the resource free of cost.

REFERENCES

[1] Aditya Morey “RAIN WATER HARVESTING SYSTEM” International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 03 Issue: 04 | Apr-2016.
 [2] Tulinave Burton Mwamila “Strategy to Overcome Barriers of Rainwater Harvesting, Case Study Tanzania” DOI: 10.4236/gep.2016.49002 September 12, 2016.
 [3] Dr. Sanjay D. Gaikwad “Application of Remote Sensing and GIS in Rainwater Harvesting: A Case from Goa, India” International Journal Of Scientific & Engineering Research, Volume 6, Issue 1, January-2015 633 ISSN 2229-5518
 [4] Garima Dadhich “A GIS based Analysis for Rooftop Rain Water Harvesting ” ISSN : 2229-3345 Vol. 7 No. 04 Apr 2016.