Feasibility Analysis of Rainwater Harvesting At Trinity Academy of Engineering Pune

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Abstract- *Water is one of the most precious resources on earth. We require water for various activities in our day- to-day life. At the rate in which India's population is increasing, it is said that India will surely replace China from its number one position of most densely populated country of the world. These will lead to high rate of consumption of most valuable natural resource "Water" resulting in augmentation of pressures on the permitted freshwater resources. In order to conserve and meet our daily demand of water requirement, we need to think for alternative cost effective and relatively easier technological methods of conserving water. Rooftop rain water harvesting is one of the best methods fulfilling those requirements. The technical aspects of this paper are rainwater harvesting collected from rooftop which is considered to be catchment areas from Institutes departmental building at Trinity Academy of Engineering Pune. First of all, required data are collected i.e. catchment areas & hydrological rainfall data. Water harvesting potential for the departments was calculated, and the tank capacity with suitable design is being considered*

Keywords- Rain Water Harvesting, Catchment area, Water conservation, Rainfall Data, Water recharge Pit.

I. INTRODUCTION

Rain water harvesting is defined as the process of collecting and storing rain for later productive use. Rainwater harvesting is a mini-scale water resources project that collect stores rainwater by structural measures and regulates and make us use of it for domestic and production use. The term water harvesting refers to collection and storage of natural precipitation and also other activities aimed at harvesting surface and all other hydrological studies and engineering interventions aimed at conservation and efficient utilization of the limited water enforcement of a physiographic unit such as a watershed It is also defined as the process of collection and storing water from the area that has been treated to increase precipitation runoff. It was very difficult to imagine few decades before that you will require water for drinking. The use value of water was never undermined, but its about time that even its exchange value is given due importance. Fresh water today is a scarce resource, and it is being felt all over the world. Water is the lifeline of any society.

II. STUDY AREA

1. Study Area: Trinity Academy of Engineering building have a rooftop area (3652.97 sq. - m). Hence, considering the Trinity Academy of Engineering building for the overflow of water continued ahead to the already lined channel in which arrangements of percolation pits would be provided to recharge the groundwater table helping to recharge wells.

Fig 1: TAE Pune Location Plan

III. METHODOLOGY

1. Rainfall Data Collection: Rainfall Data Collection Trinity Academy of Engineering situated at 18`25`N latitude and 73`54`E longitude in Pune district of Maharashtra at an elevation of 560 metres above mean sea level. Pune has a tropical wet and dry climate with average temperature ranging between 20 from June to October, with moderate rainfall and temperatures ranging from 22 to 28 °C (72 82 °F). Most of the 740 mm of annual rainfall in the city fall between June and September, and July is the wettest month of the year. The average annual monthly rainfall data has been collected from Indian Metrological Department, Shivajinagar, Pune. Again its followed that, Pune uniform average rainfall throughout the city in all location. Thus monthly rainfall data of the Pune city

is given below in the table which is assumed to be same for the station of Trinity Academy of Engineering.

Table 1: Average Rainfall Data 740 mm Year 2007-2016

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
2007	0.0	0.0	0.0	0.0	0.0	235.5	274.3	194.9	154.3	0.0	0.0	0.0
2008	0.0	0.0	0.0	0.0	0.0	97.7	108.2	173.4	298.5	28.0	0.0	0.0
2009	0.0	0.0	0.0	0.0	0.0	117.5	27.1	226.9	73.1	74.3	176.4	0.0
2010	0.0	0.0	0.0	0.0	0.0	320.3	224.9	200.5	117.6	265.4	19.1	0.0
2011	0.0	0.0	0.0	0.0	0.0	225.1	209.1	118.4	220.6	206.4	0.0	0.0
2012	0.0	0.0	0.0	0.0	0.0	35.7	66.2	204.8	54.2	144.5	0.0	0.0
2013	0.0	0.0	0.0	0.0	0.0	282.1	173.1	40.1	161.9	7.5	14.8	1.9
2014	0.0	0.0	0.0	0.0	0.0	14.0	129.2	181.0	30.2	7.0	10.1	2.4
2015	0.0	0.0	24.3	2.4	16.3	108.0	54.4	12.8	88.9	68.9	38.2	0.0
2016	0.0	0.0	7.4	0.0	6.4	23.7	23.7	141.0	125.3	45.6	0.0	0.0
Avg.	0.0	0.0	3.17	0.24	2.27	146.92	153.53	149.9	193.61	64.12	25.86	0.43

IV. RESULTS

An estimate of mean annual runoff from a given catchment can be obtained using the equation:

S = R x A x C

Where, S = Rainwater supply per annum

R = mean annual rainfall
A = Area of the catchment
C = Runoff coefficient

Area of Catchment = 3652.97 Sq.m

Average Pune Rain Fall = 740 mm (29.2 in) (0.74/m)
Source (IMD Pune)

Runoff Co-efficient (C) = 0.8 (Ground Surface Covering) Concrete 0.6 to 0.8

1. Calculation of amount of rainfall harvested from roof top.

From IS Code 15797: 2008
Annual Water Harvesting Potential = A x R x Cr
= 3653 x 0.740 x 0.85
= 2300.84 m3
= 2300840.05 Litres

2. Estimation of Water Demand

No. of Student = 1200
Teaching & Non - Teaching Staff = 200
Total =1200 + 200 = 1400

Water requirement for per/capita/person for college purpose is 35 litre/day (Standard).
= 1400 x 35/day
= 49000litre/day
= (49000litre x 30) /month
W.R= 1470000litre/month
Water Demand = 17640000 litre/year
Water Balance it is observed that the total demand of water is estimated about 1,76,40,000 litre/year.

3. Storage System

a. Underground tank or storage vessel
b. Ground tank or storage vessel

4. Location of RWH System Storage Tanks.

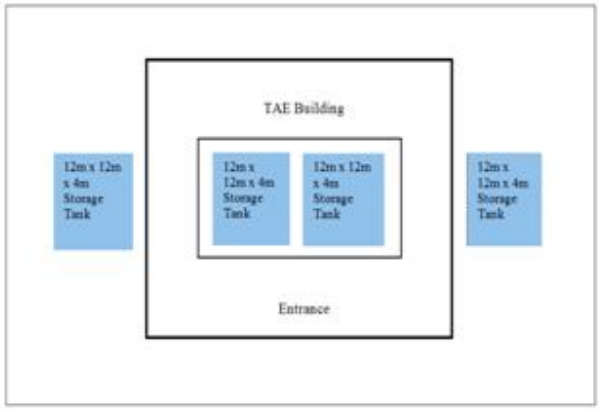

Fig 2: Location of RWH System Storage Tanks

Size of Water Tank - 4m x 12m x 12m
Number of Tanks - 4
Capacity of Each Tank – 5.76 Lacks Litres
Total Capacity of Tanks – 23 Lacks Litres

5 Alternatives to Water Storage Tank

A. RWH Pits

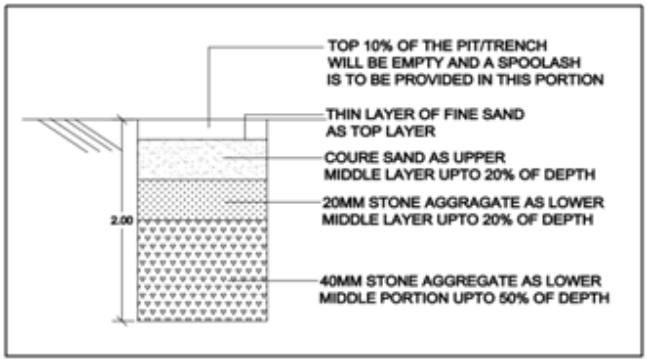

Fig 3: RWH PITS

B. Recharge through Bore Well

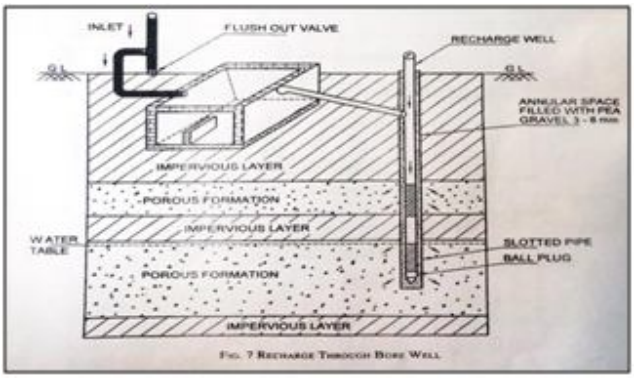

Fig 4: Recharge through Bore well

V. RESULTS

1. Total annual water demand for TAE is 17640000 Litre/year.
2. Total yield capacity of proposed RWH plant at TAE is 2300840.05 Litres.
3. As per design, four storage tanks of capacity of 576 m3 each are required, to store rain water.
4. Total cost required for storage tanks construction is approximately 2.4 Cr.
5. Total cost for water usage during summer season is 2.5 Lac.

VI. CONCLUSION

1. RWH system is not economically feasible for TAE Pune, Because of longer return periods.
2. Alternate solution for this is using recharge pits, to effectively recharge ground water table.
3. Cost for implementing recharge pits is negligible as compare to storage method, thus increasing VALUE of RWH system.

REFERENCES

[1] A.T. Badade, S.V. Diwate, S.M. Gawande, Sustainable Water Harvesting Management for Southern West Parvati Terrain of Pune, IRJET, March 2016, Volume-03, Issue-03.

[2] C.L. Jejurkar, N.S. Naik, Rainwater Harvesting Structures – A Case Study, IJCER, Jan-Feb 12, Volume-2, Issue-1.

[3] Dr. S. P. Cholke, Rain Water Harvesting Potential of R. B. N. B. College Campus, Shrirampur, IJSR, November 16, Volume 5, Issue-11.