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RAIN WATER HARVESTING A CASE OF STUDY SRIT ENGINEERING COLLEGE

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ABSTRACT

Water shortage is not kidding issue all through the world for both urban and rustic network. Urbanization, modern improvement and increment in rural field and generation has brought about overexploitation of groundwater and surface water assets and resultant weakening in water quality. The traditional water sources in particular well, stream and repositories, and so on are deficient to satisfy water request because of uneven rainfall. While the water reaping framework examine another water source. The point of the present examination is to utilize water and consequently taking near the idea of nature preservation. In this examination, the rain water reaping (RWH) framework is broke down as an elective wellspring of water at grounds of Srinivasa Ramanujan Institute of Technology (SRIT), Anantapuramu in the state of Andhra Pradesh, India. The normal result of the investigation is the improvement of water gathering framework for catchment territory of grounds from stopping region, workshop region, a portion of the gadgets division region in front of Main Building. The outcome investigation demonstrates that the present RWH framework is having the capacity 8,52,615 liters/year and development cost of Rs 6 lakhs separately and is sensibly well in examination with customary water sources. The created framework fulfills the social prerequisites and can be executed in country territories by considering all the specialized perspective.

Keywords: *Catchment, Rain water harvesting, Recharge pit, QGIS.*

I. INTRODUCTION

Rain water Harvesting is an innovation used to gather, pass on and store rain water for later use from generally clean surfaces, for example, a rooftop, arrive surface or shake catchment. RWH is the strategy of gathering water from rooftop, Filtering and putting away for further employments. Water Harvesting is a basic method of getting and holding water where its falls. It is possible that, we can store it in tanks for further utilize or we can utilize it to energize groundwater relying on the circumstance. RWH framework gives wellsprings of delicate, superb water decreases reliance on well and different sources and in numerous settings is financially savvy. RWH framework is financially less expensive in development contrasted with different sources, i.e. all things considered, trench, dam, preoccupation, and so on.

Components of Rainwater Harvesting System

A Rainwater harvesting system comprises of components for – transporting rainwater through pipes or drains, filtration, and tanks for storage of harvested water. The details of the components of rainwater harvesting system have shown in figure 1.

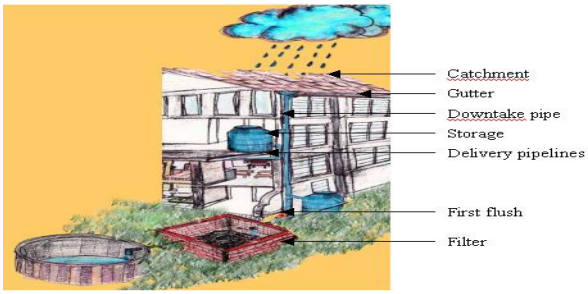

Figure 1: Components of Rainwater Harvesting System.

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The design and installation of RWH system includes following:

1. Rainwater Catchment and Conveyance
2. Rainwater Storage and Tank Sizing and
3. Rainwater Quality and Treatment.

With above writing it is discovered that the water collecting framework can be created with subjective and quantitative methodology for the contextual investigation under thought. This paper basically intends to investigate the financial advantage of water reaping framework and the technique has been shown through application to the Srinivasa Ramanujan Institute of Technology (SRIT), Anantapuramu in the state of Andhra Pradesh, India.

II. STUDY AREA

The campus of Srinivasa Ramanujan Institute of Technology (SRIT), Anantapuramu in the state of Andhra Pradesh, India is situated at 16 o00' N latitudes and 80o 00'E .KML file of Study area is prepared and shown in
figure 2, using Q-GIS software.

Figure 2: Study Area of SRIT campus.

III. MODEL DESCRIPTION

The Description of the Case Study

The grounds of this organization is arranged 18 km from the city of Ananthapuramu . The establishment is at focus of the grounds and encompassed by local location. The private convenience is given to workforce staff and understudies. The aggregate quality of grounds including understudies and staff people groups is more 3000. Along these lines, with this present quality and furthermore with the development, grounds ought to likewise expand its offices and upkeep necessities. Along these lines water is most characteristic asset being dependably in levels of popularity by people and is imperative piece of the life. Consequently, keeping in view all the above issues and status of grounds SRIT, Ananthapuramu , regulatory body focussed on water shortage issue. Along these lines, in this circumstance, rain water reaping framework can be considered as a best answer for battling against water shortage in grounds.

Problem Formulation

Plan of water gathering arrangement of SRIT grounds utilizing Geographic Information System (GIS). For this taking catchment zone of grounds from stopping region, workshop territory, a portion of the division region up to Hostel. Differentiate and compute zone by utilizing GIS. The slant of the catchment will be checked via auto level. Examine the capability of overflow from the precipitation from the catchment and recommend appropriate energize pit areas and furthermore volume of water to be revive in the ground. What will be the surmised consumption for

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these revive pits. In the event that the establishment needs to build underground stockpiling tank, what will be the rough use.

Design of RWH system

For the proposed location in SRIT campus, visual inspection, survey by Auto level and Geographic Information System (GIS) has been carried out and required analysis is done.

***For catchment 1*:**(Calculations are for 1 storm, considering intensity of storm as 2 cm/hr)

i) Catchment Area :
   a) Roof Area = 3568 m^2
   b) Open area = 82109 m^2
   Assume ,

ii) Average Rainfall intensity= 2cm/2 hr

iii) Runoff Co efficient ,
For Roof Top Area =0.95
For open area =0.84
Storm duration = 2 hours

Now by using Rational formula
For roof top area
Q = C.I.A /3.6
=(0.9x 20x 3568 x 10^{-6})/3.6
= 0.0188311 m^3/sec.
For Open Area ,
Q = C.I.A /3.6
=(0.8x 20x 82109 x 10^{-6})/3.6
=0.364928 m^3/sec.
Thus,
Total runoff = 0.0188311 + 0.364928 = 0.3837591 m3/sec.
Now,
Total runoff volume = peak runoff rate × storm duration.
=0.3837591×2×3600
= 2763.06552 m3
= 2763065litres.

For this volume of water, recharge pit of dimensions 10 m ×10 m ×1.5 m can be constructed. As the topography of the area suggests the two locations, one pit can be constructed beside boy's hostel . The second pit of same dimension can be constructed behind in front of Main Block Building.

For Catchment 2

Calculations are for 1 storm, considering intensity of storm as 2cm/hr)

Collected data –

i) Catchment Area :5258.3 m^2
   Assume ,

ii) Average Rainfall intensity= 3cm/2 hr

iii) Runoff Coefficient ,
For open area =0.8
Storm duration = 2 hours

Now by using Rational formula
For Open Area ,
Q = C.I.A /3.6
= (0.8 x 20 x 5258.3 x 10^{-6})/3.6

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= 0.024243 m3 /sec
Now,
Total runoff volume = peak runoff rate × storm duration
= 0.024243×2×3600
= 174.5496 m^3
= 174549 liters.

For this volume of water, recharge pit of dimensions 5 m × 5 m ×1.5 m can be constructed, at the open place available beside boy"s hostel.
Water obstructed in pit:
% water obstructed = 25%

For catchment 1:
If we consider a single storm of 2hrs of intensity 2cm/hr then 21.25 % of rainfall can be obstructed.

For catchment 2:
If we consider annual rainfall data then we can obstruct 25.86% of rain water.

Design of rechargepit
The recharge pit should be filled with the metal, to recharge silt free water. Hence the materials to be filled in the pit are 60 mm metal, 40 mm metal, 20 mm metal, fine sand. The material should be filled depth wise in the pit. The coarser material to be filled at the bottom and finest on the top. The uppermost fine sand layer can be separated from the 20 mm metal layer by using non corrosive wire mesh. It will help for the yearly maintenance. Depth of material for recharge pits.

Material to be filled	**% depth of material**	**Depth (in m)**
60 mm metal	35 %	0.35 m
40 mm metal	35 %	0.4 m
20 mm metal	20%	0.4 m
Fine sand	10%	0.4 m

For the recharge pit 1, 2				
Item No.	Item	Quantity (cu.m.)	Rate	Total cost
1	Excavation	175	140.00/-per cu.m.	Rs. 24500 /-
2	labour charges	Lumsum	1000/-per day	Rs.3000 /-
3	Materials (60,40,20mm metal)	160	825/-per cu.m	Rs. 132000/-
			Total	Rs. 1 /-
TOTAL=Cost of 2 pits=2×159500=				**Rs. 319000/-**

For the recharge pit 3				
Item No.	Item	Quantity (cu.m.)	Rate	Total cost
1	Excavation	40	140.00/-per cu.m.	Rs. 5600/-
2	Labour Charges	Lumsum	1000 /- per day	Rs. 2000 /-
3	Materials (60,40,20mm metal)	42.5	825/-per cu.m	Rs. 35062.5 /-
Total				**Rs. 42662.5/-**

Underground storage tank				
Item No.	Item	Quantity (cu.m.)	Rate	Total cost
1	Excavation	47.5	140 /- per cu.m.	Rs. 6650 /-
2	.C.C (1:2:4)	5.4	3950 /- per cu.m.	Rs. 19750/-
3	BBM (1:6)	12.25	4350/- per cu.m.	Rs 53287/-
4	.C.C (1:2:4)	15	4625 /- per cu.m.	Rs. 69375/-
5	Plaster (1:4)	60	65 /- per cu.m.	Rs. 4030 /-
6	Labour Charges	Lumsum	2000 /- per day	Rs. 2000 /-
			Total	**Rs. 155092/-**
Grand Total				**Rs. 516754.5/-**

Total Cost of RWH system = Cost of Recharge pit 1 + Cost of Recharge pit 2 + Cost of Recharge pit 3 + Cost of Underground Tank.
=159500+159500+ 42662.5+155092
= Rs 5,16,754.5

IV. RESULTS AND DISCUSSIONS

1. Design of rainwater harvesting system of SRIT Campus is done using Geographic Information System (GIS).
2. For Catchment 1:
   Runoff potential for one storm of two hours =2763065 liters

For recharge, size of recharge pit (1&2 each) is taken as = 10 m x 10 m x 1.5 m % of runoff from rainfall obstructed and recharge in pit = 62% = 1,711,4263.3liters

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3. For Catchment 2:
   Runoff potential for one storm of two hours = 1,74,549liters

For recharge, size of recharge pit (3) is taken as = 5 m x 5 m x 1.5 m
   % of runoff from rainfall obstructed and recharge in pit = 25 % = 43,637.25 litres.

4. Total annual runoff potential from catchment area considered (1 & 2):1,58,258 liters
5. Total annual recharge through pits: 20, 74, 152 litres
6. Filter material for filling the recharge pit is decided as 60 mm metal (35% depth), 40 mm metal (35% depth), 20 mm metal (20% depth), Fine sand (10% depth)
7. Approximate Expenditure for
   recharge pit 1: Rs 1,59,500/-
   recharge pit 2: Rs 1,59,500/-
   recharge pit : Rs 42,662.5/-
8. Approximate Expenditure for underground storage tank (5m x 5m x 1.5m)(optional) is Rs 1,82,052 /-.
9. Recharge pit / underground tank can be connected to bore well for recharging purposes.

V. CONCLUSION

Recharge of ground water table is a gradual process, we cannot suddenly increase the ground water table after constructing recharge structures, by constructing any type of recharge structure, and we can give our contribution in aquifer recharge. This will help to rejuvenate the depleting ground water resources. Also help to save the little amount of rain water which used to drain away from many years. Thus it is concluded that implementation of RWH system of IIMT College of Engineering Greater Noida campus would result in the form of the best approach to deal with present scenario of water scarcity and storing huge quantity of 20, 74, 152 litres in a year in college campus.

REFERENCES

1. *RAIN WATER HARVESTING – A CAMPUS STUDY(Indu Nirupam Shukla,Kumar,Rahul,Anurag Kumar).*
2. *Rain Water Harvesting, CAMTECH/2004/C/RWH/1.0 ,Ministry of Railways,Government of India,August 2004.*
3. *Sustainable Water Resources Development and Management, pp. 153-159.*
4. *Water Resources conservation and Management by Chatterjee ,S.N.Atlantic publishers.*
5. *Watershed Management in India by Murthy, J.V.S., Wiley Eastern , New Delhi, 1994.*
6. *Ranjit kumar Sharma , Rain Water Harvesting at N.I.T Rourkela,department of Civil Engineering, 2010.*