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Research Article

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Borewell recharging through rainwater harvesting by V-wire technology

Smita Honnannavar[1], Jyoti Kambar[2], Suman Patil[2] and Chetana Savant[2]

[1]*Assistant Professor, Civil Engineering Department, Shaikh College of Engineering and Technology, Belgaum, Karnataka*
[2]*Civil Engineering Department, Shaikh College of Engineering and Technology, Belgaum, Karnataka*

ABSTRACT

Rainwater harvesting locally collect and stores rainfall for future use. It has most important role in supporting ecosystem goods and services. An integrated plan for rooftop rainwater harvesting system including land runoff and stored pond for kakti area is done. The main objectives of the study are to estimate the rainwater harvesting potential of all the buildings lands gutters including the ground water recharge system. The cost estimation of different components of rooftop rain water harvesting project for each zone is done. However the environmental benefits of the ground water recharging with good quality water justifies such projects.

Keywords: Bore well recharge, rain water harvesting, V-wire technology, roof top, run off, collecting ponds.

INTRODUCTION

Rainwater is a free source of nearly pure water and rain water harvesting refers to collection and storage of rainwater and other activities aimed at harvesting surface and ground water. Losses through evaporation, seepage and all other hydrological and engineering interventions are prevented and are aimed at conservation and efficient utilization of the limited water endowments of physiographic unit such as a water shed. In general, water harvesting the activity of direct collection rainwater. The rainwater collected can be stored for direct use; can be recharged into ground water. The advantage of rainwater harvesting is more when surface water is inadequate to meet our demand. Major parts of our country have been facing continuous failure of monsoon and consequent deficit of rainfall over the last few years. Also, due to ever increasing population of India, the use of ground water has increased drastically leading to constant depletion of ground water level causing the wells and tube wells to dry up. Besides irrigation and domestic needs it is imperative to take adequate measures to meet the drinking water needs of the people in the country which also includes improving water quality in aquifers, improving vegetation cover and also reduce power consumption. In Kolkata, India about half the population that lives in this slum collect water from stand ponds. The rest of the slum population do not have access to the municipal water supply and have to make their own arrangements. In Bangalore, India a city of some 6 million inhabitants, it is estimated that more than half depends on public fountains. To further illustrate, India's population as per 2001 census is 1027.02 million. Over 60% of households in India meet their drinking water requirements from underground water sources such as hand pumps, tube wells and open wells. In urban areas while 68.7% households use tap water, 29% of the households directly use those underground water resources. Intense use of underground water has resulted in depletion of sub-Terrence water resources in many parts of India.

DESCRIPTION OF PROJECT AREA

Location: the Kakati area of Belgaum district, Karnataka is located at latitude 15.9309623 and longitude 74.5272802. The total area of the site is 20 acres. The catchment area behind the bore well is 1.0 acres

(4046.86 m^2). The study area is surrounded by agricultural land. The area has a plain topography with gentle slope towards the south to north east direction. Necessity of project: In present situation the rainwater from roof top area joins the nearby stream which then flows into the drainage system. The overland flow leads to erosion of soil and thus chocking the drainage system due to silting. This huge roof top area, if used for rainwater harvesting, has immense potential for ground water recharging. This will result in rise in groundwater table. The groundwater recharge will also dilute the poor quality water percolated in the groundwater throughout the year.

EXPERIMENTAL SECTION

METHODOLOGIES

1) Assumptions

- The average monthly rainfall intensity is taken as 252.5mm with help of map.
- The life of rainwater harvesting system is considered as 40 yrs.
- It is assumed that 40% of quantity of water which is recharged in ground is utilizable during lean period.

2) Design and calculation

1. Roof Based Runoff: Consider a building with a flat terrace area of 100 m^2. The average annual rainfall in Kakati is 252.5mm. Assuming a runoff coefficient of 0.8 then in one year we will capture 20160litres of water from rain fall.

Rain water Harvesting Potential(Q)= Roof Area(A) x Runoff Coefficient(K) x Annual Rain Fall(R)

Q=100 X 0.252 X0.8 = 20160 litres

2. Land Based Runoff

Consider a site with an area of 1acre and a building with a flat terrace area of 100 m^2. The average annual rainfalls in kakati is approximately 252.5mm. Assuming a runoff coefficient of 0.5 for the open area then in one year we will capture 509904.36 litres of water from rain fall.

Q=4046.86 X 0.252X0.5=509904.36 litres

Based on number of rainy days in a year:

In another simple method, the size of the tank is calculated by dividing the total harvestable rain water by number of rainy days in a year. Volume of the tank can be calculated by the following formula:

- V= Q/N
- V= Volume of tank in litres
- Q= Harvestable rain water per year in Litres
- N=Number of rainy days per year

1. Roof Based:

20160 litres per year (Q) and Number of rainy days per year is 60(N) a storage volume of 336litres would be required

V=20160/60=336 0r 0.336 m^3

2. Land Based:

Runoff from the open area is 509904.36litres per year (Q) and Number of rainy days per year is 60(N) a storage volume of 8490litres would be required

V=509904.36/60 = 8498.40 0r 8.498 m^3

3) Estimation details of bore well recharge construction:

SL.NO	Particulars items	No's	Length	Birth	Height	Quantity
1	Earth work excavation of filter media	1	3.53	3.53	1.2	14.95
					Total	14.95
2	Stone Pitching Wall					
	Long Wall	2	3.53	0.61	1.5	6.46
	Short Wall	2	3.53	0.61	1.5	6.46
					Total	12.92
3	Layer Of Course Aggregate					
	Course Aggregate	3	1.5	1.5	0.225	1.52
	Deduction of inside portion of Filter Chamber	3	$\pi\ 0.60^2/4$ =0.282		0.225	0.19
					Total	1.71
4	Layer Of Fine Aggregate					
	Fine Aggregate	2	1.5	1.5	0.225	1.01
	Deduction of in ide portion of Filter Chamber	2	$\pi\ 0.60^2/4$ =0.282		0.225	0.13
					Total	1.14
5	Charcoal and Activated carbon	1	1.5	1.5	0.05	0.11
					Total	0.11
6	Copping Surrounding Stone Pitching					
	Long Wall	2	3.53	0.61	0.1	0.43
	Short Wall	2	1.5	0.61	0.1	0 18
					Total	0.61
7	V-Wire Mess	1				1
8	R.C.C rings	3				3








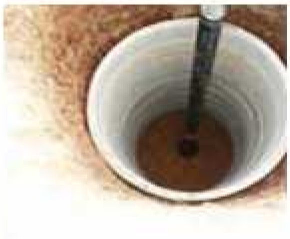





Fig 1: Installation Or Injection Of Bore Well

RESULTS AND DISCUSSION

S I no.	Parameter	Day	Min value	Max value	Value of parameter before recharge
(1)	Acidity	1	-	50	65
(2)	Alkalinity	1	200	600	747
(3)	Chloride	1	250	1000	455.2
(4)	Hardness	1	300	600	691.2
(5)	Calcium	1	75	200	628
(6)	Fluoride	1	0.5	1	0.8
(7)	pH	1	7	8.5	7.27

After 2nd, 3rd, 4th day all the value of the above parameters goes on reducing.

CONCLUSION

The water table level in the locality has increased leading to a substantial increment in the yield of the bore well. The run-off from the surrounding area, which was being wasted in channelized into pond and used to recharge the bore well which can further be put for better use such as gardening etc. The dependence on munciple water supply can be reduced and the cost of water can be saved. The properties of bore well recharge water are within its permissible limit, hence can be used for domestic purposes.

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