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Design of Rainwater Harvesting System at CJITS

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Abstract: *This research paper Of Design Of Rainwater Harvesting System focuses on the conceptualization, design, and implementation of rainwater harvesting system as an innovative solution for sustainable water management. Recognizing the increasing importance of water conservation, our study explores the feasibilityand effectiveness of utilizing rainwater harvesting pits within the campus at Christu Jyothi Institute of Technology and Science, Jangaon focuses in Rainwater Harvesting as a viable and eco-friendly approach. This initiative aims to address the increasing water stress faced by our campus and contribute to the broader goal ofsustainable water management. By capturing rainwater within the pits, the risk of flooding is mitigated, preventing soil erosion and the loss of valuable topsoil. Our system incorporates a network of strategically placed collection points such as rooftops and paved surfaces equipped with gutters and downspouts. The main aspect of our project is the integration of modern technology to enhance efficiency and monitoring. This will also help manage the distribution of harvested rainwater for irrigation, flushing, and other non-potable purposes, reducing dependency on conventional water sources*

Keywords: Rainwater harvesting, sustainability, storage, bore well and design

I. INTRODUCTION

Rainwater harvesting system, technology that collects and stores rainwater for human use. Rainwater harvesting systems range from simple rain barrels to more elaborate structures with pumps, tanks, and purification systems. The design of rainwater harvesting at CJITS College involves the installation of pipes tochannel rainwater from the roof surface into a storage tank or directly into the ground, thereby replenishing Groundwater levels and preventing waterlogging. This environmentally friendly strategy seeks to protect the campus from flooding, preserve water resources, and encourage responsible environmental within the college campus. Objectives of rainwater harvesting system are to increase the availability of water for the community by capturing and storing rainwater, to reduce the dependence on groundwater and other sources of water, which may be limited or unsustainable, to promote sustainable water management practices and raise awareness about the importance of water conservation, to involve community members in the planning, design, and implementation of rainwater harvesting systems, thus fostering a sense of ownership and responsibility, to improve the quality of water by reducing the amount of runoff, which can carry pollutants and contaminants, to enhance the resilience of the community to droughts and other water-related challenges by providing an alternative source of water and to create local job opportunities in the installation and maintenance of rainwaterharvesting systems.

CJITS Campus

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II. VARIOUS METHODS & SYSTEMS OF RAINWATER HARVESTING

SURFACE RUNOFF HARVESTING

Surface runoff harvesting is a sustainable method of rainwater harvesting that utilizes the natural flow of rainwater over the ground's surface. This technique involves capturing rainwater that flows over impermeable surfaces such as rooftops, roads, and pavements, and diverting it into storage systems for later use. The collected runoff water is typically stored in tanks, ponds, or reservoirs, where it can be used for various purposessuch as irrigation, groundwater recharge, or even for domestic consumption after appropriate treatment. Furthermore, surface runoff harvesting systems can be designed to be integrated into existing infrastructure, making them a cost- effective and sustainable solution for water management. With proper planning and implementation, surface runoff harvesting can play a significant role in promoting water sustainability, reducing flood risk, and enhancing overall resilience to climate change impacts.

ROOFTOP RAINWATER HARVESTING

Rooftop rainwater harvesting is a sustainable method aimed at collecting and storing rainwater that falls on rooftops for various purposes. The process begins with the installation of gutters and downspouts on the roof to channel rainwater towards collection points. These collection points are connectedto pipes that lead to storage tanks or reservoirs located either above or below ground. The collected rainwater undergoes filtration to remove debris and impurities before it enters the storage system. Once stored, the rainwater can be used for irrigation, toilet flushing, laundry, and other non-potable applications, reducing reliance on freshwater sources. The efficiency of rooftop rainwater harvesting depends on factors such as the size of the roof, local rainfall patterns, and the capacity of the storage system.as switches.

III. WATER QUALITY PARAMETERS OF RAINWATER

ACIDITY (Ph) The pH is of important to determine the corrosively of water. Rain is considered acidic when the pH is less 6.5, and levels below this may cause corrosion of metal roofs and fittings. WHO guidelines (1996), give 6.5 to 9.5 as acceptable parameters for pH value in rainwater.

Performing pH test on rainwater

Result: pH of rain water = 5.6

IV. METHODOLOGY

The present study area is Jangaon Mandal which is administrative division and revenue division of Jangaon district in Telangana state, India. It is covering an area of 196 sq.km. It is located on the eastern deccan plateau and it experience a tropical climate. It is a semi-arid hard rock region. The average rainfall is 780 mm. As per census data, the total population is 92,446 and the average literacyrate is 72.91 percentage with male is 73.57 percentage 31 and the female literacy rate is 57.53%. And56.7% people lives in Urban areas, 43.3% lives in rural areas Christu Jyothi Institute of Technology And Science was established in the year 1998 and is situated in 54 acres campus in Yeshwantapur, Jangaon which is about 100KMs from Hyderabad with a built up area of 21463m2.

The average monsoon rainfall data is taken from The INTEGRATED OFFICE of Jangaon District and the average rainfall data of the Jangaon district is given below from the years 2022 to the year 2023 as mentioned This rainfall data is essential for calculating the total discharge into the pipeline and also an essential factor during the design of storage tank. Hence, in our project we considered therainfall data of previous two years, from the year 2021-2024.

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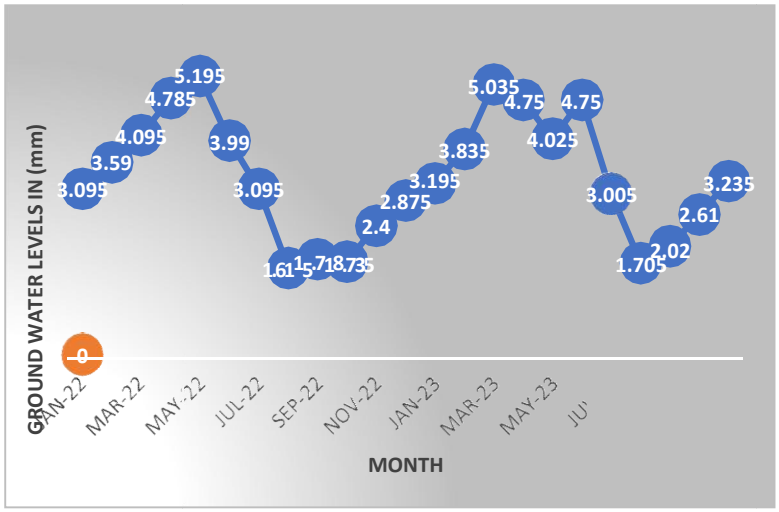
Integrated Rainfall Data of Jangaon Mi
Day Wise Monthly A

Sl. No	Month	Days																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	January, 2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	February, 2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	March, 2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0
4	April, 2023	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	May, 2023	69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June, 2023	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
7	July, 2023	0	0	0	0	35	0	9	0	14	4	4	6	18	0	1	7	0	16
8	August, 2023	2	0	1	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
9	September, 2023	0	0	30	0	27	56	1	1	0	0	1	0	0	0	0	0	0	0
10	October, 2023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	November, 2023	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

To. K.Bhavani. D/oYadaiah. CJIT. Jangaon

Rainfall Report Of 2022-2023 Of Jangaon



Groundwater levels

No	Material
1	80mm diameter PVC Pipe
2	20mm diameter PVC Pipe
3	Bracket
4	PVC - T bends20mm'
5	Glue
6	PVC L -bends
7	Straps

V. DESIGN OF ROOF TOP RAIN WATER HARVESTING SYSTEM

To design the roof-top rainwater harvesting system we need to design six main steps, they are as follows.
Determine the roof catchment area and Layout
Area Of B-TECH Block = 4000 m^2
Area Of Diploma Block = 660 m^2
Area Of PG Block = 2260 m^2Total roof catchment area = 6920 m^2
Amount of rainwater captured in CJITS Average rainfall of Jangaon = 74.15mmConsidering 80mm for future
Average rainfall (R) = 74.15mm

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The average rainfall in terms of meters per year (R) =0.07415m/yearCatchment Area (A) = 6920 m^2
Run off coefficient (Cr) = 0.8
Mean annual rain water supply(S) = Average rainfall X Area of catchment X Runoff coefficient = 74.15 x 6920 x 0.8 = 410494.4 litres/year
Transportation system (install the pipes)

Recharging of ground water level in bore well

VI. ESTIMATION AND COSTING OF RAIN WATER HARVESTING AT CJITSCAMPUS

S.NO	Description	Length (Ft)	Quantity	Cost of each	Total Cost of Pipes
1	4- Inch Pipes (Horizontal Pipes)	10	137	310/-	42,470/-
	4- Inch Pipes (Vertical Pipes)	10 &20	44 &22	310/- &500/-	28,820/-
2	L-Bends	-	15	160/-	2,400/-
3	T-Bends	-	40	180/-	7,200/-
4	Gum		1Lt	500/-	500/-
5	Clip clumps		20	150/-	3000/-
	Total Cost				84,390/-
6	Other miscellaneous				-
7	Fitting Charges				-

VII. CONCLUSION

The installation of a rainwater harvesting system on campus illustrates a sustainable approach to water management, greatly lowering reliance on outside water sources and encouraging environmental stewardship and a conservation-minded culture among both staff and students.

This study evaluated the feasibility of rainwater harvesting in a locality of CJITS Engineering College Jangaon. When people think about rainwater, they often erroneously think that it contains pollutants but the truth is that rain water is extremely clean and safe, so in such area if rainwater can be collected and stored in a proper and scientific manner, management of water resources would enter a new era. Since the discussed roof harvesting technology does not have any harmful effect on the environment. Rain water harvesting seems to be a beneficial and sustainable method, therefore advocacy for the adaptation.

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