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Understanding of Rain Water Harvesting by Experimental Method

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Abstract -*This research includes study of rainfall data of Barh (Patna) for understanding of rain water data and storage of the same can be used in future.*

Keywords*:-Catchment area, Rainwater, LPCD*

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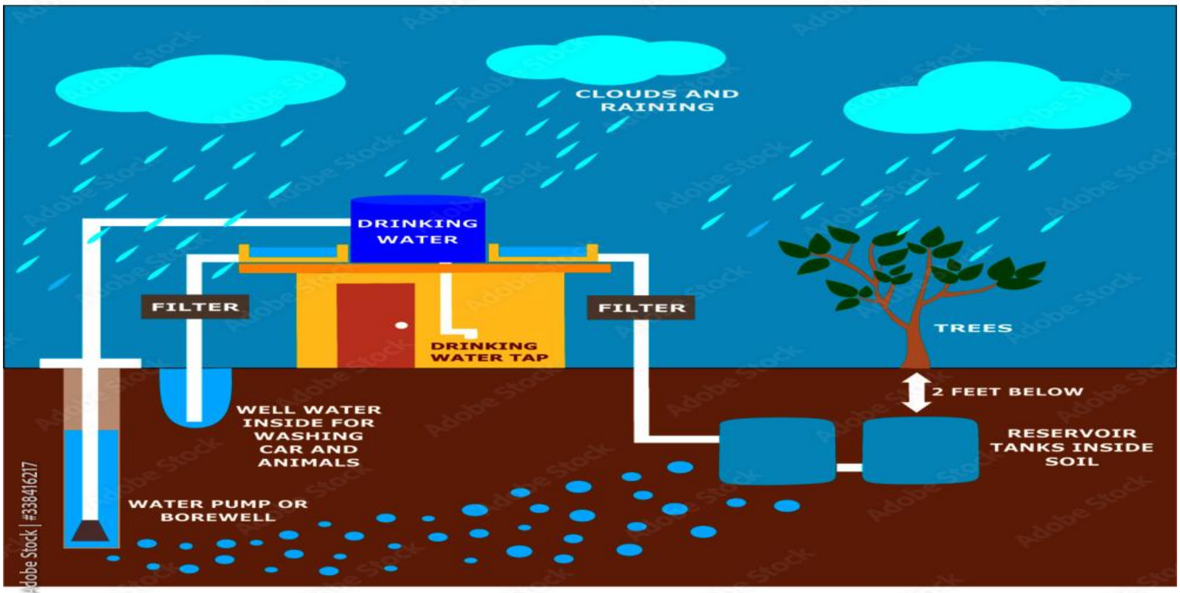
I. INTRODUCTION

Rainwater harvesting is an age-old technique that has recently regained prominence as a sustainable approach to addressing the escalating global water crisis. With the world's population expanding at a rapid pace, the demand for freshwater is also rising significantly. In numerous regions, obtaining clean water is becoming more challenging due to factors such as climate change, population growth, and other environmental pressures. Rainwater harvesting offers a practical and efficient means to help alleviate this challenge.



Rainwater harvesting in Barh, Bihar involves estimating the catchment area (A), annual rainfall (R), and runoff coefficient (C) to calculate potential collection:

Volume (liters/year) = A (m²) × R (mm) × C.

For example, a 200 m² tiled roof with 1,100 mm rainfall and C = 0.8 yields about 176,000 liters/year, adjusted for efficiency (≈150,000 liters). This harvested water can meet domestic or agricultural needs, reduce dependency on municipal supply, and help recharge groundwater. Integrating the method with traditional Ahar-Pyne systems enhances water security, supports irrigation, and improves drought resilience in the region.

II. STUDY AREA

Barh is a **town and subdivision** in the **Patna district of Bihar**, located on the southern bank of the **Ganga River**. The town is equipped with various facilities and buildings that cater to the academic and residential needs of its citizen.

BARH TOWN

Name	Length(m)	Width (m)	Area(m²)
HOUSE A	14	11	154
HOUSE B	13	14	182
HOUSE C	15	12	180
HOUSE D	20	10	200
HOUSE E	22	10	220
HOUSE F	17	10	170
HOUSE G	18	14	252
HOUSE H	16	10	160
HOUSE I	14	12.3	172.2
HOUSE J	12.5	12	150
HOUSE K	13	9	117
HOUSE L	17	12	201
HOUSE M	25	13	325
HOUSE N	21	11	231
HOUSE O	25	19	475
HOUSE P	16	8	128
	Total Area		3317.2

Table-01: Rooftop Area

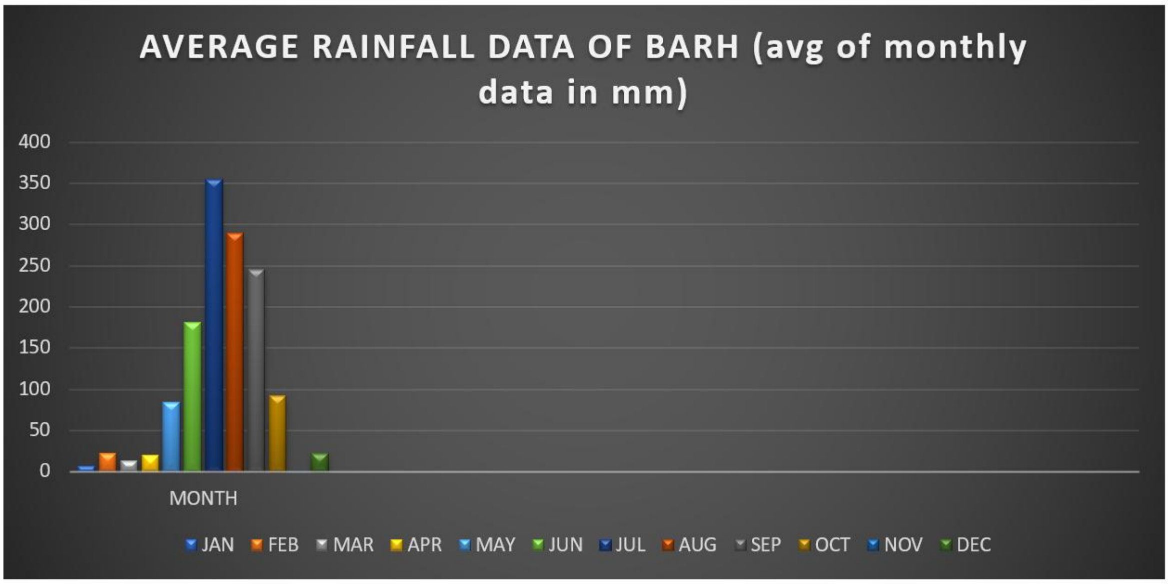
III.RAINFALL DATA

The average monthly rainfall data are being taken from the "CLIMATE OF BIHAR" by INDIAN METEOROLOGICAL DEPARTMENT. The monthly rainfall data of the Barh is given below in the table no .1.

Table-02: Monthly Average Rainfall data in mm

STATION	NO.OF YEARS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Patna	6	3.4	0	1.9	0	54.8	61.5	251.7	133	355.1	57.8	0	0	**927.2**
Nalanda	5	13.4	0	1	0	41.6	122.8	326.6	186.4	317.5	72.1	0	0	**1081.4**
Barh	5	7	23	14	20	84	182	355	290	246	92	1	22	1336

The Monthly average rainfall data plotted in the bar graph, which shows that the rainfall in themonth of June to September is maximum than any other month. Hence, rainwater can be harvest in this month effectively.



Catchment Data

The catchment area is nothing but the rooftop area of the buildings which receives rainfall. Thecatchmentareawhichisthebuilding'srooftopareaismeasured.Themeasurementwas donemanuallywiththehelpofmetertapewhichissimplesttechniqueknownas'tape survey'. Before usingthe tape, thetapewascheckedfor anyzero errorandalsolengthof the tape was also carefully checked for its accuracy. Given below in the Table No. -03 for calculation of roof top areas of the buildings situated inside the campus.

Table-02WaterUser

Block Name	Average User(no)
HOUSE A	7
HOUSE B	8
HOUSE C	10
HOUSE D	15
HOUSE E	20
HOUSE F	17

HOUSE G	7
HOUSE H	8
HOUSE I	9
HOUSE J	12
HOUSE K	8
HOUSE L	6
HOUSE M	8
HOUSE N	9
HOUSE O	7
HOUSE P	14

IV. METHODOLOGY

Runoff Potential

The formula for calculating rainwater harvesting potential or the amount of water harvested from rainfall depends on various factors, including the catchment area, rainfall intensity, efficiency of the system, and storage capacity. One commonly used formula is:

$$\text{RainwaterVolume}(m^3)=\text{CatchmentArea}(m^2)\text{x}\text{Rainfall}(m)\text{x}\text{RunoffCoefficient}$$

The catchment area is the surface that collects rainfall, such as rooftops or pavements, measured in square meters. Rainfall is measured in millimeters, and the runoff coefficient (0.5–1.0) represents the portion of rainfall that becomes runoff, accounting for factors like leakage, infiltration, and evaporation. For an impervious rooftop, the coefficient is 1. The harvested rainwater can be estimated by multiplying catchment area, rainfall, and runoff coefficient, though actual results may vary with local conditions and system design.

Sl.No.	Typesofarea	ValueofK		
		FlatLand0-5%Slope		Rollingland5%-10% slope
1.	Urbanareas	0.55		-
2.	Singlefamilyresidence	0.3		
3.	CultivatedAreas	0.5	0.6	0.72
4.	Pastures	0.30	0.36	0.42
5.	Woodenlandorforestedareas	0.3	0.35	0.50

Table-03: Value of Runoff Coefficient(K)

V. CALCULATION

Catchment area Calculation

Individual houses within the Barh, all have their specific areas calculated for rainwater harvesting purposes, which is shown in Table No.-7.

Table-04: Catchment Area

Name	Length (m)	Width (m)	Area(m²)
HOUSE A	14	11	154
HOUSE B	13	14	182
HOUSE C	15	12	180
HOUSE D	20	10	200
HOUSE E	22	10	220
HOUSE F	17	10	170
HOUSE G	18	14	252

HOUSE H	16	10	160
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	TotalArea		3317.2

VI. CONCLUSION

Rainwater harvesting is a practical, low-cost way to secure water for the future. By capturing runoff from roofs and paved areas, storing it safely, and treating it as needed, communities and households can reduce demand on strained municipal supplies, cut utility bills, and buffer against droughts and erratic monsoons. When used for non-potable needs—like flushing, cleaning, landscaping, and irrigation—it frees up freshwater for drinking and critical uses. Surplus recharge also helps stabilize groundwater levels and reduce urban flooding. With proper maintenance, quality control, and supportive policies, harvested rain becomes a reliable, climate-resilient reserve that strengthens water security for homes, campuses, industries, and cities alike.

REFERENCES

[1]. Reddy P.SaiRukesh and Rastogi A.K., (2008), Rainwater Harvesting in hostel 12 and hostel 13 of IIT Bombay, The Indians society for Hydraulics and Journal of Hydraulic Engineering.
[2]. http://www.tn.gov.in/dtp/rainwater.htm
[3]. http://www.rainwaterharvesting.org
[4]. http://www.rainwaterharvesting.org/People/innovators-urban.htm#svis