

## **Prospects of Rainwater Harvesting in the Kolkata Municipal Corporation (KMC) Area, West Bengal**

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### **Abstract**

The study investigates the potential, design, and governance of Rooftop Rainwater Harvesting (RRWH) within the urban boundaries of the Kolkata Municipal Corporation (KMC), an area facing seasonal water scarcity, rising urbanization, and diminishing groundwater resources. The research is organized into five primary objectives that collectively offer a comprehensive understanding of RRWH as a sustainable urban water management approach:

**Analysis of Rainfall trend, variability, and forecasting:** This research assesses 120 years of rainfall data to analyze temporal trends and interannual variability in rainfall. The research employs statistical methods, including the Mann-Kendall test, Sen's slope estimator, and forecasting models (ARIMA and Polynomial regression), to create a foundational understanding of the rainfall trend and patterns of the study area. These findings are essential for establishing assured rainfall thresholds that facilitate dependable RRWH system design.

**Analysis of Land Use and Land Cover Changes:** The research evaluates 30 years of land use and land cover alterations (1990-2021) employing GIS and satellite images to comprehend the rise in impervious surfaces and their effect on stormwater runoff and groundwater recharge.

The results highlight the necessity for decentralized water management strategies such as RRWH due to increasing urban expansion.


**Assessment of Rainwater Harvesting (RWH) Potential:** The study used Google Earth Pro and field measurements to quantify the rooftop area of selected educational institutions, hence estimating possible rainwater harvesting volumes. This study determines the extent to which institutional water demand, especially for non-potable applications, can be mitigated through harvested rainwater, thus decreasing dependence on municipal and groundwater resources.

**Dimensioning the Rooftop Rainwater Harvesting Structure:** This study aims to establish a scientifically rigorous methodology for calculating ideal tank sizes based on a design criterion of 60% assured rainfall. Weekly and monthly rainfall patterns have been examined to recommend tank capacity that optimizes cost, efficiency, and climatic dependability, with particular emphasis on monsoon intensity and dry-season water requirements.

**Assessment of various policies and public perception regarding RRWH:** This study conducts a critical evaluation of national and local water policies,

including 'Jal Dharo-Jal Bharo' and KMC's building regulations in relation to Sustainable Development Goals (SDGs). Perception research complements this by capturing the community and institutional views toward RRWH, highlighting deficiencies in awareness, technical competence, and policy enforcement. This facilitates the development of specific recommendations to improve adoption, governance, and system maintenance.

This study offers a comprehensive, interdisciplinary framework for the integration of rainwater harvesting within the study area by combining hydrological data, geographical analysis, infrastructure design, and socio-political assessment. The study promotes RRWH not merely as a supplementary water source but as a climate-resilient urban infrastructure vital for sustainable urban development in monsoon-dependent areas.

  
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