

## Assessment of Rooftop Rainwater Harvesting in Gomti Nagar, Lucknow

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**Abstract :** Water scarcity is a pressing issue in urban areas, even in smart cities where efficient resource management is a priority. This scarcity is mainly caused by factors such as lifestyle changes, excessive groundwater extraction, over-usage of water, rapid urbanization, and uncontrolled population growth. In the specific case of Gomti Nagar, Lucknow, Uttar Pradesh, India, the depletion of groundwater resources is particularly severe, leading to a water imbalance and posing a significant challenge for the region's sustainable development. The aim of this study is to address the water shortage in the Gomti Nagar region by focusing on the implementation of artificial groundwater recharge methods. Specifically, the research aims to investigate the effectiveness of rainwater collection through rooftop rainwater harvesting systems (RTRWHs) as a sustainable approach to reduce aquifer depletion and bridge the gap between groundwater recharge and extraction. The research methodology for this study involves the utilization of RTRWHs as the main method for collecting rainwater. This approach is considered effective in managing and conserving water resources in a sustainable manner. The focus is on implementing RTRWHs in residential and commercial buildings to maximize the collection of rainwater and its subsequent utilization for various purposes in the Gomti Nagar region. The study reveals that the installation of RTRWHs in the Gomti Nagar region has a positive impact on addressing the water scarcity issue. Currently, RTRWHs cover only a small percentage (0.04%) of the total rainfall collected in the region. However, when RTRWHs are installed in all buildings, their influence on increasing water availability and reducing aquifer depletion will be significantly greater. The study also highlights the significant water imbalance of 24519 ML/yr in the region, emphasizing the urgent need for sustainable water management practices. This research contributes to the theoretical understanding of sustainable water management systems in smart cities. By highlighting the effectiveness of RTRWHs in reducing aquifer depletion, it emphasizes the importance of implementing such systems in urban areas. The findings of this study can serve as a basis for policymakers, urban planners, and developers to prioritize and incentivize the installation of RTRWHs as a potential solution to the water shortage crisis. The data for this study were collected through various sources such as government reports, surveys, and existing groundwater abstraction patterns. The collected data were then analysed to assess the current water situation, groundwater depletion rate, and the potential impact of implementing RTRWHs. Statistical analysis and modelling techniques were employed to quantify the water imbalance and evaluate the effectiveness of RTRWHs. The findings of this study demonstrate that the implementation of RTRWHs can effectively mitigate the water scarcity crisis in Gomti Nagar. By reducing aquifer depletion and bridging the gap between groundwater recharge and extraction, RTRWHs offer a sustainable solution to the region's water scarcity challenges. The study highlights the need for widespread adoption of RTRWHs in all buildings and emphasizes the importance of integrating such systems into the urban planning and development process. By doing so, smart cities like Gomti Nagar can achieve efficient water management, ensuring a better future with improved water availability for its residents.

**Keywords :** rooftop rainwater harvesting, rainwater, water management, aquifer

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