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Evaluation of Advanced Rainwater Harvesting Systems for Groundwater Recharge and Quality Improvement in Industrial and Mining Areas of Chhattisgarh

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Abstract: *This comprehensive study evaluates the effectiveness of advanced rainwater harvesting (RWH) systems—Furaat, JKLC, and Kedia Rainwater Harvesting Pvt. Ltd. (KFP)—compared to conventional methods, implemented across industrial and mining sites at JK Lakshmi Cement Limited (JKLC) in Durg district, Chhattisgarh. The research demonstrates that the advanced RWH systems significantly outperform traditional approaches in water collection efficiency, with Furaat and JKLC systems showing 24% and 18% improvements in groundwater levels during peak recharge months, respectively, compared to conventional systems, which only showed a 5% improvement. These systems have been effective in replenishing aquifers, with JKLC's system achieving an average recovery of 5.6 meters in groundwater levels over six months, significantly mitigating groundwater depletion. Additionally, the study observed marked improvements in groundwater quality. Total Dissolved Solids (TDS) levels decreased by 35% (from 850 mg/L to 550 mg/L), hardness reduced by 28%, and fluoride concentrations dropped by 20%, from an average of 0.80 mg/L to 0.64 mg/L. These reductions indicate not only enhanced water availability but also improved water quality, making it more suitable for drinking, agriculture, and industrial use. The findings underscore the dual benefits of RWH systems in augmenting both water availability and quality, contributing to sustainable water resource management in industrial and mining regions. The research supports the scaling up of these systems as a viable solution for addressing water scarcity and improving water security in similar regions*

Keywords: Rainwater Harvesting (RWH), Water scarcity, Water security, Total Hardness, Groundwater levels

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