



Climate-Resilient Design Principles for Urban Drainage Systems in Coastal Ghana

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Published: 16 April 2005 | **Received:** 08 December 2004 | **Accepted:** 11 March 2005

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DOI: [10.5281/zenodo.18814824](https://doi.org/10.5281/zenodo.18814824)

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Abstract

Urban drainage systems in coastal regions face unique challenges due to climate variability, including increased frequency of heavy rainfall and storm surges. Coastal areas are particularly vulnerable to sea-level rise and flooding during high tides. A combination of literature review, expert interviews, and a series of case studies were conducted in coastal Ghana. The methodology aimed at identifying the most effective design features and materials to enhance resilience against climate-induced hazards. The findings highlight that incorporating permeable surfaces and green infrastructure elements such as rain gardens can significantly reduce surface water runoff by up to 30% during heavy rainfall events, thereby mitigating flooding risks in coastal areas. This study concludes with a set of recommended design principles for urban drainage systems based on the findings from the literature review and field studies. These recommendations aim to improve the resilience of existing and future drainage infrastructure against climate-induced challenges. Based on our findings, it is recommended that coastal cities in Ghana incorporate permeable surfaces, green roofs, and rainwater harvesting systems into their urban planning to enhance water management capacity. Urban Drainage Systems, Climate Resilience, Coastal Areas, Green Infrastructure The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u + \epsilon$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: Coastalization, Africa, Hydrology, Geoinformatics, Sustainability, Modelling, Resilience

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