



# Climate-Resilient Infrastructure Design for Urban Drainage Systems in Coastal Ghana: A Comparative Study

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### Abstract

Coastal urban areas in Ghana are increasingly exposed to climate-related hazards such as sea-level rise and intense rainfall events, necessitating resilient infrastructure solutions for drainage systems. A comparative study employing case studies from two selected coastal cities in Ghana. Data was collected through field surveys and hydrological simulations to assess system resilience across diverse designs. Analysis revealed that design strategies incorporating green infrastructure components such as permeable pavements and bioswales demonstrated a significant reduction ( $p < 0.05$ ) in peak discharge rates by an average of 30% compared to conventional drainage systems, under scenarios simulating moderate climate change impacts. The study underscores the critical role of integrated design approaches that integrate both structural and non-structural elements for achieving enhanced resilience in urban drainage infrastructure. Adoption of resilient design principles should be prioritised by local authorities to enhance the ability of drainage systems to withstand climate-induced stresses, thereby improving flood management outcomes. Climate-resilient design, urban drainage, coastal Ghana, green infrastructure, hydrological resilience. The maintenance outcome was modelled as  $Y = \beta_0 + \beta_1 X + u + \epsilon$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *Geographical Information Systems, Coastal Geomorphology, Climate Change Adaptation, Hydrological Modelling, Vulnerability Assessment, Sustainable Infrastructure Design, Resilience Metrics*

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