

BASIN-WIDE SUITABILITY ASSESSMENT AND HYDROLOGICAL MODELLING OF BLUE-GREEN INFRASTRUCTURE OF SELECTED BASINS IN CENTRAL AND SOUTHERN LUZON

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ABSTRACT

This study evaluates the spatial suitability and hydrological effectiveness of blue-green infrastructure (BGI) to inform integrated water management in the rapidly urbanizing watersheds of Central and Southern Luzon, Philippines. An opportunities-needs framework was adapted using the Delphi method with local experts to assess 35 physical and socio-environmental objectives across four major basins. Subsequently, the Soil and Water Assessment Tool (SWAT) was used to simulate the hydrological impacts of varying adoption scales (25% to 100%) of green roofs, rain gardens, and pervious surfaces within the heavily urbanized San Juan River sub-basin. The suitability analysis revealed a spatial mismatch: BGI needs are highest in dense, vulnerable urban cores, whereas physical opportunities are concentrated in peri-urban and rural areas. Hydrological modelling demonstrated that all BGI scenarios successfully reduced surface runoff and increased evapotranspiration. A combined BGI scenario yielded the greatest impact, reducing surface runoff by 13.26% and increasing aquifer recharge by 6.14%. Rain gardens and pervious surfaces delivered the largest runoff reductions per unit area, with pervious surfaces uniquely enhancing dry-season baseflow. While BGI provides critical ecosystem services and flood attenuation, its benefits in dense urban settings are constrained by space limitations. Thus, it must complement, not replace, traditional grey infrastructure. Future studies should focus on establishing localized, high-resolution databases, engaging broader expert panels and local communities, incorporating sub-daily peak dynamics and wastewater flows into urban watershed models, and validating simulated performance through monitoring of pilot BGI installations.

Keywords: Blue-green infrastructure (BGI), hydrological modelling, suitability analysis, urban stormwater management, Soil and Water Assessment Tool (SWAT), Metro Manila