ABSTRACT

URBAN WATER QUALITY: SOCIO-ECONOMIC DISTRIBUTION OF STREAM DEGRADATION, AND THE INFLUENCE OF CLIMATE ON BMP PERFORMANCE

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Urban water quality impairments have long burdened urban aquatic ecosystems in a phenomenon termed “urban stream syndrome”. The symptoms of this “syndrome” include physical changes in stream morphology and water level, biologically stressed environments, and perturbations in ecosystem processes. Despite years of research and costly investments in restoration and rehabilitation, urban waterways are still plagued by degradation. Improvement in urban water quality will require multi-faceted efforts, including progress on 2 key fronts: 1) increased understanding of current impairments, and 2) increased knowledge about urban stormwater infrastructure, like best management practices (BMPs). Towards both topics, engineers have quantified the influence of controls that can be manipulated in restoration and design to improve water quality, like imperviousness, real time controls, and soil amendments in BMPs. However, urban waterways remain degraded, and there are still many unknowns regarding the distribution of stream quality impairments. Improvement of urban water quality requires a better quantification of water quality distribution, and quantification of factors that impact stormwater infrastructure performance**.** This dissertation formed a more complete diagnosis of the extent of urban stream syndrome, and informed stormwater infrastructure performance variabilities through the execution of three objectives. First, the distribution of stream quality variability across socio-economic groups was evaluated through a partnership with volunteer science. Second, BMP nutrient management variability was assessed on a regional climate scale, and variable performance between climates was quantified. Finally, the influence of storm characteristics on BMP nutrient management was assessed and performance under different types of storms was quantified. This research showed that high poverty areas are disproportionately burdened by poor stream water quality and identified phosphorus leaching vulnerability for BMPs in arid climates, and intense storm events.

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