

Supplementary Materials: Interdisciplinary Collaboration on Green Infrastructure for Urban Watershed Management: An Ohio Case Study

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Abstract: Many older Midwestern cities of the United States are challenged by costly aging water infrastructure while working to revitalize urban areas. These cities developed much of their water infrastructure before the Clean Water Act became law and have struggled to mitigate contaminant loading to surface waters. An increasingly common approach to resolving these challenges is the integration of green infrastructure with gray infrastructure improvements to manage point and non-point source pollution. Stakeholder engagement and collaboration during green infrastructure planning can help address impairments and promote community involvement through the revitalization process. Mill Creek watershed in Cincinnati, OH, USA has seen improvement in watershed integrity indicators after being impaired for many decades by flashy hydrology, combined sewer overflows, and water quality degradation. A workshop was conducted to examine how integrated green and gray infrastructure has contributed to improvements in Mill Creek over the past several decades. This effort sought to examine internal and external factors that influence a multi-stakeholder watershed approach to planning, implementing, and evaluating green infrastructure techniques. Community investment and physical infrastructure, access to datasets, and skills and knowledge exchange were essential in improving use attainment in the Mill Creek. Strategic placement of green infrastructure has the potential to maximize water quality benefits and ecosystem services. However, green infrastructure deployment has been more opportunistic due to the diversity of stakeholder and decision maker interests. Future work should consider collaborative approaches to address scaling challenges and workforce development to maximize green infrastructure benefits.

Keywords: use-attainment; social network analysis; urban planning; governance; social infrastructure

SWOT Analysis for Designing Resilient Natural Green Infrastructure in the Mill Creek Watershed

	Positive / Favorable	Negative / Unfavorable
Internal Analysis	<p style="text-align: center;"><u>Strengths</u></p> <ul style="list-style-type: none"> • GI improves hydrology, water quality, and stream health • Reduces risk of flooding in downstream areas • Continuous and Real Time Monitoring equipment is already in place and maintained by US EPA and USGS • Excellent recent MBI Biological and Water Quality Assessment of Mill Creek in 2016 • The Lick Run demonstration project is already underway and expected to eliminate 1.78 billion gallons of CSOs annually GI can provide added value beyond traditional engineering (e.g., recreation, public engagement, education, etc.) • Part of a comprehensive approach that is in line with the June 2017 reinstated Total Maximum Daily Load (TMDL) 	<p style="text-align: center;"><u>Weaknesses</u></p> <ul style="list-style-type: none"> • Combined Sewer Overflows (CSOs) are common during rain events and Mill Creek's hydrology is very flashy • Mill Creek is currently dominated by treated effluent • Current public perception and lack of awareness about Mill Creek • Greater risk of flooding in upstream areas where GI is implemented • Lack of standards for GI projects and confusion over who is responsible for maintenance and other costs • Little enforcement for CWA compliance • Possible unintended consequences such as increasing exposure to toxic materials that have been buried and sealed
External Analysis	<p style="text-align: center;"><u>Opportunities</u></p> <ul style="list-style-type: none"> • Opportunity to quantitatively demonstrate impacts of GI • Brownfields and other places that are liabilities can be converted to community assets • Can create market growth and job opportunities • Human capital: available workforce that can be trained in monitoring, assessment, and construction • More demonstration sites could increase public awareness and understanding • Community engagement can increase the added value of GI for aesthetics and recreation 	<p style="text-align: center;"><u>Threats</u></p> <ul style="list-style-type: none"> • Difficult to justify the costs because it is difficult to quantify improvements to hydrology, water quality, and stream health • Research has not demonstrated that GI can lead to compliance with Clean Water Act standards • Job opportunities are not well classified as it can be impossible to create occupational titles that appropriately represent job responsibilities • There is a lack of workers experienced in GI and need for training programs • Lack of funding available for long-term monitoring and evaluation of projects

Figure S1: Summary of SWOT Analysis

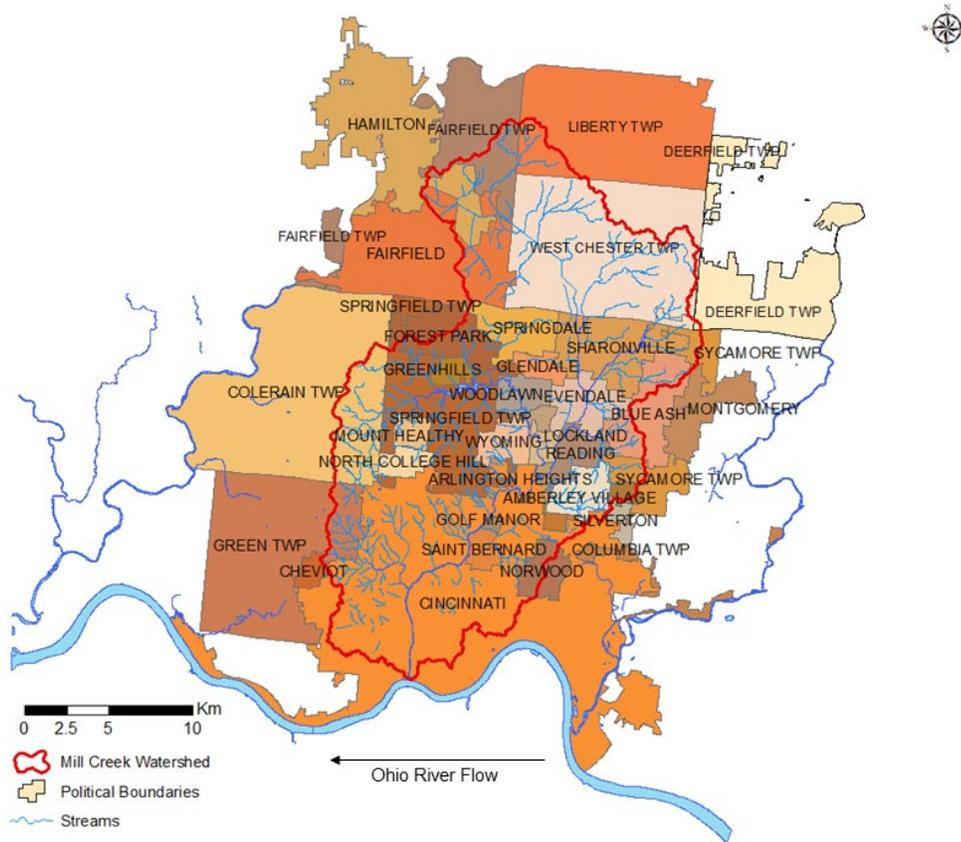


Figure S2: Thirty-six different municipalities are fully or partially within the Mill Creek watershed.

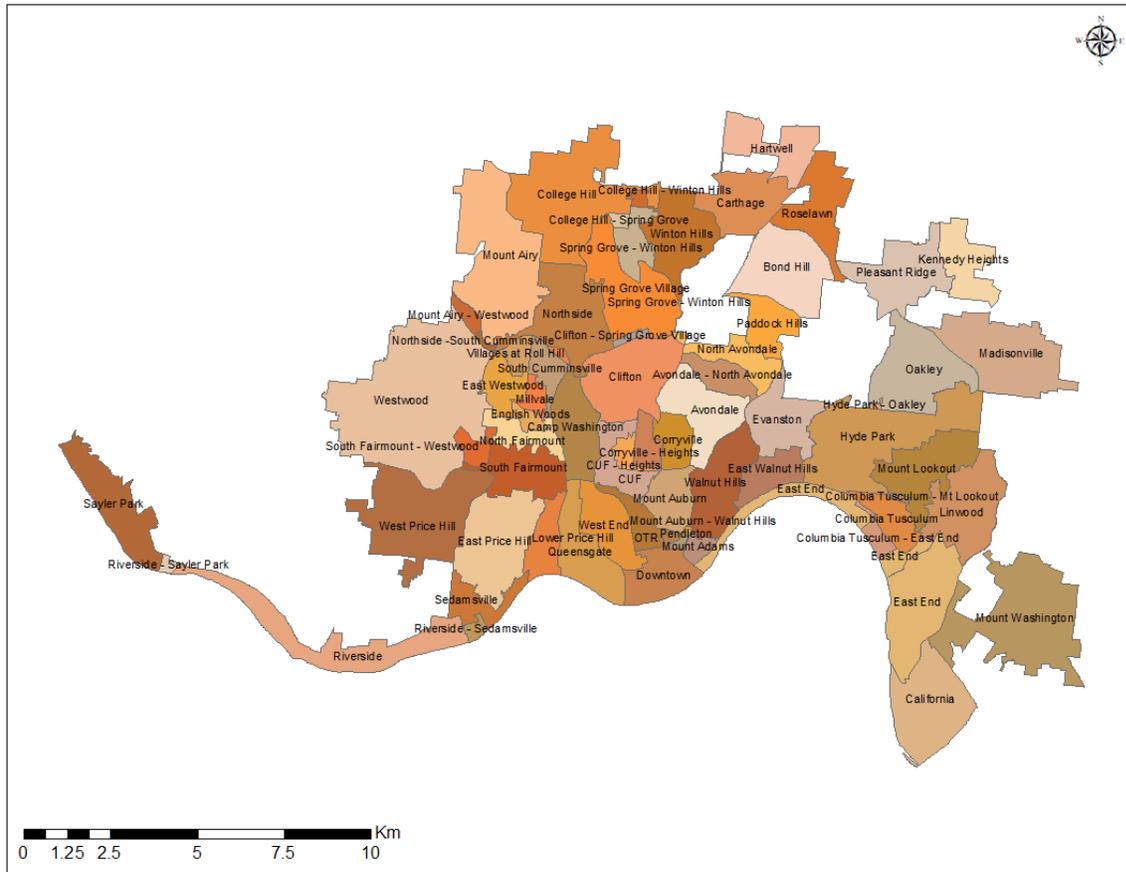


Figure S3: Within the largest municipality of Cincinnati, Hamilton county recognizes 47 different jurisdictions represented by 52 different community councils.