

# Neighborhood, Environment, and Water Research Collaborations for Green Infrastructure (NEW-GI)



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**Palencia Mobley**  
Deputy Director and Chief Engineer,  
Detroit Water and Sewerage Department (DWSD)

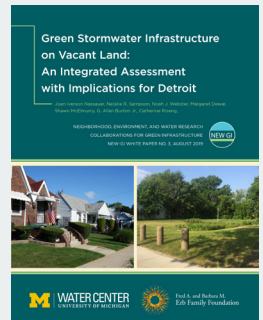
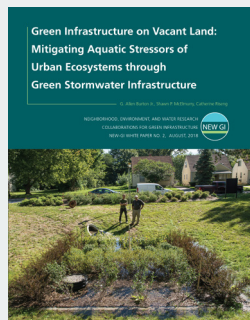
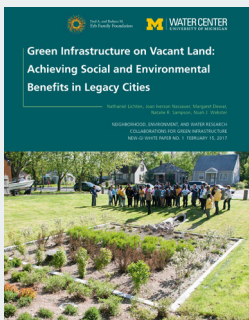
**Neighborhood, Environment, and Water Research Collaborations for Green Infrastructure (NEW-GI)** developed and assessed green stormwater infrastructure (GSI) innovations that more fully serve residents of legacy cities. The project envisioned and tested GSI designs for vacant residential property in Detroit, MI. GSI (e.g., rain gardens, stormwater ponds) aims to manage stormwater at its source through vegetation, soils, and other elements. Compared to conventional pipe-based grey infrastructure that quickly removes stormwater from developed areas, GSI may more effectively regulate local stormwater quantity and quality. It also has potential to enhance neighborhood attractiveness and improve residents’ well-being. However, achieving these benefits requires that GSI be designed and maintained to reflect the perceptions of residents and respond to the local conditions of grey infrastructure, soils, topography, and hydrology.

As a transdisciplinary action research project, NEW-GI involved researchers at the University of Michigan and Wayne State University as well as an Advisory Committee consisting of professional staff of the Detroit Water and Sewerage Department (DWSD), Detroit Land Bank Authority (DLBA), and City of Detroit Departments of Planning and Development and Housing and Revitalization, professional consultants to the DWSD, and leaders in the Cody Rouge Community Action Alliance and Warrendale Community Organization. These researchers and practitioners investigated governance of GSI in legacy cities nationally to determine model practices and common challenges, developed GSI designs for different local conditions, designed and implemented

four GSI pilot sites, and assessed how alternative designs would affect water quality and well-being of neighborhood residents. This work produced evidence-based guidance for sustainably managing stormwater in ways that enhance neighborhood landscapes and the lives of residents in Detroit and other legacy cities.

## KEY PRODUCTS

- Summaries of state-of-the-art knowledge about GSI: The research team developed two white papers that critically summarize scientific literature on the potential effects of GSI design characteristics on human well-being and water quality. These summaries synthesized scholarly literature for the practice community and were used by the project team to design GSI for legacy cities, including the four pilot sites.
- Implementation of four pilot GSI gardens: The project team collaboratively developed and refined GSI designs for implementation on DLBA vacant lots by DWSD. In 2015, four pilot site bioretention gardens were constructed in the Warrendale neighborhood in the Rouge River Watershed of Detroit. By their highly visible presence, the pilot sites inherently engaged citizens in considering how similar designs might fit in their own neighborhoods.
- Integrated assessment of neighborhood scale GSI: Based on extensive field measurements at the pilot sites and in-home interviews conducted in a census of all households nearby the pilot sites, the research team performed an integrated



assessment of GSI on vacant properties in Detroit. The integrated assessment allows decision-makers and residents to consider trade-offs regarding maintenance requirements and potential well-being benefits of different GSI design alternatives, all of which were found to be highly effective in retaining and treating stormwater.

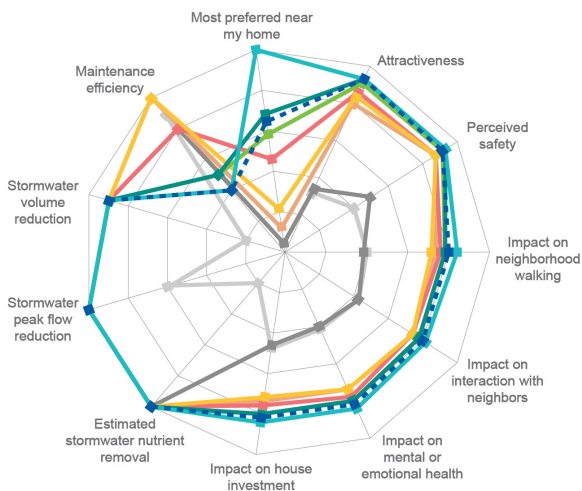
- **Technical tools for legacy cities:** The research team produced two technical reports that investigate the design of larger scale GSI practices as well as GSI governance nationally. These reports build on findings from the project to suggest different approaches to GSI maintenance challenges.
- **Scientific presentations and publications:** The research team has presented the results of NEW-GI at numerous national and international conferences in community engagement engineering, urban landscape design, landscape ecology, urban ecology, and urban planning. Researchers are producing five scientific papers (2 published, 1 submitted, 2 in preparation). Reception of this work in the scholarly community underscores credibility of the project results.

As NEW-GI was being completed, the University of Michigan Water Center initiated a project evaluation survey to gather feedback from the project's Advisory Committee members as well as a broad list of individuals who had accessed project products. Forty people, including seven Advisory Committee members, responded to the survey and their responses and comments are used illustratively in this document.

## NEW KNOWLEDGE TO FRAME CONVERSATIONS ABOUT GREEN STORMWATER INFRASTRUCTURE (GSI) IN DETROIT

*This project produced new knowledge about the potential as well as challenges for GSI to provide multifunctional benefits.*

Before this project was initiated, DWSD had already envisioned and been required by the State of Michigan Department of Environmental Quality to use GSI to control runoff from 2-year 24-hour storm events. The city's pervasive clay soil and very flat terrain, however, challenge stormwater infiltration and movement. Novel GSI designs and credible assessment of these designs were needed. The integrated assessment of the constructed NEW-GI



COMPARING BENEFITS OF THE GSI ALTERNATIVES

pilot gardens and alternative GSI designs filled several needs for new knowledge - offering new insights about how these GSI sites manage stormwater, and how residents can directly benefit from GSI in their neighborhoods. This integrated assessment was offered in the context of the team's national review of GSI governance, to offer the following key findings:

- GSI bioretention systems on the pilot sites perform extremely well to manage stormwater flows, far exceeding the capacity needed for the 2-year design storm. Medium scale (300,000 gal. capacity) GSI bioretention designs for managing stormwater from urban street catchments can be highly effective in flat, clay-soil landscapes.
- Designs that combine cues to care like flowering plants with mown turf and maintain open sight lines, may elicit stronger acceptance and enhanced well-being for residents.
- Even the least demanding form of maintenance, mowing, combined with bollards to protect a site from dumping and unwanted visitors, delivers important gains in neighborhood well-being compared the status quo for vacant property care.

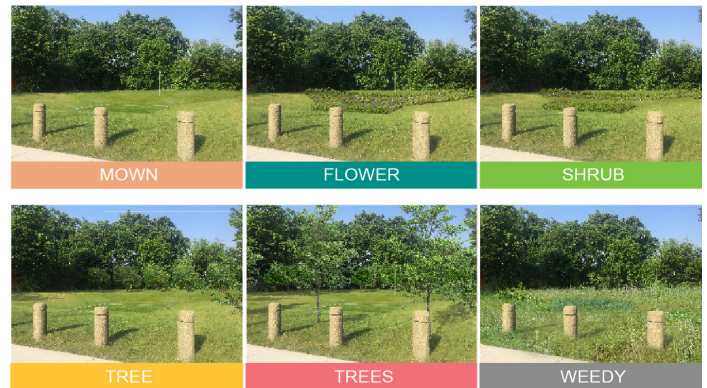
### BUILT DESIGNS

FLOWER + SHRUB



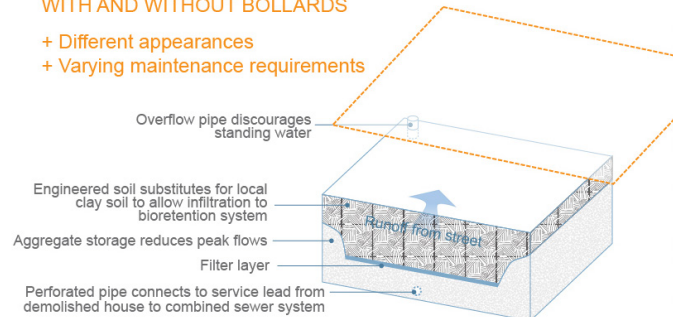
### OTHER DESIGN SCENARIOS

WITH AND WITHOUT BOLLARDS



### DIFFERENT BIORETENTION GARDEN DESIGN ELEMENTS: WITH AND WITHOUT BOLLARDS

- + Different appearances
- + Varying maintenance requirements



### SAME STORMWATER MANAGEMENT DESIGN:

- + An excavated area of two demolished houses
- + 300,000 gallons storage capacity





- Maintenance remains a central challenge for GSI design. GSI maintenance is related to design scale, and larger scale GSI practices can be a means of enhancing maintenance efficiencies.
- Governance, including legal requirements, location and installation, maintenance, and long-term land control, is explored in legacy cities nationally.

As a result of a transdisciplinary collaboration among researchers and practitioners, project products and findings quickly became part of conversations about GSI in Detroit. Project Advisory Committee members and stakeholders explained how the project brought new perspectives to stormwater management and community engagement in Detroit:

*"As we continue to evolve GSI design and location, the project findings help us refine interactions with community. The project has also helped us understand more how each community is different with respect to the preferred look and feel of GSI. What rings true is that most communities want something extremely manicured in the urban setting."*

*"The research is in support of community feedback, which indicates a desire for more rain gardens on vacant parcels in the Warrendale & Cody Rouge Neighborhoods."*

*"Will use findings to continue to build the case for why and how to scale GSI in city of Detroit."*

*"The findings on resident preferences and how very simple 'landscaping' is as preferable to more elaborate or expensive designs is really helpful in thinking about a wider expansion as a vacant land use."*

## **INFORMING GSI PRACTICE AND RESEARCH IN LEGACY CITIES**

*This project provided timely and relevant scientific information that is being used to inform sustainable stormwater management in Detroit and other legacy cities as well as to inspire research and teaching.*

NEW-GI reports have been distributed through the project team members' professional networks and made available as booklets at various events as well as online through the project page at

the Graham Institute. Consequently, a broader community of practitioners and researchers have found the project products and findings relevant and informative in their own work. In our project evaluation survey, project stakeholders shared how they were using and benefiting from project products, for example, 73% shared findings with others in their network, 58% use findings as framing for conversations about the issue, and 27% reported that they had adjusted their focus or priorities as informed by the project. Comments from survey respondents further illustrate the project's wide-ranging effects on practice, teaching and research:

*"Due to the extensive research with respect to performance, interaction with residents, and benchmarking against other cities, the project can inform design and construction guidelines, plantings and performance characteristics and community engagement strategies."*

*"This work contributes to a larger body of work being built around GSI in Detroit and I have used this research to frame and inform parallel and complementary studies."*

*"We used the findings to inform our bioretention projects in the Cody Rouge neighborhood (west-side Detroit)."*

*"(I've used the project products) to inform students and help them work with a nonprofit for neighborhood-level GSI planning in Detroit, to make recommendations with a nonprofit on GSI workforce development and best practices in bioretention, to create a program with a non-profit coalition to help Detroit residents understand and adopt GSI best practices, and to help two foundations think about how and where they invest in GSI research, policy, and implementation."*

*"These products are helping me to understand and think how best to implement maintenance programs and how to help rain garden owners with maintenance needs. Also, the multi-city comparisons are extremely helpful in learning what is possible and what is most helpful in advancing GSI."*

*"In my research and teaching...This research is so important to inform new regulatory frameworks to make green infrastructure possible. At the same time, making the lessons accessible and replicable more broadly, will make more groups to adopt some of the solutions the team have been advancing."*



## EFFECTIVE ENGAGEMENT AND CONSULTATION

*A robust engagement process proved to be crucial to overall project success.*

Advisory Committee (AC) participants were essential to this transdisciplinary project. AC members co-developed the project's governance approach, implementation methods, GSI designs, and community engagement, and they shared project findings widely. In our project evaluation survey, seven of the project's eleven AC members shared their thoughts regarding whether the project consultation process achieved its goals and what benefits they experienced because of the project. These AC members reported that the project's approach was consultative and responsive to their input. Nearly all felt the research and consultation process produced credible and relevant information. A couple saw opportunities for a more inclusive approach. They all noted important benefits from their participation, including gaining new information that was helpful to their work, increasing access to scientific information, and expanding professional networks.

## EXTENDING PROJECT REACH

*Innovative presentations of the project can make findings accessible to a broader audience.*

The research team made extra efforts to report project findings in an engaging manner by incorporating informative visual presentations in NEW-GI products. These efforts were applauded by users of reports. For example, one respondent commented that "there are really great graphics here which helps to visualize what was done and how something looks". When asked specifically about how the project products could be more accessible and usable for different audiences, survey respondents offered a variety of creative ideas, including developing complementary multimedia summaries of findings such as interactive web displays or story maps, video clips, time lapse videos of how neighborhoods could change with GSI, or museum displays. Several people noted that they appreciated being able to easily download PDFs online and suggested that slide decks and complementary factsheets could help people quickly grasp and share key takeaways. Survey respondents also offered ideas for partnering with additional groups to host discussion forums or share findings with targeted professional audiences.

## FACILITATING ENGAGED RESEARCH

*The project exemplifies an engaged research process for addressing sustainability challenges.*

NEW-GI engaged a transdisciplinary team to co-develop novel green stormwater infrastructure designs for vacant residential property in Detroit, investigate their implications for governance, and conduct an integrated assessment of their social and environmental performance. The strong Advisory Committee role paired with integration of rigorous social and environmental science elevated the process and products of NEW-GI to be widely relevant to practices and policies for green infrastructure and nature-based solutions. This engaged research process is an exemplar for developing design and engineering innovations that address technical challenges in ways that are meaningful to community life, and advance knowledge for science and practice more broadly.



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For more information on NEW-GI and to download the full reports, please go to: [www.myumi.ch/NEW-GI](http://www.myumi.ch/NEW-GI)

The Graham Institute's mission is to mobilize the passion and expertise of scholars, partners, and decision-makers to work together and bring world-class research to real-world sustainability challenges. This project is an example of how the Institute can attract external funding and support university researchers as they engage with communities and decisions makers to help identify practical approaches and pioneering solutions to the sustainability issues that threaten our collective future.

### Researchers

- Joan Nassauer** - School for Environment & Sustainability, University of Michigan
- Alicia Alvarez** - Law School, University of Michigan
- Allen Burton** - School for Environment & Sustainability, University of Michigan
- Margaret Dewar** - Urban & Regional Planning Program, Taubman College of Architecture & Planning, University of Michigan
- Shawn McElmurry** - Department of Civil & Environmental Engineering, Wayne State University
- Catherine Riseng** - School for Environment & Sustainability, University of Michigan
- Natalie Sampson** - Department of Health & Human Services, University of Michigan Dearborn
- Amy Schulz** - School of Public Health, University of Michigan
- Noah Webster** - Institute for Social Research, University of Michigan

### Advisory Committee

- Palencia Mobley, P.E., Chair** - Deputy Director and Chief Engineer, Detroit Water and Sewerage Department
- Katy Trudeau** - Deputy Director, Detroit Planning & Development Department
- Kevin Robishaw** - Manager, Inventory, Detroit Land Bank Authority
- Matthew Williams** - Planner, West Region, Detroit Planning & Development Department
- Khalil Ligon** - Lead Urban Planner, East Region, Detroit Planning & Development Department
- Kenyetta Campbell** - Executive Director, Cody Rouge Community Action Alliance
- Lisa Wallick, P.E.** - Stormwater Management Group Manager, Detroit Water and Sewerage Department
- Barbara Matney** - President, Warendale Community Organization
- Betsy Palazzola** - General Manager, Detroit Department of Housing and Revitalization
- Jodee Raines, ex-officio** - Vice President of programs, Erb Family Foundation
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