The Great Lakes water system, which holds 21% of the world’s fresh water [1], is the outlet for thousands of urban waterways in the Upper Midwest post-industrial region of the United States, and is greatly threatened by runoff pollution. As mandated through a Consent Decree [2], a legally binding document entered into by the Northeast Ohio Regional Sewer District (NEORSD) and multiple government agencies, the City of Cleveland and the NEORSD have committed to increasing gray and green infrastructure projects to alleviate urban waterway contamination from stormwater runoff and combined sewer overflows (CSOs). The Doan Brook is central to the technical efforts of Cleveland and the NEORSD and links many of Cleveland’s most diverse neighborhoods. Retrofitting landscapes focuses on the section of the Brook that is bordered on either side by the low-income Buckeye-Shaker neighborhood and the City of Shaker Heights.

Through an EPA grant proposal and design interventions created specifically for the client, LAND studio, to use in the Buckeye-Shaker area of the Doan Brook, the project explores the effect that design literacy and public involvement can have on improving water quality. This project was funded through the Dow Masters Sustainability Fellowship awarded to a group of three students, representing the schools of Architecture, Urban Planning and Design, Environment and Natural Resources, and Law at the University of Michigan. The project consisted of two deliverables: 1) design interventions and 2) an EPA Urban Waters Small Grant proposal, submitted in coordination with University of Michigan Taubman College faculty and LAND studio. For the grant proposal, Green-In-Cleveland, the group proposed a six-week series of interactive, educational events highlighting green infrastructure and stormwater management issues in Cleveland that were designed to engage the Buckeye-Shaker community in the conversation surrounding the Doan Brook’s water quality.
INTRODUCTION

The 2015 Dow Masters Sustainability Fellowship is a program offered by the University of Michigan Graham Sustainability Institute through a gift from the Dow Chemical Company. The program encourages students to devise interdisciplinary projects that address ecological, environmental, and social sustainability. Madeline Buck, Gaurav Sardana, and Dana Wall worked on a water-related initiative in the Doan Brook Watershed in Cleveland, Ohio. Throughout the project duration, they engaged in collaborative planning, inclusive and dynamic programming, and the planning of public spaces. The project is comprised of two components that explore the relation of the Cleveland-based non-profit organization, LAND studio, to improving both the Doan Brook’s adjacent public spaces and water quality. LAND studio is a non-profit organization that specializes in improving neighborhoods through public art, sustainable design, and inclusive and dynamic programming. The organization’s mission is to develop and implement innovative ideas by engaging in inclusive planning practices, and it is committed to sustainability.

Project Clean Lake

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In 2013, the Northeast Ohio Regional Sewer District and the federal government entered into a Consent Decree, Project Clean Lake, to hold the region accountable for meeting Clean Water Act standards issued by the Environmental Protection Agency [3][4]. The Decree requires the NEORSD to reduce raw sewage discharges caused by combined sewer overflows — when the combined sewage and stormwater pipes are overwhelmed during heavy rain events (2) They have vowed to make changes to their infrastructure in three ways: construction of additional underground tunnels for sewage transport, treatment plant enhancements, and green infrastructure and stormwater control measures. Project Clean Lake includes a minimum of $42 million for the implementation of green infrastructure [3]. This funding is illustrative of a push in the region to develop more innovative solutions to maintain environmental quality.

As a result of Project Clean Lake, LAND studio has joined the NEORSD and The Cleveland Foundation in designing and planning for increased green infrastructure. In 2011, OLIN, a landscape architecture and urban design firm in Philadelphia and Los Angeles, presented a vision for Cleveland, Green over Gray. OLIN presented conceptual designs for green infrastructure within the Doan Brook Watershed, categorizing locations for possible implementation into three main categories: Green Ambassador sites, Green Leave-Behind sites, and Neighborhood Connections [5]. Recently, the NEORSD has begun construction on a project adjacent to the Doan Brook, one of the sites categorized in Olín’s report as a Green Ambassador site.

Because Green over Gray is a future vision for the city of Cleveland, the interdisciplinary Fellowship team saw this as an opportunity to bridge the gap between the idea and its execution by means of developing designs, as well as an implementation framework, for a section of the Brook bordered by the Buckeye-Shaker neighborhood and the Cities of Cleveland Heights and Shaker Heights (Figure 2). Building upon OLIN’s thorough work on identifying sites and actions for them, the team worked with LAND studio to plan for the implementation framework of the project. The Fellowship team built on the design component of the project by applying for a grant with the Environmental Protection Agency’s Urban Waters Small Grants Program. The proposal project, GreenWorth Cleveland, focused on community education and engagement in issues of urban water quality, and on the benefits of green infrastructure.

DOW MASTERS FELLOWSHIP


Figure 2. Project site map.

PROJECT COMPONENTS

- CONTEXT
- DESIGN INTERVENTIONS
- GREEN-IN CLEVELAND
On July 7, 2011, a Consent Decree was initiated between the U.S. Environmental Protection Agency, the State of Ohio and the Northeast Ohio Regional Sewer District, describing the specific combined sewer overflow control measures, reduction quantities, perform-
ance goals and construction and monitoring measures the District will be required to perform over the next 25 years (Figure 3) [6]. The District's original CSO control plan did not meet the Agency's overall goals for capture [7]. Project Clean Lake was subsequently amended to include green infrastructure as an alternative.

Project Clean Lake

Project Clean Lake was conceived primarily as a gray infra-
structure system designed to contain approximately four billion gallons of water that will flow into the combined system by diverting this high volume of water to "large, underground storage tunnels rather than
directly into Lake Erie. Additionally, new interceptor sewers and relief
sewers would also provide sewer system flood relief.

Clean Lake Project

As an alternative to purely focusing on updating gray infra-
structure, the amendment proposed a more collaborative combination of up-
stream water control measures that use plants/soil systems, permeable
pavement, or stormwater harvest and reuse, to store, infiltrate, or
evapotranspiration stormwater and reduce flows to the combined sewer
system. These include ... bioretention and detention wetland
areas as well as green roofs and cisterns. The amended Consent
Decree aimed to reduce the District's CSO flows by controlling
combined system by including landscape-based environmental systems
that encourage surface infiltration and cleansing [8]. From these storage tunnels, the combined sewage
water after being appropriately treated through a stormwater control
measure, where possible" [9].

Green Infrastructure

Green infrastructure is defined in the Consent Decree as "stormwater control measures that use plants/soil systems, permeable
pavement, or stormwater harvest and reuse, to store, infiltrate, or
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measure, where possible" [9].

Direct Benefits:

Green infrastructure solutions are designed to fulfill specific
needs, from reducing runoff to water pollution. The direct benefit of
green infrastructure is the mitigation of wet weather flows by controlling
CSO events, specifically in the context of the Doan Brook watershed. Green
infrastructure solutions include low-tech infrastructure, habitat im-
provements, flood and erosion control as well as carbon sequestration—
thus performing both ecological and ecosystemic services. In the

Cleveland, Ohio

The Doan Brook is at the crossroads of both an ecological
and jurisdictional twilight zone with the Cleveland metropolitan area,
as it borders its many cities. The Brook flows through these cities and
the responsibility of maintaining the health of this waterbody falls under
many administrative domains, leading to often unmonitored overflows and
overflows.

Additionally, owing to the degrading economic conditions
within the Bell cities like Cleveland, foreclosures and redevelop-
makes in civic infrastructure have furthered the urban water
pollution has on the Doan Brook.

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Case of the Doan Brook watershed, green infrastructure projects were
proposed since they would "seek infiltration opportunities and other
options to permanently remove stormwater from the combined sewer
areas and to offload this stormwater to soil for infiltration or surface
water after being appropriately treated through a stormwater control
measure, where possible" [9].

Co-Benefits:

Green infrastructure can transform vacant brownfields locat-
ed in residential areas into valuable community assets. Repurposing
vacant land for green infrastructure can positively impact land values
by improving access to safe and maintained green spaces and provid-
ing recreational opportunities [10]. Environmental justice communities
include low income or minority communities who have suffered a dis-
proportionate burden from air, water or land pollution. Through better
performing ecosystems in the form of green infrastructure projects, pol-
tion of water and land can be reduced and indirectly address justice
concerns. While gray infrastructure will be effective in controlling the
outflow of sewage pollutants into Lake Erie, it will be largely invisible
 to the city and thus becomes a multifunctional piece of infrastructure.

On the other hand, green infrastructure provides habitat for wildlife, re-
stored landscapes and urbanization and industrialization.

Taking cues from the Green over Gray project commissioned by LAN
Design, Retrofitting landscapes reinforces "leveraging a neces-
sary infrastructural investment to provide multiple benefits." This function-
ality multiplicity will both address environmental problems and provides
public amenities for neighborhoods.

Threats

• Lack of recognized ecosystem-related industry design standards and
• Requires time for site evaluation for water flow, soil types, native vegeta-
• Weakness

<table>
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<th>Strengths</th>
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<th>Opportunities</th>
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| Provides nature's inherent resource-efficiency and polyfunctionality (water and land can be reduced and indirectly address justice concerns) | As compared to gray infrastructure, offers a large physical foot print due to low energy density. | Offers possibilities for non-technical monitoring, operations and manage-
ment by local stakeholders. | Requires site-specific study analysis to understand seasonal weather changes and extreme weather conditions. |
| Low initial (construction) expenses and low operating expenses (only print due to low energy density) | Offers low-cost risk mitigation opportunities through natural soil erosion control and excluded water purification. | Provides nature's inherent resource-efficiency and polyfunctionality (water and land can be reduced and indirectly address justice concerns) | Required rainfall or irrigation opportunities through natural soil erosion control and excluded water purification. |
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Figure 3. Doan Brook pollution marker, India Cultural Gardens, Cleveland, Ohio.
Retrofitting Landscapes created a catalog (Figure 9) of green infrastructure-based design solutions that embed micro interventions within larger urban connections. The designs aimed to make the Doan Brook visible to neighboring communities through place-making interventions along and across its length. Additionally, the designs functioned to integrate this stretch of the Doan Brook with the Buckeye/Shaker neighborhood of Cleveland, as well as the cities of Shaker and Cleveland Heights. Large urban connections, like linking lake trails and introducing supporting infrastructure (e.g., bike racks), can be combined with these micro interventions, like ramps, decks, and lookout, to increase physical and visual access to the Brook.

The larger ambition of these design solutions looked at creating regional urban connections with local design interventions across a particular stretch of the Doan Brook. With this catalog, intended to enhance visibility and allow access to the Brook, LAND studio will be equipped with an armature of possibilities that can be modified based on community inputs, budgets and pilot tests. Access, both visual and physical, to the Brook can introduce the potential of this sensitive ecosystem to city residents, thus helping the city gain a public space while simultaneously preserving it. This solution set was conceived as an open-ended design matrix, that doesn't propose a top-down design solution but rather provides end-users and local institutions with an adaptive yet exhaustive design vocabulary.

After receiving feedback about phasing these possible solutions, the preceding proposal aimed to prioritize actions, providing LAND studio with a more detailed design strategy to initiate seed-funding for their possible implementation. The two phases of the design proposal, Possibilities and Prioritization (Figures 8 and 10), offered both Retrofitting Landscapes and LAND studio with two realms of usage that can be used for advocating for funding, stewardship and custodianship of this section of the Doan Brook. Evolving from a set of basic designs, the proposal culminated in a set of implementation strategies that can help stakeholders to create maximum impact with the micro projects proposed.

The site characteristics that informed the first phase of the design interventions are as follows:

Relationship to Surrounding Neighborhood:
The site is relatively enclosed and difficult to access compared to most natural outdoor areas in the city of Cleveland, limiting physical means of access for pedestrians, public transport users, and vehicular traffic around it (Figures 5 and 7). This limits the possible social use of the space as a recreational area, and contributes to its lack of visibility as a natural urban amenity.

Use:
Owing to poor visibility in the region, the site suffers from lack of knowledge amongst neighborhoods about its existence. The steep terrain surrounding this section of the Brook (Figure 6), as well as the wild vegetation, create further difficulties in creating access to the site. Surface runoff from the regions also finds its way into the Brook within this area. Consequently, these conditions do not favor any particular use of the site.

Property Ownership:
Since the site falls partially under the jurisdiction of the City of Cleveland and the suburbs of Shaker Heights, difficulties in coordinating the operation, maintenance and funding affects the health of the Brook. There are multiple agencies involved as stakeholders - Cleveland Metroparks, City of Cleveland, City of Shaker Heights, the NEORSD, etc. - which elongates decision-making and budget allocations.

Physical Properties of the Site:
The section of the Brook is primarily impacted surface runoff from parking lots, garages and streets abutting the site (Figure 4). This urban runoff pollution, combined with limited physical and visual accessibility, are challenges that design solution set addressed.

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This solution set covered a range of micro design projects under the theme of creating physical and visual access that looked at increasing infiltration and natural water treatment capacity of the region through bioswales and micro-reforestation. Additionally, transit connectors like bus stops and bike/bus shelters were proposed at intervals to make it more accessible without depending on vehicular use, a trait to encourage more local usage. Local institutions like schools and senior-care spaces along the Brook defined the locations of lookouts, decks and ramps - more physical access to the stream as well as at-grade access points. The terrain, ranging from flat and accessible to very steep, defined the decisions for this solution set.

This map has all these layers superimposed on the region map, to facilitate for easier communication of the inter-relationships that these factors offer in defining the solutions. Simultaneously, they visually locate which locations can become strategic in improving conditions along the site, thus helping communicate these relationships to funding agencies, community members and stakeholders.

Figure 8. Doan Brook Possibilities.

Figure 9. Catalog of Micro Interventions.
These prioritization strategies were aimed at parceling the actions needed for implementation as funding arrives and were intentionally chosen to offer a range of pilot project opportunities. This prioritization was also informed by the ongoing Green Ambassador project by the NEORSD at the junction of Fairhill Road and Martin Luther King Jr. Drive for its efforts in holding surface runoff and filtration before being released into the Brook.

**MLK Jr Drive Open Space:** Requires creation of a bus route and bus shelters that function as points to pause along the Brook. Further funding will help create parklets around the area, to reinforce the connection between public transit, access and public amenity.

**Roxboro School Access Point:** Requires creating a ramp-access to the water level for school students to understand the ecology of the Brook and its construction will be mitigated by creating rain gardens and bioswales along the ramp, to highlight the interrelationships between ‘constructed’ and ‘natural’ environments.

**North Park Boulevard & Fairhill Road Cross Connections:** Required light-span decks and bridges for bike trails and physical access that span both banks of the Brook, aiming to tie the two neighborhoods of Shaker Heights and Buckeye-Shaker together.

**Fairhill Road Senior Care:** Requires slowing traffic speeds along Fairhill Road to connect elder-care institutions and residences with the green space of the Brook, thus allowing use of amenity with immediate access. Further proposals aim at domesticating the space - to add walking paths and decks to encourage more usage.

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Figure 10. Doan Brook Prioritization.
The first component of Retrofitting Landscapes created a catalog of interventions along the Doan Brook to increase its access and visibility, improve the water quality, and guide the implementation of future projects. These designs acknowledged the existing physical and jurisdictional barriers to maximizing the enjoyment of the Brook for all neighboring communities. While the concepts of the designs were developed and planned as a team, the final deliverables required proficient architectural skills. Retrofitting Landscapes decided that adding an additional component to the final Dow project would be beneficial to maximize the collaborative potential of all team members. The team chose to build on the issues addressed in the first component of the project by applying for an Environmental Protection Agency Urban Waters Small Grant.

The grant program requests projects that advance the goals of the EPA’s 2014-2018 Current Strategic Plan: water quality and environmental justice [11]. Specifically, proposed projects were required to address urban storm pollution by intentionally engaging underserved communities, and providing additional community benefits. Two project types were offered:

- Community Greening and Green Infrastructure
  Communities and Watersheds

Retrofitting Landscapes chose to continue their work in the Doan Brook Watershed as a “Community Greening and Green Infrastructur[e]” proposal type, specifically in the underserved Buckeye-Shaker neighborhood of Cleveland [12]. The team saw the grant program’s “structure” proposal type, specifically in the underserved Buckeye-Shaker Doan Brook Watershed as a “Community Greening and Green Infrastructure” option (at the scale of over-arching, neighborhood, city, or region) green infrastructure projects. Green infrastructure projects cost less per unit area than gray infrastructure projects, vary across scales, and involve resident efforts and active stewardship [13]. Compared to gray infrastructure, green infrastructure is less economical—bureaucratic, requiring permits, costs, and utility charges [14]. By elucidating this, Green-In Cleveland will emphasize the combined benefits of projects that could be developed and implemented within the community. The workshops will also empower residents through “action-focused” education. Household actions—rain gardens, tree plantings, or roof water capture—are more cost-effective, immediate, and visible. These “disadvantaged” communities, Green-In Cleveland will provide informal educational opportunities for the community to be aware of the potential future green infrastructure projects relating to the Brook. Green-In Cleveland addresses multiple goals, and seeks to provide multidimensional benefits.

Economic Benefits: By providing an event-based platform shaped by residents, Green-In Cleveland will emphasize the Buckeye-Shaker neighborhood the benefits of both micro (at the scale of individual households) and macro (at the scale of parcels, neighborhood, city, or regional green infrastructure projects. Green infrastructure projects cost less per unit area than gray infrastructure projects, vary across scales, and involve resident efforts and active stewardship [13]. Green-In Cleveland will emphasize to the Buckeye-Shaker these “disadvantaged” communities, Green-In Cleveland will provide informal educational opportunities for the community to be aware of the potential future green infrastructure projects relating to the Brook. Green-In Cleveland addresses multiple goals, and seeks to provide multidimensional benefits.

Social Benefits: Green-In Cleveland seeks to facilitate interaction amongst disparate groups in the Buckeye-Shaker neighborhood. Inter- actions will lead to a broader discussion about the role of residents in the health of the Brook, as well as how the Brook is a positive natural amenity for the community. The event series will create opportunities for multiple voices within the community—from events at the local library, to children, to events in other community locations (Figure 1). The project will also make the community aware of the multifunctional benefits of the activation of spaces through green infrastructure. Green spaces are supportive of both mental and physical health, and green infrastructure is often implemented as a way to provide both public health and environmental benefits [13].

The project’s objective is to increase awareness and knowl- ledge of the interaction between the Buckeye-Shaker neighborhood and the bordering Brook, promoting environmental and cultural stewardship. The EPA Strategic Plan aims to “promote sustainable man- agement of municipal wastewater and stormwater infrastructure” by elucidating this, Green-In Cleveland will provide informal educational opportunities for the community to be aware of the potential future green infrastructure projects relating to the Brook. Green-In Cleveland addresses multiple goals, and seeks to provide multidimensional benefits.

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Week 1: Saturday, at North Union Market
    Friday at Life Skills Union Farmers Market

Week 2: Friday at Harvey Rice Elementary
    Sunday at Reading Middle School

Week 3: Saturday, at North Union Farmers Market

Week 4: Friday at the Skills Center of Northeast Ohio

Week 5: Saturday at Cleveland Public Library Rice Branch
    Sunday tour of NEORSD Green Infrastructure Brook Conservation Area

Week 6: Friday at Cleveland Public Library Rice Branch
    Sunday tour of HDS Green Ambassador Farm/NEORSD project

Figure 12. Green-In Cleveland Proposed event series.

These informational sessions will take place weekly over the six-week period, alternating between Friday and Sunday to offer multiple attendance options. The content will begin with an overview of the hydrologic cycle and watershed characteristics. The topics of the events will later cover urban stormwater pollutants, as well as household and other green infrastructure solutions. The first two weeks will establish the basics of the hydrologic cycle, and the last two weeks will focus on green infrastructure, in addition to tips on how to use these tools is central to the program.

The neighborhood was home to a large Hungarian population, giving the neighborhood the name “Little Hungary.” The neighborhood has since experienced the neighborhood was home to a large Hungarian population, giving the neighborhood the name “Little Hungary.” The neighborhood has since experienced
Environmental Benefits: Green-In Cleveland’s educational activities will encourage community members to deliberately make micro-level changes to reduce urban runoff pollutants. This type of education can also inspire community members to participate more actively in macro-level lobbying or implementation efforts for green-infrastructure, which ultimately will improve the water quality of the Brook and regional waterways [16]. Both micro and macro developments will lead to lower cumulative contamination, fewer CSO events, and better water conditions for residents downstream. A cleaner Brook allows for a cleaner Lake Erie and better quality of life for Buckeye-Shaker.

The proposed project is a six-week series of events in the Buckeye-Shaker neighborhood. The primary components—Green Memories, Design-A-Sign workshops, and Educational Events—will engage the community in learning about urban water quality issues and green infrastructure solutions. By using community facilities and joining local, ongoing programs, Green-In Cleveland seeks to leverage existing Buckeye-Shaker relationships to highlight the benefits that green-infrastructure projects can bring to the area. The Green Memories events will allow members of the community to interactively share their perspectives of their natural surroundings and document the community’s existing knowledge of its nearby resources. Design-A-Sign workshops will allow community members to explore the role signage plays in promoting access to an amenity. The Educational Events will provide substantive, user-friendly information to promote increased awareness of green infrastructure and stormwater management best practices. The project’s primary objective is to increase awareness and knowledge of the interaction between the Buckeye-Shaker neighborhood and the bordering Brook, promoting environmental and cultural stewardship.

PROJECT PROCESS

- INTERDISCIPLINARY LEARNING
- EDUCATIONAL SITE VISITS
INTERDISCIPLINARY LEARNING

Practical Challenges:

There were a number of practical challenges that arose as a result of working on an interdisciplinary group. These were generally less about the project’s content and more about logistical issues. Participants noted that effective collaboration was often a challenge, particularly among students with different daily schedules, and there was often no overlapping time that allowed for collaboration. As the project progressed, it became clear that location, schedule, and availability could cause unnecessary delays and affect interdisciplinary learning and collaboration in any setting. Therefore, it was important to ensure that everyone’s location, schedule, and availability were consistent. However, the project’s success was also challenged by the need to bring the project down to a level that would be accessible to a wide audience. There may be valuable skills that are not realistic. There was limited time for one team member to show the interaction and insights in discussion, and will nevertheless be very valuable.

Valuing Team Expertise:

Group members were enthusiastic about interdisciplinary education and collaboration, but as the project progressed, it became clear that the group members’ expectations did not match the reality. The team had high hopes and expected to learn specific practical skills from their colleagues that were not taught in their discipline. However, it was evident that group members were not able to bring the project down to a level that would be accessible to a wide audience. One member of the group was to learn more about how to actually do design. However, in reality, this was also an advantage. The law student, unfamiliar with design language and perspectives, was able to bring the project down to a level that would be accessible to a wide audience, one that was similarly not familiar with “design-speak.”

Offices of interdisciplinary groups can keep in mind that one member’s lack of familiarity, or even confusion, with a subject or term may indicate that some knowledge in their discipline that there is an issue that needs to be clarified in order to effectively reach a wide audience. At different stages of the project, different skills became useful to the group. When Retrofitting Landscapes took on the task of developing and writing the EPA Urban Waters Grant proposal, the emphasis was shifted from the group’s community involvement to planning community involvement. The team had expectations and hopes of learning specific, practical skills from their colleagues that were not taught in their degree program. For example, a secondary interest in the project for the law student was to learn more about water quality issues. However, in reality, this was also an advantage. The law student, unfamiliar with design language and perspectives, was able to bring the project down to a level that would be accessible to a wide audience, one that was similarly not familiar with “design-speak.”

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the coordination of four major New York City agencies, and projects can involve both public and private property. For example, DEP shared how transparent communication with communities can help alleviate concerns and/or confusion about projects occurring in their neighborhood. Most importantly, the DEP emphasized how disconnected the city was from their waterways, a salient issue that the Green In Cleve-
land proposal seeks to address.

The Newtown Creek Alliance meeting involved a walking tour of the nature trail surrounding the Newtown Creek Wastewater Treat-
ment Plant. The Alliance emphasized the role that access to a polluted waterway can play in increasing public engagement, reinforcing the role of the Dow project’s proposed design interventions along the Doan Brook. The team also discussed with the Alliance the role that the media can play in glorifying polluted urban waterways. Instead of focusing on the more negative aspects of the waterways, the Alliance showed how important it was to foster a future vision of a waterway for a community. Involving the public in this vision is crucial to not just changing perspectives, but also to implementing successful projects to address water quality.

The meetings with the Gowanus Canal Conservancy, New-
town Creek Alliance, and NYC Department of Environmental Protec-
tion’s Office of Green Infrastructure assured Retrofitting Landscapes of the importance of the dual-part Dow project; that bringing to light the issues of urban waterway pollution, and including communities in the conversation, can provide community benefits and potentially improve water quality.

FIGURE SOURCES

Figure 1: Flickr, Photo Credit: “jd”
Figure 2: Retrofitting Landscapes
Figure 3: Flickr, Cleveland State University Center for Public History and Digital Humanities
Figure 4: Photo Credit: Dana Wall
Figure 5: Photo Credit: Dana Wall
Figure 6: Photo Credit: Dana Wall
Figure 7: Photo Credit: Dana Wall
Figure 8: Retrofitting Landscapes
Figure 9: Retrofitting Landscapes
Figure 10: Retrofitting Landscapes
Figure 11: Flickr, Photo Credit: “Micha7l”
Figure 12: Retrofitting Landscapes
Figure 13: Cleveland Public Library
Figure 14: LAND studio, Photo Credit: Ryan DWta
Figure 15: Photo Credit: Dana Wall
Figure 16: Photo Credit: Madeline Bock


REFERENCES

GLOSSARY OF TERMS

 Combined Sewer Overflow (CSO): Any discharge from the District’s CSS at a CSO Outfall designated in the District’s NPDES CSO Permit.

 Combined Sewer System (CSS): The portion of the District’s collection system designed to convey only municipal sewage (domestic, commercial, and industrial wastewater) and stormwater to any of the District’s three Waste Water Treatment Plants (WWTPs) or to a CSO.

 Consent Decree: United States and State of Ohio versus Northeast Ohio Regional Sewer District filed on July 7, 2011, all appendices, exhibits, and all plans, schedules, reports, memos, or other submissions approved by USEPA and/or Ohio EPA, as applicable, pursuant to the requirements of the Decree or any appendix.

 Green Infrastructure (GI) Control Measures: The range of stormwater control measures that use plant/soil systems, permeable pavement, or stormwater harvest and reuse, to store, infiltrate, or evapotranspirate stormwater runoff and will result in an additional 44-MG reduction of CSO volume systemwide. Composed of site-specific GI control measures that capture stormwater runoff, to store, infiltrate, or evaporate transpire stormwater and reduce flows to the CSS. GI control measures may include, but are not limited to, bioswales and detention wetland areas as well as green roofs and cisterns.

 GI Project: Composed of stormwater control measures that capture stormwater runoff and will result in an additional 44-MG reduction of CSO volume systemwide.

 Offloading to the Environment: The discharge of stormwater to soil for infiltration or surface water after being appropriately treated through the stormwater control measure, where possible.

 The Clean Water Act (CWA): The Clean Water Act issues permits through its National Pollutant Discharge Elimination System (NPDES) that limit the pollutants that various municipal or industrial entities can discharge from specific locations into water bodies covered by the Clean Water Act [2]. A violation of a Clean Water Act’s NPDES permit occurs during CSO events, because the sewage and other pollution is released into the water body instead of being correctly treated through the sewer [2]. If the amount of pollution released is higher than the allowance in the NPDES permit, it counts as a violation.


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