

RETROFITTING LANDSCAPES

DOW MASTERS SUSTAINABILITY FELLOWSHIP | 2015

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TABLE OF CONTENTS

TEAM PROFILE	1
DOW FELLOWSHIP	2
PROJECT COMPONENTS	5
PROJECT PROCESS	17
FIGURE SOURCES	20
REFERENCES	21
GLOSSARY OF TERMS	22

EXECUTIVE SUMMARY

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 (NEORS) and multiple government agencies, the City of Cleveland and the NEORS 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 NEORS 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.

Figure 1. Doan Brook - Ours to Protect.

MADELINE BUCK

Madeline Buck is a student at the University of Michigan Law School, and is pursuing a career in environmental law, with a focus in water law. Her interest in sustainability stems from her time as a Fulbright Scholar in Norway, where she studied sustainability initiatives in the textile industry. Last summer, she worked at the Natural Resources Defense Council in Santa Monica, CA where she looked into the law surrounding California's water rates and the challenges to creating conservation pricing.



DANA WALL

Dana Wall is a Master of Urban Planning and Master of Science in Environmental Planning dual-degree student at the University of Michigan. She is primarily interested in public and open space planning and design, as well as sustainable landscape design. For the last two summers, she has worked in New York City for the Parks Department and the Design Trust for Public Space. As she is passionate about both urban and natural environments, Dana seeks a career that integrates the two to enhance urban living.



GAURAV SARDANA

Gaurav Sardana is a Master of Architecture student at Taubman College of Architecture and Urban Planning. He studied architecture at NMIMS University in Mumbai, India, and worked on urban farming kits for semi-formal settlements in Mumbai as part of the AIGA Design Ignites Change Student Fellowship. His current research interests at the University of Michigan stem from hybrid design solutions – closed loop systems design and poly-functional infrastructure.



DOW MASTERS FELLOWSHIP

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 year-long initiative in the Doan Brook Watershed in Cleveland, Ohio. Throughout the project duration, the team sought the expertise of faculty advisors and partners María Arquero de Alarcón and Jen Maignet, both Assistant Professors at the Taubman College of Architecture and Urban Planning, and the experience of the Cleveland-based non-profit organization, LAND studio. The final project is comprised of two components that explore the relationships between design advocacy initiatives, urban water quality issues, and environmental justice.

Retrofitting Landscapes began as an exploration to build upon existing initiatives to reduce urban waterway pollution in the Cleveland area. To adopt a site-based approach, the project team initiated a partnership with LAND studio, an organization with an established interest in improving both the Doan Brook's adjacent public spaces and water quality. LAND studio is a non-profit design and place-making 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 sustainable design excellence and collaborative planning.

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 NEORSR 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 NEORSR and The Cleveland Foundation in designing and planning for increased green infrastructure. In 2013, 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 NEORSR has begun construction on a project adjacent to the Doan Brook, one of the sites categorized in Olin'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 proposed project, *Green-In Cleveland*, focused on community education and engagement in issues of urban water quality, and on the benefits of green infrastructure.

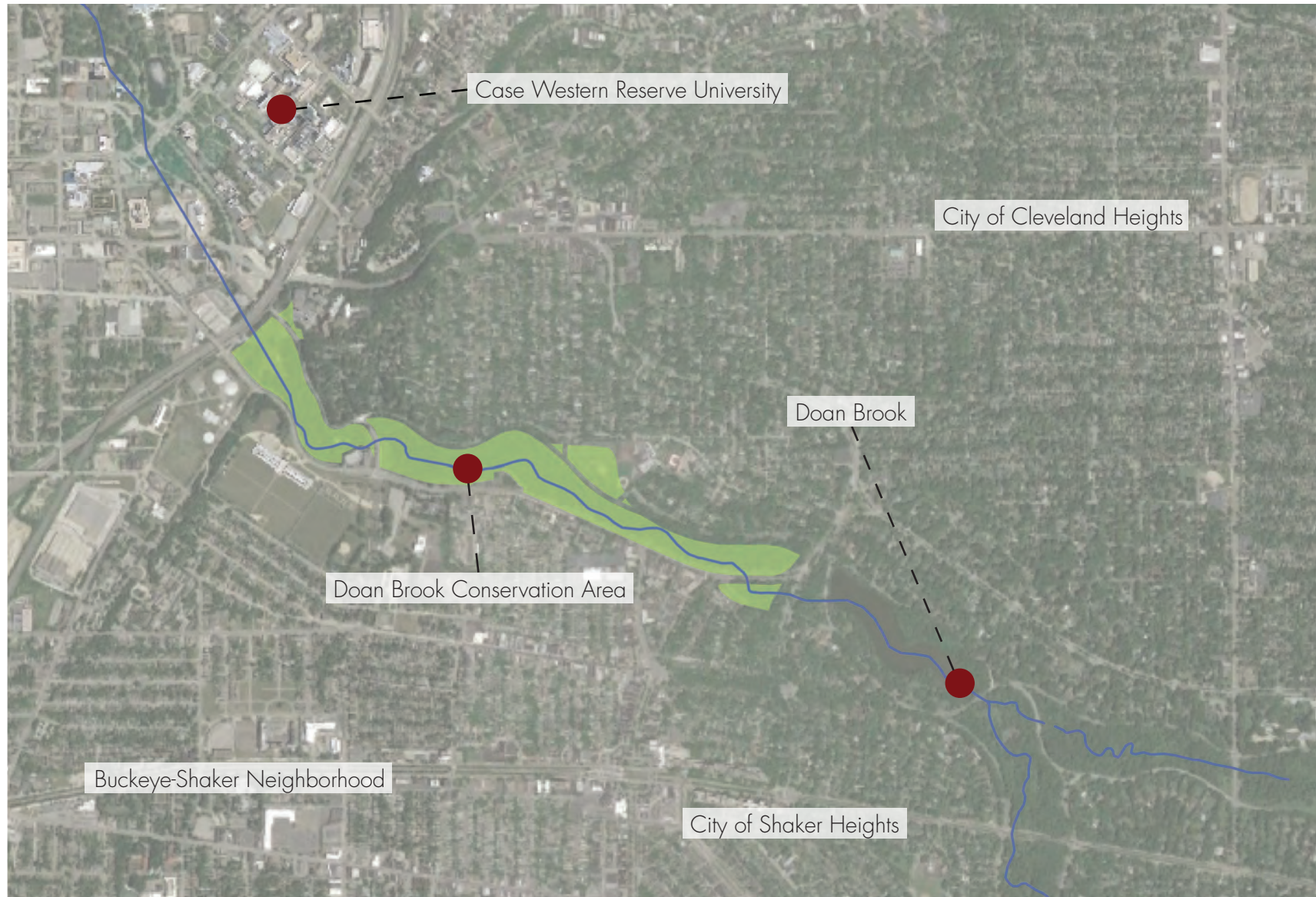


Figure 2. Project site map.

PROJECT COMPONENTS

- CONTEXT
- DESIGN INTERVENTIONS
- GREEN-IN CLEVELAND

CONTEXT

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, performance 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, *Project Clean Lake*, aimed to capture 97% of the total volume of wet weather flow in the form of surface runoff and wastewater. Due to the frequency of CSO events that affect Lake Erie and the State of Ohio’s designation of Lake Erie as a “sensitive receiving water,” 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 infrastructure 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 water bodies” [8]. From these storage tunnels, the combined sewage would be slowly pumped to wastewater treatment plants at manageable rates of handling, thus avoiding the risk of untreated water flowing directly into Lake Erie. Additionally, new interceptor sewers and relief sewers would also provide sewer system flood relief.

As an alternative to purely focusing on updating gray infrastructure through 70 miles of underground storage tunnels and sewers, the amended proposal envisioned a more cost-effective combination of updated gray infrastructure and the use of green infrastructure to achieve the capture of an additional 63 million gallons of stormwater. Thus, a hybrid system of capturing, treating and releasing water into waterbodies such as the Doan Brook (and eventually into Lake Erie) was approved in the amended Consent Decree.

Cleveland, Ohio

The Doan Brook is at the cross-roads 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 runoffs and overflows.

Additionally, owing to the degrading economic conditions within Rust Belt cities like Cleveland, foreclosures and reduced investments in civic infrastructure have furthered the impact urban water pollution has on the Doan Brook.

Green Infrastructure

Green infrastructure is defined in the Consent Decree as “stormwater control measures that use plant/soil systems, permeable pavement, or stormwater harvest and reuse, to store, infiltrate, or evapotranspire stormwater and reduce flows to the combined sewer system. These include . . . bioretention and extended detention wetland areas as well as green roofs and cisterns.” The amended Consent Decree aimed to reduce stormwater runoff before it could enter the combined system by including landscape-based environmental systems of green infrastructure that encourage surface infiltration and cleansing [7]. In addition to the water filtration and stormwater retention benefits sought by the Consent Decree, green infrastructure has multiple direct and co-benefits:

Direct Benefits:

Green infrastructure solutions are designed to fulfill specific needs, from reducing runoff to water purification. 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 projects provide water purification, habitat improvements, flood and erosion control as well as carbon sequestration - thus performing both ecological and ecosystemic services. In the

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 area 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 located 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 providing recreational opportunities [10]. Environmental justice communities include low income or minority communities who have suffered a disproportionate burden from air, water or land pollution. Through better performing ecosystems in the form of green infrastructure projects, pollution 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 mono-functional piece of infrastructure. On the other hand, green infrastructure provides habitat for wildlife, restores native flora and fauna lost to urbanization and industrialization.

Taking cues from the *Green over Gray* project commissioned by LAND studio, *Retrofitting Landscapes* reinforces “leveraging a necessary infrastructural investment to provide multiple benefits.” This functional multiplicity will both address environmental problems and provides public amenities for neighborhoods.



Figure 3. Doan Brook pollution marker, India Cultural Gardens, Cleveland, Ohio.

Green Infrastructure SWOT Analysis	
Strengths	- Provides nature’s inherent resource-efficiency and polyfunctionality (water purification, soil compaction, flood protection) - Low initial (construction) expenses and low operating expenses (only periodic monitoring and feedback)
Weakness	- As compared to gray infrastructure, often requires a large physical footprint due to low energy density - Requires time for site evaluation for water flow, soil types, native vegetation and performance maturation
Opportunities	- Offers low-cost risk mitigation opportunities through natural soil erosion containment and embedded water purification - Offers possibilities for non-technical monitoring, operations and management by local stakeholders
Threats	- Required careful initial location-specific site analysis to withstand seasonal weather changes and extreme weather conditions - Lack of recognized ecosystem-related industry design standards and valuation of cost-savings

DESIGN INTERVENTIONS

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 (eg. 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 suburb 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.



Figure 4. Fairhill Road, south side of Doan Brook at Coventry Road.



Figure 5. Existing paved path, south side of Doan Brook along Fairhill



Figure 6. Steep descent down to Doan Brook.



Figure 7. Existing trail in Conservation Area, bordered by thick vegetation on Brook side.

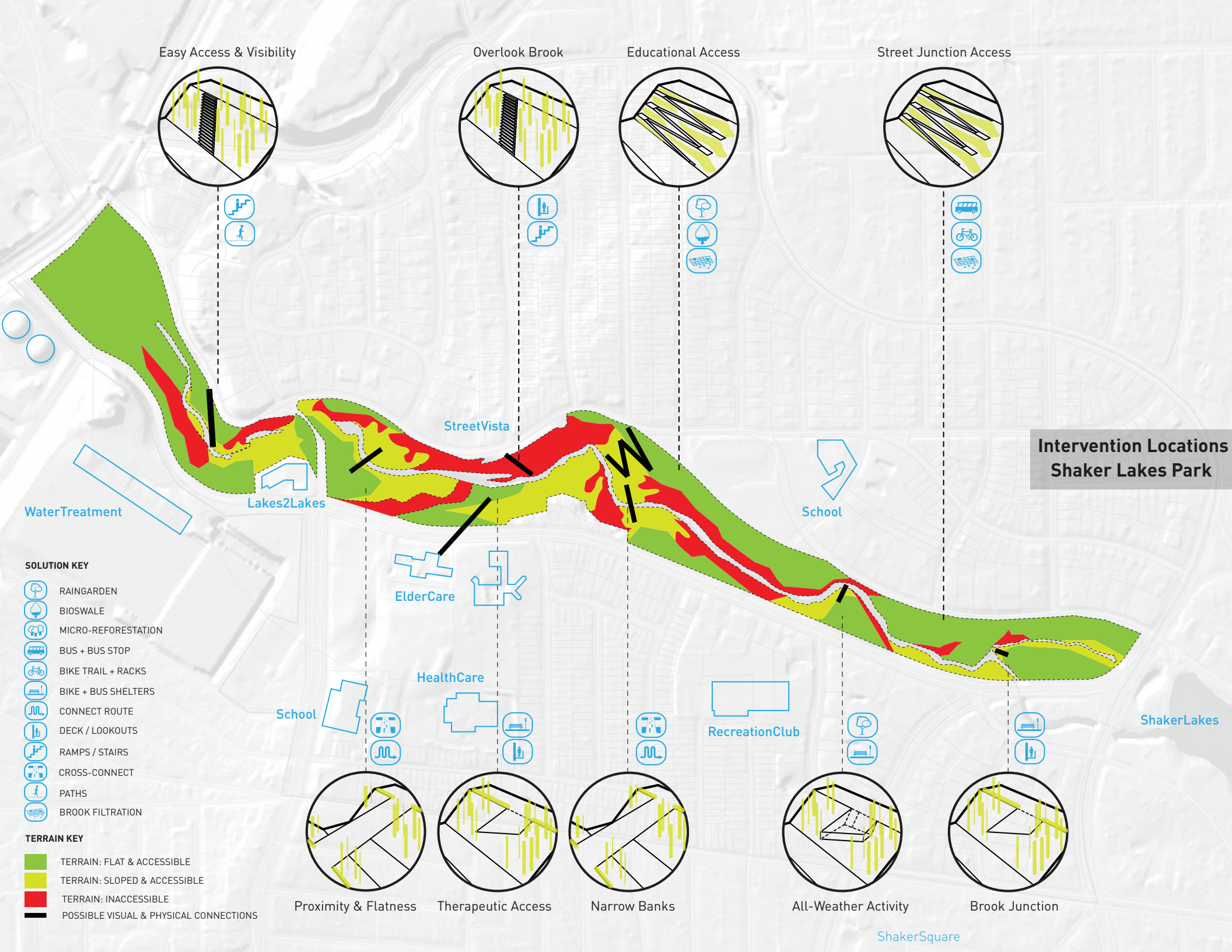
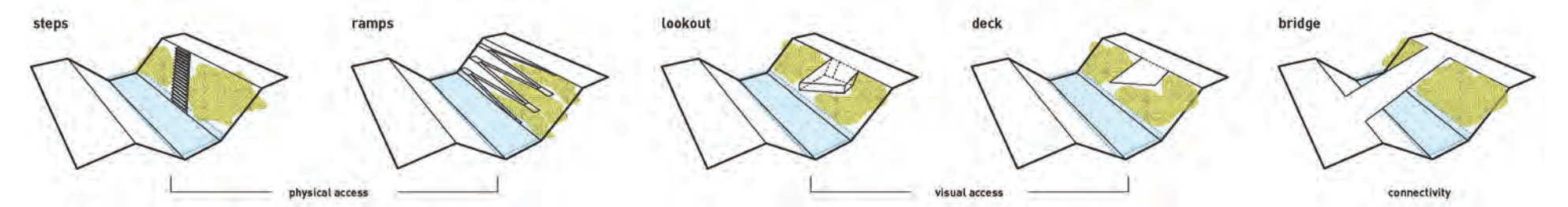


Figure 8. Doan Brook Possibilities.

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-forestation. Additionally, transit connections 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 9. Catalog of Micro Interventions.



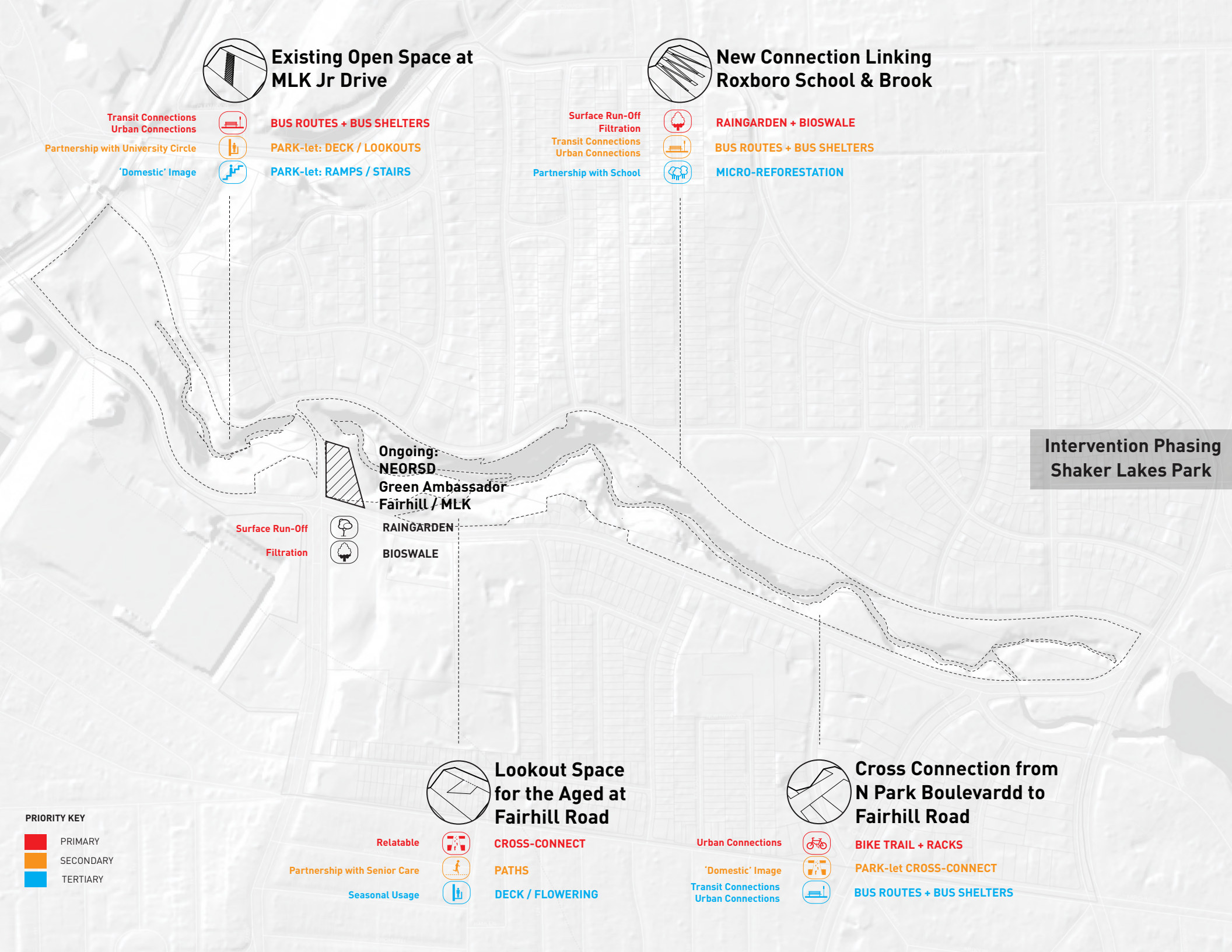


Figure 10. Doan Brook Prioritization.

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 NEORS 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 an amenity with immediate access. Further proposals aim at domesticating the space - to add walking paths and decks to encourage more usage.

URBAN WATERS SMALL GRANT PROPOSAL: Green-In Cleveland

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 discussed 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 runoff pollution by intentionally engaging underserved communities, and providing additional community benefits. Two project types were offered:

- Community Greening and Green Infrastructure
- Communities and Water Quality Data

Retrofitting Landscapes chose to continue their work in the Doan Brook Watershed as a “Community Greening and Green Infrastructure” proposal type, specifically in the underserved Buckeye-Shaker neighborhood of Cleveland [12]. The team saw the grant program’s emphasis on community involvement in the implementation of green infrastructure projects and decision making as a natural progression from the first component of the Dow project.

Located on the East Side of Cleveland, the Buckeye-Shaker neighborhood has a rich cultural history. Before the mid-20th century, the neighborhood was home to a large Hungarian population, giving it the name “Little Hungary.” The neighborhood has since experienced

a demographic shift, and is now predominantly African American. Regardless of recent vacancy and abandonment, Buckeye-Shaker is a vibrant community. It is home to the annual Soul of Buckeye festival and The Garlic Festival held in the neighborhood’s Shaker Square, a historic shopping district and light rail hub (Figure 10).



Figure 11. Shaker Square, Cleveland, Ohio.

The project’s objective is to increase awareness and knowledge of the interaction between the Buckeye-Shaker neighborhood and the bordering Brook, promoting environmental and cultural stewardship. The EPA Strategic Plan aims to “promot[e] sustainable management of municipal wastewater and stormwater infrastructure” by working with “local partners to bring appropriate and effective solutions to . . . disadvantaged communities” [11]. Operating in one of

these “disadvantaged” communities, *Green-In Cleveland* will provide informal educational opportunities for the community to be aware the potentials of future green infrastructure projects relating to the Brook. *Green-In Cleveland* addresses multiple goals, and seeks to provide multi-dimensional benefits:

Economic Benefits: By providing an event-based platform shaped by residents, *Green-In Cleveland* will emphasize to the Buckeye-Shaker neighborhood the benefits of both micro (at the scale of individual houses) and macro (at the scale of multiple parcels, neighborhood, city, or region) green infrastructure projects. Green infrastructure projects cost less per unit area than gray infrastructure projects, vary across scales, and can involve resident efforts and active stewardship [13]. Compared to gray infrastructure, green infrastructure is less economically burdensome, involving fewer taxes, costs, and utility charges [14]. By elucidating this, *Green-In Cleveland* will emphasize the cost-benefit tradeoffs 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 approaches for residents to contribute low-impact environmental solutions that also foster a culture of stewardship.

Social Benefits: *Green-In Cleveland* seeks to facilitate interaction amongst disparate groups in the Buckeye-Shaker neighborhood. Interactions 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 catered to children, to events in other community locations (Figure 11). The project will also make the community aware of the multi-functional 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 [15].

	Green Memories	Design-A-Sign	Educational Events
Week 1	Saturday, at North Union Farmers Market		Friday nature walk at Doan Brook Conservation Area
Week 2		Friday at Harvey Rice Elementary School	Sunday at Roxboro Middle School
Week 3	Saturday, at North Union Farmers Market		Friday at The Nia Coffeehouse
Week 4		Friday at Life Skills Center of Northeast Ohio	Sunday rain barrel demonstration at Art and Soul of Buckeye Park
Week 5	Saturday, at Cleveland Public Library Rice Branch		Friday at Doan Brook Conservation Area
Week 6		Friday at Cleveland Public Library Rice Branch	Sunday tour of NEORSD Green Ambassador Fairhill/MLK 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 over-arching topics: 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 water cycle, and the last two weeks will focus on green infrastructure, as education on these tools is central to the program.

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.



Figure 13. Cleveland Public Library Rice Branch.



Figure 14. Art and Soul of Buckeye Park.

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 not elements that were crucial to the final product or project, but logistically hampered its implementation. For example, since the group necessarily consisted of students from various disciplines and departments of the University, finding a common location for project discussions was a significant barrier in collaboration. Different schools have different daily schedules, and there was often no overlapping time between even three students. Moreover, the disparate locations of the different schools of the members of group made collaboration a challenge. Thus, one member of the group would be inconvenienced for every meeting. The difficulty of coordination different schools, schedules, and locations is not just limited to the graduate school realm, but can affect interdisciplinary learning and collaboration in any setting. Location, schedule, and availability can cause unnecessary delays and drag down the desired collaborative process. While in theory interdisciplinary collaboration is a way of accomplishing more by combining expertise, in practice the logistical challenges that often go along with interdisciplinary collaboration, particularly in an academic setting, may bog down the group's efforts and cause inefficiency not present in a group of individuals from one discipline or entity.

Learning Exchange:

Group members were enthusiastic about interdisciplinary education and collaboration, but as the project progressed, it was clear that the group members' expectations did not match the reality. The team had expectations and hopes of learning specific, practical skills from their colleagues that were not taught in their degree programs. For example, a secondary interest in the project for the law student was to learn more about how to actually do design. However, in practice, learning these practical skills directly from each other was

not realistic. There was limited time for one team member to show the others how to use design tools or explain legal arguments. Instead, the learning was more general and implicit.

Madeline began to understand the general way that designers and planners think and the goals and ideals of the professions, which differ from the legal perspective. Furthermore, she gained a better sense of the career and project-based challenges in the urban planning and design fields. Gaurav benefitted from seeing beyond the design element of a project. He gained a better understanding of the full picture of a design project: how his role in design would play into the planning concepts he learned, and how the project on the Doan Brook hinged on a legal document, a Consent Decree. For Dana, witnessing the communication of ideas through design was enlightening, and contributed to her developing design practice. In sum, in interdisciplinary projects, it is unlikely that group members will deliberately teach one another practical skills. Instead each member's practical skills implemented individually will allow the group to accomplish its goals more efficiently. The learning that comes from this process will come from the interaction and insights in discussion, and will nevertheless be very valuable.

Valuing Team Expertise:

The interdisciplinary composition of the *Retrofitting Landscapes* also challenged members to determine how their expertise would be most valuable to the project. The team was heavily focused on design and planning perspectives, since the majority of the group represented those disciplines. From the start, Gaurav was able to build on his experience with the Doan Brook to create a design implementation plan. During the design-heavy elements of the project, however, the imbalance of expertise in the bulk of the project work made the law student's lack of experience in design and planning principles seem less useful to the group. 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 wider audience, one that was similarly not familiar with "design-speak." Other interdisciplinary groups can keep in mind that one member's lack of familiarity, or even confusion, with a subject or term may indicate to those well-versed 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 less on design and more on planning community involvement, both realms that allowed Dana and Madeline in particular to build on the skills taught by their disciplines. Madeline was able to contribute her attention to detail and ability to write concisely, and Dana used her community engagement and participatory design education as a planner to create a robust and creative project proposal. Though focusing on their specialties, both were able to do a little bit of each kind of work, which allowed them to learn from one another. For other interdisciplinary groups, it may be helpful to keep in mind that each group member's value may ebb and flow depending on the task at hand, but all perspectives and skillsets will contribute value to the final product. The work of *Retrofitting Landscapes* also showed that, in interdisciplinary groups, each individual's contribution will not necessarily be a substantive element of their discipline. Depending on the project, substantive knowledge and perspective can be very useful. However, for *Retrofitting Landscapes*, it was more common that group members brought skills gained from the way their discipline was taught, as opposed to substantive elements. Madeline brought editing and writing skills honed in law school, Dana brought planning concepts and design skills, and Gaurav brought the ability to propose large, site-specific architectural designs. For some subjects, it may be a challenge for the actual substance of the project to represent each discipline, but the success of an interdisciplinary project can derive from its union of various discipline-based skillsets.

SITE VISITS

Retrofitting Landscapes traveled to New York City to meet with two organizations and a government agency about the Gowanus Canal and Newtown Creek, as well as citywide green infrastructure efforts. The team learned a breadth of information that reinforced the importance of both Dow project components. The Gowanus Canal Conservancy, New York City Department of Environmental Protection, and Newtown Creek Alliance generously gave their time to share their projects, as well as the challenges and opportunities of community engagement in addressing urban waterway pollution and green infrastructure implementation.

Although New York City and Cleveland are different types of urban environments with distinct and unique challenges, the Dow team found similarities in general access and water quality issues, as well as the importance of public education. Both the Gowanus Canal and Newtown Creek are channelized waterways, while the section of the Doan Brook that borders the Buckeye-Shaker neighborhood is not. However, the physical constraints that cause access issues from channelized waterways echo the physical challenges of interacting with the Doan Brook.

Conversations with members of these organizations greatly informed both components of the Dow project. The Gowanus Canal Conservancy meeting taught the team the important role design literacy can play in a community. The Conservancy explained how informing community members of the types of green infrastructure designs, as well as their functions, can increase public engagement in the project implementation process. It also emphasized the importance of place-based education programs and shared details about the organization's STEM Ecology Curriculum.

Because a large aspect of the challenges in the Doan Brook Watershed involve the lack of coordination amongst local government entities, the conversation with the NYC Department of Environmental Protection's Office of Green Infrastructure reinforced the importance of adequate collaboration amongst various stakeholders in the implementation of green infrastructure. The city's green infrastructure goals require

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 Cleveland* proposal seeks to address.

The Newtown Creek Alliance meeting involved a walking tour of the nature trail surrounding the Newtown Creek Wastewater Treatment 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 shared 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, Newtown Creek Alliance, and NYC Department of Environmental Protection'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 15. Newtown Creek facing Manhattan.



Figure 16. Gowanus Canal facing Downtown Brooklyn.

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: "Michael"

Figure 12: *Retrofitting Landscapes*

Figure 13: Cleveland Public Library

Figure 14: LAND studio, Photo Credit: Ryan DiVita

Figure 15: Photo Credit: Dana Wall

Figure 16: Photo Credit: Madeline Buck

REFERENCES

[1] United States Environmental Protection Agency. *Great Lakes Facts and Figures*. Available at: <http://www2.epa.gov/greatlakes/great-lakes-facts-and-figures>. Accessed: 11/8/15.

[2] Consent Decree, U.S. v. Ne. Ohio Reg'l Sewer Dist. (No. 1:10-cv-02895, N.D. Ohio Dec. 22, 2010), available at http://www.neorsd.org/_Library.php?SOURCE=library/04-Consent-Decree-as-filed.pdf&a=download_file&LIBRARY_RECORD_ID=5553.

[3] Northeast Ohio Regional Sewer District 1. *Project Clean Lake*. Available at: http://www.neorsd.org/_Library.php?a=download_file&LIBRARY_RECORD_ID=4939. Accessed 10/25/15.

[4] United States Environmental Protection Agency. *Summary of the Clean Water Act*. Available at: <http://www2.epa.gov/laws-regulations/summary-clean-water-act>. Accessed: 10/25/15.

[5] Olin. (August 2013). *Green Over Gray*. The Olin Studio. Pp. 26-27.

[6] Zoller, A. (2013). Introduction. In OLIN & Land studio, *Green Over Gray*. Pg. 4.

[7] NEORSD. (2012), Introduction & Background. In *Project Clean Lake Green Infrastructure Plan*. Pg 1.

[8] OLIN & LAND studio. (2013), The EPA Mandate & Project Clean Lake. In *Green Over Gray*. Pg. 14.

[9] NEORSD. (2012), Green Infrastructure Project Development, Evaluation & Prioritization. In *Project Clean Lake Green Infrastructure Plan*. Pp. 3-13.

[10] NEORSD. (2012), Green Infrastructure Project Development, Evaluation & Prioritization + Analyzing the Co-benefits of Green Infrastructure Projects & Control Measures. In *Project Clean Lake Green Infrastructure Plan*. Pp. 3-13, 5-8.

[11] U.S. Env'tl Prot. Agency. *FY 2014-2018 EPA Strategic Plan*. Wash., D.C.: GPO, 10 April 2014.

[12] Cleveland City Planning. (2014). *Buckeye-Shaker Square 2014 Neighborhood Fact Sheets*. Available at: <http://planning.city.cleveland.oh.us/2010census/downloads/Buckeye-ShakerSquare.pdf>. Accessed: 11/11/2015.

[13] Cohen, J.P., Field, R., Tafuri, A.N., & Ports, M.A. (2012). Cost comparison of conventional gray combined sewer overflow control infrastructure versus a green/gray combination. *Journal of Irrigation and Drainage Engineering*, 138(6). 534-540.

[14] Merk, O., Saussier, S., Starapoli, C., Slack, E., & Kim, J.H. (2012). *Financing green urban infrastructure*. OECD Regional Development Working Papers. Available at: http://www.oecd.org/gov/regional-policy/WP_Financing_Green_Urban_Infrastructure.pdf.

[15] Wolch, J., Byrne, J., & Newell, J.P. (2014). Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'. *Landscape and Urban Planning*, 125: 234-244.

[16] Dunn, Alexandra Dapolito, *Siting Green Infrastructure: Legal and Policy Solutions to Alleviate Urban Poverty and Promote Healthy Communities*, 37 B.C. Env'tl. Aff. L. Rev. 41, 2010, pg. 9.

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 wastewaters) 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 appendixes hereto, and all plans, schedules, reports, memoranda, or other submitals 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 evapotranspire stormwater and reduce flows to the CSS. GI control measures may include, but are not limited to, bioretention and extended detention wetland areas as well as green roofs and cisterns.

GI Project: Composed of site-specific GI 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 a stormwater control measure, where possible.

The Clean Water Act (CWA): The CWA was passed in 1972 to address water pollution in streams, rivers, and lakes throughout the United States [1]. 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 routed through the sewer [2]. If the amount of pollution released is higher than the allowance in the NPDES permit, it counts as a violation.

[1] 33 U.S.C. §1251 et seq. (1972).
[2] 33 U.S.C.A § 1342; U.S. Env'tl. Prot. Agency, Summary of the Clean Water Act, <http://www2.epa.gov/laws-regulations/summary-clean-water-act>.

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