Approaches to Neighborhood-Led Green Infrastructure in Detroit

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Table of Contents

Tables + Figures

List of Acronyms

CSO – Combined Sewer Overflow
DWSD - Detroit Water and Sewerage Department
ECN – Eastside Community Network
GLWA - Great Lakes Water Authority
GSI - Green Stormwater Infrastructure
LEAP – Lower Eastside Action Plan
MCR – Michigan Community Resources
TNC – The Nature Conservancy

Executive Summary

Like many post-industrial cities, Detroit has an outdated and overburdened combined sewer system. In a combined sewer system, heavy rains overwhelm the city's water treatment system, resulting in increased flooding and discharges of both sewage and stormwater into local rivers. In order to reduce combined sewer overflows (CSO), stormwater must enter the sewer system at a slower and steadier pace without high peaks caused by heavy rain events. In addition, Detroit has vast amounts of impervious surface, much of which is abandoned or underused, further contributing to stormwater runoff concerns.

While Detroit Water and Sewerage Department (DWSD) customers have paid stormwater drainage fees since 1975, DWSD recently implemented a new stormwater drainage fee structure based on the amount of impervious surface on each parcel. The City of Detroit has struggled to communicate the complex fee structure to property owners, which has led to increased concern about how fees are calculated and how increases in fees may affect property owners. Residential properties owners are eligible to receive credits toward drainage fees if they implement specific stormwater management projects.The stormwater interventions associated with the credit system are designed to be paid for and implemented by individual property owners, which may be feasible for some but may prove difficult for others.

Our project, in collaboration with Michigan Community Resources (MCR) and Eastside Community Network (ECN), explores whether a collective, place-based approach to green stormwater infrastructure (GSI) installations can result in joint stormwater credits towards fees in residential neighborhoods.

GSI is an approach to stormwater that focuses on managing water where it falls. Compared to traditional piped drainage systems (grey infrastructure), GSI is a cost-effective, flexible, and resilient method for managing stormwater in the context of a changing climate with an increased frequency of high-volume storms. GSI can help mitigate problems caused by aging grey infrastructure and system overload by removing water volume from grey systems through infiltration, retention, and detention on site, and by slowing the velocity of runoff and reducing 'peak flow.'

Through extensive meetings with key stakeholders and community organizations, our project explores the benefits and drawbacks of residential GSI governance models. To be feasible, these projects must meet DWSD's requirements for scalability and replicability but must also prove functional for residential neighborhood groups.

We explored the benefits and drawbacks to a wide variety of possible GSI governance entities including homeowners associations, neighborhood associations, block clubs, and cooperatives. Based on our study of existing shared systems and the Detroit context, we recommend a cooperative governance structure to administer shared stormwater fees and credits.

This project serves as an introductory study of collective, residential GSI models. We hope the result will motivate DWSD to incorporate jointly managed GSI projects into their stormwater fee and credit systems. We also hope this document will empower residents and members of the academic community and local government to continue with the investigation of how GSI can function throughout neighborhoods in Detroit.

I. Urban GSI Literature Review

What is GSI?

Green stormwater infrastructure (GSI) is an approach to stormwater management that prioritizes reducing and slowing stormwater flows and managing precipitation where it falls. Compared to traditional piped drainage systems (grey infrastructure), GSI is a cost-effective, flexible, and resilient method for managing stormwater in the context of a changing climate with an increased frequency of high-volume storms. In traditional grey stormwater systems, water is removed from the urban landscape as quickly as possible and deposited into local water bodies. During heavy rains, the volume and speed of water going into grey infrastructure can reach untenable levels, resulting in back ups and overflow of contaminants into homes and open water sources. GSI can help mitigate these problems by removing water volume from grey systems through infiltration, retention, and detention on site, and by slowing the velocity of runoff entering grey systems, which smooths sudden jumps in water volume and reduces 'peak flow.'

Common forms of GSI

GSI comes in many forms and can be adapted to the context of each site for maximum impact. **Raingardens** incorporate porous soils, durable plants and site grading to hold water from a drainage area for infiltration. **Bioretention** is similar to a raingarden but has the potential to hold much higher volumes of water and may use engineered soils for maximum storage volume. **Bioswales** are vegetated sloped swales that encourage water to flow slowly and infiltrate into soil before entering another retention, detention or grey system. **Constructed wetlands** can hold and treat very large quantities of water that would otherwise enter grey stormwater systems, with the added benefit of enhanced biodiversity and climate regulation. **Trees** are a form of GSI as they lower the water table, reducing localized flooding and allowing more water to infiltrate on site during heavy storms. **Green roofs** incorporate vegetation and soil on building roofs to hold water that would otherwise run off through gutters. **Cisterns** are used to collect and store water for reuse and are linked to impervious surfaces such as roofs or parking lots, which removes water volume from grey systems.

Potential benefits of GSI

GSI is useful in achieving a variety of environmental, social, and public health benefits beyond simply managing stormwater. Research in the field is continues to grow as practitioners and scientists observe impacts of GSI over time and in various environments.

Environmental Benefits

Ecosystem services

By reducing and slowing peak stormwater discharges, GSI reduces flood risks and mitigates pollution and erosion caused by stormwater runoff (McMahon and Benedict, 2000; Foster et al., 2011). GSI also has the potential to increase local water quality by absorbing and filtering stormwater where it falls (Davis, 2007; Davis et al., 2009). When GSI incorporates durable native plants, it can be a resource for native pollinators (Cane, 2001; Colding et al., 2006). Urban greening has also been shown to significantly reduce pollutant concentrations and improve air quality, both at street level and city scale (Pugh et al., 2012).

Climate resilience

Urban green space may also hold the key to climate resilience and the long-term sustainability of cities (Lovell and Taylor, 2009). Vegetation in GSI may enhance ecosystem services by reducing urban heat island effects (UHI), providing wildlife habitat, improving air quality (Baro et al., 2014; Paoletti, 2009; Pugh et al., 2012; Zhao et al., 2010), enriching soils (Escobedo et al., 2011), and creating microclimates (Bowler et al., 2010; Ng et al., 2012; Gill et al., 2007), all of which are essential to sustainable and resilient urban development and residents' wellbeing (Kaplan & Kaplan, 1989; Groenewegen et al., 2006; Gilchrist et al., 2015; Thompson et al., 2014).

For example, greening of urban parking lots has been shown to reduce surface temperature and mitigate urban heat island effects in Nagoya, Japan (Onishi et al., 2010). Lafortezza et al. (2009) showed that time spent in green spaces alleviated residents' perception of discomfort during periods of heat stress, implying that the presence of green spaces may make urban areas more habitable within the context of climate change.

Social Benefits

An alternative to grey infrastructure

Throughout the United States and the world, grey infrastructure for stormwater management is aging in place, resulting in inefficiencies, malfunctions, leaks, and often prohibitive repair costs for local governments. At the same time, the direct replacement of aging grey infrastructure is often a gamble in the face of population change (including population loss), climate change, market fluctuations, and financial uncertainty. In the US, municipal governments have seen gradual but large reductions in state and federal funding and rely much more heavily on local tax income and user fees than they did 50 years ago. Cities experiencing population loss are also seeing their tax bases reduced. GSI can play an important role in easing these financial burdens for municipalities (Vinyard et al., 2015). While GSI can be connected to grey stormwater systems, it can also operate at smaller system scales or be detached from citywide systems altogether, allowing flexibility within the context of population and land use changes. Installing green rather than grey infrastructure also reduces upfront construction costs. GSI provides non-monetary health and wellbeing benefits to residents that may translate into long term economic savings through reduced demand for social services.

Neighborhood empowerment and resilience

A multitude of social benefits are possible through urban greening. Westphal (2003) found that greening could lead to residents' empowerment if the planning and implementation process was inclusive and community-led. Krasny and Tidball (2009) write that community-led urban greening projects improve communities' skills in self-organization and adaptive learning, leading to increased resilience in the face of change. When greening projects incorporate stormwater management, neighborhoods receive the added benefits of increased climate resilience through reduced flood risks and UHI effects.

Benefits for vulnerable neighborhoods

Stressed neighborhoods particularly stand to benefit from urban greening projects and GSI in many ways. The link between health and socioeconomic status is well established (Bartley et al., 1997; Blane, 1995; Winkleby et al., 1992), and segregation by socioeconomic status and race is persistent in American cities (Denton and Massey, 1988; Iceland and Wilkes, 2006). Because of the particular structure of municipal finance in American cities, areas with a high proportion of residents of low socioeconomic status experience financial divestment, middle class flight, and become increasingly inhospitable places to live (Massey and Denton, 1993; Massey et al. 2009). Green space is often under-provisioned in stressed neighborhoods, partially due to financial constraints, which contributes to social inequity in the context of environmental justice (Jennings et al., 2016). For these reasons, greening projects are an appropriate and needed intervention for improving the lives of people living in stressed neighborhoods.

Greening projects and GSI have the potential to improve the experience of living in stressed neighborhoods in unique ways. For example, greening vacant lots was associated with reductions in gun crimes and vandalism in Philadelphia neighborhoods (Branas et al., 2011). Addressing neighborhood blight may also promote health outcomes and reduce stress (South et al., 2015). Studies by Thompson et al. (2012, 2014) showed positive effects of green space improvements on deprived communities, including increased mental wellbeing, lower self-reported stress levels, and reduced levels of stress hormones.

Transforming neighborhood “liabilities” into “assets”

Abandonment of urban areas is occurring in many cities all over the world, and this abandonment is almost never uniform across space. This results in patchy networks of underused and vacant space that if left unmanaged can contribute to social and environmental problems. Vacant land also carries a legacy of past use, even when it has returned to a ‘natural’ appearance (Nassauer and Raskin, 2014). This legacy can include soil contaminants, altered soil hydrology, and drainage patterns that unnecessarily overtax embedded grey infrastructure. When vacant land is repurposed as GSI through transdisciplinary and participatory processes that address its multi-layered role in urban socio-ecological systems, these formerly problematic spaces are transformed into neighborhood assets that may halt or slow the destructive process of abandonment (Lichten et al., 2016).

Public Health benefits

A large and growing body of scholarship links green space and greening to positive health and wellbeing outcomes. Green space has been shown to improve residents’ self-reported mental and physical health in a variety of ways (de Vries et al., 2003).

Increasing the quantity of urban greenspace has the potential to encourage or inspire residents to exercise. For example, Dyment and Bell (2007) showed that increased access to greenspace could increase physical activity among school-aged children, and Branas et al. (2011) found that residents' self-reported physical exercise increased with the greening of vacant lots in Philadelphia, PA.

Green space can also have tangible benefits for people healing from illness or injury, or for people in institutional housing. Views of green space have been linked to shorter hospital stays for patients recovering from surgery (Ulrich, 1984), and access to greenspace has been shown to have a positive effect on the self-reported health of people in long-term nursing care (Rappe, 2005). In addition, a review of seventeen studies by Whear et al. (2014) suggest a strong connection between time spent in green settings and reduced agitation for people with dementia.

The mental health benefits of greenspace and greening projects are manifold. Increased access to green spaces in urban environments has been shown to have a "protective effect" against anxiety and mood disorders (Nutsford et al., 2013), and access to green space in general is associated with fewer symptoms of depression and anxiety (Beyer et al., 2014). Dinno (2007) showed that participatory greenspace programs in particular hold value in reducing and promoting adaptive responses to depressive symptoms.

Visual and physical access to greenspace is also beneficial for people experiencing stress. In a 1991 study by Ulrich et al., participants exposed to natural environments experienced faster recovery from stress than those exposed to urban environments. Van den Berg et al. (2007) found similar results in their study comparing blood pressure in stressed and non-stressed individuals exposed to natural or urban settings. Hansmann et al. (2007) showed that stress recovery could be improved through physical activity in forests and parks. Research also indicates a preference among people with self-reported stress for safe natural settings (Grahn and Stigsdotter, 2010).

The positive effects of green space on wellbeing may be due to human's adaptive need for psychological restoration (Kaplan and Kaplan, 1989). Attention Restoration Theory (ART) holds that humans have limited cognitive resources for directed attention and require adequate restoration through indirect attention in order to carry out everyday tasks. Low reserves of directed attention, or directed attention fatigue, can result in increased stress, irritability, human error, and difficulty concentrating (Kaplan and Kaplan, 1989). Exposure to environments that do not require directed attention, such as natural environments, allows reserves of directed attention to replenish.

Related to ART is the Reasonable Person Model (RPM) (Kaplan and Kaplan, 2011). RPM holds that directed attention fatigue places limits on one's ability to engage in reasonable, or civil and socially expected behavior. Reasonable and effective responses to life's challenges require adequate reserves of directed attention. Fast-paced urban environments and modern schedules can result in widespread directed attention fatigue with few opportunities for restoration. RPM suggests that urban green space has the potential to increase reasonable behavior and improve social relations (Kaplan and Kaplan, 2011).

Criticism of GSI

While the benefits of GSI are many, criticism of means and methods is helping to expose possible shortcomings and avoid unintended negative impacts on neighborhoods. As with any community development and amenity provision there is the risk of activating gentrification and the displacement of current residents (Wolch et al., 2014). To prevent this, GSI must be planned with and for current residents, and policies must be put in place to maintain affordable and low-income housing, requiring a transdisciplinary approach to planning and implementation. GSI should also be equitably provisioned throughout the city and targeted in areas with the highest need for a variety of ecosystem services, not merely sited based on stormwater impacts alone (Meerow and Newell, 2017).

Hastily planned GSI also has the potential to perform ecosystem 'disservices.' When plant choices include fragile, toxic, or invasive plants, impacts can range from plant death and expensive replacement, to decreased soil permeability, to harm to children and pets, or to complete ecological upheaval. Some plants used in GSI may increase airborne allergens, pathogens, and pests (Pataki et al., 2011), leading to increased public health and environmental problems. When designs do not consider local perceptions, GSI may also exacerbate social problems. For example, if GSI has a 'naturalized' appearance in an urban neighborhood with expectations of neatness, it may appear uncared for by local residents and could encourage dumping, vandalism, and abandonment, leading to increased fear and even crime (Nassauer et al., 2009). For these reasons, designs must cater to local residents' needs and perceptions and plants must be carefully chosen for their durability and contribution within the local context. Maintenance is also key to the long term success of GSI and should be performed by a skilled and knowledgeable workforce (Lichten et al., 2016).

Uncertainty remains as to how to incorporate green space into urban environments in a way that actively maximizes ecosystem services and human wellbeing. Van den Berg et al. (2007) recognize a conflict between human preferences for natural settings and the potential for environmental sustainability in urban environments, and call for urban planning and design that integrates natural features into the urban matrix. This becomes especially important in the context of climate change, energy scarcity, and global land consumption, as dense urban living has the potential to be more sustainable and resilient than more dispersed settlement patterns.

Figure 1: A bioretention garden manages stormwater in the Warrendale neighborhood of Detroit.[1]

[1] Joan Nassuer, Michigan Radio. Image by: Dave Brenner.

II. Institutionalizing and Revolutionizing Stormwater in Detroit

The City of Detroit presents a complex environment in which to implement and maintain a GSI installation. This section will briefly describe the Detroit Bankruptcy, the US Environmental Protection Agency's oversight of Detroit Water and Sewerage Department (DWSD), and the current level of service provided by DWSD and the Great Lakes Water Authority.

In addition to this top-down governmental infrastructure, Detroit has active and innovative nonprofit leaders. This section will thus also describe a few of the community and stakeholder-led approaches to stormwater infrastructure in Detroit. For example, many Detroit nonprofits and residents have rallied not just around the issue of stormwater, but also its connected concerns (access to clean and affordable drinking water, vulnerability to flooding, and the new drainage fees). Furthermore, given Detroit's racial and socio-economic history, many nonprofits and communities use environmental justice as the primary frame for discussing this issue.

Detroit: Post-Bankruptcy and Restructuring

In the words of one of the Eastside residents who participated in our community dialogue, you cannot understand Detroit's stormwater system without first understanding the Detroit Bankruptcy.

This is for two key reasons. First, the Detroit Bankruptcy was the climax of half a century of resource flight, depopulation, deindustrialization, and disinvestment. (Sugrue, 1996). As Detroit's combined sewer system aged, the City was unable to maintain and replace the system to a high level of service. At the same time, depopulating neighborhoods increased the per capita cost of providing those services, placing a greater burden on those who remained. Second, the emergency management and financial restructuring that evolved out of the Detroit Bankruptcy are directly related to recent innovations in the Detroit drainage system, including the lease agreement with the Great Lakes Water Authority and the imposition of a new drainage fee.

EPA Action

In 1977, the Environmental Protection Agency (EPA) sued the City of Detroit and the Detroit Water and Sewerage Department for dumping toxic chemicals into the Detroit River in violation of the Clean Water Act. As a result of the 1977 lawsuit, DWSD entered a 35-year period of federal court oversight, with Judge John Feikens at the helm. This period was marked by continued disinvestment, increased regionalism, and tense intergovernmental relations. (U.S. v. City of Detroit, 2013 Order).

Recently, the federal government mandated that all illegal discharges into the Detroit and Rouge Rivers must end by 2022, or DWSD will be required to spend one billion dollars to expand non-CSO infrastructure to address the problem. (DWSD, 2017)

Financial Restructuring: Stormwater Utilities + Drainage Fees

Founded in 1836 as the Department of Water Supply, the Detroit Water and Sewerage Department (DWSD) serves 200,000 commercial and residential accounts through a 6,000 mile network of transmission and collection pipes (DWSD, 2017). DWSD is a branch of the Detroit municipal government and is governed by the Board of Water Commissioners (DWSD, 2017). Under Michigan law, water and sewer services must be funded by user fees and cannot be subsidised by property taxes (DWSD, 2017).

In January 2016, the City of Detroit entered a forty-year lease agreement with Great Lakes Water Authority (GLWA). Under the agreement, the regional water and sewer infrastructure built by DWSD has been leased to GLWA for an annual payment of $50 million (GLWA, 2016). The annual lease payment may only be used to finance much-needed system repairs (GLWA, 2016). While the agreement was billed as a cost-saving and efficiency-creating measure (GLWA, 2016), a number of Detroit residents worry that their water and sewer bills subsidize the cost of service to a regional network encompassing 126 municipalities and seven counties (Community Engagement, 2017). The lease agreement requires that GLWA "target" a no more than a four percent annual budget increase, but makes no commitment to capping rates (GLWA, 2016). Qualified customers are eligible for assistance through the Water Residential Assistance Program (GLWA, 2016).

Also in 2016, DWSD announced that it would be assessing a separate drainage fee on customer water and sewer bills (DWSD, 2016). While DWSD customers have been paying for drainage-related costs since 1975, the new drainage fee is an effort to capture the full cost of drainage--particularly in the wake of federal action described above--and to tie fee assessment to a user's impact on the system. The roll out of the new drainage fees has been marked by community confusion and concern.

To mitigate burdensome drainage fees, encourage behavioral change, and recognize efforts to reduce grey stormwater infrastructure dependency, DWSD launched a drainage charge credit system in October 2016. More recently, DWSD released guides describing appropriate green stormwater infrastructure installations and corresponding credit calculations (DWSD, 2017). DWSD is holding ongoing credit program workshops for commercial customers.

The department has also indicated that it will recognize shared GSI systems (DWSD, 2017). In order for DWSD to accept a shared system between multiple property owners, DWSD requires contributing properties to enter a legal agreement and demonstrate system effectiveness. In conversations, DWSD has further stated that an acceptable shared residential GSI model must be reproducible and scalable, and that DWSD must be able to collect from the entity--and therefore also place a lien on the entity in the event of failure to pay the drainage fee (DWSD, 2017).

Community Approaches to Stormwater

Detroit has active and innovative nonprofit leaders representing a cross-section of stakeholder concerns and passions, including access to clean and affordable drinking water, vulnerability to flooding, and the impact of new drainage fees. Some of the organizations currently active in this area include Eastside Community Network in partnership with LEAP, Detroit Collaborative Design Center (DCDC) in partnership with the Great Lakes Environmental Law Center, and The Nature Conservancy in partnership with Eastern Market. Regional universities have also worked to improve stormwater management in Detroit, through community partnerships, faculty research, and capstone courses.

This section is by no means an exhaustive list of community initiatives; rather, it is a brief overview of some of the current community approaches to stormwater in Detroit.

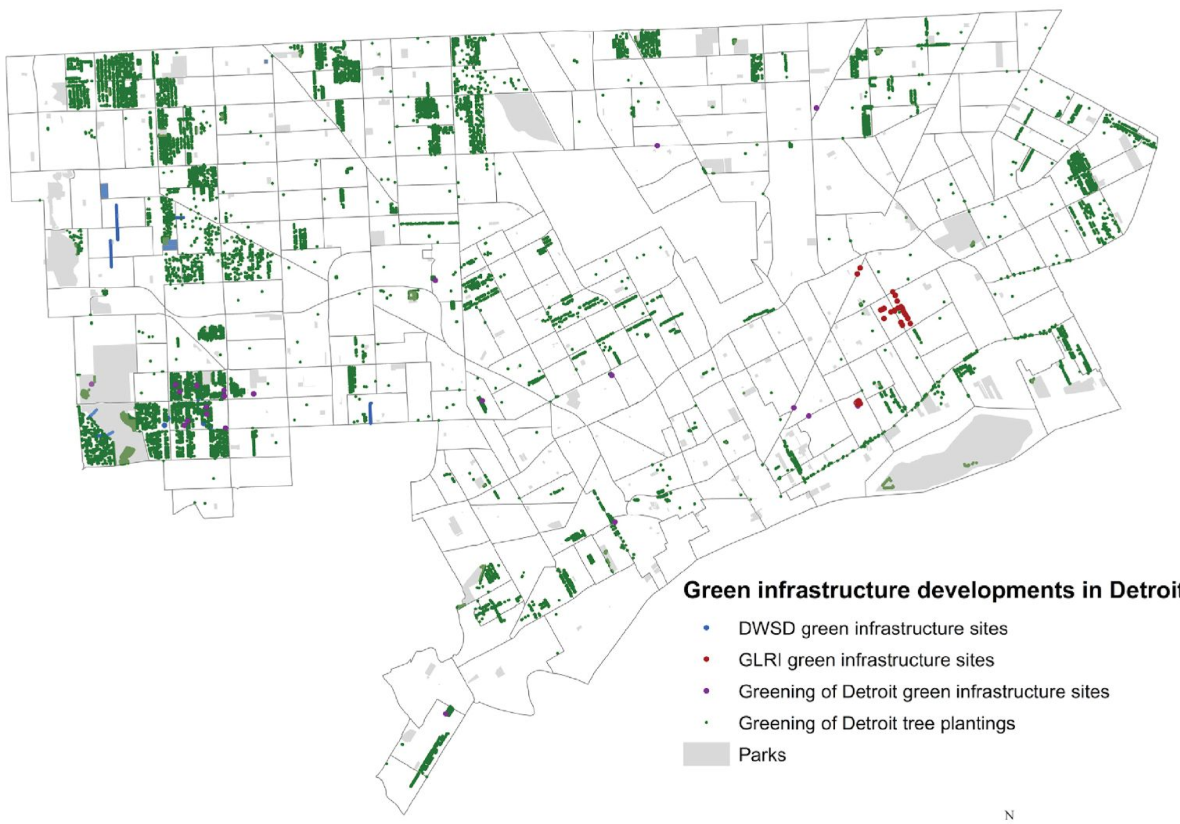

Figure 2: Map of Green Infrastructure Projects in Detroit[2]

Eastside Community Network is a community development and resident engagement organization based in the Lower Eastside of Detroit. Its mission is to be "a catalyst to improve the quality of life on Detroit's Eastside." (ECN, 2017). Green infrastructure plays both a central and supporting role in achieving ECN's mission. The organization's vision for the neighborhood includes "[v]acant land repurposed with naturescapes, blue and green infrastructure" and "[b]eautiful green thoroughfares connecting all neighborhoods." (ECN, 2017). GSI may also help ECN achieve some of its other goals, including job creation, quality education, a diverse and inclusive neighborhood, and "a strong sense of identity and ownership amongst residents." (ECN, 2017). ECN is also a founding partner of the Lower Eastside Action Plan

[2] Meerow, Sara, and Joshua Newell. *Spatial Planning for Multifunctional Green Infrastructure: Growing Resilience in Detroit*. Vol. 159, 2017.

(LEAP), a resident-led revitalization strategy that includes a number of recommendations for the installation of GSI. ECN has overseen the implementation of LEAP since 2013.

While ECN has focused on implementing GSI within residential neighborhoods, several other organizations are exploring shared GSI installations in commercial contexts. The Nature Conservancy and Eastern Market have partnered to design a collaborative system in which commercial stakeholders could improve stormwater management and reduce drainage fees. Similarly, the Detroit Collaborative Design Center (affiliated with University of Detroit Mercy School of Architecture), The Nature Conservancy, and the Great Lakes Environmental Law Center (affiliated with Wayne State University Law School) are developing strategies for shared GSI between commercial properties in the Grandmont Rosedale and Brightmoor neighborhoods. (DCDC, 2017).

These ongoing community initiatives have been instrumental to our project, and we hope that our research and analysis can help community-based organizations realize their visions for a greener, more sustainable, and more equitable Detroit.

III. Case Studies

The case studies included in this section provide examples of implementation of GSI fees and credits in cities across the United States. With the aim to reduce burdens on low-income households, the case studies contain ideas for improving stormwater drainage fee and credit policies in Detroit.

Baltimore

Background

As stipulated by the Maryland Legislature, the City of Baltimore was required to introduce a stormwater remediation fee as a dedicated funding source to mitigate the increasing impacts of stormwater management by July 1, 2013.

Fees + Credits

The City determines its fees through a three-tier flat rate fee structure. has an online system of determining costs for individual properties.[3] The city developed a few ways of providing fee credits for qualifying property owners. Credits are earned by reducing the amount of impervious service at a home and by installing green infrastructure such as rain gardens with a maximum credit of 45% of the fee for treating the impervious surfaces on site. Most interestingly, the city provides credits for participating in public events directly aimed at reducing stormwater such as trash cleanups, de-paving, tree-planting, etc. Despite the rewards for participation being tremendously low, the idea is promising for application in Detroit.

Requirements for receiving credits for participation in public events are listed below:

- For every 8 hours, you can get a credit of $10/year for a maximum of $30 within a 12-month time frame.
- Residents that exceed the $30/year maximum can gift the credit to another property.
- Multiple residents of the same single family property may all receive participation credit

[3] http://dpwapps.baltimorecity.gov/cleanwaterbaltimore/what-is-stormwater-runoff/

towards their stormwater remediation fee, up to the 24-hour maximum.

- The credit for a customer's participation in an event may only be applied to one property.
- The credit is good for 12 months. Only events in which the organizers have received certification from the City are eligible for participation credits.

Policy Recommendation

While at first glance, the credits in exchange for volunteer hours on GSI projects appears dismal, the concept is good. Perhaps a similar participation for credits model could be applicable for Detroit, but with different ratios. For example: For every 1 hour volunteered, you can get a credit of $10, for up to $200/year.

Cleveland

Background

Cleveland (2012 Regional Infrastructure Plan)

The Northeast Ohio Regional Sewer District (District) services 62 communities and more than 1 million people in an approximately 350-square-mile tributary area. In 2010, the District began the implementation phase of a regional stormwater management program; this effort will expand the District's responsibilities and services to regional stormwater issues.

On July 7, 2011, a Consent Decree was approved between the U.S. EPA, the State of Ohio and the District. The Consent Decree requires the District to develop a Green Infrastructure Plan (GI Plan).

Through the GI plan, green infrastructure projects must capture 44-Million gallons of wet weather CSO through green infrastructure improvements, and spend $42 million on such projects, by July 7, 2019.

Projects are prioritized in areas where the land is easy to acquire (especially through the Cleveland Land Bank) and where projects can improve socioeconomic conditions in the service area. A Baseline Index was developed to determine priority sites using modified versions of available GIS databases.[4]

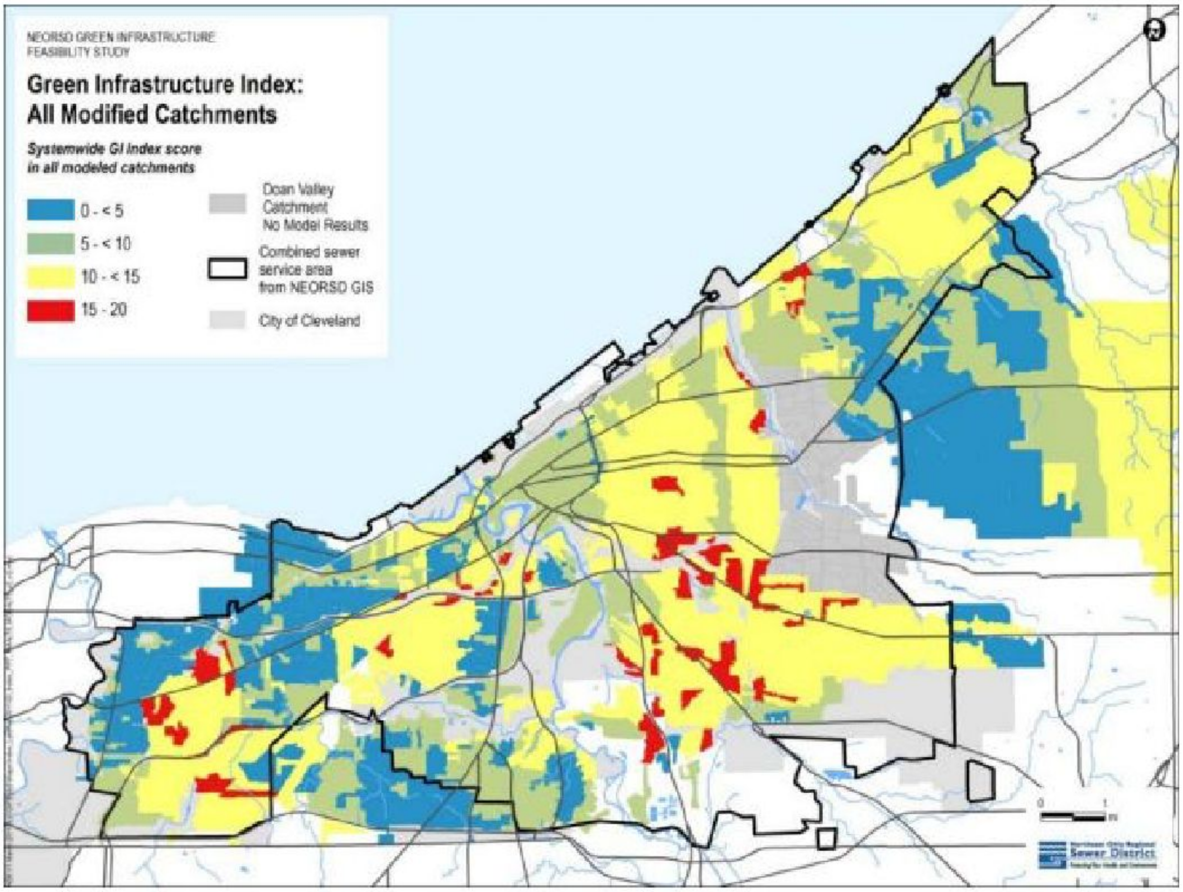

Figure 3: Green Infrastructure Index; City of Cleveland.

Fees + Credits[5]

Residents are charged a stormwater fee for all impermeable surface on their property. Each 3,000 square feet of impermeable surface is one Equivalent Residential Unit (ERU). Residents are charged the present rate per ERU times the number of ERUs on their property.

[4] The Baseline Index includes variables such as: available land, development opportunities, greenways, imperviousness, parks >3 acres, partnership opportunities, soil drainage, well-drained soils, and environmental justice.
[5] https://www.neorsd.org/I_Library.php?a=download_file&LIBRARY_RECORD_ID=4699

Individual residential properties (up to 4 units) can apply for an up to 25% reduction in their stormwater fee, through: building rain gardens or on-site stormwater storage; reducing the amount of impervious surface (e.g. through installing pervious pavement); or installing vegetated filter strips on their property.

All property owners are eligible for stormwater quantity credits of up to 75% when a GSI project reduces the runoff or peak flow from their property. As in Detroit, only properties whose stormwater is actually captured by the GSI project are eligible for the credit. Stormwater quality credits of up to 25% can be earned by GSI that treats stormwater, especially from industrial or agricultural properties. Finally, schools that teach about stormwater pollution prevention will receive a 25% fee reduction.

Policy Recommendation

Cleveland's Baseline Index uses many variables, including the ability to improve socioeconomic conditions, to determine site prioritization. We suggest DWSD adopt a similar system for ranking sites that include socio-economic factors when determining project locations or reduced drainage fee charges. Furthermore, Cleveland has a system that defines what percentage reduction in fees residents can expect for a given GSI project. Offering similar predictability in Detroit could incentivize more residents to attempt GSI projects.

Milwaukee

Background

Milwaukee Metropolitan Sewerage District (MMSD) currently serves 1.1 million people with 300 miles of regional sewers. It has numerous green infrastructure planning projects under way, including specific targets within its 2035 plan to reduce the number of CSOs to zero and a triple-bottom-line analysis modeled on Philadelphia's plan. However, MMSD does not have a regional plan.

Nonetheless, there are regional goals that the City of Milwaukee must comply with. Hence, by 2035, MMSD must capture 740 million gallons of water in its service area every time it rains. To that end, a tunnel storage system built in the 1990s, with a capacity of 1 billion gallons, has reduced sewage overflow from between 8-9 billion, to 1 billion gallons annually. Furthermore, MMSD must adopt stringent development goals related to impervious surfaces.

Funding

MMSD's capital budget is financed primarily through a tax on district properties based on their value, and a similar charge placed on 10 nonmember communities outside Milwaukee County that are also serviced by MMSD. For 2011, tax revenue and nonmember billings are estimated to be $111 million. MMSD's operating expenses are funded primarily through sewer service charges, estimated at $66.7 million for 2011. Revenue is also generated from the sale of fertilizer manufactured from sewage sludge, with an estimated net income of $7.8 million for 2011.

Green Infrastructure Projects

Unlike in Detroit, MMSD undertook its green infrastructure investments proactively, absent federal or state action. These began with a downspout disconnection program to redirect building downspouts to rain barrels, and a cooperative partnership with public entities and private businesses to install 60 rain gardens.

In addition, MMSD has a stormwater management manual that discusses volume control, impervious surface reduction, and standard operating and maintenance requirements that encourage the use and long-term maintenance of green infrastructure practices.

Fees + Credits

Sewerage fees apply to any property EXCEPT mobile homes, condominium units or dwellings containing 1 to 4 units. The fee is collected quarterly and based on the total area of impervious surface on the property.

The current quarterly fee is $20.18 per ERU (Equivalent Residential Unit). One ERU is equivalent to 1,610 square feet of impervious surface. Thus the annual fee is $0.050/square foot impervious surface [($20.18 x 4 quarters)/1610].

Discounts for non-residential properties may reach 60% under certain conditions.[6]

Stormwater Management Fee Credits are summarized in the table below.

Table 1: Stormwater Fee Reduction (Credit) for TSS Reduction through Green Infrastructure Implementation			
TSS Reduction Achieved	SWMP Not Required (Existing Building, No SWMP)	SWMP Required (New Development – Must Achieve >80% TSS Removal)	(Re-development – Must Achieve >40% TSS Removal)
10%	7.50%	0%	0%
20%	15%	0%	0%
30%	22.50%	0%	0%
40%	30%	0%	0%
50%	37.50%	0%	15%
60%	45%	0%	30%
70%	52.50%	0%	45%
80%	60%	0%	60%
90%	60%	7.50%	60%
100%	60%	15%	60%

Figure 4: Stormwater Management Fee Credits, City of Milwaukee

Policy Recommendation

Milwaukee has taken a proactive approach to reducing its stormwater runoff. A key distinction between Milwaukee and other cities studied, is that stormwater fees are charged only to properties greater than 4 units. While Detroit has taken a different approach, perhaps a lower fee could be charged to properties 4 units and under.

Pacific Northwest

Stormwater fees and credit systems are common among localities in the Pacific Northwest. Washington and Oregon have strong statewide regulations and ambitious goals for stormwater

[6] (1) Discharges flow directly into a qualifying receiving stream (2) Discharges flow directly into a qualifying receiving stream without crossing another property and the property owner is a holder of, or has filed a proper and complete application for, a municipal stormwater discharge permit (3) Discharges directly into a stormwater collection system constructed and maintained by the Milwaukee Metropolitan Sewerage District without crossing another property (4) Discharges directly into a storm sewer constructed and maintained by the City on the subject property pursuant to an easement

management and water quality protections that prioritize the health of water ecosystems and fishing resources. Counties and cities have adapted and built upon these environmental protections in various ways. Many local governments offer incentives to installing GSI through stormwater credit programs. Credits may also be available for residents in need of financial assistance. While the structure of stormwater fees and credits varies from one local government to the next, most charge fees by parcel type and impervious area, and provide a list of qualifying GSI interventions for credit. Only Portland offers a version of fee and credit sharing and it is administered on a case-by-case basis.

Figure 5: Comparison of Stormwater Fees + Credits in the Pacific Northwest[7]

State	Governing Unit	Fee Structure	Fee/Credit Sharing	Credits for	Credit Basis	Max Credit
WASHINGTON	King County	Flat fee for residential properties	None	Low-income seniors, use of pre-approved facilities, features, or BMPs	stormwater management and equity measures	50%
	Thurston County	Fixed rate for residential parcels or per multifamily unit	None	No credits available for residential. Commercial credits for third party certifications, use of BMPs, and rainwater harvesting	stormwater management	50%
	City of Arlington	Charge per unit of impervious area	None	Use of BMPs, senior citizens, low income households	stormwater management and equity measures	-
	City of Olympia	Flat rate for single family parcels	None	Senior citizens, disabled people. Credits for LID on commercial properties only	stormwater management and equity measures	50%
	City of Seattle	Charge per 1000 feet of impervious area	None	LID, rainwater harvesting, senior citizens, disabled people, low income households	stormwater management and equity measures	50%
	City of Yakima	Flat rates for three classes of residential property. No fee for undeveloped land	None	No credits available for residential. Commercial credits for qualified stormwater facilities and rainwater harvesting	stormwater management	20%
OREGON	Marion County	Flat rate for single family parcels. Base rate plus charge for impervious area for multifamily	None	No credits available for residential. Commercial credits for management facilities by assigned performance value	stormwater management	67%
	City of Bend	Base rate for single family and duplex properties	None	Quality and quantity of water managed, reduced peak flow.	stormwater management	59% or up to base rate
	City of Portland	Flat rates for three classes of residential property	Credits may be shared on a case-by-case basis	Low-income households, managing roof runoff, rainwater harvesting, large trees	stormwater management and equity measures	100%

[7] King County, WA www.kingcounty.gov, Thurston County, WA www.co.thurston.wa.us, City of Arlington www.arlingtonwa.gov, City of Yakima www.yakimawa.gov, City of Seattle www.seattle.gov, City of Olympia www.olympiawa.gov, City of Portland www.portlandoregon.gov, Marion County www.co.marion.or.us, City of Bend www.bendoregon.gov

IV. Community Engagement Strategy

Goals

Community engagement played a critical role in our development of a neighborhood approach to green stormwater infrastructure. From the beginning, we understood that the neighborhood model must be both acceptable to DWSD and feasible for communities. Therefore, conversations with community members centered on existing modes of community participation and advocacy. Further, as described in Section II, the Detroit context is unique; community meetings and interviews helped us to navigate these complexities as outsiders.

The American Planning Association identifies five categories of community engagement: inform, involve, consult, collaborate and empower. Our community engagement plan incorporated several of these strategies. First, we educated residents about the potential of neighborhood-led GSI efforts. Second, we solicited feedback about potential opportunities and challenges in implementation. Third, we empowered residents to continue to investigate the possibility of joint GSI projects in Detroit.

Throughout the project, our group actively listened to community guidance on the research topic and methodology. We also remain committed to producing a useful and accessible report that will be distributed to Michigan Community Resources (MCR), Eastside Community Network (ECN), and other organizations and working groups that contributed to the project.

Initial Stakeholder Meetings

Our group organized and attended several stakeholder meetings during the first months of the fellowship period. These meetings were essential as they allowed the group to meet with other individuals and organizations working on GSI projects in Detroit. The meetings were also useful in determining gaps in the GSI research and subsequently, the development of our group's research question. Lastly, introductory meetings provided the group with a comprehensive understanding of the needs of residents of Detroit as well as Detroit's Water and Sewerage Department in developing a joint model for GSI.

Figure 6: Schedule of meetings with stakeholders and community organizations during 2017.

Date	Organization
February	Lydia Levinson, Michigan Community Resources
February	Professor Larissa Larsen, University of Michigan Taubman College of Architecture and Urban Planning
April	Detroit Green Task Force - Blue/Green Infrastructure Subcommittee
April	Professor Margaret Dewar and Lecturer Libby Levy, University of Michigan Taubman College of Architecture and Urban Planning
April	Lesley Rivera, The Nature Conservancy
April	Eric Rothstein, Detroit Water and Sewerage Department (DWSD) Subcontractor
April	Urban Planning Capstone students, University of Michigan Taubman College of Architecture and Urban Planning
April	Donna Givens, Eastside Community Network (ECN)
April	Professor Joan Nassauer, University of Michigan School of Environment and Sustainability
October	Ceara O'Leary, Detroit Collaborative Design Center
October	Detroit Land + Water Works Coalition Meeting
October	Detroit Residents, Eastside Community Network (ECN)
October	Donna Givens, Eastside Community Network (ECN)
November	Oday Salim, Attorney, Great Lakes Environmental Law Center

Meeting with Eastside Community Network

On October 24, 2017, group members met with nine residents at a meeting hosted by ECN. Residents represented several neighborhoods within the LEAP/Chandler Park area, ECN's area of focus, on the east side of the city. Our group chose to partner with ECN in collecting this information because the organization has an interest in guiding residents in GSI projects and has worked on GSI in the past. In addition, it was important to our project to choose a particular area of the city in which to narrow our scope and evaluate how the collective GSI model would function.

This meeting was an opportunity to educate residents about the requirements and potential benefits of a collective GSI project, and to guide their reflection on how these projects may serve their neighborhoods given existing conditions, assets, and constraints. Our group asked residents for a description of their neighborhood, whether they participated in neighborhood-led initiatives in the past, and the likelihood that their neighbors would be interested in joining a collective GSI project to reduce their stormwater drainage fees. For educational materials and questions from this meeting, see Appendix.

Of five residents that completed written responses to questions asked at the meeting, all shared that they believed their neighbors would be interested in participating in a joint GSI project that might lead to shared drainage fee credits. Three residents said that they would be very likely to be involved in a joint GSI project if they were educated more about the responsibilities of an administrative entity and were confident that the Detroit Water and Sewerage Department (DWSD) would accept the project. Finally, all residents expressed concern over the recent updates to stormwater drainage fees and their desire for clearer communication of changes by DWSD.

Interview with Donna Givens, Eastside Community Network

After Eastside Community Network's meeting with residents, our group interviewed Donna Givens, ECN's Executive Director, to share key takeaways from the meeting and solicit additional feedback on the project. With Givens's leadership and GSI experience, her feedback on our project was essential in identifying how this project may impact residents, potential drawbacks of the model, and areas for improvement or further clarification.

Givens had several concerns about our proposed use of a homeowner's association-type model for implementing a GSI project. First, she believed that small non-profits typically do not have the institutional expertise to effectively manage the money, materials and people required for this type of project. Instead, she suggested that ECN or a similar already-existing entity could serve as a "fiscal agent" for groups interested in taking on such a project.

Second, Givens worried that the "homeowners" part of the association would further disenfranchise the majority of Detroit residents who rent their homes. We agreed, and therefore focused our report on community associations whose membership can include all community residents. Yet Givens simultaneously felt that the best place to gain momentum for GSI is in wealthier neighborhoods like Indian Villages, where nearly all residents own their homes. These residents are better able to pay higher stormwater drainage fees than neighborhoods with lower incomes, but their larger lot sizes mean GSI could offer them substantial financial incentives. Our group and Givens recognize the equity concerns of focusing on higher income residents in Detroit, but agree that, absent significant economic assistance, low income residents will struggle to implement GSI projects.

Finally, Givens was worried that DWSD's incentives for GSI were insufficient to allow all but the wealthiest neighborhoods to see the value of GSI. Certainly, DWSD has reasons to not provide additional incentives, as stormwater fees are the financing mechanism for infrastructure upgrades required by the 2013 consent decree. Yet, DWSD cannot be effective in the long-term if it alienates residents who are working the hardest to lower the burden on DWSD's infrastructure.

Limitations

Our community engagement strategy provided an introductory understanding of the feasibility of joint GSI projects for Detroit residents. Our hope is that future studies of collective residential GSI models will take an even stronger approach to the American Planning Association's strategies for community engagement. The development of GSI models for residential neighborhoods must involve education and collaboration with residents.

V. A Model for Neighborhood-led GSI in Detroit

Goals of a Shared Model

In developing a model for shared green stormwater infrastructure, we had to address the needs of both DWSD and residential consumers. If DWSD does not approve the shared model, customers will not receive credit for implementing GSI. If the shared model is not feasible for residents, they will not adopt it.

DWSD has indicated that it will recognize shared GSI systems (DWSD, 2017). In order for DWSD to accept a shared system between multiple property owners, DWSD requires contributing properties to enter a legal agreement and demonstrate system effectiveness. This second requirement may prove onerous, as participants must demonstrate that stormwater runoff generated on the property is managed by the GSI installation and not contributing to CSO, a requirement that has been challenging for existing GSI projects in Detroit. In conversations, DWSD has added that an acceptable shared residential GSI model must be replicable and scalable, not increase administrative costs, and allow DWSD to collect from the entity--and therefore also place a lien on the entity in the event of failure to pay the drainage fee.

Resident concerns center on cost. Implementation of GSI may be expensive, and residents may not enjoy returns on their investment for a long time. Residential lots within the City of Detroit are relatively small and provide limited space for GSI installation. If residents could leverage vacant lots and pool capital, GSI may be more feasible. However, the shared model must be cost-effective, protect individual owners from others' failure to pay, address liability concerns, and provide for the continued maintenance and administration of the system without over-burdening participants.

Entity Types Explored

Each neighborhood has unique conditions that impact what organizing structure is most appropriate for a GSI project. The below chart focuses on two of the key factors to consider--namely, who benefits from the GSI, and who lives in the houses.

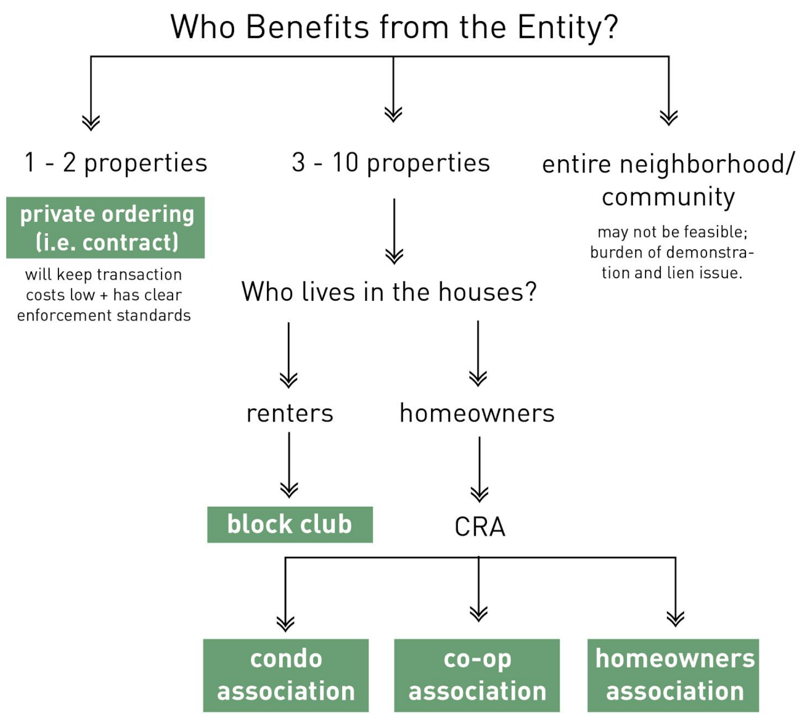

Figure 7: Decision Tree[8]

Community Residential Associations (CRA)

CRA is the umbrella term for condominium, cooperative and homeowners associations. As of 1998, 205,000 such associations represented over 42 million Americans. (Stabile, 1998). What makes them attractive for a GSI project is that they combine the service orientation of a government and the performance-based focus of a business. (*Ibid.*).

CRAs' main goals are to maintain commonly owned neighborhood resources, and provide services. (Dean, 1989). Many also emphasize protection of neighborhood aesthetics and real estate value. (*Ibid.*). They accomplish these goals through creating and enforcing covenants, conditions and restrictions (CC&Rs)[9] on properties, as well as charging their members

[8] Diagram created by authors.
[9] CC&Rs are described by Stabile as an "integrated design" for community development and governance integrating "consumers, services, organization, operations and finance." p. 165

"assessments." (*Ibid.*) Most importantly from DWSD's perspective, CRAs also provide procedures for collecting delinquent assessments. (*Ibid.*)

Some critiques of CRAs include that their private structure can be challenging to navigate, thus restricting access to participation and increasing parochialism in local government. (Silverman, 2004).

Condominium

Condominium Associations (CAs) are CRAs that can only include owners of property. Members own their individual properties, and have unrestricted access to all common property owned by the association. CAs represent around 61% of all CRAs. (*Ibid.*)

CAs enforce building and maintenance norms for individual properties as in other CRAs, and manage commonly owned spaces in the community. Most CAs are established in new developments, as it is challenging to create *ex post* agreements on access to common lands. Finally, the fact that CA membership is restricted to owners has the same negative equity implications as with Homeowners Associations (namely, that renters lack the ability to make decisions about the places they live).

Cooperatives (co-ops)

Cooperatives are CRAs that offer members "stock" in the ownership of common property interests. This pseudo-corporate form represents 4% of all CRAs (*Id.*) Cooperatives operate like businesses, with Boards of Directors, Officers and Employees serving the Shareholders. Residents can therefore decide in advance how they want decisions to be made by the Board, while retaining the ability as shareholders to speak up about decisions they disagree with. The shares structure allows the community to offer relatively stronger ownership interests to those who have or will invest the most time or money in the GSI project, as opposed to the CA's equal ownership model.

We believe (as will be detailed below) that this structure is the most democratic, and effective for the type of project we are discussing. Nonetheless, if Cooperative shares are expensive or closely held, then a few residents may still dominate the entity's decision-making.

Neighborhood Association

Neighborhood Associations (NAs) represent the residents of a given neighborhood, and seek to redress the issues that matter most to them. While often a representative model, NAs rarely have the formal entity structure that DWSD would require of an entity operating a GSI project. Furthermore, because NAs tackle many community issues, adding a GSI project would likely be an onerous obligation. And if the GSI project became insolvent, that could threaten the assets that the NA had allocated for other important community projects.

Figure 8: Chandler Park Neighborhood Association[10]

Block Group

Block clubs are NAs at a smaller scale. They are similarly responsive to members, and to pursuing diverse initiatives. But without a formal entity structure, and with so much already on their plates, it is unlikely that a block group model for GSI would be attractive to DWSD, or community residents.

Figure 9: Gladstone Block Club[11]

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[10] LEAP Annual Report, 2016.

[11] Gladstone Block Club Facebook page.

Private agreements

Residents can always decide to make a private contract that dictates who has what role and liability with regards to a GSI project. There is typically very little protection from liability in such a contract, so it would only be useful with a very limited number of residents, who know each other well, and have the means to insure against a failed project. Even so, it would be very challenging to secure outside funding for such a GSI project.

Figure 10: Entity Comparison Chart

Entity Type	Description	Detroit Example	Advantages	Disadvantages
Community Residential Association	Maintain commonly owned neighborhood amenities, provide services		Homeowners have long-term stake in neighborhood.	Exclusion of renters means the entity may not be representative.
Condominium	Membership vested in owners, who also have access to commonly owned land.	The Park Shelton	Have a structure for ownership and maintenance of common resources, alongside existing properties.	Still not responsive to renters. Often a complex structure to set up, especially without existing understanding on common areas.
Cooperative	Members have "shares" in common property.	Town Square Co-op	Shares allow for clear, representative decision-making	Initial allocation of shares can still be inequitable. No relation to properties besides the commonly held one.
Neighborhood Association	A group of citizens united by living in a neighborhood, and caring about certain issues.	Brush Park CDC	Bottom-up responsiveness	Focused on many initiatives, not just GSI. Not necessarily tied to property interests, issues.
Block Group	Typically more informal and local. Responds to community concerns.	Gladstone Block Club	Responsive, local	Rarely formal enough to meet DWSD's requirements.

Why Cooperatives (co-ops)?

Cooperatives are uncommon forms in the United States of America, particularly compared with the proliferation of homeowners associations. Whereas homeowners associations were popular tools for race- and income-based exclusion from the 1930s onward, historically cooperatives have been used to increase residential integration and address inequality (Rothstein, 2017).

The potential for a cooperative model extends beyond residential communities to include labor and employment, consumption of goods, production of art, and even provision of electricity. (Co-opLaw.org) For example, in the 1930s, electric cooperatives emerged in rural areas of the United States to provide affordable and reliable electricity in lieu of traditional utilities. Electric cooperatives continue to provide services today in low-density communities. Similarly, as Detroit neighborhoods experience continued vacancies, the traditional stormwater grid may not be as efficient or cost-effective as a GSI cooperative.

What is Required to Create a Cooperative?

Residents interested in implementing a GSI project must consider whether they have sufficient undeveloped land on their individual properties, or on nearby side-lots, such that the project can significantly reduce stormwater runoff, and thus the fees charged by DWSD.

Then, residents must decide which entity is the best vehicle for them to use for the project. We recommend that residents discuss their options thoroughly, among themselves and with an attorney, before deciding how to proceed. If residents decide to form a cooperative in Michigan, they must file as a non-profit corporation. The fees for a non-profit corporation are $20 for the Articles of Incorporation (see below) and $20 for Annual Reports.[12]

Residents (with the assistance of an attorney) will then draft several documents that formally outline the roles and obligations of cooperative members. For the cooperative to formally exist, residents must draft and file Articles and Bylaws. Members may also draft an Operating

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[12] See generally, https://micondolaw.com/michigan-community-association-law-hoas-co-ops-summer-resorts/co-ops-the-michigan-general-corporation-statute/

Agreement or Financial Commitment document, which prospectively outline members' obligations to each other, and to the entity.[13]

Articles

The Articles of Incorporation outline the essential Purpose of the cooperative, its Powers of operation, and the roles of its Directors, Owners and Members.[14] Articles must be filed in a state, though not necessarily the state where the project will occur.

Whichever state a cooperative incorporates in will have specific requirements of what the Articles must describe (see below for more details). Typically, the Articles do not contain much more than is required by that state. Amending the Articles is challenging and not responsive to all members (usually requiring approval of a supermajority of the Board of Directors), so members prefer to place most details on the operation of the entity in the Bylaws.[15] Nonetheless, the information contained in the Articles is given great deference by courts, being treated almost like a statute.[16] (*Id.*)

Bylaws

Bylaws offer a more detailed description of how the cooperative will operate. Although not all states require the filing of Bylaws (unlike Articles), we recommend that residents still file their Bylaws, in order to provide predictability to members, and to DWSD. The resulting "working plan" of the cooperative would include, for example, whether membership will be awarded through stocks, or through payment of a one-time or annual membership fee.[17] It would also detail how meetings of Members, Directors or Officers would take place, and how Members, Directors or Officers might gain or lose authority within the cooperative.[18]

Optional Operating Agreement

Residents can, in addition to the documents discussed above, contract among themselves regarding commitments of time, money or other resources to the project. However, these

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[13] http://www.uwcc.wisc.edu/pdf/cir40.pdf
[14] Ibid.
[15] Ibid.
[16] Ibid.
[17] http://www.uwcc.wisc.edu/pdf/stockvnonstock_2015.pdf
[18] http://www.uwcc.wisc.edu/pdf/cir40.pdf

agreements would only bind the parties to the agreement (not all members of the cooperative), and might lead to conflicts of interest if their terms differ from the commitments outlined in the Articles or Bylaws.

What Should These Documents Address?

Liability & Insurance

All corporations, like individuals, may be liable for actions which harm another entity or individual. The corporate form shields cooperative members from most liability, but if a lawsuit were filed, members might still have to pay attorney's fees to defend themselves. Therefore, we would recommend that a cooperative purchase liability insurance, in order to provide for such contingencies. Descriptions of how liability insurance would be purchased and maintained could be located either in the Bylaws or an Operating Agreement.

Level of Maintenance

GSI projects require upkeep so that they continue to drain stormwater, and do not pose a risk to residents. If DWSD is to provide long-term credits to a cooperative administering such a project, they will need assurances that the project will remain functional over time. The cooperative would therefore describe in its Bylaws what maintenance levels are required for the project, and how they will be paid for (annual assessments on members, diversion of the first $X of stormwater credits, etc.)

Contribution of Capital & Distribution of Credits

All Corporations must detail how individuals can receive shares of the corporation. A cooperative would therefore, in its Articles or Bylaws, describe what economic or noneconomic actions residents must take in order to earn shares in the entity. This may include the purchase of a side-lot, the financing of part of the GSI project, or the contribution of labor or materials to the completion of the project.

Termination (sale/foreclosure)

All corporations also must consider what happens if they are no longer economically viable. A cooperative must, in the Articles, therefore describe what would happen to the shares and other assets of the cooperative if the project runs out of money. The members can determine what such a sale or foreclosure would look like, provided they comply with state bankruptcy laws.

Other Conditions on Ownership

Along with setting preconditions for owning shares in the cooperative, members may also want to require that all other members live in the community, own their property, or root for the Lions. Those conditions, stated in the Articles or Bylaws, would be binding on future members, unless amended by a supermajority of members. Such conditions help personalize the project, but members should beware that conditions that DWSD dislikes may make it harder for the cooperative to receive stormwater credits.

VI. Where do we go from here?

Our intention for this project has been to demonstrate that a neighborhood-led green stormwater infrastructure project is feasible from a community, administrative, and legal perspective. Our hope is that some of the research and analysis provided in this report may empower communities to implement shared GSI projects in Detroit.

The Section I overview of GSI, its benefits, and its limitations may be useful for communities who are in the early stages of considering GSI projects. Where the benefits of GSI align with the goals of communities, they may be especially valuable; this section may be used to effectively communicate the benefits to participants, funding sources, and government agencies. While GSI installations offer many benefits, they may not be suitable for all topographies or communities; this section may assist communities in determining whether GSI is appropriate.

Section II is most useful for communities outside Detroit that may consider adopting drainage fees, and that may look to Detroit as a model. Communities within Detroit are, naturally, familiar with the context in which the new drainage fees and GSI operate. Simultaneously, Section III may be useful to communities both within and outside Detroit. Finally, we hope that DWSD will consider some of these concerns and models as they continue to develop standards for shared GSI systems in Detroit.

The cooperative model offers many economic and legal benefits as compared to other entities that might implement GSI projects. For example, if the cooperative can build a GSI project on a side-lot, then DWSD could credit stormwater fees to that property, and the entity could distribute those credits to shareholders. There would be no chance of the entity filing for bankruptcy, and residents could receive predictable credits for many years. The cooperative model also has a strong history in Detroit, as such entities have furthered equity and social justice missions there for many years. Yet even a cooperative faces practical challenges to implementing GSI in Detroit.

Before a cooperative breaks ground, it must first secure the funds to implement the GSI project. While project finance was not a central focus of our project, we are able to identify several possible sources for interested groups. DWSD has offered to provide matching grants for approved GSI projects, up to five million dollars city-wide. (DWSD, 2017). Detroit Future City offers grants up to $13,000 to block clubs and community-based organizations to install GSI through their Field Guide to Working with Lots.[19]

Residents would also need a suitable location to implement the GSI project. Detroit's side-lot program[20] offers many opportunities to acquire nearby vacant lots for around $500. The cooperative could own that side-lot directly, and avoid any ownership or use conflicts between project partners. Without a side-lot, the project would likely be on a cooperative member's land, complicating the project. Residents would then need a legal entity or agreement that distributes risks and opportunities of their private property, without diminishing their ownership of that property. A final alternative location would be land owned by the city of another government entity. But there is no evidence that government entities would donate their land for such a project.

Finally, the reality is that shared residential GSI systems are best suited to large, owner-occupied single family lots with long-term occupancy rates, an ideal that is rarely present in Detroit, let alone at a scale to generate shared GSI systems. Neighborhood-led approaches to GSI may therefore be more appropriate in neighborhoods such as Indian Village. However, the cooperative model may still be feasible for renter households in communities with longer tenancies. We recommend that DWSD consider the equity implications of promoting a shared GSI model that depends on homeownership.

[19] https://dfc-lots.com/
[20] http://auctions.buildingdetroit.org/sidelots

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