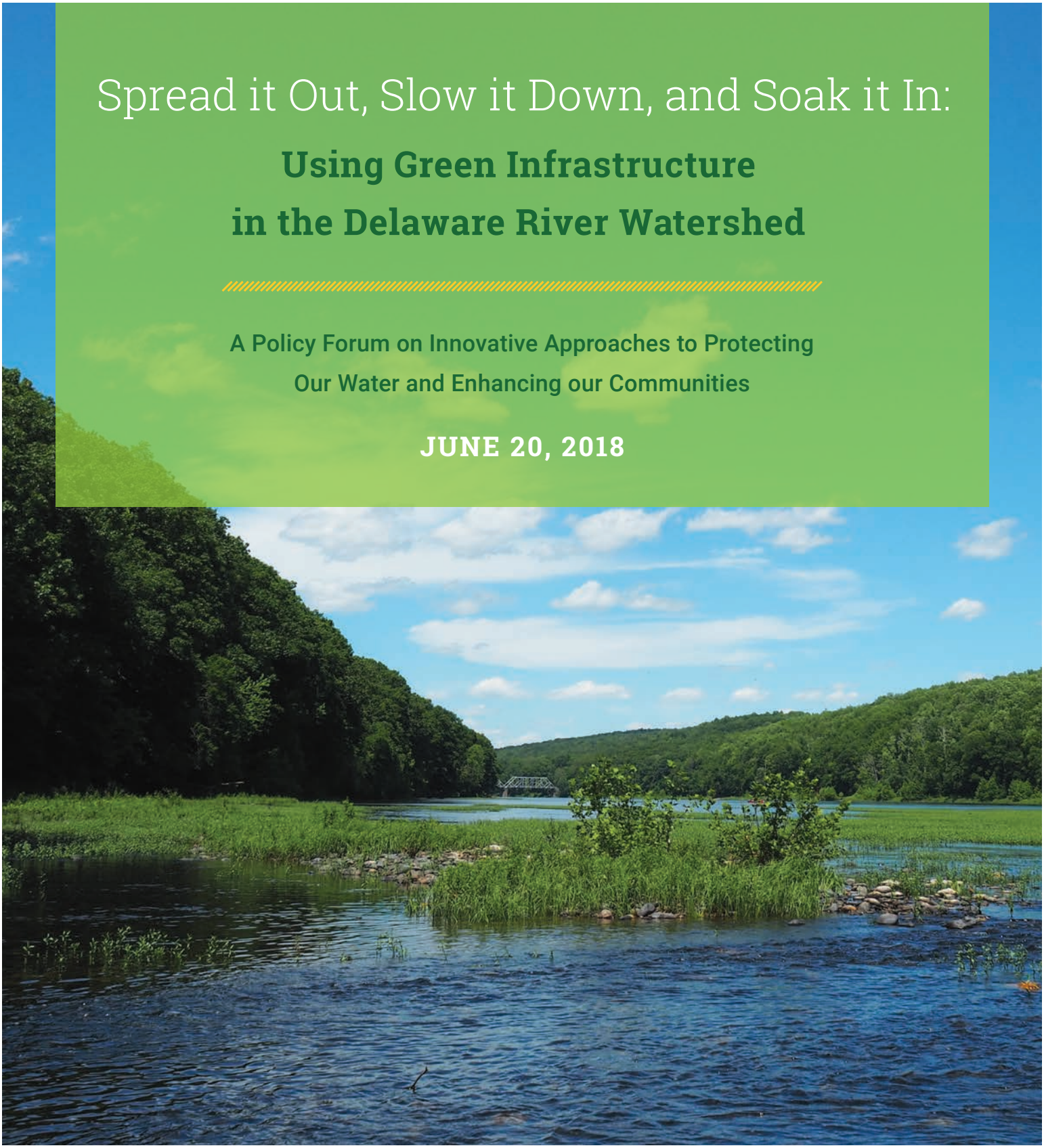
Spread it Out, Slow it Down, and Soak it In:

Using Green Infrastructure in the Delaware River Watershed

A Policy Forum on Innovative Approaches to Protecting Our Water and Enhancing our Communities

JUNE 20, 2018



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Authored by Simon Gruber, CUNY Institute for Sustainable Cities
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EXECUTIVE SUMMARY

For 25 years, the New York League of Conservation Voters Education Fund (NYLCVEF) has been dedicated to educating, engaging, and empowering New Yorkers to effectively advocate for the environment. Since 2017, NYLCVEF has participated in the Delaware River Watershed Initiative (DRWI), a project established by the William Penn Foundation to conserve the land and water, and protect the health of, the Delaware River Watershed. This major collaborative conservation effort spans four states, including New York, and consists of more than 50 organizations aligned in their efforts to improve and protect the land and water quality of the delicate and diverse ecosystems that comprise the watershed. Nearly 15 million people in the region—about half of whom live in New York City and northern New Jersey—rely on the reservoirs in the watershed for clean drinking water, and the communities along the river and its tributaries rely on the river for farming, forestry, tourism and recreation.

Although the upper Delaware River is mostly rural and forested, water quality is increasingly threatened due to booming industrial development, economic pressures on owners to sell farms and forested land to developers, and the growing influx of tourists. Currently, no local municipality in this area is designated as a municipal separate storm sewer system (MS4) by New York State, meaning that unless local communities choose to incorporate better stormwater management into community planning on their own, there is limited regulatory oversight for protecting waterways from polluted runoff. Continued protection and coordination among local leaders is required if the region is to continue providing its clean drinking water and recreational opportunities to millions of people. Especially as the intensity of rainstorms in the region increases, more sustainable strategies for managing stormwater will be needed to mitigate flood damage and protect the river and its tributaries.

Green infrastructure (GI) practices are becoming the preferred approach for managing stormwater in many areas undergoing new development, and for retrofitting urban areas. GI seeks to maintain and restore natural functions of watersheds in two main ways: 1) preserve as much natural area as possible in new developments and minimize the extent of impervious surfaces; and 2) use engineered practices to capture runoff and allow the water to either infiltrate to soils and groundwater, be taken up by trees and plants, or be reused for irrigation or other beneficial uses. This strategy seeks to protect local waterways by reducing the quantity of water flowing into them and by minimizing impacts to water quality from polluted runoff.

Despite these benefits, challenges exist to shifting away from conventional methods for managing stormwater to GI methods. In addition to resistance from developers and local leaders and outdated permitting processes that still—in some ways—favor traditional approaches, GI is often perceived to be more expensive at the outset. However, increasing education on existing funding opportunities, the long-term benefits of GI, and updating local policies and codes can help support a transition to more sustainable methods of managing stormwater.

NYLCVEF, in collaboration with partners from the DRWI, commissioned this paper to provide background for our policy forum on GI in the watershed. Its main areas of focus are to 1) describe GI and its benefits compared to traditional methods of managing stormwater; 2) identify challenges to increasing the use of GI in local municipal planning and new development projects; and 3) present opportunities for overcoming challenges, including policy recommendations and potential funding for GI planning, design, and construction.

Key findings and recommendations include:

- Preserve existing GI in the watershed. Conserving natural areas of land and water will limit the amount of engineered GI needed later on.
- Revise local codes and laws that have the potential to limit GI.
- Expand technical assistance and community outreach for GI funding programs.
- Increase adoption of small-scale GI by more community engagement and by broadening the discussion of its benefits for public, residential, and commercial sites.
- In state, county, and local policies and programs, highlight the links between GI and other land use and planning frameworks, such as Complete Streets, smart growth, resilience, health and wellness, and energy planning.

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Green vs. Gray Infrastructure

Typically, water drainage practices for buildings and roads in the Delaware River Watershed and most other areas have been designed to enable rain and snowmelt to flow off the site, often to open or buried channels or pipes, and to rapidly convey water to a stream or other waterbody. This approach is often referred to as conventional or gray infrastructure, and it helps protect buildings and other infrastructure from flooding and other problems. However, as communities in the watershed grow and develop, and as more buildings and paved areas—termed impervious surfaces—cover the land, this approach can cause significant damage to key watershed functions that help protect water quality, enable groundwater recharge, and support healthy habitats for wildlife and stream ecology. When the total impervious surface cover in smaller watersheds exceeds 10% of the land area, streams and water quality begin to experience significant adverse impacts.

Better protection for streams and water quality

When rain and snowmelt accumulate on roads, parking areas, and other impervious surfaces, it tends to flow downhill rapidly towards a nearby stream or other waterbody. Commonly, catch basins or other structural elements are used to capture this water and channel it into culverts or other linear conveyance structures. This traditional drainage infrastructure is designed to quickly move water away from buildings and streets and carry it to a natural water body. In addition to problems discussed above, the combination of impervious surfaces and conventional drainage strategies has other specific impacts on streams and water quality, including the following:

- Non-point source pollution from roads, parking lots and other areas is carried into local streams, degrading water quality and harming aquatic life. GI is a key strategy for filtering out these non-point pollutants.
- Erosion of stream banks is exacerbated, and over time, stream channels can become deeply cut or incised, leaving them lower than they were before, which can lead to another problem—floodplain and wetland areas adjacent to streams can become disconnected from the stream itself, damaging stream ecology and biodiversity. This can also reduce the ability of water to spread out in floodplains during storms, leading to greater flood risks farther downstream.
- The rapid conveyance of water to streams or other water bodies contributes to the risk and intensity of flooding in downstream areas. Floods are generally viewed as impacting buildings and other infrastructure, but they can also create major water quality risks when hazardous materials are released.

In contrast, GI seeks to preserve, mimic, and restore the beneficial properties and functions of a natural, undeveloped landscape. For example, in wooded areas most rainfall infiltrates the soil and surface runoff is minimal, except for large storm events or extended wet periods when the soil becomes saturated. When surface flow does occur over a forest floor, meadow, or other open space, the roughness of the plants, soils, and leaf litter helps to slow it down, and as noted above, filtration and other processes in healthy landscapes provide other benefits for water quality.

Potential benefits for reducing property damage from site drainage and localized flooding

The use of GI for site-scale stormwater management is not likely to significantly reduce flood risks from rain and snowmelt events in larger stream and river corridors, but it can potentially make a real difference at a smaller scale. For example, places where runoff

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from one or more properties causes localized flooding on adjacent sites or roads, GI practices can reduce surface runoff and limit these problems, especially during smaller storms.

Co-Benefits of GI for health, sustainability and community connections

Beyond managing stormwater and water quality, GI provides a wide range of other benefits:

- Trees and other plants help filter out many air pollutants, a key human health benefit.
- Cooling benefits of GI are valuable for using outdoor areas and reducing energy use in buildings, and this can be important for downtowns, business districts, and residences.
- A large and growing body of research shows a range of health, wellness and social benefits of green space, including reduced stress and improved learning and productivity.
- Planted areas can be designed to provide crucial habitat for pollinators.
- Community beautification supports higher property values, longer visitation time and more shopping in business districts.
- More attractive and comfortable outdoor areas promote community and social connections, which are critical for health, resilience and longevity. The Growing Green Cities project in Newburgh, NY, is aimed at raising awareness of the co-benefits of green infrastructure and other green space.

The Role of Healthy Soils & Plants for Water Quality & Recharge

Most GI practices include the filtration of water through healthy soils and plants. For example, rain gardens, street trees, vegetated swales, some types of porous paving systems that include grassy surfaces, stormwater planters, and green roofs, all include plants that are selected for these specific environments. Water harvesting by using a rain barrel or larger cistern is a GI practice that does not include soils or plants per se, but the water is often used to irrigate gardens or plants.

Healthy, abundant topsoil is a precious resource that is often ignored or underappreciated. Soil compaction, which is widespread in suburban and urban areas, leads to a major decline in the health of the soil and its ability to support healthy plants and trees. GI works by filtering out silt and sediment from stormwater, capturing pollutants in the soil where contaminants can be broken down and rendered harmless by the microbes in the soil, and allowing plants and trees to take up the key nutrients in stormwater, including phosphorus and nitrogen. When excess amounts of these nutrients enter waterbodies, they contribute to the growth of aquatic plants and algae, including harmful algal blooms that can be toxic to people, pets and wildlife. Using GI for stormwater can be very effective for mitigating some of these problems and risks.

New York State Policies & Regulations for Stormwater Management

Stormwater plans are required for most development projects in New York State based primarily on the Federal Clean Water Act. New York and other states have adopted state regulations for administering these plans. The New York State Department of Environmental Conservation (NYS DEC) reviews stormwater plans for specific projects in certain cases.[1] More typically, the planning board, or another local office, is the only agency to review stormwater plans. Towns, villages, and cities in New York State are able to adopt their own local laws and codes for drainage and stormwater management, and these local requirements for GI can exceed—but cannot weaken—the state's regulations. With minimal state oversight on most development projects in the watershed, careful local review of stormwater plans

1 "New York Standards and Specifications for Erosion and Sediment Control." New York State Department of Environmental Conservation, Chemical and Pollution Control, 2016. https://www.dec.ny.gov/chemical/29066.html

is necessary, and should be required, for effective implementation of GI practices.

In 2010, NYS DEC adopted an updated set of requirements that favors GI for stormwater plans for subdivisions and site plans. These policies and regulations indicate a strong preference for using GI practices rather than conventional stormwater ponds for new development. Before 2010, retention and detention ponds were the most common design approach for meeting state stormwater management requirements. Stormwater ponds are still being used in some new development projects, such as the Resorts World casino in Monticello, NY that opened in 2018.

In general, GI for stormwater management is relatively new in the Delaware River Watershed, and recent research identified only a small number of sites with GI in Sullivan County, including the E.B. Crawford Library in Monticello and the Catskill Brewery in Livingston Manor. The library has porous paving bricks and a public lawn designed to work as GI in a new site upgrade, and an older vegetated swale in the rear parking lot. The Brewery has a green roof and porous paving using a plastic geogrid product to stabilize the unpaved parking lot.

Changing Precipitation Patterns in the Northeast US

The importance of investing in greener strategies for managing stormwater in the Delaware River watershed is likely to grow in the next 10-20 years. Most climate change models indicate that the frequency of more intense rainstorms is likely to increase, with rain coming in relatively short, rapid bursts, as compared to historical conditions. This pattern is already evident in measured weather records of the past 60-70 years.

In the northeast U.S., there has been a 71% increase in the amount of precipitation falling in heavy storms from 1958-2012—a larger increase than any other part of the U.S. Research comparing weather events in the 1970s and the 1990s in the Catskill Mountains and southeast NY region indicates major, more recent changes: what had been the 10-year flood during the period 1960-1990 became the 5-year flood during 1980-2011, and the 25-year flood from 1960-1990 became the 10-year flood for 1980-2011. Heavier storms that are smaller have also become more frequent. In recent years, storms of 2 inches or more of rainfall are occurring on average more than twice every year, up from an average of about once each year in 1950, as measured in Poughkeepsie, NY.[2] While most GI practices are designed mainly to capture runoff from these smaller storms, porous paving systems that include an ample underground reservoir using coarse stone can contain water from an 8-inch storm. At the same time, for water quality protection, managing water from the much more frequent, smaller storms is the primary goal for GI.

These trends suggest that more widespread use of GI for stormwater should be part of municipal and regional strategies and plans aimed at mitigating hazards, increasing resilience, and planning for future development. Steps to preserve, restore, and enhance groundwater recharge are likely to become especially important for protecting water supplies and the availability of groundwater for private and municipal wells, maintaining the flow of groundwater to streams in dry weather, and reducing the risk of depleted aquifers. In addition to addressing these issues, GI can provide benefits relevant to other impacts of climate change, such as cooling the air, which can mitigate human health risks from heat stress, a risk that is exacerbated by urban heat island effects in neighborhoods with more buildings and paved areas. For cooling, trees have particular benefits because of their scale and abundance on the landscape.

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2 Simon Gruber. "Precipitation & Storm Recurrence Trends in the Hudson Valley and Catskill Mountain Regions in NY State." CUNY Institute for Sustainable Cities, 5 April 2015. http://www.cunysustainablecities.org precipitation-storm-recurrence-trends-hudson-valley-catskill-mountain-regions-ny-state/

CHALLENGES TO WIDESPREAD USE OF GREEN INFRASTRUCTURE

The cost of GI, for both the initial installation and maintenance over time, is seen as a significant barrier to its use among developers and municipal leaders.[3] However, there is a growing body of evidence that suggests GI can have the same or even lower costs than conventional stormwater and drainage practices, especially when full lifecycle costs are considered. GI has the potential to minimize long-term costs from flood damage, and insurance rates for sites with porous paving areas could also be lowered over time as the insurance industry begins to understand their reduced risk of icing and its associated hazards. Especially for the popular outdoor recreation areas in the watershed, community green spaces appeal to tourists and visitors. More research and education is needed to demonstrate these additional and long-term economic and social benefits.

Often, GI requires maintenance, yet most local leaders and planners lack the resources to maintain GI projects, which means projects may not maintain their effectiveness over time. In the Delaware River Watershed, training resources for municipal leaders, planning board members, and other relevant stakeholders are limited. NYS DEC lists trainings on its website, including workshops offered by the Cornell Cooperative Extension of Orange County for engineers and landscape architects on the technical aspects of stormwater design and regulatory compliance; however more training for planning boards and community members is needed.

Another challenge to implementing more GI in the New York part of the watershed is that GI is relatively new to this region, and there is a lack of local experience with it. Local decision-makers, project managers, developers, and others involved in project planning, financing, and design decisions are often not aware of the advantages of GI for managing stormwater, as well as its potential economic and community benefits.

Similarly, this lack of awareness results in limited coordination among sectors for planning, implementing, and maintaining GI projects. For example, engineers may not have the expertise to choose plants or trees for a rain garden. In addition, outdated or needless local codes and ordinances could act as a barrier to GI implementation. For example, local laws that prohibit flat roofs can prevent property owners from installing green roofs.[4] More collaboration between planners, designers, and community groups is needed to ensure GI projects are achievable and implemented in ways that will be effective and benefit the community.

At the state level, the New York part of the Delaware River Watershed receives minimal state oversight and enforcement for stormwater plans due to the fact that these communities are not designated MS4s. MS4 municipalities are designated based on population, and the total number of New Yorkers living in the 2,363 square miles of the basin is only approximately 200,000.[5] Non-MS4 municipalities are not required to enact local stormwater laws and programs; however whether or not a municipality is an MS4, project developers are required to submit a Stormwater Pollution Prevention Plans (SWPPP) with their site plans. However, SWPPP's are not always reviewed by the municipality or inspected by the NYS DEC.[6] Non-MS4 municipal officials can review SWPPP's and adopt requirements in local comprehensive plans to fill this gap, but technical assistance and support for specific projects is limited.

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photo (facing page): © Washington Environmental Council (WEC)

3 Emily Vail. Andrew Meyer. "Barriers to Green Infrastructure in the Hudson Valley: An electronic survey of implementers." Hudson River Estuary Program, New York State Water Resource Institute at Cornell University, 2013. https://www.dec.ny.gov/docs/remediation_hudson_pdf/giresults12.pdf.

4 Emily Vail. "Green Infrastructure Codes and Ordinances." Hudson River Estuary Program. NYS Department of Environmental Conservation. New York State Water Resources Institute at Cornell University, 19 March 2015. https://wri.cals.cornell.edu/sites/wri.cals.cornell.edu/files/shared/Green%20Infrastructure%20Codes%20and%20Ordinances%20Vail%203-19-15.pdf

5 "Comprehensive Wildlife Conservation Strategy for New York." New York State Department of Environmental Conservation.

6 Emily Svenson. "Reviewing Stormwater Management in Site Design: A Guide for Planning Board Members." Lower Hudson Coalition of Conservation Districts, Version 2, 2015. https://www.lhccd.net/uploads/7/7/6/5/7765286/planning_board_sw_guide_2015.pdf


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RECOMMENDATIONS

Collaboration at the state and local level is needed to address these challenges. NYLCVEF will continue working with partners across sectors to establish and advance practical policy recommendations for protecting the Delaware River Watershed. The following recommendations are aimed at increasing GI implementation in the Delaware River Watershed.

- **Preserve existing GI in the watershed. Conserving natural areas of land and water will limit the amount of engineered GI needed later on.** The New York region of the Delaware River Watershed is mainly rural and forested, with the exception of smaller developed areas, so preserving and repairing existing natural areas such as wetlands, flood plains, stream and river corridors, and forested watershed regions should be central to discussions about GI. These areas provide flood protection, reduce the impact of storms and broadly improve water quality. New York State should update its wetlands maps and consider amending regulations to allow for improved maintenance of these water resources. As the population grows in the watershed, it will be crucial to site and plan for development in less sensitive areas.

- **Revise local codes and laws that have the potential to limit GI.** Review existing model laws and best practices from other municipalities, and use them as guides to organize local code review roundtables. Bringing together key stakeholders to inventory and score existing codes on their potential to prevent GI projects will encourage more creative GI projects and also provide the occasion for collaboration and broader community sustainability planning.

- **Implement local demonstration projects along with education and training to build support.** More education, training, and technical assistance are needed to educate local groups and landowners about what they can do at a smaller scale, on private property and public land, in addition to options for larger projects. For example, in May 2018, members living at the Dynamite Youth Center recently participated in a GI education workshop sponsored by Sullivan Renaissance. Since the workshop, staff have expressed interest in building a demonstration rain garden on their property, which already has a greenhouse. More rain gardens are sprouting up in Sullivan County, and there are a number of GI demonstration projects in nearby Orange County, including a green roof at SUNY Orange in Newburgh. Increased capacity for local groups for educational and technical assistance could help facilitate more projects. Building GI into existing programs, such as community gardening, would be a cost-effective way to raise awareness.

- **Explore innovative incentive programs for new GI and for retrofitting existing areas.** One approach, implemented several years ago by Ithaca, NY, is to adopt a local law that provides a direct incentive to property owners to reduce impervious areas. Incentive programs in other areas include similar area-based fee systems, which puts a fee on the amount of stormwater produced and incentivizes property owners to invest in retrofits for a reduction in stormwater fees. To further increase the financial incentive for property owners, the city of Washington D.C. has introduced a stormwater credit trading program.[7]

photo (facing page): © Washington Environmental Council (WEC)

7 Alisa Valderrama. "Making Stormwater Markets: How Cities Can Spur Voluntary Green Stormwater Management on Private Land." Living Architecture Monitor, Vol. 20, Issue 1, Spring 2018, pp. 34. http://www.nxtbook.com/dawson/greenroofs/lam_2018spring/index.php#/38

"NYLCVEF will continue working with partners across sectors to establish and advance practical policy recommendations for protecting the Delaware River Watershed."

- **Expand technical assistance and community outreach for GI funding programs.** State and county grant programs are available to support planning, design, or construction of GI projects in the Delaware River watershed in NY, in addition to the projects supported by the William Penn Foundation. Specific funding opportunities include Sullivan County's Plans and Progress program, the NYS Environmental Facilities Corporation's Green Innovation Grants Program (GIGP), the Clean Water State Revolving Fund (a low-interest loan program), NYS Department of State's local waterfront revitalization and watershed planning grants, and the Climate Smart Communities program. Other opportunities for funding are possible under the new federal Delaware River Basin Restoration Program, but details for this are still being developed. To ensure that municipalities are effectively taking advantage of these resources, more outreach about existing programs and technical assistance are needed.

- **Increase adoption of small-scale GI through more community engagement.** Engage trusted local leaders as GI ambassadors to motivate residents to get involved in small-scale GI projects. The Energize NY program, based in Westchester County, has demonstrated significant success using trusted local leaders to encourage home energy assessments and retrofits to reduce energy use. Using this approach, community leaders in the Delaware River watershed can be enlisted as ambassadors to engage and encourage others in the community to adopt GI practices. The Catskill Brewery, a successful local business, and the Ethelbert B. Crawford Public Library in Monticello are two examples of local institutions that are early adopters and can potentially play this role. A home and small business drainage assessment program, similar to a home energy assessment, is also an approach that could be explored.

- **In state, county, and local policies and programs, highlight the links between GI and other land use and planning frameworks, such as Complete Streets, smart growth, resilience, health and wellness, and energy planning.** The broader community and public health benefits of GI and community greening should be included in community planning. GI can support other land use and infrastructure planning frameworks, such as Complete Streets, smart growth, health and wellness, resilience, and aging in place. Raising awareness about these opportunities and engaging state and local stakeholders to pursue these ideas may be an important way to expedite more GI.

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CONCLUSION & NEXT STEPS

As the Delaware River Watershed region of New York State continues to experience more intense rain events and as more tourists travel to river and its streams for recreation, it's important that we conserve sensitive areas of forest, streams, and floodplains, but also incorporate sustainable development practices, like GI, into our design planning. Educating New Yorkers about the benefits of GI and working together with county and state partners will help make GI more possible for small communities and improve its effectiveness, which will—over the long-term—have significant payoff for property value, tourism, and water quality.

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