GREAT LAKES REGIONAL GREEN INFRASTRUCTURE POLICY ANALYSIS:

ADDRESSING BARRIERS TO IMPLEMENTATION

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Great Lakes Commission
Credit Valley Conservation

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des Grands Lacs

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EXECUTIVE SUMMARY

Throughout the Great Lakes basin, communities are faced with growing stormwater management challenges. Green infrastructure (GI) can serve as a key aspect of local stormwater solutions by decreasing the volume of water running into sewers and streams and improving water quality by trapping sediment and nutrients. GI includes a broad variety of stormwater management tactics like natural features and rain gardens, green roofs, and porous pavement, that mimic nature and increase infiltration of stormwater.

Local communities are generally at the forefront of stormwater management, challenges, and innovation, but municipalities' capacity to develop GI is heavily influenced by federal, state, and provincial policy. Many policies and funding programs can foster GI implementation, while others either do little to incentivize GI or amplify unnecessary barriers. This report is targeted to federal, state, and provincial policymakers that can help create enabling conditions for local GI progress. The key policy recommendations identified below are designed to reduce barriers and provide a stronger foundation for communities to advance GI.

United States Federal Policy

Recommendation: *Fully fund the Clean Water State Revolving Fund (CWSRF) and incentivize GI projects through prioritization, interest rate reductions, and extension of funding eligibility for qualified projects to operations and maintenance (O&M).*

Rationale: In the United States, the Clean Water State Revolving Fund (CWSRF) is the most promising source of funding for GI, but dedicated sustainability funding is underutilized for GI. Maintaining this funding is critical and a focus should be placed on increasing the prevalence of GI developments. Because uncertainty surrounding the O&M of new technologies is a barrier to implementation, allowing funding to be used for O&M will further foster GI projects.

Recommendation: *Establish minimum performance-based standards to address runoff volume and water quality. Regulatory programs should support local watershed conditions through science-based approaches that address local challenges while also working toward water quality standards.*

Rationale: Currently, the extent of enforceable federal regulations on stormwater management is limited to consent decrees issued to permit holders in violation of the permit terms. This approach has a narrow scope and is reactionary. Defined performance standards will foster innovation in green infrastructure to meet permit requirements before they are violated. Many states have developed performance requirements, but a federally-defined minimum requirement should be established. Requirements should be oriented toward

watershed outcomes and allow for flexibility in achieving goals to accommodate local conditions and resource objectives.

Recommendation: *Promote and coordinate the integration of GI into permitting, planning, research, technical assistance, and funding programs.*

Rationale: The Environmental Protection Agency (EPA) and other federal agencies work with select communities to build capacity for local development through ordinance review, technical assistance, and grant opportunities. Expanding this effort with an eye toward comprehensive inclusion of GI in all stages of planning and increasing confidence in performance will develop a culture that promotes GI locally.

United States State Policy

Recommendation: *Require consideration or, preferably, incorporation, of GI to meet best management practices (BMP) and public education requirements in state administration of National Pollutant Discharge Elimination System (NPDES) program. Similar to the federal recommendation, states should develop performance-based runoff control standards that align with watershed goals.*

Rationale: Many communities lack familiarity of GI, so if it is not explicitly stated as an option it may not be considered. To go further, states can define a preference for GI, require that communities consider GI in their planning, or require some incorporation of GI in BMPs. Currently, the extent of enforceable regulations on stormwater management is limited to consent decrees issued to permit holders in violation of the permit terms. Though consent decrees often prompt innovation, this approach is not desired, as it reacts to water quality issues rather than preventing them.

Recommendation: *Dedicate funding to GI planning, implementation, O&M, and research. Where it is a barrier, amend state legislation to explicitly allow municipalities to establish stormwater utilities and/or levy fees.*

Rationale: Funding is a pre-requisite to GI progress. The clear authority for municipalities to establish stormwater utilities will reduce uncertainty and allow for increased funding streams and incentives for green infrastructure.

Canadian Federal Policy

Recommendation: *Prioritize GI projects under Infrastructure Canada's Funding Programs. In addition to GI implementation, funds can be allocated toward research on long-term performance, lifecycle costs and benefits gained by protecting natural GI assets.*

Rationale: Infrastructure Canada's Funding Programs, such as the Federal Gas Tax Fund and Municipal Asset Management Program, could be key sources of investment in GI, as they are already an important source of funding for implementing municipal infrastructure projects.

Canadian Provincial Policy

Recommendation: *Include GI in municipal asset management plans, policies, and strategies.*

Rationale: In Québec, GI has started to become a mandatory component of municipal asset management. By including GI in the definition of 'core infrastructure assets' in Ontario under the *Asset Management – Infrastructure for Jobs and Prosperity Act*, the applicability of policies (including municipal asset management) would be expanded and additional funding opportunities would become available.

Recommendation: *Create new funding mechanisms to support capital and operating costs for GI.*

Rationale: A significant challenge in the Canadian portion of the Great Lakes Basin is a lack funding. Utilizing municipal stormwater fees, development charges in Ontario, incentive programs, and/or public-private partnerships can provide critical funding for GI advancement.

On both sides of the border, GI implementation is limited by funding, lack of familiarity with GI practices, and uncertainty around performance. Because there are no requirements that actively compel GI investment under current policy, local advances in GI depend on motivated leadership. The recommendations outlined above and discussed in more detail in the report provide federal, state, and provincial actions to reduce barriers and increase the use of GI in local communities.

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INTRODUCTION

Growing populations, increased urbanization, and aging infrastructure present challenges for stormwater management across the Great Lakes basin. As communities continue to develop, natural landscapes are replaced with buildings, parking lots, streets, and sidewalks. The increase in impervious surfaces results in more surficial water flow after rain events and ultimately more water entering storm sewers. Flowing water carries suspended solids, phosphorus, and other contaminants in its path to sewers and waterways.

Traditional stormwater infrastructure aims to remove water from developed areas through a series of pipes that convey water to treatment systems or directly to receiving waters. Detention or retention ponds may serve as temporary storage of excess stormwater to reduce the peak flow of runoff and allow some suspended materials to settle out. The "pipes and ponds" system has been the paradigm in stormwater management across the Great Lakes region, but often fails to adequately protect communities from flooding and water quality impacts. The volume of stormwater can overwhelm the sewer system, and while stormwater ponds slow the rate of stormwater flow, the net volume is unaffected. Stormwater discharged to waterways may be high in suspended solids, nutrients, trash, and other pollutants. Water quality issues are amplified in areas where sanitary and storm sewer systems are combined and storm events overwhelm pipe capacity, triggering overflows of stormwater and raw sewage.

Green infrastructure (GI) helps to restore the natural hydrological regime by mimicking nature – either through engineered nature-based solutions like bioswales and rain gardens or through systems that imitate that type of infiltration, like pervious pavement. Existing natural areas of infiltration, such as wetlands or forests, are also considered GI under most functional definitions. Similarly, low impact development (LID) is a stormwater management strategy that seeks to minimize the impacts of runoff at a particular site by managing stormwater as close to the source as possible. The suite of practices will collectively be referred to as GI in this report. By capturing and treating stormwater at its source, GI effectively helps mitigate both water quality and water quantity concerns and therefore can be a key strategy to meet watershed goals. Although GI presents a promising solution to increasingly difficult stormwater management challenges, its use across the Great Lakes basin remains limited.

Lack of clear stormwater standards, limited funding opportunities, and general uncertainty in performance can deter incorporation of GI in stormwater management, especially in areas that have not experienced previous success. These hurdles are rooted in federal, state, and provincial government policies, but government agencies are rarely actively engaged in the planning and implementation of GI on the ground. Innovation in GI is often developed at the local level, by community groups, consultants, and local stakeholders who are experiencing the impacts of inadequate stormwater management firsthand. The progress may be related to an external incentive, but frequently is attributable to motivated local leadership pushing for improved stormwater management. It is for this reason that there are large discrepancies in use

of GI between communities. While implementation of GI may remain a largely local endeavor, federal, state, and provincial government can facilitate its adoption in communities through partnerships, policy initiatives, and funding opportunities. This report was therefore developed for federal, state, and provincial leadership to provide instruments to create enabling conditions for municipalities to implement GI. By aligning with local needs, federal, state, and provincial policy can reduce barriers for municipalities to advance GI and promote comprehensive stormwater and watershed management.

UNITED STATES POLICY BACKGROUND AND FRAMEWORK

The United States (U.S.) federal government works in conjunction with the states to manage water resources, often delegating authority to the states, as long as states comply with the minimum national requirements. States may impose more stringent standards than federally defined standards but cannot relax regulations. Each state structures their authority over cities, towns, and municipalities in different ways, granting municipalities varying levels of power to administer regulations. Stormwater management is predominantly undertaken at the local or county-wide level but is heavily influenced by the policies established by state and federal government. Thus, strategic state and federal initiatives can expand resources for stormwater management and create enabling conditions for local GI progress.

United States Federal Policy

The U.S. Federal Water Pollution Control Act, also known as the Clean Water Act (CWA), authorizes the U.S. Environmental Protection Agency (EPA) to regulate the discharge of stormwater through a National Pollutant Discharge Elimination System (NPDES) permit program (P.L. 92-500). Both combined sewer system (CSS) and urban-area municipal separate storm sewer system (MS4) discharges are regulated by NPDES permits, though MS4 communities may be unregulated if they are located outside of “urbanized areas,” as defined by the Bureau of the Census. States can apply to implement NPDES programs, and the federal government has authorized all Great Lakes states to do so. Nonetheless, it is the CWA that grants the federal government the authority to manage stormwater discharges.

The absence of language referring to GI is a barrier, so the simple act of directly incorporating GI into guidance documents is valuable.

The CWA Combined Sewer Overflow (CSO) Control Policy and NPDES permits do not require or mention the use of GI in the nine minimum controls[1] required to meet NPDES requirements. MS4 NPDES permits, on the other hand, require six minimum control measures, including post-construction runoff control[2]. Post-construction (or new development) runoff controls must include implementation of best management practices (BMPs) and permit holders are required to ensure the long-term operation and maintenance of the controls. GI is not required for runoff control nor explicitly mentioned in either the regulation or association guidelines, but examples of BMPs identified in

NORTHEAST OHIO REGIONAL SEWER DISTRICT – PROJECT CLEAN LAKE

In 2011, a Consent Decree was filed between the EPA, Ohio, and the Northeast Ohio Regional Sewer District (NEORSD) to compel the NEORSD to reduce CSO volumes from 4.5 billion gallons per year to 494 million gallons. NEORSD was required to develop a Green Infrastructure Plan that detailed how the District would meet the GI requirements in the Consent Decree: control an additional 44 million gallons of wet weather CSO volume and spend at least $42 million on GI projects (NEORSD 2012). As of 2017, NEORSD-funded projects were projected to control over 16 million gallons of stormwater, with additional grant funding ongoing.

The Fleet Avenue GI site in Cleveland will control 4.8 million gallons of stormwater per year (NEORSD).

[1] The nine minimum controls for CSO permits are proper operation and regular maintenance programs, maximum use of collection system for storage, review and modification of pre-treatment requirements to minimize CSO impacts, maximize flow to the treatment plant, prohibition of CSOs during dry weather, control solid and floatable materials in CSOs, pollution prevention, public notification of CSO occurrences and impacts, and monitoring.

[2] The other minimum control measures for NPDES permittees are public education and outreach, public participation/involvement, illicit discharge detention and elimination, construction site runoff control, and pollution prevention.

the permit guidelines explicitly include GI practices like porous pavement and rain gardens. Because GI diverges from traditional stormwater management practices and there may be uncertainty around its use, specifically listing GI as an appropriate method can remove barriers for decision-makers.

If discharges exceed permit limits, a consent decree may be issued to compel the permittee to come into compliance with the CWA. These consent decrees come in different forms with varying levels of prescriptive requirements. GI can be required or may be used to meet more descriptive targets outlined in a consent decree. Although not all of them include a GI requirement, consent decrees are currently the only U.S. federal policy mechanism that *requires* GI. Consent decrees are enforcement measures; not regulatory programs. They are issued in response to a permit violation and are generally very costly--frequently in the hundreds of millions of dollars (EPA 2017).

Numerous other federal incentives and funding sources are available for GI, the most notable being the Clean Water State Revolving Fund (CWSRF, 33 U.S.C. §1383). CWSRF is a partnership between the federal government and the states, which receive grants from EPA, match the federal funds by 20 percent, and ultimately award the funds to eligible recipients. The CWSRF primarily provides low interest loans, with some subsidies, for wastewater and stormwater projects, financing over $126 billion in water quality projects since its inception in 1987. To be eligible for CWSRF funding, a dedicated repayment source must be identified. CWSRF covers capital costs only and may not be used for operations and maintenance or monitoring. Funds from CWSRF are overwhelmingly allocated to the wastewater sector, with just over 1 percent of historical funds going toward stormwater (EPA 2018). In 2014, the program eligibility language was amended to specifically authorize stormwater runoff measures, which encompass a wide range of GI approaches. Although only small portions of CWSRF funding have been used for GI to date, the CWSRF represents a critical funding pool for GI.

As part of the 2009 American Reinvestment and Recovery Act (ARRA, P.L 111-5), 20 percent of CWSRF funding was earmarked for sustainability initiatives, including GI and water or energy efficiency projects, under the Green Project Reserve (GPR). Since the inception of the GPR, $800 million has been invested in over 600 GI projects, which accounts for only 21 percent of GPR funding (EPA 2015). Although virtually all GI practices are eligible under the CWSRF, the EPA notes that "[t]he difficulty lies in translating eligibilities to actual infrastructure. Communities are sometimes reluctant to pursue green infrastructure solutions due to a lack of familiarity, inability to secure a repayment source, or other logistical barriers" (EPA 2015). To build communities' capacity for GI, EPA initiated a technical assistance program in 2012. The technical assistance provides support for communities from planning to implementation. Given that GI comprises multiple disciplines, jurisdictions, and scales of management, developing these partnerships across levels of government is critical to improving stormwater management.

The EPA administers the CWSRF, but also has additional funding opportunities for GI. The Section 319 Grant Program was developed under the CWA to help states address nonpoint

source pollution. Grants are awarded to states, which then provide subgrants to local stakeholders. The grant program guidance specifically identifies the importance of GI in stormwater and nonpoint source management. In 2013 under the Great Lakes Restoration Initiative (GLRI), the EPA also began awarding Great Lakes Shoreline Cities grants to fund GI projects to improve water quality. The program has awarded over $10 million in grants since its inception (EPA 2016).

TECHNICAL ASSISTANCE: MACATAWA WATERSHED

The Macatawa Area Coordinating Committee (MACC) in Michigan was one of the 17 communities selected for the EPA's technical assistance program. With EPA guidance and input, key GI barriers in the watershed and opportunities to update local ordinances and codes to address those barriers were identified (EPA 2013). In 2014, MACC published the Macatawa Watershed Stormwater Guidebook to further promote GI in the area and, in 2017, hosted a GI seminar.

In addition to projects housed within the agency, the EPA is part of the Green Infrastructure Collaborative (Collaborative) with six other federal agencies and numerous nongovernmental organizations and private-sector entities. The Collaborative was formed in 2014 to help communities with their GI implementation. Federal representation includes the Department of Agriculture (USDA), Department of Defense (DOD), Department of Transportation (DOT), Department of Housing and Urban Development (HUD), and Department of Interior (DOI), and Department of Energy (DOE). The Collaborative highlights the interdisciplinary nature of stormwater management infrastructure planning, development, and outcomes. Though GI has clear ties to water quality and quantity, it also holds key associations with transportation infrastructure, resiliency efforts, and energy efficiency, among others.

Largely, agency commitments under the Collaborative include trainings, fostering dialogue and engagement, and sharing resources. However, implementation of practices at agency facilities is also included, as are some funding and incentive programs.

The DOT initiated the Transportation Investment Generating Economic Recovery (TIGER) Discretionary Grant program in 2009 and continued investment in the program is incorporated into their commitments under the Collaborative. TIGER grants are designed for capital projects related to surface transportation infrastructure that will achieve national objectives. Environmental sustainability is a primary selection criterion and avoiding adverse water quality impacts and providing stormwater mitigation, including GI, are also identified as selection criteria. Thus, the program allows and encourages GI to be incorporated into larger transportation infrastructure projects but does not provide support for standalone GI implementation.

Surface transportation infrastructure is closely tied to stormwater management, as road networks both generate and convey runoff. Transportation planning and projects are key

opportunities to more widely implement GI. Metropolitan Planning Organizations (MPOs) are required by the federal government to promote regional transportation in urbanized areas. MPOs provide a framework for regional coordination, and many have expanded beyond isolated transporation planning to include coiniciding regional development like stormwater management. Many states have additional regional planning organizations (e.g., Councils of Governments or planning commissions) that operate similarly. This regional approach can be a key tool in aligning federal, state, and local efforts.

HUD's participation in the Collaborative includes sharing lessons and resources that have come out of their Sustainable Regional Planning Grant and Community Challenge Grants programs on a web portal. Both programs provide funding for sustainable development planning, including regional GI plans. These grants compliment the Community Development Block Grant program, which funds implementation of community development projects. Although the grants themselves are not explicitly part of the Green Infrastructure Collaborative, they provide federal support for GI opportunities.

SYRACUSE CONNECTIVE CORRIDOR

Syracuse, New York was awarded a $10 million TIGER grant in 2011 for continued work on a multi-modal transportation development. Only about 50 of the applicants (of the 828) were awarded funding. The Connective Corridor includes rain gardens, porous pavements, 285 new trees, and over 4,000 shrub plantings. In total, the GI projects manage 26 million gallons of stormwater per year. Although the TIGER grant did not directly fund the GI installations, commitment to GI was included in the application and is part of the selection criteria.

GI installation along the Connective Corridor (Save the Rain).

Given the vast number of possibilities for implementing GI and the wide array of benefits, there is support for GI from multiple U.S. federal agencies. This diversity in investments is a key strength in U.S. federal GI policy. Partnerships that encompass the multi-faceted aspects of GI can help local communities leverage support for stormwater management. Because it may be easier or more efficient to incorporate GI into existing development plans, involving agencies like DOT and HUD proves to be valuable.

Recommendations

Although numerous opportunities for communities to implement GI exist, there remains little incentive for communities that are not otherwise interested in GI to do so. Should a community actively wish to implement GI, the federal government has provided various levels of support, but in the absence of motivated local government or regulatory requirements and enforcement mechanisms federal government resources will remain underutilized.

Despite growing popularity and success of GI, many local decision-makers (city planners, engineers, and elected officials) believe it carries greater risks than traditional stormwater management practices. Without any policy encouraging or guiding them to transition away from traditional "pipes and ponds," this risk simply may not seem worth it. Studies by the EPA and the American Society of Landscape Architects both found that in most cases, GI either reduced or did not impact costs (ECT, Inc. 2017). However, for many communities, the uncertainty of using new techniques often overshadows the benefits of GI.

A stronger regulatory framework compelling GI would shift the perception of risk and uncertainty for decision-makers. Currently, the only enforceable and behavior-changing component of federal policy is in the form of consent decrees for NPDES violations. Consent decrees spur innovation because communities are forced to find ways to hit defined targets. However, GI implementation stemming from a consent decrees only advances GI in the area of non-compliance, doing little to incentivize GI across a broader geography. Moreover, due to their reactive nature, the use of consent decrees is not recommended not as a standard policy mechanism for advancing GI. Development of pro-active enforceable policies that prevent threats to water bodies holds greater promise to advance greater GI implementation at less cost. Establishing enforceable policy is recommended to increase use of GI in communities not under consent decree and lacking political will or public support to independently pursue opportunities for GI. To that end, EPA should institute performance-based requirements for runoff control for new and redeveloped sites. Performance standards can be water quantity-based (e.g., infiltrate the first 1.5 inches of rainfall) or water quality-based (e.g., reduce total suspended solid [TSS] load by 80 percent). Performance standards should be descriptive in nature and be accompanied with technical guidance so that communities are not overly burdened with achieving and assessing compliance. Retrofits should also be required during infrastructure reconstruction efforts. Transportation infrastructure development policy also has strong potential advancing GI, such as requirements to maintain predevelopment hydrology for new transportation developments.

The consent decree represents the extent of the enforceable U.S. federal policy for GI.

The CWSRF should continue to be fully funded, as it represents perhaps the greatest potential in funding sources for GI. However, language and scope should be modified to

incentivize using GI in CWSRF projects. Priority systems (i.e., means of evaluating and ranking proposed projects) for awarding funds should be developed to promote GI and GI projects should be eligible for lower interest rates.

On top of uncertainty surrounding costs and effectiveness of installing GI, operations and maintenance (O&M) presents a considerable hurdle for municipalities, which have experience and familiarity maintaining traditional stormwater systems but may not know what to expect for GI. Therefore, CWSRF language should be amended to allow for funding to be used for O&M if a defined percentage of the funding is used for GI elements. Funding pools for regional planning and implementation/installation exist, but without completing the cycle to cover all phases of GI stormwater management, communities have reason to be hesitant to employ GI.

Providing funding for O&M would also increase incentives to companies to provide GI training to employees. A 2017 workforce report found that GI projects make up a small portion of the work for companies that offer GI services. Approximately 75 percent of the workforce in core GI occupations spends less than 10 percent of their time doing GI work (Jobs for the Future 2017). Well-trained, qualified maintenance staff are integral to the success of GI developments. But given the relatively small proportion of GI-related work, companies providing maintenance services may not find the training a valuable investment. Increasing O&M funding and requirements, and thus opportunities, will spur investment in workforce training. To further increase the GI workforce, EPA could establish a grant program specifically for stormwater management jobs training, similar to their Environmental Workforce Development and Job Training grants for brownfield redevelopment occupations.

It is evident through the Green Infrastructure Collaborative that EPA is working to expand GI, and these efforts should continue to be developed. EPA should promote and coordinate the integration of GI into permitting, planning, research, technical assistance, and funding programs[3]. Comprehensive integration of GI into long-term planning by means of practice should promote the acceptance of GI.

State Policy

As described above, all Great Lakes states have been granted authority by EPA to administer NPDES permits. Thus, the CWA is a backbone to GI policy in states as well. Consent decrees under the CWA may involve both the EPA and state, or states may fully execute the consent decrees, providing federal requirements are met, depending on how NPDES authority has been delegated to the state. States also partner with the EPA to administer CWSRF funds granted to states. After matching the federal contribution by 20 percent, states award loans to applicants and oversee the projects.

[3] This recommendation is consistent with the proposed Water Resources Development Act amendments, as introduced in May 2018.

All Great Lakes states are home rule states, giving local municipalities the authority to pass ordinances and govern themselves as they see fit. This further amplifies the role of local actions to reach state or federal GI priorities. Nonetheless, there are many ways that states can strengthen the ability of local governments to implement GI. States can help advance GI with funding opportunities, enabling municipalities to access alternate funding sources, and setting performance standards.

Stormwater management is typically funded through the general tax pool, but states can promote GI by providing dedicated low-interest loans or grants. Local stormwater fees can also be a valuable funding mechanism to ensure earmarked funding for GI planning, construction, and O&M. Funds from stormwater utilities may create a pool for the dedicated repayment source required by CWSRF. A stormwater utility fee or tax can also provide a funding pool for future stormwater management and serve as an incentive to install GI. Since many fees are determined based on the parcel's amount of impervious surface, reducing imperious surface using GI can result in lower stormwater volume and reduce charges. However, establishing a distinct stormwater utility that assesses, collects, and disburses funds may face barriers, depending on state law.

Public-private partnerships (P3s) present another financing mechanism for stormwater management and advancement of GI. These long-term contracts between the public and private sector increase private investment in stormwater infrastructure but may face public scrutiny due to concerns over private industry revenue margins and equitable development. State legislation can broadly enable P3s or may enable P3s for specific project types (e.g., transportation).

States can also develop performance standards for stormwater infiltration or runoff water quality. As with consent decrees, enforceable requirements that set targets can encourage innovative solutions to reach those targets. Local decision-makers may be more likely to invest in GI if doing so also accomplished compliance with state standards. While post-construction runoff control is required for MS4 NPDES permits, they do not necessarily need to meet specific standards. Performance-based standards can be applicable to MS4 permittees or can be crafted to apply to all development sites, including those in CSS and unregulated areas.

Planning initiatives that span jurisdictions and establish partnerships can improve the climate for GI development by creating a roadmap for opportunities for progress. Asset management is a critical, though often underused, aspect of water infrastructure planning. Most water systems in the Great Lakes region are not required to conduct asset management and where it is required, it is often limited to traditional drinking or wastewater systems (Great Lakes Commission 2017). Undertaking asset management and incorporating stormwater infrastructure that includes GI can ultimately lead to a better understanding of resource allocation needs to optimize infrastructure performance for phases of water management. The information gleaned from comprehensive asset management planning can help reduce barriers to implementing GI.

Minnesota

Minnesota state NPDES requirements go beyond federal water quality requirements. Language promoting GI is built into NPDES permitting, with federal BMPs required under post-construction management expanded on to note that the highest preference is given to GI practices. According to Wisconsin Sea Grant, "[e]ven the absence of language referring to GI is a barrier" to implementation, so an outright statement of preference for GI removes this barrier and encourages implementation (Wisconsin Sea Grant undated). Further, new development is required to have no net increase (from pre-project conditions) in stormwater discharge volume, TSS, and total phosphorus (TP); while redevelopment is required to result in a net reduction in each of these categories. These standards only apply to MS4 areas. For development that outside of an MS4 area, on-site retention of one inch of stormwater runoff from new impervious surfaces is required.

Minnesota statutes required the Minnesota Pollution Control Agency (MPCA) to enable and promote the implementation of GI through performance/design standards or other tools. Accordingly, the MPCA developed Minimum Impact Design Standards (MIDS) in 2013 that established the retention volume requirements. The MPCA 2017 Stormwater Manual details these requirements and further aids local governments in reaching them by providing an in-depth guide to managing stormwater, determining the most appropriate BMP for a given area, implementing the BMP, and the operation and maintenance of installed BMPs.

In addition to this operational support, funding is available in Minnesota through a variety of sources, including Clean Water Legacy Act grants, the Small Cities Development Grant program, and Point Source Implementation Grants. Minnesota has P3 enabling legislation, but only for transportation projects (ECT, Inc. 2017). Under home rule, individual municipalities can pass legislation permitting P3s for other types of projects, though at the time of publishing, none have passed in Minnesota. In Minnesota, home rule only extends to a certain classification of municipalities, termed home rule charter cities (cities without home rule are statutory cities).

Minnesota has 197 stormwater utilities - more than any state in the U.S. (Campbell *et al* 2017). Approximately 62 percent of Minnesota residents live in an area with a stormwater utility[4]. Each is structured differently at the municipal level but are generally established as fees rather than taxes. Under Minnesota State Statute 444.075, municipalities are explicitly given authority to put stormwater utility charges in place, which has two main benefits. Because the power to issue fees are a part of the state statutes, Minnesota extends the ability to levy fees not just to home rule charter cities, but also to statutory cities. Additionally, the inclusion of stormwater fees in statutes removes uncertainty from municipalities' decision-making and may serve as a prompt to cities simply by its presence.

[4] Based on reported stormwater utility communities listed in Campbell *et al* 2017 and July 2016 U.S. Census Bureau population data.

The combination of ample funding and educational resources with defined performance standards gives municipalities in Minnesota a strong foundation on which scale up GI across the state.

Wisconsin

Similar to Minnesota, the state's implementation of CWA is more stringent than is required by federal law. Discharge permits are referred to as Wisconsin Pollutant Discharge Elimination System (WPDES) permits and incorporate GI requirements. Public education components, which are required under the federal NPDES for MS4 communities, specifically include promoting GI. Although installation is not required, "[c]onsideration of environmentally sensitive land development designs for municipal projects, including green infrastructure and low impact development" is required. New development and redevelopment sites have post-construction performance standards for infiltration, TSS in runoff, and peak discharge.

The Wisconsin Department of Natural Resources (DNR) published a Watershed Permitting Guidance in 2014 to inform decision-makers about the use and implementation of watershed-wide permitting. The guidance was directed to encourage watershed permitting where appropriate to achieve water quality objectives through a holistic approach across the watershed. Watershed permitting is open to any type of discharge permit, including stormwater discharges. The Menomenee River Watershed is the first watershed in the state to implement this type of permitting for their stormwater discharges. Under the watershed permit, municipalities in the watershed developed a regional framework that includes a cooperative approach to address GI progress and challenges.

Wisconsin DNR's Urban Nonpoint Source & Stormwater Management Grant Program provides funding for stormwater management planning and construction projects. Additionallu, Coastal Management grants are available for a wide variety of projects, including GI. Wisconsin has P3 enabling legislation but only for transportation projects (ECT, Inc. 2017). Although cities and villages in Wisconsin operate under home rule, constitutional home rule is rarely used due to complicated rules and court cases which have narrowed the power of home rule.

Wisconsin has 126 stormwater utilities covering approximately 53 percent of the residents of Wisconsin[5], representing a key incentive for GI and source of stormwater management funding (Campbell *et al* 2017). State statutes specifically allow municipalities to charge a stormwater utility fee and collected revenue must be used for stormwater management (Stat. 66.0821). Given the limitations on home rule in Wisconsin, the clear authorization from the state to implement a stormwater utility is critical.

[5] Based on reported stormwater utility communities listed in Campbell *et al* 2017 and July 2016 U.S. Census Bureau population data.

Although Wisconsin lacks a dedicated statewide funding source for GI, clear performance standards, established GI requirements, and statutory authority for stormwater utilities encourage local entities to adopt GI.

Illinois

Illinois MS4 NPDES requirements include GI provisions in three areas: education/outreach, construction stormwater management, and post-construction BMPs. GI information must be included in education and outreach programs. From an installation standpoint, incorporating GI in stormwater management during construction is required to the extent practicable. GI techniques are also listed as the highest preferences of BMPs to be included post-construction and permit details require that the selection of a BMP must be accompanied by rationale for not selecting an approach with higher preference. Illinois does not have a statewide performance standard for stormwater retention or water quality of stormwater runoff, though some areas have regional post-construction standards.

Illinois passed Public Act 96-26, the Illinois Green Infrastructure for Clean Water Act of 2009, which required the Illinois Environmental Protection Agency (IEPA) to evaluate of practices influencing GI and make recommendations for policy changes to foster the implementation of GI. It also assessed the efficacy of GI techniques. Although the Act and subsequent evaluation was an encouraging sign of commitment from Illinois, the recommendations in the report (including the development of performance standards, a formal prioritization structure for SRF funds, and education) were not adopted. Several factors contributed to the lack of implementation, including the perception that some of these initiatives would be taken on by the federal government.

Illinois Green Infrastructure Grants were historically a key source of funding for GI in Illinois, with 40 grants awarded for a total of approximately $20 million since 2011. The program is not currently accepting applications but has been critical in advancing GI in Illinois. Legislative amendments to IEPA's authority, prompted by the initiation of the GPR in 2009, opened the SRF funding to GI projects in Illinois. As discussed previously, this pool of funding holds high potential for GI. Prior to 2009, only wastewater projects were eligible for the SRF program in Illinois.

Illinois Green Infrastructure Grants awarded approximately $20 million to 40 projects since 2011.

Like Minnesota and Wisconsin, Illinois has P3 enabling legislation, but only for transportation projects, though home rule authority could be used to establish P3s for other types of infrastructure. There are 27 stormwater utilities in Illinois which have generally been established in home-rule municipalities (Campbell *et al* 2017), with an additional municipality scheduled to launch a stormwater utility in 2018. Only about 8 percent of the Illinois population lives in an area

with a stormwater utility[6]. Illinois Municipal Code gives all municipalities the authority to own and operate utilities, but does not specifically permit the power to operate stormwater utilities (65 ILCS 5/Art. 11 Div. 117). Municipalities are, however, given the authority to charge user fees for stormwater systems under 65 ILCS 5/11 Div. 139. The Chicago Metropolitan Agency for Planning (CMAP) describes the authority to establish utilities as perfectly clear, but "non-home rule municipalities may feel more comfortable with more direct legislative language" (2013).

The perceived complexity of establishing a utility may also be a greater barrier than the legality of stormwater utilities. Though few stormwater utilities have been established in Illinois, many communities have undertaken feasibility studies on creating the utility and ultimately determined that other forms of revenue raising were easier. Why Illinois communities perceive this complexity as a barrier more so than in other states is not entirely evident, but the outcome of more limited stormwater utility coverage is clear.

GI requirements and prioritization for BMPs in NPDES permits elevate GI in regulated MS4 communities, and historical funding programs further advanced initiatives. However, the lack of performance standards and limited implementation of stormwater utilities may hinder GI in Illinois communities.

Indiana

Indiana MS4 NPDES permits do not directly reference GI by name, though infiltration and vegetative practices are included in the list of BMPs that can be used to satisfy BMP requirements. There is no identified preference for type of BMPs used. There are no performance standards for most permittees, the exception being the sole Phase I[7] NPDES permit holder in Indiana – Indianapolis. Under Phase I NPDES regulations in Indiana, the first inch of runoff must be treated.

There is no dedicated state-level funding for GI in Indiana, but there have been several successful GI projects funded under the Indiana CWSRF program. Indiana has P3 enabling legislation for transportation and public facilities projects. Although P3 opportunities are broadly defined in Indiana, P3s may have lost favor in the court of public opinion after an unsuccessful transportation P3 (the contract was ultimately terminated). Indiana has 80 stormwater utilities, which serve approximately 52 percent of the population[5] (Campbell *et al* 2017). Indiana state code has a chapter dedicated to stormwater management and includes provisions for levying stormwater fees (Indiana Code section 8-1.5-5-7). This authority was subsequently affirmed in an Indiana Court of Appeals decision in 2017 (*Mint Management, LLC v. City of Richmond).*

[6] Based on reported stormwater utility communities listed in Campbell *et al* 2017 and July 2016 U.S. Census Bureau population data.

[7] NPDES coverage was originally only required for medium and large cities (or certain counties) with populations of 100,000 or more. These permit holders are considered Phase I permit holders.

Legislation permissive of stormwater fees is the main form of state support for local GI implementation. GI may be inhibited by lack of funding, exclusion from NPDES permits, and no performance standards.

Michigan

The Michigan Drain Code of 1956 is a historic piece of legislation at enables Michigan to establish drainage districts, giving power and funding to watershed wide management through a county Drain Commissioner. However, the success of GI appears to be highly dependent on the administration of the county Drain Commissioner. In motivated drainage districts with leadership interested in advancing GI, progress is evident, but GI is stagnant in areas lacking the specific direction. Drain Commissioners are not solely responsible for watershed management, but rather are a unique piece of a complicated network of stormwater management that also includes municipalities, counties, and regional agencies.

Michigan has shifted away from general NPDES permits, instead requiring individual coverage for each municipality, though communities may establish cooperative agreements to work with other jurisdictions to meet the terms of their permits. The NPDES permit application prompts municipalities to include GI in their public education program. GI is not specifically noted as a BMP for post-construction runoff but "infiltration" BMPs are referenced and the associated Department of Environmental Quality (DEQ) compliance assistance document encourages the incorporation of GI. Post-construction performance standards are in place in regulated MS4 areas but not in other areas. Water volume control is required for sites that do not discharge to the Great Lakes or connecting channels of the Great Lakes, while water quality/treatment requirements apply to all regulated MS4 sites. The DEQ compliance assistance document provides guidance for how to establish and assess performance standards for a given site.

Michigan's Stormwater, Asset Management, and Wastewater (SAW) Program provides grants for GI planning and low-interest loans for GI construction. Michigan has eight stormwater utilities, and judicial precedent (the Bolt decision) creates hurdles for municipalities to collect stormwater fees (Campbell *et al* 2017,

THE BOLT DECISION

The City of Lansing, MI stormwater utility fee was challenged in court in 1998, and ultimately rescinded after the court determined the user fee was actually a tax and thus required a vote. The decision established three criteria of user fees: fees must 1) serve a regulatory purpose rather than a revenue-raising purpose; 2) be proportionate to the cost to provide the service; and 3) be generally voluntary in nature. These criteria are limiting to the establishment of stormwater utility fees. In 2011, The City of Jackson levied the first stormwater fee in Michigan since the Bolt decision, and it was subsequently struck down in court (*Bolt v City of Lansing).*

WMEAC 2017). About 12 percent of the Michigan population is covered by a stormwater utility[8]. Legislation to specifically permit stormwater utilities was introduced in 2016 and 2017, but failed to pass. P3 enabling legislation covers a wide range of public projects and could be used for stormwater contracts.

Funding for GI planning and construction is useful in advancing GI in Michigan. However, the absence of direct reference to GI in NPDES permit requirements, limitation of performance standards primarily to regulated MS4 areas, and barriers to establishing stormwater utilities restrict GI progress.

Ohio

The General Ohio MS4 NPDES permit explicitly mentions "green infrastructure stormwater management techniques" as an option for the non-structural and structural BMPs that are required under the permit. Prioritization of BMPs is not provided in the permit, though permitees are required to report rationale behind selecting the chosen BMPs. Post-construction permits have treatment requirements for TSS and floatables, but do not include volume retention standards (apart from a single permit – Big Darby Creek Watershed – outside of the Great Lakes basin). The Ohio Department of Natural Resources (ODNR) developed standards for stormwater management, land development, and urban stream protection in 2006, most recently updated in 2014, though it should be noted these standards are not requirements. Nonetheless, the standards prominently discuss

NEWARK DOWNTOWN RENOVATION PROJECT

The City of Newark, a CSS community, received a $3.8 million low-interest loan through the Alternative Stormwater Infrastructure Loan program for the Newark Downtown Renovation Project. The project was initiated in 2015 and focuses on updated streetscapes, including bricks, bioswales, and shade tree bumper islands. When completed, the project is anticipated to reduce stormwater runoff to sewers by 70 percent and reduce pollutants to the rivers by 20 to 40 percent.

Rendering of Downtown Newark bioswales (OHM Advisors)

[8] Based on reported stormwater utility communities listed in Campbell *et al* 2017 and July 2016 U.S. Census Bureau population data.

reducing impervious surfaces and using GI as stormwater management techniques to reduce overland runoff.

Ohio has an Alternative Stormwater Infrastructure Loan program that offers below-market rate loans for GI developments up to $5 million. These funds can cover design, site preparation, construction, and outreach elements, but long-term operations and maintenance is not an eligible expense for these loans. There are 106 stormwater utilities in Ohio that serve approximately 62 percent of the population[9], although the Chagrin River Watershed Partners reported that many of the utilities do not have a credit program (e.g., offer reduced fees or credits for GI installations) associated with the utility (Campbell *et al* 2017, CRWP 2017). Thus, in these communities, while the utilities can provide key funding for stormwater management that could be used for local GI installation and/or maintenance, the use of utilities as an incentive for GI may be limited. State law specifically permits municipal corporations (cities, towns, counties, etc.) to establish user fees for water, sanitary sewer, and/or stormwater, and further gives county commissioners the authority to establish regional sewer districts which also may charge fees (O.R.C. 6119). Ohio's P3 enabling legislation is limited to transportation projects, though it could be used as a financing mechanism through home rule (ECT, Inc. 2017).

Water quality performance standards, the active inclusion of GI in NPDES permits, a dedicated funding program, and local authority to establish a stormwater utility foster the advancement of GI in Ohio. The stormwater management standards are beneficial but would be more impactful if they represented enforceable requirements.

Pennsylvania

The Pennsylvania Storm Water Management Act (Act 167) was enacted in 1978 with the goal to "control post-development stormwater runoff rate, volume, and quality to replicate pre-development conditions." Act 167 requires each county to prepare and adopt a watershed-based stormwater management plan and to review and revise the plan at least every five years. Although GI is not included in Act 167 (and was not a commonly known practice or term of art at the time), watershed management plans were required to include a survey of runoff characteristics, the impacts of vegetation and existing development, and an assessment of alternative runoff control techniques and their efficiency within a given watershed. Following the adoption of the plan, municipalities are required to adopt and implement ordinances and regulations to ensure municipal development regulations are consistent with the stormwater management plan.

[9] Based on reported stormwater utility communities listed in Campbell *et al* 2017 and July 2016 U.S. Census Bureau population data.

Ordinances from these stormwater management plans can be used for NPDES permit compliance if the plan was approved by the Pennsylvania Department of Environmental Protection (PA DEP). Pennsylvania NPDES permits explicitly include GI, but do not contain any GI requirements or stated preference for GI BMPs. Under the newly revised MS4 program, MS4 communities discharging to waters designated as 'impaired' are required to quantify baseline pollutant loads and reduce sediment, phosphorus, and nitrogen loading by ten, five, and two percent, respectively. Additionally, there are post-construction standards for on-site retention and TSS, phosphorus loads, and nitrogen loads. There are not performance standards for communities that discharge to unimpaired waters.

Only 153 of the 2,862 approved projects under PennVEST have addressed stormwater, with even fewer incorporating GI.

PA DEP funds 75 percent of the costs to implement standards and ordinances identified in the watershed-based stormwater management plans, but funding does not entail development or installation of GI (PA DEP 2007). Pennsylvania's Infrastructure Investment Authority (PennVEST) is a robust funding program that includes CWSRF administration, additional Commonwealth low-interest loans, and grants for design, engineering, and construction of water infrastructure, including stormwater. Similar to the national CWSRF, use for stormwater projects has been limited: as of January 2017, only 153 of the 2,862 approved projects addressed stormwater. Presumably, only a small portion of the stormwater projects have been for GI. Thus, while PennVEST has potential for future GI funding, it does not appear to be a key funding source at present.

Pennsylvania has 12 stormwater utilities that serve approximately 14 percent of residents[10] (Campbell *et al* 2017). In 2013, legislation was amended to expand the scope of projects that can establish utilities (referred to as authorities in Pennsylvania) to include "stormwater management planning and projects" (53 PA.C.S.). Further legislation was passed in 2016 to permit some municipalities (second class townships) to charge stormwater fees without the burdensome process of establishing an authority – which requires state endorsement (P.L. 439, No. 62). Pennsylvania has P3 enabling legislation, but only for transportation projects (ECT, Inc. 2017). As a home rule state, municipalities could nonetheless enter into a P3 for water infrastructure projects.

The Pennsylvania Storm Water Management Act established a strong foundation for GI, and PA DEP funding for the planning process can help communities develop ordinances to advance GI. Additional funding opportunities further promote GI, even if they are being underutilized for GI.

[10] Based on reported stormwater utility communities listed in Campbell *et al* 2017 and July 2016 U.S. Census Bureau population data.

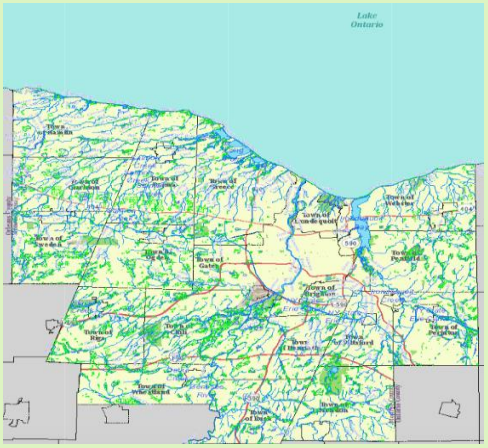
New York

The New York implementation of the NPDES program, the State Pollutant Discharge Elimination System (SPDES) requires MS4 communities to develop stormwater management programs (SWMP) in order to gain coverage under the general SPDES permit. GI is required to be considered in SWMPs. Post-construction standards require pre-construction hydrologic conditions are met and treatment of any stormwater that cannot be retained on-site. The New York State Stormwater Manual details regulations as well as BMPs to reach standards, and GI is emphasized in the Manual.

The Environmental Protection Fund (EPF), created by New York in 1993 and financed primarily through real estate transfer taxes, provides grants for a wide range of environmental projects. Since its inception, over $2.7 billion has been awarded from the EPF. Under the broader EPF, the Water Quality Improvement Project (WQIP) specifically funds water quality work, and GI can also be funded through Urban and Community Forestry Grants Program. Since 2009, the Green Innovation Grant Program has also provided funding for stormwater design and other green technologies.

MONROE COUNTY STORMWATER COALITION

Monroe County received a $100,000 grant through the Water Quality Improvement Project (WQIP) to develop a comprehensive GIS map of stormwater management practices. This will allow the Stormwater Coalition to manage GI practices as they are installed and to identify gaps where stormwater practices are not being used.



Monroe County GIS map, to be updated with GI features.

New York has one city – Ithaca, New York – with a stormwater utility (Campbell *et al* 2017), covering less than 1 percent of the population of New York.[11] New York does not have P3 enabling legislation for any type of project, but the 2011 Infrastructure Investment Act encourages private sector investment (ECT, Inc. 2017). Municipalities could also enact P3s using home rule.

Post-construction performance standards and the requirement to prepare SWMPs and consider GI fosters adoption of GI. Additionally, the availability of grants drives GI implementation.

[11]Based on reported stormwater utility community listed in Campbell *et al* 2017 and July 2016 U.S. Census Bureau population data.

Policy Analysis Summary by State

	NPDES Permit	Post-construction standards	Funding opportunities	Stormwater Utilities
Minnesota	- GI identified as highest preference BMP	- Yes: No net increase in stormwater discharge volume, TSS, or phosphorus (MS4 communities); retain 1 inch of runoff from new impervious surfaces (all areas)	- Clean Water Legacy grants, Point Source Implementation Grants, Small Cities Development Grant program	- Stormwater utilities explicitly authorized - 62 percent of state covered by a stormwater utility
Wisconsin	- public education must include GI - consideration of GI practices required	- Yes: infiltration, TSS, and peak discharge standards	- Urban Nonpoint Source & Storm Water Management grants	- Stormwater utilities explicitly authorized - 53 percent of state covered by a stormwater utility
Illinois	- public education must include GI - GI identified as highest preference BMP; rationale for selection of lower preference BMP must be reported	- None at state level	- Illinois Green Infrastructure Grants provided $20 million; no longer accepting applications	- Stormwater fees are explicitly permitted; power to establish utilities authorized but stormwater not directly referenced - 8 percent of state covered by a stormwater utility
Indiana	- No explicit reference to GI; infiltrative practices stated as option for BMP	- Only for sole Phase I MS4 community (Indianapolis): must treat first inch of runoff	- None at state level	- Authority to levy stormwater fees granted by state code; affirmed in Court of Appeals decision - 52 percent of state covered by stormwater utility
Michigan	- GI included in public education requirements - GI not specifically identified as BMP option in permit, but compliance assistance document encourages GI	- In MS4 communities only: water quality requirements for all regulated MS4s; volume requirements under many conditions	- Stormwater, Asset Management, and Wastewater Program grants and loans	- Authority to charge fees highly limited; Bolt Decision established precedent - 12 percent of state covered by stormwater utility
Ohio	- GI referenced as BMP option but no preference identified; rationale for selection of BMP must be reported	- Yes: TSS and floatables	- Alternative Stormwater Infrastructure Loan program	- User fees for stormwater authorized by state law - Regional sewer districts can be established and charge fees - 62 percent of state covered by stormwater utility, but many without credit program
Pennsylvania	- GI identified as option for BMP	- Yes: standards for communities discharging to impaired waters	- PennVEST (grants and low-interest loans) - state funds 75 percent of costs to implement standards and ordinances identified in stormwater management plans	- Stormwater utility establishment explicitly authorized, but process to establish utility burdensome - Authority to levy fees without establishing utility for certain municipalities - 14 percent of state covered by stormwater utility
New York	- GI must be considered in stormwater management programs	- Yes: pre-construction hydrologic conditions must be met; stormwater not retained must be treated	- Water Quality Improvement Project grants under Environmental Protection Fund - Green Innovation Grant Program	- Complicated regulatory framework to establish utility - One stormwater utility in state

Recommendations

States in the U.S. have a wide variety of policies that influence the prevalence and success of GI in municipalities. State-level NPDES programs provide a key mechanism for GI implementation. To maintain authorization from EPA to administer NPDES, states must meet the minimum federal requirements. However, many Great Lakes states go beyond what is required by the CWA to promote GI through requirements or standards. All Great Lakes states should follow that model, with a specific focus on incorporating GI.

Permitting programs in all states should require incorporation of GI in BMPs and public education programs. At the very least, GI should be explicitly included in the list of BMPs and identified as a preferential BMP. Requiring justification of using a lower preference BMP, as seen in Illinois permits, is also a valuable tool to promote GI: permittees have to actively defend the exclusion of GI from their planning. By compelling municipalities to consider GI when they otherwise may not, the likelihood of GI being incorporated into planning inherently increases.

Many Great Lakes states also have performance standards or post-construction requirements for water volume management and/or water quality. Creating these standards promotes innovation, even if GI is not specifically implicated as the means to achieve the standard. Municipalities and developers alike will be more likely to install GI if doing so would facilitate meeting standards. Descriptive standards that hinge on watershed outcomes are the most appropriate, as they inherently accommodate for local conditions and allow for flexibility. As discussed in the U.S. federal section, strong policy not only encourages progress but also shifts the perception of risk.

Funding is a critical component of any infrastructure development, GI included. States should dedicate funding to GI and, for broader grant or loan programs, identify incorporating GI as a preferential method in requests for applications. Eligible initiatives under state-level GI funding should include local planning efforts to address ordinances and codes. Many institutional barriers to GI exist at the local level (e.g., parking regulations, land use codes, public works standards, and community plans), thus states could expand their impact by funding local initiatives that specifically address these institutional barriers and improve the local acceptance of advancing GI as a way of doing business.

P3s represent another potential for financing GI, although there may be public pushback to incorporating P3s into water infrastructure. States should engage residents as they consider entering into a P3 to assess public perception and carefully structure the P3.

States should promote coordination and partnerships across jurisdictions and agencies to provide the foundation for local decision-makers to advance GI. Increased coordination will help identify watershed priorities and incorporate GI throughout the stages municipal planning efforts. Asset management can be a key resource in establishing and tracking watershed priorities, and GI features should be included in asset management planning to the extent it is already underway. In areas with limited asset management, states should work to develop resources and procedures to incorporate asset management in water infrastructure planning.

Outreach and education on stormwater management and GI is a critical step in increasing the prevalence of GI in communities. States should emphasize education programs and join in outreach efforts. Public perception is also important in the acceptance of stormwater utilities, which serve as both a funding source and an incentive of GI. Where this is a barrier, states should amend legislation to explicitly enable municipalities to establish stormwater utilities and levy fees. In the absence of clear direction, municipalities may be less likely to create a utility.

Because GI presents more uncertainty than traditional stormwater management, the relatively simple act of the active inclusion of GI in acceptable practices in permits, policy, design specifications can give confidence to decision-makers to incorporate GI practices in their stormwater management. Removing uncertainty will encourage communities to consider GI. Building confidence in GI practices with reliable performance data is also important to reducing uncertainty around GI installation.

CANADIAN POLICY BACKGROUND AND FRAMEWORK

Authority for fresh water resource management in Canada is divided between the Federal government and the provinces, and, in practice, results in a complex regulatory network that spans municipal, regional, provincial and Federal levels of government (Simon Fraser University 2011). The Federal government has constitutional power over fisheries, trans-boundary waters, and First Nations lands; provincial governments have power over surface and groundwater quantity and quality regulation; and regional and municipal government have responsibility for land-use planning, water services, and infrastructure (Simon Fraser University 2011). Water resource management, including GI implementation, is a shared responsibility among federal and provincial ministries, municipalities, conservation authorities, developers, property owners, and non-governmental organizations. The authority to regulate water resources is first established through legislation. Policy is developed to implement legislation, and guidelines are developed to support a specific policy or legislation.

CONSERVATION AUTHORITIES

Unique to Ontario, Conservation Authorities are local watershed management agencies that deliver services and programs to protect and manage impacts on water and other natural resources in partnership with all levels of government, landowners and many other organizations. Conservation Authorities are legislated under the *Conservation Authorities Act*, 1946.

Canadian Federal Policy

Legislation in Canada provides the legal framework and direction for the management and protection of water resources and the environment. GI is not specifically addressed in federal legislation, but there are *Acts* that nonetheless are relevant to stormwater management planning and may have the potential to advance the adoption of GI**.**

The management of water resources in Canada, including research and the planning and implementation of programs relating to the conservation, development, and utilization of water resources, is detailed in the *Canada Water Act* (R.S.C., 1985, c. C-11). It sets the stage to conduct research, collect data, and establish inventories respecting any aspect of water resource management or the management of any specific water resources. This includes developing a water quality management plan with respect to the water quality standards that shall be attained, the treatment that may be required for any waste that is or may be deposited into the water, and the types of treatment facilities to achieve the water quality standard (R.S.C., 1985, c. C-11). However, the definition of "waste" does not include stormwater.

The *Canadian Environmental Protection Act* (S.C. 1999, c. 33) targets the prevention of toxic substances entering the environment and establishes nationally consistent standards of environmental quality. GI is not specifically addressed as a means to prevent pollution and/or toxic substances from entering the environment.

The *Canadian Environmental Assessment Act* (S.C. 2012, c. 19, s. 52) protects the components of the environment from significant adverse environmental effects caused by a designated project (one or more physical activities that are carried out in Canada or on Federal lands). No specific clauses or statements addressing stormwater or GI are included in the *Canadian Environmental Assessment Act*, although its implementation requires the assessment of alternatives that would reduce adverse environmental effects, such as GI.

GI can be funded through the federal Gas Tax Fund (GTF), a component of the Building Canada Fund. The federal government provides the GTF to provincial and territorial governments, which in turn make allocations to municipalities for a variety of infrastructure projects (Infrastructure Canada undated). Funds can be invested in projects where economic, environmental, or community benefits can be demonstrated. Funds can also be invested in capacity-building projects that support municipal asset management (Infrastructure Canada undated).

Recommendations

Federal legislation and policy does not include specific authority or direction to implement GI; however, the *Canadian Environmental Assessment Act* provides the scope to include GI as a means to reduce adverse environmental effects for projects under its jurisdiction, particularly as it relates to fisheries resources. To encourage the implementation of GI under the *Act*, it is recommended that stormwater management and GI be defined in the legislation.

Through the Investing in Canada plan, the Government of Canada is making new investments in infrastructure, with a key objective to support a low carbon, green economy. Under Infrastructure Canada's Funding Programs, the Federal government has the ability to give more priority to projects that promote the inclusion of GI when assessing proposed infrastructure projects (GIOC 2017). For example, the Federal Gas Tax Fund is an important source of funding for implementing municipal infrastructure projects, which could include GI. However, it does not provide funding for long term operation and maintenance costs. Ongoing research is required to determine the costs associated with maintenance, upgrading, and replacement of GI assets; in addition to the benefits gained by protecting natural GI assets. Thus, it is recommended that a proportion of federal infrastructure funds be put to GI research and investment for stormwater management and climate change resiliency. This would also include developing a framework for dedicated funding that would assess climate change risks/vulnerabilities, update flood maps and models, implement GI upgrades, and develop adaptation plans (Amec Foster Wheeler and Credit Valley Conservation 2017).

Provincial Legislation, Policy, and Guidelines

Ontario

Water resources in Ontario are protected and conserved under the *Ontario Environmental Protection Act* (R.S.O. 1990, CHAPTER E.19) and the *Ontario Water Resources Act* (RSO 1990, c O-40). The *Ontario Environmental Protection Act* is the principal pollution control statute in Ontario and governs the discharge of contaminants into the natural environment where the discharge could cause an adverse effect. The *Ontario Water Resources Act* prohibits practices or actions that result in pollutant discharge into Ontario waters that can significantly affect water quality and ecosystem health. "Sewage" is defined in the *Ontario Water Resources Act* to include drainage and stormwater, though neither regulation promotes or references GI. The *Clean Water Act* (S.O. 2006, CHAPTER 22) gives municipalities the authority to regulate drinking water threats and specifically identifies stormwater systems, including combined sewer discharge and untreated discharge from a stormwater retention pond, as a threat to drinking water quality.

Water infrastructure and stormwater management legislation, policy, and guidelines are developed at the provincial level, while regional and municipal governments are responsible for the planning, design, establishment, operation and maintenance of municipal stormwater management. Municipal stormwater management deals with the component of the urban surface run-off that is or would be collected by means of separate municipal storm sewers, and source control facilities and practices. The *Planning Act* (R.S.O. 1990, CHAPTER P.13) promotes sustainable development and recognizes the decision-making authority of municipal governments, including providing a basis for municipalities to prepare an Official Plan for

development. Municipalities are also authorized to establish zoning by-laws and land use planning tools through the *Act*. The *Planning Act* encourages municipalities to incorporate GI policies into their Official Plans and to identify specific actions to be taken to achieve climate change objectives. These policies have the ability to encourage the implementation of GI (R.S.O. 1990, Chapter P.13, p. 18-43).

Pursuant to Section 3 of the *Planning Act*, the Provincial Policy Statement (PPS) was established in 2014 and sets the policy foundation for regulating the development and use of land while protecting resources of provincial interest, including the quality of the natural and built environment. The PPS states that "planning authorities should promote GI to complement infrastructure" and planning for stormwater management should seek to maintain hydrologic function, reduce water quality and water quantity impacts, and promote stormwater best management practices, including stormwater attenuation and re-use, and low impact development" (OMMAH 2004).

Infrastructure planning is also encouraged by the *Asset Management – Infrastructure for Jobs and Prosperity Act* (S.O. 2015, CHAPTER 15), which focuses on principled, evidence-based, and strategic long-term infrastructure planning that supports job creation and training opportunities, economic growth, and protection of the environment. The *Act* states that "infrastructure planning and investment should minimize the impact of infrastructure on the environment and respect and help maintain ecological and biological diversity, and infrastructure should be designed to be resilient to the effects of climate change" (S.O. 2015, CHAPTER 15, p.3). While GI would align with these goals, it is not incorporated in the definition of infrastructure.

The *Municipal Act* (S.O. 2001, Chapter 25) requires municipalities to have a plan that not only protects their tree canopy and natural vegetation, but also enhances it. The *Municipal Act* also "authorize[s] Cities to pass a by-law respecting the protection or conservation of the environment[…] include[ing] the power to require the construction of green roofs or of alternative roof surfaces that achieve similar levels of performance to green roofs" (S.O. 2001, Chapter 25, s.97).

The *Ontario Places to Grow Act* (S.O. 2005, CHAPTER 13) similarly addresses sustainable development: with growth plans prepared by the Minister of Municipal Affairs for designated growth plan areas (e.g. Greater Golden Horseshoe).

Specific to stormwater and wastewater, the *Water Opportunities and Water Conservation Act* (S.O. 2010, c. 19 - Bill 72) recommends the development of strategies for maintaining and improving municipal services to ensure they can satisfy future demand, consider technologies/services and practices that promote the efficient use of water and reduce negative impacts on Ontario's water resources. The Act will require municipalities to prepare water sustainability plans, including asset management, financial plan, water conservation plan, risk assessment, and customer service strategies.

The role of GI will be emphasized in the Ministry of Environment and Climate Change (MOECC) Low Impact Development Stormwater Management Guidance Manual, anticipated for release in 2019. The LID Stormwater Management Guidance Manual is an emerging document that will complement the 2003 MOE Stormwater Management Planning and Design Manual (2003 Manual), with a focus on source (lot level) and conveyance controls (MOECC 2017). The 2003 Manual provides guidance on conventional stormwater management systems (conveyance facilities and end-of-pipe facilities), with little emphasis on source controls at the lot level (e.g. infiltration, reuse, evapotranspiration methods, storage, and treatment). The new LID Stormwater Management Guidance Manual will address the advancements and innovative source control approaches currently used to manage stormwater, in addition to traditional conveyance and end of pipe controls (MOECC 2017). The Manual will also include detailed design considerations to help municipalities in meeting the source and conveyance control criteria for GI best management practices. Finally, the LID Stormwater Management Guidance Manual will emphasize the process and expectations for incorporating GI to all forms of development, including urban intensification and retrofit; and establish provincial targets for stormwater volume reduction (MOECC 2015).

GROWTH PLAN FOR GREATER GOLDEN HORSESHOE

Under the Places to Grow Act, a comprehensive land use planning policy for the Greater Golden Horseshoe Region of Southern Ontario was prepared (MMAH 2017). GI is recommended throughout the plan as a method to protect and enhance natural heritage and hydrologic features and functions and to adapt to climate change. Stormwater master plans that incorporate GI are recommended for municipalities and large-scale developments (MMAH 2017). Upper- and single-tier municipalities will also develop policies in their official plans to identify actions that undertake stormwater management planning in a manner that assesses the impacts of extreme weather events and incorporates appropriate GI and protects the Natural Heritage System and water resource systems (MMAH 2017).

GI in Ontario has the potential to be funded through the *Drainage Act* (R.S.O. 1990, CHAPTER D.17), which provides a process for the construction and maintenance of communal drainage works on both private and public lands. As defined in the *Act*, communal drainage works could include GI among the suite of drainage tools (R.S.O. 1990, CHAPTER D.17, s.1). Through the development of Assessment and Maintenance Schedules, the *Act* ensures that the cost of constructing and operating drainage works is funded by public and private users in perpetuity. The Sustainable Technologies Evaluation Program (STEP) Water partnership is carrying out a critical analysis of the *Drainage Act* to determine if it could serve as suitable legislation to

facilitate the wide-scale adoption of communally-owned GI on both public and private property (Credit Valley Conservation 2017).

The *Development Charges Act* (S.O. 1997, CHAPTER 27) also provides funding opportunities for stormwater management. Under the *Act*, the council of a municipality may through a by-law impose development charges (DC) against developers to pay for increased capital costs required because of increased needs for services from development (S.O. 1997, Chapter 27). The *Act* allows each municipality to outline its projected growth and provide justification in a background study which can shape the municipality's DCs (Baumeister 2012). In relation to GI, municipalities are enabled to collect for growth-related capital costs, which include stormwater drainage and control services (S.O. 1997, Chapter 27, s.5).

The LID Stormwater Management Guidance Manual will emphasize the process and expectations for incorporating LID in development and establish stormwater volume reduction targets for Ontario.

Québec

The Québec government policy "Politique Administrative Pour un Gouvernement Écoresponsable," aims to reduce the environmental impact of governmental activities and act in a socially responsible way. This multidisciplinary policy is based on several laws, policies, and plans, including the Action Plan on Climate Change. The latest version (2013-2020) presents 30 priorities with over $2.6 billion invested, including four priorities are related to rainwater management and/or GI (e.g. porous pavement, grassed ditches, filter belts, and green roof systems). $34 million is earmarked for the goal to adopt greener building standards, which aims to accelerate the emergence of green buildings by adding green provisions to the Québec Construction Code which set the minimal building standards. The Sustainable Rainwater Management Guide, established in 2010 by the Ministry of Municipal Affairs, Regions and Land Occupancy (MAMOT) outlines several solutions like rain gardens, green roofs, permeable pavement, street planters, and rain cisterns for implementation by municipalities.

The Ministry of Sustainable Development, Environment, and Action against Climate Change (MDDELCC), recognizing "the importance of reviewing rainwater management practices in Québec, especially now that climate change has heightened the effects of runoff on receiving water bodies" established new requirements for stormwater management in January 2012. The guidance stated goals to maximize infiltration and identified that the selection of BMPs should aim to preserve the natural hydrologic rain cycle. The MDDELCC also prepared a Stormwater Management Guide (Guide de gestion des eaux pluviales), in conjunction with the new regulations detailing BMPs. The Stormwater Management Guide presents different approaches and techniques for reducing the hydrological consequences of urbanization. In addition to

describing the most commonly used stormwater management structures, it presents criteria that can guide the planning, design and implementation of best practices. The Guide was updated in March 2014.

In 2013, the Bureau du Normalisation du Québec (BNQ) launched the BNQ 3019-190 normative guidelines to reduce the urban heat island effect, targeting stormwater management namely by proposing highly permeable materials and rainwater catchment zone by infiltration.
The legislative and regulatory framework concerns both the ministry of the Environment (MDDELCC) and of Municipal affairs (MAMOT). The Environment Quality Act (EQA; R.S.Q., c. Q-2) contains several articles that are relevant to the stormwater management. Under Article 22, construction works likely to affect the quality of the environment or which provide for the issuance, deposit, or release of a contaminant to the environment beyond the prescribed quantity or concentration must be authorized in advance by the MDDELCC. The first paragraph of Article 22 subjects the prior obtaining of a certificate all construction works and activities likely to contaminate the environment. The obligation extends to all works and activities carried out in a regular or intermittent flow stream, a lake, marsh, swamp, pond or bog. Since 2014, municipal sewer extension projects must include compensatory actions to avoid an increase in the annual frequency of combined sewage overflows, in accordance with the Canada-wide Strategy for the Management of Municipal Wastewater Effluent (CCME 2009). Compensatory measures consist of removing the equivalent flow of the development or redevelopment project from the sewer system in the municipal territory or controlling peak flows during rain conditions. This mandatory measure leaves more room for GI implementation in development projects to meet stormwater control requirements. March 23, 2018 marked the new EQA and the beginning of the gradual implementation of a new environmental permitting regime. The new EQA promises to provide Québec with a clear, predictable, and optimized authorization system that complies with the highest environmental protection standards. The approach, based on the level of environmental risk, aims at focusing efforts on projects with significant environmental impacts. This approach therefore lightens the process for lower-risk activities by allowing the use of a simple declaration of conformity from the project initiator. These activities may begin within 30 days of the Minister receiving the declaration, which is a significant reduction in time compared to the previous situation.

While the new EQA licensing regime came into force on March 23, 2018, several regulations are yet to be amended for the new permitting regime to be fully implemented. It is still too soon to measure the real impacts on GI works.

Apart from the EQA, which deals with work authorizations for sewerage systems as well as interventions on shorelines, shorelines, and flood-prone areas, several other laws and regulations may need to be considered for stormwater management. These include the *Act* respecting land use planning and development (R.S.Q., c. A-19.1), which is administered by the MAMOT. To help land use planners quickly identify all aspects of the process of developing a sustainable stormwater management plan, the MAMOT issued a GI integration guide (Guide d'intégration de la gestion durable des eaux pluviales dans l'aménagement d'un site), developed by the Québec Urban Infrastructure Research and Expertise Center (CERIU).

The Municipal Powers Act (LCM) grants authority to municipalities to establish bylaws that can include defining standards for a maximum discharge rate to sewers, which may prompt developers to include GI in their design. The LCM also allows municipalities to enter into contracts with private parties to operate its waterworks or sewer system (i.e, a P3).

LONGUEUIL PUBLIC MARKET

Longueuil Public Market opened in 2014 and consists of a 70,000 square-foot facility with two traffic lanes and 225 parking spaces. The increase in impervious surface associated with the development would have exceeded the city's maximum authorized sewer discharge rate of 10 liters per second per hectare. To come into compliance, six BMPs were installed: the recovery and storage of roof water, bioretention cells, infiltration trenches, a dry basin, gutter juxtaposed to a floodplain, and a permanent level water basin. It is estimated that collectively, these BMPs can divert 40% of rainwater in winter from the municipal stormwater network (2,062,000 liters) and 60% in summer (7,892,000 liters). The GI practices also remove an average of 80% of suspended solids and reduce fecal coliform concentrations by 99%.

Under the Québec Department of Municipal Affairs and Land Occupancy (MAMOT), Québec's 2017–2027 Infrastructure Plan calls for $7 billion in investments in municipal infrastructure. When combined with contributions from the Government of Canada and municipalities, $15 billion will be invested in five categories of municipal infrastructure over the next 10 years, including GI.

GI in Québec can also be funded with the Green Fund, established in 2006. The Green Fund is financed from the carbon market, royalties for the disposal of residual materials, and water use fees. Money from the water use fees is then reinvested in three domains: integrated water management, water quality monitoring, and initiatives that promote the acquisition, sharing and dissemination of knowledge on water.

PROMOTING EXCELLENCE IN WATER MANAGEMENT

Water treatment and distribution are key component of water conservation and the recovery of water resources. Through experience sharing and the optimization of practices, municipalities participating in Réseau Environnement's programs of excellence (PEX) can provide their citizens with 100% quality service 100% of the time. For more than 15 years, the PEXEP-T program (program of excellence in drinking water treatment) has steadily grown to become a reference throughout Québec. In fact, more than 27 municipalities have joined the PEXEP–T, which involves forty-five treatment stations serving nearly 4 million Québecers. By integrating sustainable stormwater management into the land use plan, it is possible to go further and improve water quality at the watershed scale.

With the desire to stimulate, increase capacity, and recognize the administrations that are committed to the protection of the environment, Réseau Environnement initiated the Rainwater Excellence Program which aims to control rainwater at the source and reduce pressure on the infrastructures. The participatory approach and the sharing of expertise are prioritized to establish a network of champions. In addition to be recognized as a leader in stormwater management, the municipality benefits from alternative decision-making processes and shared governance, as well as technical and educational resources to integrate new stormwater management practices and ensure the sustainability and repetition of projects. The development of this program benefits from the sharing of knowledge developed by municipalities and partner organizations such as the Urban Infrastructure Research and Expertise Center, the Ruelles Bleues-Vertes Alliance, the Québec Watershed Organisms Association, the Great Lakes and St. Lawrence Cities Initiative, and the MDDELCC.

Recommendations

The majority of the current legislation and policy that supports the implementation of GI in Canada occurs at the provincial level. However, barriers related to a lack of familiarity with GI and a lack of sufficient performance data to inspire confidence among decision makers may preclude the use of GI by municipalities. This makes it difficult for municipalities to accurately identify funding requirements for GI when limited information has been collected on its true cost and economic, environmental, and community value. Progress is underway to assign an economic value to GI, which includes life cycle benefits compared to costs. For example, in 2011 the Ontario Network for Ecosystem Services (ONES) was founded, which aims to influence policies and programs and to increase awareness and provision of ecosystem benefits and services to society. Additionally, a database of GI performance data is in progress as part of STEP (https://sustainabletechnologies.ca/) to support decision makers with design and approvals of GI

projects implemented across a wide variety of regions. This may inspire confidence amongst municipalities and developers as to the performance of GI with respect to managing stormwater.

An additional aspect of confidence building consists of establishing recognized, design and construction codes and standards. The Canadian Standards Association (CSA) recently completed the consultation phase of its new standard for Construction of Bioretention Systems and announced its intention to consult interested parties on a new bioretention systems design standard. The Bureau de la Normalisation du Québec also developed standardized guidelines.

A significant challenge of implementing GI in the Canadian portion of the Great Lakes Basin is a lack of funding. There is a strong need to create a new funding mechanism that would support capital costs and operating budgets to implement GI. To increase the financial capacity to build GI, funding can be secured through various mechanisms, such as a consistent source of federal and provincial public infrastructure funding, municipal stormwater user fees/charges, and/or incentive programs (GIOCE 2014). Several municipalities have created a dedicated funding source for stormwater management operation and maintenance through a stormwater management fee/charge (e.g., City of Mississauga, ON and Repentigny, QC). The *Drainage Act* in Ontario and the *Municipal Powers Act* in Québec allows for the development of public-private drainage infrastructure, and the *Drainage Act* ensures that the cost of constructing and operating drainage works is funded by public and private users in perpetuity. Another approach to address funding gaps around the implementation, operation, and maintenance of GI could be through public-private partnerships.

In Ontario, development charges (DCs) have the potential to be used as a funding tool that would ensure capital cost of GI stormwater infrastructure is appropriately funded upfront. However, long term maintenance of GI stormwater infrastructure cannot be addressed through DCs alone and would require funding through another revenue stream (e.g. general tax base and/or a dedicated stormwater management fee/charge). DCs can also influence the type of development that occurs and may serve as a policy instrument to achieve more efficient and intensive growth patterns and reduce sprawl into Greenfield areas. Denser development in existing urban areas typically has lower infrastructure costs than sprawling development.

In Québec, GI has started to become a mandatory component of municipal asset management plans, policies, and strategies. In Ontario, that is still to come. GI could be included as a core infrastructure asset under the *Asset Management - Infrastructure for Jobs and Prosperity Act* and the *Water Opportunities and Water Conservation Act.* The *Water Opportunities and Water Conservation Act* will require conservation plans that will establish efficiency standards and support green infrastructure implementation and give authority to the Ontario Clean Water Agency to finance and promote water/wastewater technologies, which will open additional funding opportunities for GI. Finally, applications for a stormwater management Environmental Compliance Approvals (ECA) under Section 53 of the *Ontario Water Resources Act* could be amended to make GI use a condition for stormwater approvals or expansions (Binstock

2011). This strategy has proved to be effective in Québec but requires technical guidance to support land use planners and civil engineers adapt their practice.

CONCLUSION

Although GI progress is most apparent on the local level, federal, state, and provincial governments can facilitate GI development through top-down programs aimed at removing barriers. Despite the growing need for improved stormwater management, communities may struggle to incorporate GI. Lack of familiarity with GI practices and uncertainty around the performance and financing of GI are common among local decision-makers. Given this uncertainty, putting already-limited funds toward GI may not be appealing to communities. By developing performance-based standards, establishing dedicated funding and other incentives, and educating communities on the benefits of GI, federal, state, and provincial government can improve the climate for GI adoption.

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APPENDICES

Appendix A Resources

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Appendix B Great Lakes Green Infrastructure Champions Advisory Team

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The Great Lakes Green Infrastructure Champions Advisory Team supported the preparation of this report by providing resources, jurisdiction-specific expertise, and reviewing drafts. The views expressed in the report do not necessarily reflect the opinions or positions of the individuals, agencies, organizations, or companies represented on the Advisory Team.

Appendix C Policy Analysis by State

	NPDES Permit	Post-construction standards	Funding opportunities	Stormwater Utilities
Minnesota	- GI identified as highest preference BMP	- Yes: No net increase in stormwater discharge volume, TSS, or phosphorus (MS4 communities); retain 1 inch of runoff from new impervious surfaces (all areas)	- Clean Water Legacy grants, Point Source Implementation Grants, Small Cities Development Grant program	- Stormwater utilities explicitly authorized - 62 percent of state covered by a stormwater utility
Wisconsin	- public education must include GI - consideration of GI practices required	- Yes: infiltration, TSS, and peak discharge standards	- Urban Nonpoint Source & Storm Water Management Grants	- Stormwater utilities explicitly authorized - 53 percent of state covered by a stormwater utility
Illinois	- public education must include GI - GI identified as highest preference BMP; rationale for selection of lower preference BMP must be reported	- None at state level	- Illinois Green Infrastructure Grants provided $20 million; no longer accepting applications	- Stormwater fees are explicitly permitted; power to establish utilities authorized but stormwater not directly referenced - 8 percent of state covered by a stormwater utility
Indiana	- No explicit reference to GI; infiltrative practices stated as option for BMP	- Only for sole Phase I MS4 community (Indianapolis): must treat first inch of runoff	- None at state level	- Authority to levy stormwater fees granted by state code; affirmed in Court of Appeals decision - 52 percent of state covered by stormwater utility
Michigan	- GI included in public education requirements - GI not specifically identified as BMP option in permit, but compliance assistance document encourages GI	- In MS4 communities only: water quality requirements for all regulated MS4s; volume requirements under many conditions	- Stormwater, Asset Management, and Wastewater Program grants and loans	- Authority to charge fees highly limited; Bolt Decision established precedent - 12 percent of state covered by stormwater utility
Ohio	- GI referenced as BMP option but no preference identified; rationale for selection of BMP must be reported	- Yes: TSS and floatables	- Alternative Stormwater Infrastructure Loan program	- User fees for stormwater authorized by state law - Regional sewer districts can be established and charge fees - 62 percent of state covered by stormwater utility, but many without credit program
Pennsylvania	- GI identified as option for BMP	- Yes: standards for communities discharging to impaired waters	- PennVEST (grants and low-interest loans) - state funds 75 percent of costs to implement standards and ordinances identified in stormwater management plans	- Stormwater utility establishment explicitly authorized, but process to establish utility burdensome - Authority to levy fees without establishing utility for certain municipalities - 14 percent of state covered by stormwater utility
New York	- GI must be considered in stormwater management programs	- Yes: pre-construction hydrologic conditions must be met; stormwater not retained must be treated	- Water Quality Improvement Project grants under Environmental Protection Fund - Green Innovation Grant Program	- Complicated regulatory framework to establish utility - One stormwater utility in state