



Elements of a Green Infrastructure Maintenance Business Plan

A Stakeholder-Driven Process to Determine the Preferred Approach to Green Infrastructure Maintenance in Southeast Wisconsin

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About the Green Infrastructure Technical Assistance Program

Stormwater runoff is a major cause of water pollution in urban areas. When rain falls in undeveloped areas, soil and plants absorb and filter the water. When rain falls on our roofs, streets, and parking lots, however, the water cannot soak into the ground. In most urban areas, stormwater is drained through engineered collection systems (storm sewers) and discharged into nearby water bodies. The stormwater carries trash, bacteria, heavy metals, and other pollutants from the urban landscape, polluting the receiving waters. Higher flows also can cause erosion and flooding in urban streams, damaging habitat, property, and infrastructure.

Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, *green infrastructure* refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water. Green infrastructure can be a cost-effective approach for improving water quality and helping communities stretch their infrastructure investments further by providing multiple environmental, economic, and community benefits. This multi-benefit approach creates sustainable and resilient water infrastructure that supports and revitalizes urban communities.

The U.S. Environmental Protection Agency (EPA) encourages communities to use green infrastructure to help manage stormwater runoff, reduce sewer overflows, and improve water quality. EPA recognizes the value of working collaboratively with communities to support broader adoption of green infrastructure approaches. Technical assistance is a key component to accelerating the implementation of green infrastructure across the nation and aligns with EPA's commitment to provide community focused outreach and support in the President's *Priority Agenda Enhancing the Climate Resilience of America's Natural Resources*. Creating more resilient systems will become increasingly important in the face of climate change. As more intense weather events or dwindling water supplies stress the performance of the nation's water infrastructure, green infrastructure offers an approach to increase resiliency and adaptability.

For more information, visit <http://www.epa.gov/greeninfrastructure>.

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Executive Summary

The Milwaukee Metropolitan Sewerage District (MMSD) is faced with a number of challenges related to green infrastructure. The Green Infrastructure Technical Steering Committee listed ensuring proper maintenance as their second highest priority in MMSD's 2013 Regional Green Infrastructure Plan. Many green infrastructure owners lack the resources and training to maintain green infrastructure in the long term. To address this issue, MMSD recognizes the need for a strategic business plan for green infrastructure maintenance in southeast Wisconsin. This plan will identify the general structure, funding, equipment, training, and overall collaboration needed to ensure long-term maintenance. After completion of the strategic business plan, the next step will be to prepare an implementation plan to refine the recommendations and create a clear pathway to accomplishing the work. The ultimate goal is to craft a workable, state-of-the-art program that ensures consistent and effective maintenance of green infrastructure. This process can serve as a model for other utilities around the country.

The process for developing the strategic green infrastructure maintenance business plan started with a compilation of all possible options for administering a green infrastructure maintenance program in the form of possible business models, including scenarios in which maintenance is performed by regional entities, local municipalities, and property owners. Using the broad range of business models, MMSD and EPA solicited feedback from stakeholders to determine which business models would best meet the region's needs, and then refined the business models to reflect stakeholder input. MMSD engaged stakeholders throughout the strategic green infrastructure maintenance business plan development process, recognizing that many communities and NGOs have knowledge and experience to bring to the discussion, and that stakeholder buy-in and public education are keys to successful maintenance.

This report reflects the feedback provided by MMSD and local stakeholders regarding the suitability of the different business models for conducting maintenance. The outcomes and findings from this process are intended to inform MMSD and local stakeholders as they move forward in developing a green infrastructure maintenance program for the region. The following are some of the key findings from the green infrastructure maintenance business plan development process, organized by business model:

Regional Model

- A blanket regional approach to green infrastructure operation and maintenance is not considered feasible among participating stakeholders.
- A regional approach to training and certification has potential but requires uniform maintenance and inspection standards.
- A regional approach to maintenance activities has potential on a case-by-case basis.

Local Model

- There is a need to expand green infrastructure maintenance expertise at the local level.
- Municipalities are interested in retaining maintenance responsibilities, although outsourcing aspects of maintenance is a viable option.

Owner-led Model

- Green infrastructure maintenance on private property will rely heavily on the owner-led model, increasing the need for private-property owner education and training to establish expectations and build confidence.
- There is a need for focused discussion on private-property (commercial/industrial/residential) maintenance issues, including incentives and disincentives.

The following are recommendations for steps that MMSD and municipalities in the region can take to further the development of a comprehensive maintenance business plan:

- Assess the economic implications of each option to determine economies of scale.
- Explore development of Green Infrastructure Service Center and identify suite of services.
- Research existing green infrastructure maintenance certification standards.
- Develop a maintenance and inspection training and certification program to improve local expertise and better ensure quality performance of maintenance and inspection duties.
- Consider development of contractor specifications and qualifications language.

The following are some of the lessons learned that could help other entities take a similar approach to evaluate feasible green infrastructure maintenance options and craft a strategic business plan.

- Assess existing maintenance activities to understand current approaches and capabilities.
- Be aware of municipal variations in perspectives and resources.
- Do not assume that one approach will work for everything.
- Bring all stakeholders to the table, including private-property owners, to ensure a well-balanced perspective on maintenance challenges and needs.

MMSD will continue to develop a business plan for green infrastructure maintenance. Ultimately, conducting maintenance under a strategic green infrastructure maintenance business plan will likely have to incorporate all three business models to adequately serve the existing and projected green infrastructure strategies on public and private property.

I Introduction

The Milwaukee Metropolitan Sewerage District (MMSD) is faced with a number of challenges related to green infrastructure, including planning and identifying resources for maintenance; building public awareness and changing the public's perception about the functionality of green infrastructure; gaining support for more consistent and widespread implementation of green infrastructure strategies in MMSD's satellite municipalities; helping to establish a pool of trained and certified professionals to perform maintenance; and ensuring the proper tools are in place for effective enforcement and inspection. The Green Infrastructure Technical Steering Committee listed ensuring proper maintenance as their second highest priority in MMSD's 2013 Regional Green Infrastructure Plan; communicating the benefits of green infrastructure to municipalities and the public was the fourth highest priority. In addition, the municipal code and ordinance review project underway with MMSD's service area municipalities since 2012 has consistently identified maintenance concerns as a primary barrier to more consistent and widespread use of green infrastructure in site development and public works projects.

To address the challenges associated with green infrastructure maintenance, MMSD partnered with the U.S. Environmental Protection Agency (EPA) to create a stakeholder-endorsed strategic green infrastructure maintenance business plan for southeast Wisconsin. This report provides background on MMSD's green infrastructure program and existing maintenance efforts and describes options for crafting a sustainable, stakeholder-driven maintenance business model to meet the region's green infrastructure maintenance needs as well as other regional objectives (e.g., educating the public, creating jobs, and providing opportunities for job training).

I.1 MMSD Regional Green Infrastructure Plan

MMSD (2011) has established a 2035 Vision of zero basement backups, zero overflows, and improved water quality in Southeast Wisconsin. The Regional Green Infrastructure Plan (Plan) documents focuses in on a cornerstone for meeting MMSD's 2035 Vision—capturing the first 0.5 inch of rainfall on impervious surfaces, the equivalent of 740 million gallons of stormwater storage for each storm (MMSD 2013). The Plan focuses on approaches that would treat runoff from impervious surfaces and enhance the absorptive capacity of turf grass areas to provide economic, social, and environmental benefits to the region. Table 1 summarizes the quantity of green infrastructure needed to achieve the 740 million gallon stormwater storage target.

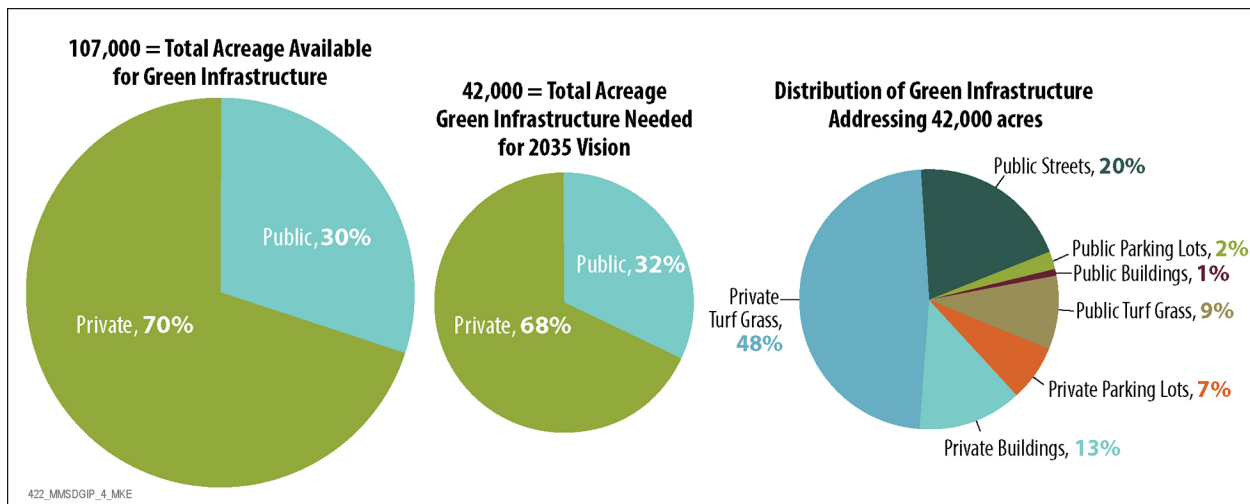
According to the Plan, there are approximately 107,000 total acres available for green infrastructure (70 percent private land, 30 percent public land). Of the total acres, green infrastructure is needed on 42,000 acres (68 percent private, 32 percent public) to achieve the 2035 Vision goal. The distribution of green infrastructure among private and public lands on those 42,000 acres includes private turf grass (48 percent), private buildings (13 percent), private parking lots (7 percent), public streets (20 percent), public turf grass (9 percent), public parking lots (2 percent), and public buildings (1 percent). Overall, green infrastructure from impervious areas provides approximately 60 percent of the volume goal, with the remaining 40 percent provided by green infrastructure from turf grass areas.

Table I. Green infrastructure needs to achieve the per storm 740 million gallon stormwater storage target.

Green Infrastructure Strategy	Quantity	Description
Green roofs	1,490 acres	Equivalent to 13,000 buildings with new green roofs (assumes 5,000 square feet per roof)
Bioretention/bioswales/greenways/rain gardens	650 acres	Equivalent to 189,000 rain gardens (10 feet by 15 feet each)
Stormwater trees	738,000	Equivalent to nine new trees per average city block
Native landscaping	8,600 acres	Equivalent to 1,700 average city blocks with native landscaping
Porous paving	1,190 acres	Equivalent to 10,300 average city blocks having 25 percent porous pavement
Rain barrels	152,000	Equivalent to 152,000 homes with one rain barrel each
Cisterns	2,020	Equivalent to 2,020 larger buildings with a cistern (assumes minimum 6,500 square foot roof)
Soil Amendments	15,200 acres	Equivalent to 2,900 average city blocks with soil amendments

Source: MMSD 2013.

Examples of green infrastructure projects include green roofs for businesses and public properties, porous pavement for streets and parking lots, green streets, stormwater trees, rain gardens, rainwater catchment systems, native landscaping to replace turf, and constructed wetlands. Figure 1 shows where green infrastructure is recommended to be distributed across public and private lands (MMSD 2013).



Source: MMSD 2013.

Figure I. Green infrastructure planned for 42,000 acres.

The Plan summarizes the multiple economic, social, and environmental benefits that green infrastructure provides to residents, municipalities, and the public. It also lays out strategies for stakeholders throughout the region to maximize their investments in green projects. The Plan builds upon past success in the region and sets out the following objectives:

- Capture the equivalent of the first 0.5 inch of rainfall from impervious surfaces with green infrastructure.
- Strive towards the 2035 Vision rainwater harvest goal of the first 0.25 gallon per square foot of area of rainfall for reuse.
- Complement MMSD’s Private Property Inflow and Infiltration (I&I) Reduction Program and Integrated Regional Stormwater Management Program.
- Help municipalities and other entities prioritize green infrastructure actions.
- Help meet receiving water quality standards by acknowledging Watershed Restoration Plan recommendations for the Menomonee and Kinnickinnic Rivers.
- Meet MMSD’s Wisconsin Pollutant Discharge Elimination System (WPDES) discharge permit requirement for installing green infrastructure volume capture within the MMSD service area.

1.2 Overview of MMSD’s Current Green Infrastructure Maintenance Activities

MMSD has significant experience operating and maintaining grey infrastructure, including pipes, inline storage structures, pump stations, and water reclamation facilities. Satellite communities similarly have experience maintaining sewer systems and other “grey” infrastructure components. The majority of MMSD’s maintenance budget is targeted towards operating water reclamation facilities, including CSO control infrastructure. To date, green infrastructure has been only a small part of this budget.

MMSD has both a capital budget, which is funded primarily by property taxes, and an operation and maintenance (O&M) budget funded primarily by user charges. Projects funded under the capital budget are generally larger in scale than projects funded under the O&M budget.

Typically, in order for green infrastructure project installation to be funded from the capital budget, the District must secure a long-term interest such as a conservation easement in the infrastructure. As of December 2014, the distinction between the capital and O&M budgets is important when assigning others to maintain green infrastructure. The capital budget typically funds projects like greenways, porous pavement, bioretention, and wetlands. O&M funding typically goes

MMSD’s WPDES Permit Green Infrastructure Requirement

“...must ensure that green infrastructure practices/control measures are put in place and maintained in the MMSD service area.”

“Any green infrastructure practices/control measures that are put in place to fulfill the retention capacity requirement must be maintained during the term of this permit.”

toward smaller projects such as green roofs, rain barrels, rain gardens, native landscaping, and trees. This is always the case for private property installations.

MMSD does not typically build and maintain green infrastructure. However, MMSD does provide funding to others, including municipalities and area businesses, to install green infrastructure projects and requires the funding recipient to provide maintenance for 10 years (prior to 2013, the requirement was for five years) through maintenance agreements. For projects funded through the capital budget, MMSD sets maintenance requirements through conservation easements. MMSD began developing condition assessment forms in 2013 to ensure that funding recipients fulfill their maintenance obligations. These forms will be updated as new field needs arise, and MMSD hopes to incorporate this information into its asset management system.

MMSD has expanded its efforts related to workforce development and pre-apprenticeship to include local worker employment in green infrastructure installation, sometimes referred to as the Fresh Coast Jobs Initiative. In 2014, MMSD collaborated with Groundwork Milwaukee to employ ten young adults for 10 weeks on rain garden and rain barrel installation projects in two Milwaukee neighborhoods. As a part of this summer program, participants were introduced to career pathways in water technology and the construction trades. In 2013 and 2014, MMSD utilized summer interns to expand neighborhood and community engagement and facilitate residential property owner education and green infrastructure installation. In this effort, MMSD is also working with the Milwaukee Area Workforce Investment Board (MAWIB) as a partner to provide internship to students in the Milwaukee Area Technical College's Water Technology Certificate Program. MMSD will continue to use the resources of its Workforce & Business Development Program and collaborations with local workforce development partners to expand training, employment, and contracting opportunities for workers and businesses alike to participate and succeed in this developing industry.

MMSD has developed a green infrastructure maintenance manual that includes standard operating procedures (SOPs) and condition assessment forms. This manual is still in draft form and is not yet publicly available.

MMSD is also focused on finding ways to inexpensively and remotely monitor maintenance needs of green infrastructure. The lack of methods for credible and time-efficient monitoring of how green infrastructure systems are performing in the field was cited consistently as a barrier by municipal staff and consulting engineers participating in the code and ordinance project. MMSD is collaborating with its private operator, Veolia Water Milwaukee, who is leading a study to help identify ways to remotely meter and detect green infrastructure performance in different seasons. This capability will be important as MMSD continues to expand the region's green infrastructure, and to rely on its capacity to manage stormwater.

Maintenance of municipally owned green infrastructure is performed by a wide variety of parties. In general, some combination of municipal staff—including contractors or volunteers—is employed to do this work. In some cases, the contractor has to perform maintenance during the period of establishment. Several municipalities have developed structured programs with SOPs and maintenance plans. MMSD would like municipalities to share their experiences with others as they undertake new green infrastructure projects.

I.3 Developing a Strategic Green Infrastructure Maintenance Business Plan

Many green infrastructure owners lack the resources and training to maintain green infrastructure in the long term. To address this issue, MMSD recognizes the need for a strategic business plan for green infrastructure maintenance in southeast Wisconsin. This plan will identify the general structure, funding, equipment, training, and overall collaboration needed to ensure long-term maintenance. After completion of the strategic business plan, the next step will be to prepare an implementation plan to refine the recommendations and create a clear pathway to accomplishing the work. The ultimate goal is to craft a workable, state-of-the-art program that ensures consistent and effective maintenance of green infrastructure. This process can serve as a model for other utilities around the country.

I.3.1 Process Overview

The process for developing the strategic green infrastructure maintenance business plan started with a compilation of all possible options for administering a green infrastructure maintenance program in the form of possible business models. In addition, EPA conducted a preliminary review of existing MMSD and municipal green infrastructure strategies and maintenance approaches. Using the broad range of business models, MMSD and EPA solicited feedback from stakeholders to determine which business models would best meet the region's needs, and then refined the business models to reflect stakeholder input. EPA then prepared a draft report that summarized the findings related to the refined business model for MMSD and local stakeholder review and feedback. This report reflects the feedback provided by MMSD and local stakeholders. The outcomes and findings from this process are intended to inform MMSD and local stakeholders as they move forward in developing a green infrastructure maintenance program for the region. This report provides a foundation for the next steps in the overall process.

I.3.2 Stakeholder Involvement

MMSD engaged stakeholders throughout the strategic green infrastructure maintenance business plan development process, recognizing that many communities and NGOs have knowledge and experience to bring to the discussion, and that stakeholder buy-in and public education are keys to successful maintenance. The process for involving stakeholders started with the development of a project communication plan that identified goals, target audiences, potential messages and outreach formats, as well as communication channels. The project communications plan is available in Appendix A. EPA worked with MMSD to identify the most effective manner to reach key stakeholders by coordinating dialogue opportunities with planned green infrastructure meetings and offering two sessions for facilitated community discussions. MMSD scheduled the first stakeholder meeting to coincide with the September 2014 Technical Advisory Team (TAT) meeting. The TAT is comprised of representatives from the 28 municipalities in MMSD's planning area. Following the TAT meeting, MMSD invited key stakeholders representing local government, businesses, landscaping contractors, workforce development organizations, and environmental non-governmental organizations to participate in two facilitated community discussions. During each of these meetings, stakeholders heard presentations on the range of potential green infrastructure maintenance business models and engaged in discussion on the merits and challenges associated with each. Stakeholders also discussed maintenance challenges they face with each type of green infrastructure strategy. MMSD made the presentation materials and the meeting summary available on MMSD's FreshCoast 740 website (www.freshcoast740.com). These materials are available in Appendix B.

In addition to the facilitated community discussions, EPA developed survey questions for the key stakeholder groups for MMSD to distribute. The survey was intended to get additional stakeholder

feedback on current green infrastructure maintenance activities and associated costs, gauge interest in specific aspects of the potential business models, and identify areas of potential collaboration and cooperation. Survey questions and summarized results are available in Appendix C.

This report presents stakeholder feedback obtained through the facilitated community discussions and the survey in relevant sections on current green infrastructure maintenance activities and the potential business models. The major conclusions presented at the end of this report also reflect stakeholder input provided throughout the process.

I.3.3 Report Organization

The subsequent sections of this report present the information compiled and assessed through the process described above. Section 2 describes the factors that influence how a green infrastructure maintenance program is administered. Section 3 provides an overview of the elements of a green infrastructure maintenance program, including maintenance activities, training, inspections, certification of maintenance professionals, tracking maintenance, and funding. Section 4 describes the business model options for each of the maintenance program activities, refined with stakeholder input. Section 5 presents conclusions and next steps to develop the strategic green infrastructure maintenance business plan.

2 Overview of Factors Influencing Green Infrastructure Maintenance

Like all infrastructure, green infrastructure strategies require maintenance to ensure proper function. However, green infrastructure maintenance activities and logistics differ from the activities and logistics associated with traditional stormwater infrastructure. For example, green infrastructure generally is smaller-scale than traditional stormwater ponds and basins. It is dispersed among multiple parcels, and there may be several small-scale strategies located on a single parcel. This is in contrast to regional stormwater ponds or dry detention basins that provide a central treatment point for runoff from an individual property or subdivision, or in the case of regional systems, that treat runoff from multiple properties in a single, large facility. There are several factors that influence successful maintenance of green infrastructure strategies. These factors include property type and ownership, scale, design, and funding, and are discussed in the following sections.

2.1 Property Type and Ownership

Stormwater management infrastructure of all types is located on a combination of public and private properties, and is found within transportation and utility rights-of-way as well. Each type of property and ownership or easement structure involves different considerations for maintenance, and particularly for the types of vegetation-intensive, distributed strategies associated with green infrastructure. Property type and ownership can influence maintenance in terms of who the responsible entity might be, restrictions on access and activities within the land area, and the training, equipment, and other resources the responsible entity has available to perform the maintenance. Therefore, it is important to consider the issue of property type, ownership, and maintenance responsibility when developing a strategic green infrastructure maintenance business plan.

Strategies on public property and in the right-of-way are generally managed by public agencies. Volunteer crews may be used for activities such as rain garden or rain barrel installation, streambank planting, or removing invasive species. Depending on the type of strategy, its location, and maintenance needs, green infrastructure strategies might be maintained by a public works department, parks department, transportation department, sewer authority, or similar departments. Each department has different skill sets and equipment; parks staff might be more experienced in vegetation management, whereas public works or transportation departments are more likely to have equipment for sediment removal and street sweeping. Staff training might be needed to ensure that maintenance crews are able to recognize problems with green infrastructure and know which routine and remedial maintenance actions are needed.

Green infrastructure on private property might be maintained by the property owner, volunteers, or a public agency. The type of property maintenance service depends in part on the type of property (i.e. residential, institutional, commercial) and also on the types of common open spaces and land areas involved (i.e. parking lots, common areas in a residential subdivision, etc.). Commercial and institutional properties, in particular, often use contracted maintenance services to manage landscapes and stormwater management systems.

If property owners are solely responsible for performing stormwater maintenance, the cost of that maintenance is borne by individuals rather than the community as a whole. Property owners would need education, guidance, and possibly training about their responsibility for maintenance and how to properly conduct the necessary maintenance activities, based on the type of green infrastructure strategy. In some instances, a maintenance agreement or other legal mechanism might be needed to

ensure compliance with maintenance requirements and to allow entry for inspections, if performed by an entity other than the property owner. MMSD currently has a maintenance requirement—typically 10 years—as part of its partnership funding award agreements for both public and private property.

Given the property types and ownership of green infrastructure strategies, there are three entities with potential primary green infrastructure maintenance responsibilities:

1. Regional entities, like MMSD or possibly a new regional entity formed to address green infrastructure maintenance needs.
2. Local governmental entities, like municipalities and counties, that often use contracted maintenance and landscaping services.
3. Private property owners, who may in some cases also use contracted maintenance and landscaping services. The appropriate roles for each of these entities in a long-term green infrastructure maintenance program are discussed in a later section of this report.

Other groups—such as non-governmental organizations, business improvement districts, and volunteers—might work with the three entities described above to collaboratively address green infrastructure O&M needs.

2.2 Scale

One of green infrastructure’s defining features is the variety of scales at which these strategies work. While most green infrastructure strategies are considered small-scale, there are variations in spatial scale of these strategies that have important implications for maintenance. For example, green infrastructure strategies can have site applications (e.g., green roofs, rain gardens), neighborhood applications (e.g., green streets, wetlands), and regional applications (e.g., preservation of open space, such as MMSD’s Greenseams® program). Regional strategies might require regional oversight, especially if the strategies cross municipal boundaries. Parcel-based green infrastructure strategies can be small (500–2,000 square feet) or large (0.1 acre or greater), and often involve multiple small-scale features, but are generally managed at the local or property owner level. Understanding scale is important to the Milwaukee region’s maintenance needs. Municipal staff participating in an MMSD-supported review of local codes and ordinances indicated that the challenge of managing multiple different, small-scale strategies, and ensuring that a system made up of these types of strategies is performing to the standards required in a stormwater permit, is a significant deterrent to greater acceptance of green infrastructure strategies.

2.3 Green Infrastructure Design

Because maintenance needs and costs are key considerations in the design of green infrastructure, it is important to address these considerations during the design phase to ensure that the green infrastructure strategy will not only be appropriate for the specific circumstances, but also suitable for local climate, rainfall patterns and other factors. For example, a forebay at the inlet will slow the runoff and collect sediment, oils and grease, and other pollutants. A forebay can be designed for easy cleaning and will protect downstream parts of the green infrastructure from clogging.

Design should also consider the potential for erosion, which can be a problem if the substrate is insufficiently secured, there are steep slopes, or if the system experiences high flow rates. Erosion will reduce the effectiveness and the life span of the system. In systems that include vegetation, native plant species should be selected as they are already adapted to local climate conditions. This will help to increase the rates of plant survival and reduce maintenance costs.

Ensuring that green infrastructure projects are planned and designed with maintenance in mind can help maximize environmental benefits and reduce the cost of the project over its lifespan. Several important maintenance factors to consider prior to project implementation include:

- Type of maintenance to be performed
- Frequency of maintenance and available personnel to perform maintenance
- Cost of replacement components (e.g., plants, shrubs, porous pavement)
- Availability of component replacement (e.g. plant nurseries, permeable surfacing suppliers, etc.)
- Sufficient funds in place to cover maintenance activities, including the cost of replacement components.

Developing a maintenance plan for a particular site or a manual that describes maintenance for a particular type of green infrastructure strategy can also help ensure green infrastructure projects are sustainable and continue to protect water quality and effectively manage stormwater. Maintenance plans often include basic elements such as:

- Identification of the parties responsible for maintenance
- Maintenance schedules
- Inspection requirements
- Frequency of inspections
- Easements or covenants for maintenance
- Identification of funding sources (USEPA 2013).

In addition, maintenance plans could also include estimated costs to help with annual fiscal planning, as well as specific requirements from a product manufacturer, depending on the materials used in the green infrastructure strategy.

Figure 2 lists various design elements and field strategies that can be implemented to reduce the cost and intensity of required maintenance.

Design Elements to Optimize Maintenance

- Consider upstream and downstream site attributes
- Ensure accessibility (right-of-way, easements, vehicle access, cleanouts)
- Document maintenance requirements (sediment removal schedule)
- Communicate function, use and specialized maintenance needs (signage, manuals, etc.)
- Involve maintenance staff in selection and design
- Install pretreatment (sediment traps, vegetative buffers, etc.)
- Use anti-clogging devices (inlet/outlet)
- Plan to inspect regularly (look for maintenance triggers such as ponding, conduct infiltration tests)
- Select appropriate vegetation (native plants, maximum height for roadways and safety)

Field Practices to Optimize Maintenance

- Keep sediment out of planting area
- Certify soils and other materials
- Inspect all plants prior to planting
- Stabilize exposed areas prone to erosion
- Ensure that strategies are well-defined and understood before assuming responsibility for them

Source: Tetra Tech 2010.

Figure 2. Maintenance considerations.

2.4 Resource Availability

Identifying resources for green infrastructure maintenance, in the forms of funding, equipment, and expertise, are crucial to the success of a strategic green infrastructure maintenance business plan. A strategic green infrastructure maintenance business plan should address funding, equipment, and training needs to ensure entities responsible for maintenance have the appropriate budget, materials, and knowledge. Where possible, a strategic green infrastructure maintenance business plan should identify opportunities to leverage existing resources among entities with a responsibility for and interest in green infrastructure maintenance.

3 Elements of a Green Infrastructure Maintenance Plan

A successful maintenance program is built on the foundation of a regulatory framework that requires owners of green infrastructure strategies to maintain the systems according to an established standard. Typically, requirements for green infrastructure maintenance are set forth in maintenance agreements developed for individual properties or strategies; those agreements are not necessarily standardized from one property to the next. A common set of standards or a template for maintenance agreements can be developed to ensure that all maintenance agreements include a set of essential elements and required programmatic and technical tasks. These tasks are the basic elements needed for a strategic green infrastructure maintenance business plan and include the following:

- **Maintenance Activities.** This element focuses on conducting the appropriate maintenance activities for a particular green infrastructure strategy at the necessary frequency using the right equipment.
- **Training.** This element ensures that all potential entities responsible for green infrastructure maintenance—from individuals to landscape contractors to municipal staff—have the expertise necessary to conduct maintenance activities.
- **Inspection.** This element focuses on field visits of green infrastructure strategies to ensure all of the components are functioning properly and, if necessary, that maintenance needs are documented and reported to the appropriate entity responsible for performing maintenance activities.
- **Certification.** This element applies standards to training and inspection requirements, allowing individuals and organizations the opportunity to demonstrate knowledge of these standards and establish themselves as trusted providers of green infrastructure maintenance-related services.
- **Tracking.** Effective green infrastructure maintenance requires comprehensive knowledge about the type, location, and maintenance needs of green infrastructure strategies. This element focuses on documenting this information over time and sharing this information with green infrastructure strategy owners and the entities responsible for inspections and maintenance.
- **Funding.** Identifying and sustaining consistent sources of funding to finance green infrastructure maintenance is a key element of a successful strategic green infrastructure business plan. Funding mechanisms should be dedicated and reliable to ensure green infrastructure maintenance is not undermined as a result of competing priorities.

These are the basic elements that should be considered when developing and implementing a strategic green infrastructure maintenance business plan. This section provides an overview of each of these green infrastructure elements, including the current approaches used by MMSD and local stakeholders to address these elements. An informal survey of key stakeholders (e.g., local government staff, non-governmental organizations, contractors/landscapers, residents/businesses, and workforce development organizations) provided insights on current green infrastructure maintenance practices and perspectives in southeast Wisconsin. Understanding current approaches to these green infrastructure maintenance elements is essential to identifying potentially feasible options for improved coordination and integration through a strategic green infrastructure maintenance business plan for southeast Wisconsin.

3.1 Maintenance Activities

Maintenance activities, frequency, and equipment needs vary for each type of green infrastructure strategy. While the current suite of green infrastructure strategies funded by MMSD in southeast Wisconsin consists of primarily green roofs, permeable pavement, and rain catchments, the projected number of green infrastructure strategies needed to meet the volume goals for the region will significantly increase both the variety of types and total number of green infrastructure strategies over time. As a result, the need to conduct green infrastructure maintenance activities will increase and diversify over time.

Unlike traditional stormwater infrastructure, most green infrastructure involves vegetation. Healthy vegetation is one of the key factors in the successful performance of these strategies. Therefore, vegetation maintenance is an important component of a green infrastructure maintenance program. Such maintenance includes watering during the establishment phase, assessing plant health, pruning, mulching to control weeds when appropriate, removing unwanted vegetation, and replacing plants as necessary. Additionally, green infrastructure strategies require trash, debris and sediment removal, and sometimes structural and erosion-related repairs, possibly on an increased frequency based on location of the strategy and the associated pollutant types. For example, infiltration strategies located near streets, with increased loadings of salt and other pollutants, might require a change in the top 3-5 inches of soil every five years.

Green infrastructure infiltrates runoff to filter out pollutants and retain stormwater, so the permeability and overall health of the soil is critical to the performance of green infrastructure. Infiltration rates can diminish over time if the surface of a green infrastructure strategy becomes clogged with fine particles, organic matter (leaf litter), or other materials that prevent percolation. Soils also can become compacted if strategies are subject to excessive foot or vehicle traffic. Soils may need to be scraped, aerated, tilled, or replaced if standing water is present several days after a storm, which would indicate poor drainage. Permeable pavement may need to be vacuumed or, in the most challenging cases, the pavement removed and reinstalled to restore permeability.

Table 2 provides an overview of green infrastructure strategies and the general types of associated maintenance activities, including maintenance frequency and equipment needs. As mentioned in Section 1, MMSD has developed a draft green infrastructure maintenance manual that includes SOPs for each type of green infrastructure strategy. The information in Table 2 is currently consistent with the information in MMSD's draft green infrastructure manual; the information in the manual will continue to evolve.

Table 2. Green infrastructure strategy maintenance activities, frequency, and equipment needs.

Strategy	Maintenance Activities	Frequency	Equipment Needed
Rainwater Harvesting	Check for visible damage or leaks and repair	As needed	
	Check for any debris or obstructions in the gutter, downspout, or diverter	Spring and fall, or as needed	Ladder
	Drain and clean the cistern or rain barrel	Annually before winter	Hose
	Store empty rain barrel	Over winter	
	Empty barrel if rainfall is predicted	As needed	
Rain Gardens	Check and remove litter and plant debris	Spring and fall, or as needed	
	Thin crowded vegetation	Spring and fall, or as needed	Shovel, pruning shears
	Check soil performance and quality to determine if exposure to pollutants is affecting vegetation (e.g., white soil from too much salt)	Spring and fall, or as needed	
	Check and correct any erosion in the rain garden	As needed	
	Add new mulch if appropriate	Spring	Shovel, rake
	Remove and replace any dead and diseased plants	Spring and fall	Shovel
	Mow turf areas to the height prescribed by the local municipality	As needed during the growing season	Mower
	Check for and remove unwanted vegetation (e.g., weeds, invasive species)	As needed during the growing season	Shovel, weed puller
Native Landscaping	Water plants	As needed during extended hot and/or dry periods	Hose or irrigation system
	Trim vegetation back	Annually in fall	Pruning shears
	Check for and repair bare or eroded areas	As needed during the growing season	
	Check for and remove unwanted vegetation (e.g., weeds, invasive species)	Spring and fall, or as needed	Shovel, weed puller
	Remove and replace any dead and diseased plants	Spring and fall	Shovel
	Thin crowded vegetation	Spring and fall, or as needed	Shovel

Strategy	Maintenance Activities	Frequency	Equipment Needed
Stormwater Trees	Water trees	As needed during extended hot and/or dry periods	Hose, irrigation system, or tree water bags
	Add new mulch if desirable	Spring	Shovel, rake
	Check for exposed tree roots, clumps of grass, and leaning	Spring and fall	
	Rake, collect, and dispose of or compost leaves	Fall	Rake and potentially compost bin/pile
	Trim branches to remove broken/dead twigs and for clearance	Winter, early spring, or summer	Pruning shears
Permeable Pavement	Check for leaves, grass clippings, mulch, sediment, and trash	After heavy rain	Flat-blade shovel, trash grabber
	Check the pavement for any residing water, debris, or trash	After heavy rain	
	Vacuum sweep to help prevent clogging and ensure water passes through the pavement (consult product recommendations)	As needed if sediment or ponding is observed	Vacuum-powered street sweeper
	Maintain any surrounding planted areas to avoid unwanted/dead vegetation in pavement spacing	Spring and fall, or as needed	Shovel, rake
	Inspect the pavement to check for any sunken, damaged or missing units/sections and replace them as needed or supplement the aggregate between the pavers	Annually	Additional pavers
Bioswales	Check for any water that does not properly drain	After heavy rain	
	Check for trash and debris collected around the bioswale	After heavy rain	Shovel, rake, trash grabber
	Check for and remove any materials that may cause clogging	Spring and fall, or as needed	Shovel
	Prune or trim vegetation	Annually or as needed during the growing season (depending on the vegetation)	Pruning shears
	Check for bare areas, exposed roots, and cracks in soil	Spring and fall	Shovel, rake
	Remove and replace any dead and diseased plants	Spring and fall	Shovel

Strategy	Maintenance Activities	Frequency	Equipment Needed
Green Roofs	Remove dead, diseased, overgrown, or unwanted vegetation (e.g., weeds, invasive species)	Spring and fall	Ladder if needed to access roof, shovel
	Check for bare areas and replace vegetation	Spring and fall	Ladder if needed to access roof, shovel
	Inspect roof for damage and/or leaking using flood tests or low-voltage leak detection and make repairs if necessary	Spring and fall	Ladder if needed to access roof
	Check for any clogging and repair	As needed	Ladder if needed to access roof
Greenways	Check to make sure water is properly draining and not ponding	After heavy rain, as often as feasible	
	Check for and remove trash and/or debris	After heavy rain, as often as feasible	Shovel, rake, trash grabber
	Replace dead and diseased vegetation	Spring and fall	Shovel
	Check for and remove unwanted vegetation (e.g., weeds, invasive species)	Spring and fall	Shovel, weed puller
Wetlands	Check for and repair any erosion	After heavy rain, as often as feasible	
	Check for clogged riser or bypass structure	After heavy rain, as often as feasible	
	Check the riser, barrel, and embankment for failure (e.g., separation of structural components)	After heavy rain, as often as feasible	
	Check the low-level release valve for leaking or if the liner has failed	After heavy rain, as often as feasible	
	Check for and remove dead, diseased, overgrown, and unwanted vegetation (e.g., weeds, invasive species)	Spring and fall	Shovel, rake, weed puller
	Check for bare areas in the wetland area and revegetate if necessary	Spring and fall	Shovel
	Check for and remove unwanted vegetation (e.g., weeds, invasive species)	Spring and fall, or as needed	Shovel, weed puller
	Check for any clogging caused by debris or vegetation and thin if necessary	Spring and fall	Shovel

3.2 Training

Training programs focused on the unique characteristics of green infrastructure can help to promote effective maintenance activities and inspection procedures among individuals, organizations, and businesses with a role in green infrastructure maintenance. Training resources can vary from hands-on, field training sessions to how-to videos to guidance manuals and fact sheets. Stakeholder survey results indicate that 2 of 6 responding nonprofit organizations and 1 of 12 responding landscapers/consultants provide green infrastructure training, while 6 of 12 responding landscapers/consultants have had hands-on training and 5 of 12 responding landscapers/contractors have used training manuals (Figure 3).

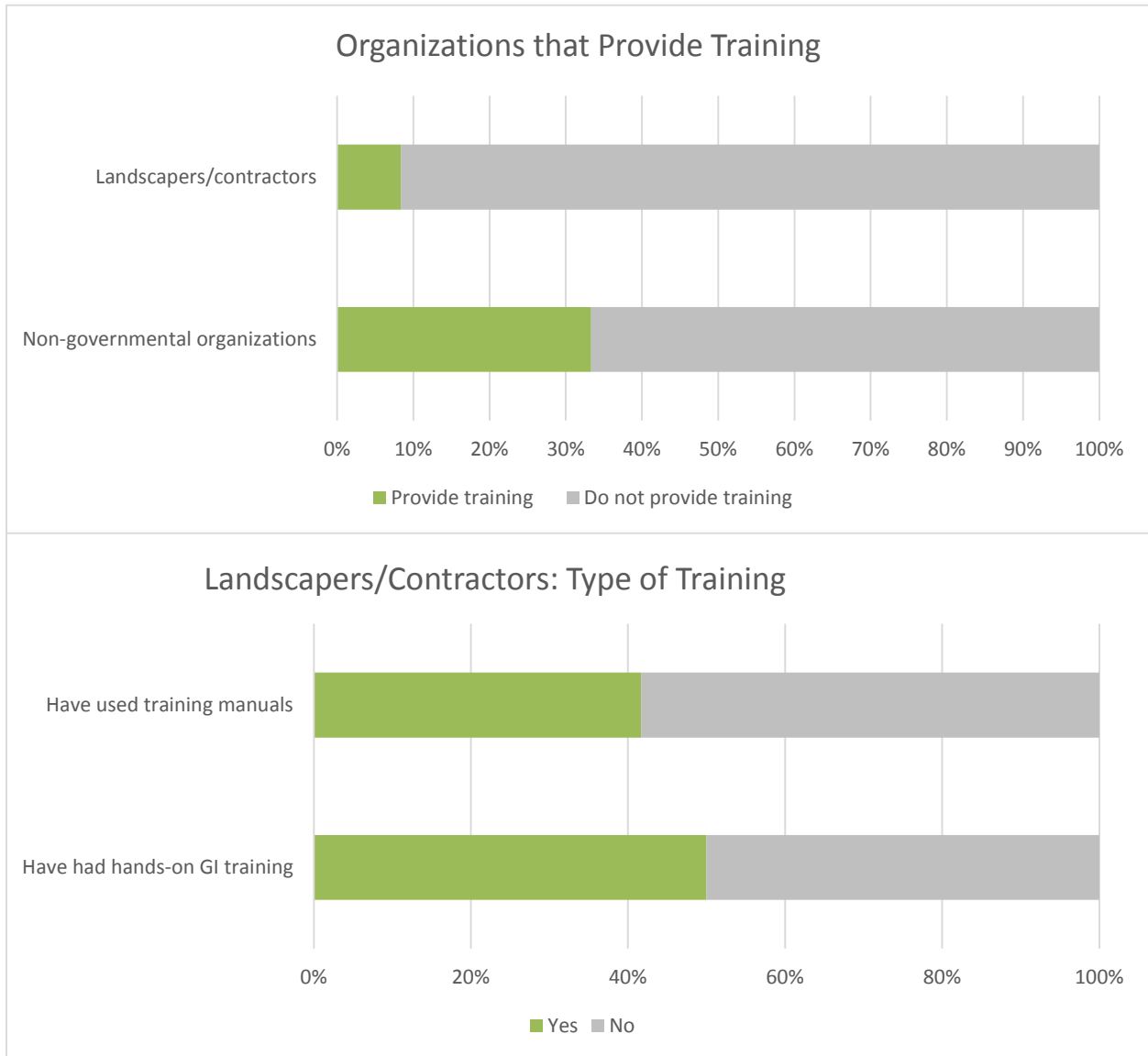


Figure 3. Survey results showing organizations that provide training (top) and the types of training that landscapers/contractors receive (bottom).

Training is needed for municipal staff and others who will be responsible for maintenance. Where contractors are used, the contracting entity or individual should ensure the contractor has appropriate experience and qualifications for green infrastructure maintenance before hiring. MMSD maintains a Green Vendor list of firms that provide green infrastructure-related services. As of November 2014, 9 of the 41 listed firms indicate that they provide green infrastructure maintenance services, although there is no indication whether these firms have received formal training in green infrastructure maintenance. MMSD is currently developing a Request for Qualifications (RFQ) for their Green Vendor list. MMSD's forthcoming green infrastructure maintenance manual would serve as an additional training resource and as a maintenance standard for others to use when developing training materials and opportunities. MMSD is also providing training through its internship program, including working with the MAWIB as a partner to provide internships to students in the Milwaukee Area Technical College's Water Technology Certificate Program. The interns have focused on performing inspections, but MMSD will introduce maintenance activities on a very small scale in the near future. According to the stakeholder discussions facilitated by EPA and MMSD, not all municipalities have formal, documented maintenance procedures. The lack of procedures could prove challenging for training municipal staff and contractors who have specific green infrastructure maintenance expectations and needs.

3.3 Inspections

Inspections play an important role in a green infrastructure maintenance program, ensuring that green infrastructure strategies are functioning properly and performing as expected. The foundation for an inspection program is a legal requirement (usually in the form of a maintenance agreement) for green infrastructure strategy owners to demonstrate that the assets are maintained to a specified standard. Once that requirement is established, an inspection program can be developed on the basis of a number of models described in Section 4.4, including inspections by MMSD or local municipal staff, third party inspectors, property owners (self-inspection), and remote telemetry.

Tailoring inspection frequency during critical periods, such as the growing season, can be key to ensuring the vegetation health of a green infrastructure strategy. MMSD developed a condition assessment form as part of the draft green infrastructure maintenance manual and to meet discharge permit requirements. The condition assessment form is a tool for conducting the annual inspections that MMSD uses to ensure the green infrastructure strategies implemented using MMSD funds remain effective. Starting in 2012, MMSD requires the project partner to submit an annual maintenance report that they can reference when conducting the inspections. The inspections conducted during the summer of 2013 using the condition assessment form provided MMSD with baseline information about each green infrastructure strategy funded by MMSD, allowing subsequent tracking of each strategy's performance and condition over time.

None of the surveyed non-governmental organizations provide green infrastructure inspection services at this time. The survey results indicated that 35 percent of stakeholder groups would be interested in green infrastructure inspection training; Figure 4 shows each group's interest in inspection training.

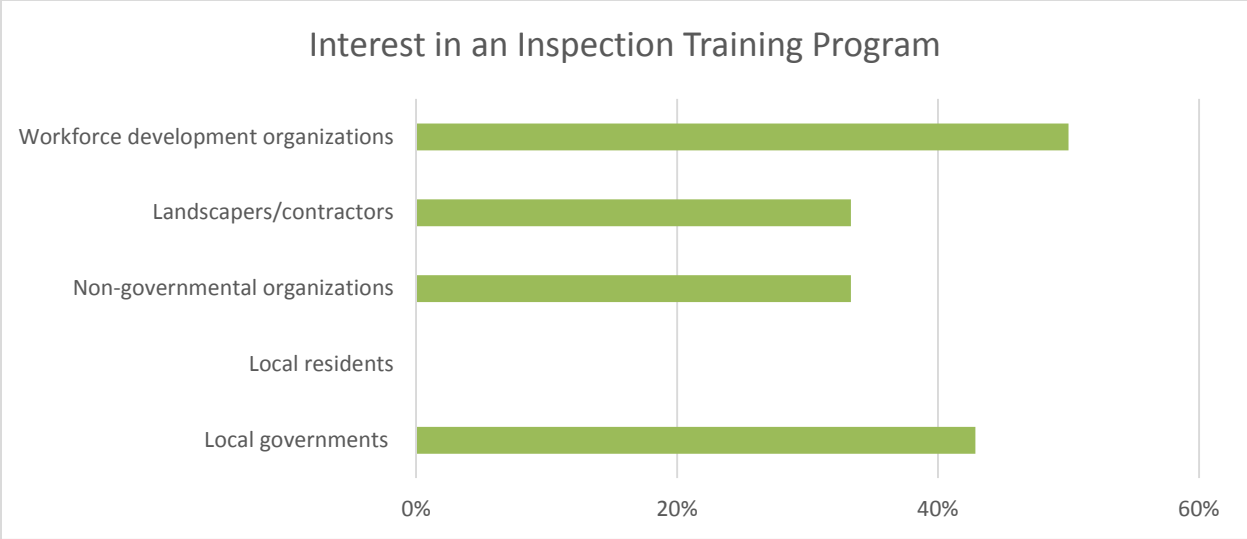


Figure 4. Survey results showing stakeholder interest in green infrastructure maintenance or inspection training programs.

3.4 Certification

To ensure that inspections and maintenance are conducted by qualified individuals, a certification program can be established for individuals responsible for conducting maintenance and inspections. The legal driver for such certification would be set forth in maintenance agreements that specify standards for maintenance personnel and inspector qualifications. Certification programs are key for individuals who want the necessary expertise and credentials for conducting green infrastructure maintenance and inspections. These programs are also beneficial for property owners who are looking to hire staff or contract for services with specific, demonstrated expertise.

While there are some entities providing green infrastructure training in southeast Wisconsin, it appears that these training opportunities are limited and that no entities offer a formal green infrastructure maintenance and inspection certification program. MMSD maintains a list of firms that provide green infrastructure-related services, referred to as the Green Vendor list. As of November 2014, 9 of the 41 listed firms indicate that they provide green infrastructure maintenance services, although there is no indication whether these firms have received adequate training or are certified by an outside organization in green infrastructure maintenance. A formal certification program in southeast Wisconsin, or recognition of certification earned from another program outside the region, would give firms the opportunity to become certified, and MMSD could allow firms to indicate their certification status on the Green Vendor list.

Of the stakeholder groups participating in the survey, 52 percent responded that they are interested in a green infrastructure inspection and maintenance certification program; Figure 5 shows each stakeholder group’s interest.

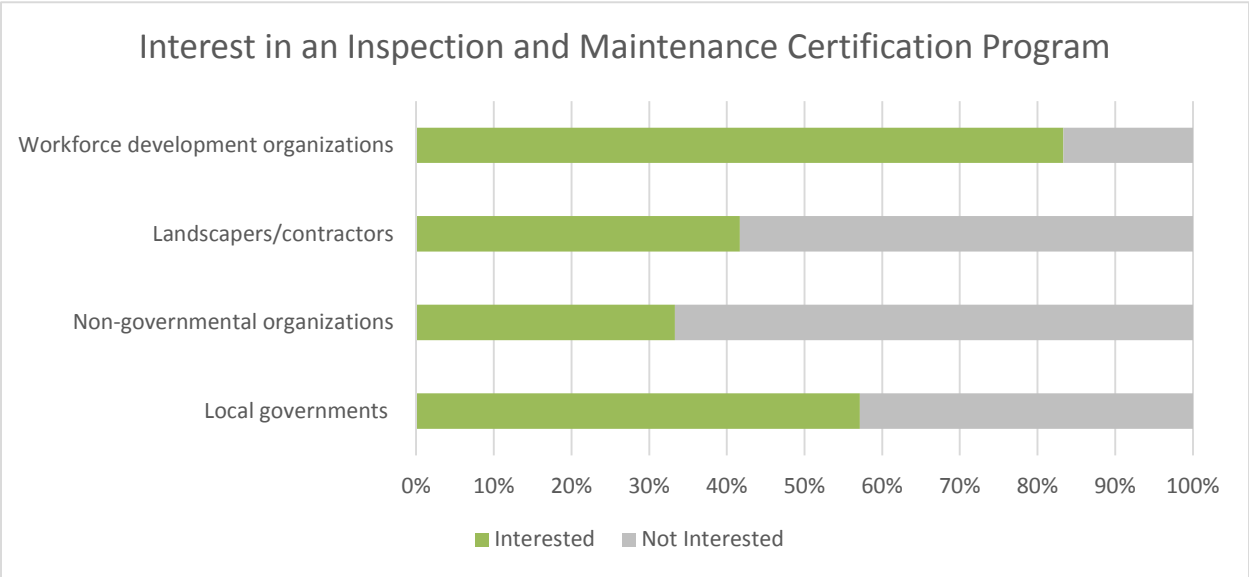


Figure 5. Stakeholder interest in an inspection and maintenance certification program.

3.5 Tracking

The dispersed nature of green infrastructure strategies and the variations in maintenance needs and frequencies result in a significant need for a comprehensive tracking program. MMSD’s 2013 Wisconsin Pollutant Discharge Elimination System (WPDES) permit includes a green infrastructure tracking requirement that states:

The Permittee will work with its regional partners to develop methods for tracking green infrastructure implementation and to pilot the development of a green infrastructure portfolio standard. The purpose of the tracking system and standard is to develop a system that can be used to assess and set goals for the increasing use of green infrastructure over time in order to manage wet weather flows.

MMSD currently tracks the location, type, and ownership of all green infrastructure strategies implemented using MMSD funding and is in the process of integrating green infrastructure strategies into the larger asset management process. However, there is a recognition among stormwater managers of the potential benefits of coordinating tracking over time throughout the region. Strengthening the tracking system on a regional basis would address an important barrier to greater use of green infrastructure strategies. Several municipalities in the region are working to improve record-keeping elements by requiring the submittal of as-built plans for stormwater treatment system and providing property owners with annual reminders of required inspections and reporting. Additionally, a tracking system could be used to record maintenance of green infrastructure strategies—particularly for larger, more complex systems. Maintenance agreements could require that property owners certify that green infrastructure strategies have been inspected using an inspection checklist such as MMSD’s condition assessment form, and found to be working properly. Such a certification would provide both property owners and responsible municipal staff with some assurance that the green infrastructure strategy is maintained and working according to a set of technical standards, such as those in MMSD’s draft green infrastructure maintenance manual. This type of documentation or certification would

demonstrate that maintenance activities are effective and that the strategy is performing as anticipated, which is a primary concern of municipal officials who approve green infrastructure strategies. To be appealing as a permit-related program, such a certification would need to be valid until the next required inspection.

3.6 Funding

According to the Regional Green Infrastructure Plan, 15 percent of the annual costs to implement the 2035 Vision capture goal—\$10.4 million—are incremental annual operation and maintenance costs. This cost will be roughly split between public and private entities under the Plan’s implementation recommendations. Currently MMSD assesses contributing jurisdictions’ sewer use charges to pay for maintenance of infrastructure based on wastewater flow, the strength of wastewater discharged to MMSD, and a connection charge. No charges are assessed based on stormwater contributions to the reclamation facilities via combined systems or inflow and infiltration (I&I). In addition to MMSD, there are 28 contributing jurisdictions within the MMSD planning area that have a stake in the successful implementation of the Regional Green Infrastructure Plan. Many of the municipalities within the MMSD planning area have developed stormwater utilities to recover stormwater management-related costs based on Equivalent Residential Units or ERUs, which reflect the typical amount of impervious surface on a single-family parcel in each municipality (average size area of 3,256 square feet per property). The total amount of stormwater utility fees collected in 2014 by the 20 municipalities within the planning area was \$34,257,516. It is unknown what portion of this budget currently goes to green infrastructure maintenance. In the survey, EPA and MMSD asked local governments approximately how much they spend on green infrastructure maintenance per year (see Figure 6). Of the seven local governments that responded, two spend \$500–\$999 annually, one spends \$1,000–\$4,999 annually, and one spends more than \$10,000 annually. Three of the seven responding local governments were unsure of annual expenditures on green infrastructure maintenance.

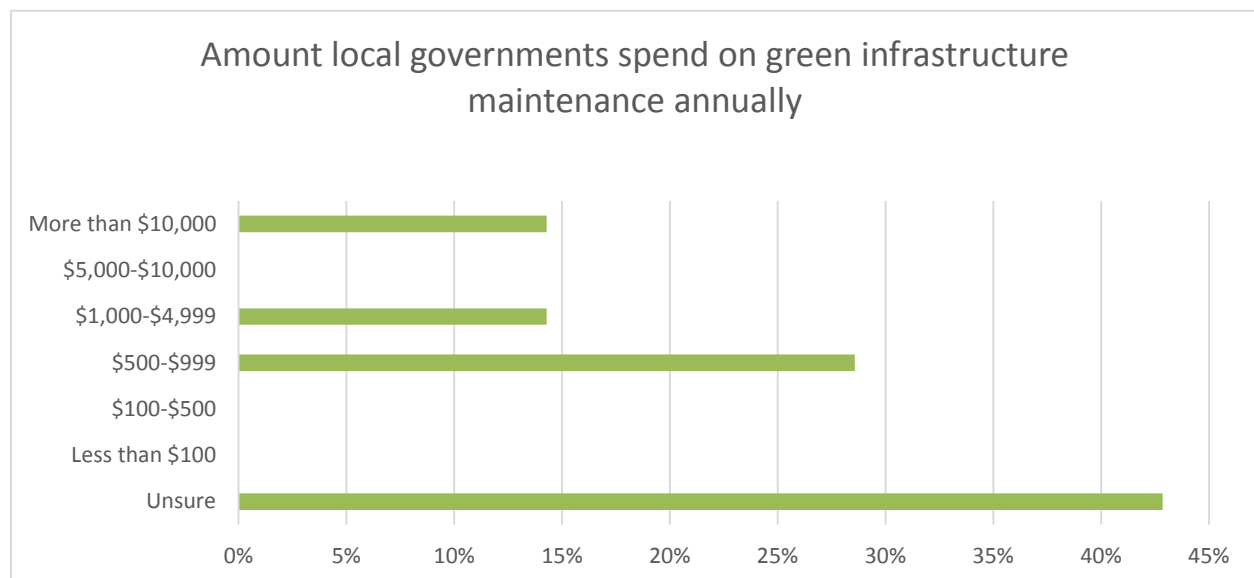


Figure 6. Amount spent annually by local governments for green infrastructure maintenance.

4 Potential Green Infrastructure Maintenance Business Models and Options

The information on the elements of a green infrastructure maintenance plan presented in Section 3, in conjunction with stakeholder input obtained through facilitated community discussions and an informal survey, provide the foundation for a draft strategic green infrastructure maintenance business plan. The initial assumption of this project was that MMSD and stakeholders would consider potential business models and select one that appeared to be most feasible for southeast Wisconsin. However, the facilitated discussions with stakeholders, as well as survey responses, indicated that there is no one business model for green infrastructure maintenance that is most suitable under all conditions. Given the diversity of green infrastructure strategies, the mix of public/private property, and the interests of the various stakeholders in the region, a strategic green infrastructure maintenance business plan has to maintain flexibility and acknowledge variations in maintenance needs depending on the different combinations of factors. As a result, this section presents a range of potential options for coordinating and integrating the green infrastructure maintenance elements presented in Section 3.

4.1 Business Model Characteristics

There are a variety of ways to approach green infrastructure maintenance, given the mix of green infrastructure strategies on public and private property with different entities playing a potential role in the elements associated with green infrastructure maintenance. The options for conducting each of the green infrastructure maintenance elements can vary depending on which entity has the primary responsibility for conducting the element. In this section, three possible business models are discussed under each green infrastructure maintenance element. The three potential business models are as follows:

- Regional Model
- Local Model
- Owner-led Model

Figure 7 is a graphical representation of each model showing the potential relationships between stakeholders involved in green infrastructure maintenance. Table 3 contains detailed summaries of the characteristics of the three models. Under all three models, the responsible entity can choose to outsource aspects of green infrastructure maintenance by either hiring contractors or entering into a partnership agreement with an organization. This decision will likely depend on factors including available resources, existing expertise, and scale and location of the green infrastructure strategies.



Source: Tetra Tech, Inc.

Figure 7. Regional, local, and owner-led models for green infrastructure maintenance and possible roles of other stakeholders.

Table 3. Characteristics of the three potential green infrastructure O&M business models.

Regional Model	Local Model	Owner-led Model
Model Description		
<p>Under the Regional Model, a regional entity—either MMSD or a new regional services entity, such as a “Green Team”—is responsible for either conducting or coordinating maintenance-related activities for some or all green infrastructure strategies. This could include small or large-scale green infrastructure strategies in the right-of-way, on public property, or on private property. The Regional Model could be well-suited for situations in which specialized training is needed or specialized equipment is called for, or where economies of scale can be achieved.</p> <p>The left graphic in Figure 7 illustrates the Regional Model and potential relationship of a regional entity with other stakeholders involved in green infrastructure maintenance.</p>	<p>Under the Local Model, local governments are responsible for either conducting or coordinating maintenance-related activities for some or all green infrastructure strategies. This could include small or large-scale green infrastructure strategies in the right-of-way, on public property, or on private property.</p> <p>The center graphic in Figure 7 illustrates the Local Model and potential relationship of municipalities with other stakeholders involved in green infrastructure maintenance.</p>	<p>The Owner-led Model applies to private property only. Under this model, property owners are responsible for conducting or coordinating maintenance-related activities for all green infrastructure strategies on their properties.</p> <p>The right graphic in Figure 7 illustrates the Owner-led Model and the potential relationship of property owners with other stakeholders involved in green infrastructure maintenance.</p>

Regional Model

Local Model

Owner-led Model

Institutional Structure

The regional entity performs maintenance for some or all green infrastructure strategies in the right-of-way and on public property. The regional entity also can issue contracts to private businesses to perform maintenance or establish partnerships with service groups.

From a legal perspective, the regional entity could enter into a contract with a property owner or local municipality that would detail the locations and nature of the work to be performed and address liability issues and contingencies.

Local municipalities perform maintenance of strategies in the right-of-way and on public property in their jurisdictions or can issue contracts to private businesses to perform maintenance or establish partnerships with service groups.

Property owners are responsible for ensuring maintenance of all green infrastructure strategies on their properties. Owners can decide whether to perform maintenance themselves or outsource to a landscape maintenance contractor.

Regional Model

Local Model

Owner-led Model

Compliance Tracking and Inspections

The regional entity integrates its green infrastructure database with an asset management system to schedule maintenance and to record findings and activities. Regional entity maintenance staff enter maintenance data into the database, and contractors can submit reports detailing inspection results and/or maintenance activities that were performed.

The following inspection programs apply (see Section 4.4):

- Regional entity-led inspections
- Contracted third-party certified inspections
- Remote telemetry

Local municipalities create a green infrastructure database, which would be linked to the municipality's asset management system (if used) to schedule inspections and maintenance and record findings and activities. Since most jurisdictions in metropolitan Milwaukee have issued permits to multiple private property owners that require annual maintenance of stormwater infrastructure, these annual inspections would be included in the database and the overall management program. The local agency can report a summary of inspection and maintenance activities to the regional entity for tracking and permit/Total Maximum Daily Load (TMDL) compliance purposes. The regional entity can provide a green infrastructure database template to local municipalities to ensure information required for annual reporting.

The following inspection programs apply (see Section 4.4):

- Local municipal inspections
- Contracted third-party certified inspections
- Remote telemetry

Periodic inspections of green infrastructure are necessary with this model to ensure that maintenance is being performed as prescribed. Inspections can be performed by the regional entity, municipal staff, or a third-party certified inspector who reports findings to the local or regional entity.

Inspection and maintenance frequency and responsibilities can be documented in a maintenance agreement to ensure that requirements are clearly understood and are transferred to the new owner upon sale of a property. A requirement that property owners are responsible for green infrastructure strategy maintenance can be included in a local ordinance or through a maintenance agreement at the time of green infrastructure installation.

The following inspection programs apply (see Section 4.4):

- MMSD-led inspections
- Local municipal inspections
- Contracted third-party certified inspections
- Remote telemetry (monitoring)
- Self-inspection with photo-documentation

Regional Model

Local Model

Owner-led Model

Technical Considerations and Equipment Needs

The regional entity might own some small-scale equipment needed to perform green infrastructure maintenance (e.g., shovels, trash bags); additional large-scale items such as vacuum trucks might need to be purchased or leased through inter-municipal or inter-agency agreements to use this business model. If qualified contractors are used to perform some or all of the maintenance, it is assumed contractors would provide their own equipment.

Deploying equipment to the dispersed green infrastructure strategy locations can be a logistical challenge. An asset management system can be used to schedule maintenance activities for strategies located close by to reduce travel time and fuel consumption. The database of green infrastructure strategies could include a field for equipment required for maintenance to ensure that crews arrive prepared.

Local municipalities may or may not already own the equipment needed to perform green infrastructure maintenance. For municipalities that lack equipment, the regional entity could establish a program to lend, lease or rent equipment as needed. There are many examples in the Great Lakes region of communities that have inter-municipal or rental agreements for equipment such as vacuum trucks and sweepers; typically, lease costs reflect costs of liability and necessary maintenance or repairs. Deploying the equipment is less of a challenge than in the regional model because of the smaller geographic area for maintenance.

Any typical municipal infrastructure asset management system can be used to schedule inspections and maintenance activities and efficiently deploy crews who are qualified to perform green infrastructure maintenance. The database of green infrastructure strategies could include a database field listing the equipment required for maintenance of specific strategies to ensure that crews arrive prepared.

Qualified maintenance professionals would procure their own equipment to perform maintenance on private property.

Regional Model

Local Model

Owner-led Model

Local Economic Impacts and Benefits

As green infrastructure strategies are installed on public property and in the right-of-way, the maintenance burden for which the regional entity is responsible would increase, necessitating creation or expansion of its maintenance workforce to meet this demand. These jobs would be local and seasonal in nature. In some cases, these jobs could allow youth or chronically unemployed to be trained and enter the workforce.

If contractors are used, the maintenance program would generate work for local businesses that are able (and possibly certified) perform inspections and/or maintenance of green infrastructure strategies. Competition among contractors for maintenance work could potentially reduce maintenance costs. Public agencies can readily increase or decrease contract activity based on demand for maintenance services, which allows more flexibility than hiring full-time agency staff.

Each municipality's maintenance burden will continue to increase as more strategies are installed in the right-of-way or on public property. The local municipalities would need to expand their maintenance work forces incrementally to meet this demand, which would create local, seasonal need for green infrastructure maintenance tasks. It is important to note that municipalities may be averse to adding staff, as new municipal employees represent a future cost. Contracting maintenance can in some cases provide a more flexible alternative, especially considering the seasonal nature of the maintenance work, but this must be balanced against local staff structure, union issues, and other staffing needs that could be met through new hires during the "off season" for green infrastructure such as plowing.

As more green infrastructure is installed over time, and if certified maintenance is required of public and private sectors, the market—and demand for both certified landscape maintenance professionals and MMSD/municipal inspectors—will continue to grow, creating seasonal green jobs.

Regional Model

Local Model

Owner-led Model

Training and Certification Needs

Training programs are needed for maintenance crews to recognize green infrastructure strategies, identify damage or indicators of failure, perform routine cleaning and debris removal, distinguish between desirable and pest plants, assess plant health and identify replacement needs, appropriately schedule and conduct pruning, and prevent stormwater pollution during maintenance activities (e.g., protect storm drains and safely dispose of debris and sediment).

If contractors are used, the regional entity can outline maintenance standards and expectations in contracts and conduct contract oversight and spot-checks in the field to ensure that standards are being met. Training programs would be needed both for contractors performing maintenance and regional entity staff who will oversee them. Public agencies, in partnership with local technical colleges or other job training services, can provide training and certification programs for maintenance contractors. Certification programs can provide a career ladder for local workforce development.

Training programs are needed for municipal maintenance crews (and contractors, if used) to recognize green infrastructure strategies, survey them for damage or indicators of failure, perform routine cleaning and debris removal, distinguish between desirable and pest plants, assess plant health and identify replacement needs, appropriately schedule and conduct pruning, and prevent stormwater pollution during maintenance activities (e.g., protect storm drains and safely dispose of debris and sediment). Plant maintenance can be delegated to parks or facilities maintenance staff who are already familiar with vegetation management. Local municipalities would need to track that the proper maintenance is getting done at the prescribed frequency (see Sections 3.1: Maintenance Activities and 3.5: Tracking and that staff are appropriately trained for those activities (see Sections 3.2: Training, 3.3: Inspections, and 3.4: Certification).

Owners may want to use their own staff to perform green infrastructure inspection and maintenance, in which case those personnel would need to be trained/certified. Alternatively, owners can hire a qualified third-party. If third-party inspectors are used, the regional entity (e.g., MMSD or a Green Team) would need to set up a training and certification program and maintain a list of certified inspectors for property owners. The regional entity can provide training to landscape professionals to become certified to maintain green infrastructure strategies. Attendance at workshops can lead to certification.

The regional entity can offer workshops and user-friendly maintenance manuals for property owners (e.g., homeowners) who undertake basic maintenance on their own, including recognizing and troubleshooting performance issues. The regional entity can also maintain a list of qualified maintenance professionals on its website (e.g., MMSD's Green Vendor list) as a resource for property owners responsible for maintenance.

Regional Model

Local Model

Owner-led Model

Stakeholder Engagement and Education Needs

Outreach to the public can focus on the importance of green infrastructure maintenance and the role the regional entity performs in providing this service. The public can be provided a mechanism to report problems with green infrastructure strategies (e.g. hotline, web page, etc.) and to provide feedback on the maintenance program, crew performance, etc.

Outreach to the public can focus on the importance of green infrastructure maintenance and the role the city or village performs in providing this service. The public can be provided a mechanism to report problems with green infrastructure strategies (hotline, web page) and provide feedback on the maintenance program, crew performance, etc.

Outreach to property owners and homeowner and business associations can include detailed information about the nature and importance of their green infrastructure strategies, how they operate, and what is required for maintenance. This could include workshops about green infrastructure maintenance, common problems, and simple maintenance property owners can perform on their own.

4.2 Business Model Options for Maintenance Activities

As discussed in Section 3, local governments and property owners currently have the primary responsibility for conducting green infrastructure maintenance in southeast Wisconsin due to the location of green infrastructure strategies on public and private property. Through the development of a strategic green infrastructure maintenance business plan, MMSD can consider alternative approaches using the three potential business models, as described in Sections 4.2.1 to 4.2.3.

4.2.1 Regional Model Options

During facilitated stakeholder discussions, participants were open to the possibility of a regional entity conducting green infrastructure maintenance for certain types of green infrastructure strategies. More specifically, the group focused on the creation of a Green Team or a Green Infrastructure Service Center. One of the services this regional entity could provide would be maintenance. Similar to a contractor, the regional entity could enter into a contract with a municipality, a neighborhood association, or even a property-owner to provide green infrastructure maintenance services.

Local governments, local residents/businesses, and non-governmental organizations that responded to the survey indicated that there is some interest in having a regional entity maintain certain types of green infrastructure strategies. Those responding to the survey had the most interest in having a regional entity maintain bioretention/bioswales/greenways (41 percent of all respondents) and permeable pavement (41 percent), followed by green alleys/streets/parking lots (30 percent). There was potential interest for regional maintenance for every green infrastructure strategy except rain barrels/cisterns and native landscaping. Some respondents were unsure about regional maintenance (18 percent) or did not want any strategies maintained by a regional entity (18 percent). Figure 8 shows the survey results for each stakeholder group.

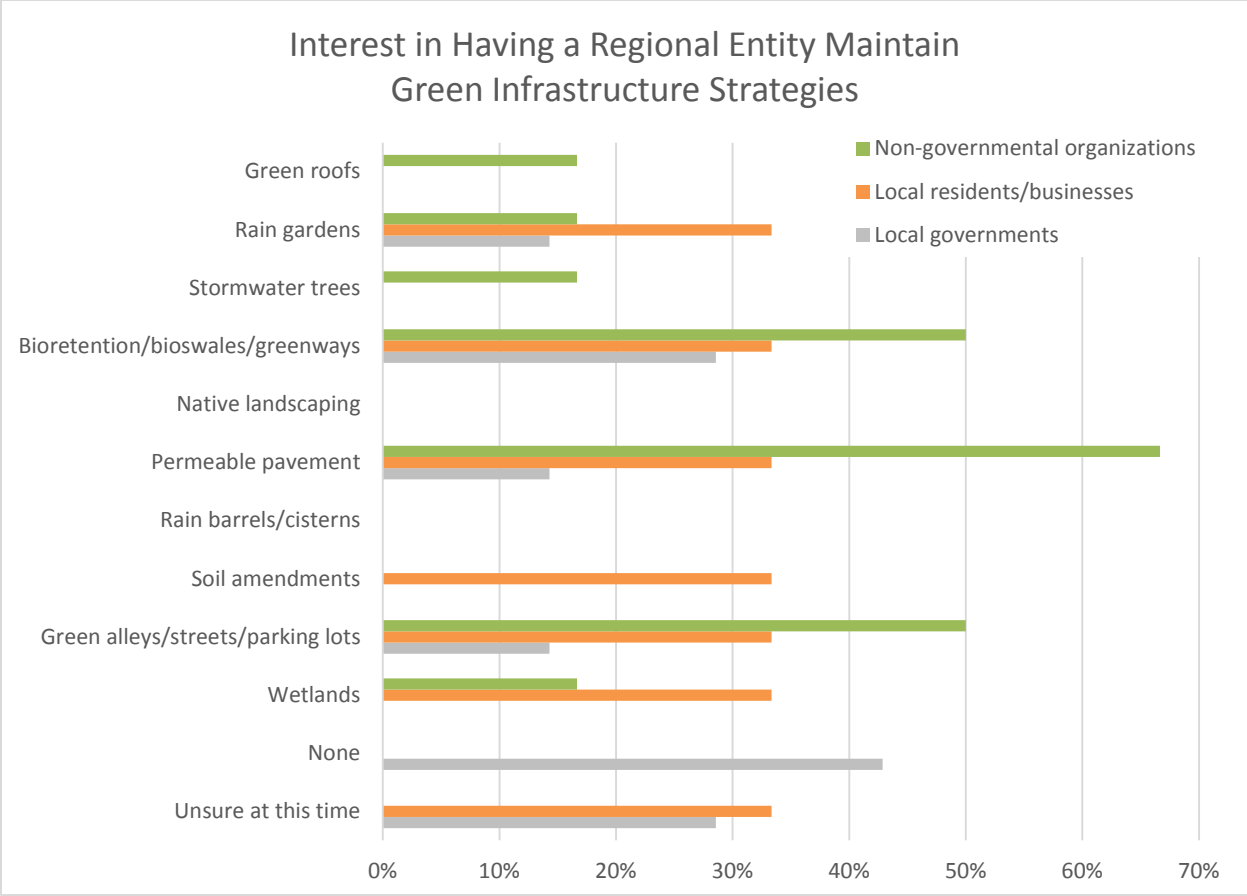


Figure 8. Survey results indicating stakeholder group interest in having certain types of green infrastructure be maintained by a regional entity.

Stakeholders participating in the strategic green infrastructure maintenance business plan development process raised the issue of scale and the effect on maintenance. Their concern was that a regional entity might not have the ability to conduct all green infrastructure maintenance activities on public property in southeast Wisconsin given the size of the region and the number of green infrastructure strategies that will be implemented over time.

4.2.2 Local Model Options

This is largely the model used for existing green infrastructure maintenance on public property and rights-of-way. Participants in the facilitated stakeholder discussions stated that maintenance demands on municipal department staff are becoming a challenge, resulting in more municipalities seeking contractor support. Participants wanted to retain maintenance responsibility for key green infrastructure strategies, particularly those that are considered showpieces to their municipalities or are associated with rights-of-way (e.g., street sweeping). There is a concern about the need for improved green infrastructure maintenance expertise within local contractors/landscaping firms. Improved contract specifications and contractor qualifications for use in request for proposal (RFP) language, specific requirements in MMSD easements and permits for the use of certified contractors in annual maintenance and inspections/reports, and increased integration among agencies to hire the most qualified contractors could help drive the demand for local green infrastructure maintenance expertise. In addition to contracting, another alternative under this model is to create a collaborative partnership

to do voluntary maintenance activities. Volunteer service groups who sign up could perform straightforward maintenance like trash removal and weeding, with municipal staff or contractors performing maintenance that requires specialized equipment or expertise. Local governments and non-governmental organizations responding to the survey indicated an interest in creating a partnership program for developing and administering a volunteer maintenance program (46 percent) and securing contractor support for shared maintenance (38 percent). However, volunteer maintenance must be overseen and sustained in cases where permit or easement compliance is reliant on periodic maintenance and reporting.

4.2.3 Owner-led Model Options

Property owners may choose to perform maintenance themselves or hire landscape maintenance companies to do the work. A regional entity or local municipality can choose to perform maintenance of green infrastructure strategies on private property on behalf of the owner using a maintenance easement. The cost of maintenance may be borne by tax- or ratepayers, or property owners could pay a fee for service. When maintenance is performed by a regional entity or local municipality, there is more assurance that maintenance is performed as prescribed, and green infrastructure performance can be more closely tracked.

4.3 Business Model Options for Providing Training

As discussed in Section 3, some stakeholders currently conduct green infrastructure maintenance training. All of the potential green infrastructure maintenance business models will require training on proper green infrastructure maintenance activities and inspections. Each business model has options to consider for training.

Regional Model. During the facilitated community discussions, participating stakeholders expressed an interest in a regional approach to developing and conducting training on green infrastructure maintenance and inspections. The local governments, residents/businesses, non-governmental organizations, landscapers, and workforce development representatives that responded to the survey indicated a strong interest in green infrastructure maintenance training (60 percent), as well as an interest in green infrastructure inspection training (35 percent; see Figure 9). Regional training programs would require regional green infrastructure maintenance and inspection standards to serve as the basis for the training. As mentioned, MMSD is finalizing a green infrastructure maintenance manual for strategies implemented with MMSD funding. If other regional stakeholders agreed that the final manual represents a strong suite of maintenance and inspection standards for the region, it could serve as the basis for training resources.

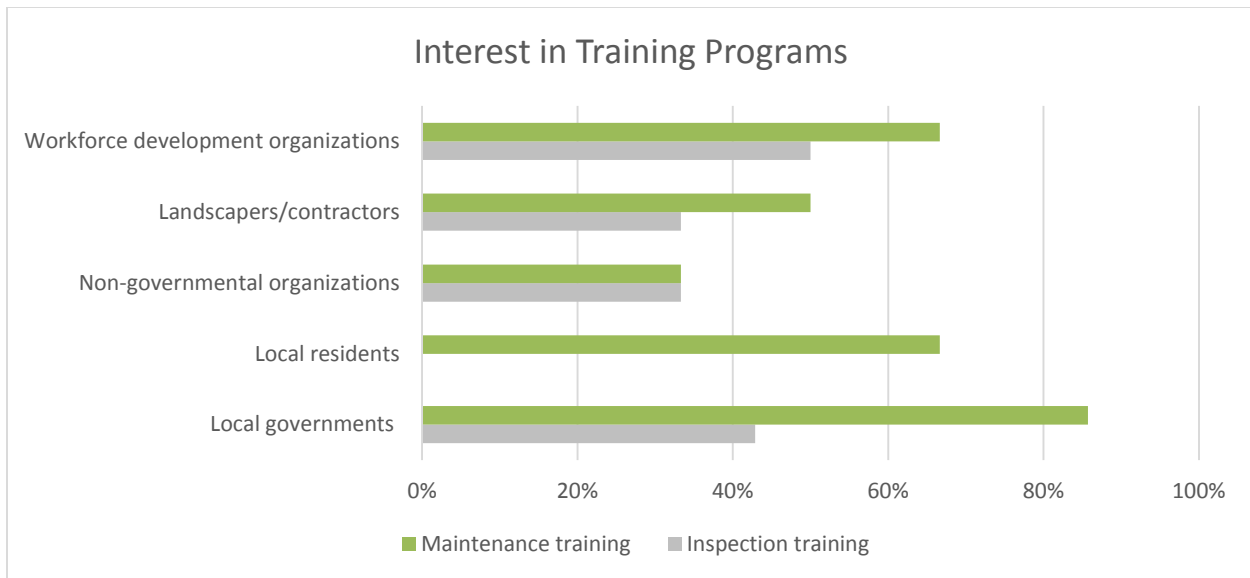


Figure 9. Survey results indicating stakeholder interest in maintenance and inspection training programs.

Local Model. Under this model, individual local governments could develop and conduct their own training for municipal staff responsible for green infrastructure maintenance activities based on local maintenance and inspection standards. While this option allows local governments to offer training with a focus on municipal-specific standards, it also could create a burden on local governments that might also need to train contractors and volunteers who want to provide maintenance services to the municipality.

Owner-led Model. Private property owners who choose to conduct green infrastructure maintenance for themselves would need to seek out maintenance training from non-governmental organizations or existing online resources. For private property owners who outsource maintenance to certified companies, outreach and education would still be beneficial, but the nature of the training might be less technical.

It is important to note the perspectives of landscapers/contractors and the workforce development community on the issue of green infrastructure maintenance and inspection training. A training program could be established to ensure that a skilled private-sector workforce is available to perform green infrastructure maintenance. Landscapers/contractors who responded to the survey indicated an interest in training programs. Of those who responded, landscapers/contractors would possibly require staff to participate in training if it was free or had a minimal charge (58 percent) and others would require participation regardless of cost (25 percent). Workforce development organizations that responded to the survey indicated that individuals have expressed an interest in receiving green infrastructure training (66 percent). One respondent stated that places to refer people to for green infrastructure training are needed.

4.4 Business Model Options for Inspection Programs

Periodic inspections of green infrastructure strategies are essential to ensure that maintenance is being performed and to recognize problems with performance prior to failure. Inspections can be performed by public agencies, which would also facilitate green infrastructure tracking and reporting if required by

water quality regulations. Alternatively, a program can be established to train and certify private-sector inspectors to conduct inspections on private property if property owners are responsible for maintenance. These private-sector inspectors can report inspection findings to the property owner or directly to the public agency for tracking and reporting. A third option is to require property owners to self-report maintenance and submit photo-documentation of the condition of the strategy. Also, telemetry can be used to remotely assess the performance of some types of green infrastructure strategies, alerting the responsible entity when a green infrastructure strategy requires maintenance or repair. Finally, a hybrid approach could be used in which a regional entity inspects large-scale or high-priority green infrastructure strategies, while local municipalities or third party inspectors perform more routine inspections. These inspection program alternatives and their applicability to the green infrastructure maintenance business models are summarized in Table 4.

Table 4. Options for conducting green infrastructure inspections.

Inspection Program Type	Applies to Publicly Owned Strategies	Applies to Privately Owned Strategies	Applicable Maintenance Business Models	Notes
Regional Entity-led Inspections¹	✓	✓	<ul style="list-style-type: none"> • Regional Model • Local Model • Owner-led Model 	<ul style="list-style-type: none"> • Inspection procedures would be standardized throughout the region. • Scheduling and tracking of results would be centralized. • Additional full- or part-time MMSD staff may need to be hired to meet inspection burden.
Local Municipal Inspections	✓	✓	<ul style="list-style-type: none"> • Local Model • Owner-led Model 	<ul style="list-style-type: none"> • Inspection procedures/standards may vary from one municipality to the next unless a centralized training and certification program is in place. • Inspection results from multiple municipalities more difficult for MMSD to track. • Additional full- or part-time municipal staff may need to be hired to meet inspection burden.
Contracted Third-Party Certified Inspections	✓	✓	<ul style="list-style-type: none"> • Regional Model • Local Model • Owner-led Model 	<ul style="list-style-type: none"> • Inspection procedures/standards may vary among contractors, although contracts can outline maintenance standards and expectations that contractors need to meet; contract oversight and spot-checks in the field can ensure that standards are being met. • The private sector can add staff more easily to meet an increasing inspection burden.

Inspection Program Type	Applies to Publicly Owned Strategies	Applies to Privately Owned Strategies	Applicable Maintenance Business Models	Notes
Remote Telemetry	✓	✓	<ul style="list-style-type: none"> Regional Model Local Model Owner-led Model 	<ul style="list-style-type: none"> Telemetry is most appropriate for larger-scale strategies or those on public property. Strategies that cannot be remotely monitored would require traditional inspections. Telemetry equipment will require capital expenditures by permittees and the management entity. Equipment will require periodic maintenance. Telemetry data would need to be transmitted continually and reviewed periodically by the management entity to trigger maintenance activities.
Self-Inspection with Photo-Documentation		✓	<ul style="list-style-type: none"> Owner-led Model 	<ul style="list-style-type: none"> Self-inspection standards would be highly variable unless property owners were required to use standard checklists and protocols. Outreach and education would be needed to inform property owners of their responsibility to self-inspect. Some property owners might not have the means to obtain and submit photo-documentation. Additional administrative burden and cost associated with sending self-inspection reminders and compliance notices.

1. Regional entity could be MMSD, a Green Team, or other group.

4.5 Model Options for Certification

A green infrastructure certification program does not currently exist for southeast Wisconsin. Such a program requires maintenance and inspection standards to serve as the basis for certification. Options under each business model are presented below.

Regional Model. In addition to training, stakeholders participating in the facilitated community discussions and survey expressed an interest in taking a regional approach to developing and conducting a certification program. Local governments, residents/businesses, non-governmental organizations, landscapers, and workforce development organizations responding to the survey indicated a desire for a Green Infrastructure Service Center to provide green infrastructure inspection/maintenance certification (52 percent). As previously mentioned, a certification program requires a set of green infrastructure maintenance and inspection standards. Under the Regional Model, a set of regionally accepted green

infrastructure maintenance and inspection standards would be needed as the basis for a certification program.

Local Model. Local certification programs for green infrastructure maintenance and inspection would also require locally-developed and approved standards to serve as the basis for certification. It could also be that a local certification program follows regional standards, but is adapted to address specific local needs and concerns. A local certification program would require local resources from either a municipality or a local partner to develop and administer the certification program.

Owner-led Model. Private property owners might choose to seek out certification programs, or projects that receive public funds for installation might require that maintenance be performed by trained and certified individuals. Such certification programs could help boost confidence in the ability to maintain and inspect green infrastructure strategies, which often translates to more successful green infrastructure operation and maintenance.

4.6 Business Model Options for Tracking

Green infrastructure tracking currently takes both a regional model and a local government approach, and ultimately the preferred tracking method might match the model or models selected for maintenance. MMSD tracks green infrastructure strategies implemented with MMSD funds that require a 10-year maintenance agreement and, in some cases, a conservation easement. Local governments take their own tracking approaches, ranging from spreadsheets to databases. MMSD has expressed the ability to track municipal and privately-owned green infrastructure strategies in their asset management system and Geographic Information System (GIS) if there is widespread interest in doing so. Of the stakeholder groups responding to the survey, 29 percent indicated interest in having a Green Infrastructure Service Center conduct tracking at a regional level (Figure 10). If tracking of green infrastructure strategies were not coordinated at a regional level, data collection could be made more consistent across multiple sectors if a minimum set of data elements were recorded, such as location, ownership, type, stormwater treatment capacity, maintenance frequency, and whether maintenance has been performed.

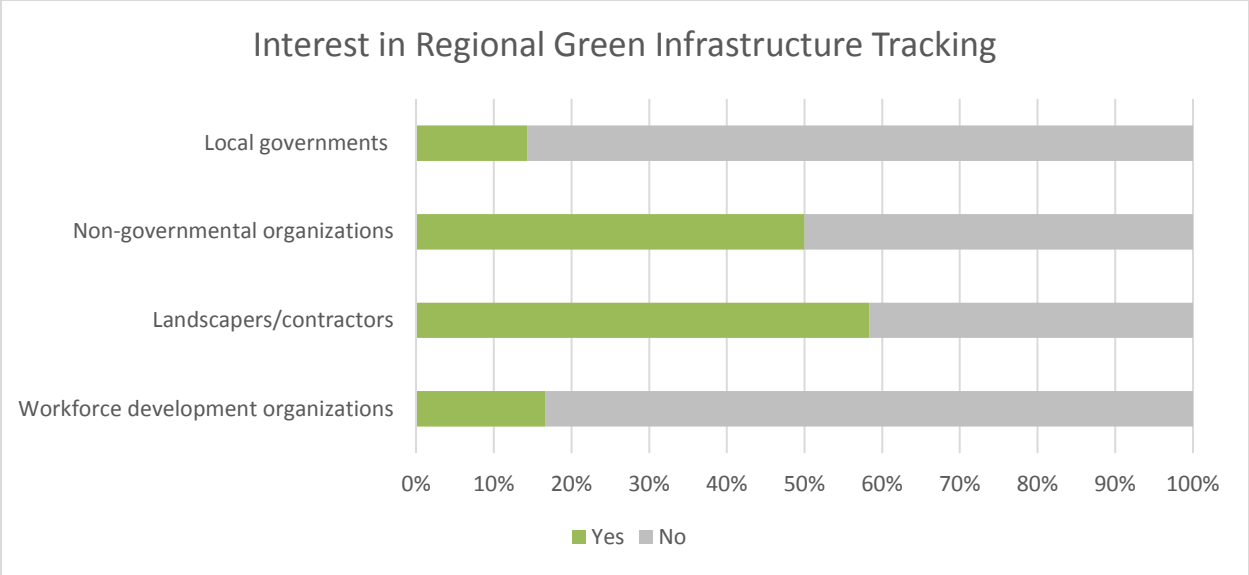


Figure 10. Survey results indicating stakeholders’ interest in tracking of green infrastructure strategies at the regional level.

4.7 Business Model Options for Funding

There are a variety of funding options to consider associated with regional entities and local governments, whereas few funding options exist to pay for owner-led maintenance. The following describes some options to consider to fund the anticipated green infrastructure maintenance activities.

4.7.1 Regional (MMSD) Funding Approaches

Existing Service Fees. Currently MMSD assesses contributing jurisdictions’ sewer use charges to pay for operations and maintenance of infrastructure purely on the flow and strength of wastewater discharged to MMSD—no charges are assessed based on stormwater contributions to the reclamation facilities via combined systems or I&I. MMSD can support green infrastructure implementation projects because keeping flows out of the sewer system helps preserve the capacity of the water reclamation facilities and helps reduce CSOs.

Stormwater or Drainage Fees. Twenty of the municipalities within MMSD’s planning area have existing stormwater utilities to help finance stormwater controls required by their applicable MS4 permit. It may theoretically be possible for MMSD to also levy a stormwater or drainage fee in order to fund the controls outlined in the Regional Green Infrastructure Plan to reduce combined sewer overflows (CSOs) and I&I. For example, Washington, DC has two different stormwater fees, one through the District Department of the Environment (DDOE) to fund stormwater controls required for the District’s Municipal Separate Storm Sewer System (MS4) and the Clean Rivers Impervious Area Charge through DC Water to fund stormwater controls required for the District’s combined sewer system.

Demonstration Project Partnerships. Municipalities may want to partner with community groups or local businesses to compile funding or acquire in-kind support of labor or materials in order to implement demonstrative projects that meet both groups’ objectives.

Federal or State Grants. EPA or state environmental agencies may make grant funding available to assist regional entities with the development of stormwater utilities or green infrastructure plans. The Urban Nonpoint Source and Storm Water Grant Program (<http://dnr.wi.gov/Aid/UrbanNonpoint.html>) offers competitive grants to local governments for planning and construction of projects to control stormwater runoff. Cities, villages, towns, counties, regional planning commissions, tribal governments and special purpose lake, sewage, or sanitary districts can apply for funding. Eligible project areas are urban lands with a population density of at least 1,000 people per square mile or non-permitted commercial or municipally-owned industrial use, or areas that are expected to become urban within 20 years. Planning grants can fund projects to explore local financing options for evaluation of stormwater utilities and programs. The grants can also reimburse administrative costs for initial establishment of local stormwater management funding programs, which can be used by municipalities to pay for both capital and maintenance costs associated with green infrastructure.

Public-Private Partnerships (PPPs). PPPs can be defined as interactions between public and private entities, to provide a service to the public and offer another financing mechanism to communities. Typical participants in PPPs are often government entities, non-profits, and private sector investors. More and more, government agencies around the country are exploring the idea of inviting private participation and investment in stormwater management infrastructure in ways similar to that being used to fund energy efficiency retrofits. Various models are being explored that would avoid the need by property owners and municipalities for traditional lending and would create a green infrastructure investment market that could help to finance the installation and maintenance of strategies on private land often more cost-effectively than is possible on public lands. Three options to secure funds for green infrastructure strategy maintenance using PPPs that are worthy of consideration are:

- Encouraging and facilitating the aggregation of smaller green infrastructure projects within the service area to reduce transaction costs, improve economies of scale, and distribute risk, thereby removing some of the barriers that can inhibit investment in smaller projects;
- Developing a green infrastructure subsidy program to finance the installation and maintenance of green infrastructure on private lands (single projects or aggregated) by those invested in the long-term performance of the strategies; and
- Forming a partnership with one or more local service organizations, some of which currently work with MMSD, to conduct lower-cost maintenance while supporting job training and green entrepreneurship which is a key economic benefit of green infrastructure and a goal identified in the Regional Green Infrastructure Plan (i.e., creation of 500 green maintenance jobs at full implementation and 160 construction jobs on average each year).

4.7.2 Local Government Funding Approaches

Each locality may need to plan for capital costs for implementation of public projects as well as maintenances costs for the life of each strategy installed. In addition, if the locality commits to any level of maintenance of private strategies, a funding mechanism for these costs will need to be identified as well. Below are the different types of funding available to municipalities to pay for green infrastructure construction and maintenance. Table 5 describes possible financing approaches for each maintenance business model.

General Fund. General funds are relatively consistent from year to year, but competition for the funding is typically high and stormwater management may be considered a low priority. In addition, using general fund dollars is not an equitable way to pay for stormwater management because the basis of property taxes—the value of a property—has no real bearing on the cost of managing the property’s runoff.

Existing Capital Improvement Funds. Capital outlay funds can be used to implement green infrastructure strategies as a part of planned public projects. These funds typically would not be available for regular maintenance, however, and would only address green infrastructure projects on public property.

Stormwater Utility Fees. Many of the municipalities within the MMSD planning area have developed stormwater utilities to finance local stormwater management related costs. The fee structure is usually based on stormwater “services” provided per ERU. The total amount of stormwater utility fees collected in 2014 by the 20 municipalities within the planning area was \$34,257,516. It is unknown what portion of this budget currently goes to green infrastructure. A 15 percent increase of this amount would meet the estimated annual incremental operation and maintenance costs of the 2035 Vision capture goal to be borne by the public sector at full implementation—\$5.2 million. In addition, credits against these fees could be used to incentivize green infrastructure installation on private property through reimbursement of installation costs to the property owner. A portion of the existing service fees—or increased fees—could be used to pay for locally-led maintenance activities, or an additional credit toward this fee could be provided to property-owners in exchange for self-inspection/reporting of green infrastructure strategy condition.

Other Fees. Municipalities could create and then earmark certain service based or in-lieu fees to fund maintenance of green infrastructure strategies. For example, inspection and maintenance costs could be incorporated into the plan review or permitting fees for new or redevelopment. It also may be appropriate to allow developers to pay into a fund in-lieu of implementing on-site post-construction controls and this money could be used to install and maintain regional publicly owned facilities or could be “traded” to private properties that are more suited for on-site post-construction controls.

State Revolving Loan Funds. Clean Water or Drinking Water State Revolving Fund (SRF) dollars may be used to fund development of a utility for local governments in the planning area that may not already have one but want to develop one in order to finance stormwater management. For example the Green Project Reserve is a dedicated federal fund for green infrastructure, water efficiency, and environmentally innovative projects under the SRF. These funds can also be used to pay for planning and capital costs of water quality improvement projects, but funds would likely not be available to pay for maintenance.

Demonstration Project Partnerships. Municipalities may want to partner with community groups or local businesses to compile funding or acquire in-kind support of labor or materials in order to implement demonstrative projects that meet both groups’ objectives.

Federal or State Grants. EPA or state environmental agencies may make grant funding available to assist municipalities with the development of stormwater utilities or green infrastructure plans.

4.7.3 Private Owner Funding Approaches

Generally, grant and loan funds are available to pay for *capital* expenditures associated with green infrastructure, but there are no funding programs that pay for ongoing maintenance costs. Unless maintenance is performed by a regional entity or local municipality, the property owner is fully responsible for paying for maintenance, whether the maintenance is performed by the owners themselves or by a contractor. This fact can be a significant disincentive for private property owners to voluntarily construct green infrastructure strategies, which is why some communities are taking on maintenance of green infrastructure on private property using public funds.

Under a regional or local business model, if a regional entity or local municipality were to perform maintenance that was paid for by private owners, a fee-for-service system could be established by which a flat fee could be charged per maintenance event based on the nature of the maintenance to be performed as well as the strategy's size and complexity. This option provides a transparent and predictable cost structure for the private owner but is not as readily adjustable for inflation and changes in operational costs. Alternatively, maintenance costs could be charged on a time-and-materials (T&M) basis, which results in potentially variable costs to the private owner but better reflects the true cost to the regional entity or local municipality for performing the service.

In an owner-led model, property owners perform maintenance themselves or use contractors. In some cases property owners might be remiss in performing green infrastructure maintenance as prescribed, resulting in signs of failure or poor performance. In those cases, to prevent or mitigate total failure of the strategy, municipalities can perform corrective actions and bill the property owner to recover incurred costs on a case-by-case basis.

Under any of the three business models, the cost of privately owned green infrastructure maintenance can be partially or fully offset in municipalities where a stormwater fee discount or other ongoing financial incentive is in place. When considered over the long term, an owner of a green infrastructure strategy can recoup some or all of the capital and maintenance expenditures depending on the magnitude of the incentive and whether it is paid in perpetuity.

Table 5. Financing options applicable to green infrastructure maintenance business models.

Model	Funding Approaches
Regional Model	<p>MMSD Approaches:</p> <ul style="list-style-type: none"> • Establishment of regional MMSD stormwater utility with separate user fee based on jurisdiction contribution into the systems—directly billed by MMSD or by the local government. • Public-private partnerships developed to create a mechanism to use private investors/capital to fund the design, installation, and/or maintenance of green infrastructure strategies. • Partnering with local organizations¹ to provide paid or volunteer labor to inspect and maintain strategies. <p>Local Government Approaches:</p> <ul style="list-style-type: none"> • None <p>Private Owner Approaches:</p> <ul style="list-style-type: none"> • Owner pays a fee for maintenance service (flat fee or T&M) • Maintenance costs could be offset by stormwater incentives that are ongoing.
Local Model²	<p>MMSD Approaches:</p> <ul style="list-style-type: none"> • None unless MMSD will need additional funds to track maintenance conducted by local governments. <p>Local Government Approaches:</p> <ul style="list-style-type: none"> • Multi-jurisdictional funding—multiple local governments combine funding to hire contractor(s) to provide maintenance services. • General revenue appropriations. • Development of new or increase of existing stormwater utility user fees. • Plan review fees. • In-lieu fees for post-construction controls. <p>Private Owner Approaches:</p> <ul style="list-style-type: none"> • Owner pays a fee for maintenance service (flat fee or T&M) • Maintenance costs could be offset by stormwater incentives that are ongoing.
Owner-led Model³	<p>MMSD Approaches:</p> <ul style="list-style-type: none"> • Administrative costs to track owner self-inspection and maintenance certifications would have to be funded via one of the models described in the Regional Model, but the funding level would be decreased. <p>Local Government Approaches:</p> <ul style="list-style-type: none"> • Administrative costs to enforce against non-compliant property owners would have to be funded via one of the models described in the Local Model, but the funding level would be decreased. <p>Private Owner Approaches:</p> <ul style="list-style-type: none"> • Owner pays for all maintenance costs. • If corrective actions taken by regional entity or local municipality, owner reimburses those costs. • Maintenance costs could be offset by stormwater incentives that are ongoing.

Notes: 1. Organizations include community groups, colleges and universities, trade schools, green jobs training programs, or court-ordered community service programs. 2. This model could be funded using just one of the approaches described or a “blended” approach using more than one. 3. Based on existing legal authority, these approaches presume that MMSD would administer the program and utilize local governments to enforce against property owner non-compliance.

5 Conclusions and Next Steps

The process of developing a strategic green infrastructure maintenance business plan with stakeholder involvement verified that MMSD and stakeholders in southeast Wisconsin are facing similar green infrastructure maintenance challenges to other communities around the country. Despite the challenges, the process revealed the opportunities for improving green infrastructure maintenance that exist because of the region's commitment to green infrastructure, the desire to leverage resources in a manner that will meet the region's most pressing needs, and the openness to collaborative and cooperative approaches.

5.1 Conclusions

Ultimately, conducting maintenance under a strategic green infrastructure maintenance business plan will likely have to incorporate all three business models to adequately serve the existing and projected green infrastructure strategies on public and private property. There are some types of strategies (i.e., larger, more complex strategies or those that require special equipment or expertise) that might lend themselves to regional services, while others might be a better fit for the local model (e.g., small-scale strategies or those that require relatively frequent, routine maintenance). Different models could be used to maintain private vs. public green infrastructure strategies. As acknowledged by participating stakeholders, there are opportunities to partner and leverage resources among public sector entities, non-governmental organizations, and workforce development interests until the green infrastructure maintenance demand grows to create a stronger incentive for the private sector to develop qualified and well-trained staff in green infrastructure maintenance. For example, a Green Team or a Green Infrastructure Service Center could be contracted by local governments or private entities to do maintenance work until a green infrastructure maintenance training and certification program can produce more qualified individuals and firms. As more qualified firms are added to the MMSD Green Vendor list, the regional entity could phase out of providing maintenance services and focus on other elements of green infrastructure maintenance, such as outreach, education, and technical assistance (see Section 4.3).

This section presents the primary findings identified through the strategic green infrastructure maintenance business plan development process and identifies recommended next steps for MMSD and stakeholders in southeast Wisconsin. The business models provide an organizing framework for presenting the conclusions.

Conclusions Related to the Regional Model

- **A blanket regional approach to green infrastructure O&M is not considered feasible among participating stakeholders.** According to stakeholders, green infrastructure maintenance requires a suite of approaches that addresses the various factors influencing green infrastructure maintenance decisions, such who owns the green infrastructure strategy, its size and complexity, and other key factors. The 28 municipalities have differing priorities, budgets, and levels of expertise. Variations in these local factors, coupled with the issues of property ownership and scale, would create challenges if a uniform approach to maintenance were adopted. The stakeholders who participated in the process appear to prefer a flexible program that recognizes opportunities for leveraging and partnership, with regional approaches to specific elements (e.g., training).

- **A regional approach to training and certification has potential but requires uniform maintenance and inspection standards.** During the community meetings, stakeholders stated a need for a focus on developing skills in both individuals and small businesses to help small businesses grow green infrastructure maintenance services for the region. However, the lack of uniform maintenance and inspection standards could affect a regional approach to training and certification. Two perspectives emerged from the facilitated community meetings: 1) consistency of maintenance standards for the region could be beneficial and help to lower costs, and 2) regional maintenance standards will not always make sense for every community across the region due to community differences. If there is to be a regional training and certification program, there will need to be regionally applicable maintenance and inspection standards on which to base the program. This will require further discussion among MMSD and local stakeholders.
- **A regional approach to maintenance activities has potential on a case-by-case basis.** The survey highlighted specific types of green infrastructure strategies for which a regional approach to maintenance could make sense—bioretention/bioswales/greenways, permeable pavement, and green alleys/streets/parking lots. If a Green Infrastructure Service Center were to be established, an idea that interested some participating stakeholders, the Center could provide maintenance services to municipalities and individuals on an as-needed basis. As the private sector develops staff expertise through training and certification programs, maintenance services provided by a potential Green Infrastructure Service Center could gradually phase out.

Conclusions Related to the Local Model

- **There is a need to expand green infrastructure maintenance expertise at the local level.** The facilitated community discussions highlighted municipalities' challenges related to conducting green infrastructure maintenance using in-house staff. Either the demand is too significant and staff resources are limited, or staff lack the adequate expertise. Although some municipalities are outsourcing maintenance work, participating stakeholders mentioned that contractors do not always have all the expertise necessary to maintain a range of green infrastructure strategies. Demand for more qualified contractors could drive local contractors to hire more qualified staff. This could be accomplished by including green infrastructure maintenance contract specifications and contractor qualifications in request for proposal language. Improved integration among municipalities to hire the most qualified contractors will result in higher quality services throughout southeast Wisconsin.
- **Municipalities are interested in retaining maintenance responsibilities, although outsourcing aspects of maintenance is a viable option.** This relates to the regional maintenance services on a case-by-case basis mentioned above.

Conclusions Related to the Owner-led Model

- **Green infrastructure maintenance on private property will rely heavily on the owner-led model, increasing the need for private-property owner education and training to establish expectations and build confidence.** Stakeholder discussions focused heavily on public property green infrastructure maintenance issues due to lack of private-property owner representation in the meetings and survey responses. However, 68 percent of the needed green infrastructure strategies to achieve the 2035 Vision must be located on private property, which could place a

significant burden on a regional entity to perform maintenance over a dispersed area. As a result, the owner-led maintenance model will play a significant role in the overall green infrastructure maintenance plan for southeast Wisconsin. This is likely to translate into a substantial need for private-property owner education and training. Stakeholders working with private-property owners emphasized the need to provide technical assistance and training that will boost confidence. For example, GroundWork Milwaukee performs site visits and one-on-one outreach to promote maintenance and build confidence. This group recommends starting with one-on-one visits in the first year, conducting block parties to promote maintenance in the second year, and providing one-on-one assistance in third year.

- **There is a need for focused discussion on private-property (commercial/industrial/residential) maintenance issues, including incentives and disincentives.** Due to the lack of private-property owners participating in the process, there is a need for additional discussion on incentives to promote green infrastructure maintenance on private property and disincentives that might hinder maintenance.

5.2 Recommended Next Steps

The following are recommendations for steps that MMSD and municipalities in the region can take to further the development of a comprehensive O&M business plan:

- **Assess the economic implications of each option to determine economies of scale.** The scope of this report did not include examining the economic considerations associated with each maintenance business model. However, this information is extremely important for identifying the most cost-effective approaches to maintenance. An economic analysis could show that certain business models will generate lower overall costs for maintenance and could help prioritize the future course of action for the region to promote maintenance activities that will maximize available resources.
- **Explore development of Green Infrastructure Service Center and identify suite of services.** The recommendations section of MMSD's Regional Green Infrastructure Plan introduces the concept of a Green Infrastructure Service Center that could provide technical expertise and resources to supplement municipal staff. Through the survey and stakeholder involvement process associated with this project, municipal representatives shared thoughts on the potential services that a Green Infrastructure Service Center could provide. Survey results indicated interest in having services such as training, certification, and tracking provided through a potential Green Infrastructure Service Center. As a next step, MMSD could work with the TAT and other interested stakeholders to begin brainstorming the structure, functions, and financing of a Green Infrastructure Service Center.
- **Research existing green infrastructure maintenance certification standards.** Certification of green infrastructure maintenance providers is a significant issue to address for all business models. MMSD should consider first researching existing green infrastructure maintenance certification standards used in the Great Lakes region or by other reputable organizations (e.g., American Society of Landscape Architects) to determine what other programs use and identify how these standards could work in southeast Wisconsin. MMSD could work with the TAT to identify existing certification standards that could be adopted or adapted in southeast Wisconsin. As part of this effort, MMSD and the TAT can also compile and assess information on

current regional and municipal green infrastructure maintenance standards, where they exist, to determine how these standards compare to standards outside southeast Wisconsin.

- **Develop a maintenance and inspection training and certification program to improve local expertise and better ensure quality performance of maintenance and inspection duties.** Using research findings on existing green infrastructure maintenance certification standards, as well as information about existing maintenance and inspection training, MMSD can craft a maintenance and inspection training and certification program. The target audiences for the maintenance and inspection training and certification program would include contractors and individuals that provide maintenance services to municipalities, residences, and commercial facilities. The program could also be used to train and certify municipal staff for municipalities that want to cultivate internal staff expertise for either conducting maintenance or inspecting contractors providing these services.
- **Consider development of contractor specifications and qualifications language.** Members of the TAT that participated in this project raised the need for contractor specifications and qualifications language to use in RFPs focused on green infrastructure maintenance services. MMSD and the TAT could collaborate to either identify minimum green infrastructure maintenance specifications that should be incorporated into future RFPs or actual model language that MMSD and municipalities could adapt to fit their needs from contract to contract.

5.3 Lessons Learned

MMSD will continue to develop a business plan for green infrastructure maintenance. The stakeholder-based approach used by MMSD and EPA for examining green infrastructure maintenance needs and identifying possible maintenance business models through this project has applicability in other regions and municipalities across the country. This section addresses some of the lessons learned that could help other entities take a similar approach to evaluate feasible green infrastructure maintenance options and craft a strategic business plan.

- **Assess existing maintenance activities to understand current approaches and capabilities.** It is key to understand the current protocols, standards, and approaches, as well as capabilities and resources, for green infrastructure maintenance at the outset. As this project kicked-off, MMSD had done an informal survey of the 28 municipalities in the service area to understand approaches to green infrastructure maintenance. This project then used a more systematic tool for assess existing green infrastructure approaches and needs, but not all 28 municipalities participated. Some of this information was made available through a parallel MMSD project to review municipalities' existing codes and ordinances to identify barriers to green infrastructure. Having all of this information compiled, assessed, and reviewed before identifying business models could help define the most feasible models and the nuances related to each model.
- **Be aware of municipal variations in perspectives and resources.** The 28 municipalities in the MMSD service area have a range of capabilities and resources to perform green infrastructure maintenance. Some prefer to do the maintenance work in-house and others wish to retain the services of local contractors. The strategic business model for green infrastructure developed at a regional level must acknowledge and account for these varying perspectives and resources, allowing flexibility and not locking municipalities into an approach that is counter to their vision for achieving their own green infrastructure maintenance goals.

- **Do not assume that one approach will work for everything.** Building off of the previous lesson, strategic business models must be flexible enough to accommodate the needs of different stakeholders. Green infrastructure is about diffuse approaches tailored to meet the individual needs of a site. As a result, green infrastructure maintenance approaches should mirror this diffuse and diverse approach. There are opportunities for consistency to achieve economies of scale, but the strategic business plan should include business models for maintenance that can stand-alone or work in conjunction with other models. This is referred to as a hybrid approach.
- **Bring all stakeholders to the table, including private-property owners, to ensure a well-balanced perspective on maintenance challenges and needs.** The stakeholder involvement process for this project focused heavily on municipalities and their maintenance needs, capabilities, and concerns. MMSD's green infrastructure goals rely heavily on implementation by private-property owners. As a result, addressing private-property owners' maintenance challenges and needs will be essential over time. Due to the focus on municipalities, the strategic business plan will need further development to better address private-property owners. Having this key group of stakeholders represented throughout the process would have ensured the business models relied more on actual input rather than assumptions.

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Appendix A: Milwaukee Metropolitan Sewerage District Green Infrastructure Operations & Maintenance Business Model Communications Plan

Introduction and Purpose

Milwaukee Metropolitan Sewerage District (MMSD) is faced with a number of challenges related to green infrastructure (green infrastructure), including: funding operations and maintenance (O&M) of green infrastructure, gaining public awareness and changing the public's perception about green infrastructure's functionality, creating a pool of trained and certified professionals to perform O&M, and ensuring the proper tools are in place for effective enforcement and inspection. According to MMSD's Regional green infrastructure Plan, of the top five concerns expressed by the Green Infrastructure Technical Steering Committee, ensuring proper maintenance was the second highest priority and communicating the benefits of green infrastructure was the fourth highest priority.

MMSD is in the process of identifying a sustainable, stakeholder-endorsed strategic business implementation plan for the O&M of green infrastructure in southeast Wisconsin. The strategic business implementation plan focused on O&M issues will meet the institutional needs of MMSD and its partner agencies to ensure that green infrastructure will continue to function as designed over the long term.

To support the development of the green infrastructure Strategic O&M Business Plan, MMSD will engage stakeholders throughout the process. This document describes the communication activities and approaches that MMSD will undertake to ensure that the green infrastructure Strategic O&M Business Plan takes stakeholder input and concerns into consideration. The information contained in this document will also help to inform a broader regional green infrastructure communication plan intended to support MMSD's Regional green infrastructure Plan.

USEPA, through contractor support, is assisting MMSD with development of the green infrastructure Strategic O&M Business Plan and the project schedule begins in June 2014 and ends December 2014. As a result, the schedule for stakeholder communications activities related to the green infrastructure Strategic O&M Business Plan focuses on this six-month schedule. However, it is important to note that stakeholder communications related to O&M activities will need to extend far beyond this six-month project period as green infrastructure implementation progresses throughout the region. Communication activities will span two phases. Phase I will focus on near-term stakeholder communications and engagement related to the development of the green infrastructure Strategic O&M Business Plan, and Phase II will focus on recommendations for communications activities beyond the development of the green infrastructure Strategic O&M Business Plan. During Phase I, MMSD will have stakeholder communications support from Tetra Tech, Inc. that will coincide with the development of the green infrastructure Strategic O&M Business Plan. For Phase II communications, MMSD will need to determine roles and responsibilities among MMSD staff and local partners.

This communications plan presents information related to stakeholder outreach and engagement for the green infrastructure Strategic O&M Business Plan under six key elements:

1. Goals and objectives
2. Target audiences
3. Messages
4. Formats

5. Distribution
6. Evaluation

To reiterate, this document should be considered a subset of MMSD's broader Regional green infrastructure Communications Plan initiated by MMSD staff, with communication activities coming under MMSD's FreshCoast740 outreach and education campaign. The information under each of the six key elements can inform broader green infrastructure communications efforts.

Goals and Objectives

MMSD's overarching goal for the green infrastructure Strategic O&M Business Plan is to outline and assign the *who, what, where, when, why, and how* of operating and maintaining green infrastructure in southeast Wisconsin, addressing topics such as incentives, finance mechanisms, and funding; institutional framework and governance; maintenance standards and protocols; and equipment and training needs.

MMSD recognizes that developing the green infrastructure Strategic O&M Business Plan should involve key stakeholders who will play a role in operating and maintaining green infrastructure in the region. Stakeholder education is key to successful green infrastructure O&M. Involving stakeholders who will play a role in O&M activities in the early stages of O&M program development—developing maintenance standards and protocols, identifying equipment and training needs, overcoming institutional barriers, and identifying opportunities—will increase the probability of sustained, stakeholder involvement in actual O&M.

Objectives for stakeholder communications and engagement in developing MMSD's green infrastructure Strategic O&M Business Plan include:

- To identify a comprehensive list of regional stakeholders that currently or potentially play a role in green infrastructure O&M activities;
- To engage regional stakeholders with green infrastructure O&M interests to participate in the green infrastructure Strategic O&M Business Plan development process;
- To achieve a baseline level of awareness on green infrastructure O&M issues among participating stakeholders to ensure everyone is informed and able to provide meaningful input on potential O&M business models;
- To provide adequate opportunities for participating stakeholders to share feedback on potential O&M business models;
- To develop a prioritized matrix of O&M business models based on stakeholder input.
- To develop general organizational structures/funding models for implementation

By meeting these objectives, stakeholders' input should help MMSD answer the following questions:

1. What are the skills in the workforce and what is missing?
2. Who has and who needs equipment for O&M?
3. What type of O&M training would be beneficial?
4. What funding sources are used for O&M?

Target Audiences

There are numerous categories of stakeholders that either currently perform green infrastructure O&M or have the potential to participate in green infrastructure O&M activities. These stakeholders are the

key target audiences for this communication plan to support the development of MMSD's green infrastructure Strategic O&M Business Plan. Categories of stakeholders include the following:

Agency Partners

- Wisconsin Department of Natural Resources
- U.S. Environmental Protection Agency
- U.S. Forest Service/National Park Service

Environmental Nongovernmental Organizations

- Mequon Nature Preserve (<http://mequonnaturepreserve.org/>)
- Schlitz Audubon (<http://www.sanc.org/>)
- Urban Ecology Center (<http://urbanecologycenter.org/>)
- Sweet Water/Southeastern Wisconsin Watershed Trust, Inc. (<http://www.swwtwater.org/>)
- 1000 Friends of Wisconsin (<http://www.1kfriends.org/what-we-do/watershed-protection/>)
- American Rivers (<http://www.americanrivers.org/?s=milwaukee>)
- Trust for Public Land (http://www.tpl.org/?qclid=CJDJxOSoy78CFc1_MgodqHsAug)
- The Conservation Fund (<http://www.conservationfund.org/places-we-work/wisconsin/>)
- Groundwork Milwaukee (<http://www.groundworkmke.org/index.html>)
- Ozaukee Washington Land Trust (<http://owlt.org/>)

Foundations

- Brico Fund (<http://www.bricofund.org/index.php/grantmaking/>)
- Greater Milwaukee Foundation (<http://www.greatermilwaukeefoundation.org/grants/grant-seekers/grantmaking-priorities-and-guidelines/>)
- Helen Bader Foundation (<http://www.hbf.org/what-we-do/workforce-development>)

Landscape Contractors

- Marek Landscaping (<http://mareklandscaping.com/>)
- Applied Ecological Services (<http://www.appliedeco.com/>)
- Wisconsin Landscape Contractors Association-Metro Milwaukee Chapter (<http://www.findalandscape.org/>)
- MMSD Green Vendor list (<http://www.freshcoast740.com/en/Green-Vendors>)

Workforce Development Organizations

- Wisconsin Regional Training Partnership (<http://www.wrtpp.org/index.php>)
- Milwaukee Community Service Corps (<http://www.milwaukeecommunityservicecorps.org/>)
- 16th St Community Health Center (<http://sschc.org/>)
- Jobs for the Future GreenWays Initiative through the Milwaukee Area Workforce Funding Alliance (<http://www.jff.org/initiatives/greenways/our-approach>) (see also Milwaukee DPW Urban Forestry Workforce Partnership below)

Neighborhood Organizations

- Milwaukee neighborhood associations and development corporations (<http://city.milwaukee.gov/NeighborhoodGroups>)
- Northwest Side Development Corporation (<http://nwscdc.org/about/>)

- Milwaukee Development Corporation (http://www.mmac.org/economic_development/Milwaukee_Development_Corporation.aspx)
- Burleigh Street Community Development Corporation (<http://www.burleighstreet.org/>)

Municipalities

- 28 municipalities in MMSD's service area participating on the Technical Advisory Team; many conducting some form of green infrastructure according to FreshCoast740 My Community page (<http://www.h2ocapture.com/Community>)

City of Milwaukee Departments/Programs

- City of Milwaukee Office of Environmental Sustainability's HOME GR/OWN program (<http://city.milwaukee.gov/homegrownmilwaukee.com>)
- Milwaukee DPW's Urban Forestry Workforce Partnership (<http://www.iff.org/initiatives/greenways/milwaukee-urban-forestry-workforce-partnership>)
- Milwaukee County

MMSD Facilities and Programs

- Veolia Water Milwaukee (<http://www.veoliawatermilwaukee.com/home/>)
- MMSD green infrastructure Funding Programs (http://www.freshcoast740.com/Funding-Programs?sc_lang=en)
- Rain Barrel Sales
- Rain Garden Plant Sales
- Green Streets Program
- Regional Green Roof Initiative (2010-2013)
- Green roofs (added to green infrastructurePP in 2014)
- Green Infrastructure Partnership Program (green infrastructure reimbursement program)

MMSD can use this initial list of target audiences with an interest in green infrastructure O&M to determine if other organizations, agencies, or departments should be invited to participate in the development of MMSD's green infrastructure Strategic O&M Business Plan.

Messages

Messages should be tailored to resonate with specific key target audiences and are intended to evoke a change in the behavior of an individual or a group of individuals. For the purpose of the green infrastructure Strategic O&M Business Plan development process, messages should help to meet the objectives presented above. Specifically, messages should encourage stakeholders to participate in the process of identifying and prioritizing green infrastructure O&M business models. The messaging for implementation of selected O&M protocols and procedures will evolve to focus on encouraging stakeholders to conduct green infrastructure O&M according to the business plan established with stakeholder support. Those messages should be captured after the Strategic green infrastructure O&M Business Plan is complete and integrated into an overall Regional green infrastructure Communications Plan. The MMSD Public Information Manager will review and approve all messages.

Recommended messages related to communications for the Strategic green infrastructure O&M Business Plan development process are provided below. Messages focus on the three phases of outreach: awareness, education, action.

Awareness

Although many of the stakeholders that will be invited to participate in the process have a baseline awareness of green infrastructure, there might be some that aren't aware of the role that green infrastructure will play in southeast Wisconsin and MMSD's commitment to green infrastructure. Messages to help raise potential participating stakeholders' awareness are found in MMSD's Regional green infrastructure Plan (Phase I). Messages to raise awareness can include the following:

- MMSD's 2035 Vision calls for zero basement backups, zero overflows, and improved water quality.
- Property owners can help achieve the 2035 Vision by capturing stormwater and allowing it to soak into the ground or evaporate instead of entering sewers and contributing to sewer overflows or basement backups using green infrastructure strategies.
- Green infrastructure strategies are being installed throughout the region, but more are needed to achieve the 2035 Vision.
- A new discharge permit condition requires MMSD to add one million gallons of green infrastructure capacity to the region annually.
- Green infrastructure can save taxpayers money, create local jobs, and increase property values.
- Green infrastructure can improve our quality of life, decrease crime rates, and beautify our neighborhoods, our city, our region.
- Green infrastructure can help us conserve energy, improve water and air quality, and help reduce the risk of flooding.
- MMSD has developed a Regional green infrastructure Plan that identifies green infrastructure opportunities, costs, and benefits.
- To achieve the FreshCoast740 goal, we need to manage water where it falls.

Education

Once there is a baseline awareness of green infrastructure in southeast Wisconsin, messaging can focus on educating stakeholders on the importance of green infrastructure O&M, the need for protocols and processes to ensure adequate green infrastructure O&M in the region, and the different types of O&M business models to consider. Messages to help educate potential participating stakeholders on O&M can include the following:

- Green infrastructure strategies have different O&M requirements than other types of stormwater management approaches.
- O&M helps keep green infrastructure strategies functional.
- Understanding the O&M needs for different types of green infrastructure strategies will ensure everyone can enjoy the benefits of green infrastructure in the near and long-term.
- Several partners in the region are currently performing different types of green infrastructure O&M activities.
- A consistent set of standards for green infrastructure O&M has not been developed for the region.
- Standardizing green infrastructure O&M across the region will make regional implementation more successful.

- MMSD is initiating a stakeholder-based process to develop a Strategic green infrastructure O&M Business Plan that will help to standardize green infrastructure O&M activities across the region.

Action

After educating potential stakeholders on green infrastructure O&M issues, the next phase is to provide information about the actions they can take. In the context of this project, action will focus on participating as a stakeholder in the development of MMSD’s Strategic green infrastructure O&M Business Plan, with the understanding that after completion of this plan, they will be asked to use the plan in conducting green infrastructure O&M activities. The plan will also guide the development of new business models to implement and fund O&M. Messages to promote stakeholder participation in the process can include the following:

- You may have an important role in green infrastructure O&M in the region.
- Your input on developing standardized green infrastructure O&M approaches for the region is important to MMSD while crafting a Strategic green infrastructure O&M Business Plan.
- Sharing your experience and expertise in green infrastructure O&M will ensure a stronger, successful regional approach to O&M.
- You know which green infrastructure O&M approaches will work best in your neighborhood/municipality.
- Your concerns about green infrastructure O&M in your neighborhood/municipality should be taken into account when developing a standardized approach to green infrastructure O&M.
- Your thoughts on which tools and resources are necessary to implement a regional green infrastructure O&M approach will help MMSD and partners collaborate and allocate resources.
- Tell MMSD which O&M approaches should be highest priority in MMSD’s Strategic green infrastructure O&M Business Plan.

Messages will evolve as MMSD staff and other local partners provide input on ways to educate and involve other key stakeholders in the development of the green infrastructure Strategic O&M Business Plan. Different messages are likely to resonate with different target audiences, depending on what phase of outreach is most appropriate for each target audience. For example, messages associated with the awareness phase might not be as important to stakeholders that have participated on MMSD’s Green Infrastructure Technical Steering Committee.

Format & Distribution

Outreach messages should be formatted and distributed in a manner tailored to each target audience (e.g., electronic resources, print material, events, technical assistance mechanisms), depending on the needs and communication characteristics of each audience.

Communication formats and distribution channels will need to serve the key target audiences participating in the process to develop the Strategic green infrastructure O&M Business Plan. Therefore, they will be very project-specific in nature, as opposed to formats used for communication with broader audiences on green infrastructure issues to promote regional implementation and O&M.

Communication formats needed include:

Invitation to Participate. An invitation to participate in the process will be one of the first outreach formats used in the process to develop the Strategic green infrastructure O&M Business Plan. It will

need to include appropriate messages about the importance of green infrastructure in the region, the need for standardized O&M, what role the target audience can play and why it is important. The invitation will also provide an overview of logistical information about the process and the level of participation requested.

Presentations. Presentations will be an important format for delivering outreach messages on aspects of potential green infrastructure O&M models that could be used in southeast Wisconsin. MMSD can use presentations at stakeholder engagement events and make them available on the MMSD website as appropriate. It will be important to tailor presentations to key target audiences to ensure content achieves the right balance of narrative and visuals.

Fact sheets. Fact sheets can provide brief overviews of green infrastructure O&M business models for participating stakeholders to review and discuss during in-person feedback events. Fact sheets will address the following information:

- Institutional structure description
- Applicable financing mechanisms, including summaries of existing cost information, as available
- Compliance tracking and assurance
- Equipment needs and technical considerations
- Local economic impacts and benefits
- Training/certification needs
- Stakeholder engagement and education needs

Like presentations, MMSD can use fact sheets at in-person events and distribute them to participants electronically for review.

Case study information. Examples of green infrastructure O&M approaches in action can help highlight technical, financial, programmatic, and social components for stakeholders to consider when evaluating and comparing approaches. This type of information can work well in both electronic and printed formats and will be integrated into the final Strategic green infrastructure O&M Business Plan.

There are a variety of distribution channels for communicating messages throughout the green infrastructure Strategic O&M Business Plan development process. Some distribution channels are also mechanisms for obtaining stakeholder input and feedback. Two types of distribution channels are electronic and the others focus on person-to-person communication that provides stakeholders with the opportunity to provide input to the process.

Email. Email is likely to be an important distribution channel to reach stakeholders with an invitation to participate, information to review, and notifications about other aspects of the Strategic green infrastructure O&M Business Plan development process.

MMSD website. The website can be another key distribution channel for information about the process and green infrastructure O&M, either during the process or after the development of the green infrastructure Strategic O&M Business Plan.

Facilitated focus group sessions. Focus group sessions allow for small group discussions on a specific set of questions. During a session, MMSD can present one or more O&M models to focus group participants representing a particular interest (e.g., landscape contractors, municipal officials, workforce development interests) and ask the small group for feedback.

One-on-one interviews. Where it is important to communicate with a key member of a particular target audience and it is unlikely that the individual can participate in a group event, or input is not likely to be freely given at a group event, then a one-on-one interview approach might be necessary. This would allow MMSD to educate a particular individual on O&M issues and tailor the messages to that individual. It would then allow MMSD to ask the individual very specific questions on O&M approaches, giving the individual the opportunity to share feedback in a direct manner.

Electronic survey. This distribution channel is focused less on communicating messages and more on obtaining stakeholder feedback on specific O&M issues and to help prioritize O&M business models. This approach would be most effective if MMSD uses it in conjunction with other distribution methods that are intended to convey information to participating stakeholders throughout the process. Free online survey tools, such as Survey Monkey, are available.

Existing stakeholder meetings. Targeting key audiences at their existing meeting venues, rather than scheduling and inviting them to participate in a separate meeting, can be an effective way to reach specific groups of stakeholders. Existing meetings are held by the Intergovernmental Cooperation Council (ICC), the **Technical Advisory Team (TAT)**, and Sweetwater. These existing meetings could be good venues for sharing information about MMSD’s green infrastructure Strategic O&M Business Plan and obtaining stakeholder input.

Recommended Communication Action Items and Schedule

Based on information about target audiences, messages, and format/distribution, this section presents recommended action items and a schedule for implementing stakeholder communication activities to support MMSD’s green infrastructure Strategic O&M Business Plan development process. **Table 1** presents a stakeholder communication plan matrix that summarizes communications activities, schedule, target audience, and responsible entity. This matrix will evolve as MMSD and Tetra Tech discuss the details of the project.

Table 1. Stakeholder Communications Plan Matrix to Support MMSD’s green infrastructure Strategic O&M Business Plan Development Process

Communications Activity	Schedule	Key Target Audiences	Responsible Entity
Complete list of stakeholders to be invited to participate in the process	July 7-11, 2014	TBD	Tetra Tech MMSD
Select appropriate communication messages/formats/distribution/feedback mechanisms for specific target audiences	July 7-11, 2014	All	Tetra Tech MMSD
Draft stakeholder participation invitation letter	July 18, 2014	All	Tetra Tech MMSD
Send stakeholder participation invitation letter via email	July 25, 2014	All	MMSD
Compile list of RSVPs and questions from stakeholders	August 15, 2014	MMSD	Tetra Tech
Develop draft stakeholder engagement activity agendas	July 25, 2014	Varies by type of activity	Tetra Tech

Communications Activity	Schedule	Key Target Audiences	Responsible Entity
Develop draft stakeholder engagement presentation	August 1, 2014	All	Tetra Tech
Develop other draft stakeholder communication materials, as selected	August 1, 2014	Varies by type of message/format/communications activity	Tetra Tech
Facilitate stakeholder engagement events	September 18, 2014 (coordinate w/TAT meeting) October 16, 2014 (coordinate w/TAT meeting)	TBD	Tetra Tech MMSD
Compile stakeholder feedback on O&M business models	October 30, 2014	MMSD Stakeholders	Tetra Tech
Prepare final memorandum of overall stakeholder engagement findings and prioritized O&M models based on stakeholder input	November 15, 2014	MMSD Stakeholders	Tetra Tech

Evaluation

Evaluation provides a feedback mechanism to gauge success of the communications activities and, to some extent, the success of the green infrastructure Stakeholder O&M Business Plan development process. Evaluation information will also help to inform the development of a broader communications plan for MMSD’s Regional green infrastructure Plan.

Evaluation tools must be built into the stakeholder communication activities at the beginning to generate meaningful feedback and determine whether communication goals and objectives were met. The most important objectives are raising awareness, providing education, and generating participation in the green infrastructure Strategic O&M Business Plan development process.

Table 2 provides preliminary ideas on potential tracking indicators for communication activities. Actual indicators will be defined once details of the communication activities are finalized with MMSD input.

Table 2. Summary of Stakeholder Communication Activities and Tracking Indicators

Communication Plan Activities	Tracking Indicators
Inviting stakeholders to participate	<p>Of the total number of invited stakeholders, how many stakeholders stated interest in participating in the form of a commitment?</p> <p>Were there additional stakeholders recommended by invited stakeholders to participate in the process? If so, were additional stakeholders invited and did they state interest in participating in the form of a commitment?</p> <p>Was there adequate representation from each key target audience category?</p>
Developing/distributing communication materials	<p>Of the total number of participating stakeholders, what percentage of stakeholders indicated that the communication materials assisted in their understanding of green infrastructure O&M issues, needs, and approaches?</p>
Presenting O&M approaches	<p>Of the total number of participating stakeholders, what percentage of stakeholders indicated that the presentation raised their awareness about green infrastructure O&M issues, needs, and approaches?</p>
Facilitating stakeholder engagement activities	<p>Of the total number of stakeholders that committed to participating in the process, how many stakeholders sustained participation throughout the process?</p> <p>Were all key target audience categories represented throughout the process?</p>

Appendix B: Community Conversation Presentation Slides and Meeting Summaries

Community Conversation Presentation Slides

Going Green and Staying Green: Options for Green Infrastructure (GI) Operation & Maintenance (O&M) in Southeast Wisconsin



A Community Conversation with
Milwaukee Metropolitan Sewer District (MMSD)

September 18, 2014

Overview of GI O&M Issues

- Smaller-scale, dispersed strategies
- Mix of strategies on publicly and privately owned land
- Mix of current and potential entities with O&M responsibilities and capabilities
 - MMSD staff
 - Municipal department staff
 - Private property owners
 - Contactors/landscapers
 - Workforce development organizations
 - Volunteers
- Variety of current and potential funding sources



Overview of GI Strategy O&M Needs

- Varies from strategy to strategy
- Several factors to consider:
 - Time commitment
 - Skill and training
 - Equipment
 - Frequency and timing



Rain Harvesting O&M Needs

- Check for:
 - Low levels of water
 - Visible damage and leaks
 - Debris and obstructions in gutter, downspout, diverter
- Drain, clean, store cistern or barrel
- Minimal equipment needs (ladder and hose)
- Minimal skill



Rain Garden and Native Landscaping O&M Needs

- Check for:
 - Litter and plant debris
 - Weeds and invasives
- Thin, trim, and weed
- Add new mulch
- Replace dead or diseased plants
- Mow turf
- Water during hot/dry periods
- Minimal equipment needs (shovel, rake, shears, mower)
- Minimal skill



Stormwater Trees O&M Needs

- Check for:
 - Exposed tree roots and clumps of grass
 - Leaning
- Rake, collect, and dispose/compost leaves
- Add new mulch
- Trim dead branches
- Water during hot/dry periods
- Minimal equipment needs (shovel, rake, shears, hose)
- Minimal skill



Bio-Swale O&M Needs

- **Check for:**
 - Water that doesn't properly drain
 - Trash and debris
 - Bare areas, exposed roots, cracks in the soil
- **Remove:**
 - Dead/diseased plants
 - Materials that might clog
- **Trim vegetation**
- **Minimal equipment needs (shovel, rake, shears)**
- **Some training required**



Wetlands O&M Needs

- **Check for:**
 - Erosion
 - Clogged riser or bypass structure
 - Failing riser, barrel, embankment, lining
 - Leaking low-level release valve
 - Bare areas
- **Remove:**
 - Dead/diseased plants
 - Materials that might clog
- **Trim vegetation**
- **Revegetate bare spots**
- **Minimal equipment needs (shovel, rake, shears)**
- **Training required**



Greenways O&M Needs

- Check for:
 - Ponding
 - Contamination
- Remove trash and debris
- Replace dead/diseased vegetation
- Minimal equipment needs (shovel, rake)
- Training required



Green Roofs O&M Needs

- Check for:
 - Roof damage
 - Leaking
 - Clogging
- Remove dead/diseased vegetation
- Replace vegetation in bare areas
- Minimal equipment needs (ladder, shovel)
- Training required



Porous Pavement O&M Needs

- Check for:
 - Leaves, grass, clippings, trash
 - Residing water
 - Damaged pavers
- Vacuum sweep to prevent clogging
- Maintain surrounding vegetation
- Replace damaged pavers
- Heavier equipment needs (street sweeper, flat-blade shovel, rake, pavers)
- Training required



Discussion

- Are there other O&M needs (e.g., equipment, training, inspections) for the GI strategies presented?

Current GI O&M Approaches in Southeast Wisconsin

- MMSD has a 10 yr maintenance requirement associated with GI funding
- MMSD recently asked municipalities about GI O&M approaches (8 responded)
 - Two municipalities stated O&M a deterrent to GI implementation
 - Of six w/GI strategies, five have formal approach for assessing condition
 - Using a mix of staff, contractors, and volunteers; approaches vary

Discussion

- How are current approaches to GI O&M working in your municipality/community?
- What's your perspective on how GI O&M activities in your municipality/community will change in the future?

Potential Business Models for Improving GI O&M

- Identified potential business models for GI O&M
 - Public property
 - Private property
- Business models examine associated factors:
 - Compliance tracking
 - Inspection
 - Equipment and training needs
 - Economic impacts/benefits

Potential O&M Entities Considered in Business Models



Centralized Regional Model (GI Strategies on Public Property)

Municipalities

Volunteers

Property Owners



Possible
inspection
support

Contractors

- Performs all maintenance
- Integrates GI database with asset management system
- Conducts/contracts inspections
- Expand maintenance workforce for seasonal O&M
- Trains crews

Centralized Regional Model w/Contractors (GI Strategies on Public Property)

Municipalities

Volunteers

Property Owners



Possible
inspection
support

Maintenance
support

Contractors

- MMSD responsible, but contracts out maintenance
- Contractors use MMSD's GI database
- Conducts or contracts inspections
- MMSD oversees contractor activities
- Can train contractor
- Increase or decrease contract activity as needed

Regional Model w/Partnerships (GI Strategies on Public Property)



Local Model (GI Strategies on Public Property)



Owner-Led Model (GI Strategies on Private Property)



- Responsible for all maintenance via ordinance or maintenance agreements, but can outsource
- Self-inspect OR MMSD, municipalities or 3rd party w/reports to MMSD
- Expand demand for inspectors or seasonal O&M
- Training needed for crews or contractors

Hybrid Model Based on GI Strategy (GI Strategies on Private Property)



- Property owners responsible for simple GI strategies, but can outsource
- MMSD/municipalities responsible for complex GI strategies
- Self-inspect OR MMSD, municipalities or 3rd party w/reports to MMSD
- Expand demand for inspectors or seasonal O&M
- Training needed for crews or contractors

Discussion

- What are the significant challenges associated with each model?
- Which models are best suited for Southeast Wisconsin and why?
- Which models would work best for specific GI strategies and why?

Next Steps

- Community conversations this afternoon
- More detailed feedback from stakeholders on current/desired O&M approaches
- Update GI O&M business models based on stakeholder feedback
- Prepare recommendations
- Present updated findings and recommendations in October/November



Community Conversation Meeting Summary

MMSD TAT Summary

During the September Technical Advisory Team (TAT) meeting, Karen Sands provided an update on the MMSD Green Infrastructure Maintenance Strategic Business Plan project that is being supported by Tetra Tech through an EPA Technical Assistance grant. Kellie DuBay from Tetra Tech presented six potential maintenance business models for the TAT to consider and provide feedback. A brief overview of the business model options that were presented is provided below.

- **Centralized Regional.** This model focuses on one primary entity, such as MMSD or a collaborative Green Team, conducting maintenance activities for green infrastructure strategies on public and/or private property.
- **Centralized Regional with Contractor Support.** Similar to the Centralized Regional model, but with contracting support to conduct inspections and/or maintenance activities for green infrastructure strategies on public and/or private property.
- **Centralized Regional with Partnerships.** Similar to the Centralized Regional model, but with volunteer groups conducting basic maintenance activities (e.g., weeding, litter pick-up, visual inspections) for free or a small stipend, with more complex maintenance activities performed by a primary entity.
- **Locally-led.** Municipalities, either individually or collaboratively, responsible for conducting maintenance activities for green infrastructure strategies on public and/or private property, with contractor support as needed.
- **Private Property Owner-led.** Private property owners responsible for maintenance activities on green infrastructure strategies on their private property, with the option of hiring contractors as needed.
- **Hybrid by Green Infrastructure Strategy.** Private property owners responsible for maintenance activities on specific types of green infrastructure strategies on private property, with maintenance assistance from either municipalities or MMSD for more complex green infrastructure strategies.

A summary of the TAT's initial feedback on the green infrastructure maintenance business models is presented below.

Note that the bulleted statements are summarizations of points made by participants. These points were not necessarily agreed upon by the group as a whole.

Centralized Regional

- There is a question of whether MMSD could perform maintenance on assets they do not own.
- Similarly, it could be problematic to have one entity perform on a different entity's streets.

Centralized Regional w/Contractor Support

No specific comments on this model.

Centralized Regional w/Partnerships

- In Milwaukee, experience has shown there can be uneven delivery of maintenance services by third-parties.
- What is in the incentive or rationale for private citizens/companies to perform maintenance on the public right of way?

Locally-Led Model

- One municipality stated that forestry department staff conducts green infrastructure maintenance, but there isn't enough staff to meet the demand. Therefore, the municipality is starting to contract out this work.
 - ✓ There is a concern about having to increase the level of inspection by existing staff.
 - ✓ Current maintenance needs go beyond what interns/seasonal help can do, due to lack of expertise.
 - ✓ Municipality's contract spells out maintenance requirements for bioswales. Different parts of the city have different expectations on bioswale maintenance. If some communities within the municipality want a higher level of maintenance services, these community areas would need to determine how this additional increment of services could be delivered.
 - ✓ Eventually the municipality will start to implement porous pavement and will have maintenance needs for that green infrastructure strategies.
- Another municipality uses a qualified contractor to perform green infrastructure maintenance.
 - ✓ Seasonal staff is often the size of regular staff.
 - ✓ Tried using college students, but they aren't invested and are only available for a portion of the season (May – August whereas the maintenance season can run from April to October); active management is also needed for what one would expect to be fairly straightforward tasks (e.g., weeding and picking up trash).
 - ✓ Transitioning to contracting, but still a challenge.
 - ✓ Existing relationship with a contractor (The Green Team: <http://www.greenteamwi.com/services.html>) has evolved over time. The Green Team has hired staff with expertise, based on contract scope (e.g., staff with expertise in native landscaping).
 - ✓ Using an informal approach to maintenance tracking and documentation.
- EPA suggests writing the qualifications for maintenance contractors into the bid expectations.

Owner-Led

No specific comments on this model.

Hybrid

No specific comments on this model.

In addition to the maintenance business models, the TAT raised other maintenance related issues. These additional issues are summarized below.

Workforce development

- MMSD uses workforce development for capital construction, not maintenance; but could move in that direction.

Design for Maintenance

- If a green infrastructure strategy isn't designed for easy maintenance, maintenance will likely not occur and the strategy could end up being removed. Considerations for access to the strategy and ease of routine maintenance should be specifically considered in green infrastructure designs.
- Native landscaping (e.g., 4-10 feet tall grasses that residents didn't expect) often generates complaints. Community members generally prefer landscapes that look designed and have a low plant profile.
- In Milwaukee, bioswales with tall grasses have had to be redone due to the impact on traffic and public safety.
- Need to keep in mind that the first three years of a green infrastructure strategy are the most challenging and often need the most maintenance; after that native vegetation is established and requires less weeding.

Funding Approaches

- Milwaukee has a stormwater fee (it goes to cover both capital and maintenance); non-residential properties can receive a discount/credit for implementing green infrastructure, but they must maintain the green infrastructure strategy. This credit is not often used, because the cost of installing the green infrastructure often appears to be greater than the amount of the credit, especially in the short-run.
- Some municipalities would be forced to make budget trade-offs.
- Conditional use permits may be an option in some situations for requiring owners to maintain at their own expense.

Tracking

- A tracking system is needed at the local level to maintain an inventory of green infrastructure, to store data, and to help schedule maintenance and track the performance of maintenance.
- A tracking system is needed at the regional (i.e., MMSD) level to quantify the level of green infrastructure implementation across the region and to help demonstrate compliance with permit terms. MMSD is developing a regional asset management system to track District-funded green infrastructure. The system doesn't have a trigger for maintenance (yet) but this can be added to the system as necessary.

Community Conversations Summary

On Thursday, September 18, 2014, stakeholders participated in community conversations on green infrastructure maintenance issues. There were two afternoon sessions available to stakeholders, each providing stakeholders with the opportunity to hear an overview of green infrastructure maintenance needs, the current state of green infrastructure maintenance in southeast Wisconsin, and the green infrastructure maintenance business models under consideration for the MMSD green infrastructure maintenance project. Presented below is a summary of the comments provided by stakeholders during the two community conversations.

Maintenance Needs by Green Infrastructure Strategy

- **Litter pick-up.** In the experience of the 30th Street Corridor, litter “pick-up” is sometimes needed 2x/day or more. It isn’t “frequent” or “as needed” and definitely not seasonal. One lesson learned is the function of street planters is not clear to people in the area, including those waiting at bus stops, and litter is very frequently tossed into the strategies. The condition of the green infrastructure strategies is often better where the strategy is in front of a building that is in use, vs. an abandoned building or vacant lot.
- **Infiltration rates.** For some green infrastructure strategies, maintenance should include checking infiltration rates.
- **Heavier equipment.** Some invasive species (e.g., phragmites) removal requires larger equipment and more training (e.g., use of herbicides). Other maintenance may require heavy equipment, e.g., to remove and dispose of sediment in the gravel media of a constructed wetland. Maintenance needs may fall into two categories, minor or routine maintenance, where equipment and specialized training may not be necessary, and more intensive maintenance that may require technical training (e.g., removal of soil media that may have contaminants) or heavy equipment. It may be beneficial to consider developing a management plan for different types of strategies in a community, and conducting yearly assessments.
- **Longer-term maintenance needs.** As noted above, there may be routine maintenance that is needed on a frequent basis, and there may be other types of maintenance that may be important but is needed less frequently. For example, for subsurface wetlands, need to dredge sediment and clean the media as part of longer-term maintenance.
- **Pollutant monitoring.** Pollutant content of material collected by green infrastructure strategies (maybe every 2-3 years do a check on the pollutant levels as a second tier of maintenance).
- **Rain barrel overflows.** Modify maintenance needs matrix to say that there should be checking of overflow areas to ensure that the areas can accept overflow water.
- **Porous pavement types and standards.** Consider other options that don’t involve pavers such as poured-in place and pre-cast. Some manufactured products do have maintenance standards that should be followed and DNR has a technical standard for porous pavement which includes maintenance.
- **Soil amendments.** Mention soil amendment maintenance implications; use the MMSD brochure on soil amendments.

- **Early maintenance needs.** Where native plants are used in a green infrastructure installation, maintenance plans need to recognize that early maintenance is more intensive until the strategy becomes established (three years again mentioned as the typical timeframe).
- **Awareness.** Mindsets need to change so that maintenance of green infrastructure becomes as commonplace as regular yard maintenance or snow removal. Also need folks to realize that there is already a hidden cost of not using/maintaining green infrastructure.

Maintenance Business Model Options

Overarching (applicable to all business models)

- Consider adding a circle to the business models to represent neighborhoods.
- Consider differentiating circles for contractors to show a difference between size and expertise (small business contractors v. larger contractors that might not be locally-based).
- Consider a model based on imperviousness...if the property owner goes over the specified amount of imperviousness, there is a “cost” for that. The cost could be in the form of a fee, or it could be in the form of more of the right-of-way in front of that property being used for green infrastructure.
- The right maintenance model is dependent on specifics of the strategy, the physical setting, and its setting within the community.
- Who decides when maintenance isn’t adequate (in terms of inspection/enforcement)? Need to develop triggers/flags in inspection and enforcement or offer technical assistance.
- Focus on public property as much as possible; allows for MOUs and more incentives (However, Green Infrastructure Regional Plan shows a need for significant green infrastructure implementation on private property to achieve 740 million gallon goal).

Centralized Regional

- Can’t envision why one entity would do all maintenance.
- Potential for political issues with this model.
- Would want to locally retain perform maintenance on green infrastructure strategies that are a local showpiece.
- MMSD should consider how the concept of a Green Infrastructure Service Center, as mentioned in the Regional Green Infrastructure Plan, fits with the centralized model and the other models for delivery of maintenance services. The service center could, for example, provide training, tracking, and technical assistance. The service center, could, potentially perform more technically complex inspections, monitoring, or maintenance services. Other activities that would lend themselves to centralization include funding, standards, and certification of contractors.
- If MMSD were the centralized entity, scale becomes an issue. The region is too large for MMSD to address.
- A variation of this model would be to allow municipalities to contract MMSD for maintenance if they want; otherwise they are responsible.

- MMSD should not be involved in maintenance for private property. A permitting/regulatory standard for private property is necessary.

Centralized Regional w/Contractor Support

- Not all companies/contractors have all the expertise needed to conduct green infrastructure maintenance. Might need to assemble skills through subcontractors.
- Region is lacking skilled firms/workers to do this type of maintenance.
- Existing maintenance contracts for agencies (e.g., Dept. of Transportation) might not focus on green infrastructure maintenance and, therefore, might not involve contractors qualified to do green infrastructure maintenance. These existing contracts might limit a community's ability to do green infrastructure maintenance work on their own until the contract expires.
- There needs to be better request for proposal (RFP) language (contract specifications and contractor qualifications) and better integration among agencies to hire the most qualified contractors.
- Milwaukee County is pre-qualifying contractors.
- Procurement requirements for municipalities often focus on the low-bidder and can be at cross-purposes with green infrastructure expertise needed.
- Milwaukee County has an RFP out to privatize maintenance of specific strategies (porous pavement, bioswales) and two proposals have come in. The county will need to evaluate this approach over the next year. Contractors receive a schedule for maintenance but the county will still conduct inspections.
- Demand for green infrastructure maintenance will drive private companies to develop expertise and potentially reduce costs.
- It is important to keep revenue local. Contractors used for green infrastructure maintenance should be local so that local resources don't leave the region. Look at the "local goods" model being used for other procurement.
- If qualified contractors bid on green infrastructure maintenance, contracting could be a more effective approach through competitive bidding.

Centralized Regional w/Partnerships

- Consider the Philadelphia example where volunteers demonstrate commitment to maintenance and receive stipends. Flint, MI also has a program along these lines.
- Perhaps businesses and other organizations could "sponsor" and maintain a group of strategies, similar to the adopt-a-highway model.
- Volunteering encouraged, but won't solve all the problems.
- Business Improvement Districts are one possible type of volunteer group.

Local Model

- Identify municipal (sub-regional) partnership opportunities, such as joint ownership of equipment (like street sweepers).

Owner-Led

- Relying on property owners doesn't seem as if it will be successful, unless there is a very motivated group of property owners or there is an incentive or a regulation to drive on-going maintenance. Otherwise, the maintenance will likely be uneven.
- Consider using a homeowner association special service area (SSA) approach; if the homeowner association doesn't do the necessary maintenance and the municipality has to conduct the work, the SSA arrangement allows the city to bill the homeowner association for the maintenance services.

Hybrid

No specific comments on this model.

Other Maintenance Issues

Workforce development

- The Regional Green Infrastructure Plan assumed a workforce of approximately 500 for maintenance upon full build out of the green infrastructure envisioned in the plan. This provides a perspective on what is the overall regional maintenance need.
- Desire to see green infrastructure maintenance with year round employment, which is a challenge given that most work needs to be done from April through October.
- Example of a veteran training program that provides year round jobs for small number of vets; led to a few participating vets developing skills that allowed them to start their own business.
- Jobs for green infrastructure maintenance will generate buy-in from communities.
- Use the Milwaukee Community Service Corps as an example for workforce development.
- Need real funding for workforce development because this won't be a straightforward process.
- Focus on developing skills in both individuals and small business to help small businesses grow these services for the region.
- Need individuals that have the ability to make technical recommendations during the inspection process. If a corps of inspectors or workers is assembled, training will be necessary.

Design for Maintenance

- If designed to require less maintenance, some green infrastructure strategies could still function years later despite lack of maintenance.
- Where native plants are used in a green infrastructure strategy, the establishment period is crucial to good self-sustainment of the strategy.
- Make low maintenance green infrastructure choices.
- When locating green infrastructure such as street planters, it is probably a good idea to stay away from areas where people assemble, e.g., bus stops, due to concerns about litter and trampling of plants.
- Ensure that there is a nice selection of plants in rain gardens; this requires education, designing for maintenance and acceptance, and safety issues.

- Design charrettes can be used to facilitate acceptance of green infrastructure: can include showing photos of different vegetation during each season.
- Use of actual plants (plugs) at installation rather than seeds helps ensure that the vegetation becomes established.
- Need to be aware that older residents may need assistance to perform maintenance tasks.

Funding

- Need funding information on each of the maintenance business models.
- For the 30th Street corridor, the costs of doing maintenance doubled in a 4 year period. There are a number of reasons for this, some of which are unique to that community area.

Tracking

- Need to consider developing a triage/prioritization approach to maintenance when green infrastructure strategies significantly increase in number.
- Consider using a tracking/work order framework; pass information through to MMSD and the database could help specify and send out work orders to different entities when needed.
- A web-based tool could give reminders to private property owners (and allow picture uploading); also provide training and give checklists to facilitate maintenance.

Agency Communication/Coordination

- Response times from agencies should be days, not weeks; need better integration.
- Agencies could send out letters to residents and businesses when maintenance is needed.
- Need MOUs that lay out roles and responsibilities.

Education/Involvement

- Provide education on costs of status quo versus costs of green infrastructure; show that existing maintenance isn't very different.
- Need an information and education (I&E) strategy for each maintenance business model.
- Educate property owners about the look of rain gardens at each phase to ensure they won't pull them out.
- GroundWork Milwaukee does site visits and one-on-one outreach to promote maintenance/build confidence; start with one-on-one, then second year do block parties, in third year go back to one-on-one.
- High levels of involvement at 16th street corridor design charrettes; good approaches to community involvement and educating residents on the maintenance needs of green infrastructure strategies.
- Recent community engagement activity conducted by the 16th Street Community Health Center asked residents, "What would make green infrastructure on public land better for you?" Residents said pavers in rain gardens and bioswales to allow for passing through and signage. Need to incorporate these design features to gain acceptance (and determine if there are ways to have these features help with maintenance).

- Need to build confidence with property owners, such as having weeding parties to reinforce skills/knowledge.
- Consider private property owners' capabilities, specifically elderly and renters.
- Involve youth in maintenance activities.
- Tie maintenance to safety/property benefits (chimney sweep example, needed for public safety).
- Visual inspections seem more appropriate for homeowners; technical inspections seem more appropriate for trained staff.

Property Ownership

- Vacant properties pose a problem because there is a question of who is responsible. When needs are reported, it can take six weeks for a response to get an area mowed.
- Need jurisdictional map for green infrastructure maintenance (showing locations of green infrastructure strategies on public and private property and who has responsibility).
- Need more discussion on maintenance on private property (commercial/industrial/residential); incentivize implementation and maintenance.

Regulation

- Need regulatory inspection and enforcement of green infrastructure, like under conditional use permits.
- People pay attention to regulations, both carrots and sticks; should consider having an incentive where performing above standards results in a bonus.
- Need to do an estimate of voluntary compliance; if the % is low, then need regulations; need code compliance model for private property.
- Consider income level of neighborhoods before discussing regulations and disincentives (fines) for green infrastructure implementation and maintenance.
- Codes and ordinance can affect design and maintenance.
- Enforcement of maintenance; need to incentivize on private property.
- Private residential green infrastructure encouraged, but there shouldn't be enforcement only technical assistance.
- Need more enforcement of construction erosion control (that will affect green infrastructure strategies). For example, it is known that if sediment from a construction site runs into a bioswale or rain garden, the strategy will most likely become clogged.

Maintenance Standards

- Consistency of maintenance standards for the region could help to lower costs; this would be a good role for MMSD.
- Developing regional standards won't always make sense for every community across the region due to community differences.

Appendix C: Southeast Wisconsin Green Infrastructure Maintenance Survey and Results

Goal: Obtain specific information from municipalities and other entities interested in and responsible for green infrastructure maintenance. Information will be used to help refine maintenance business models, with an emphasis on opportunities/priorities for regional maintenance approaches.

Who Do You Represent: (Select one that best represents your affiliation)

- Municipality (please specify department)
- County (please specify department)
- Workforce development
- Environmental non-governmental organization
- Community-based non-governmental organization
- Landscaper/contractor
- Resident (please specify whether homeowner or rental tenant)
- Business owner
- Other (please specify)

Please answer the set of questions under the category that best describes your affiliation.

QUESTIONS FOR LOCAL GOVERNMENTS

7 responses: 6 municipalities (3 public works, village manager, utilities), 1 county (Milwaukee County Facilities Management)

1. *What are the types of green infrastructure strategies currently in your jurisdiction? (Check all that apply)*

- Bioretention/bioswales/greenways (6 of 7)
- Rain gardens (5 of 7)
- Green roofs (4 of 7)
- Stormwater trees (4 of 7)
- Native landscaping (4 of 7)
- Wetlands (4 of 7)
- Rain barrels/cisterns (3 of 7)
- Soil amendments (3 of 7)
- Green alleys/streets/parking lots (3 of 7)
- Permeable pavement (2 of 7)
- Other (please describe)
- None
- Unsure

2. *On what type of property are existing green infrastructure strategies in your jurisdiction located? (Check the one that best applies)*

- Public property only (3 of 7)
- Mix, with most on public property (3 of 7)
- Mix, with most on private property (1 of 7)
- Private property only
- Unsure at this time

3. *Does your jurisdiction maintain any of the green infrastructure strategies in your jurisdiction?*

- Yes, public property only (7 of 7)
- Yes, public and private property
- No, require private property owners to conduct maintenance
- No maintenance being done or required at this time

4. *What is your jurisdiction's current funding source for green infrastructure maintenance? (Check all that apply)*

- Operational and maintenance budget (6 of 7)
- Capital budget (1 of 7)
- Stormwater-based service fee (1 of 7)
- Grant
- Other (please specify)
- Unknown
- Not applicable, no maintenance being done

5. *Approximately how much does your jurisdiction spend annually on green infrastructure maintenance?*

- Less than \$100
- \$100-\$500
- \$500-\$999 (2 of 7)
- \$1,000-\$4,999 (1 of 7)
- \$5,000-\$10,000
- More than \$10,000 (1 of 7)
- Other (please specify)
- Unsure (3 of 7)
- Not applicable; no current expenditures on green infrastructure maintenance

6. *What types of green infrastructure strategies are the most challenging to maintain?*

- Rain gardens (3 of 7)
- Bioretention/bioswales/greenways (3 of 7)
- Permeable pavement (3 of 7)
- Green roofs (2 of 7)

- Native landscaping (2 of 7)
- Green alleys/streets/parking lots (1 of 7)
- Wetlands (1 of 7)
- Rain barrels/cisterns
- Soil amendments
- Stormwater trees
- Other (please describe)

Comment: Each has its own challenges

7. What types of green infrastructure strategies would you like to try but haven't because of maintenance concerns?

- None (5 of 7)
- Permeable pavement (2 of 7)
- Bioretention/bioswales/greenways (1 of 7)
- Green alleys/streets/parking lots
- Green roofs
- Native landscaping
- Rain barrels/cisterns
- Rain gardens
- Soil amendments
- Stormwater trees
- Wetlands
- Other (please describe)
- Unsure

8. What types of green infrastructure strategies would your jurisdiction want to have maintained by a regional entity? (Check all that apply.)

- None (3 of 7)
- Bioretention/bioswales/greenways (2 of 7)
- Unsure at this time (2 of 7)
- Rain gardens (1 of 7)
- Permeable pavement (1 of 7)
- Green alleys/streets/parking lots (1 of 7)
- Green roofs
- Native landscaping
- Rain barrels/cisterns
- Soil amendments
- Stormwater trees
- Wetlands
- Other (please specify)

9. *Would your jurisdiction be interested in partnering with other jurisdictions to perform green infrastructure maintenance? If so, which type of partnering would your jurisdiction be interested in? (Check all that apply.)*

- Not interested in partnering (3 of 7)
- Securing contractor support for shared maintenance (3 of 7)
- Purchasing equipment for shared maintenance use (1 of 7)
- Partnership program for developing and administering a volunteer maintenance program (1 of 7)
- Partnership program for developing and administering an inspection program
- Securing contractor support for shared inspections
- Other (please specify)

Comment: Interested in partnerships, but need more information

10. *Would your jurisdiction be willing to contribute funding to a regional entity to support green infrastructure maintenance activities?*

- Yes (1 of 7)
- No (4 of 7)

11. *If a regional Green Infrastructure Service Center were available, which services would your jurisdiction be most likely to use? (Check all that apply)*

- Green infrastructure maintenance training (6 of 7)
- Green infrastructure inspection/maintenance certification (4 of 7)
- Green infrastructure inspection training (3 of 7)
- Green infrastructure monitoring (2 of 7)
- Green infrastructure maintenance (2 of 7)
- Green infrastructure tracking (1 of 7)
- Green infrastructure inspections
- Other (please specify)

Comments:

- Can't commit to anything right now.
- Can't answer, that's a policy decision.
- Maintenance if green infrastructure should be the responsibility of the owner, just like any other infrastructure. Regional training, certification and tracking would be helpful.

QUESTIONS FOR LOCAL RESIDENTS/BUSINESSES

Four responses: 3 residents, 1 non-profit (not sure if they rep residents or not)...will separate out their responses for clarity

1. What are the types of green infrastructure strategies you currently have in place? (Check all that apply)

- Rain barrels/cisterns (2 of 3 residents/1 nonprofit)
- Rain gardens (1 of 3 residents/1 nonprofit)
- Stormwater trees (1 nonprofit)
- Bioretention/bioswales/greenways (1 nonprofit)
- Native landscaping (1 nonprofit)
- Soil amendments (1 nonprofit)
- None (1 of 3 residents)
- Green alleys/streets/parking lots
- Green roofs
- Permeable pavement
- Wetlands
- Other (please describe)
- Unsure

Comment from nonprofit: we install all of the above

2. Who maintains these green infrastructure strategies? (Check all those that apply.)

- Someone in my family/business (2 of 3 residents/1 nonprofit)
- A contractor is paid to perform maintenance
- No one has maintained our green infrastructure strategies yet
- Our green infrastructure strategies don't need maintenance
- Unsure at this time

3. If maintenance is being conducted, has the person conducting the maintenance activities been trained?

- Yes (1 nonprofit)
- No (1 of 3 residents)
- Unknown

4. What types of green infrastructure strategies are the most challenging to maintain?

- Green roofs
- Rain gardens (1 of 3 residents)
- Native landscaping (1 of 3 residents; 1 nonprofit)
- Bioretention/bioswales/greenways

- Green alleys/streets/parking lots
- Permeable pavement
- Rain barrels/cisterns
- Soil amendments
- Stormwater trees
- Wetlands
- Other (please describe)
- None
- Unsure

Comment: Wet spring helped reduce watering requirements

5. What types of green infrastructure strategies would you like to try but haven't because of maintenance concerns?

- Green roofs (1 nonprofit)
- Stormwater trees (1 of 3 residents)
- Native landscaping (1 of 3 residents)
- Permeable pavement (1 nonprofit)
- Wetlands (1 nonprofit)
- None (1 of 3 residents)
- Bioretention/bioswales/greenways
- Green alleys/streets/parking lots
- Rain barrels/cisterns
- Rain gardens
- Soil amendments
- Other (please describe)
- Unsure

6. Do you use contractors for other landscaping services?

- Yes
- No (1 of 3 residents; 1 nonprofit)

7. What types of green infrastructure strategies would you want to have maintained by a municipality or a regional entity? (Check all that apply.)

- Bioretention/bioswales/greenways (1 of 3 residents; 1 nonprofit)
- Green alleys/streets/parking lots (1 of 3 residents; 1 nonprofit)
- Permeable pavement (1 of 3 residents; 1 nonprofit)
- Wetlands (1 of 3 residents; 1 nonprofit)
- Native landscaping (1 nonprofit)
- Rain gardens (1 of 3 residents)
- Soil amendments (1 of 3 residents)

- Unsure at this time (1 of 3 residents)
- Green roofs
- Stormwater trees
- Rain barrels/cisterns
- Other (please specify)
- None

8. *Would you be interested in partnering with other residents or businesses to perform green infrastructure maintenance? If so, which type of partnering would you be interested in? (Check all that apply.)*

- Purchasing equipment for shared maintenance use (1 of 3 residents)
- Developing and administering a volunteer maintenance program (1 of 3 residents/1 nonprofit)
- Securing contractor support for shared maintenance
- Other (please specify)
- Not interested in partnering

9. *How much are you willing or do you currently pay annually to maintain green infrastructure strategies? Please select the green infrastructure strategies and list the price. List the price and the green infrastructure strategy associated.*

- Unsure at this time (1 of 3 residents)
- Green roofs: \$_____/yr.
- Rain gardens: \$_____/yr.
- Stormwater trees: \$_____/yr.
- Bioretention/bioswales/greenways
- Native landscaping: \$_____/yr.
- Permeable pavement: \$_____/yr.
- Rain barrels/cisterns: \$_____/yr.
- Soil amendments: \$_____/yr.
- Green alleys/streets/parking lots
- Wetlands: \$_____/yr.
- Other (please specify): \$_____/yr.
- Not willing to pay for green infrastructure strategy maintenance
- Not currently paying anything for green infrastructure strategy maintenance

10. *Assuming there's an economy of scale for regionalization of green infrastructure maintenance, would you be willing to contribute funding to a regional entity to support green infrastructure maintenance activities?*

- Yes (2 of 3 residents)
- No (1 of 3 residents/1 nonprofit)

11. *If there was a regional Green Infrastructure Service Center available, which services would you be most likely to use? (Check all that apply)*

- Green infrastructure maintenance training (2 of 3 residents; 1 nonprofit)
- Green infrastructure implementation (e.g., design, siting, developing) technical assistance (2 of 3 residents/ 1 nonprofit)
- Other (please specify)

Comment: None. I'm an old gardener doing fine.

QUESTIONS FOR NON-GOVERNMENTAL ORGANIZATIONS

Six responses: 1 grantor; 5 environmental NGOs

1. *What are the types of green infrastructure strategies that you promote through funding, education, technical assistance, training, or other services? (Check all that apply)*

- Stormwater trees (6 of 6)
- Bioretention/bioswales/greenways (6 of 6)
- Rain gardens (5 of 6)
- Native landscaping (5 of 6)
- Permeable pavement (5 of 6)
- Rain barrels/cisterns (5 of 6)
- Soil amendments (5 of 6)
- Green roofs (4 of 6)
- Green alleys/streets/parking lots (4 of 6)
- Wetlands (4 of 6)
- Other (please describe)
- None
- Unsure

2. *On what type of property are the green infrastructure strategies you promote located? (Check all that apply)*

- Public property (5 of 6)
- Residential property (3 of 6)
- Business property (1 of 6)
- Other (please specify)
- Unsure
- Not applicable

3. *What type of green infrastructure maintenance support do you provide? (Check all that apply)*

- Actual maintenance (4 of 6)
- Education about maintenance needs during design phase (4 of 6)

- Technical assistance (2 of 6)
- Training (2 of 6)
- Not applicable; don't provide green infrastructure maintenance support (1 of 6)
- Inspections (0 of 6)
- Other (please specify)
- Unsure

4. *Approximately how much do you spend annually on green infrastructure maintenance support? (Check one that best applies.)*

- Less than \$100
- \$100-\$500
- \$500-\$1,000
- \$1,000-\$5,000 (1 of 6)
- \$5,000-\$10,000 (1 of 6)
- More than \$10,000 (1 of 6)
- Other (please specify)
- Unsure (2 of 4)
- Not applicable; no current expenditures on green infrastructure maintenance (1 NA of 4)

5. *What types of green infrastructure strategies are the most challenging to maintain? (Check all those that apply.)*

- Permeable pavement (3 of 6)
- Bioretention/bioswales/greenways (1 of 6)
- Green alleys/streets/parking lots (1 of 6)
- Native landscaping (1 of 6)
- Rain gardens (1 of 6)
- Green roofs (0 of 6)
- Rain barrels/cisterns (0 of 6)
- Soil amendments (0 of 6)
- Stormwater trees (0 of 6)
- Wetlands (0 of 6)
- Other (please describe)

6. *What types of green infrastructure strategies would the groups/individuals you work with like to try but haven't because of maintenance concerns? (Check all those that apply.)*

- Green alleys/streets/parking lots (2 of 6)
- Permeable pavement (2 of 6)
- Bioretention/bioswales/greenways (1 of 6)
- Native landscaping (1 of 6)
- Rain gardens (1 of 6)
- Green roofs

- Rain barrels/cisterns
- Soil amendments
- Stormwater trees
- Wetlands
- Other (please describe)
- None
- Unsure

7. *What types of green infrastructure strategies would the groups/individuals that your organization work with want to have maintained by a regional entity? (Check all that apply.)*

- Permeable pavement (4 of 6)
- Bioretention/bioswales/greenways (3 of 6)
- Green alleys/streets/parking lots (3 of 6)
- Green roofs (1 of 6)
- Rain gardens (1 of 6)
- Stormwater trees (1 of 6)
- Wetlands (1 of 6)
- Native landscaping
- Rain barrels/cisterns
- Soil amendments
- Other (please specify)
- None
- Unsure at this time

8. *Which entities would your organization be interested in partnering with to perform or support green infrastructure maintenance? (Check all that apply.)*

- Local governments (6 of 6)
- MMSD (6 of 6)
- Workforce development organizations (5 of 6)
- Business groups (2 of 6)
- Volunteer organizations (2 of 6)
- Residential groups (1 of 6)
- Other (please specify)
- Not interested in partnering

9. *Which type of partnering would your organization be interested in? (Check all that apply.)*

- Partnership program for developing and administering a volunteer maintenance program (5 of 6)
- Developing and providing maintenance training (3 of 6)
- Partnership program for developing and administering an inspection program (3 of 6)
- Securing contractor support for shared maintenance (2 of 6)

- Purchasing equipment for shared maintenance use (1 of 6)
- Securing contractor support for shared inspections (1 of 6)
- Other (please specify)
- Not interested in partnering

Comments: Narrative answer provided: We would be happy to partner with anyone interested. However, when we develop projects we do so in a way that our organization has minimal maintenance responsibilities. This is because of our staff capacity and programmatic focus. We provide training to residents so they can maintain their installations. We are always available to help with support on an as needed basis.

10. Would your organization be willing to contribute funding to a regional entity to support green infrastructure maintenance activities?

- Yes (1 of 6)
- No (5 of 6)

11. If a regional Green Infrastructure Service Center were available, which services would your organization be most likely to use? (Check all that apply.)

- Green infrastructure tracking (3 of 6)
- Green infrastructure monitoring (3 of 6)
- Green infrastructure maintenance (3 of 6)
- Green infrastructure inspection training (2 of 6)
- Green infrastructure maintenance training (2 of 6)
- Green infrastructure inspection/maintenance certification (2 of 6)
- Green infrastructure inspections (2 of 6)
- Other (please specify)

QUESTIONS FOR LANDSCAPERS/CONTRACTORS

12 responses: 4 consultants, 2 contractors, 1 non-profit, 1 landscaper, 1 business owner, 1 developer/property manager, 1 landscape/ecology design-build firm business owner, 1 landscape architect

1. What are the types of green infrastructure strategies that you currently maintain for customers? (Check all that apply)

- Native landscaping (9 of 12)
- Bioretention/bioswales/greenways (8 of 12)
- Permeable pavement (8 of 12)
- Rain gardens (8 of 12)
- Rain barrels/cisterns (6 of 12)
- Soil amendments (6 of 12)
- Green alleys/streets/parking lots (5 of 12)
- Stormwater trees (5 of 12)

- Green roofs (4 of 12)
- Wetlands (3 of 12)
- Other (please describe) (1 of 12 – Blue Roofs)
- None
- Unsure

Comments:

- Do not maintain but design and specify
- Green and sustainable infrastructure
- We usually design green infrastructure, but have maintained them too

2. *On what type of property do you currently maintain green infrastructure? (Check all that apply)*

- Businesses (8 of 12)
- Public property (8 of 12)
- Rights of way (7 of 12)
- Residences (5 of 12)
- Don't maintain any green infrastructure strategies at this time (1 of 12)
- Other (please specify) (community gardens, water reclamation facility)
- Unsure at this time

3. *Have you/your staff had training specific to green infrastructure strategies? If so, where did you obtain training? (Check all that apply)*

- Hands-on training (6 of 12)
- How-to manuals (5 of 12)
- How-to fact sheets (4 of 12)
- Instructions provided by the customer (3 of 12)
- How-to videos (2 of 12)
- Unsure where to get information and training (2 of 12)
- Know where training is available, but haven't had training yet (1 of 12)
- Other (please specify)

Comments:

- We provide training for O&M, including the materials mentioned above
- Professional seminars
- We will do hands on training in spring with the installation company

4. *If a training and certification program was made available for contractors, would you require staff to participate? (Check one that best applies.)*

- Possibly, if a minimal charge (5 of 12)
- Yes, regardless of cost (3 of 12)

- Possibly, if free (2 of 12)
- No, regardless of cost
- Other (please specify)

Comments:

- Would participate if available; we have also provided training events around the country
- If a minimal charge and also competently delivered

5. What types of green infrastructure strategies are the most challenging to maintain? (Check all that apply.)

- Bioretention/bioswales/greenways (6 of 12)
- Native landscaping (5 of 12)
- Permeable pavement (5 of 12)
- Green roofs (4 of 12)
- Rain gardens (3 of 12)
- Green alleys/streets/parking lots (1 of 12)
- Rain barrels/cisterns (1 of 12)
- Soil amendments (1 of 12)
- Stormwater trees (1 of 12)
- Wetlands (1 of 12)
- Other (please specify)
- None
- Unsure at this time

Comments:

- Depends upon the location specifics
- None are challenging to maintain; except for underbudgeting

6. If a regional Green Infrastructure Service Center were available, which services would your organization be most likely to use? (Check all that apply)

- Green infrastructure maintenance training (6 of 12)
- Green infrastructure inspection/maintenance certification (5 of 12)
- Green infrastructure inspection training (4 of 12)
- Green infrastructure inspections (4 of 12)
- Green infrastructure tracking (4 of 12)
- Green infrastructure maintenance (4 of 12)
- Green infrastructure monitoring (3 of 12)
- Other (please specify)

Comments:

- Hard to say, need to learn more
- Probably none as we have an in-house program

7. What else is needed to help contractors in southeast Wisconsin provide quality services related to green infrastructure maintenance?

- Increased demand for green infrastructure maintenance services (9 of 12)
- Training opportunities for existing staff (6 of 12)
- Experienced job applicants (3 of 12)
- Unsure (1 of 12)
- Other (please specify)

Comments:

- My perspective is more on the consulting side and less hands on O&M. Hope this survey information was useful, but the questions are not as applicable to what I do on a day to day basis.
- Please contact existing green infrastructure organizations, Energy Exchange Inc. and Walnut Way Conservation Corp.
- We are not actually contractors. We are a development/ property management company, but we do maintain some of our green infrastructures ourselves.
- Please also focus on green infrastructure design and installation. We have seen several missed "lessons learned" in the public projects. In addition, many public inspectors are not trained in landscape installation and thereby allow substandard installations to occur. Before looking at maintenance, we need to make sure these are being designed and installed correctly and effectively.
- I am a designer and write specification for my projects. I wish there were more experienced people in maintenance. Competitive bidding puts the responsibility on the lowest bidder.

QUESTIONS FOR WORKFORCE DEVELOPMENT ORGANIZATIONS

Total respondents: 6 (5 workforce development; 1 neighborhood community development corporation)

1. Have members of the community expressed an interest in receiving training to design, install or maintain green infrastructure strategies such as rain gardens, permeable pavement, green roofs, etc.?

- Yes (4 of 6)
- No (2 of 6)

2. Have members of the community expressed an interest in hiring individuals with training to design, install, or maintain green infrastructure strategies such as rain gardens, permeable pavement, green roofs, etc.?

- Yes (2 of 6)
- No (4 of 6)

3. If you answered Yes to Question 2, who has requested trained individuals to hire for green infrastructure services? (Check all that apply.)

- Residents (2 of 6)
- Businesses (2 of 6)
- Local governments
- Other (please specify)
- Unsure

4. What trainings do you provide that are related to green infrastructure? (Check all that apply.)

- Rain garden installation and maintenance (1 of 6)
- Rain barrel installation and maintenance (1 of 6)
- Bioswale installation and maintenance (1 of 6)
- Other (please specify)

Comments:

- Rain Barrel Manufacture, would like to move into rain gardens
- We focused on building green homes and deconstruction activities
- None at this point in time (2)
- Other: Permeable paving systems, cisterns, Aquascape systems

5. What green infrastructure services does your organization need to include as an element of your workforce development efforts? (Check all that apply.)

- Staff training (3 of 6)
- New hire with expertise in green infrastructure (2 of 6)
- Demand for these services (2 of 6)
- Funding (1 of 6)
- Unsure (1 of 6)
- Technical assistance
- Other (please specify)

Comment: Places to refer people for training

6. If a regional Green Infrastructure Service Center were available, which services would your organization be most likely to use or contribute to? (Check all that apply)

- Green infrastructure inspection/maintenance certification (5 of 6)
- Green infrastructure maintenance training (4 of 6)
- Green infrastructure inspection training (3 of 6)
- Green infrastructure inspections (1 of 6)
- Green infrastructure tracking (1 of 6)
- Green infrastructure monitoring (1 of 6)
- Green infrastructure maintenance (1 of 6)
- Other (please specify)

Comments:

- We're interested in learning more about the Districts Plans for Green Infrastructure
- Partner with a CBO or existing nonprofit to place a green infrastructure service center. MMSD seems to be the organization to drive demand for installation and maintenance. The market will respond.