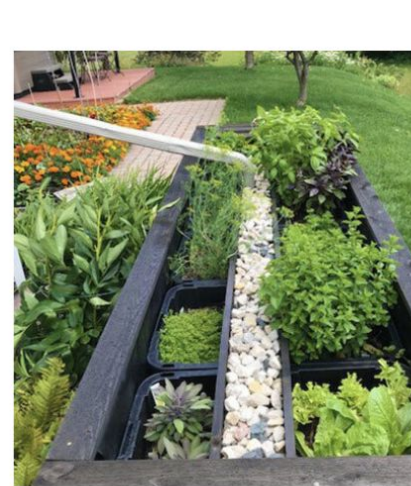


Green Infrastructure Inspection and Maintenance Standards



Carrie Bristoll-Groll, PE | Principal Engineer & CEO



— “

IMPROVING THE BUILT AND NATURAL
ENVIRONMENTS WITHIN COMMUNITIES
THROUGH SUSTAINABLE ENGINEERING
AND DESIGN

” —



MMSD SERVICE AREA MAP

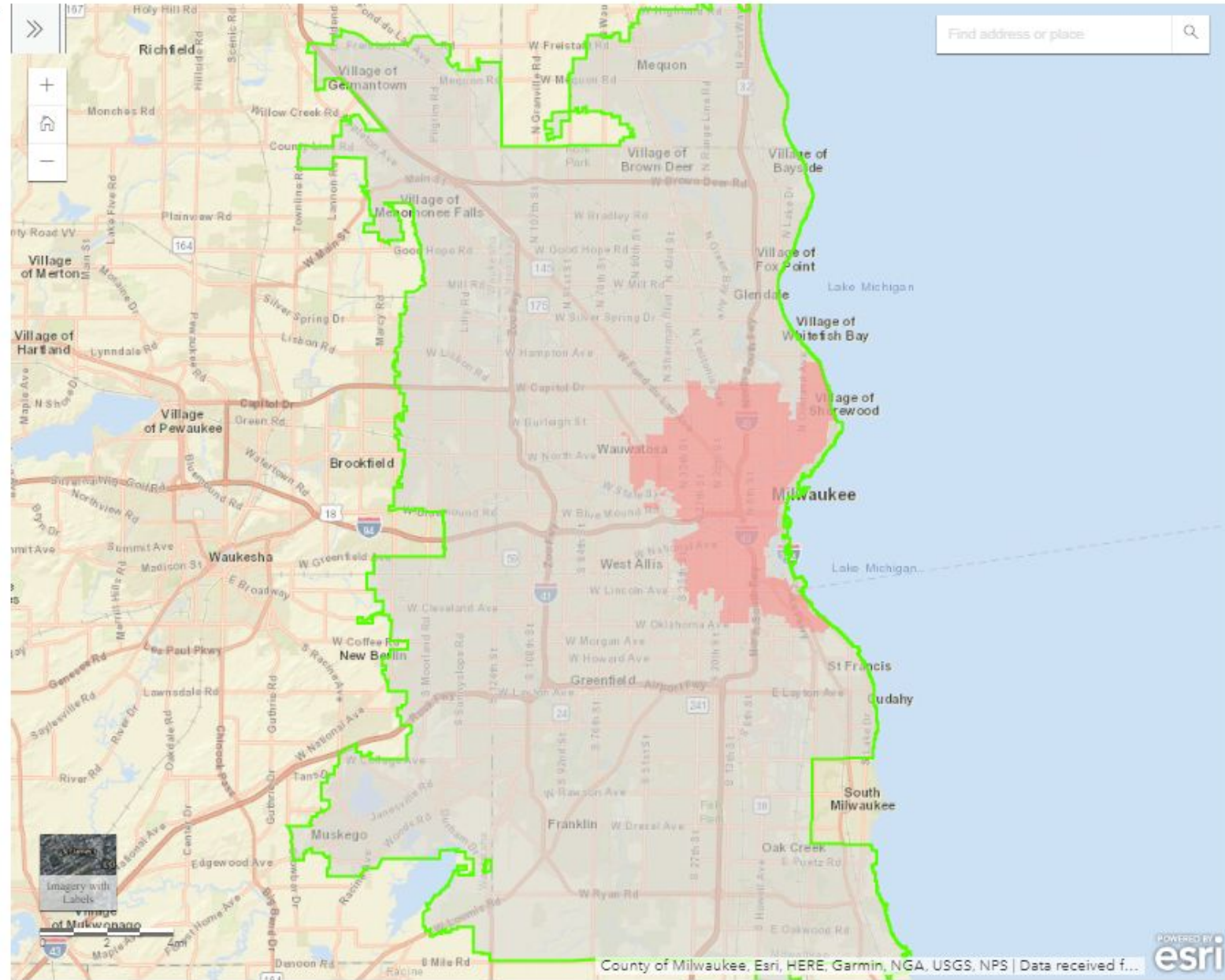
(District Boundary and Combined Sewer Area)

*Data for the Combined Sewer Area is provided by the City of Milwaukee, and represents the best information currently available.

Milwaukee Metropolitan Sewerage District

Regional government agency that provides water reclamation and flood management services for about 1.1 million people

- Serve 411 square miles
- 28 Communities
- Covers six watersheds (all or segments of)





ZERO Basement Backups. ZERO Overflows. IMPROVED stormwater management!



*740 MILLION GALLONS OF
GREEN INFRASTRUCTURE*



OUTLINE

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OTHER RESOURCES

PROJECT TEAM

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Rob Roseen - Waterstone Engineering, Portsmouth, New Hampshire

Juli Beth Hinds – Birchline Planning, San Diego, California

Peer Review Committee: MMSD, Milwaukee County, DNR, SSE staff, private ecology/biology/native landscape specialty firms

SCOPE/GOALS

Provide GI maintenance standards based upon existing DNR maintenance standards, the District's sizing tool for GI design, and research from vendors, past projects, other resources.

For future use by municipalities, or private entities when hiring maintenance crews to manage GI/stormwater assets; and for engineers, landscape architects and volunteers or private GI owners when designing/choosing what GI to use.

Also interview 21 local municipalities to gather information on past GI lessons learned and best practices moving forward.

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Managing Turf to Improve Water Infiltration and Retention

The purpose of the experiment was to observe whether the intensive management of turf resulted in improved water infiltration and to what degree. A five-year study of water infiltration was conducted by the Milwaukee Metropolitan Sewerage District, the University of Wisconsin - Milwaukee (UWM), and Earthcare Natural Lawn and Landscapes on adjacent parcels of turf on the UWM campus. This study suggests that taking a managed approach to lawncare improves infiltration and water retention, resulting in reduced sheet flow.



Maximizing Stormwater Capture Using GI In The CSSA 2020

The Milwaukee Metropolitan Sewerage District (MMSD), US Army Corps of Engineers (USACE), City of Milwaukee, and Village



Green Infrastructure Maintenance Standards

The GI O&M Manual is intended to set standards for maintaining GI, as consistent and effective maintenance is critical to unlocking the full potential of GI to benefit our communities. The GI O&M Manual outlines recommended tasks, frequencies, equipment and material needs, safety steps, and weather considerations that need to be considered for effective GI maintenance.



Green Infrastructure Maintenance Analysis & Lessons Learned for Municipalities

The goal of this report is to illuminate green infrastructure maintenance barriers and successes, summarize the lessons learned, and ultimately prescribe recommendations regarding maintenance needs to both municipalities and MMSD.

STORMWATER FACILITY AND GREEN INFRASTRUCTURE MAINTENANCE

GREEN INFRASTRUCTURE:

- What is it?

MAINTENANCE DOCUMENTS:

- Title of Strategy
- Description
- Common practices & applications
- Components (detail)
- Inspection and Maintenance
- Tasks, indicators, and frequency tables
- Expected annual maintenance tables



SSE partnered with multiple other specialty firms to develop these maintenance documents

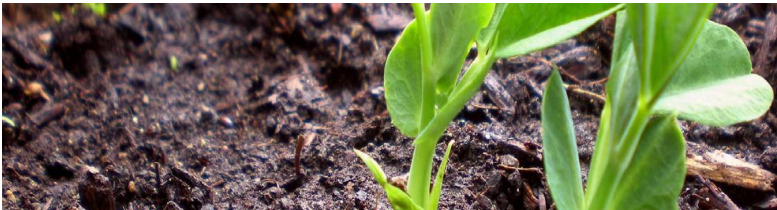
GREEN INFRASTRUCTURE STRATEGIES (AS DEFINED BY MMSD)



BIOSWALES Landscape features that capture and infiltrate runoff and can also remove pollutants.



NATIVE LANDSCAPING The use of native plants that can tolerate drought and flooding cycles because of deep roots and climate-specific adaptations.



SOIL AMENDMENTS Materials worked into the soil to enhance its ability to infiltrate and absorb water.



STORMWATER TREES Trees that can hold rainwater on their leaves and branches, infiltrate it into the ground, absorb it through root systems, and evapotranspire it to the atmosphere.

GREEN INFRASTRUCTURE STRATEGIES (AS DEFINED BY MMSD)



RAIN GARDEN Landscape features that capture and infiltrate runoff and can also remove pollutants.



GREEN ROOF Roofs that are either partially or completely planted with vegetation in growing soil.



CONSTRUCTED WETLANDS/WET PONDS Have soils that are inundated or saturated for part of or for the entire year.



RAINWATER HARVESTING Capture and store rainwater for outdoor water uses.

AND VARIOUS PAVEMENTS



POROUS ASPHALT Pavements that are open graded flexible pavement combined of coarse aggregate and an asphalt binder.



PERMEABLE INTERLOCKING CONCRETE PAVEMENT (PICP) Consists of concrete pavement units or bricks that when assembled into a patterns, creates open joints.



PERVIOUS CONCRETE Open-graded rigid pavement typically consisting of approximately 20% voids.

TITLE OF STRATEGY

The title of the individual strategy.

DESCRIPTION

A description of the individual strategy.

COMMON PRACTICES AND APPLICATIONS

Common locations and applications of where individual strategies are installed.

TYPICAL SECTION

A visual representation of the specific GI strategy that lists the common components, including what is located under the surface.

INSPECTION AND MAINTENANCE

A summary of the expected inspection, operations and maintenance of the individual strategy.

MAINTENANCE TASKS

A table that lists each individual maintenance task that may be provided for when performing operations and maintenance on a specific strategy. The table also includes a brief description of the maintenance tasks, indications of when the task is necessary, and the recommended minimum frequency of the task.

EXPECTED ANNUAL MAINTENANCE SCHEDULE

A table that lists the specific maintenance tasks that are expected to be performed on an annual basis. It lists the task, season (spring, summer, fall, winter, post 2-inch rain event), and frequency each task is expected to be performed during each season or event.

GI TITLE OF TASK

- 1) Concrete Repair
- 2) Deicing
- 3) Erosion Repair
- 4) Gravel Joint Filling
- 5) Manual Weed Control
- 6) Mowing
- 7) Invasive Species Control
- 8) Mulch Amendment/Replacement
- 9) Organic Debris Removal
- 0) Pipe Jetting
- 1) Blowing
- 2) Pruning (Structural)



GI DESCRIPTION

BIOSWALE

(ALSO REFERRED TO AS: BIOFILTERS, BIORETENTION, BIOFILTRATION, AND BIOINFILTRATION)

DESCRIPTION

A stormwater management practice that allows water to pool in a depressed vegetated area and then infiltrate through engineered soils and into a gravel layer where water collects and is stored. The infiltrating or engineered soil layer is a special mix that typically includes sand mixed with compost. This layer is typically 18 to 24 inches deep to prevent disturbance of the gravel layer during maintenance activities. Both bioswales and rain gardens include an engineered soil layer. Unlike a rain garden, the bioswale includes a gravel storage layer and sewer systems. These sewer systems often include a section of perforated underdrain located within the gravel layer that carries stormwater to a discharge point. They also typically include cleanouts and a series of overflow structures that control the ponding depth. Bioswales can capture the stormwater runoff where it infiltrates through the engineering soil to remove pollutants. Bioswales can also retain the stormwater, slowly discharging to downstream storm sewer systems and waterways.



GI COMMON PRACTICES AND APPLICATIONS

COMMON PRACTICES & APPLICATIONS

Bioswales can be constructed in a wide range of previously disturbed or developed areas, including areas with insufficient soils. Bioswales can be lined on the bottom, preventing stormwater from infiltrating, or



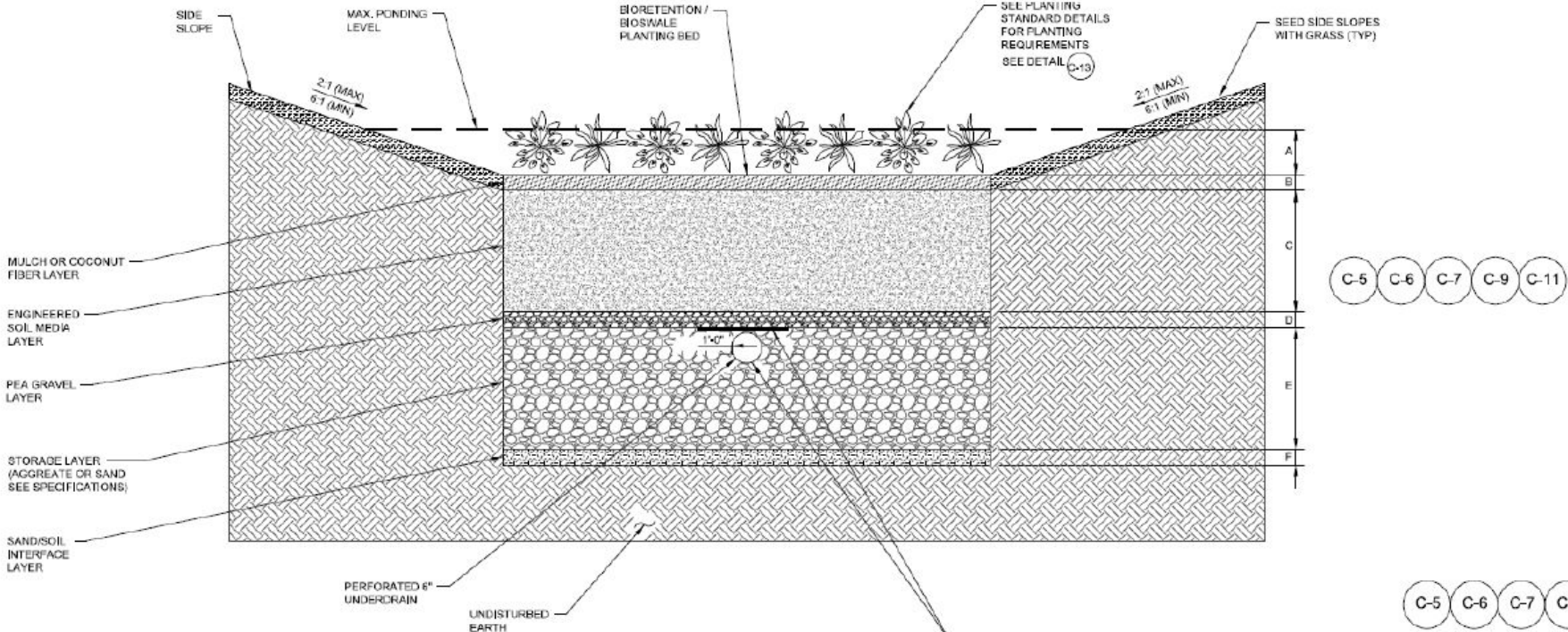
can be purposely constructed in native soils with positive drainage to allow for infiltration of the treated stormwater. The engineered soils are used to provide infiltration and pollutant removal, and the gravel layer is used for collection and storage. Because of their filtration and storage layers, bioswales are well suited for applications with runoff from large impervious surfaces such as parking lots and roadway medians and can be incorporated or retrofitted into these designs.

TYPICAL SECTION

BIOSWALE TYPICAL SECTIONS AND COMPONENTS

(Taken from MMSD's Bioretention-Bioswale GI Strategy Typical Details which can be found in MMSD's GI Calculator download.

Check the link for the most up-to-date sections: https://www.freshcoastguardians.com/static/GI_calc.zip



C-5 C-6 C-7 C-9 C-11

C-5 C-6 C-7 C-9 C-11

UNDERDRAIN SHALL BE PLACED WITH CROWN 1" BELOW TOP OF STORAGE LAYER, UNDERDRAIN SHALL BE PROTECTED FROM CLOGGING BY 4" LAYER OF PEA GRAVEL ABOVE THE UNDERDRAIN WHEN GRAVEL STORAGE IS USED. IF SAND STORAGE LAYER IS USED, A FILTER SOCK MAY BE USED TO PROTECT UNDERDRAIN FROM CLOGGING. IN GRAVEL STORAGE LAYER NO FILTER SOCK IS ALLOWED. PROVIDE SINGLE LAYER OF FILTER FABRIC ABOVE UNDERDRAIN. FABRIC SHALL EXTEND 1'-0" ON BOTH SIDES OF UNDERDRAIN.

DIMENSION	LAYER NAME	DEPTH
A	SURFACE PONDING	X
B	MULCH OR COCONUT FIBER	X
C		
D		
E		
F		

BIORETENTION / BIOSWALE TYPICAL CROSS-SECTION

(SLOPED SIDES)

SECTION A
NTS C-1

INSPECTION AND MAINTENANCE FOR EACH STRATEGY

BIORETENTION / BIOSWALE INSPECTION & MAINTENANCE

This section provides guidance on maintenance activities that are typically required for these systems, along with suggested frequency for each activity. Individual systems may have more- or less- frequent maintenance needs depending on a variety of factors including the occurrence of large storm events, regional hydrologic conditions, and the upstream land use. Site-specific maintenance plans should always be consulted, as the successful functionality of the bioswale may have specific maintenance requirements that were considered during design.

Referring to Planting Plans & Photos: It is especially important to refer to planting plans and photos that show what types of vegetation should be present, and where maintenance crews should or should not mow.

Timing of Inspections: Bioretention should be inspected in the spring after snow melt, and after the end of the growing season to ensure the system will function as intended. In addition, because inflows from large storm events can damage vegetation, cause erosion, and clog inlets and outfall structures, bioswales should be inspected after any rain event of 2 inches in 24 hours or more. Inspection during the time of weed growth is also especially critical, as it is usually the top maintenance activity associated with these systems. For the Milwaukee area, this will begin in late-May through mid-July

Inspection Focus: Inspections should focus on the growth and condition of vegetation, including any weeds or invasives; soil conditions (especially sediment build-up or clogging); structural integrity; and stormwater flow paths and erosion. Maintenance of any items identified in the inspections should be completed within seven days of the inspection.

MAINTENANCE TASKS SPECIFIC TO THIS STRATEGY

Task	Description	Maintenance Indicator	Minimum Frequency
Growing Medium/Planting Bed Components			
Erosion Repair	Stabilize any disturbed areas with seed or live plantings and biodegradable erosion matting.	If minor (<20 sf), nonrecurring erosion is present within the bioswale, or if erosion is deeper than 2 inches.	As needed
Mulch Amendment/Replacement	Amend (i.e. rake, aerate, and add material) or replace mulch in bioswale.	If visible mulch is observed to have bare spots, depth is less than 2 inches or appears compacted or disarrayed in or around bioswale.	Annually, or as needed
Organic Debris Removal	Remove excess organic debris (e.g., leaves, plant decay, etc.) from bioswale.	If present in bioswale.	Biannually
Sediment Removal	Remove sediment from bioswale basin and surrounding areas, including gutters and sidewalks.	If sediment is present or visible in or around the bioswale, and if sediment is more than 1-inch deep.	Biannually or as needed
Settling Repair	Repair areas of bioswale that have settled.	Area is observed to be lower than surrounding areas of designed elevation of bioswale.	As needed
Surface Media Renovation	Remove top inches of filter media and cultivating the surface.	Bioswale is clogged or not draining properly or within 48 hours of a rainfall.	As needed

MAINTENANCE TASKS SPECIFIC TO THIS STRATEGY

Structural Components			
Concrete Repair	Repair cracks on concrete structures.	If cracks or fractures are present on concrete structures located in bioswale.	As needed
Structural Clearing & Maintenance	Clear trash, debris, sediment, etc. from inlet and outlet structures, including catch basins and curb inlets, to clear and restore to function.	Clogged inlets, outlets, or outfall structures.	Biannually
Pipe Jetting	Jet pipes clogged with trash debris, sediment, etc. to clear and restore to function; maintain at least 50% function.	Clogged inlets, outlets, or outfall structures.	As needed
Vacuum Cleaning	Vacuum out trash, debris, sediment, etc. from clogged structures.	Clogged inlets, outlets, or outfall structures.	As needed
Vegetation Components			
Invasive Species Control	Control invasive species impacting desired plant species in bioswale. Refer to Appendix of Top 10 Invasive Species for list of the most common invasive species found in GI strategies in Southeastern WI.	Invasive plants are present in bioswale.	Biannually, or as needed

GI EXPECTED ANNUAL MAINTENANCE TABLES

BIORETENTION / BIOSWALE EXPECTED ANNUAL MAINTENANCE VISITS

It is recommended to complete twelve (12) site visits annually for bioswale maintenance. The timing and the tasks related to each of these site visits is detailed in the table below.

Task	Spring	Summer	Fall	Winter	After 2-inch Rainfall ¹
Site Inspection	1 ²				2
Mowing			1 ³		
Manual Weed Control	3	3	3		
Pest Management		1	1		
Invasive Species Control		1	1		

MAINTENANCE TASKS DEFINED

GRAVEL JOINT FILLING

DESCRIPTION

This section describes the procedure for filling the joints in permeable interlocking concrete pavements with gravel. This task should be performed when approximately 20% of the gravel is missing between the joints, typically after 5 years, or after a sweeping event occurs where joint material is incidentally removed.

EQUIPMENT & MATERIALS

- Disposal Bin
- Skid Steer with Mechanical Brush Attachment or Broom
- (Clear-washed) Gravel Material

MAINTENANCE TASKS DEFINED

INSTRUCTIONS

- 1) Obtain clear-washed joint material and check the manufacturer specifications for type of gravel joint material needed for specific product.
- 2) Dump gravel joint material onto pavement.
- 3) If using skid steer, use mechanical brush attachment with the brush turned to 30-degree angle to push piles of gravel in passes over the permeable interlocking concrete pavement to fill joints.
- 4) If using broom, brush gravel over permeable interlocking concrete pavement to fill joints.
- 5) Brush using either of the two methods until joints are full or to “lip” of pavers. Joints are full when excess material is left at the end of a pass with broom or brush.
- 6) Store or dispose of excess material and trash at an approved facility or location.

SPECIAL CONSIDERATIONS

- Obtain clear-washed joint material from a reputable vendor.
- Review facility plans, manufacturer specifications, and manufacturer recommendations for joint material sizes, and product recommendations.

10 MOST COMMON INVASIVE SPECIES IN SE WISCONSIN

8. Garlic Mustard (*Aliiaria petiolata*)

- Common name: Mustard root, garlic root, and garlicwort.
- Range and Habitat
 - Invades high quality upland and floodplain forests and savannas, as well as disturbed areas, such as yards and roadsides. Can be found on the upper or dryer edges of storm water ponds, infiltration areas and biofilters. It is sometimes found in full sun, though most often grows in areas with some shade, and does not do well in acidic soils.

¹ *Mechanical control (i.e. hand pulling) is the preferred method and should be attempted first. If mechanical control is deemed ineffective, and chemical application is necessary to control invasive weeds, a licensed and responsible professional should directly apply herbicide to stems when possible. Spraying herbicide can have a detrimental effect to surrounding flora and fauna.*

10 MOST COMMON INVASIVE SPECIES IN SE WISCONSIN

- Native herbaceous cover has been shown to decline at sites invaded by garlic mustard.
- Garlic mustard exudes antifungal chemicals into the soil that disrupt associations between mycorrhizal fungi and native plants, suppressing native plant growth (WDNR, July 2015).
- Identification
 - Leaves: First year plants have basal leaves that are dark green, heart or kidney-shaped, with scalloped-edges and wrinkled appearance. On second year plants, stem leaves on flowering plants are alternate, triangular, with large teeth, and up to 2-3" across. Leaves and stems smell like garlic when crushed.
 - Flowers: Small, white, 4-petaled, and abundant. Bloom throughout the spring.
 - Fruits & seeds: Seed pods are long (1-2 ½)", slender capsules (siliques) green in color, drying to pale brown. Inside, seeds are small, shiny black, and arranged in a single row. Plants can be recognized in late summer and fall by their dry, papery brown, erect seedpods atop dead stalks. Seeds remain viable in the soil for at least 7 years.
 - Roots: White, slender taproot, "S"-shaped at the top. Will resprout from the root crown if only the top of the plant is removed (WDNR, July 2015).

10 MOST COMMON INVASIVE SPECIES IN SE WISCONSIN

- Similar species:
 - Several native white flowered plants, the toothworts (*Dentaria* spp.) and sweet cicely (*Osmorhiza claytonii*), bloom at about the same time as garlic mustard and may be mistaken for it. The leaves of native violets (*Viola* spp.) and the non-native creeping Charlie (*Glechoma hederacea*) may be mistaken for first year garlic mustard plants, but they will not have a garlic odor when crushed (WDNR, July 2015).
- Control
 - Mechanical: Hand pull in early spring before seed set. If plants are flowering, place in plastic bags for trash disposal or burn. Cut plants at their base just after the flower stalks have elongated but before any flowers have opened; may have to cut more than once during a growing season. Place pulled/cut plants in plastic bags for trash disposal. Use controlled burns in fall or early spring.

10 MOST COMMON INVASIVE SPECIES IN SE WISCONSIN

8. Garlic Mustard (*Alliaria petiolata*)



LINKED ADDITIONAL RESOURCES

MMSD RESOURCES

RESOURCE	AVAILABLE FROM	WEB ADDRESS
PLANS		
Regional Green Infrastructure Plan	MMSD	https://www.mmsd.com/static/MMSDGIP_Final.pdf
GI Operations & Maintenance Implementation Framework, 2016	MMSD	https://www.freshcoastguardians.com/application/files/6115/0427/9939/GI_OM_2016_Final_Report.pdf
Milwaukee Green Streets Plan, 2013	City of Milwaukee	https://www.mmsd.com/application/files/7814/8779/8665/Green_Streets_Stormwater_Manag.pdf
Various Plans	Fresh Coast Resource Center	https://www.freshcoastguardians.com/resources/our-plans
SIZING AND DESIGN OF GREEN INFRASTRUCTURE		
Green Infrastructure Desktop Sizing Tool	MMSD	http://www.freshcoastguardians.com/resources/sizing-your-project
Green Infrastructure Standard Specifications and Plan Templates, 2016	MMSD	https://www.mmsd.com/application/files/7514/8658/7515/MMSD_GI_Specs_and_Plan_Template_Report.FINAL012717.pdf
Green Infrastructure Plant Selection Tool	MMSD	https://www.freshcoastguardians.com/resources/services/plant-selection
MAINTENANCE AND CARE OF GREEN INFRASTRUCTURE		
Fresh Coast Resource Center Operation & Maintenance Manual	MMSD	https://www.freshcoastguardians.com/contact
Green Infrastructure Care:	MMSD	
Rain Barrels	Fresh Coast Resource Center	https://www.freshcoastguardians.com/application/files/1915/5119/6195/13-056c2_DiverterRainBarrel02142019_Web.pdf
Rain Gardens	Fresh Coast Resource Center	https://www.freshcoastguardians.com/resources/green-strategies/rain-gardens
Soil Amendments	Fresh Coast Resource Center	https://www.freshcoastguardians.com/resources/green-strategies/soil-amendments
Native Landscape	Fresh Coast Resource Center	https://www.freshcoastguardians.com/resources/green-strategies/native-landscaping
Stormwater Tree	Fresh Coast Resource Center	https://www.freshcoastguardians.com/resources/green-strategies/stormwater-trees
Green Roofs	Fresh Coast Resource Center	https://www.freshcoastguardians.com/resources/green-strategies/green-roofs
Porous Pavements	Fresh Coast Resource Center	https://www.freshcoastguardians.com/resources/green-strategies/porous-pavement
Bioswales	Fresh Coast Resource Center	https://www.freshcoastguardians.com/resources/green-strategies/bioswales
Wetlands	Fresh Coast Resource Center	https://www.freshcoastguardians.com/resources/green-strategies/wetlands
VENDORS AND GREEN INFRASTRUCTURE TRAINING		
Green Vendor List	MMSD	https://www.freshcoastguardians.com/resources/vendors
Fresh Coast Resource Center Training Support	Fresh Coast Resource Center	https://www.freshcoastguardians.com/resources/services/workforce-development-training
FUNDING PROGRAMS		
Green Infrastructure Partnership Program	MMSD	https://www.mmsd.com/what-we-do/green-infrastructure/funding-programs
Green Solutions	MMSD	
Fund for Lake Michigan	FFLM	https://fundforlakemichigan.org/apply-for-funding/
Sweet Water Mini-Grant Program	Sweet Water	https://www.swwtwater.org/mini-grants
Wisconsin Coastal Management Program	Wisconsin Office for Coastal Management	https://doa.wi.gov/Pages/LocalGovtsGrants/CoastalGrants.aspx

UNIT BID PRICES

2019 UNIT COSTS FOR MAINTENANCE BID ITEMS

	DETAILED DESCRIPTION	UNIT	TYPICAL UNIT PRICE	NOTES	SOURCES FOR ESTIMATED COST	2018 PRICES ¹
PLANTING MEDIA, COVER, AND SOD						
Compost	Blue Ribbon - Certified Organic	CY	\$40.00		Minor's - Retail (2019)	\$73.00
Shredded Hardwood Bark Mulch	Hemlock blend	CY	\$45.00		Minor's - Retail (2019)	\$63.53
Engineered Soil	Owl Run Nursery (pick-up/delivered)	CY	\$60.00		Owl Run Nursery (2019)	\$58.59
Sod	Blue Grass Blend	SF	\$3.50		Minor's - Retail (2019)	\$4.75
UNDERDRAINS						
6" PVC Underdrain (perforated)		LF	\$25.00		Minnesota BMP Calculator (2019)	\$24.95
PLANTS AND PLANT MATERIALS						
Native Plant Plugs	32 - 38 Cell Plug	EACH	\$3.00	<i>enter any restrictions on when is the best time to order plugs/shrubs</i>	Taylor Creek Nursery Wholesale (2019)	\$5.63
Root Stock Plants (18" spacing)	Variety of species	EACH	\$3.00		Raintree Nursery (2019)	\$3.77
Perennials, #1 Gallon	Variety of species incl. premium, #1 containers	EACH	\$15.00	Consult a restoration nursery for the correct mix for your location and soil type	Minor's - Retail (2019)	\$13.87
Shrubs, #5 Gallon	Variety of species, #5 containers	EACH	\$60.00		Minor's - Retail (2019)	\$59.00
<i>Example Varieties:</i>						
Ozark Witch Hazel		EACH	\$50.00		Minor's - Retail (2019)	\$50.00
Gray Dogwood		EACH	\$25.00		Minor's - Retail (2019)	\$50.00
Arrowwood Viburnum		EACH	\$30.00		Minor's - Retail (2019)	\$30.00
Pardon Me Daylily	#1 container, premium	EACH	\$20.00		Minor's - Retail (2019)	\$20.00
Northwind Switch Grass	#1 container, premium	EACH	\$18.00		Minor's - Retail (2019)	\$20.00
SEEDING MIXES						
Diverse Prairie Mix	"High Diversity P rairie Mix"	SY	\$0.30		Taylor Creek Nursery Wholesale (2019)	\$0.42
Detention Basin Wet Prairie Mix	"Wet Seed Mixes - Swale and Basin Mix"	SY	\$0.20		Taylor Creek Nursery Wholesale (2019)	\$1.70
Erosion Control Mix		SY	\$0.50		Reinders - Retail (2019)	\$1.88
WISDOT Seed Mix No. 75 (Erosion Control)	\$0.47/SY = \$2280/AC	LBS				
"Infiltration Seeding"	"Clay Soils - Mesic Prairie Mix" / SY	LS	\$0.25		Taylor Creek Nursery Wholesale (2019)	\$3,680.00
DECIDUOUS TREES						
Sienna Glen Maple	3" Caliper	EACH	\$300.00	<i>enter any restrictions on when is the best time to order trees</i>	Minor's - Retail (2019)	\$400.00
Swamp White Oak	3" Caliper	EACH	\$300.00		Minor's - Retail (2019)	\$400.00
Prairie Titan Kentucky Coffee Tree	2.5" Caliper (3" not available)	EACH	\$250.00		Minor's - Retail (2019)	\$400.00
Winter King Hawthorn	1.75"	EACH	\$175.00		Minor's - Retail (2019)	\$250.00
American Hornbeam	2"	EACH	\$250.00		Minor's - Retail (2019)	\$250.00
Autumn Brilliance Serviceberry	8"	EACH	\$225.00		Minor's - Retail (2019)	\$200.00
PAVER BLOCKS						
Paver Blocks (any variety)		SF				\$7.33
Permedge Permeable Paver Edge Restraint		LF				\$6.27
Pavers with Settling Stone & Joint Aggregate		SF				\$13.13
Permeable 'patio paver' with underlayment		SF				\$18.35
Kiarastone Pavers		SF				\$8.81
STORM SEWER						

STRATEGIC MAINTENANCE ENSURES LONGEVITY AND FUNCTION!



Green Infrastructure
for Water Quality and
Watershed
Management



Grey Infrastructure /
Traditional Drainage
Design



Watershed Modeling
for Quality and
Quantity



Facility and GI
Inspection and
Maintenance

THANK YOU!



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