



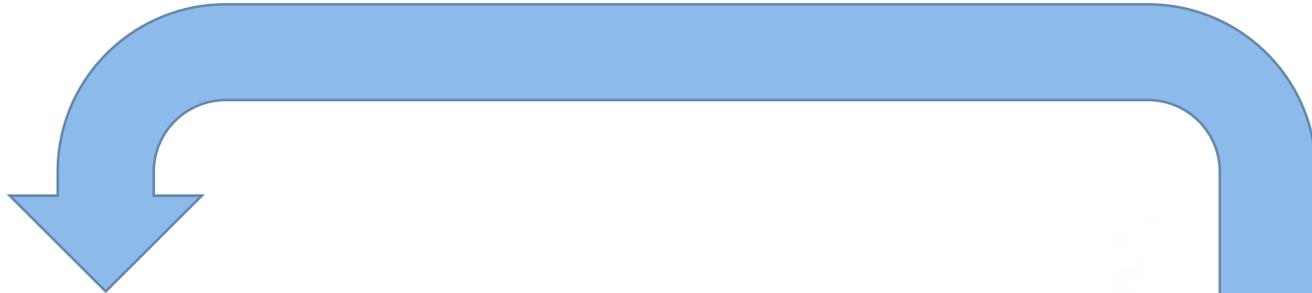
# Designing Green Infrastructure for Lower O&M

## (Professional Opinions on) Designing GI for Lower O&M

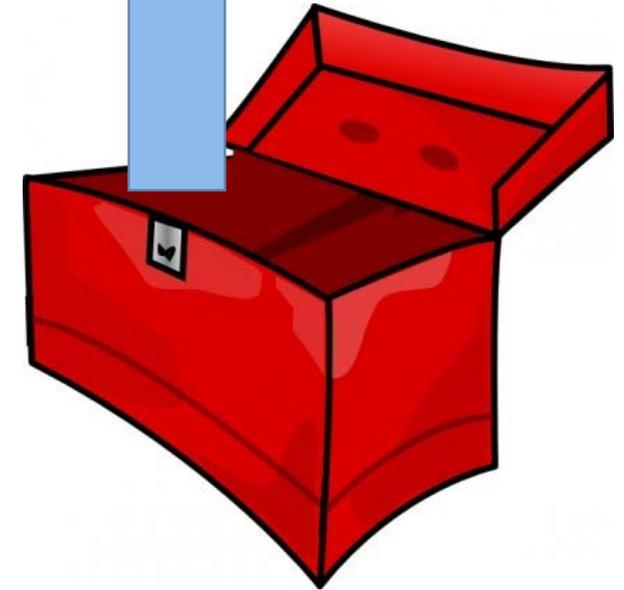
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- 01 | Design Considering Existing Assets, Equipment and Policies  
Maureen A. McBroom  
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## New Storm Water Tools in the Toolbox



Bioswales  
Permeable pavement  
Rain Gardens  
Constructed Wetlands  
Storm Water  
Trees/Planters  
Green roofs  
Cisterns/Rain  
Barrels  
Native Landscaping



## Codes and Ordinances Revisions

- Revised to allow additional technology, cost effective practices to be used on smaller private properties
- Be prepared for different inspection & maintenance needs for different practices
  - More frequent inspections?
  - Native vegetation care & maintenance vs. traditional mowed grass?
  - More frequent street cleaning?

## Existing Resources and Equipment for Inspections and Maintenance

- Equipment?
  - Shared/group arrangements?
- Staff?
  - Experienced vs. Trainees?
  - Permanent vs. Seasonal?
- Contractors?
  - Availability? Experience?
- *Funding/Budgets?*



## Private Property Owner Inspections and Maintenance

- Program for private property owners to report to municipality:
  - Inspections
  - Required Maintenance
  - Completed Maintenance
- Municipal staff time, costs incurred to
  - Operate program
  - Complete missing inspections
  - Complete required maintenance if owners do not.
- *Funding/Budgets? Education Needs?*



## Consider Maintenance Needs During Permit Reviews

- Discuss future maintenance needs of recently submitted permits/plans:
  - DPW
  - Engineering
  - Planning
- Understand inspection frequencies & expected maintenance timelines for new facilities
  - Build inspections & maintenance time & costs into future budgets.

## Local Storm Water Specs

- Develop list of preferred storm water practices/details for developers/private property owners
  - Permeable pavers vs. asphalt/concrete?
  - Recommended vegetation with a history of success?
  - Access drive width for municipal vehicles?
  - Minimum number of curb cuts in front of bioswales to prevent erosion?



Encourage uniformity of the various practices constructed in the community.

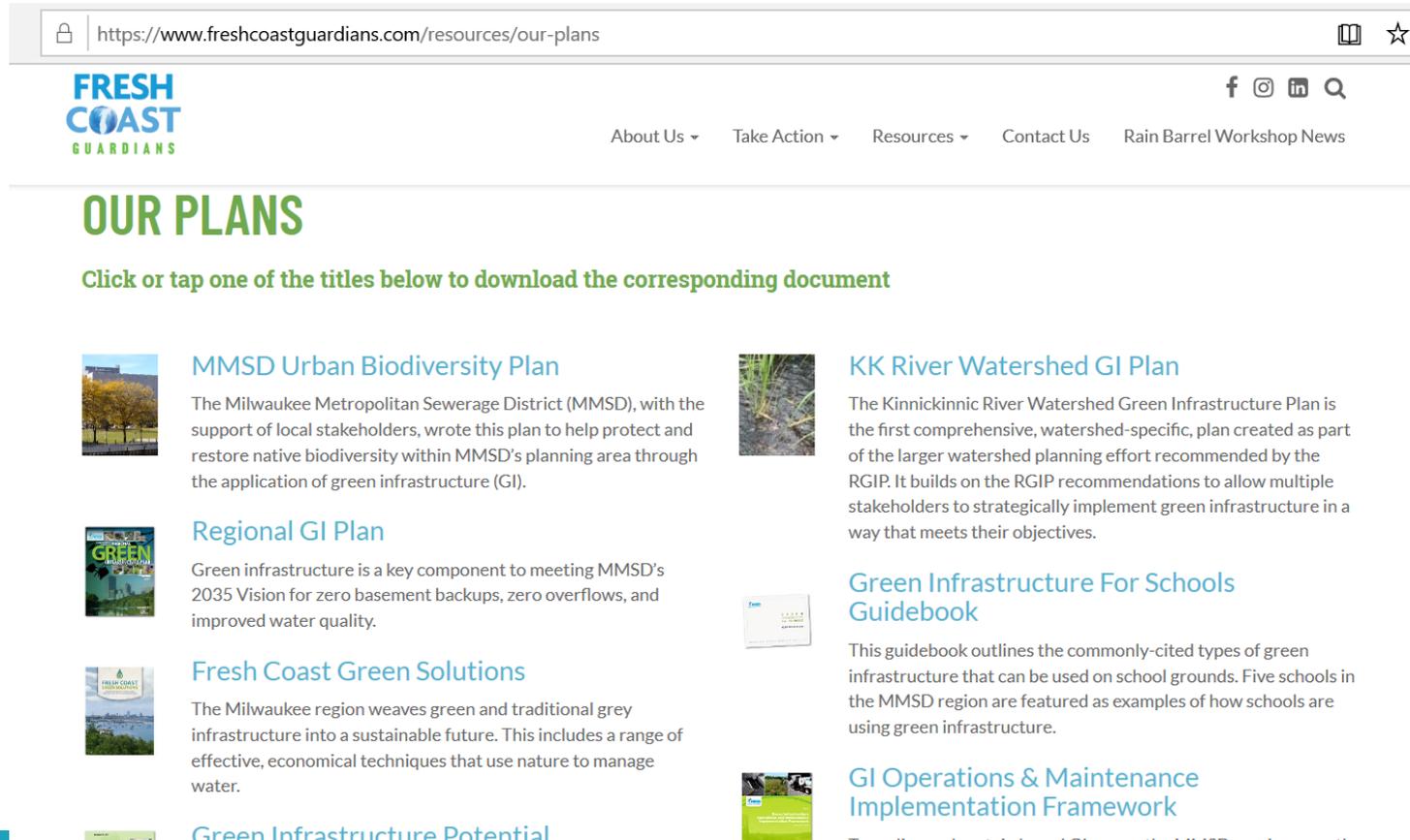
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# MMSD Green Infrastructure for Schools Guidebook

<https://www.freshcoastguardians.com/resources/our-plans>



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### MMSD Urban Biodiversity Plan

The Milwaukee Metropolitan Sewerage District (MMSD), with the support of local stakeholders, wrote this plan to help protect and restore native biodiversity within MMSD's planning area through the application of green infrastructure (GI).
- 

### Regional GI Plan

Green infrastructure is a key component to meeting MMSD's 2035 Vision for zero basement backups, zero overflows, and improved water quality.
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### Fresh Coast Green Solutions

The Milwaukee region weaves green and traditional grey infrastructure into a sustainable future. This includes a range of effective, economical techniques that use nature to manage water.
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### Green Infrastructure Potential
- 

### KK River Watershed GI Plan

The Kinnickinnic River Watershed Green Infrastructure Plan is the first comprehensive, watershed-specific, plan created as part of the larger watershed planning effort recommended by the RGIP. It builds on the RGIP recommendations to allow multiple stakeholders to strategically implement green infrastructure in a way that meets their objectives.
- 

### Green Infrastructure For Schools Guidebook

This guidebook outlines the commonly-cited types of green infrastructure that can be used on school grounds. Five schools in the MMSD region are featured as examples of how schools are using green infrastructure.
- 

### GI Operations & Maintenance Implementation Framework

MMSD Green Infrastructure for  
Schools Guidebook  
<https://www.freshcoastguardians.com/resources/our-plans>



## GREEN INFRASTRUCTURE SOLUTIONS IN THIS GUIDE



### BIOSWALES

p. 84

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



### GREEN ROOFS

p. 88

Partially or completely planted roofs with vegetation growing in soil or other growing media to hold rainwater.



### GREENWAYS

p. 92

Riparian and non-riparian buffer zones and strips that store and drain stormwater runoff into the ground naturally.



### NATIVE LANDSCAPING

p. 96

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



### PERMEABLE PAVEMENT

p. 100

Pavement that can reduce and infiltrate surface runoff through its permeable surface into a stone or filter media below.



### RAIN GARDENS

p. 104

Gardens that are watered by collected or pooled stormwater runoff, slowly infiltrating it into the ground along root pathways.



### **RAINWATER CATCHMENT**

p. 108

The capture and storage of water, potentially for reuse later.



### **REMOVAL OF PAVING & STRUCTURES**

p. 112

Removal of structures or paving in order to allow infiltration.



### **SOIL AMENDMENTS**

p. 116

Materials worked into the soil to enhance its ability to infiltrate or absorb water.



### **TREES**

p. 120

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.



### **WETLANDS**

p. 124

Areas that have soils that are inundated or saturated for part of the year or the entire year.

# GREEN INFRASTRUCTURE RATING GUIDE

	<b>Initial Cost (Design, Materials, Installation)</b>	<b>Level of Maintenance</b>	<b>Permits Required</b>	<b>Involve Professionals</b>
\$\$\$	>\$25 per square foot, Typical project >\$10,000	Frequent maintenance, expertise and/or special equipment required	Multiple permits from different departments required	Certified professionals required for both design and installation
\$\$	\$10 to \$25 per square foot, Typical project <\$10,000	Seasonal maintenance, training required for maintenance	At least one permit will be required	Professionals recommended, but no certification required
\$	<\$10 per square foot, Typical project <\$1,000	Seasonal maintenance, no special equipment	Permit requirement may depend on municipality	Professional may be used for either design OR installation
	No cost	No maintenance required	No permit will be required	No professionals

# PERMEABLE PAVEMENT

Porous pavement is a surface that can reduce and infiltrate stormwater runoff through its permeable surface into a stone or filter media below. Unlike traditional concrete and asphalt, this specially designed material helps manage water where it falls, absorbing rain and melting snow into the ground. Porous pavement comes in concrete, asphalt, and paver systems.

\$\$\$

START-UP COST

\$\$\$

VOLUNTEERS & MAINTENANCE

★★★

STORMWATER EFFECTIVENESS

★★

LEARNING OPPORTUNITIES



## PAVEMENT TYPES

### Permeable Pavement

Permeable (or porous or pervious) pavement is asphalt or concrete that contain voids or spaces (15% to 25% of the total volume) that allow stormwater to infiltrate to an underlying gravel layer. This layer stores the water and promotes infiltration into the soil.

### Permeable Pavers

Permeable pavers are paving materials, typically made of concrete, brick, stone, or composite materials, that promote the local infiltration of rainwater and snowmelt by allowing water to pass through gaps between the blocks. The blocks themselves are not porous.



### Porous Turf

Porous turf is artificial or living turf grass planted over subgrade storage. Porous turf can be used for athletic fields or as an alternative schoolyard surface to pavement.

## WHAT PERMEABLE PAVEMENT DOES

Urbanized areas contain a high percentage of impervious surfaces such as streets, rooftops, parking lots, and other paved areas. Schools have large expanses of impervious surfaces for schoolyard play, parking, sidewalks, and service drives. Given the four seasons in Wisconsin, having a specific amount of hard surfaces at schools in proportion to outdoor student activities at any given time is



Pervious: Water flows through. Filtering is in the pavement

Permeable: Water flows around. Filtering is in the joint stone or bedding stone



## Precast Pervious Pavement



# Precast Pervious Pavement (Spancrete Replenish)

## Design Guidance

- Allow NO run-on of vegetated areas, lawn clippings, high sediment areas
- Fully Pervious Pavement area with no run-on: once annual vacuum sweeping or use of household garden hoses sprayer to remove debris from top surface
- With 2:1 Run-on of paved areas, vacuum sweep/garden sprayer method twice per year

# Permeable Pavement

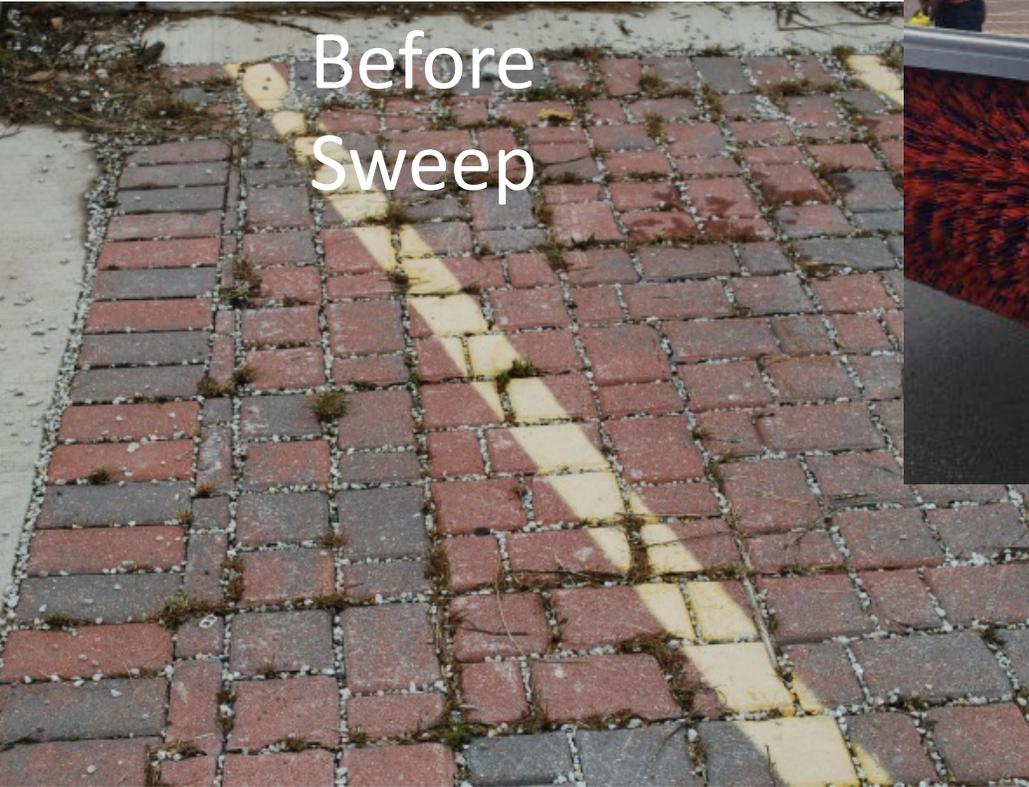


## Design Guidance

- Allow NO run-on of vegetated areas, lawn clippings, high sediment areas
- Fully Permeable Pavement area with no run-on: once annual vacuum sweeping, replacement of joint stone 5-10 years
- With 2:1 Run-on of paved areas, vacuum twice per year, replace joint stone every 5 years



**STORMWATER  
SOLUTIONS  
ENGINEERING LLC**



## Annual Maintenance Costs- 2 acre Permeable Parking Lot

Tasks	Contractor/Expenses
Mechanical Sweeping	\$500
Joint Replenish	\$1,016
Light Surface Cleaning	\$344
SUBTOTAL	\$1,850

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## Simple and bold



Less variety can make maintenance easier

# Don't force it



Implement GI where it will perform effectively

## Fill it with plants, not mulch



Use proper plant spacing and sizes at installation

## GI is a filter



Bioinfiltration basin at installation

# Filters clog



Bioinfiltration basin after one growing season

# Salt tolerance



Gravel edge as a buffer for easier maintenance

## There is maintenance...



...and then there is higher maintenance

## Q/A?

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01

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