

# Effective Operation & Maintenance Agreements for Stormwater Practices

Green Infrastructure Seminar, April 2012

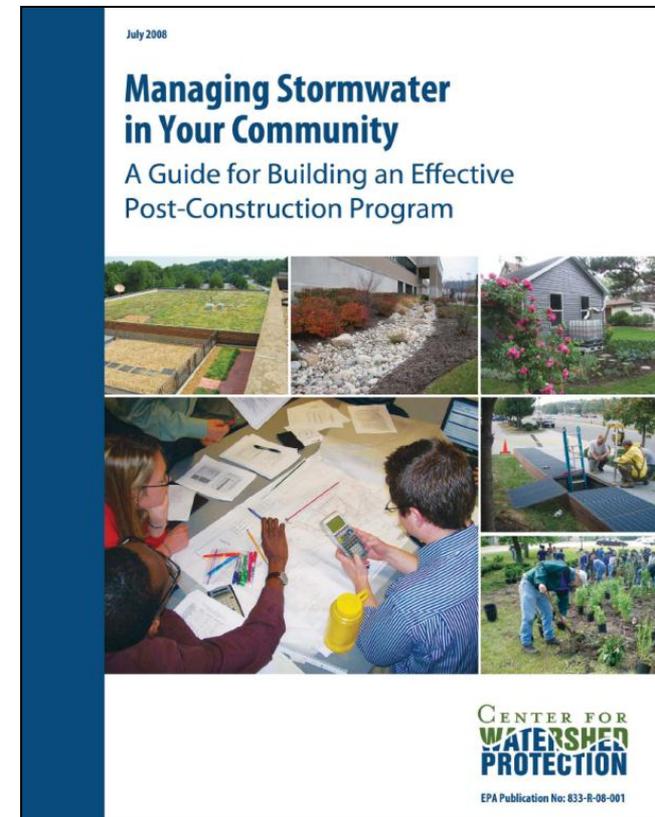


# What is required?

- MS4 Phase II: “A plan to ensure adequate long-term operation and maintenance of selected BMPs, including types of agreements between the permittee and other parties such as the post-development landowners or regional authorities.”

# Getting Started

1. Who is responsible for maintenance?
2. Structural versus routine maintenance?
3. Legal authority?
4. How will maintenance be tracked, verified, and enforced?



# Who is responsible?

- Private property owners (local program provides oversight and guidance)
- Local program (MS4 permittee)
- Hybrid of private/local program – most common

**Table 9.4. Three Maintenance Program Approaches**

Typical Program Characteristics	Typical Annual Maintenance Program Budget Range <sup>a</sup>	Typical Funding Mechanisms
<b>1. Private Maintenance</b>		
<ul style="list-style-type: none"> <li>▶ Property owners and homeowners associations responsible for maintenance</li> <li>▶ Less costly for local program, but often is a neglected program element</li> <li>▶ Legal and program tools needed to establish responsibility: ordinance, maintenance agreement, easements, and compliance tools</li> <li>▶ Strong outreach and education needed for effective program</li> </ul>	\$5K to \$100K	General fund  Plan review and inspection fees  Maintenance bonds or escrow accounts
<b>2. Local Program Maintenance</b>		
<ul style="list-style-type: none"> <li>▶ Local program responsible for most maintenance functions</li> <li>▶ Owners may be responsible for routine tasks (mowing, picking up trash, aesthetics)</li> <li>▶ Requires highest budget and staff commitment</li> <li>▶ More common in cities and towns with established public works function and jurisdiction over roads and drainage</li> </ul>	\$100K to \$1.5M	Stormwater utility  Other utility (e.g., sewer) rates  Transportation maintenance funds  General fund
<b>3. Hybrid Approach: Blend of Public and Private Maintenance</b>		
<ul style="list-style-type: none"> <li>▶ Local government maintains facilities on public land and/or major private facilities within easements, while private parties are responsible for facilities on most private property</li> <li>▶ Most common maintenance approach</li> <li>▶ Can be cost-effective, but still requires local government budget and staffing</li> </ul>	\$50K to \$300K	Stormwater utility  Capital improvement program  General fund

<sup>a</sup> Maintenance program budget figures were derived from research on local stormwater programs, primarily Phase II MS4s, conducted in 2005 (CWP, 2006). Because most programs are still in the early stages of program development, these figures represent nominal costs associated with a maintenance program, and do not include other costs, such as the cost of stormwater capital improvement projects. Costs will increase as program responsibilities and accountability increase. Typically, larger municipalities, such as Phase I communities, have much larger maintenance budgets.

# Who is responsible for structural vs. routine maintenance?

Many programs assign routine maintenance to property owner while retaining responsibility for structural.

<b>Structural Maintenance Items</b>	<b>Routine Maintenance Items</b>
<ul style="list-style-type: none"><li>▶ Clogged or broken pipes</li><li>▶ Missing or broken parts (e.g., valves, seals, manholes)</li><li>▶ Cracked concrete</li><li>▶ Erosion at outfall or on banks</li><li>▶ Regrading or dredging</li><li>▶ Landscaping needs complete refurbishment</li></ul>	<ul style="list-style-type: none"><li>▶ Mowing</li><li>▶ Removal of small amounts of sediment</li><li>▶ Removal of vegetative overgrowth and woody plants</li><li>▶ Removal of trash and yard debris</li><li>▶ Replacing dead or diseased landscaping</li><li>▶ Control of invasive plants</li></ul>

# Legal authority?

Proper legal authority includes:

- Assigning maintenance responsibility through legally binding maintenance agreements
- Authority to access, inspect, and maintain SCMs
  - Where will SCMs be located? In right-of-way, easements, private property
- Enforcement mechanisms
  - Notices of Violation
  - Civil penalty
  - Ability to perform maintenance and bill the owner

# Maintenance Agreements

Requirements for plan review approval:

- Maintenance agreement recorded in the property deed
- O&M Plan on file
- Easements shown on final plat

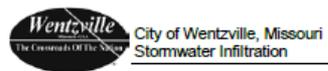
# O&M Plan

- Provide plan template and inspection checklist for SCM types:
  - Stormwater ponds
  - Wetlands
  - Infiltration practices
  - Filtering practices
  - Open channel practices
  - Riparian buffers
  - Proprietary practices



# Property owner agrees to:

- Build practice
- Perpetually located in easement
- Maintain & operate in accordance with O&M Plan
- Self-inspection & reporting
- Written approval required before modifying
- The City may perform work and bill the owner



## STORMWATER INFILTRATION INSPECTION CHECKLIST

Location: \_\_\_\_\_ Owner Change: Y N  
 Owner Name, Address, Phone: \_\_\_\_\_  
 Date: \_\_\_\_\_ Time: \_\_\_\_\_ Site Conditions: \_\_\_\_\_

Inspection Item	Y/N	Comments/Corrective Action Needed
Complete drainage of facility in about 24 to 48 hours after rain event?		
Clear of debris and trash?		
Standing water in observation well or other areas when no water should be present?		
Evidence of leaks or seeps?		
Erosion in area draining to facility?		
Undesirable vegetation growth?		
Other (describe)?		
<b>Other</b>		
Have there been any complaints from residents?		
Public hazards?		

Inspector Name (printed) \_\_\_\_\_ Inspector Signature \_\_\_\_\_

Inspections shall be completed at least once per calendar year. Provide completed copies of inspection reports to The City of Wentzville, Stormwater Coordinator, 200 E. Fourth Street, Wentzville, MO 63385 – fax 636-639-2057. *Documentation of the corrective action taken (date, by whom, what was done, etc.) must be provided for each item noted above.*

# Maintenance Inspections

- How often? Annual self-inspections by property owner most common
- Establish your expectations or “service level”

## Green Stormwater Operations and Maintenance Manual



Seattle Public Utilities

August 2009

Service Category	Service Level A (Excellent Effort)	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service D (Poor Effort)
<b>Weeds</b>	<p>No weedy species present</p> 	<p>Occasional weedy species (5-10%)</p> 	<p>Lots of Weedy species (10-20%)</p> 	<p>Weedy species predominant (More than 20%)</p> 
<b>Erosion and bare spots</b>	<p>No erosion or bare spots</p> 	<p>Some erosion and bare spots (0-5%)</p> 	<p>Substantial erosion and bare spots (5-10%)</p> 	<p>Completely eroded and bare spots (More than 10%)</p> 
<b>Aesthetics</b>	<p>Healthy, well-maintained vegetation; excellent appearance</p> 	<p>Appearance is good</p> 	<p>Moderate appearance</p> 	<p>Poorly maintained appearance</p> 
<b>Mulch</b>	<p>Deep mulch layer (4"-6"), clean edges, limited compaction</p> 	<p>Some mulch (2"-4"), loose edges, some compaction</p> 	<p>Little mulch (Less than 2"), no defined edge, shoulder compaction</p> 	<p>No mulch present, no defined edge, shoulder compaction</p> 

Service Category	Service Level A (Excellent Effort)	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Poor Effort)
<b>Bioretention + biofiltration (vegetation &amp; soils/substrate)</b>	<ul style="list-style-type: none"> <li>At least 100% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least 18 - 24 inches high</li> <li>Soil is well aerated, no evidence of vehicle compaction</li> <li>No erosion, channelization or scouring</li> <li>Water drains within 24 hours</li> <li>No visible bare spots</li> <li>Acceptable level of sediment or debris accumulation</li> </ul>	<ul style="list-style-type: none"> <li>80% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least 18 - 24 inches high</li> <li>Some evidence of vehicle compaction (lack of mulch)</li> <li>Some erosion, channelization or scouring</li> <li>Most water drains within 24 hours, minimal long-term ponding</li> <li>A few bare spots 10-20%</li> <li>Acceptable level of sediment or debris accumulation</li> </ul>	<ul style="list-style-type: none"> <li>Less than 80-50% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least 18 - 24 inches high</li> <li>Compacted soils</li> <li>Erosion, channelization or scouring</li> <li>The presence of long-term ponding (&gt; 72 hours)</li> <li>Many bare spots</li> <li>Significant build up of sediment or debris</li> </ul>	<ul style="list-style-type: none"> <li>Less than 50% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least 18 - 24 inches high</li> <li>Compacted soils</li> <li>Erosion, channelization or scouring</li> <li>The presence of long-term ponding (&gt; 72 hours)</li> <li>Many bare spots or noxious weeds/grass</li> <li>Significant build up of sediment or debris</li> </ul>
<b>Swale bottom vegetation</b>				
<b>Sediment or debris accumulation</b>				
<b>Conveyance (vegetation &amp; soils/substrate)</b>	<ul style="list-style-type: none"> <li>Healthy vegetation</li> <li>No erosion, channelization or scouring</li> <li>No bare spots</li> <li>No build up of sediment or debris</li> <li>No non-designed obstructions to flow</li> </ul>	<ul style="list-style-type: none"> <li>Mostly healthy vegetation</li> <li>Some erosion, channelization or scouring</li> <li>Minimal bare spots 10-20%</li> <li>Some build up of sediment or debris</li> <li>Minimal non-designed obstructions to flow (over-grown vegetation, trash rack blockages)</li> </ul>	<ul style="list-style-type: none"> <li>Some vegetation</li> <li>Erosion, channelization or scouring</li> <li>Many bare spots 20-40%</li> <li>Significant build up of sediment or debris</li> <li>Significant non-designed obstructions to flow (over-grown vegetation, trash rack blockage)</li> </ul>	<ul style="list-style-type: none"> <li>Poor or no vegetation</li> <li>Erosion, channelization or scouring</li> <li>Many bare spots 40% or more</li> <li>Significant build up of sediment or debris</li> <li>Significant non-designed obstructions to flow (over-grown vegetation, trash rack blockage)</li> </ul>

<input type="checkbox"/> Curb cuts	Curb is up to 10% blocked 	Curb is between 10-40% blocked 	Curb is above 40% blocked 	<input type="checkbox"/> remove trash and organic debris and dispose properly
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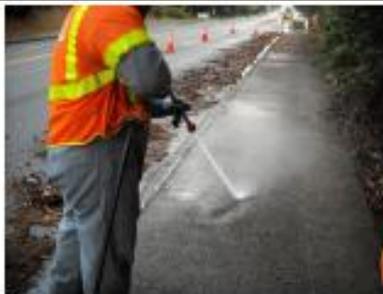
Porous/pervious pavers	water infiltrates well, pavers are up to 10% clogged or minimal ponding is observed 	water infiltrates well, pavers are between 10-40% clogged and minimal ponding is observed 	water does not infiltrate well, pavers are more than 40% clogged 	vacuum debris, weed burn as required
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<b>Street</b>	Infiltration rate of 20 +in/hr	Infiltration rate of 10 in/hr	Infiltration rate of 3 in/hr	based on peak flows for 100yr design storm 3 in/hr and excess capacity for localized failure
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<b>Sidewalk</b>	Infiltration rate of 20 +in/hr	Infiltration rate of 10 in/hr	Infiltration rate of 1 in/hr	
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			Test infiltration rates per SPU Materials Lab procedure.
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	Pressure wash @2500 psi bi-annually	Pressure wash @ 2500 psi annually	Pressure wash @ 2500 psi annually	
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			Pressure wash pavement with an industrial machine
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# Designing for Maintenance

Design Standards should consider:

- Pretreatment – forebays, filter strips, etc.
- Conveyance system design to minimize erosion, including inlet and outlet protection
- Maintenance access
- Safety features – gentle slopes, pond benches, confined space entry, locks for risers/valves
- Plan for sediment removal and disposal
- Planting plans that improve function/aesthetics while reducing future maintenance, i.e. reduce erosion potential, stabilize banks, prevent access by geese, shade ponds.

# How to track, verify, enforce?

Post-Construction Program – Tracking Objectives:

- Tracking long-term O&M
- Tracking SCMs as a means of post-construction program evaluation

# SCM Inventory

- Existing SCMs (Time-intensive; phase, use interns?)
  - Type
  - Design Features (size, drainage area, design storm/treatment volume, pipe sizes)
  - Condition (structural, vegetation, sedimentation, trash)
  - Location in easement/common area? Maintenance responsibility?
  - Maintenance Access
- Future SCMs – Require construction inspections and as-built plans to establish accurate baseline

# Tracking O&M

## Privately-owned:

- Maintenance agreements and as-built plans
- Inspection dates and reports
- Changes in ownership

## Publicly-owned:

- Inspection/Maintenance Costs
- Photos
- General condition (categories?)
- Maintenance needs for prioritizing (none, routine, major, reconstruction)
- Maintenance work orders/tasks completed
- Feedback to evaluate list of approved SCMs and design standards
- Retrofit opportunities

# Program Evaluation Tracking

Your MS4 program is a dynamic program that should change over time through an iterative process.

SCM Tracking can provide data to:

- Determine success in meeting measurable goals
- Determine whether program changes are necessary
- Plan future activities
- Document progress for annual report/audit

# Measurable Goals

- Output vs. Outcome-Based Measurable Goals
- Outcome-Based are less common, more difficult to measure
- Tracking SCMs can provide data for both. Example outcome-based goals:
  - % of developed land treated by post-construction SCMs and/or LID SCMs
  - X pounds of a target pollutant (or %) removed based on approved post-construction SCMs (modeled)
  - X pounds of sediment removed from SCMs annually

# Tracking Indicators

Base Indicators (recommended for all programs) for output and outcome-based goals:

- Number and type of SCMs approved/installed (structural and non-structural)
- Number of maintenance inspections
- Number of SCMs maintained/ maintenance activities
  - # requiring routine, major maintenance, reconstruction

Supplemental Indicators:

- Number of LID SCMs
- Pounds of sediment/trash removed from SCMs

# Tracking System

- Paper files (as-built plans, inspection reports, maintenance agreements)
- GIS database
  - SCM layer (location and type)
  - Easements and property boundary layers

# Waukesha County, WI

## Types of BMPs Being Tracked

*List can be expanded*

- Bioretention Area
- Compensatory Flood Storage
- Constructed Wetland
- Dam
- Dry Detention Basin
- Filter Strip
- Grassed Swale
- Green Roof
- Infiltration Basin
- Infiltration Basin with Wet Forebay
- Infiltration Trench/Structure
- In-ground Water Quality Device
- Kettle
- Native Prairie
- Permanent Sediment Trap
- Porous Asphalt
- Rain Garden
- Sand Filter
- Underground Storage/Detention
- Wet Detention Basin
- Wetland



# Viewing BMP Data Through the Database

BMP Listing Project Listing Permit Tracking User Access Management Pick List Maintenance

**Waukesha County**  
**Storm Water (BMP) Tracking System**  
Provided by the Department of Parks and Land Use

## BMP Data Entry

Project Identifier: Polo Fields

BMP Identifier: 497

BMP Description: Infiltration Basin #1

Municipality: Town of Lisbon

Survey Township: Lisbon

Section: 15

1/4 Section: SW

Status: In Service

BMP Type: Infiltration Basin

Drainage Area Served (Acres): 34.30

As-Built Date: 7/22/2009  (m/d/yyyy)

Planned Inservice Date: 5/4/2007  (m/d/yyyy)

Next Planned Inspection Date: 9/1/2009  (m/d/yyyy)

Certification Date: 7/20/2009  (m/d/yyyy)

Certification PE Name: Paul De Vries, PE

Certification Company: MSA Professional Services, Inc

Watershed: Fox River Watershed

Subwatershed: Sussex Creek

Hydrologic Unit:

Parcel: LS8T0203058

Maintained By: Titleholders of Outlot

**GEO Locators**

Northing: 425695.93

Easting: 2469467.52

Create Date: 12/11/2008 2:41:10 PM Last Updated Date: 8/31/2009 2:48:53 PM Update Count: 3

## BMP Description

### Location

- Municipality
- Township / Range
- Section
- ¼ Section
- X:Y Coordinate

## Status

### BMP Type

- Drainage Area (Acres)
- As-Built Date
- Planned In-service Date

## Certification Date

- Certifying Engineer & Company
- Next Planned Inspection Date
- Watershed/Subwatershed
- Parcel
- Who Maintains the BMP

# Resources

- [www.cwp.org](http://www.cwp.org) - *Managing Stormwater in Your Community: A Guide for Building an Effective Post-Construction Program*
- [www.waukeshacounty.gov](http://www.waukeshacounty.gov) – Department of Parks & Land Use

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