

STORMWATER MANAGEMENT PRACTICE OPERATION & MAINTENANCE MANUAL

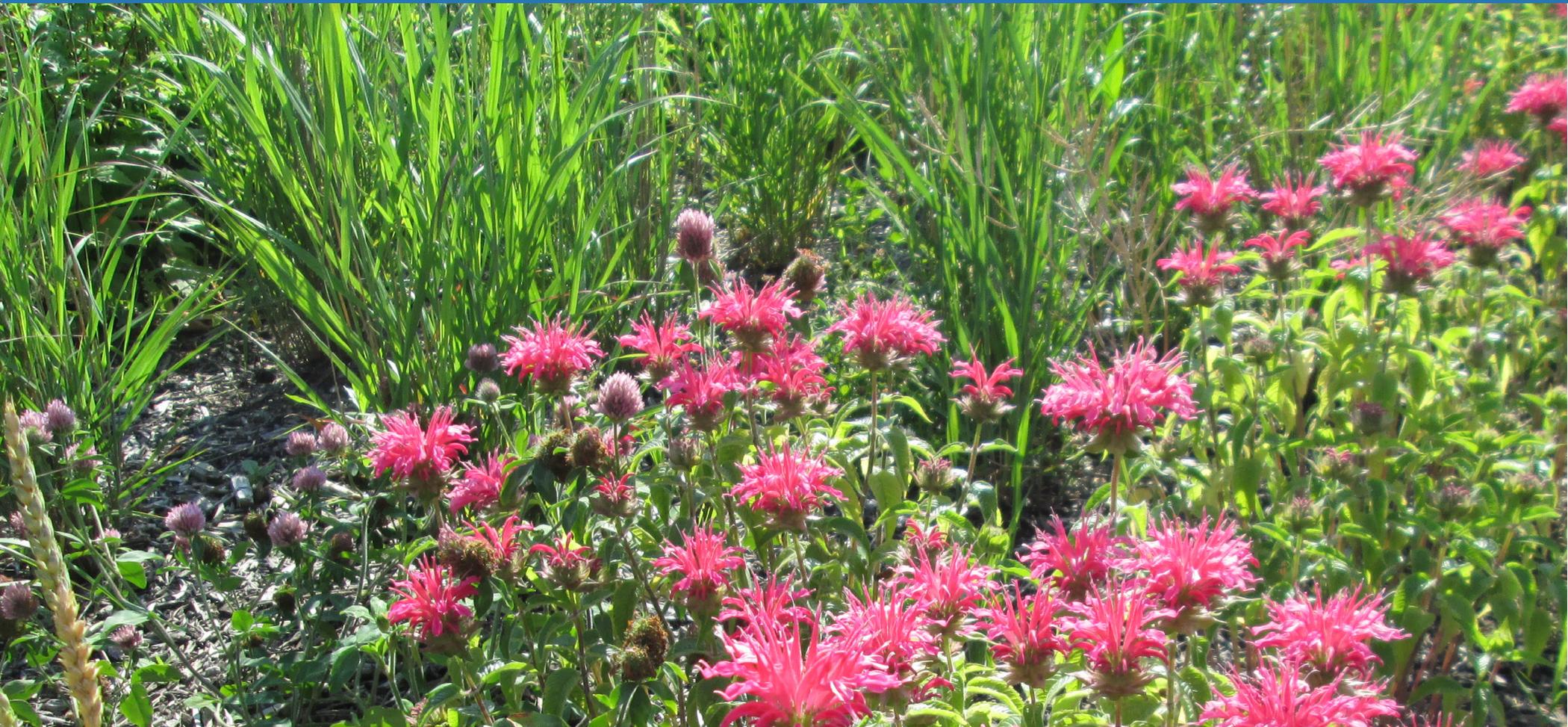


Table of Contents

1.0 Maintaining My SMP	7
1.1 Anatomy of an SMP	8
1.2 How Do I Know If My SMP Is Working Properly?	8
1.3 Maintenance 101	10
1.4 Routine Inspections	10
1.5 Routine Maintenance Tasks	11
1.6 SMP Performance Problems“Most Wanted” List	12
1.7 How To Use This Manual	13
1.8 What Is An SMP?	13
1.9 When And How Should I Maintain My SMP?	13
1.10 Things To Look For When Inspecting Your SMP	14
1.11 The Key To Maintenance	15
1.12 Maintenance Tasks and Trouble Shooting	16
2.0 Stormwater Management Practices	20
2.1 Rain Gardens	22
2.2 Constructed Wetlands	28
2.3 Subsurface Storage Or Infiltration	34
2.4 Storm Water Swale	40
2.5 Cisterns And Rain Barrels	46
2.6 Porous Pavement	52
2.7 Planter Boxes	56
2.8 Green Roofs	62
3.0 Image Citations	70

MAINTAINING MY SMP

Chapter 1





1.0 MAINTAINING MY SMP

Congratulations! You are a proud owner of a stormwater management practice (SMP)! You may be wondering why your SMP is so important to Philadelphia's streams and rivers.

Stormwater is a problem shared by all of Philadelphia's citizens. During small rain storms, water that falls on hard surfaces like roads and rooftops flows into drains and pipes that carry it away. In parts of the City served by a separate sewer system, this stormwater is kept separate from wastewater and is piped directly to streams. In parts of the city served by a combined sewer system, stormwater mixes with wastewater and is carried to wastewater treatment plants.

This becomes a problem during big storms, when the water treatment plants can be overwhelmed by too much volume of mixed stormwater and wastewater. This excess volume is released into streams, bringing with it a mix of trash, bacteria, sediment, and chemicals. By owning and maintaining your SMP, you are doing your part to help prevent excess stormwater from overwhelming sewer systems in the first place.

Now that your SMP has been designed and installed, the next step is to understand how to maintain it. Why is maintenance so important? Your SMP is one of many similar facilities that together are helping to keep Philadelphia's streams and rivers healthy. So, the City and its waterways are counting on you to keep your SMP in good working order. Keep in mind that proper SMP maintenance is required for renewing stormwater credits. If you accepted funds through the Stormwater Management Incentive Program (SMIP), you are obligated to provide on-going and proper maintenance per your operations and maintenance agreement.



Keeping your SMP clean and working will protect your property, the environment, and local waterways!

1.1 ANATOMY OF AN SMP

SMPs work by collecting and storing stormwater so it can soak into the ground, be reused, or slowly released back into the sewer system after a period of time. To do this, SMPs typically have three main parts:

1. **Inflow System:** An inflow system brings water from hard surfaces into the SMP. It is usually made up of inlets, piping, sloped ground, and/or open channels that allow the water to flow to the SMP.
2. **Storage Area:** A storage area is where stormwater is collected and stored. This may be a small or large planted earthen basin, a tank, or an underground vault.
3. **Outflow system:** An outflow system allows water to flow from the storage area or control structure back to the City sewer and usually consists of piping or open channels.

1.2 HOW DO I KNOW IF MY SMP IS WORKING PROPERLY?

A FUNCTIONING SMP:

Common required maintenance tasks for stormwater tree trenches are listed in Table 1-1. The frequencies provided in the table are approximate and can be modified as needed to adjust to site-specific conditions. Maintenance protocols for additional tasks not listed here are found in Division 2.

1. Lets water in--through inlets, downspouts, pipes, or direct sheet flow.
2. Keeps the water in one place (usually a small landscaped area) long enough for it to pool and seep back into the ground, or be reused.
3. Lets excess water out during heavy rains.
4. Shows no evidence of significant erosion or unstable soil.
5. Its planted areas contain healthy, thriving plants.
6. Shows no evidence of structural damage to any pipes, inlets, or other manufactured components.

SMP Cross-Section

The graphic below shows how these parts might work together in a very simple vegetated SMP. While designs may vary, similar concepts would apply to other types of SMPs--such as rain barrels and subsurface vaults, among

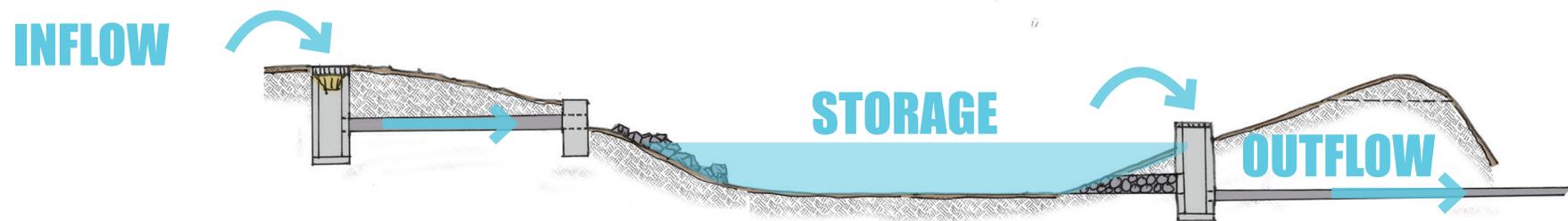


Figure 1-1. SMP with Typical Features

1.3 MAINTENANCE 101

SMPs need to be maintained in order to work properly. As the owner of the SMP, it is your responsibility to maintain your SMP and keep it working. This means checking it regularly for signs of problems (see “Routine Inspections”). It also means performing routine tasks like those listed below (see “Routine Maintenance Tasks”) to ensure that water is getting into and out of the SMP; that plants, if there are any, are thriving; and that there are no major erosion or settling problems that would limit the function of your the SMP.

For example, if leaves build up in points of inflow and outflow, eventually water may not be able to get into or out of the SMP. Most maintenance problems, like clogging, start off small and are easy to prevent if detected early. An effective maintenance

1.4 ROUTINE INSPECTIONS

Routine inspection of your SMP may prevent costly repairs. You should check your rain garden at least 4 times per year in the winter, spring, summer, and fall. Recording your observations will assist you with creating a list of maintenance tasks that need to be completed to properly maintain your SMP. In between these formal inspections, it is important to keep an eye on your SMP. Look for potential problems such as clogs, erosion, unhealthy plants, and loss of storage area (see the “most wanted” list of

1.5 ROUTINE MAINTENANCE TASKS

Upon inspection of your SMP, specific maintenance tasks will be necessary to address any potential issues you may have observed. Some possible tasks and issues they may prevent are described below. These tasks can be found throughout this manual as helpful guidance for each specific SMP, regardless of whether your SMP is vegetated or

not!

Trash and sediment removal prevents clogging of inflow systems, storage areas, and outflow systems, which are often a major source of problems for SMPs.

Establishment watering will help young plants survive--usually recommended during the first two years after planting.

Erosion repair helps prevent loose soil from damaging plants or clogging structures. This task may include slope stabilization, planting, or minor re-grading.

Pruning in winter months helps keep trees and shrubs healthy and tidy all year long.

AN EFFECTIVE MAINTENANCE PROGRAM INCLUDES:

1. Visual checks to make sure your SMP is working properly.
2. Routine care and cleaning to prevent problems and to resolve any problems that may arise.
3. Record keeping to track your observations and maintenance activities in order to

WHAT TOOLS WILL I NEED?

Most SMPs can be maintained using simple gardening tools similar to the ones shown below. However, if the job is too big for tools you have on hand, you may need to hire a landscaper or other contractor who owns the correct equipment.



1.6 SMP PERFORMANCE PROBLEMS “MOST WANTED” LIST

As you maintain your SMP, you’ll need to keep an eye out for performance issues that can have serious effects on the ability of your SMP to do its job of managing stormwater. Most of the problems your SMP could encounter will fall within one of the following “most wanted” categories. Most of these can be prevented through correct routine maintenance using simple tools.

Clogging of inflow and outflow systems: Trash, sediment, and debris can build up in pipes, swales, inlets, and other structures which prevent water from flowing into or out of the SMP. Keeping all of these systems clog-free is priority number one in keeping SMPs functioning.

Filling in of storage area, or extended ponding: The part of an SMP that collects and holds stormwater—known as the storage area—is designed to be a specific size in order to hold the proper amount of stormwater. If trash, sediment, or debris builds up within the storage area, there is less room for stormwater. Likewise, if water ponds for longer than 72 hours, there won’t be enough room for more water if/when the next storm comes. So, if your storage area is being filled, either by water or built up “stuff”, clearing the area and determining the cause are important maintenance tasks.

Erosion: When a lot of water travels quickly over bare ground, it can wash away the soil, leaving behind small gullies called “erosion.” Erosion can damage and expose plant roots and transport soil towards areas where it may cause clogs (for example, around inflow and outflow systems). Catching erosion problems early will allow you to stabilize bare soil with plants or other material, or you may need to enlist the help of a professional if erosion is severe.

Unhealthy plants: Many SMPs (for example, rain gardens) count on plants to keep

stormwater from eroding the soil, and to help remove pollutants. SMPs are normally designed to use hardy plants that can thrive in wet soil—but sometimes even these plants can be damaged by drought or extreme conditions. Keeping your plants healthy will lead to an SMP that works better and is more stable in the long term.

WHAT IF I NEED HELP OR HAVE ADDITIONAL QUESTIONS?



1.7 HOW TO USE THIS MANUAL

This manual is designed to help you keep your SMP working properly. The previous pages describe how to go about maintaining your SMP (“Maintenance 101”) and provide a list of common problems you might encounter (“SMP Performance Problems ‘Most Wanted’ List”).

Eight different types of SMPs are described within this manual. Each SMP section contains four parts: a description of that SMP type; suggested tasks for when and how you should maintain your SMP; a photo guide of things to look for when inspecting your SMP, with examples of potential problems organized by inflow, outflow, and storage systems; and an SMP Inspection & Maintenance Log for your records. Each of these sections and additional helpful hints are described generally below.

1.8 WHAT IS AN SMP?

Each SMP section contains a description of the SMP and some of its main distinguishable features. If you are not sure of the type of SMP you own, this description is meant to help you figure it out!

1.9 WHEN AND HOW SHOULD I MAINTAIN MY SMP?

Each SMP section contains a list of “Do’s” and “Don’ts” for proper maintenance. This section also gives a table, organized by system (storage area, inflow and outflow systems), that describes when and how to provide maintenance of your SMP. An example of this table is shown here. These descriptions are paired with an icon within the “Things to Look for when Inspecting your Rain Garden” illustrations to help remind you of potential issues and maintenance tasks. These icons are described in more detail in the “Inspection and Maintenance Tasks and Trouble Shooting” section on the following page.

Maintain Your Rain Garden If:

Storage Area	Water does not fully drain within 72 hrs, and all outflow structures are clear.	
	Large volumes of trash, debris, or sediment cause significant loss of storage volume.	
	Plants are significantly overgrown as compared to design.	
	Presence of weak, dead, or hanging limbs; overhead wire conflicts.	
	Settling or soil void areas visible from the surface of the SMP.	
	Four or more consecutive days of dry weather in May-August; wilted, brown appearance of vegetation.	
	Post-establishment, more than 10% of the intentionally vegetated area is bare.	
	Gullied or washed out areas are present anywhere in the SMP.	
Inflow System	Plants are blocking the flow of water into the SMP.	
	Trash, sediment, or debris are blocking the flow of water into the SMP.	
Outflow System	Plants are blocking the flow of water out of the SMP.	
	Trash, sediment, or debris are blocking the flow of water out of the SMP.	

1.10 THINGS TO LOOK FOR WHEN INSPECTING YOUR SMP

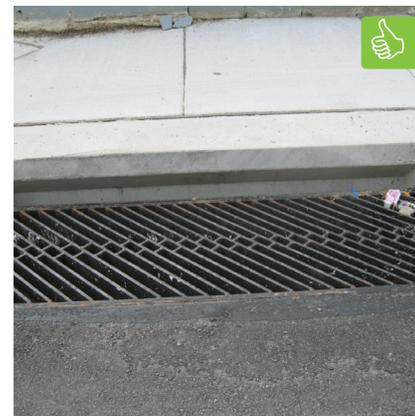
These notes offer general guidance on problems you should watch for, task-specific recommendations, and notes to help you determine when you might need professional assistance. Examples of these sections are outlined here:

Look!

Inflow systems direct water into your SMP. These come in many shapes and sizes, ranging from simple to complex.

If water is not getting to your SMP, you might need to clear trash, sediment, and plant material from these inflow systems regularly. If this doesn't do the trick, you may need to call a professional.

The boxes on the right show features within your SMP that should be continuously inspected and maintained.



Call a Professional If:

- ✓ Look to this text for issues that may require outside assistance.

1.11 THE KEY TO MAINTENANCE

The key to effective maintenance is frequent inspection and care! Inspection & maintenance logs like the one shown here are provided in this manual at the end of each SMP section. Checklists can be used with prescriptive task lists to identify the appropriate maintenance task to solve common problems. This page can be printed or torn from the manual for use during all inspections.

		INSPECTOR INITIALS					ISSUES OBSERVED/MAINTENANCE COMPLETED
		Inflow outflow, and surface systems clear of trash, sediment, & plant	Storage areas clear of trash & sediment and water drains within	Vegetation is healthy, with no major areas of bare soil or large	All structures accessible and in good condition.	No ruts, gullies, or soil voids are found in SMP surface area.	
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1.12 MAINTENANCE TASKS AND TROUBLE SHOOTING

The table to the right explains how to carry out typical maintenance tasks, and offers guidance for trouble shooting common problems. Each SMP-specific section of this manual describes problems that would require maintenance. Icons shown in the left most column of the table below cross-reference problems with maintenance tasks.

The inspection program described in this manual is geared toward maintaining proper function of your SMP for stormwater management purposes. Aesthetic and other considerations may demand additional inspection and maintenance according to the preference of the property owner. Furthermore, briefly checking your site after any large storm is a good practice for catching problems early.

	Maintenance Task	Basic Maintenance	Trouble Shooting
	Remove trash, sediment, & debris	Most trash, sediment, and debris can be removed easily using a shovel, rake, or shop vac. However, subsurface pipes or porous pavement that become clogged may need to be vacuumed with special equipment.	If trash or sediment are frequently building up within your SMP, you might need to consider where they are coming from. You may need to consult a professional to determine the best course of action.
	Water plants during first 2-3 years of establishment	During the months of June through September, water during any period of four or more consecutive days of dry weather.	If plants appear brown, dry, or wilted between watering or after full establishment, it may be necessary to increase the watering schedule.
	Repair eroded areas	Replace washed-out soil and stabilize the area with stone and/or additional plantings.	If erosion is persistent, consider stabilizing slopes using turf matting, or slowing the flow of stormwater using alternative engineered systems. You may need to consult a professional to determine the best course of action.
	Prune trees & shrubs	Dead, broken, or undesirable limbs should be pruned when the tree or shrub is dormant, usually in the months of January or February.	If growth of trees or shrubs creates a conflict with pedestrian areas or utilities, significant pruning of healthy limbs may be needed.
	Weed, mow, or cut excess vegetation	Aggressive vegetation is best controlled by hand or using mechanical tools. Avoid the use of pesticides, as these can wash through the system during rain.	If dense vegetation becomes an ongoing problem, either for aesthetic or clogging reasons, it may need to be replaced with a less aggressive variety. You may need to consult a landscape professional to select alternative species.
	Replant/reseed	Dead or missing plants can be replaced using nursery stock or a simple seed mix. New plants should be watered and kept clear of trash and debris to ensure establishment.	If bare areas persist despite replanting efforts, there may be a deeper problem. Erosion, contamination, or simply poor quality soil could all impact plant survival. If this is the case, consider stabilizing or replacing soil, redirecting water flow, amending soil, or alternate plant selection.
	Repair settled areas or soil voids	Stabilize and fill small soil voids with stone and/or soil using simple hand tools. If voids are located near pedestrian or vehicular travelways, mark the area using flags or cones until the problem can be addressed.	If large or recurring voids are present in your SMP you may need to consult a professional to determine the best course of action.
	Call a professional	You may encounter problems that you aren't able to solve yourself. If an issue is recurring or you can't find its source, you may need to enlist the services of a trained engineer, landscaper, or utility investigator.	

STORMWATER MANAGEMENT PRACTICES

Chapter 2



2.0 Stormwater Management Practices



RAIN GARDENS
(Page 22)



RAIN BARRELS/CISTERNS
(Page 46)



CONSTRUCTED WETLANDS
(Page 28)



SUBSURFACE STORAGE OR INFILTRATION
(Page 34)



SWALES
(Page 40)



POROUS PAVEMENT
(Page 52)



PLANTER BOXES
(Page 56)



GREEN ROOFS
(Page 62)

2.1 RAIN GARDENS

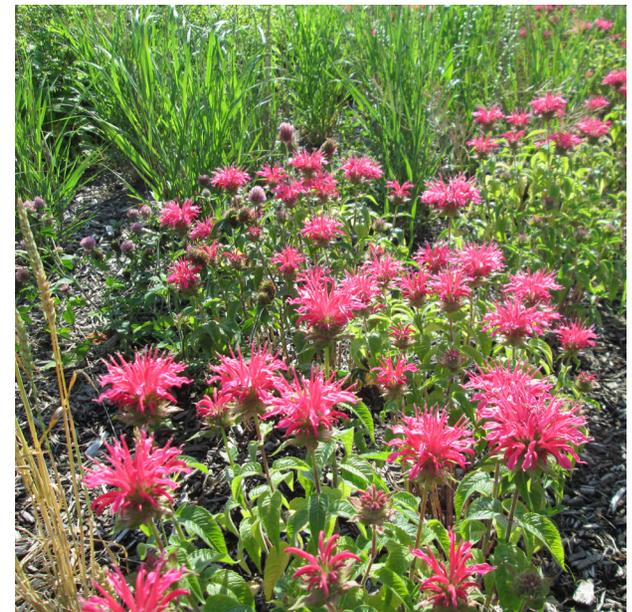
WHAT IS A RAIN GARDEN?

A rain garden is a landscaped low area in the ground designed to capture, store, and soak up stormwater. Rain gardens are usually planted with a variety of grasses, flowers, and shrubs, and may have special soil that helps water soak into the ground.

WHEN AND HOW SHOULD I MAINTAIN MY RAIN GARDEN?

Like any other landscape feature, rain gardens that are maintained regularly can remain healthy and functional for many years. Unlike most gardens, though, rain gardens need some special attention to keep them working as absorbent “sponges” for stormwater.

Inspect your rain garden four times per year using the Inspection & Maintenance Log included in this manual. Your rain garden needs maintenance if any of the conditions listed in the table below are present (see “Maintain Your Rain Garden If:”). When performing maintenance, follow these simple do’s and don’ts to keep your rain garden working properly.



Maintenance Do's and Don'ts

DO:

- ✓ Check for signs of erosion, trash, sediment, or water that stands for more than 72 hrs.
- ✓ Remove any weeds that are preventing water from entering or leaving your rain garden (but be sure not to pull out too many plants!).
- ✓ Remove trash or sediment that is blocking water from entering your rain garden.
- ✓ Water young plants, and established plants that look brown or wilted.

DON'T:

- ✗ Apply large amounts of salt or sand around your rain garden during the winter months. Plants don't like too much salt or sand!
- ✗ Pile snow or leaves in your rain garden; this can crush plants.
- ✗ Apply fertilizer or pesticides. These are often unnecessary, and can even make conditions worse. Consult your local nursery or PWD if your plants are not thriving.

Maintain Your Constructed Rain Garden If:

NOTE: Use the icons below to refer back to maintenance tasks described on page 17 ("Inspection and Maintenance Tasks and Trouble Shooting").

Storage Area	Water does not fully drain within 72 hrs, and all outflow structures are clear.	
	Large volumes of trash, debris, or sediment cause significant loss of storage volume.	
	Plants are significantly overgrown as compared to design.	
	Presence of weak, dead, or hanging limbs; overhead wire conflicts.	
	Settling or soil void areas visible from the surface of the SMP.	
	Four or more consecutive days of dry weather in May-August; wilted, brown appearance of vegetation.	
	Post-establishment, more than 10% of the intentionally vegetated area is bare.	
	Gullied or washed out areas are present anywhere in the SMP.	
Inflow System	Structural condition is settled and looks like it is cracking in places.	
	Plants are blocking the flow of water into the rain garden.	
Outflow System	Trash, sediment, or debris are blocking the flow of water into the rain garden.	
	Plants are blocking the flow of water out of the rain garden.	
	Trash, sediment, or debris are blocking the flow of water out of the SMP.	

THINGS TO LOOK FOR WHEN INSPECTING YOUR RAIN GARDEN

STORAGE AREA DEBRIS

Look!  

Storage areas need to stay clear for the SMP to do its job. If the storage area is full of trash or other debris, clean it out and dispose of the material. If water is ponding for more than 72 hours, this may be a sign of a deeper problem and you might need professional assistance.



STORAGE AREA: EROSION & SOIL VOIDS

Look!   

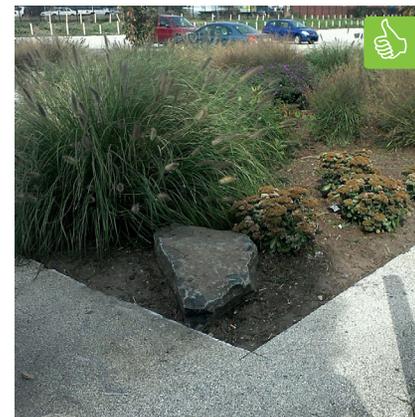
When soil erodes, it can clog structures, smother plants, and cause unstable conditions in the wetland. If you notice minor gullies, erosion, or settled areas you may be able to repair them yourself using simple hand tools. If the problem requires more equipment or expertise than you have available, you may need to enlist the help of a professional landscaper or engineer.



STORAGE AREA: PLANTS

Look!     

Plants help to hold soil in place and thus prevent erosion. They also “drink up” excess water in the soil. You may need to plant more plants, weed, or prune vegetation within your rain garden especially when you observe soil erosion and vegetation blocking the ways the water can get into or out of the rain garden.



Rain Garden Cross-Section

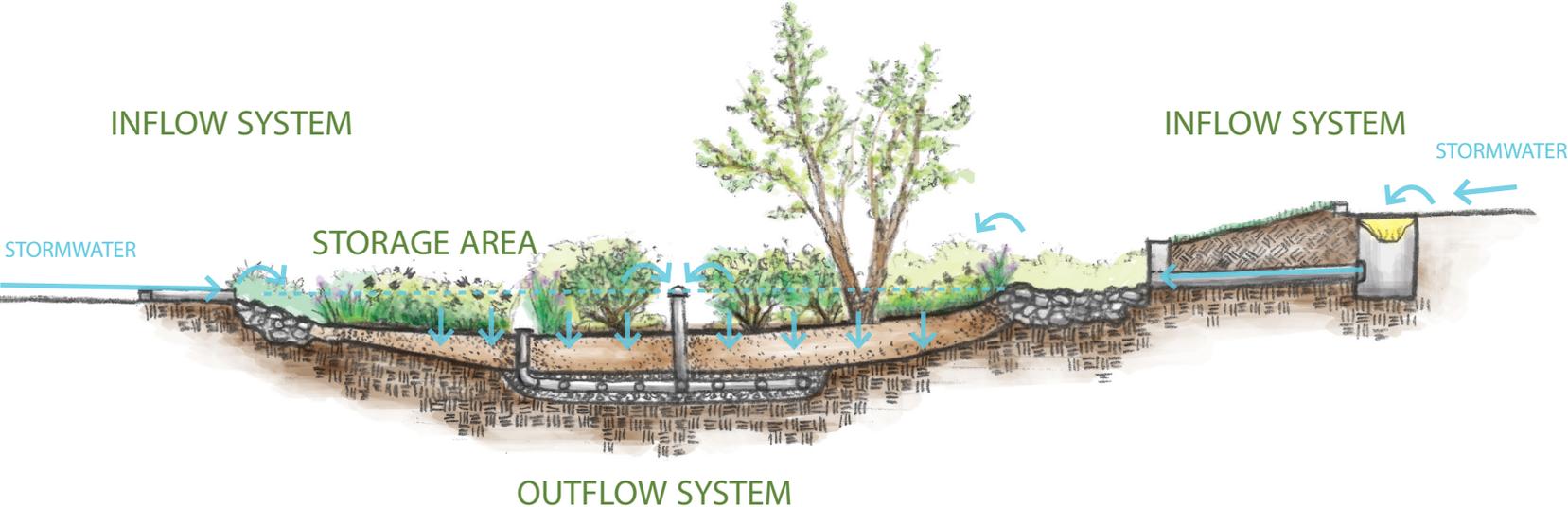


Figure 2-1. Rain Garden with Typical Features

INFLOW SYSTEM

Inflow systems direct water into your SMP. These come in many shapes and sizes, ranging from simple to complex.

Look! 

If water is not getting to your SMP, you might need to clear trash, sediment, & plant material from these inflow systems regularly. If this doesn't do the trick, you may need to hire a professional.



OUTFLOW SYSTEM

Outflow systems carry extra water out of the rain garden. They are sometimes hard to see from the surface--but if they aren't working, ponded water is often a visible sign of a problem.

Look! 

If you think there may be a problem with your outflow system, and you can't see an obvious cause, you may need to hire a professional to determine the reason for the



 Call a Professional If:

- ✓ You think underground pipes may be clogged.
- ✓ Standing water is present for more than 72 hrs.
- ✓ You see major erosion or settling.

RAIN GARDEN QUARTERLY INSPECTION & MAINTENANCE LOG

		INSPECTOR INITIALS					ISSUES OBSERVED/MAINTENANCE COMPLETED
		Inflow, outflow, and surface systems clear of trash, sediment, & plant	Storage areas clear of trash & sediment and water drains within	Vegetation is healthy, with no major areas of bare soil or large	All structures accessible and in good condition.	No ruts, gullies, or soil voids are found in SMP surface area.	
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2.2 CONSTRUCTED WETLANDS

WHAT IS A CONSTRUCTED WETLANDS?

A constructed wetland is a large, shallow depression in the ground designed to capture and store large amounts of stormwater. Constructed wetlands are usually made up of a series of connected shallow and deep pools, and are usually planted with a variety of native wetland vegetation. Unlike many other types of SMPs, constructed wetlands are designed to be wet most of the time.

WHEN AND HOW SHOULD I MAINTAIN MY CONSTRUCTED WETLAND?

Constructed wetlands that are maintained regularly can remain healthy and functional for many years.

Inspect your constructed wetland four times per year using the Inspection & Maintenance Log included in this manual. Your wetland needs maintenance if any of the conditions listed in the table below are present (see "Maintain Your Constructed Wetland If:"). When performing maintenance, follow these simple do's and don'ts to keep the storage area, inflow, and outflow systems working properly.



Maintenance Do's and Don'ts:

DO:

- ✓ Check for signs of erosion, trash, or sediment.
- ✓ Be on the lookout for large stands of reeds or other plants that seem to be taking over the wetland (in most cases these shouldn't be weeded by hand may require professional control).
- ✓ Remove any large deposits of sediment that are taking up space in the wetland or killing off plants.
- ✓ Water trees and non-aquatic plants during establishment if they look dry or brown.

DON'T:

- ✓ Apply too much salt or sand around your wetland during the winter months. Plants don't like too much salt or sand!
- ✓ Apply fertilizer. This is often unnecessary, and can even make conditions worse. Consult your local nursery or PWD if your plants are not thriving.

Maintain Your Constructed Wetland If:

NOTE: Use the icons below to refer back to maintenance tasks described on page 17 ("Inspection and Maintenance Tasks and Trouble Shooting").

Storage Area	Aggressive plants (e.g. large strands of common reed) are causing a loss of storage volume.	
	Large volumes of trash, debris, or sediment cause significant loss of storage volume.	
	Presence of weak, dead, or sediment cause significant loss of storage volume.	
	Settling or soil void areas visible from the surface of the wetland.	
	Four or more consecutive days of dry weather in May-August; wilted, brown appearance of vegetation.	
	Post-establishment, more than 10% of the intentionally vegetated area is bare.	
	Gullied or washed out areas are present anywhere in the wetland.	
Inflow System	Plants are blocking the flow of water into the wetland.	
	Trash, sediment, or debris are blocking the flow of water into the wetland.	
Outflow System	Plants are blocking the flow of water out of the wetland.	
	Trash, sediment, or debris are blocking the flow of water out of the wetland.	

THINGS TO LOOK FOR WHEN INSPECTING YOUR CONSTRUCTED WETLAND

STORAGE AREA DEBRIS

Look!  

Storage areas need to stay clear and erosion-free for the wetland to do its job. If the storage area is full of trash or debris, it may only require simple cleaning. If there is more debris than you can easily remove yourself, this may be a sign of an inflow problem and you might need professional assistance.



STORAGE AREA: EROSION

Look!   

When soil erodes, it can clog structures, smother plants, and cause unstable conditions in the wetland. If you notice minor gullies, erosion, or settled areas you may be able to repair them yourself using simple hand tools. If the problem requires more equipment or expertise than you have available, you may need to enlist the help of a professional landscaper or engineer.



STORAGE AREA: PLANTS

Look!     

Diverse wetland plant communities help to hold soil in place and maintain wetland conditions. Common reeds (see bottom right) are an aggressive species that can take over constructed wetlands and may even significantly alter the wetland hydrology if not properly controlled. Keep an eye on which plant species are growing in your wetland. It's important to maintain a diverse variety of plants.



Constructed Wetland Cross-Section

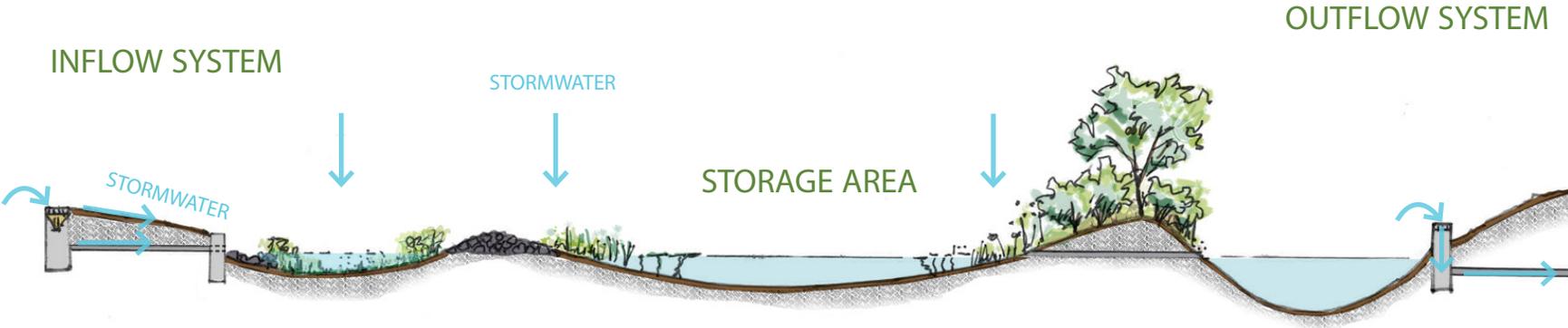


Figure 2-2. Constructed Wetland with Typical Features

INFLOW SYSTEM

Inflow systems direct water into your wetland. These come in many shapes and sizes, ranging from simple to complex.

Look!  

If water is not getting to your wetland, you might need to clear trash, sediment, & plant material from these inflow systems regularly. If this doesn't do the trick, you may need to hire a professional.

OUTFLOW SYSTEM

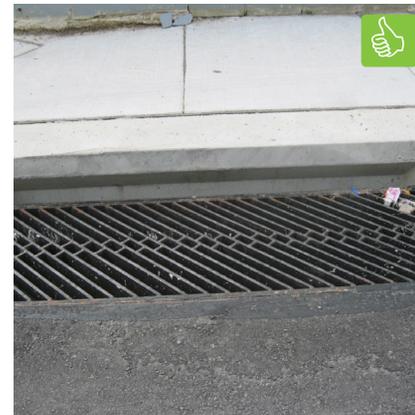
Outflow systems carry extra water out of the wetland. If they aren't working, the water in the wetland can get too high.

Look!  

If you think there may be a problem with your outflow system, and you can't see an obvious cause, you may need to hire a professional to determine the reason for the problem. Often, constructed wetlands contain access structures that allow entry to subsurface pipes.

 Call a Professional If:

- ✓ You think pipes to or from the wetland may be clogged.
- ✓ You see major erosion.
- ✓ Sediment or debris are taking up space and you can't remove it yourself.
- ✓ Reeds seem to be taking over the wetland.



CONSTRUCTED WETLAND QUARTERLY INSPECTION & MAINTENANCE LOG

		INSPECTOR INITIALS					ISSUES OBSERVED/MAINTENANCE COMPLETED
		Inflow, outflow, and surface systems are clear of trash, sediment, & plant	Storage areas are clear of trash & sediment.	Vegetation is healthy and diverse with no major areas of bare soil.	All structures are accessible and in good condition.	No ruts, gullies, or soil voids are found in SMP surface area.	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
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2.3 SUBSURFACE STORAGE OR INFILTRATION

WHAT IS A SUBSURFACE STORAGE OR INFILTRATION SYSTEM?

Subsurface storage or infiltration systems are located underneath sidewalks, parking, or vegetated areas and are designed to capture, store, and sometimes infiltrate stormwater underground. Systems typically capture water from inlets or roof drains. Water is stored in stone beds, half pipe, or crate-type chambers that allow water to slowly seep into the ground.

WHEN AND HOW SHOULD I MAINTAIN MY SUBSURFACE STORAGE OR INFILTRATION SYSTEM?

Subsurface storage or infiltration systems require annual pipe inspection (see Annual Inspection & Maintenance Log provided in this section). The system may also require flushing to ensure that underground pipes and connections remain clear and free of clogs. Your SMP needs maintenance if any of the conditions listed in the table below are present (see "Maintain Your Subsurface Infiltration or Storage System If:").

Unless you have access to subsurface cleaning equipment, you will need to hire a pipe cleaning contractor to inspect hard-to-access pipes and to remove trash, debris, and sediment from subsurface systems. These systems should only be inspected once per year to avoid possibly unnecessary pipe inspections. Inspections should be conducted from the ground surface without entering confined spaces to the extent possible. If confined space entry is required, you may need to call a professional. Listed below are some simple do's and don'ts to keep your system working properly.



Maintenance Do's and Don'ts:

DO:

- ✓ Keep inflow areas (inlets, filters, etc.) free of trash, sediment, and debris that could cause clogs deeper in the system.
- ✓ Vacuum or flush pipes and underground chambers every year to prevent clogs.
- ✓ Seek professional assistance for any areas you can't easily reach on your own.

DON'T:

- ✗ Flush your system with harsh chemicals. Organic cleaners, or sometimes just water and a scrub brush, are all you should need to keep your system clean.

Maintain Your Constructed Subsurface or Infiltration System If:

NOTE: Use the icons below to refer back to maintenance tasks described on page 17 ("Inspection and Maintenance Tasks and Trouble Shooting").

Storage System	Large volumes of trash, debris, or sediment in pipes or chambers are causing significant loss of storage volume.	
	Settling or void areas are visible from the surface of the SMP.	
Inflow System	Trash, sediment, or debris are blocking the flow of water into the SMP.	
Outflow System	Trash, sediment, or debris are blocking the flow of water out of the SMP.	

THINGS TO LOOK FOR WHEN INSPECTING YOUR SUBSURFACE STORAGE OR INFILTRATION SYSTEM

STORAGE SYSTEM

Storage areas can easily fill up with trash, sediment, and debris. Systems that treat stormwater from roofs are typically more likely to remain clear, while systems that treat stormwater from parking areas and drive areas tend to fill up with debris more quickly.

Look! 

For surface-accessible systems like rain barrels, debris within storage areas can be easily removed using hand tools. For subsurface tanks and cisterns, you may need to seek professional help from contractors that own the appropriate subsurface cleaning equipment.

INFLOW SYSTEM

If the inflow system is clogged, water won't be able to enter the storage area. Leaf litter, sediment, and trash are common causes of inflow clogs.

Look! 

For surface-accessible systems like rain barrels, inflow clogs are easy to identify and correct. For subsurface tanks and cisterns, you may need to seek professional help from contractors that own the appropriate pipe and inlet cleaning equipment.

OUTFLOW SYSTEM

If the outflow system is clogged, the storage area will back up with water and the rain barrel or system won't function properly.

Look! 

For surface-accessible systems like rain barrels, outflow clogs are easy to identify and correct. For subsurface tanks and cisterns, you may need to seek professional help from

 Call a Professional If:

- ✓ You notice sinking, settling, or damaged areas at the surface of the SMP.
- ✓ Water isn't getting into or out of the system, and you don't know why.
- ✓ You are not able to effectively clean your system with the equipment you have on hand.



Sub-Surface Storage Cross-Section

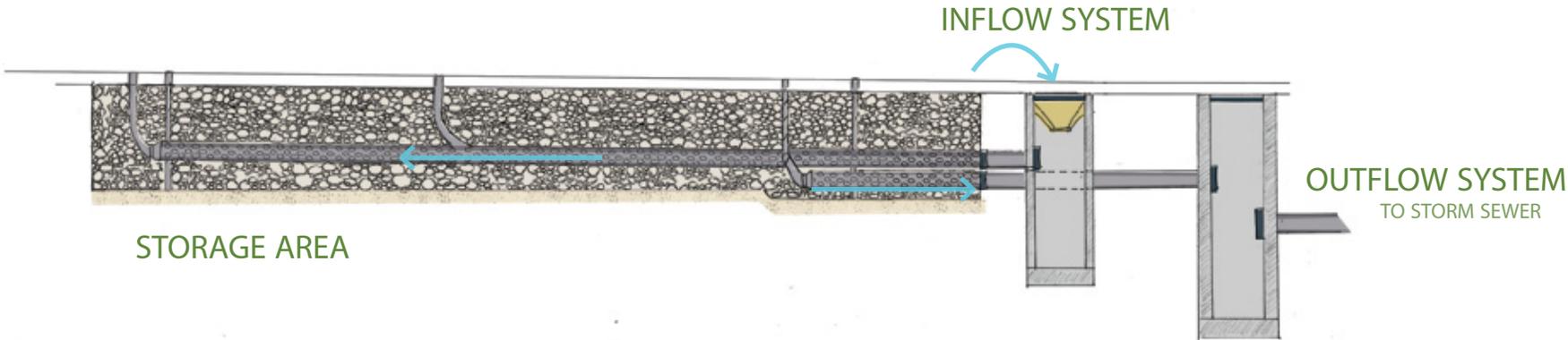


Figure 2-3. Sub-surface Storage with Typical Features

UBSURFACE STORAGE OR INFILTRATION SYSTEM ANNUAL INSPECTION & MAINTENANCE LOG

		INSPECTOR INITIALS		ISSUES OBSERVED/MAINTENANCE COMPLETED	
		Inflow, outflow, and subsurface storage areas are clear of trash,	There are no signs of sinking, settling, or damage visible from the surface of		
		<input type="checkbox"/>	<input type="checkbox"/>		
		<input type="checkbox"/>	<input type="checkbox"/>		
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2.4 STORMWATER SWALE

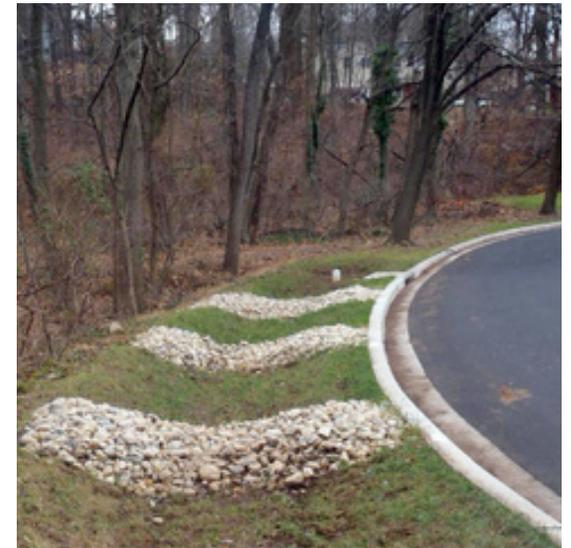
WHAT IS A STORMWATER SWALE?

A stormwater swale is an open shallow channel designed to carry water from one place to another. Stormwater swales are often used together with other types of SMPs, like rain gardens or constructed wetlands, and are usually planted with simple grasses or turf. Swales may or may not be designed to absorb stormwater.

WHEN AND HOW SHOULD I MAINTAIN MY STORMWATER SWALE?

Swales that are maintained regularly can remain healthy and functional for many years.

Inspect your swale four times per year using the Inspection & Maintenance Log included in this manual. Your swale needs maintenance if any of the conditions listed in the table below are present (see "Maintain Your Swale If:"). When performing maintenance, follow these simple do's and don'ts to keep the storage area, inflow, and outflow systems working properly.



Maintenance Do's and Don'ts:

DO:

- ✓ Check for signs of erosion, trash, or sediment build-up.
- ✓ Remove any large deposits of sediment that could block the flow of water or damage plants.
- ✓ Water plants and trees during establishment and if they look dry or brown.

DON'T:

- ✓ Apply too much salt or sand around your swale during the winter months. Plants don't like too much salt or sand!
- ✓ Apply fertilizer. This is often unnecessary, and can even make conditions worse. Consult your local nursery or PWD if your plants are not thriving.

Maintain Your Swale If:

NOTE: Use the icons below to refer back to maintenance tasks described on page 17 ("Inspection and Maintenance Tasks and Trouble Shooting").

Storage Area	Large volumes of trash, debris, or sediment cause significant loss of storage volume.	
	Plants are significantly overgrown as compared to design.	
	Weak, dead, or hanging limbs, or overhead wire conflicts are observed.	
	Settling or soil void areas visible from the surface of the swale.	
	There are four or more consecutive days of dry weather in May-August during establishment; or wilted, brown vegetation is observed.	
	Post-establishment, more than 10% of the intentionally vegetated area is bare.	
Inflow System	Gullied or washed out areas are present anywhere in the swale.	
	Plants are blocking the flow of water into the swale.	
Outflow System	Trash, sediment, or debris are blocking the flow of water into the swale.	
	Plants are blocking the flow of water out of the swale.	
	Trash, sediment, or debris are blocking the flow of water out of the swale.	

THINGS TO LOOK FOR WHEN INSPECTING YOUR STORMWATER SWALE

STORAGE AREA DEBRIS

Look!  

The body of the swale needs to stay clear and free of debris in order to do its job. If the storage area is full of trash or debris, it may only require simple cleaning. If there is more debris than you can easily remove yourself, this may be a sign of an inflow problem and you might need professional assistance.



STORAGE AREA: EROSION

Look!   

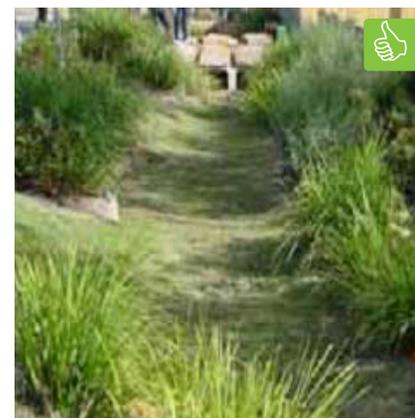
When soil erodes, it can clog structures, smother plants, and cause unstable conditions in the swale. If you notice minor gullies, erosion, or settled areas you may be able to repair them yourself using simple hand tools. If the problem requires more equipment or expertise than you have available, you may need to enlist the help of a professional



STORAGE AREA: PLANTS

Look!     

Plants help to hold soil in place and thus prevent erosion. They also “drink up” excess water in the soil. You may need to plant more plants, weed, or prune vegetation within your swale especially when you observe bare areas, soil erosion, or vegetation blocking



Stormwater Swale Cross-Section and Perspective

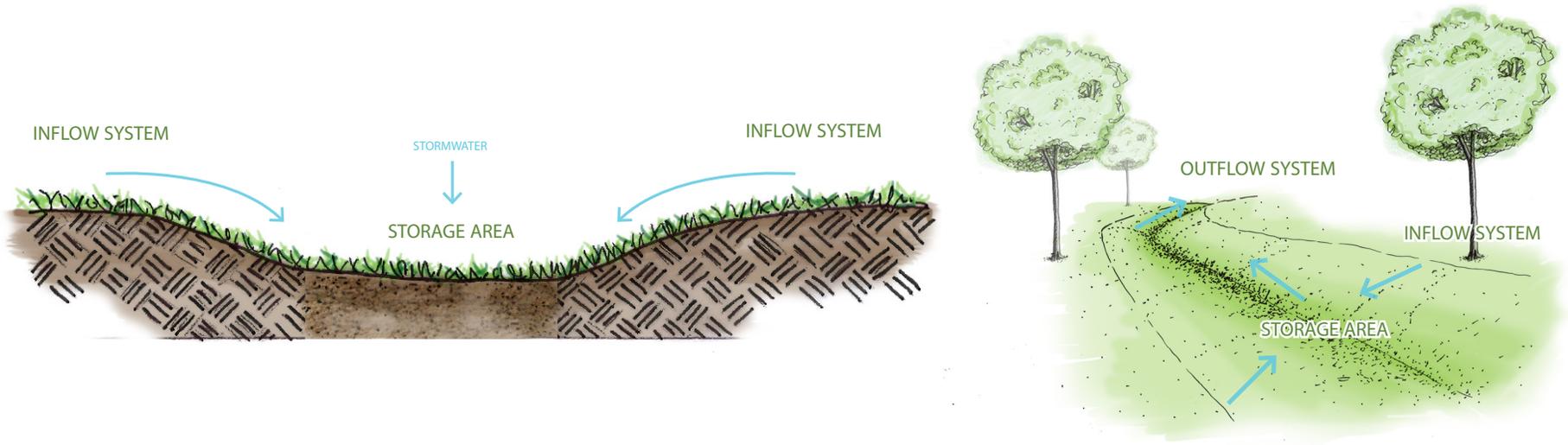


Figure 2-4. Stormwater Swale with Typical Features

INFLOW SYSTEM

Inflow areas are the places where water flows into your swale. These can be a single point, such as the end of a pipe, or they can run the length of the swale (for example: when stormwater from sidewalks or parking lots flows in along the sides of the swale).

Look!  

If water is not getting to your swale, you might need to clear trash, sediment, & plant material from these inflow system regularly.

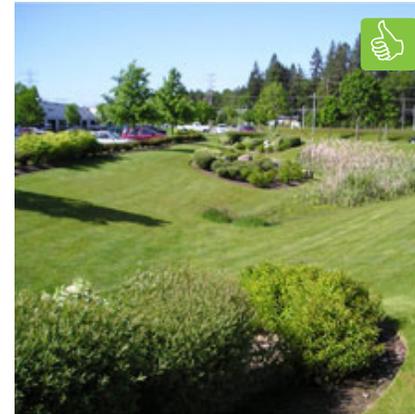


OUTFLOW SYSTEM

Outflow areas are where water exits the swale, usually into another SMP (such as a rain garden). If these areas are blocked with trash or debris, the water can't follow its intended path.

Look!  

If water is not getting out of your swale, you might need to clear trash, sediment, & plant material from these systems regularly.



Call a Professional If:

- ✓ Water does not drain within 72 hours, and all inflow and outflow structures are clear.
- ✓ You see major erosion.
- ✓ Sediment or debris are blocking the flow of water, and it's not something you can fix yourself.

STORMWATER SWALE QUARTERLY INSPECTION & MAINTENANCE LOG

		INSPECTOR INITIALS			ISSUES OBSERVED/MAINTENANCE COMPLETED
		Inflow, outflow, and surface systems are clear of trash, sediment, & plant	Vegetation is healthy, with no major areas of bare soil.	No ruts, gullies, or soil voids are found in SMP surface area.	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
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2.5 CISTERNS AND RAIN BARRELS

WHAT IS A CISTERN OR RAIN BARREL?

Cisterns and rain barrels are large metal or plastic containers designed to capture and store stormwater for reuse. Captured rainwater can be used for irrigation, toilet flushing, or industrial processes. Cisterns and rain barrels may be small or large depending on how much water is needed. Simple systems are usually made by placing a plastic barrel underneath a roof downspout; more complex systems involve large tanks that may be located above or below ground.

WHEN AND HOW SHOULD I MAINTAIN MY CISTERN OR RAIN BARREL?

Cisterns and rain barrels are low-maintenance systems that require limited care. Inspect your SMP four times per year using the Inspection & Maintenance Log included in this manual. Your SMP needs maintenance if any of the conditions listed in the table below are present (see "Maintain Your Cistern or Rain Barrel If:"). Listed below are some simple do's and don'ts to keep your rain barrel or cistern clean and working properly.



Maintenance Do's and Don'ts:

DO:

- ✓ Check inflow pipes, screens, and valves for debris that could cause clogs.
- ✓ If your rain barrel or cistern is above-ground, drain it before the first frost and close off valves to prevent freezing and damage.
- ✓ If your cistern is located underground, it may need to be flushed or vacuumed occasionally to remove trash, sediment, and debris.

DON'T:

- ✓ Flush your system with harsh chemicals. Organic cleaners, or sometimes just water and a scrub brush, are all you should need to keep your system clean.

Maintain Your Cistern and Rain Barrel If:

NOTE: Use the icons below to refer back to maintenance tasks described on page 17 ("Inspection and Maintenance Tasks and Trouble Shooting").

Storage System	Large volumes of trash, debris, or sediment are causing significant loss of storage volume.	
Inflow System	Trash, sediment, or debris are blocking the flow of water into the SMP.	
Outflow System	Trash, sediment, or debris are blocking the flow of water out of the SMP.	

THINGS TO LOOK FOR WHEN INSPECTING YOUR CISTERN OR RAIN BARREL

INFLOW SYSTEM

If the inflow system is clogged, water won't be able to enter the storage area. Leaf litter, sediment, and trash are common causes of inflow clogs.

Look!  

For surface-accessible systems like rain barrels, inflow clogs are easy to identify and correct. For subsurface tanks and cisterns, you may need to seek professional help from contractors that own the appropriate pipe and inlet cleaning equipment.

OUTFLOW SYSTEM

If the outflow system is clogged, the storage area will back up with water and the rain barrel or system won't function properly.

Look!  

For surface-accessible systems like rain barrels, outflow clogs are easy to identify and correct. For subsurface tanks and cisterns, you may need to seek professional help from contractors that own the appropriate pipe cleaning equipment.

STORAGE AREA

Storage areas can easily fill up with trash, sediment, and debris. Systems that treat stormwater from roofs are typically more likely to remain clear, while systems that treat stormwater from parking areas and drive areas tend to fill up with debris more quickly.

Look!  

For surface-accessible systems like rain barrels, debris within storage areas can be easily removed using hand tools. For subsurface tanks and cisterns, you may need to seek professional help from contractors that own the appropriate subsurface cleaning

Call a Professional If:

- ✓ Parts are missing or malfunctioning and you can't fix or replace them yourself.
- ✓ Water isn't getting into or out of the system and you don't know why.
- ✓ You are not able to effectively clean your system with the equipment you have on hand.



Cistern Cross-Section

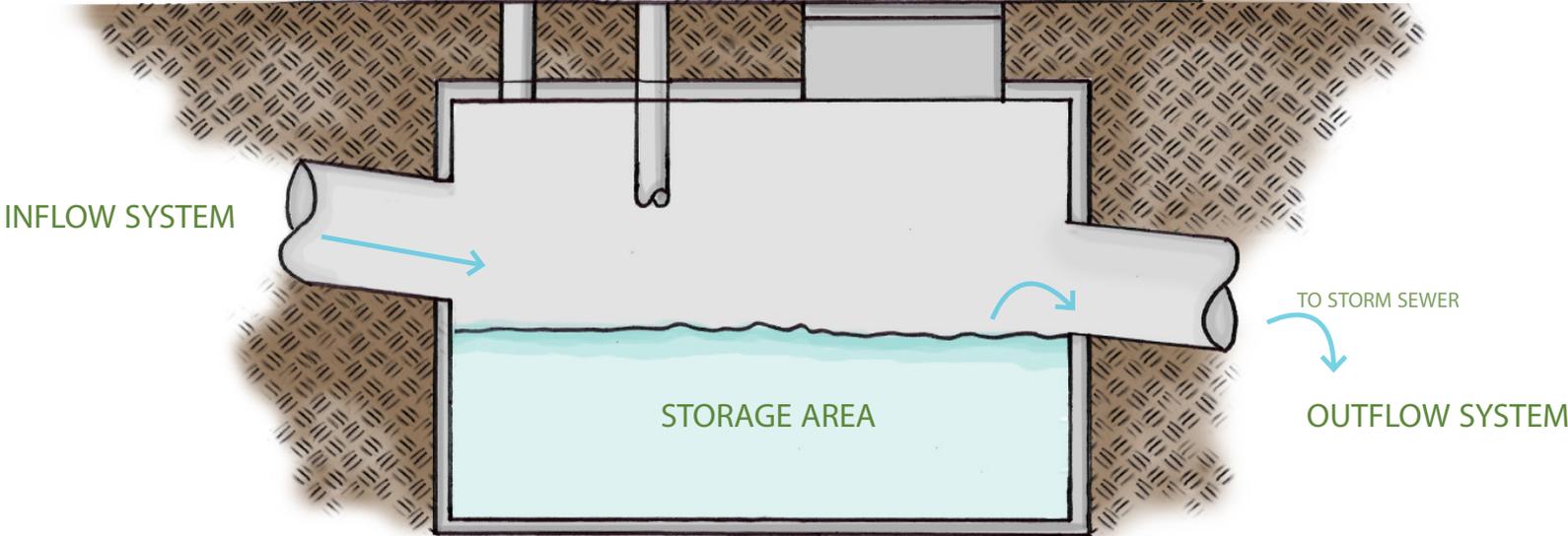


Figure 2-5. Cistern with Typical Features

CISTERN AND RAIN BARREL QUARTERLY INSPECTION & MAINTENANCE LOG

		INSPECTOR INITIALS		ISSUES OBSERVED/MAINTENANCE COMPLETED
		Inflow, outflow, and surface systems are clear of trash, sediment, & debris.	There are no broken, cracked, leaking, or otherwise damaged parts.	
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2.6 POROUS PAVEMENT

WHAT IS POROUS PAVEMENT?

Porous pavement is a type of permeable hardscape that allows water to filter through the surface into the underlying soil or gravel. Porous pavement can be made of concrete, asphalt, or pavers, and usually looks very similar to traditional types of pavement.

WHEN AND HOW SHOULD I MAINTAIN MY POROUS PAVEMENT?

Porous pavement requires some special attention to prevent its “pores”--the tiny spaces that let water in--from clogging with sediment and debris. When porous pavement clogs, it stops absorbing water and goes back to functioning just like any other kind of pavement.

Inspect your SMP four times per year using the Inspection & Maintenance Log included in this manual. Your porous pavement needs maintenance if any of the conditions listed in the table below are present (see “Maintain Your Porous Pavement If:”).

The good news is, simple vacuuming techniques can prevent clogging. There are many different types of systems that sweep, vacuum, and power wash porous pavement, with varying degrees of effectiveness. Regenerative air systems-- devices



Maintenance Do's and Don'ts:

DO:

- ✓ Check your system regularly: watch how water flows during rain storms, and note if there are any areas where water ponds or runs off the porous surface. This can be a sign of an early clog.
- ✓ Always clean up trash, leaves, or spills before they get ground into the porous surface.
- ✓ Vacuum the porous surfaces using regenerative air equipment where available to remove sediment and fine debris.

DON'T:

- ✗ Apply sand to your porous pavement (deicing salt is okay, though).
- ✗ Drive trucks or heavy machinery over porous pavement; too much weight can compact the surface.
- ✗ Hose, scrub, or power wash porous pavement without using a vacuum at the same time. High pressure cleaning can push sediment deeper into the surface.
- ✗ Plant trees where branches will overhang the porous surface and drop leaves and other debris.

Maintain Your Porous Pavement If:

NOTE: Use the icons below to refer back to maintenance tasks described on page 17 ("Inspection and Maintenance Tasks and Trouble Shooting").

Inflow System (porous surface)	Porous surface appears even slightly clogged with sediment or fine debris. 
	Settling, deterioration, or loose material are visible from the surface of the SMP. 
	Ponding is visible on the porous surface during or after storms. 

THINGS TO LOOK FOR WHEN INSPECTING YOUR POROUS PAVEMENT

INFLOW SYSTEM: SURFACE

Porous pavement surfaces need to stay clear and unclogged in order to work properly. Since there aren't a lot of components to these systems, it's easy to test if your porous pavement is working. Simply pour a few gallons of water onto the surface in a few different places, and watch where the water goes. If the water soaks through immediately, the porous surface is doing its job. If the water pools or runs off the surface you will know that the surface is clogged.



Look!

Watch for ponding, sediment, holes, sunken areas, surface deterioration, and caked-on debris. These can all be signs that your system isn't working properly.

Porous Pavement Cross-Section

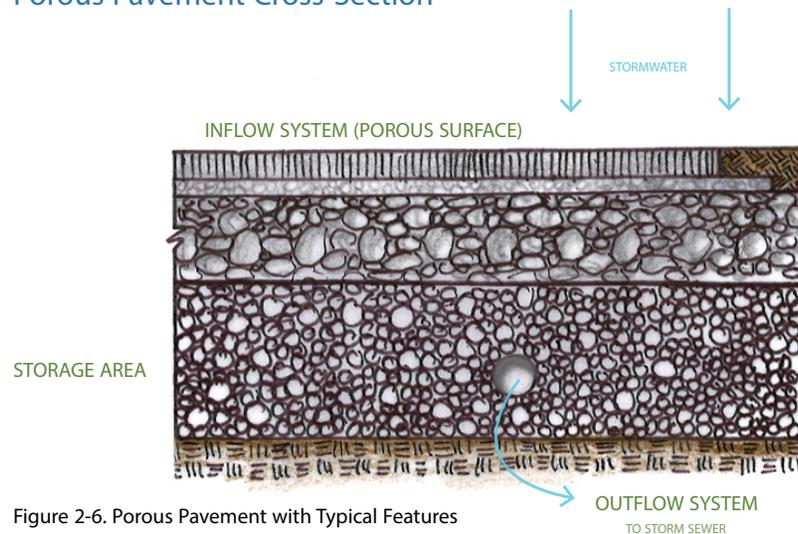
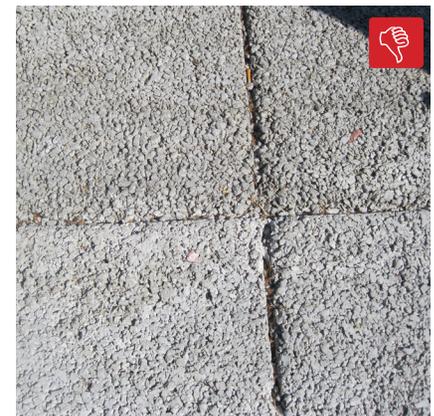


Figure 2-6. Porous Pavement with Typical Features

Call a Professional If:

- ✓ You notice large puddles or other signs of clogging.
- ✓ Settling or voids are visible from the surface.
- ✓ Water poured over the porous surface does not infiltrate rapidly.
- ✓ You don't have the appropriate vacuum sweep equipment to clean your porous pavement.
- ✓ There is obvious surface deterioration.



POROUS PAVEMENT QUARTERLY INSPECTION & MAINTENANCE LOG

		<i>INSPECTOR INITIALS</i>				<i>ISSUES OBSERVED/MAINTENANCE COMPLETED</i>
		<i>Porous surface is clear of trash, sediment, leaves, and other debris.</i>	<i>Water poured over the porous surface infiltrates rapidly.</i>	<i>There is no evidence of ponding during rain storms.</i>	<i>The porous surface is smoothly graded without holes, loose gravel, or sunken</i>	
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2.7 PLANTER BOXES

WHAT IS A PLANTER BOX?

A planter box is a structure filled with soil media and planted with vegetation or trees. Planter boxes are designed to capture, store, and soak up stormwater. Often times, planter boxes are incorporated into a street landscape using curbs as the sides of the box.

WHEN AND HOW SHOULD I MAINTAIN MY PLANTER BOX?

Like any other landscape feature, stormwater planter boxes that are maintained regularly can remain healthy and functional for many years. Unlike most gardens, though, stormwater planter boxes need some special attention to keep them working as absorbent “sponges” for stormwater.

Inspect your stormwater planter box at least four times per year using the Inspection & Maintenance Log included in this section. Your planter needs maintenance if any of the conditions listed in the table below are present (see “Maintain Your Planter Box If:”). When performing maintenance, follow these simple do’s and don’ts to keep your planter working properly.



Maintenance Do's and Don'ts:

DO:

- ✓ Check for signs of erosion, trash, sediment, or water that stands for more than 3 days.
- ✓ Remove any weeds that are preventing water from entering or leaving your planter box (but be sure not to pull out too many plants!).
- ✓ Remove trash or sediment that is blocking water from entering your planter box.
- ✓ Water young plants, and established plants that look brown or wilted.

DON'T:

- ✓ Apply a large amount of salt or sand around your planter box during the winter months. Plants don't like too much salt or sand!
- ✓ Pile snow or leaves in your planter box; this can crush plants.
- ✓ Apply fertilizer or pesticides. These are often unnecessary, and can even make conditions worse. Consult your local nursery or PWD if your plants are not thriving.

Maintain Your Planter Box If:

NOTE: Use the icons below to refer back to maintenance tasks described on page 17 ("Inspection and Maintenance Tasks and Trouble Shooting").

Storage Area	Water does not fully drain within 72 hrs, and all outflow structures are clear.	
	Large volumes of trash, debris, or sediment cause significant loss of storage volume.	
	Plants are significantly overgrown as compared to design.	
	Weak, dead, or hanging limbs, or overhead wire conflicts are observed.	
	Settling or soil void areas visible from the surface of the planter.	
	There are four or more or more consecutive days of dry weather in May-August during establishment; or wilted, brown vegetation is observed.	
	Post-establishment, more than 10% of the intentionally vegetated area is bare.	
	Gullied or washed out areas are present anywhere in the SMP.	
Inflow System	Plants are blocking the flow of water into the planter.	
	Trash, sediment, or debris are blocking the flow of water into the planter.	
Outflow System	Plants are blocking the flow of water out of the planter.	
	Trash, sediment, or debris are blocking the flow of water out of the planter.	

THINGS TO LOOK FOR WHEN INSPECTING YOUR PLANTER BOX

STORAGE SYSTEM: DEBRIS

Look!  

Storage areas need to stay clear for the SMP to do its job. If the storage area is full of trash or other debris, clean it out and dispose of the material. If water is ponding for more than 72 hours, this may be a sign of a deeper problem and you might need professional assistance.



STORAGE SYSTEM: EROSION & SOIL VOIDS

Look!   

Erosion and resulting soil voids may expose roots of vegetation or transport soil to unwanted locations (such as inflow or outflow systems). Soil may need to be replenished or taken from areas of excess and placed in areas where not enough soil exists.



STORAGE SYSTEM: PLANTS

Look!     

Plants help to hold soil in place and thus prevent erosion. They also “drink up” excess water in the soil. You may need to re-plant, weed, or prune vegetation within your planter box especially when you observe soil erosion and vegetation blocking inflow or outflow areas.



Planter Box Cross-Section

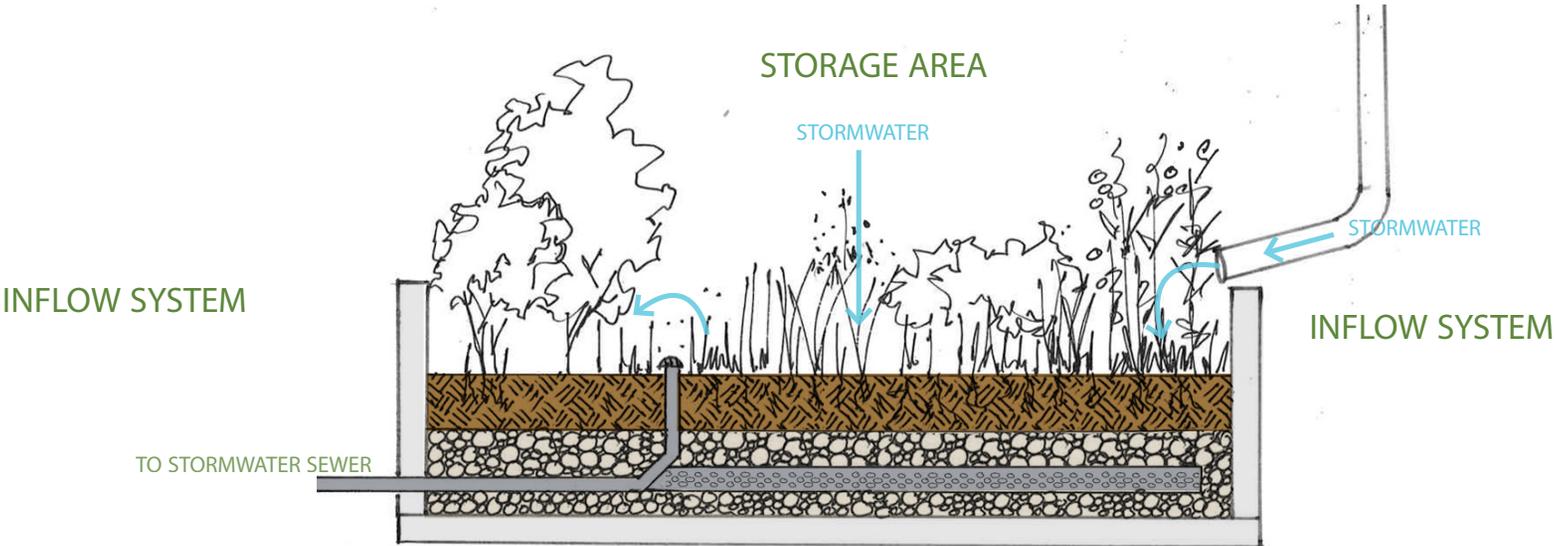


Figure 2-7. Planter Box with Typical Features

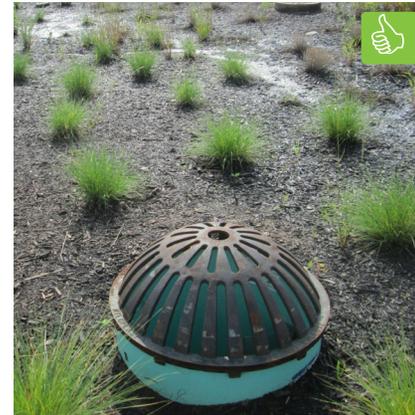
INFLOW SYSTEM

Outflow systems carry extra water out of the planter box. They are sometimes hard to see from the surface--but if they aren't working, ponded water is often a visible sign of a problem.



Look!

If you think there may be a problem with your outflow system, and you can't see an obvious cause, you may need to hire a professional to determine the reason for the problem. Often, planter boxes contain access structures that allow entry to subsurface



OUTFLOW SYSTEM

Inflow systems direct water into your SMP. These come in many shapes and sizes, ranging from simple to complex. Typically an inflow system is a pipe or curb cut that directs stormwater into the planter.



Look!

If water is not getting to your SMP, you might need to clear trash, sediment, & plant material from these inflow systems regularly.



Call a Professional If:

- ✓ You think underground pipes may be clogged.
- ✓ Standing water is present for more than 72 hrs.
- ✓ You see major erosion or settling.

PLANTER BOX QUARTERLY INSPECTION & MAINTENANCE LOG

		INSPECTOR INITIALS				ISSUES OBSERVED/MAINTENANCE COMPLETED
		Inflow, outflow, and surface systems are clear of trash, sediment, & plant	Vegetation is healthy, with no major areas of bare soil.	Any structures are accessible and in good condition.	No ruts, gullies, or soil voids are found in SMP surface area.	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
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2.8 GREEN ROOFS

WHAT IS A GREEN ROOF?

A green roof is a planted surface installed over a traditional roof structure. Green roofs usually include several engineered layers of material including waterproofing, drainage and filter layers, soil, and plants. These may be installed either as fixed structures or as a series of removable modules. Generally, green roofs have shallow soil depths (<6") which is great for a certain type of short vegetation known as sedums. Green roofs with deep soil layers may contain shrubs or trees with larger root systems. Green roofs may also provide benefits other than stormwater management such as added insulation for the building, which may lower energy costs.

✓ WHEN AND HOW SHOULD I MAINTAIN MY GREEN ROOF?

Green roofs that are maintained regularly can remain healthy and functional for many years. Inspect your SMP four times per year using the Inspection & Maintenance Log included in this manual. Your green roof needs maintenance if any of the conditions listed in the table below are present (see "Maintain Your Green Roof If:").

Since different types of green roofs may vary widely in thickness, planting type, and design, it's important to develop a maintenance plan that's suited to your type of system. Work with your designer to identify what kind of plants you have, and what kind of nutrient and watering schedule they may need. Regardless of specifics, there are simple steps you can take to keep your green roof working properly.



Maintenance Do's and Don'ts:

DO:

- ✓ Check any drains, screens, and weirs for debris that could cause clogs.
- ✓ Check plants for signs of drought or nutrient deficiency (signs can include brown, bleached, or discolored leaves, or wilted plants).
- ✓ Remove weeds and invasive plants twice a year.

DON'T:

- ✓ Over-water your plants. Green roofs typically contain drought-tolerant plants with shallow root systems. Only in extreme droughts is it necessary to water your green roof, or if larger vegetation exists (such as trees and shrubs).
- ✓ Apply fertilizer without consulting a professional. Green roof plants often require a careful balance of nutrients, and too much or too little can cause problems. Talk to your local nursery or PWD if your plants are not thriving.

It's important to check the plants on your green roof regularly. Plants soak up stormwater and help remove nutrients and pollution. When plants are unhealthy, your green roof may not work properly and actions should be taken to fix the problem.

Maintain Your Green Roof If:

NOTE: Use the icons below to refer back to maintenance tasks described on page 17 ("Inspection and Maintenance Tasks and Trouble Shooting").

Storage Area (roof surface)	Water does not fully drain within 72 hrs, and all outflow structures are clear	
	There have been four or more consecutive days of dry weather in May-August during plan establishment; or you observe wilted or brown vegetation.	
	Post-establishment, more than 10% of the intentionally vegetated area is bare.	
Inflow System	Plants are blocking inflow weirs or drains.	
	Trash, sediment, or debris are blocking inflow weirs or drains.	
Outflow System	Plants are blocking flow of water off of the green roof.	
	Trash, sediment, or debris are blocking the flow of water off of the green roof.	

THINGS TO LOOK FOR WHEN INSPECTING YOUR GREEN ROOF

INFLOW AND OUTFLOW SYSTEMS

The body of the green roof needs to stay clear of debris and trash in order to do its job. When inflow or outflow points are clogged, water may pond on your roof.

Look! 

Depending on how your green roof is designed, water may enter the system via direct rainfall or via weirs or drains that carry water from other roof areas. Almost all systems will have some type of drain that allows excess water to exit the roof via some type of roof drain system. It's important to make sure any inflow and outflow areas remain clear and free of clogs.

STORAGE AREA

Plants soak up stormwater and help remove nutrients and pollution. When plants are unhealthy, your green roof may not work properly and actions should be taken to fix the problem. 

Look!

Check to make sure that your plants are getting established on the surface. If they are

 Call a Professional If:

- ✓ Parts are missing or malfunctioning and you can't fix or replace them yourself.
- ✓ Water isn't getting into or out of the system and you don't know why.
- ✓ You are not able to effectively clean your system with the equipment you have on hand.
- ✓ Plants are dead or continually unhealthy.



Green Roof Cross-Section

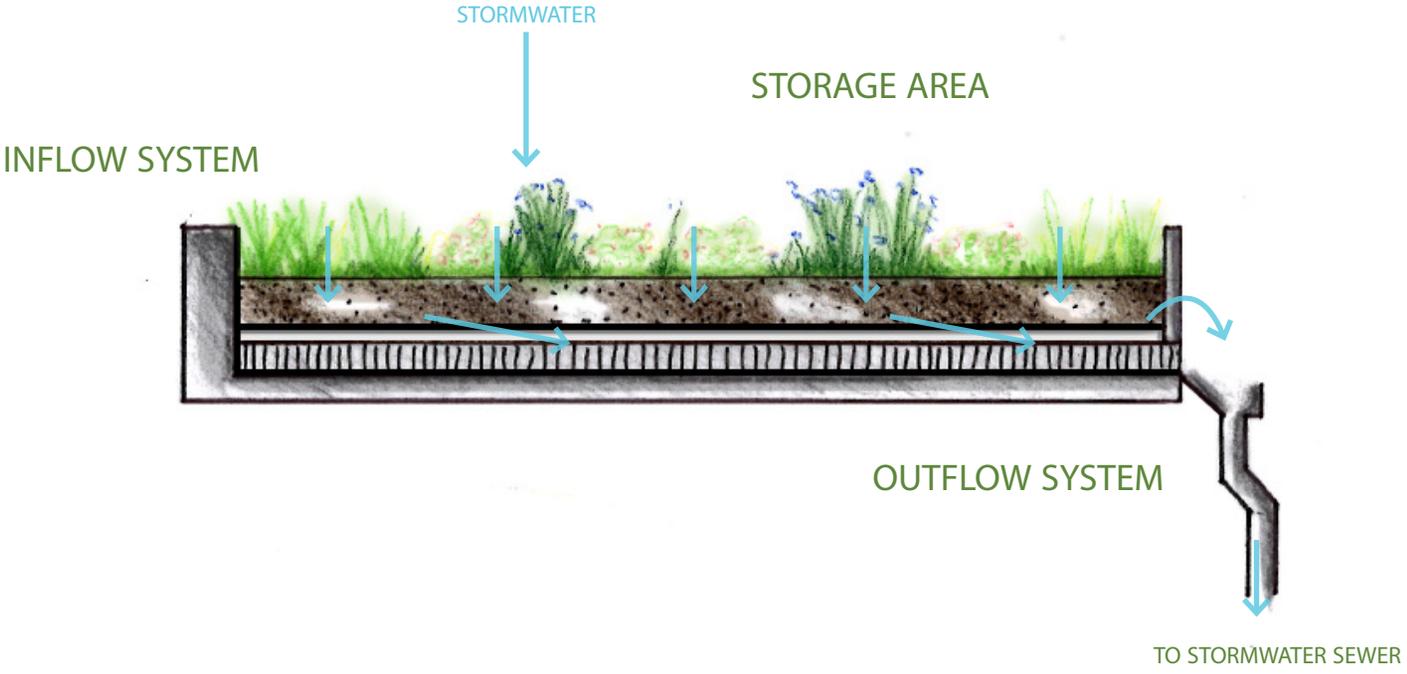


Figure 2-8. Green Roof with Typical Features

GREEN ROOF QUARTERLY INSPECTION & MAINTENANCE LOG

		INSPECTOR INITIALS				ISSUES OBSERVED/MAINTENANCE COMPLETED
		Inflow, outflow, and surface systems are clear of trash, sediment, & plant	Vegetation is healthy, with no major areas of bare soil.	Any structures are accessible and in good condition.	No ruts, gullies, or soil voids are found in SMP surface area.	
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