

Maintaining Stormwater Control Measures



Guidance for Private Owners & Operators

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This publication was created through the collaborative efforts of the **Northeast Ohio Storm Water Training Council (NEOSWTC)** and its members.



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- **Biohabitats**
- **City of Avon Lake**
- **Chagrin River Watershed Partners, Inc.**
- **Center for Planning and Community Development and the Countryside Program, Levine College of Urban Affairs, Cleveland State University**
- **Cuyahoga County Board of Health**
- **Cuyahoga County Soil and Water Conservation District**
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- **Ohio Environmental Protection Agency**
- **Ohio Department of Natural Resources and Old Woman Creek National Estuarine Research Reserve**
- **Stark County Soil and Water Conservation District**
- **Summit County Soil and Water Conservation District**
- **U.S. Environmental Protection Agency**

Mission Statement:

To coordinate efforts among its member organizations in order to provide a consistent message in its curriculum and coordinated offerings of high quality training opportunities on storm water related issues and assisting in compliance achievement, with a focus on the regulated aspects for regulated entities in Northeast Ohio.

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HISTORY OF STORMWATER MANAGEMENT SOLUTIONS IN OHIO

History of Stormwater Management Solutions in Ohio

Ohio communities have long acted and reacted to reduce the adverse impacts of stormwater on public health and safety due to flooding, increased runoff or pollution problems. Early stormwater management involved installing drainage improvements, primarily focusing on conveying surface drainage away from roadways and developments through ditches, sewers and culverts. Necessary steps in runoff management followed as combined sewers and subsequent separate storm and sanitary sewers were installed to deal with human health and aesthetic problems associated with sewage. Maintenance of these early improvements required keeping the system flowing and clear of blockages. This initial era of stormwater management that occurred from the mid-1800s until the 1970s was dominated by the common enemy approach to water management, i.e., the practice of conveying runoff from properties as fast as possible to nearby streams, waterways and lakes. It was not until the 1970s and 1980s that communities began to require stormwater ponds (basins) to capture and detain runoff to prevent downstream flooding caused by changes in the watershed.

At that time, many communities were responding to the fact that civil courts had held municipalities liable for damages to downstream landowners for flooding and streambank erosion. The criteria for stormwater control basins established at this time focused on capturing larger infrequent storm events and releasing them at a lower discharge rate. This method of limiting the highest flows from a development site is called peak discharge control and is what dominated stormwater management from the 1970s until the 1990s in Ohio. Detention basins from this period were designed to fill after large storms occurred and then would detain excess runoff for a few hours. Maintenance responsibilities of these facilities have largely been left to private landowners unless facilities were regional and received flow from multiple parcels.

Maintenance and inspection of stormwater control basins of this era is typically infrequent due to the less frequent filling by storms and perhaps the limited understanding of property owners regarding maintenance. Typical maintenance consists of keeping the outlets clear of debris and maintaining the structural integrity of the dam and outlet structure, but often these stormwater control basins are unmanaged unless other purposes (such as

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providing a recreation area or an aesthetic water feature) dictate a regular need to mow or inspect the area.

The need for treating urban runoff pollution, though evident prior to the 1980s, did not alter stormwater facility design in Ohio significantly until 2003 when the Ohio Environmental Protection Agency (Ohio EPA) added a specific post-construction treatment stormwater runoff volume to the agency's construction general permit involving soil disturbances of 1 acre or more. The National Urban Runoff Program 1979-1983, which monitored pollution from urban runoff in 28 locations in the U.S., evaluated stormwater control measures (SCMs) in use at that time and demonstrated the need for treating stormwater quality in addition to quantity. This program showed that urban runoff competed with sanitary waste in terms of the types of pollutants affecting public health and that treatment to remove pollutants from stormwater runoff was only occurring to a limited degree by the SCMs being used at the time.

New SCMs that provided water quality treatment brought additional features to traditional practices such as stormwater control basins and an entirely new set of control measures such as bioretention, infiltration, permeable pavements and flow-through practices. Extended detention stormwater control basins provide from 24 to 48 hours of detention time for the prescribed water quality treatment volume when required by Ohio EPA's Construction General Permit and typically have forebays at the basin inlets and smaller outlet orifices and a micro-pool at the outlet of a stormwater control basin to maximize capture of suspended solids. Bioretention, permeable pavement and infiltration control measures typically utilize highly effective filtering for water quality treatment and reduce a substantial portion of the stormwater runoff volume.

While inspection and maintenance of older generations of SCMs were sometimes ignored indefinitely, this latest generation of SCMs provides more work during more frequent storms and is dependent on timely maintenance for continuing function. Preventing clogging, removing collected sediment and maintaining proper drainage through facilities is the major focus of maintenance. As designs of SCMs advance to improve treatment of additional pollutants, increase onsite infiltration and reduce offsite runoff there will be even greater emphasis and requirements placed on frequent, routine maintenance.

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KEY POINTS TO REMEMBER WHEN USING THIS GUIDANCE MANUAL

Key Points to Remember When Using This Guidance Manual

- **Identify critical SCM features and associated maintenance needs:**

Maintaining the proper function of each SCM depends upon understanding each SCM and its specific operation and maintenance needs. This inspection and maintenance guidance manual includes general information on the maintenance needs of common SCMs. See the operation and maintenance plan developed by the SCM designer for particular guidance and Appendix 3 for a list of additional sources of operation and maintenance resources.

- **Understand the parties and actions identified in the inspection and maintenance agreement:**

Inspection and maintenance agreements should spell out all obligations to inspect, maintain and repair the SCM and identify the specific person(s) or entity responsible for inspection and maintenance. See Appendix 4 for an example inspection and maintenance agreement.

- **Train personnel and provide equipment needed to complete inspection and maintenance:**

A successful SCM maintenance program uses knowledgeable and trained personnel with legal access to complete routine inspections as well as the necessary equipment and funding to correct SCM deficiencies in the timeframe specified within the inspection and maintenance agreement.

- **Perform routine inspection:**

The frequency of routine inspections may be found in the inspection and maintenance agreement, technical guidance provided by the designer or manufacturer, or documents discussing the SCM's design and intended operation. Typically, operation and maintenance of SCMs in Ohio is the responsibility of the property owner on which the control measure is located and is often identified in the inspection and maintenance agreement. See Appendix 2 for example inspection and maintenance check lists for each SCM described within this manual.

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- **Establish a record keeping procedure:**

Establishing a record keeping procedure will help to define chronic maintenance problems and aid future budget preparation. Annual review of maintenance activities will assist in identifying chronic problems that can be addressed before they evolve into systemic, long term problems requiring more expensive corrective measures.

- **Define costs and allocate resources:**

Routine costs can typically be predicted for an annual budget. Non-routine maintenance tasks will require infrequent but considerable expenses. Define routine and non-routine costs and develop budgeted funds to address both as required.

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Stormwater Control Measures

Over the next few pages we will discuss common SCMs approved for use in Ohio. A good understanding of SCM design and operation will enable property owners and operators of SCMs to plan and implement required maintenance activities on schedule.

If your SCM is not listed in this manual, please contact your local stormwater manager.

- Bioretention Area (*page 7*)
- Dry Pond or Dry Extended Detention Basin (*page 9*)
- Wet Pond or Wet Extended Detention Basin (*page 11*)
- Vegetated Infiltration Swale (*page 13*)
- Permeable Pavement (*page 15*)
- Green Roof (*page 18*)
- Non-Structural SCMs: Riparian & Wetland Setbacks and Conservation Areas (*page 19*)
- Rain Barrels & Cisterns (*page 21*)
- Rain Gardens (*page 23*)
- Sand Filter System (*page 25*)
- Underground Detention (*page 27*)
- Oil-Water Separator (*page 29*)

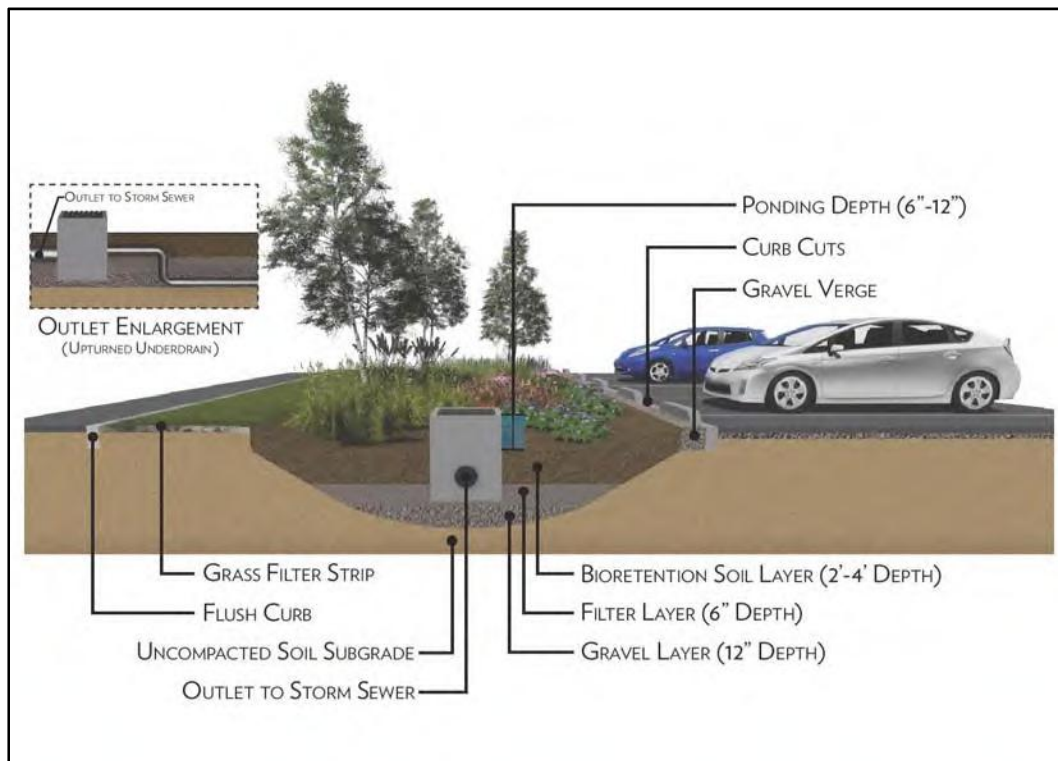
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Bioretention Area

Bioretention areas are depressed areas that allow shallow ponding of stormwater runoff that utilize specified soil media, mulch and vegetation to capture and treat stormwater runoff from impervious surfaces such as parking lots and rooftops. The soil media, mulch and vegetation filter pollutants to improve water quality within urban environments. The specified soil media, composed of sand, is placed over layers of sand, pea gravel and gravel within the depression which enables ponded stormwater runoff to be treated and filtered and before either soaking into the underlying soils or leaving through an underdrain pipe. Underdrains may be installed to drain the bioretention area to local sewers or appropriate outlet. Bioretention areas are planted with specific types of plant material that can withstand both wet and dry weather conditions. Recommended plant material information for Bioretention Areas can be found in Appendix 5.



Typical bioretention area cross-section view. Credit: Chagrin River Watershed Partners, Inc.

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*Planted bioretention area with **sidewalk curb cut** in foreground. Stormwater runoff is conveyed through gravel to shallow depression of bioretention area. Credit: Northeast Ohio Regional Sewer District*



***Weeds and untrimmed plantings** prevent stormwater runoff from entering the bioretention area from the curb cut. Credit: Northeast Ohio Regional Sewer District*



*Stormwater flow will be blocked by the dead vegetation on the outlet **catch basin grate**. Credit: Chagrin River Watershed Partners*



*Erosion of side slopes and subsequent **sediment accumulation** within bioretention area and contribute to clogging issues. Credit: Summit Soil & Water Conservation District*

MAINTENANCE REQUIRED WHEN:

- Standing water is visible 48 hours after a rain event.
- Erosion is visible within the bioretention area, or on the slopes and inlets leading into the bioretention area.
- Vegetation, sediment or debris is blocking inlets or outlets.
- Vegetation is wilting, discolored, or dying.
- Foul odors present.
- Sediment has accumulated over the mulch or soil media.

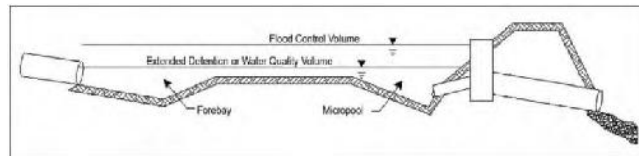
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Dry Pond or Dry Extended Detention Basin

Dry ponds, also known as dry extended detention basins, are stormwater control ponds designed to capture stormwater runoff and detain the stormwater runoff for a designed period of time. Older dry ponds drain completely between storm events and are typically maintained in a mowed grass condition, these ponds have a primary role of detaining flows from large storm events. More recent dry ponds should also capture excess sediments, trash and debris and can remove contaminants from stormwater prior to being released downstream or into a local sewer system. More recently built dry ponds will have additional features called forebays (at inlets) or micropool (at the outlet) that help capture excess sediments, trash and debris and can remove contaminants from stormwater before it leaves the pond.



*Typical Dry Pond cross-section view showing different levels of ponding control during storm events.
Credit: Ohio Rainwater & Land Development Manual*



*Well maintained dry detention basin. **Forebay** in the background. Main pool area receives periodic mowing to maintain vegetation. Credit: Cuyahoga Soil & Water Conservation District*



*Outlet structure with multiple drains **free of obstruction** such as vegetation, trash or sediment. Credit: Summit Soil & Water Conservation District*

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MAINTENANCE REQUIRED WHEN:

- Standing water is visible 72 hours after a rain event.
- Outlet is blocked by trash, debris or vegetation.
- Erosion within the emergency spillway, or blocked by debris.
- Erosion of side slopes or dam portion of pond.
- Low flow orifice, forebay, and micro pool are blocked by trash, debris, or sediment.
- Excessive (wetland) vegetation growing within dry pond area.
- Animal burrows within dam portion or side slopes of pond.
- Trees growing on the dam.
- Foul odors present.

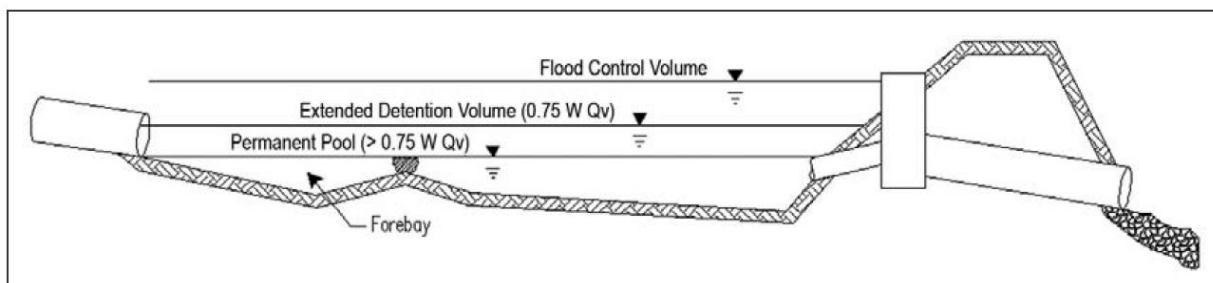
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Wet Pond or Wet Extended Detention Basin

Wet ponds or wet extended detention basins are designed to hold water in a permanent pool. Stormwater runoff generated during storm events is stored above the permanent pool surface providing flood control protection while affording some ability to settle out sediments and contaminants from the stormwater before releasing it downstream or into a local sewer system.

Wet ponds typically contain a principle outlet structure or pipe and an emergency spillway. Wet ponds can either be dug out ponds or created by building a small dam or embankment to hold stormwater runoff. Principle outlet structures or pipes and emergency spillways should be inspected frequently to ensure they are not blocked and are operational. Vegetation along the dam, embankment and emergency spillway should be maintained in a mowed grass condition.



Typical Wet Pond cross-section view showing different levels of ponding control during storm events and permanent pool level. Credit: Ohio Rainwater & Land Development Manual

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*Wet pond with maintained shoreline containing **aquatic bench** for wetland vegetation to improve pollutant removal. Credit: Ohio Department of Natural Resources Division of Soil & Water Resources.*



*Wet pond containing a **forebay pool** to capture sediment entering the wet pond from the storm sewer inlet pipe visible in the background. Captured sediment is periodically removed from the forebay area. Credit: Summit Soil & Water Conservation District*

MAINTENANCE REQUIRED WHEN:

- Outlet is blocked by trash, debris or vegetation.
- The emergency spillway is blocked by debris or has signs of erosion.
- Erosion of dam, embankment or side slopes of pond.
- Low flow orifice, forebay, and micro pool are blocked by trash, debris, or sediment.
- Dam or embankment shows signs of visible water seepage.
- There are animal burrows within dam, embankment or side slopes of pond.
- Woody vegetation is growing on the dam.
- Foul odors present.
- Pond depths have been significantly reduced due to sediment accumulation.
- Algae blooms covering over 1/3 of pond surface area occur in the summer.
- Beavers are present in the basin.

NOTE: If your wet pond is protected by perimeter fencing, periodic inspections of its integrity should be conducted.

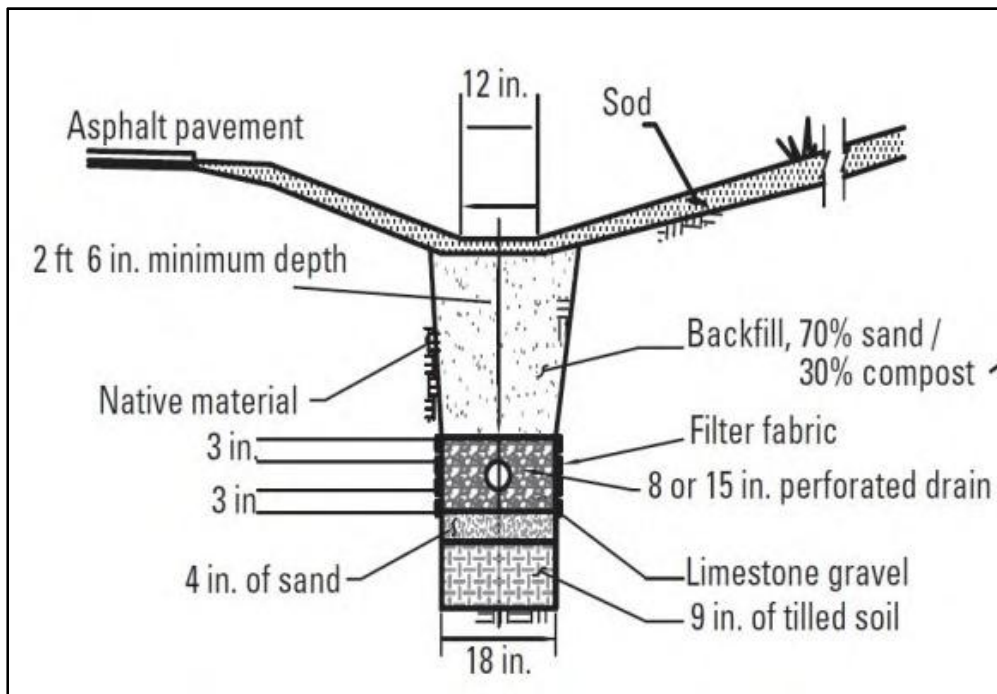
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Vegetated Infiltration Swale

Vegetated infiltration swales are linear, concave-shaped conveyance systems designed to collect and transfer runoff in a non-erosive manner from hard surfaces to other SCMs or natural waterways. Vegetated infiltration swales are vegetated with turf grass or perennial plants which trap sediment and filter pollutants from stormwater runoff as it flows through the swale. Constructed with a mixture of sand and compost, vegetated infiltration swales do allow stormwater runoff to soak into the swale during low flow runoff conditions.



Typical vegetated infiltration swale cross-section view showing how stormwater runoff drains through swale system. Credit: Chagrin River Watershed Partners, Inc.

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Well maintained **vegetated infiltration swale** with stone check dam. Credit: Chagrin River Watershed Partners, Inc.



Maintained **turf grass** protects underlying specialized soils from erosion and slows flow through the swale. Credit: Ohio Department of Natural Resources Division of Soil & Water Resources.

MAINTENANCE REQUIRED WHEN:

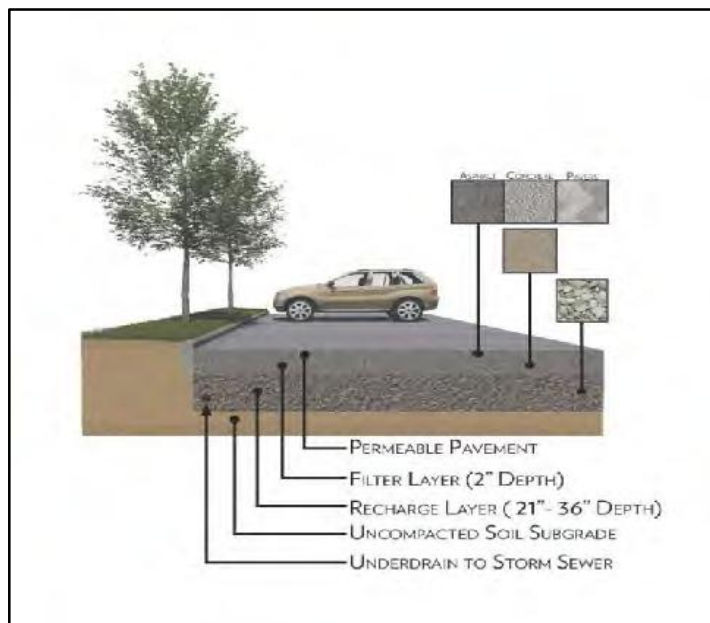
- Erosion or bare soil is visible in the bottom of the swale or on side slopes.
- Standing water is visible after 24 hours.
- Vegetation is in poor condition or dead.
- Trash, debris and sediment have accumulated within the swale or in front of culverts or over catch basins outlets.
- Foul odor present.

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Permeable Pavement

Permeable pavement materials consist of permeable interlocking concrete pavement (PICP), pervious concrete, porous asphalt or other permeable materials such as geogrids or grass pavement systems that provide structure and stability yet allow water to pass through the pavement and infiltrate into underlying gravel layers and existing soils beneath. Permeable pavements are constructed in place of traditional asphalt or concrete in parking areas, driveways, sidewalks and low traffic vehicular roadways.

All permeable pavements allow infiltration of runoff, but individual designs dictate how much storage of precipitation and stormwater runoff from the heaviest rain events will occur. Regular inspection and periodic removal of accumulated sediments from the surface are required for permeable pavement systems. This is achieved by vacuuming and sweeping the surface of the pavement with a vacuum-sweeper as defined in the SCM's inspection and maintenance agreement. Grass paving systems are cellular in nature and allow for vegetation to grow through them are commonly used in overflow parking areas and used on infrequently traveled access driveways. Regular inspection of grass paving systems to determine the health of vegetation, usually turf grass, is periodically required.



Typical permeable pavement cross-section view showing how stormwater runoff drains through the pavement system. Diagram also shows different pavement surfaces available. Diagram Credit: Chagrin River Watershed Partners, Inc.

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Permeable interlocking concrete pavement (PICP) with 1/8" joints to allow stormwater runoff to infiltrate below the individual paver units. Credit: Chagrin River Watershed Partners, Inc.



Pervious concrete within a parking lot with debris beginning to accumulate on the surface. Credit: Chagrin River Watershed Partners, Inc.



Permeable interlocking concrete pavement (PICP) shown with **accumulated sediment** along the curb indicating need for maintenance. Credit: Chagrin River Watershed Partners, Inc.



Porous asphalt within a parking lot. Credit: Chagrin River Watershed Partners, Inc.

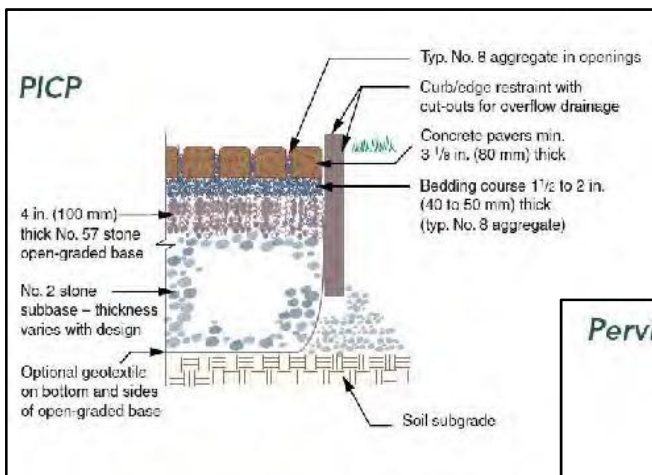


Surface ponding over PICP indicating **clogged joints** and the need for maintenance. Credit: Chagrin River Watershed Partners, Inc.

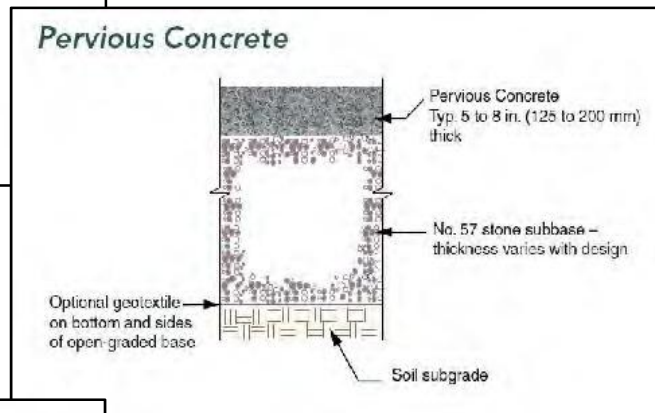
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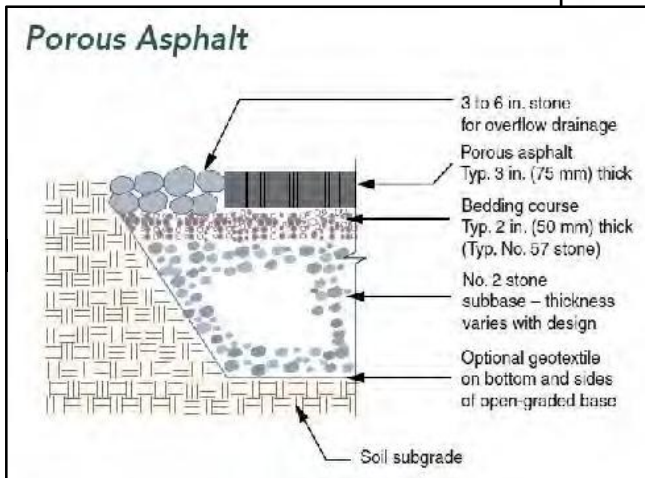
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Typical industry standard construction of PICP. Credit: Interlocking Concrete Pavement Institute



Typical industry standard construction of pervious concrete. Credit: Interlocking Concrete Pavement Institute



Typical industry standard construction of porous asphalt. Credit: Interlocking Concrete Pavement Institute

MAINTENANCE REQUIRED WHEN:

- Standing water is visible on the surface after a rain event.
- Significant amounts of sediment and/or debris have accumulated on the pavement surface or in PICP joints creating clogging issues.
- Vegetation found growing between PICP joints.
- Deterioration of porous asphalt or pervious concrete pavement surface that generates fine sediments which lead to clogging issues.
- For PICP, gravel between pavers is missing.

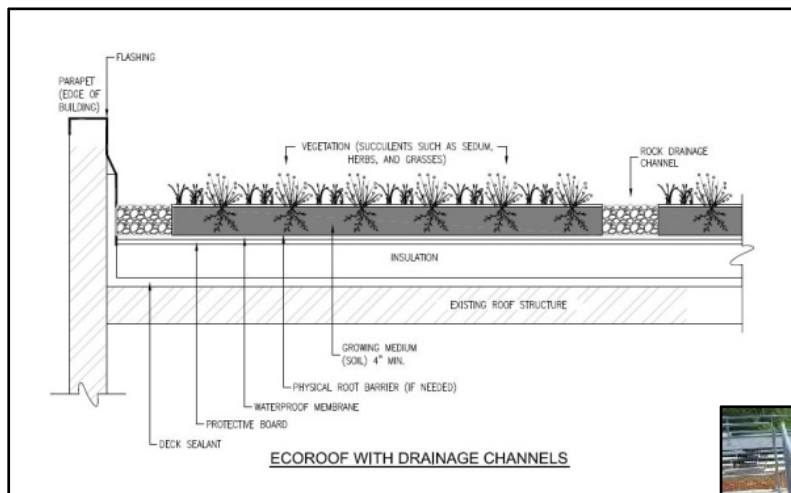
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Green Roof

Green roofs intercept precipitation and slow and reduce runoff from rooftops through storage and evapotranspiration performed by plants. In addition to reducing the amount of stormwater runoff and improving its quality, green roofs also reduce the effect of city “heat islands” and provide microhabitats for birds and insects.



*City of Portland Oregon
Bureau of Environmental
Services typical
specifications for the
Ecoroof green roof.
Diagram Credit: City of
Portland Oregon Bureau
of Environmental Services.*



*Green roofs are planted with specific plant types such as **sedums** that tolerate variable weather conditions, particularly long dry periods. Credit: Chagrin River Watershed Partners, Inc.*

MAINTENANCE REQUIRED WHEN:

- Vegetation shows signs of stress or dies.
- Debris collects around the drains.
- Leaks are observed in the synthetic roof membrane.
- Unwanted vegetation appears.
- Animal burrows or damage is observed.
- Plant material needs to be watered during dry periods.

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Non-Structural SCMs: Riparian & Wetland Setbacks and Conservation Areas

Riparian and wetland setbacks require the protection of vegetation, soils and drainage patterns in these naturally sensitive areas to protect water quality and wildlife habitat. Local government ordinances or resolutions specify widths and terms of protection and use within these areas. Setback and easement boundaries are often demarcated in the field with signage. Conservation areas are often protected through a conservation easement that dictates terms of use and maintenance of a specific area often with the intent to maintain existing natural conditions for water quality and habitat protection. Maintenance typically requires an annual inspection for encroachment into or disturbance within the boundaries of the designated setbacks or easement areas. Inspection of vegetation to control non-native or invasive species may also be required with periodic reporting requirements often detailed in the terms of the easement or local ordinance or resolution requirements.

Additional non-structural SCMs involve educational efforts, management strategies, and planning alternatives by communities and are often associated with the way land is used and managed. Limiting the frequency of fertilizer applications for lawn areas or holding household hazardous waste disposal events are two examples of non-structural SCMs which provide public awareness to the community about how to reduce their contributions to stormwater pollution.

Implementing these practices can have a long-lasting effect on the health of the local environment and can significantly reduce maintenance costs for structural SCMs.



*Stable riparian area and floodplain vegetation **filtering pollutants** from stormwater runoff prior to entering sensitive streams. Credit: Chagrin River Watershed Partners, Inc.*

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Encroachment and vegetation removal within protected riparian area. Note resulting erosion of streambanks along residential properties due to encroachment. Credit: Chagrin River Watershed Partners, Inc.

Shallow rooting depth of turf grass provides limited streambank stability. **Woody vegetation** is preferred. Credit: Summit Soil & Water Conservation District



MAINTENANCE REQUIRED WHEN:

- Encroachment into riparian and wetland setback boundaries or conservation easement boundaries observed.
- Vegetation removal or disturbance is observed.
- Significant populations of non-native or invasive plants are observed.
- Significant soil erosion of stream banks or natural areas observed due to lack of vegetation.

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Rain Barrels & Cisterns

Rain barrels and cisterns are structures that collect rooftop rainwater that would otherwise drain to natural waters or sewer systems. The collected stormwater can be used to water plants, trees, or lawns during dry periods.

A rain barrel is typically composed of a 40-55 gallon barrel or drum with some type of diverter or connection from a downspout, a spigot or hose to drain the barrel, and some type of overflow mechanism. Openings to the air are screened to keep debris and pests out. An overflow mechanism is provided so that when the rain barrel is full, excess water flows back into the downspout and then to a sewer system or into a landscaped area such as a rain garden.

Cisterns are similar to rain barrels in function but hold larger quantities of water. They are typically constructed out of reinforced concrete, galvanized steel, or plastic. Cisterns may be installed underground, at ground level, or elevated depending on the site and space constraints of the property.



*Dual **rain barrels** connected in series from the downspout diverter. Once barrels are full, rainwater continues down the downspout. Credit: Chagrin River Watershed Partners, Inc.*



*Hose connection from **downspout diverter** to barrel should be positioned without sags or loops to allow free flow of rainwater into the barrel. Downspout diverter should be placed 2 feet above the rain barrel. Credit: Chagrin River Watershed Partner, Inc.*

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Large cistern (silver tank) capturing stormwater runoff from a green roof at the Cleveland Metroparks West Creek Reservation Watershed Stewardship Center. Credit: Northeast Ohio Regional Sewer District.

MAINTENANCE TIPS AND SUGGESTIONS

- Inspect rain barrel or cistern on a regular basis and periodically during a rain event to ensure all openings and connections are clear of debris and flowing freely.
- Clean gutters regularly to reduce debris and leaves from clogging connections and being deposited into the barrel or cistern.
- Once a year, tip empty rain barrels over and rinse the inside with a hose to remove collected debris. If a significant amount of algae is observed within the barrel, apply a small capful of chlorine bleach into the barrel to help prevent further algae growth.
- Insure the barrels or cisterns are stable on a strong, sturdy, and flat base.
- Rain barrels and cisterns must be appropriately winterized. Typically this entails draining and diverting flows for the winter months to prevent ice damage or leaks.
- For cisterns, refer to manufacturer recommendations for sediment removal and maintenance of pumps or filters if present.

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Rain Garden

A rain garden is a shallow, landscaped depression that contains native plants that can tolerate both wet and dry conditions. It captures stormwater runoff from rooftops and driveways and allows it to soak into the ground before it reaches natural waters or sewer systems. Rain gardens also provide habitat for wildlife such as birds, butterflies and other pollinators.

Rain gardens typically do not contain drainage pipes or outlet structures to convey captured stormwater runoff from the shallow, landscaped depression as do bioretention areas and vegetated infiltration swales. Rain gardens rely solely on amended soils to allow stormwater runoff to soak into the ground and evapotranspiration by plants to remove stormwater runoff from the rain garden.



*Newly planted rain garden showing **shallow, landscaped depression** and earthen berm. Credit: Chagrin River Watershed Partners, Inc.*

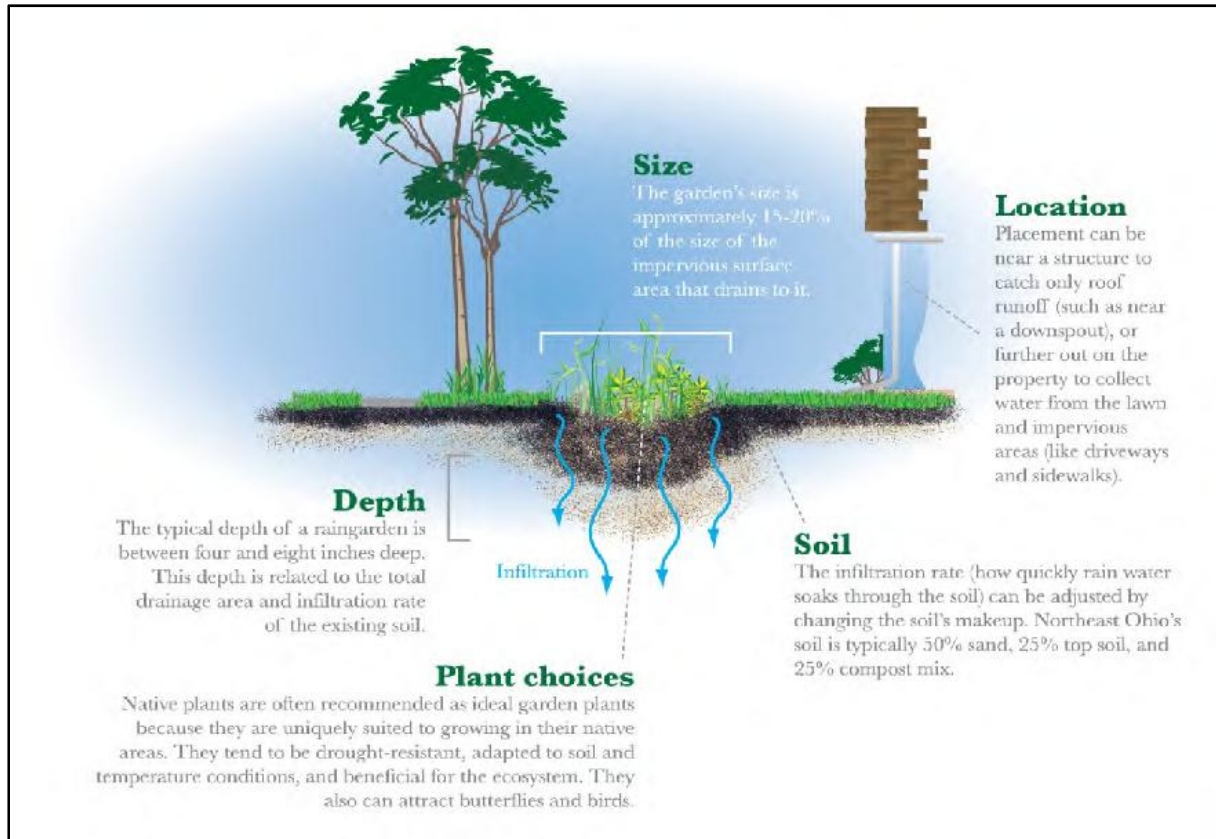
*Fully mature rain garden **capturing runoff** from paved surfaces at the Northeast Ohio Regional Sewer District administrative offices in Cleveland. Credit: Northeast Ohio Regional Sewer District*



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Rain garden receiving disconnected downspout from residential roof.

Credit: Northeast Ohio Regional Sewer District

MAINTENANCE REQUIRED WHEN:

- Standing water is visible 24 hours after a rain event.
- Erosion is visible within the rain garden, on the slopes and inlets leading into the rain garden, or on the berm if present.
- Vegetation, sediment or debris blocking inlets or is excessively present in rain garden.
- Vegetation is wilting, discolored, or dying.
- Foul odors present.
- Mulch cover is inadequate.

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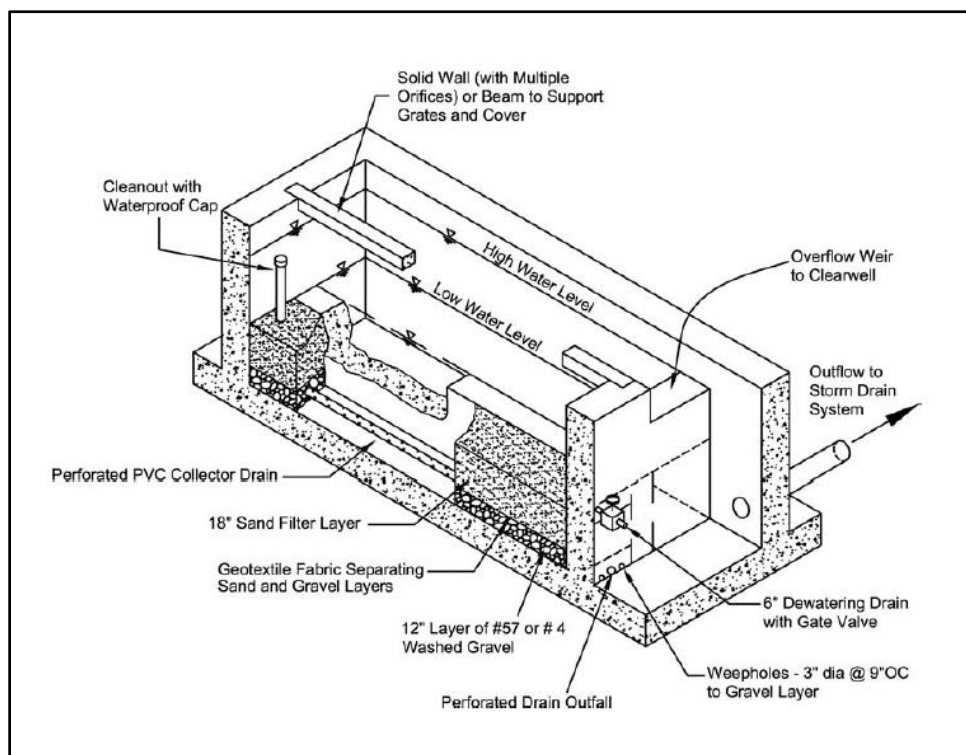
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Sand Filter System

Sand filtration systems are used to treat runoff from highly impervious settings (commercial/office complexes and high density residential areas). To save space, sand filters are usually constructed inside a concrete shell and placed underground.

Sand filters consist of a series of chambers that remove sediment, floatable debris, and oil before slowly filtering stormwater through layers of sand or a sand/peat mix where additional pollutants are removed when they become trapped between sand particles and other filter media. In some sand filter systems, microbes help remove heavy metals and excess nutrients such as phosphorus and nitrogen through biochemical conversion.



Example sand filter, the Delaware Sand Filter, showing filtering and draining components. Credit: Ohio Rainwater & Land Development Manual

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STORMWATER CONTROL MEASURES



Sand filter installed to capture stormwater runoff from **commercial parking lot**. Credit: Ohio Department of Natural Resources Division of Soil & Water Resources.



Sand filter chamber showing **sand filter bed** prior to installation. Credit: Ohio Department of Natural Resources Division of Soil & Water Resources.

MAINTENANCE REQUIRED WHEN:

- Standing water is noticeable in the sediment and/or filter chambers.
- The facility has reached its capacity for sediment accumulation. Reference the manufacturer's inspection and maintenance manual for specific sediment accumulation thresholds within the chambers.
- Excessive amounts of oil and trash are visible on the surface of the collection chambers.
- Sand surface layer has formed a hardened crust.
- Manufacturer's regular maintenance time interval has passed.

* *Do not enter sand filter chambers to inspect system unless Occupational Safety & Health Administration (OSHA) regulations for confined space entry are followed.*

* *Follow inspection and maintenance instructions and schedules provided by system manufacturer and installer.*

MAINTAINING STORMWATER CONTROL MEASURES

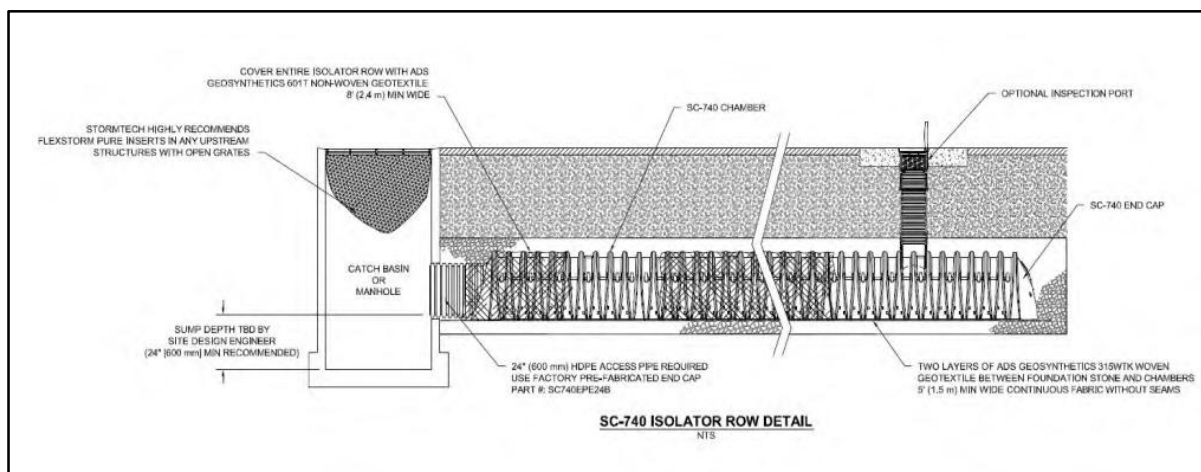
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STORMWATER CONTROL MEASURES

Underground Detention

Underground detention consists of large underground pipes or chambers that capture and store stormwater runoff before slowly releasing it to a stormwater system.

Underground detention is often used in space limited areas, such as parking lots, roadways, and paved areas in commercial, industrial, or residential developments, where adequate land for a surface SCM facility is unavailable. Pretreatment structures may be integrated into the underground detention system or built as a standalone control measure near the system to remove pollutants from the stormwater before it is released to a stormwater system or water resource.



Underground detention storage configuration. Credit: StormTech a Division of ADS, Inc.

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STORMWATER CONTROL MEASURES



*Installation of **underground detention system** within permeable parking lot at the Courtyard by Marriott hotel in Cleveland, Ohio. Credit: Northeast Ohio Regional Sewer District*



***Open-bottom underground detention pipe** segments awaiting installation into gravel backfilled storage layer. Credit: StormTech a Division of ADS, Inc.*

MAINTENANCE REQUIRED WHEN:

- Ponding on surface area draining to system.
 - Sediment and debris is accumulated at the inlets or outlets of system.
 - There is visible damage to the inlets or outlets.
 - Inspection of pipes or chambers through inspection port (if present) using a flashlight and stadia rod reveal sediment accumulation that exceeds design criteria.
- * Do not enter underground detention manholes to inspect system unless Occupational Safety & Health Administration (OSHA) regulations for confined space entry are followed.*
- * Follow inspection and maintenance instructions and schedules provided by system manufacturer and installer.*

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STORMWATER CONTROL MEASURES

Oil-Water Separator

Oil-water separators are single or multi-chambered devices used to remove oil, sediment, and other pollutants from stormwater as it moves through the system. They are typically used in industrial and garage facilities to provide pretreatment of floor drain water. Oil-water separators allow oil and other substances lighter than water to either float to the top of the system or be intercepted and collected for disposal. Substances heavier than water (i.e., sediment and other solids) settle into sludge at the bottom of the system. Removal of pollutants from an oil-water separator according to the design levels and schedule is critical, since unmaintained devices nearly always export concentrated sediments and oils.

MAINTENANCE REQUIRED WHEN:

- Accumulated sediment and sludge at bottom of system has reached manufacturer's recommended volume to be removed.
- Floating oil layer or oil container has reached manufacturer's recommended volume to be removed.
- Spills or leaks are noticed in the system.
- Oil or other pollutants are discharging from the system outlet.
- Obstructions from trash or debris are visible at the inlet or outlet.

** Do not enter systems unless Occupational Safety & Health Administration (OSHA) regulations for confined space entry are followed.*

** Follow inspection and maintenance instructions and schedules provided by system manufacturer and installer.*

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ROUTINE AND NON-ROUTINE MAINTENANCE

Routine and Non-Routine Maintenance

All SCMs require inspection to determine when routine and non-routine maintenance shall be performed. Routine maintenance may include items such as removing accumulated sediment from the SCM, removal of debris blocking inlets or outlet pipes within the SCM, pruning or replacing plant material or mowing designated grass areas of the SCM. Some routine maintenance items may have a seasonal frequency requirement such as leaf debris removal, mulching or plant material maintenance (i.e. pruning, mowing, transplanting or plant replacement). Non-routine maintenance may include repair or replacement of key components of the SCM such as specialized soil mixes, damaged inlets, outlets or drain pipes or removal of significant amounts of accumulated sediment and debris that are clogging the SCM and compromising the SCM's functionality. Listed below are common issues that, if observed within the SCM, may indicate the need for SCM maintenance. A brief description of each common issue is also listed along with the particular SCMs that can be affected by the issue.

- Sediment Accumulation & Clogging
- Distressed Vegetation
- Erosion, Bank Failure & Channel Formation within SCM
- Ponding Water Beyond Design Criteria of SCM
- Pests
- Pollution You Can See and Smell

Sediment Accumulation & Clogging

Sediment can clog special soil media designed to infiltrate stormwater runoff. Sediment, along with debris and trash can clog outlets, inlets and underdrains. SCMs affected by excessive sediment accumulation and clogging are: Bioretention Areas, Vegetated Infiltration Swales, Permeable Pavements, Rain Gardens, Sand Filters, Dry Ponds, Wet Ponds, Underground Detention, Rain Barrels and Cisterns.

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ROUTINE AND NON-ROUTINE MAINTENANCE

Distressed Vegetation

Dying or diseased plant material reduces the pollutant removal function of SCMs that incorporate plants into their design. Loss of plant material also enables erosion of special soil media to occur. SCMs affected by distressed vegetation are: Bioretention Areas, Vegetated Infiltration Swales, Rain Gardens and Green Roofs.

Erosion, Bank Failure & Channel Formation within SCM

Erosion of dams, embankments, side slopes or the formation of channels by erosion within the SCM may cause failure to SCMs containing these features. SCMs affected by erosion, bank failure and channel formation are: Dry Ponds, Wet Ponds, Bioretention Areas, Vegetated Infiltration Swales and Rain Gardens.

Ponding Water Beyond Design Criteria of SCM

Stormwater runoff that remains ponded beyond the design specifications of the SCM may indicate blockage or clogging of outlets, underdrains or special soil media by sediment, debris and trash. SCMs affected by unintended standing water or prolonged ponding are: Dry Ponds, Bioretention Areas, Vegetated Infiltration Swales, Rain Gardens, Permeable Pavements, Sand Filters and Underground Detention.

Pests

Pests such as insect infestations, burrowing animals, beavers, excessive geese, harmful algal blooms and noxious weeds can be a detriment to SCM function, stability and water quality treatment. SCMs most affected by pests include: Bioretention Areas, Vegetated Infiltration Swales, Rain Gardens, Green Roofs, Dry Ponds, Wet Ponds, Rain Barrels and Non-Structural SCMs such as Riparian & Wetland Setbacks and Conservation Areas.

Pollution You Can See and Smell

Foul odors, oil sheens on the water surface and discoloration of the water may be indicators of SCM failure or excessive pollutants entering or captured by the SCM. Any SCM can be affected by excessive pollutant loading and should be inspected with the assistance of a qualified stormwater management professional. Investigate the source of excessive pollutant loads.

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ROUTINE AND NON-ROUTINE MAINTENANCE

Recommendations for Routine and Non-Routine Maintenance

The following section lists general recommendations for routine and non-routine maintenance items. Some routine maintenance items are completed on a seasonal basis, others require greater frequency. Non-routine maintenance items often require professional expertise and assistance before appropriate corrective measures can be determined. Resources for professional assistance are listed in Appendix 3.

Bioretention Area

Routine Maintenance:

- **Sediment and Debris:** Remove gross accumulated sediment and debris from the mulch or grass surface area of the bioretention area.
- **Outlet Structure:** Keep outlets of bioretention area free from blockage by sediment, debris, trash, mulch or plant material.
- **Erosion and Scour:** Repair soil erosion or scouring within the bioretention area, side slopes or inlets leading into the bioretention area.
- **Mulch:** Maintain a 2 to 3 inch depth of hardwood bark mulch layer within the planted area of the bioretention area. If an excessive depth of mulch exists, remove mulch until the mulch layer is 2 to 3 inches in depth.
- **Curb Cuts:** Keep curb cuts to bioretention area free from blockage by sediment, debris and trash.
- **Weeds:** Remove weeds and invasive plants from bioretention area.
- **Vegetation Management:** Inspect plant health seasonally to ensure vigorous growth. Prune plants, particularly shrubs and trees, during the dormant season (fall to early spring).
- **Snow Removal:** Do not pile or store snow within the bioretention area as this will compact the specialized soils and add sediments that may lead to clogging.

Non-Routine Maintenance:

- **Plant Replacement:** Replace diseased or dying plants.
- **Water Ponding Period:** When ponding continues beyond a 48 hour period or the designed ponding duration, there may be construction, or design issues that need to

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ROUTINE AND NON-ROUTINE MAINTENANCE

be corrected. Contact your local community stormwater manager, state technical assistance staff and the designer for further consultation.

- Specialized Soil Replacement: Clogging of the specialized soil by fine sediments may require complete replacement of the specialized soil, mulch and plant materials.

Dry Pond or Dry Extended Detention Basin

Routine Maintenance:

- Outlet Structures: Keep outlets such as principle spillway pipe, water quality orifice pipe and emergency spillway free from blockage by sediment, debris, or trash.
- Dam/Embankment: Mow grassed dam and embankment of dry pond to prevent establishment of woody vegetation.
- Erosion and Scour: Repair soil erosion or scouring on the side slopes leading into the dry pond or within the bottom or forebay of the dry pond.
- Vegetation Management: Remove woody vegetation from ponding area of dry pond.
- Sediment and Debris: Remove accumulated sediment, debris and trash from the dry pond forebay, low flow channel and ponding area. Remove sediments when accumulation reaches 6 inches in depth.

Non-Routine Maintenance:

- Excessive Sediment: Remove sediment accumulation from the ponding area prior to 25 percent of the ponding storage volume being lost within the dry pond.
- Invasive Vegetation: Treat and remove invasive vegetation from ponding area, side slopes and emergency spillway.
- Outlet Structure: Repair or replace damaged outlet structure.
- Erosion Protection: Repair or replace riprap or stone protection at pipe inlets, pipe outlets or emergency spillway.
- Dam/Embankment: Seek professional consultation if seepage or leaks appear during ponding or erosion is discovered on the dam or embankment of the dry pond.

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Wet Pond or Wet Extended Detention Basin

Routine Maintenance:

- Outlet Structures: Keep outlets such as principal spillway pipe, water quality orifice pipe and emergency spillway free from blockage by sediment, debris, or trash.
- Dam/Embankment: Mow grassed dam and embankment of wet pond to prevent establishment of woody vegetation.
- Erosion and Scour: Repair soil erosion or scouring on the side slopes leading into the wet pond.
- Vegetation Management: Remove vegetation from at least 10 feet away from the outlet structure.
- Sediment and Debris: Remove accumulated sediment, debris and trash from the wet pond forebay and ponding area. Remove sediments when the pool volume has become significantly reduced or the pond begins to become eutrophic.

Non-Routine Maintenance:

- Excessive Sediment: Remove sediment accumulation from the forebay and ponding area prior to 25 percent of the ponding storage volume being lost within the wet pond.
- Invasive Vegetation: Treat and remove invasive vegetation from ponding area, side slopes and emergency spillway.
- Outlet Structure: Repair or replace damaged outlet structure.
- Erosion Protection: Repair or replace riprap or stone protection at pipe inlets, pipe outlets or emergency spillway.
- Dam/Embankment: Seek professional consultation if seepage, leaks or erosion is discovered on the dam or embankment of the wet pond.

Vegetated Infiltration Swale

Routine Maintenance:

- Sediment and Debris: Remove accumulated sediment and debris from the mulch or grass surface area of the vegetated infiltration swale.

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- **Outlet Structure:** Keep culverts or drains within the vegetated infiltration swale free from blockage by sediment, debris, trash, mulch or plant material.
- **Erosion and Scour:** Repair soil erosion or scouring within the swale area or side slopes leading into the vegetated infiltration swale.
- **Curb Cuts:** Keep curb cuts to the vegetated infiltration swale free from blockage by sediment, debris and trash
- **Weeds:** Remove weeds and invasive plants from the vegetated infiltration swale.
- **Vegetation Management:** Inspect plant health seasonally to ensure vigorous growth. Prune plants, particularly shrubs and trees, during the dormant season (fall to early spring).
- **Snow Removal:** Do not pile or store snow within the vegetated infiltration swale as this will compact the specialized soils and add sediments that may lead to clogging.

Non-Routine Maintenance:

- **Plant Replacement:** Replace diseased or dying plants.
- **Ponding Water:** If ponding water occurs beyond the precipitation event, contact your local community stormwater manager for further consultation.
- **Specialized Soil Replacement:** Clogging of the specialized soil by fine sediments may require complete replacement of the specialized soil, mulch and plant materials.
- **Underdrain Flushing:** Some vegetated infiltration swales are constructed with perforated underdrain pipes that drain the infiltration swale's specialized soils. If the underdrains become clogged with fine sediments they may need to be flushed with special equipment or replaced.

Permeable Pavement

Routine Maintenance:

- **Ponding:** Inspect pavement during rain events to detect ponding and clogging.
- **Sediment and Debris:** Remove accumulated sediment and debris from the pavement surface area.

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- Weeds: Remove weeds, grass or any other plant material growing on the surface of the pavement.

Non-Routine Maintenance:

- Vacuum Sweep: Vacuum sweep entire surface or known clogged areas using a regenerative air street sweeper beginning at 1,500 rpms and increase if needed. More than one pass may be necessary.
- Gravel Replacement: Replace gravel within joints between permeable pavers for PICP, especially after vacuum sweeping.
- Pavement Cleaning: Remove surface stains using a biodegradable detergent.
- Pavement Repair: Replace deteriorated permeable pavers, pervious concrete and porous asphalt following manufacturer guidelines.

Green Roof

Routine Maintenance:

- Moisture Level: Check moisture level of growing media daily during growing season to maintain adequate moisture for plant survival.
- Irrigation: Irrigate vegetation during periods of drought per manufacturer's specifications.
- Weeds: Remove weeds and invasive plants.
- Outlets: Keep outlets such as drains and gutters free from blockage by sediment, debris, trash, mulch or plant material.
- Vegetation Management: Inspect plant health seasonally to ensure vigorous growth.
- Leaks or Damage: Inspect system components for leaks and damage based on manufacturer's specifications.

Non-Routine Maintenance:

- Erosion: Replace eroded or displaced soil or other growing medium materials.
- Trimming Vegetation: Trim vegetation per manufacturer's specifications.
- Plant Replacement: Replace diseased or dying plants.
- Soil Test: Perform annual soil test to check soil fertility and pH.

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- Fertilizer Application: Apply slow-release fertilizer per manufacturer's specifications.
- System Component Repair: Repair or replace damaged system components based on manufacturer's specifications.

Non-Structural SCMs: Riparian & Wetland Setbacks and Conservation Areas

Routine Maintenance:

- Encroachment: Inspect boundaries and internal areas of riparian and wetland setbacks or conservation areas for encroachment, damaged vegetation or soil-disturbing activities. Report non-compliance issues to appropriate regulatory authority or conservation easement holder.
- Vegetation Management: Inspect plant health seasonally to ensure vigorous growth and protection from soil erosion.

Non-Routine Maintenance:

- Invasive Vegetation: Treat and remove invasive vegetation from riparian and wetland setbacks or conservation areas per the terms of setback regulations or conservation easement agreements.
- Sign Replacement: Replace riparian and wetland setback or conservation area boundary signs if damaged, vandalized or removed.

Rain Barrels & Cisterns

Routine Maintenance:

- Leaks: Inspect system components for leaks at all connections and joints per manufacturer's specifications.
- Clogging: Inspect system components for clogging at all connections and joints per manufacturer's specifications.
- Winterization: Properly winterize rain barrels and cisterns to protect connections, pipes and storage containers from freeze damage.

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Non-Routine Maintenance:

- **Algae Control:** If algae accumulate within the storage container, dewater and rinse thoroughly to remove algae.
- **Pest Control:** If mosquito larvae appear within the storage container, determine their point of access and seal the storage container to prevent access to the stored water.
- **System Component Repair:** Repair or replace damaged system components based on manufacturer's specifications.

Rain Garden

Routine Maintenance:

- **Sediment and Debris:** Remove accumulated sediment and debris from the mulch layer of the rain garden.
- **Erosion and Scour:** Repair soil erosion or scouring within the rain garden or side slopes leading into the rain garden.
- **Mulch:** Maintain a 2 to 3 inch depth of hardwood bark mulch layer within the rain garden. If an excessive depth of mulch exists, remove mulch until the mulch layer is 2 to 3 inches in depth.
- **Curb Cuts:** Keep curb cuts to rain garden free from blockage by sediment, debris and trash.
- **Weeds:** Remove weeds and invasive plants from rain garden.
- **Vegetation Management:** Inspect plant health seasonally to ensure vigorous growth. Prune plants, particularly shrubs and trees, during the dormant season (fall to early spring).
- **Snow Removal:** Do not pile or store snow within the rain garden as this will compact the specialized soils and add sediments from snow melt that may lead to clogging.

Non-Routine Maintenance:

- **Plant Replacement:** Replace diseased or dying plants.
- **Ponding Water:** When ponding continues beyond a 24 hour period, contact your local community stormwater manager for further consultation.

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ROUTINE AND NON-ROUTINE MAINTENANCE

- Specialized Soil Replacement: Clogging of the specialized soil by fine sediments may require complete replacement of the specialized soil, mulch and plant materials.

Sand Filter System

Routine Maintenance:

- Sediment and Debris: Remove accumulated sediment, debris, trash and oil/grease from sand filter bed and collection chambers per manufacturer's specifications.
- Outlet and Inlet Structures: Keep outlets and inlets of sand filter free from blockage by sediment, debris and trash.
- Erosion and Scour: Repair soil erosion or scouring at the outlet(s) of the sand filter.

Non-Routine Maintenance:

- Filter Media Replacement: Replace entirety of sand or other filter media if clogged.
- Leaks or Damage: Inspect system components for leaks and damage based on manufacturer's specifications.

* *Do not enter sand filter chambers to inspect system unless Occupational Safety & Health Administration (OSHA) regulations for confined space entry are followed.*

* *Follow inspection and maintenance instructions and schedules provided by system manufacturer and installer.*

* *Properly dispose of all wastes removed from the sand filter system.*

Underground Detention

Routine Maintenance:

- Sediment and Debris: Remove accumulated sediment, debris and trash from inlets, detention chambers and outlets per manufacturer's specifications.
- Erosion and Scour: Repair soil erosion or scouring at the outlet(s) of the underground detention if overflow is discharged onto ground surfaces.

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- **Inspection Port:** Inspect the monitoring well or inspection port to ensure access by qualified personnel to determine if accumulation of sediment and debris within detention chambers requires removal per manufacturer's specifications.

Non-Routine Maintenance:

- **System Component Repair:** Repair or replace damaged system components based on manufacturer's specifications.
- * *Do not enter underground detention manholes to inspect system unless Occupational Safety & Health Administration (OSHA) regulations for confined space entry are followed.*
- * *Follow inspection and maintenance instructions and schedules provided by system manufacturer and installer.*
- * *Properly dispose of all wastes.*

Oil-Water Separator

Routine Maintenance:

- **Oil and Sludge Removal:** Remove captured oils, grease and sludge from separation chambers and dispose of properly per manufacturer's specifications.
- **Oil Containment Chamber:** Remove floating oil layer or empty oil container once it has reached manufacturer's recommended volume to be removed. If system contains oil-absorbing pads, replace before completely saturated.
- **Sediment and Debris:** Inspect inlets and outlets to ensure they are free of sediment, debris and trash.
- **Sediment Collection Chamber:** Remove accumulated sediment and sludge at bottom of system when it has reached manufacturer's recommended volume to be removed.
- **Erosion and Scour:** Repair soil erosion or scouring at the outlet(s) of the oil-water separator system if overflow is discharged onto ground surfaces.

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Non-Routine Maintenance:

- System Component Repair: Repair or replace damaged system components based on manufacturer's specifications.
- * *Do not enter systems unless Occupational Safety & Health Administration (OSHA) regulations for confined space entry are followed.*
- * *Follow inspection and maintenance instructions and schedules provided by system manufacturer and installer.*
- * *Properly dispose of all wastes.*

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INSPECTION & MAINTENANCE AGREEMENTS AND EASEMENTS

Inspection & Maintenance Agreements and Easements

SCMs serve to control flooding, protect community infrastructure and improve water quality. Routine inspection of SCMs provides a state of readiness and performance control for when storm events occur.

Agreements

In Ohio, responsibility for operation and maintenance of SCMs lies with the owner of the SCM. Typically, the property owner on which the SCM is constructed is the owner of the control measure and is legally obligated to operate and maintain the control measure. Legal obligations for operation, maintenance, inspection and repair of SCMs can be identified in an Inspection and Maintenance Agreement. Inspection and Maintenance Agreements are typically executed between the property owner and a local government jurisdiction (i.e. municipal or county department). An Inspection and Maintenance Agreement is a legally binding document that lists the SCMs and their legally defined locations, ownership, operation and maintenance requirements. Inspection frequency, funding requirements and access easements to the SCMs are typically listed in the Inspection and Maintenance Agreement.

In the event that the Inspection and Maintenance Agreement cannot be located, consult the local government with jurisdiction for stormwater management in your community to determine if an agreement exists and who is responsible for conducting inspections and completing maintenance.

Easements

Legally defined easements for access to the SCM in the form of right-of-entry agreements often provide permission for responsible parties to access, operate and maintain the SCMs. Easements may be temporary, but are often permanent and should be reviewed to determine access in perpetuity to the SCM.

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TIPS TO LESSEN MAINTENANCE COSTS

Tips to Lessen Maintenance Costs

- Don't neglect needed maintenance. If properly cared for, a stormwater control measure (SCM) can perform effectively during storm events and protect properties from flooding, erosion and improve water quality. Neglected SCMs will fail and may become financially burdensome to maintain or repair at a later date.
- Property owners, homeowner associations and businesses can reduce maintenance costs and the potential liability of those legally responsible for the SCM by implementing the following best management practices in and around the areas draining to the SCM.
 - a) Manage grass clippings, leaves, soil or trash so that none of these can get into the SCM or stormwater inlets draining to the SCM. These will clog integral components (i.e. pipe inlets/outlets, specialized soils and drains) of the SCM or conveyance system (i.e. storm sewer pipes, inlets, swales) delivering stormwater runoff to the control measure.
 - b) Do not leave bare areas unvegetated. Bare soils and erosion produce fine sediments that can quickly clog a SCM.
 - c) Do not over fertilize lawn and landscaping areas. Excess fertilizers can wash off the landscape and over hard surfaces during storm events and drain to SCMs stimulating plant or algae growth near or within inlets, outlets or pipes of the SCM.
 - d) Manage pet wastes properly. Animal wastes not properly disposed of in appropriate trash receptacles can contribute disease causing bacteria and pathogens to stormwater runoff and decrease the longevity of treatment components (i.e. filters, specialized soils) within SCMs.
 - e) Keep contributing drainage areas to the SCM (i.e. streets, gutters and parking lots) free of trash, debris and yard wastes to prevent clogging of integral SCM components.

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TIPS TO LESSEN MAINTENANCE COSTS

- f) Manage salt and other deicers carefully. Sweep up and properly dispose of salt and other deicing agents to protect grass and plant materials from damage during winter and spring months.

- g) Maintain vigorous plant growth in vegetated areas. Plant native trees, shrubs and perennials in existing turf areas to help stormwater soak into the ground. Select species that require little or no fertilizer or pest control and that are adapted to an acceptable range of site conditions.

Glossary of Commonly Used Terms

Berm: An elongated elevated earthen ridge that is used to hold or direct stormwater runoff.

Bioretention: A process in which contaminants and sediment are removed from stormwater runoff. Stormwater is collected into the treatment area which consists of a ponding area comprised of specialized soils that allow runoff to filter through the mulch layer and underlying soils. The surface may be turf grass or planted with perennials, shrubs or trees.

Bioretention Area: Location where stormwater runoff is filtered through specialized soil mixes that remove pollutants and allow runoff to infiltrate downward into underlying soils.

Cistern: A storage container connected to the downspout of a roofed structure designed to capture and store large amounts of stormwater runoff for use at a later time period. Cistern may be installed underground, at ground level, or elevated.

Conservation Easement: A legal agreement used to protect natural, educational, recreational or cultural resources by limiting or restricting potentially damaging uses of the land.

Curb Cut: An opening in the concrete or asphalt curbing of streets or parking lots that is flush with the surface of the pavement and the SCM to allow stormwater runoff to flow into the SCM.

Dam: The earthen structure or embankment that impounds runoff in a pond, lake or reservoir.

Dry Pond or Dry Extended Detention Basin: A stormwater design feature that provides temporary stormwater runoff storage; gradually releasing a controlled volume of stormwater over a 24- to 48-hour interval to increase settling of urban pollutants and protect channels from degradation. Dry ponds dewater fully.

Debris: Dead plant or other organic material consisting mainly of fallen leaves.

Emergency Spillway: The structure that safely conveys overflows from a pond, lake or reservoir facility during large precipitation events.

Evapotranspiration: The process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and by transpiration from plants.

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Eutrophic: A lake or pond characterized by an abundant accumulation of sediment and nutrients that support dense growth of algae or other aquatic plants, the decay of which depletes oxygen from the water column.

Flood Plain: The relatively level land to either side of a stream or river, which is inundated during high flows. It is often used to reference the 100-year flood plain.

Forebay: A distinct area near an inlet of a pond to enhance deposition of incoming sediments.

Green Roof: A roof covered with vegetation and specialized soil medium designed to support plant life and provide positive drainage that filters rainwater and optimizes energy conservation.

Impervious Cover: Any hard surface that prevents water from infiltrating into the soil.

Infiltration: The gradual downward movement of water from the surface through the soil to groundwater.

Inlet: A structure that controls and conveys an SCM's inflow of stormwater runoff.

Integrated Pest Management Plan: A plan that minimizes the application of pesticides and fertilizers on vegetation or grassed areas.

Micropool: A small pool area typically located near the outlet of a dry or wet pond.

Monitoring Well: Inspection point for SCMs that contain underground components or storage chambers. Also known as an observation port.

Permeability: The capacity for transmitting water through a material or through soil.

Post-Construction Stormwater Management Practices: Those practices designed for the treatment of stormwater pollutants and effects of stormwater runoff after construction is completed.

Permeable Pavement: An alternative to conventional pavement whereby stormwater runoff is diverted through a porous surface and into layers of underground stone that act as a storage reservoir. The stored stormwater runoff then gradually infiltrates into the subsoil or an underdrain system.

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Outlet: A structure that controls and conveys an SCM's outflow of stormwater runoff.

Oil-Water Separator: A system used to separate oil and water into separate components for removal from stormwater runoff and further pollutant treatment.

Rain Barrel: A storage container connected to the downspout of a roofed structure designed to capture and store stormwater runoff for use at a later time period.

Rain Garden: A shallow depression containing amended soils intended to allow collected runoff to soak into existing soils landscaped with perennial plant materials that assist with pollutant removal and evapotranspiration of collected rainwater and stormwater runoff.

Riparian Setback: The vegetated transition zone between flowing water and terrestrial ecosystem, which provides a continuous exchange of nutrients and woody debris between land and water. It generally includes not only the stream channel, but also flood plains and associated wetlands.

Riprap: Rock placed over a layer of geotextile fabric, sand or gravel used to armor stormwater pipe outlets or emergency spillways against flowing water reducing erosion and scouring of soils.

Sand Filter: A filtering system used in stormwater runoff management consisting of layers of sand arranged in chambers that filter pollutants and sediment from runoff as it passes through the system.

Stabilization: Vegetative or structural soil cover controlling erosion that includes permanent and temporary seed, mulch, sod or stone.

Side Slopes: Slopes of dams, embankments, spillways, and the facility perimeter.

Stormwater Control Measure (SCM): Practices used to lessen the impacts of stormwater runoff. These techniques may involve structures, vegetation, or altering construction operations. Also known as best management practices (BMPs).

Stormwater Treatment: The removal of pollutants from urban runoff and improvement of water quality, accomplished largely by deposition and utilizing the benefits of natural processes.

MAINTAINING STORMWATER CONTROL MEASURES
Guidance for Private Owners & Operators

APPENDIX 1

Stormwater Management: A system of structural and non-structural practices used to control water quantity and improve water quality of stormwater runoff.

Swale: An elongated depression in the land used to convey stormwater runoff.

Trash Rack: Device placed upstream of the principle outlet or drain to intercept debris.

Underdrain System: The drainage system used in bioretention and vegetated infiltration swales to convey stormwater runoff that did not fully infiltrate into underlying soils of the SCM.

Underground Detention: An underground stormwater detention system comprised of chambers, vaults or pipes that store captured stormwater runoff and allow runoff to infiltrate through a layer of gravel into underlying existing soils.

Water Quality Volume: The extended detention volume captured for the purposes of treating pollutants and protecting stream stability downstream. This volume is prescribed by the Ohio Environmental Protection Agency's Construction General Permit.

Wet Pond or Wet Extended Detention Basin: A stormwater design feature that provides temporary stormwater runoff storage; gradually releasing a controlled volume of stormwater over a 24 to 48-hour interval to increase settling of urban pollutants and protect channels from degradation. A conventional wet pond or wet extended detention basin has a permanent pool of water.

Woody Vegetation: A plant that produces wood as its structural tissue. Woody plants are usually either trees or shrubs.

Inspection & Maintenance Check Lists

(Listed on following page)

- Bioretention Area
- Dry Pond or Dry Extended Detention Basin
- Wet Pond or Wet Extended Detention Basin
- Vegetated Infiltration Swale
- Permeable Pavement
- Green Roof
- Non-Structural SCMs: Riparian & Wetland Setbacks and Conservation Areas
- Rain Barrels & Cisterns
- Rain Gardens
- Sand Filter System
- Underground Detention
- Oil-Water Separator

Bioretention Area Inspection and Maintenance Checklist

Facility:			
Location/Address:			
Date:	Time:	Weather Conditions:	Date of Last Inspection:
Inspector:		Title:	
Rain in Last 48 Hours <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, list amount and timing:			
Pretreatment: <input type="checkbox"/> vegetated filter strip <input type="checkbox"/> swale <input type="checkbox"/> turf grass <input type="checkbox"/> forebay <input type="checkbox"/> other, specify: _____ <input type="checkbox"/> none			
Site Plan or As-Built Plan Available: <input type="checkbox"/> Yes <input type="checkbox"/> No			

Inspection Item	Comment	Action Needed
1. PRETREATMENT		
Sediment has accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash and debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. DEWATERING		
Standing water is present after 24 hours. If yes, describe sheen, color, or smell.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. INLETS		
Inlets are in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment has accumulated and/or is blocking the inlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around the inlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. VEGETATION		
Vegetation is wilting, discolored, or dying due to disease or stress.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Vegetation needs to be controlled through mowing or manual removal.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. BIORETENTION MAIN INFILTRATION AREA		
Trash and debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment has accumulated at the surface.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Topmost layer is caked or crusted over with sediment.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is evident.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Mulch is compacted.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sinkholes or animal borrows are present.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. SIDE SLOPES AND EMBANKMENT		
Erosion is evident.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sinkholes or instability is evident.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. OUTLETS AND OVERFLOW STRUCTURE (i.e., catch basin)		
Outlets or overflow structures in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash or debris is blocking the outlets or overflow structure.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around the outlets or overflow structure.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Height from surface of practice to top of overflow structure is insufficient to allow for ponding during rain events.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No

Additional Notes

Wet weather inspection needed **Yes** **No**

Site Sketch:

Dry Pond or Dry Extended Detention Basin Inspection and Maintenance Checklist

Facility:			
Location/Address:			
Date:	Time:	Weather Conditions:	Date of Last Inspection:
Inspector:		Title:	
Rain in Last 48 Hours <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, list amount and timing:			
Pretreatment: <input type="checkbox"/> vegetated filter strip <input type="checkbox"/> swale <input type="checkbox"/> forebay <input type="checkbox"/> other, specify:			
Site Plan or As-Built Plan Available: <input type="checkbox"/> Yes <input type="checkbox"/> No			

Inspection Item	Comment	Action Needed
1. PRETREATMENT		
Sediment has accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash and debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. DEWATERING		
The water quality orifice is visible.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. INLETS		
Inlets are in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment has accumulated and/or is blocking the inlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around the inlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. EMBANKMENT		
Sinkholes or cracks are visible in the embankment.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trees or woody vegetation present on the dam or embankment.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. BASIN OR BOWL AREA		
Trash and debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Invasive plants are present.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is evident on the basin floor or low flow channel.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
The micro-pool has sediment accumulation.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sinkholes or animal borrows are present.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. SIDE SLOPES AND EMBANKMENT		
Erosion is evident.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sinkholes, animal borrows or instability are present.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. OUTLETS AND OVERFLOW STRUCTURE		
Outlets or overflow structures in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash or debris is blocking the outlets or overflow structure.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around the outlets or overflow structure.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Joints are not water tight and/or leaks are visible.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No

Additional Notes

Wet weather inspection needed **Yes** **No**

Site Sketch:

Wet Pond or Wet Extended Detention Basin Inspection and Maintenance Checklist

Facility:			
Location/Address:			
Date:	Time:	Weather Conditions:	Date of Last Inspection:
Inspector:		Title:	
Rain in Last 48 Hours <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, list amount and timing:			
Pretreatment: <input type="checkbox"/> vegetated filter strip <input type="checkbox"/> swale <input type="checkbox"/> forebay <input type="checkbox"/> other, specify:			
Site Plan or As-Built Plan Available: <input type="checkbox"/> Yes <input type="checkbox"/> No			

Inspection Item	Comment	Action Needed
1. PRETREATMENT		
Sediment has accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash and debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. DEWATERING		
The water quality orifice is visible.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. INLETS		
Inlets are in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment has accumulated and/or is blocking the inlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around the inlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. EMBANKMENT		
Sinkholes, cracks or seeps are visible in the embankment.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trees or woody vegetation present on the dam or embankment.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. BASIN PERMANENT POOL		
Trash and debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment has accumulated and reduced pool volume.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Invasive plants are present.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is present at shoreline.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Excessive algae blooms are present.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. SIDE SLOPES AND EMBANKMENT		
Erosion is evident.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sinkholes, animal borrows or instability is present.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. OUTLETS AND OVERFLOW STRUCTURE		
Outlets or overflow structures in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash or debris is blocking the outlets, trash racks or overflow structure.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around the outlets or outlet structure.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Joints are water tight and no leaks are visible.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No

Additional Notes

Wet weather inspection needed **Yes** **No**

Site Sketch:

Vegetated Infiltration Swale Inspection and Maintenance Checklist

Facility:			
Location/Address:			
Date:	Time:	Weather Conditions:	Date of Last Inspection:
Inspector:		Title:	
Rain in Last 48 Hours <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, list amount and timing:			
Pretreatment: <input type="checkbox"/> vegetated filter strip <input type="checkbox"/> swale <input type="checkbox"/> turf grass <input type="checkbox"/> forebay <input type="checkbox"/> other, specify:			
Site Plan or As-Built Plan Available: <input type="checkbox"/> Yes <input type="checkbox"/> No			

Inspection Item	Comment	Action Needed
1. PRETREATMENT		
Sediment has accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash and debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. DEWATERING		
Standing water is present after 24 hours. If yes, describe sheen, color, or smell.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. INLETS		
Inlets are in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment has accumulated and/or is blocking the inlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around the inlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. VEGETATION		
Vegetation is wilting, discolored, or dying due to disease or stress.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Vegetation needs to be controlled through mowing or manual removal.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. MAIN INFILTRATION AREA		
Trash and debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment has accumulated at the surface.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Topmost layer is caked or crusted over with sediment.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is evident.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Mulch is compacted.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sinkholes or animal borrows are present.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. SIDE SLOPES AND EMBANKMENT		
Erosion is evident.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sinkholes or instability is evident.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. OUTLETS AND OVERFLOW STRUCTURE (i.e., catch basin)		
Outlets or overflow structures in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash or debris is blocking the outlets or overflow structure.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around the outlets or overflow structure.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Height from surface of practice to top of overflow structure is insufficient to allow for ponding during rain events.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No

Additional Notes

Wet weather inspection needed **Yes** **No**

Site Sketch:

Site Sketch:

Green Roof Inspection and Maintenance Checklist

Facility:			
Location/Address:			
Date:	Time:	Weather Conditions:	Date of Last Inspection:
Inspector:		Title:	
Rain in Last 48 Hours: <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, list amount and timing:			
Type of Irrigation System: <input type="checkbox"/> overhead <input type="checkbox"/> drip <input type="checkbox"/> other, specify:			
Results from Most Recent Soil Test Available: <input type="checkbox"/> Yes <input type="checkbox"/> No			
Site Plan or As-Built Plan Available: <input type="checkbox"/> Yes <input type="checkbox"/> No			

Inspection Item	Comment	Action Needed
1. VEGETATION		
Plant cover is less than 90%.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Vegetation is wilting, discolored, or dying due to disease, pests, or stress.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Vegetation is stressed due to drought.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Vegetation needs to be controlled through manual removal or mowing if specified by manufacturer.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. GROWING MEDIUM/SOIL LAYER		
Standing water is present. If yes, describe color or smell.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment has accumulated at the surface or throughout the media.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Gullies or other evidence of erosion are observed.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Soil depth is insufficient.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Based on most recent soil test, fertilization is needed.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. STRUCTURAL COMPONENTS		
Waterproof membrane is cracked or leaking.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Other structural components are in poor condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. INLETS/DRAINAGE LAYER		
Inlets are in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, vegetation, trash or debris are blocking inlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. IRRIGATION SYSTEM		
Drip lines, supply lines, or other irrigation components are not functioning or are in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No

Additional Notes

Wet weather inspection needed Yes No

Site Sketch:

Non-Structural Stormwater Control Measure Inspection and Maintenance Checklist

Facility:			
Location/Address:			
Date:	Time:	Weather Conditions:	Date of Last Inspection:
Inspector:		Title:	
Rain in Last 48 Hours <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, list amount and timing:			
Non-structural SCM Type: <input type="checkbox"/> riparian setback <input type="checkbox"/> wetland setback <input type="checkbox"/> conservation area <input type="checkbox"/> other, specify:			
Pretreatment: <input type="checkbox"/> vegetated filter strip <input type="checkbox"/> level spreader <input type="checkbox"/> gravel verge <input type="checkbox"/> other, specify:			
Site Plan or As-Built Plan Available: <input type="checkbox"/> Yes <input type="checkbox"/> No			

Inspection Item	Comment	Action Needed
1. PRETREATMENT		
Sediment has accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash and debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion or scouring is visible	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. UNAUTHORIZED ACTIVITY		
There is unauthorized dumping of yard waste, litter or debris.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
There are unauthorized structures or construction activity.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
There is unauthorized removal of vegetation or trees.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
There are unauthorized recreational activities or motorized vehicles.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. VEGETATION		
Vegetation is dying or diseased.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Invasive vegetation is present.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. NON-STRUCTURAL AREA		
The boundaries are clearly marked.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Signage is visible and intact.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Other:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No

Additional Notes

Wet weather inspection needed Yes No

Site Sketch:

Rain Barrel/Cistern Inspection and Maintenance Checklist

Facility:			
Location/Address:			
Date:	Time:	Weather Conditions:	Date of Last Inspection:
Inspector:		Title:	
Rain in Last 48 Hours <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, list amount and timing:			
Pretreatment: <input type="checkbox"/> downspout screen <input type="checkbox"/> gutter guards <input type="checkbox"/> rain barrel filter/screen <input type="checkbox"/> other, specify:			
Site Plan or As-Built Plan Available: <input type="checkbox"/> Yes <input type="checkbox"/> No			

Inspection Item	Comment	Action Needed
1. PRETREATMENT		
Sediment and debris have accumulated in gutter.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
The screen or trap is clogged or not attached.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. FOUNDATION		
Barrel foundation is unstable.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. INLETS/DOWNSPOUTS		
Gutters and downspouts joints are disconnected and/or leaks are present.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Downspouts are disconnected to barrel and/or leaks are present.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Diverter is disconnected and/or leaks are present.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. SPIGOT		
Visible leaks are present and connections are not tight.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Valves and knobs do not turn.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. RAIN BARREL/CISTERN		
Sediment accumulated at bottom of barrel.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Odor of mildew present or algae is visible inside the barrel.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Cracks or leaks are visible in barrel.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Mosquito larva is visible in barrel.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. OVERFLOW STRUCTURE		
Overflow is directed away from the structure or disconnected from the downspout.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Other:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No

Special Notes: An untrained individual should never enter a cistern. Never drink water from a rain barrel or a cistern. Always follow the manufacturer's manual and recommended maintenance schedule.

Additional Notes

Wet weather inspection needed Yes No

Site Sketch:

Rain Garden Inspection and Maintenance Checklist

Facility:			
Location/Address:			
Date:	Time:	Weather Conditions:	Date of Last Inspection:
Inspector:		Title:	
Rain in Last 48 Hours <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, list amount and timing:			
Pretreatment: <input type="checkbox"/> vegetated filter strip <input type="checkbox"/> swale <input type="checkbox"/> turf grass <input type="checkbox"/> other, specify: _____ <input type="checkbox"/> none			
Inlet Type: <input type="checkbox"/> swale <input type="checkbox"/> disconnected downspout <input type="checkbox"/> pipe <input type="checkbox"/> sheet flow			
Site Plan or As-Built Plan Available: <input type="checkbox"/> Yes <input type="checkbox"/> No			

Inspection Item	Comment	Action Needed
1. PRETREATMENT		
Sediment has accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash and debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. DEWATERING		
Standing water is present after 24 hours. If yes, describe sheen, color, or smell.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. INLET		
Structural inlet in poor condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment has accumulated and/or is blocking the inlet.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around the inlet.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. VEGETATION		
Vegetation is wilting, discolored, or dying due to disease or stress.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Vegetation needs to be controlled through mowing or manual removal.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. RAIN GARDEN MAIN INFILTRATION AREA		
Trash and debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment has accumulated at the surface.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Topmost layer is caked or crusted over with sediment.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is evident.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Mulch is compacted.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sinkholes or animal borrows are present.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. EDGES AND BERM		
Erosion is evident.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sinkholes or instability is evident.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. OUTLET AND OVERFLOW STRUCTURE (i.e., catch basin)		
Outlet or overflow structure in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash or debris is blocking the outlets or overflow structure.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around the outlets or overflow structure.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Height from surface of practice to top of overflow structure is insufficient to allow for ponding during rain events.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No

Additional Notes

Wet weather inspection needed **Yes** **No**

Site Sketch:

Sand Filter System Inspection and Maintenance Checklist

Facility:			
Location/Address:			
Date:	Time:	Weather Conditions:	Date of Last Inspection:
Inspector:		Title:	
Rain in Last 48 Hours <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, list amount and timing:			
Pretreatment: <input type="checkbox"/> vegetated filter strip <input type="checkbox"/> swale <input type="checkbox"/> turf grass <input type="checkbox"/> forebay <input type="checkbox"/> other, specify: _____ <input type="checkbox"/> none			
Site Plan or As-Built Plan Available: <input type="checkbox"/> Yes <input type="checkbox"/> No			

*Do not enter sand filter chambers to inspect system unless Occupational Safety & Health Administration (OSHA) regulations for confined space entry are followed.

*Follow inspection and maintenance instructions and schedules provided by system manufacturer and installer.

*Properly dispose of all wastes.

Inspection Item	Comment	Action Needed
1. PRETREATMENT		
Sediment has accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash and debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. INLETS		
Inlets are in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash or debris have accumulated and/or is blocking the inlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. SAND OR SAND/PEAT FILTER LAYER		
Sediment accumulation threshold has been reached.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Surface is hardened/crusted.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. COLLECTION CHAMBERS		
Trash and debris have accumulated in chambers.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Oil is visible at surface.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. OTHER SYSTEM COMPONENTS		
Structural deterioration is evident.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
7. OUTLETS		
Outlets in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash or debris are blocking outlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around outlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
8. OTHER		
Evidence of ponding water on area draining to system.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Evidence that water is not being conveyed through the system.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Additional Notes		
Wet weather inspection needed <input type="checkbox"/> Yes <input type="checkbox"/> No		

Site Sketch:

Underground Detention System Inspection and Maintenance Checklist

Facility:			
Location/Address:			
Date:	Time:	Weather Conditions:	Date of Last Inspection:
Inspector:		Title:	
Rain in Last 48 Hours <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, list amount and timing:			
Pretreatment: <input type="checkbox"/> vegetated filter strip <input type="checkbox"/> swale <input type="checkbox"/> turf grass <input type="checkbox"/> forebay <input type="checkbox"/> other, specify: _____ <input type="checkbox"/> none			
Site Plan or As-Built Plan Available: <input type="checkbox"/> Yes <input type="checkbox"/> No			

*Do not enter underground detention chambers to inspect system unless Occupational Safety & Health Administration (OSHA) regulations for confined space entry are followed.

*Follow inspection and maintenance instructions and schedules provided by system manufacturer and installer.

* Properly dispose of all wastes.

Inspection Item	Comment	Action Needed
1. PRETREATMENT		
Sediment has accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash and debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. INLETS		
Inlets are in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash, or debris have accumulated and/or is blocking the inlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. CHAMBERS		
Sediment accumulation threshold has been reached.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash and debris have accumulated in chambers.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. OTHER SYSTEM COMPONENTS		
Structural deterioration is evident.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. OUTLETS		
Outlets in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash or debris are blocking outlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around outlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. OTHER		
Evidence of ponding water on area draining to system.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Evidence that water is not being conveyed through the system.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Additional Notes		
Wet weather inspection needed <input type="checkbox"/> Yes <input type="checkbox"/> No		

Site Sketch:

Oil-Water Separator Inspection and Maintenance Checklist

Facility:			
Location/Address:			
Date:	Time:	Weather Conditions:	Date of Last Inspection:
Inspector:		Title:	
Rain in Last 48 Hours <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, list amount and timing:			
Pretreatment: <input type="checkbox"/> vegetated filter strip <input type="checkbox"/> swale <input type="checkbox"/> turf grass <input type="checkbox"/> forebay <input type="checkbox"/> other, specify: _____ <input type="checkbox"/> none			
Site Plan or As-Built Plan Available: <input type="checkbox"/> Yes <input type="checkbox"/> No			

*Do not enter underground detention chambers to inspect system unless Occupational Safety & Health Administration (OSHA) regulations for confined space entry are followed.

*Follow inspection and maintenance instructions and schedules provided by system manufacturer and installer.

* Properly dispose of all wastes.

Inspection Item	Comment	Action Needed
1. PRETREATMENT		
Sediment has accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Trash and debris have accumulated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. INLETS		
Inlets are in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash, or debris has accumulated and/or is blocking the inlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. OIL CONTAINMENT CHAMBER		
Oil volume threshold has been reached.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Oil-absorbing pads are saturated.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. SEDIMENT COLLECTION CHAMBER		
Sediment accumulation threshold has been reached.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sludge accumulation threshold at bottom of chamber has been reached.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. OTHER SYSTEM COMPONENTS		
Structural deterioration is evident.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Spills or leaks are evident.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
5. OUTLETS		
Outlets in poor structural condition.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sediment, trash or debris is blocking outlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Erosion is occurring around outlets.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. OTHER		
Evidence of ponding water on area draining to system.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Evidence that water is not being conveyed through the system.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No
Additional Notes		
Wet weather inspection needed <input type="checkbox"/> Yes <input type="checkbox"/> No		

Site Sketch:

Operation & Maintenance Resources

(Listed on following page)

Reference Publication List

Rainwater and Land Development: Ohio's Standards for Stormwater Management, Land Development and Urban Stream Protection
http://soilandwater.ohiodnr.gov/portals/soilwater/pdf/stormwater/Intro_11-6-14.pdf

Chagrin River Watershed Partners, Inc., Model Inspection and Maintenance Agreement for Stormwater Best Management Practices, September 26, 2008

The Importance of Operation and Maintenance for the Long-Term Success of Green Infrastructure A Review of Green Infrastructure O&M Practices in ARRA Clean Water State Revolving Fund Projects; U.S EPA Office of Water; March 2013, PA-832-R-12-007

Hinman, C., Low Impact Development Technical Guidance Manual for Puget Sound; Washington State University Pierce County Extension; January 2005, Publication No. PSAT 05-03, Hinman, C.

Chesapeake Stormwater Network, Technical Bulletin No. 10, Bioretention Illustrated: A Visual Guide for Constructing, Inspecting, Maintaining and Verifying the Bioretention Practice, October 20, 2013, Scott, T., Lane, C., Schueler, T; CSN.

Resource Agency List

Local Ohio County Soil and Water Conservation Districts
<http://soilandwater.ohiodnr.gov/swcds/find-a-local-swcd>

Cuyahoga County Board of Health
www.ccbh.net

Northeast Ohio Regional Sewer District
www.neorsd.org

Northeast Ohio Area Wide Coordinating Agency
<http://www.noaca.org/index.aspx?page=99>

Ohio Department of Natural Resources
<http://soilandwater.ohiodnr.gov/water-conservation/stormwater-management>

Ohio Environmental Protection Agency
<http://www.epa.ohio.gov/dsw/storm/index.aspx>

U.S Environmental protection Agency
<http://water.epa.gov/polwaste/npdes/stormwater/index.cfm>

Resources for Stormwater Training, Technical Information and Research

Northeast Ohio Stormwater Training Council

www.nehiostormwater.com

Chagrin River Watershed Partners, Inc. National Estuarine Research Reserve System (NERRS) Science Collaborative: Implementing Credits and Incentives for Innovative Stormwater Management

<http://www.crowp.org/index.php/projects/research-projects/nerrs-science-collaborative>

Ohio Stormwater Association

<http://www.ohioswa.com/resources/>

North Carolina State University Stormwater Inspection & Maintenance Program

<http://www.bae.ncsu.edu/topic/bmp-im/>

University of New Hampshire Stormwater Center

<http://www.unh.edu/unhsc/>

Center for Watershed Protection

<http://www.cwp.org/>

Watershed Organizations

Ohio Watershed Network* – Ohio State University Extension

http://ohiowatersheds.osu.edu/groups/wgp_all

*Provides listing of all local watershed organizations.

Inspection & Maintenance Agreement Template

(Listed on following page)

EXAMPLE INSPECTION AND MAINTENANCE AGREEMENT FOR STORMWATER CONTROL MEASURES

PLEASE NOTE:

- This is an **example Inspection and Maintenance Agreement** containing typical language used by communities.
- Agreements are tailored to each development project to list the specific stormwater control measures covered by the agreement, and the funding and operation and maintenance conditions accepted by the community.

This Inspection and Maintenance Agreement, made this _____ day of _____ 20__, by and between the *[party responsible for the project on which the stormwater control measure (SCM) will be located]* (hereafter referred to as the Owner) and the *[Community]* hereafter referred to as the Community, provides as follows:

WHEREAS, the Owner is responsible for certain real estate shown as Tax Map No. (*parcel number*) that is to be developed as (*development's official name*) and referred to as the Property; and,

WHEREAS, the Owner is providing a stormwater management system consisting of the following stormwater control measures (SCMs) (*all components of the stormwater management system listed here*) as shown and described on the attached Comprehensive Stormwater Management Plan (*attach copy of development's approved plan*); and,

WHEREAS, to comply with Section **XXXX.XX** of the Codified Ordinances of the *[Community]* Comprehensive Stormwater Management, pertaining to this project, the Owner has agreed to maintain the SCMs in accordance with the terms and conditions hereinafter set forth.

NOW, THEREFORE, for and in consideration of the mutual covenants and undertaking of the parties, the parties hereby agree as follows:

A. FINAL INSPECTION REPORTS AND AS BUILT CERTIFICATION

The Owner shall certify in writing to the *[Community]* within 30 days of completion of the SCMs that the SCMs are constructed in accordance with the approved plans and specifications. The Owner shall further provide As Built Certifications of the locations of all access and maintenance easements and each SCM, including those SCMs permitted to be located in, or within 50 feet of, water resources, and the drainage areas served by each SCM.

B. MAINTENANCE PLANS FOR THE STORMWATER CONTROL MEASURES

1. The Owner agrees to maintain in perpetuity the SCMs in accordance with approved Maintenance Plans listed in #2 below and in a manner that will permit the SCMs to perform the purposes for which they were designed and constructed, and in accordance with the standards by which they were designed and constructed, all as shown and described in the approved Comprehensive Stormwater Management Plan. This includes all pipes and channels built to convey stormwater to the SCMs, as well as structures, improvements, and vegetation provided to control the quantity and quality of the stormwater.

2. The Owner shall provide a Maintenance Plan for each SCM. The Maintenance Plans shall include a schedule for monthly and annual maintenance. The Owner shall maintain, update, and store the maintenance records for the SCMs. The specific Maintenance Plans for each SCM are as follows:

Note: This section must be tailored to the SCMs approved for a specific development and the maintenance necessary and associated schedule for each SCM. Please refer to manual for details on each SCM.

3. The Owner shall perform all maintenance in accordance with the above Maintenance Plan and shall complete all repairs identified through regular inspections, and any additional repairs as requested in writing by the **[Community]**.

C. INSPECTION AND REPAIRS OF SCMs

1. The Owner shall inspect all SCMs listed in Section B above, every three (3) months and after major storm events for the first year of operation.
2. The Owner shall inspect all SCMs listed in Section B above at least once every year thereafter.
3. The Owner shall submit Inspection Reports in writing to the **[Community]** engineer within 30 days after each inspection. The reports shall include the following:

The date of inspection; _____

Name of inspector; _____

The condition and/or presence of:

- (i) _____
- (ii) _____
- (iii) _____
- (iv) _____
- (v) _____
- (vi) _____
- (vii) _____
- (viii) Any other item that could affect the proper function of the Facility.

4. The Owner grants permission to the **[Community]** to enter the Property and to inspect all aspects of the SCMs and related drainage whenever the **[Community]** deems necessary. The **[Community]** shall provide the Owner copies of the inspection findings and a directive to commence with the repairs if necessary.
5. The Owner shall make all repairs within ten (10) days of their discovery through Owner inspections or through a request from the **[Community]**. If repairs will not occur within this ten (10) day period, the Owner must receive written approval from the **[Community]** engineer for a repair schedule.
6. In the event of any default or failure by the Owner in the performance of any of the covenants and warranties pertaining to the maintenance of the SCMs, or the Owner fails to maintain the SCMs in accordance with the approved design standards and Maintenance Plan, or, in the event of an emergency as determined by the **[Community]**, it is the sole discretion of the **[Community]**, after providing reasonable notice to the Owner, to enter the property and take whatever steps necessary to correct deficiencies and to charge the cost of such repairs to the Owner. The Owner shall reimburse the **[Community]** upon demand, within thirty (30) days of receipt thereof for all actual cost incurred by the **[Community]**. All costs expended by the **[Community]** in performing such

necessary maintenance or repairs shall constitute a lien against the properties of the Owner. Nothing herein shall obligate the *[Community]* to maintain the SCMs.

D. FUNDING

The Owner shall specify the method of funding for the perpetual inspection, operation, and maintenance of the SCMs listed in this Inspection and Maintenance Agreement. This funding mechanism shall be approved by the *[Community]*.

E. INDEMNIFICATION

1. The Owner hereby agrees that it shall save, hold harmless, and indemnify the *[Community]* and its employees and officers from and against all liability, losses, claims, demands, costs and expenses arising from, or out of, default or failure by the Owner to maintain the SCMs, in accordance with the terms and conditions set forth herein, or from acts of the Owner arising from, or out of, the construction, operation, repair or maintenance of the SCMs.
2. The parties hereto expressly do not intend by execution of this Inspection and Maintenance Agreement to create in the public, or any member thereof, any rights as a third party beneficiary or to authorize anyone not a party hereof to maintain a suit for any damages pursuant to the terms of this Inspection and Maintenance Agreement.
3. This Inspection and Maintenance Agreement shall be a covenant that runs with the land and shall inure to the benefit of and shall be binding upon the parties hereto, their respective successors and assigns, and all subsequent owners of the property.
4. The current Owner shall promptly notify the *[Community]* when the Owner legally transfers any of the Owners responsibilities for the SCMs. The Owner shall supply the *[Community]* with a copy of any document of transfer, executed by both parties.
5. Upon execution of this Inspection and Maintenance Agreement, it shall be recorded in the County Clerk's Office of the *[County]*, of Ohio, at the Owner's expense.

IN WITNESS WHEREOF, the Owner has caused this Inspection and Maintenance Agreement to be signed in its names by a duly authorized person.

(Sign) Individual Owner

(Please type)

By: _____
Appropriate Community official

Disclaimer
The information contained herein is for illustration purposes only and should not be considered as legal advice. This document is a template and should not be considered applicable for all situations or facts and circumstances. The reader is advised to consult with retained counsel to obtain appropriate legal advice on the use or modification of any of this document or concepts contained herein.

Bioretention Area & Rain Garden Planting Lists

(Listed on following page)

SHRUBS FOR BIORETENTION & RAIN GARDENS					
Genus	Species	Cultivar	Common Name	Height	Spread
<i>Aesculus</i>	<i>parviflora</i>		Bottlebrush Buckeye	8-12'	8-15'
<i>Aesculus</i>	<i>pavia</i>		Red Buckeye		
<i>Aronia</i>	<i>arbutifolia</i>	Brilliantissima	Red Chokeberry	6-9'	6-8'
<i>Aronia</i>	<i>melanocarpa</i>	Autumn Magic	Black Chokeberry	4'	
<i>Cephalanthus</i>	<i>occidentalis</i>		Buttonbush	3-6'	3-6'
<i>Clethra</i>	<i>alnifolia</i>		Summer Sweet	6-8'	4-6'
<i>Clethra</i>	<i>alnifolia</i>	Ruby Spice	Summer Sweet	3-6'	3-6'
<i>Clethra</i>	<i>alnifolia</i>	hummingbird	Summer Sweet	30"	4'
<i>Cornus</i>	<i>amomum</i>		Silky Dogwood	6-10'	6-10'
<i>Cornus</i>	<i>racemosa</i>		Gray Dogwood	10-15'	10-15'
<i>Cornus</i>	<i>racemosa</i>	Muskingum	Gray Dogwood	2'	4'
<i>Cornus</i>	<i>sericea</i>	Isanti	Compact Redosier Dogwood	5'	5'
<i>Cornus</i>	<i>sericea</i>	Silver and Gold	Silver & Gold Dogwood	5-7'	
<i>Cornus</i>	<i>sericea</i>	Flavirama	Yellow Twig	7-9'	7-9'
<i>Hamamelis</i>	<i>vernalis</i>		Witch Hazel	10-12'	
<i>Ilex</i>	<i>glabra</i>	Compacta	Compact Inkberry	3-4'	3-4'
<i>Ilex</i>	<i>glabra</i>	Nordic	Nordic Holly	3-4'	3-4'
<i>Ilex</i>	<i>verticillata</i>	Afterglow	Afterglow Winterberry	3-6'	
<i>Ilex</i>	<i>verticillata</i>	Red Sprite	Red Sprite Winterberry	2-4'	
<i>Itea</i>	<i>virginica</i>	Henry's Garnet	Virginia Sweetspire	3-4'	4-5'
<i>Itea</i>	<i>virginica</i>	Sarah Eve	Virginia Sweetspire	3-4'	
<i>Magnolia</i>	<i>virginiana</i>		Sweetbay Magnolia	15-20'	15-20'
<i>Myrica</i>	<i>pensylvanica</i>		Bayberry	5-12'	5-12'
<i>Physocarpus</i>	<i>opulifolius</i>	Diablo	ninebark	6-8'	6-8'
<i>Potentilla</i>	<i>fruticosa</i>	Goldfinger	Goldfinger Potentilla	2-3'	3-4'
<i>Potentilla</i>	<i>fruticosa</i>	Jackmanii	Jackman Potentilla	3-4'	3'
<i>Sambucus</i>	<i>canadensis</i>	Laciniata'	Elderberry	5-12'	
<i>Thuja</i>	<i>occidentalis</i>		Arborvitae		
<i>Vaccinium</i>	<i>corymbosum</i>		Highbush blueberry	4-8'	3-4'
<i>Vaccinium</i>	<i>hybrid</i>	Ornablue	Highbush blueberry	3'	3'
<i>Vaccinium</i>	<i>hybrid</i>	Tophat	Highbush blueberry	20"	2-3'
<i>Xanthorrhiza</i>	<i>simplicissima</i>		Yellowroot	2-3'	
TREES FOR BIORETENTION & RAIN GARDENS					
Genus	Species		Common Name		
<i>Acer</i>	<i>rubrum</i>		Red Maple		
<i>Acer</i>	<i>saccharinum</i>		Silver Maple		
<i>Amelanchier</i>	<i>canadensis</i>		Service Berry		
<i>Betula</i>	<i>nigra</i>		River Birch		
<i>Celtis</i>	<i>occidentalis</i>		Hackberry		
<i>Gleditsia</i>	<i>triacanthos var.inermis</i>		Honey Locust		
<i>Gymnocladus</i>	<i>dioica</i>		Kentucky Coffee Tree		
<i>Hamamelis</i>	<i>vernalis</i>		Witchhazel		
<i>Liquidambar</i>	<i>styraciflua</i>		Sweetgum		
<i>Magnolia</i>	<i>virginiana</i>		Sweetbay Magnolia		
<i>Metasequoia</i>	<i>glyptostroboides</i>		Dawn Redwood		
<i>Nyssa</i>	<i>sylvatica</i>		Tupelo, Blackgum		
<i>Quercus</i>	<i>bicolor</i>		Swamp White Oak		
<i>Quercus</i>	<i>palustris</i>		Pin Oak		
<i>Salix</i>	<i>spp.</i>		Willows		
<i>Taxodium</i>	<i>distichum</i>		Bald Cypress		

FORBS FOR BIORETENTION & RAIN GARDENS			
Scientific Name	Common Name	Basin Bottom	Basin Side-Slope
<i>Anemone canadensis</i>	Canada Anemone		X
<i>Anemone virginiana</i>	Thimbleweed		X
<i>Asclepias incarnata</i>	Swamp Milkweed	X	
<i>Asclepias tuberosa</i>	Butterfly Weed		X
<i>Aster dumosus (novi-belgii)</i>	New York Aster		X
<i>Aster laevis</i>	Smooth Aster		X
<i>Aster novae-angliae</i>	New England Aster	X	
<i>Baptisia australis</i>	Blue False Indigo		X
<i>Baptisia leucantha</i>	White False Indigo		X
<i>Boltonia asteroides</i>	Boltonia (false aster)	X	
<i>Chelone glabra</i>	Turtlehead	X	
<i>Coreopsis tripteris</i>	Tall Coreopsis	X	
<i>Eryngium yuccifolium</i>	Rattlesnake Master		X
<i>Eupatorium maculatum</i>	Joe-pye Weed	X	
<i>Eupatorium perfoliatum</i>	Boneset	X	
<i>Geranium maculatum</i>	Wild geranium		X
<i>Heliopsis helianthoides</i>	Ox-eye Sunflower	X	
<i>Iris versicolor</i>	Blue Flag Iris	X	
<i>Liatris pycnostachya</i>	Prairie Blazing Star		X
<i>Liatris spicata</i>	Dense Blazing Star	X	
<i>Lysimachia ciliata</i>	Fringed Loosestrife		X
<i>Monarda fistulosa</i>	Wild Bergamot		X
<i>Oenothera fruticosa</i>	Evening Primrose		X
<i>Physostegia virginiana</i>	False Dragonhead	X	
<i>Pycnanthemum muticum</i>	Mountain Mint		X
<i>Ratibida pinnata</i>	Yellow Coneflower		X
<i>Silphium perfoliatum</i>	Cup Plant	X	
<i>Smilacina stellata</i>	Starry Solomon's Seal		X
<i>Silphium terebinthinaceum</i>	Prairie Dock		X
<i>Solidago rugosa</i>	Rough Goldenrod	X	
<i>Tradescantia ohiensis</i>	Ohio Spiderwort		X
<i>Thalictrum dasycarpum</i>	Meadowrue	X	
<i>Vernonia fasciculata</i>	Ironweed	X	
<i>Veronicastrum virginicum</i>	Culver's Root	X	
<i>Zizia aurea</i>	Golden Alexanders	X	X
GRASSES FOR BIORETENTION & RAIN GARDENS			
Scientific Name	Common Name		
<i>Andropogon gerardii</i>	Big Bluestem		
<i>Carex hystericina</i>	Porcupine Sedge		
<i>Carex vulpinoidea</i>	Fox Sedge		
<i>Elymus canadensis</i>	Canada Wild-rye		
<i>Panicum virgatum</i>	Switch Grass		
<i>Spartina pectinata</i>	Prairie Cord Grass		
FERNS FOR BIORETENTION & RAIN GARDENS			
Scientific Name	Common Name		
<i>Onoclea sensibilis</i>	Sensitive Fern		
<i>Matteuccia struthiopteris</i>	Ostrich Fern		
<i>Thelypteris noveboracensis</i>	New York Fern		

List of Common Invasive Plants

(Listed on following page)

Weedy & Volunteer Plants to be Removed

Below is a sampling of weedy & volunteer species commonly found in the landscape. These rapid spreaders should be removed to prevent competition for resources with the intentional plantings.



Common Name: Goutweed
Scientific Name: *Aegopodium podagraria*



Common Name: Garlic Mustard
Scientific Name: *Alliaria petiolata*



Common Name: Wild Onion
Scientific Name: *Allium crispum*



Common Name: Wild Chervil
Scientific Name: *Anthriscus sylvestris*



Common Name: Purslane
Scientific Name: *Portulaca spp.*



Common Name: Common Pigweed
Scientific Name: *Amaranthus hybridus*



Common Name: Giant Ragweed
Scientific Name: *Ambrosia trifida*



Common Name: Common Burdock
Scientific Name: *Arctium minus*



Common Name: Narrowleaf bittercress
Scientific Name: *Cardamine impatiens*



Common Name: Nodding Plumless Thistle
Scientific Name: *Carduus nutans*



Common Name: Knapweed
Scientific Name: *Centaurea spp.*



Common Name: Greater celandine
Scientific Name: *Chelidonium majus*

Weedy & Volunteer Plants to be Removed

Below is a sampling of weedy & volunteer species commonly found in the landscape. These rapid spreaders should be removed to prevent competition for resources with the intentional plantings.



Common Name: Canada Thistle
Scientific Name: *Cirsium arvense*



Common Name: Oakleaf Goosefoot
Scientific Name: *Chenopodium glaucum*



Common Name: Chicory
Scientific Name: *Chichorium intybus*



Common Name: Bindweed
Scientific Name: *Convolvulus arvensis*



Common Name: Trailing Crownvetch
Scientific Name: *Coronilla varia*



Common Name: Crabgrass
Scientific Name: *Digitaria spp.*



Common Name: Common Dandelion
Scientific Name: *Taraxacum officinale*



Common Name: White Clover
Scientific Name: *Trifolium repens*



Common Name: Spotted Ladysthumb
Scientific Name: *Polygonum persicaria*



Common Name: Foxtail Bristlegrass
Scientific Name: *Setaria italica*



Common Name: Reed Canary Grass
Scientific Name: *Phalaris arundinacea*



Common Name: Barnyard Grass
Scientific Name: *Echinochloa crus-galli*