Chapter 14 - Maintenance of Stormwater Management Facilities

Proper maintenance of stormwater management facilities is essential to ensure proper long-term operation of these systems. Possible problems which may develop without proper maintenance include:

- Stormwater structures may become clogged with debris reducing flow capacity which may cause upstream flooding;
- Stormwater storage facilities may fill with sediment or debris reducing storage capacity and diminishing the ability of the facility to lower storm flows which may result in flooding downstream;
- BMPs may not remove pollutants at the design levels required to meet the water quality requirements. If vegetation is not periodically cut and removed, it may release nutrients back into the environment, negating their water quality benefit.

Stormwater management facilities include detention and retention basins, bioretention, grassed swales, and other BMPs that are intended to control stormwater runoff and change the characteristics of that runoff including, but not limited to, the quantity and quality, the period of release or the velocity of flow. Stormwater management facilities also include pipes and open channels, where the pipes and open channels are integral parts of the BMP (e.g. the pipes in a detention basin that convey flow from the outlet structure through an embankment to the discharge), and where the pipes and open channels are being used as BMPs to store or treat stormwater.

Pipes (culverts and storm drains) and open channels that do not store or treat stormwater and are not an integral part of a BMP are storm drainage systems and not stormwater management facilities.

Maintenance of stormwater management facilities are addressed in this Chapter. Maintenance of culverts, storm drains, and open channels that are not stormwater management facilities are addressed in their respective chapters.

The maintenance guidance provided in this chapter is the routine maintenance that should be anticipated for typical nonproprietary BMPs; however, it is not meant to be all-inclusive. It is the applicant's responsibility to provide a project specific maintenance plan and schedule as part of the maintenance agreement.

Information on BMP maintenance may also be found in the Manufacturer's literature.

14.1 Responsibility for Maintenance

Maintenance of stormwater management facilities is the responsibility of the permittee during construction until all work is completed, including final clean up and site stabilization, to the satisfaction of the County. At the completion of construction, maintenance of stormwater management facilities becomes the responsible party or land owner's responsibility in accordance with the executed Maintenance Agreement.

The County is not responsible for maintaining private stormwater management facilities.

14.2 Maintenance Agreements

A legally binding maintenance agreement specifying the parties responsible for the proper maintenance of all stormwater management facilities shall be secured prior to issuance of any permits for land disturbance activities.

Responsibility for the operation and maintenance of stormwater management facilities, after the completion of construction, shall remain with the responsible party or property owner and shall legally pass to any successor or owner.

The maintenance agreement shall include a project specific appendix that lists all stormwater management facilities present on the property; the minimum frequency of inspections and maintenance, and the routine maintenance that is to be performed for each stormwater management facility. The project specific appendix to the maintenance agreement is to be prepared by the applicant and submitted to the County with the Stormwater Management Plan for review. The information contained within the VA SWM Handbook, the VA BMP Clearinghouse, and Manufacturer literature shall be used, by the applicant, as a guide in preparing the project specific appendix to the maintenance agreement; however, the maintenance requirements shall be written to be specific to the project. When landscaping is a component of the stormwater management facility, a project specific maintenance schedule for the landscaping shall be provided that is reflective of the plant species that are used. The landscaping maintenance schedule shall contain guidance regarding methods, frequency, and time of year for landscape maintenance. The maintenance requirements shall stress the need to remove cut and remove vegetation from the BMP and the specific rate and method of fertilization, if any.

A sample Maintenance Agreement is included on Roanoke County's website

In addition, the applicant shall also establish easements for stormwater management facilities to grant the County the right of access for periodic inspections as described in Chapters 3 and 15.

14.3 Maintenance Program

A consistent maintenance program is the best way to ensure that stormwater management facilities will continue to perform their necessary functions. The following components are common to many stormwater management facilities maintenance programs and shall be followed, where applicable.

- Regular Inspections
  Scheduled inspections and additional inspections after major storm events are necessary to understand the condition of the stormwater management facility and discover deficiencies so that they may be corrected.

- Vegetation Management
  Most stormwater management facilities rely on vegetation to filter sediment from stormwater and to stabilize the ground surface of the BMP.

  - Mowing
    Some stormwater management facilities may have no mow zones. Do not mow areas meant to stay natural. If mowing is allowed and desired, most grasses are hardiest if maintained as an upland meadow, with a blade height of 6 to 8 inches. If a shorter lawn is desired, additional lawn care will be needed to maintain turf health. Never cut grasses below a blade height of 4 inches. Grasses on embankments should be cut at least twice in the spring growing season, once in the summer, and twice in the fall growing season.

    Grass clippings should be collected, removed from the BMP, and disposed of properly. Ideally grass clippings should be composted and used as fertilizer or mulch in an upland area. Grass clippings must never be dumped into streams, open channels, storm drains, ponds, or stormwater management facilities as they will release nutrients as they decay which will flow into streams.

  - Fertilization
    One of the primary purposes of most stormwater management facilities is to remove nutrients from stormwater; therefore, it is important to not over fertilize. **Often fertilization is not required**, especially if grass is maintained at a height of 6 to 8 inches. Only fertilize where necessary to maintain the health of vegetation and then take care to apply only the minimum that is required.

  - Pest and Weed Control
    Avoid unnecessary pesticide and herbicide use. When absolutely required, use pesticides and herbicides in accordance with listed instructions and

never allow spray to enter water as many of these chemicals are toxic to aquatic life in small concentrations.

- Removing Accumulated Sediment
  Vegetation surrounding stormwater management facilities is designed to trap sediment; therefore, vegetation is likely to become laden with sediment and bare spots may emerge. Bare spots should be raked, backfilled if needed, and covered with top soil. Disturbed areas should be reseeded and mulched. Excess material should be removed and may be used as a mulch or soil supplement. If the soil becomes compacted, then aeration may be necessary.

- Unwanted Vegetation
  Embankments must be kept clear of woody plants (trees and bushes) because their roots could cause seepage or slope failure. Consistent mowing should control any unwanted vegetation.

- Slope, Embankment and Outlet Stabilization
  Stable slopes and embankments are necessary to ensure that erosion does not add to water quality problems and that embankments do not breach. Maintaining a health stand of grasses on slopes and embankments and preventing the grown of deep rooted (trees and shrubs) vegetation on embankment areas are important. Animal burrows can also cause deterioration to embankments. Animal burrows should be filled in as soon as they are discovered. In some cases animal control may be needed to avoid excessive burrows. Outlet structures are particularly vulnerable to undercutting and erosion. A small problem, if it is not corrected, may quickly result in the need to replace an entire structure. Consult a professional engineer if sink holes, cracking, wet areas around the outlet pipe, pipe displacement, or rusting of the pipe is observed.

- Debris and Litter Control
  Regular debris and litter removal will reduce the chance of clogging outlet structures, prevent damage to vegetated areas, reduce mosquito breeding habitats, improve site appearance, and reduce conditions for excessive algae growth.

- Mechanical Components
  Some stormwater management facilities have mechanical components including valves, sluice gates, anti-vortex devices, fence gates, locks, and access hatches that require periodic maintenance.

- Insect Control
  The simplest way to control insects, particularly mosquitoes, is to avoid stagnant water. Most stormwater management facilities are designed to be dry within a short time after a rain event. If an insect problem develops in a detention basin or

infiltration facility, then there is a maintenance issue that needs to be corrected. In stormwater management facilities, such as retention basins, that are designed to have a permanent pool of water insects may be controlled by the prompt removal of floatable debris and perhaps by introducing and maintaining a fish population.

- Access Road and Area Maintenance
  Most stormwater management facilities are designed to be accessible by heavy machinery for maintenance and repairs. Access should be maintained by periodic removal of woody vegetation and upkeep of gravel areas.

- Sediment and Pollutant Removal
  The primary purpose of many stormwater management facilities is the removal of sediments and nutrients (which are often attached to sediments). Sediment will naturally accumulate in a stormwater management facilities and must be periodically removed. The frequency of sediment removal will vary widely depending on the stormwater management facility's type and character of the contributing watershed. Removed sediments and pollutants should be properly disposed of in an upland area. They should be stabilized with vegetation so that they are not eroded by rainfall. Once sediment is removed, the stormwater management facility should be quickly restabilized, usually with vegetation. If maintenance operations disturb more than 5,000 square feet, an erosion and sediment control permit will be required before commencing work. Sediment and pollutant removal will usually take heavy equipment and is beyond the capabilities of most property owners without the assistance of appropriate contractors.

- Component Repair or Replacement
  Eventually, like all infrastructure, stormwater management facilities' components will need to be repaired or replaced. Components may include inflow and outflow devices, trash racks and anti-vortex devices, valves, orifices, pipes, concrete structures, filter or infiltration media, earthworks such as embankments and side slopes

Following completion of construction, routine maintenance shall be performed on stormwater management facilities as required and as specified in the Maintenance Agreement.

If the County becomes aware that a stormwater management facility has not been adequately maintained, is not functioning properly, or has becomes a danger to public safety, public health, or the environment, the responsible party will be notified in writing. The responsible party shall then be required to address the deficiency issue within a reasonable time as identified in the written notice. Failure to address the deficiency issue may result in enforcement actions.

14.3.1 Earthen Embankments

Earthen embankments are an integral part of many BMPs including detention and retention basins and constructed wetlands. For Earthen Embankments maintenance guidance, see Table 14.1.

Table 14.1
Earthen Embankments Maintenance

Required Action	Maintenance Objective	Frequency of Action
Inspections	Inspect earthen embankments for signs of settlement, seepage, woody vegetation growth, animal burrows, and good ground cover.	Annually
Vegetation Management	Objective is to maintain a healthy grass cover free of trees and brush • Mow grass on embankments to a height of 6 to 8 inches. • Remove all trees and brush from embankment and at least 25' beyond embankment. When removing trees and brush, extract as much of the root as possible. • Fertilize, lime, or treat with pesticide or herbicide when needed to maintain grass health (do not over fertilize). • Reseed embankments as necessary to maintain vegetation. • Avoid over-fertilization.	Mow grass on embankments at least twice during both growing seasons and once during the summer.
Slope, Embankment, and Outlet Stabilization	• Fill animal burrows with compacted fill. • Regrade, repair, and revegetate eroded embankments. • If there are signs of seepage or embankment slumps consult with a professional engineer.	As needed based on damage observed during routine maintenance or inspections
Debris and Litter Control	Keep the embankment clear of debris and litter	During inspections or mowing
Mechanical Components	Not applicable	Not applicable
Insect Control	Not applicable	Not applicable
Access Road and Area Maintenance	Remove woody plants and maintain surface in drivable condition	Annually
Sediment and Pollutant Removal	Not applicable	Not applicable
Component Repair and Replacement	Replace embankments that have major erosion, seepage, or slumping problems. Consult with a professional engineer.	Infrequent

14.3.2 Principal Spillways

Principal Spillways are an integral part of many BMPs including detention and retention basins and constructed wetlands. Principal spillways normally consist of an outlet structure, pipe through an embankment, and outlet discharging to a downstream open channel. For guidance for the maintenance of Principal Spillways, see Table 14.2.

Table 14.2
Principal Spillways Maintenance

Required Action	Maintenance Objective	Frequency of Action
Inspections	Inspect outlet structure for signs of cracks, spalling, broken or loose sections, or leakage, and corrosion or damage to anti-vortex device or trash rack; inspect pipe for signs of corrosion or settling; inspect outlet protection for signs of erosion or damage.	Semiannually and after every major storm event inspect the outlet structure, pipe, and outlet protection.
Vegetation Management	Not applicable	Not applicable
Slope, Embankment, and Outlet Stabilization	Repair any erosion damage to outlet protection.	As needed based on damage observed during routine inspections
Debris and Litter Control	Keep outlet structure clear of debris. Remove debris from the BMP and properly dispose of in an upland area.	Semiannually and after major rain events as a minimum. Debris removal may be more frequent.
Mechanical Components	If a drain valve is present, exercise the valve semiannually to insure proper function. Periodically lubricate the stem and paint exposed metal to protect from corrosion.	As noted
Insect Control	Not applicable	Not applicable
Access Road and Area Maintenance	Remove woody plants and maintain surface in drivable condition	Annually
Sediment and Pollutant Removal	Not applicable	Not applicable
Component Repair and Replacement	Repair or replace outlet structure components to correct leakage, cracks, spalling, broken or loose sections, or corrosion. Repair or replace pipe to correct settlement, leakage, or corrosion. Repair or replace outlet protection to correct erosion damage. Take care to avoid changing the BMP discharge characteristics and to avoid damage to the embankment. Repairs and replacements may require consulting a professional engineer.	Infrequently

14.3.3 Emergency Spillway

Emergency Spillways are an integral part of many BMPs including detention and retention basins and constructed wetlands. Emergency spillways normally consist of an open channel, usually trapezoidal in cross-section, which are constructed beside an embankment to carry stormwater discharge from the BMP that is too great to be carried by the principal spillway. Emergency spillways should only discharge stormwater very infrequently Emergency spillways are most often vegetated (grassed), but may be protected against erosion by rip rap or concrete. For Emergency Spillways maintenance guidance, see Table 14.3.

Table 14.3
Spillway Maintenance

Required Action	Maintenance Objective	Frequency of Action
Inspections		Annually, and after any rain event that results in flow through the emergency spillway.
Vegetation Management	For a vegetated spillway the objective is to maintain a healthy grass cover free of trees and brush • Mow grass to a height of 6 to 8 inches. • Remove all trees and brush from spillway. When removing trees and brush, extract as much of the root as possible. • Fertilize, lime, or treat with pesticide or herbicide when needed to maintain grass health (do not over fertilize). • Reseed spillway as necessary to maintain vegetation. Avoid over-fertilization.	Mow grass at least twice during both growing seasons and once during the summer.
Slope, Embankment, and Outlet Stabilization	Repair any damage to outlet.	As needed based on damage observed during routine inspections
Debris and Litter Control	Keep the emergency spillway clear of debris and litter.	During inspections or mowing
Mechanical Components	Not applicable	Not applicable.
Insect Control	Not applicable	Not applicable
Access Road and Area Maintenance	Remove woody plants and maintain surface in drivable condition	Annually
Sediment and Pollutant Removal	Not applicable	Not applicable
Component Repair and Replacement	Repair slopes and protective linings as needed.	Infrequently

14.3.4 Sediment Forebay

A sediment forebay is used as a pretreatment device to allow sediment to settle from the incoming stormwater runoff before it enters the balance of the BMP. A sediment forebay helps to isolate the sediment deposition in an accessible area, which facilitates BMP maintenance.

For Sediment Forebay maintenance guidance, see Table 14.4.

Table 14.4
Sediment Forebay Maintenance

Required Action	Maintenance Objective	Frequency of Action
Inspections	Observe depth of sediment deposition	Annually
Vegetation Management	Not applicable	Not applicable
Slope, Embankment, and Outlet Stabilization	Not applicable	Not applicable
Debris and Litter Control	Remove debris and litter that accumulates in the sediment forebay	During inspections or as needed intermittently
Mechanical Components	Not applicable	Not applicable
Insect Control	Not applicable	Not applicable
Access Road and Area Maintenance	Remove woody plants and maintain surface in drivable condition	Annually
Sediment and Pollutant Removal	Remove accumulated sediment. Dispose of sediments in an upland area and stabilize with vegetation. If necessary, obtain erosion and sediment control permit, prior to performing land disturbance.	Generally every 3 – 5 years or when 6 – 12 inches of sediment has accumulated.
Component Repair and Replacement	Not applicable	Not applicable

14.3.5 Landscaping

Landscaping is an integral part of many BMP's. It is important that the landscaping thrive in order for it to fully function for pollutant uptake and ground stabilization.

For Landscaping maintenance guidance, see Table 14.5.

Table 14.5
Landscaping Maintenance

Required Action	Maintenance Objective	Frequency of Action
Inspections	Observe landscaping growing conditions. If landscaping is not thriving, correct conditions by applying fertilization, pesticide, herbicide, or soil amendment.	Monthly during the first growing season. Annually, in the fall, thereafter.
Vegetation Management	Each site shall have a site specific landscape maintenance schedule, depending on the species used, that includes guidance regarding methods, frequency, and time of year for landscape maintenance and fertilization.	Varies. Different plant communities will require different levels of maintenance.
Slope, Embankment, and Outlet Stabilization	Not applicable	Not applicable
Debris and Litter Control	Remove debris and litter.	During inspections or as needed intermittently during vegetation management.
Mechanical Components	Not applicable	Not applicable
Insect Control	Not applicable	Not applicable
Access Road and Area Maintenance	Not applicable	Not applicable
Sediment and Pollutant Removal	Not applicable	Not applicable
Component Repair and Replacement	Provide reinforcement planting after the first growing season, if necessary. Thereafter, replace landscaping that dies or fails to thrive.	As needed based on observation during inspections

14.3.6 Stormwater Detention and Retention Basins

For the design of basins see VA BMP Clearinghouse specifications.

For maintenance guidance of stormwater basins, refer to the maintenance guidance for Earthen Embankments, Principal Spillways, Emergency Spillways, Sediment Forebay, and Landscaping contained in this chapter.

For additional maintenance guidance for basins, see Table 14.6.

Table 14.6
Basins Maintenance (1)

Required Action	Maintenance Objective	Frequency of Action
Inspections	(1)	(1)
Vegetation Management	(1)	(1)
Slope, Embankment, and Outlet Stabilization	(1)	(1)
Debris and Litter Control	Keep the embankment clear of debris and litter	During inspections or mowing
Mechanical Components	(1)	(1)
Insect Control	(1)	(1)
Access Road and Area Maintenance	(1)	(1)
Sediment and Pollutant Removal	(1), also remove accumulated sediment from basin area. Dispose of sediments in an upland area and stabilize with vegetation. If necessary, obtain erosion and sediment control permit, prior to performing land disturbance.	(1), Depending on the effectiveness of the sediment forebay and the condition of the watershed, sediment removal from the basin may be required every 5 – 10 years.
Component Repair and Replacement	(1)	(1)

(1) Refer to the maintenance guidelines for Earthen Embankments, Principal Spillways, Emergency Spillways, Sediment Forebay, and Landscaping contained in this chapter.

14.3.7 Constructed Wetlands

For use of constructed wetlands as a BMP, see VA BMP Clearinghouse specifications.. For constructed wetlands maintenance guidance, refer to the maintenance guidance for Earthen Embankments, Principal Spillways, Emergency Spillways, Sediment Forebay, and Landscaping contained in this chapter.

For additional maintenance guidance for constructed wetlands, see Table 14.7.

Table 14.7
Constructed Wetlands(1)

Required Action	Maintenance Objective	Frequency of Action
Inspections	(1), Document plant species distribution and fatality rates and verify compliance with landscaping requirements; document sediment accumulations, water elevations, and condition of the outlet.	(1), Inspect at least semiannually for the first 3-years.
Vegetation Management	(1)	(1)
Slope, Embankment, and Outlet Stabilization	(1)	(1)
Debris and Litter Control	Keep the embankment clear of debris and litter	During inspections or as needed intermittently
Mechanical Components	(1)	(1)
Insect Control	(1)	(1)
Access Road and Area Maintenance	(1)	(1)
Sediment and Pollutant Removal	(1), As necessary, remove accumulated sediment from constructed wetland area and re-establish vegetation. Dispose of sediments in an upland area and stabilize with vegetation. If necessary, obtain erosion and sediment control permit, prior to performing land disturbance.	(1), Depending on the effectiveness of the sediment forebay and the condition of the watershed, sediment removal from the constructed wetland may be required infrequently (every 10 years or less frequent).
Component Repair and Replacement	(1)	(1)

(1) Refer to the maintenance guidelines for Earthen Embankments, Principal Spillways, Emergency Spillways, Sediment Forebay, and Landscaping contained in this chapter.

14.3.8 Infiltration Practices

For the design of infiltration basins and infiltration trenches as BMPs see VA BMP Clearinghouse specifications.

14.3.8.1 Infiltration Basin

For Infiltration Basin maintenance guidance, refer to the maintenance guidance for Earthen Embankments, Principal Spillways, Emergency Spillways, Sediment Forebay, and Landscaping contained in this chapter. For additional maintenance guidance for infiltration basins, see Table 14.8A.

Table 14.8A
Infiltration Basin Maintenance (1)

Required Action	Maintenance Objective	Frequency of Action
Inspections	(1), Inspect basin to ensure that the basin functions as designed. Examine infiltration basin and outlet for clogging. Inspect for erosion, slumping, excessive sedimentation levels and vegetation overgrowth.	(1), Monthly for the first 6-months; and thereafter semiannually and after major rain events.
Vegetation Management	(1)	(1)
Slope, Embankment, and Outlet Stabilization	(1)	(1)
Debris and Litter Control	Keep the buffer area clean to reduce litter and floatables minimizing the clogging of the infiltration basin.	During inspections or mowing
Mechanical Components	Ensure no standing water remains in basin after storm events. Standing water indicates infiltration is clogged.	Repair as needed based on observation during semiannual inspection.
Insect Control	Remove accumulated sediment in basin and restore filtration area. If standing water is present during dry weather, the infiltration basin has become clogged.	Remove sediment accumulation every 2 years or when infiltration basin has standing water.
Access Road and Area Maintenance	(1)	(1)
Sediment and Pollutant Removal	Sediment shall be removed and disposed in an upland area and stabilized with vegetation when sediment fills the sediment reserve capacity, or when the basin loses its infiltration capacity. If necessary, obtain erosion and sediment control permit, prior to performing land disturbance. Avoid compacting the floor of the infiltration basin.	Depending on the effectiveness of the sediment forebay and the condition of the watershed, sediment removal may be required infrequently (every 10 years or less frequent).
Component Repair and Replacement	(1)	(1)

(1) Refer to the maintenance guidelines for Earthen Embankments, Principal Spillways, Emergency Spillways, Sediment Forebay, and Landscaping contained in this chapter.

14.3.8.2 Infiltration Trench

For maintenance requirements of infiltration trenches, see Table 14.8B.

Table 14.8B
Infiltration Trench Maintenance

Required Action	Maintenance Objective	Frequency of Action
Inspections	Inspect infiltration trenches to ensure that the BMP continues to function as initially intended. Examine for clogging of infiltration trench. Document depth of water in observation well or assessable pretreatment device to assess dewater capacity of the facility.	Quarterly inspection for the first year, and semiannual inspection thereafter
Vegetation Management	Buffer strips shall be mowed to 4 to 6 inches to limit unwanted vegetation. Trees shall be pruned such that the drip line does not extend over the surface trench. All trees shall be removed within the trench to prevent the puncture of filter fabric.	Cut grass twice during both growing seasons and once during the summer. Prune overhanging trees annually.
Slope, Embankment, and Outlet Stabilization	Regrade, repair, and revegetate eroded and slumped buffer strips.	As needed based on damage observed during inspections.
Debris and Litter Control	Keep the buffer area clean to reduce litter and floatables minimizing the clogging of the infiltration trench.	During inspections or mowing
Mechanical Components	Not applicable.	Not applicable
Insect Control	Not applicable	Not applicable
Access Road and Area Maintenance	Remove woody plants and maintain surface in drivable condition	Annually
Sediment and Pollutant Removal	Remove accumulated sediment in infiltration trench and restore filtration area.	Every 2 years or when sediment causes infiltration trench to have standing water.
Component Repair and Replacement	Remove and replace top 6”-12” gravel and filter cloth sediment barrier.	As needed based on observation during inspections.

14.3.8.3 Porous Pavement

For the design of porous pavement as a BMP see VA BMP Clearinghouse specifications.

For maintenance requirements of porous pavement, see Table 14.8.C.

Table 14.8.C
Porous Pavement Maintenance

Required Action	Maintenance Objective	Frequency of Action
Inspections	Inspect pavement to ensure proper structural operation, and that the permeable aspect of the pavement has not become clogged with debris. Measure water depth in storage layer	Quarterly, and after every major rain events, until performance characteristics of the structure has been verified; thereafter, annually
Vegetation Management	Not applicable	Not applicable
Slope, Embankment, and Outlet Stabilization	Not applicable	Not applicable
Debris and Litter Control	Vacuum clean pavement surface, followed by high pressure water washing. Do not use sand or other abrasives during winter weather as they will clog the surface.	Monthly
Mechanical Components	Not applicable	Not applicable
Insect Control	Not applicable	Not applicable
Access Road and Area Maintenance	Not applicable	Not applicable
Sediment and Pollutant Removal	Not applicable	Not applicable
Component Repair and Replacement	No repair is possible. If pavement becomes clogged, complete replacement is required.	Depends on frequency and thoroughness of pavement cleaning

14.3.9 Bioretention Filter

See VA BMP Clearinghouse specifications for the design of bioretention filters as BMPs. For maintenance guidance for bioretention filters, see Table 14.9.

Table 14.9
Bioretention Filter Maintenance

Required Action	Maintenance Objective	Frequency of Action
Inspections	Inspect filter to ensure that it continues to function as initially intended. Observe sedimentation, standing water, and vegetation.	Semiannually
Vegetation Management	Provide adequate fertilization, pruning, and other care for landscaping.	Varies depending on plant species
Slope, Embankment, and Outlet Stabilization	Not applicable	Not applicable
Debris and Litter Control	Remove debris and litter.	During inspections
Mechanical Components	Not applicable	Not applicable
Insect Control	Not applicable	Not applicable
Access Road and Area Maintenance	Not applicable	Not applicable
Sediment and Pollutant Removal	Remove accumulated sediments and dispose of them in an upland location and stabilize with vegetation.	Annually
Component Repair and Replacement	Replace mulch layer. On an as needed basis replace the planting soil and vegetation to restore infiltration capacity to the underdrain.	Every 2 years for routine mulch replacement. Every 5 years for planting soil replacement.

14.3.10 Sand Filters

See VA BMP Clearinghouse specifications for the design of sand filters. For maintenance guidance for sand filters, see Table 14.10.

Table 14.10
Sand Filter Maintenance

Required Action	Maintenance Objective	Frequency of Action
Inspections	Monitor and document water level in filter chamber and rate of dewatering after storm events.	Quarterly and after each major rain event for the first year, semiannually and after each major rain event thereafter.
Vegetation Management	Not applicable	Not applicable
Slope, Embankment, and Outlet Stabilization	Not applicable	Not applicable
Debris and Litter Control	Not applicable	Not applicable
Mechanical Components	Not applicable	Note applicable
Insect Control	Not applicable	Not applicable
Access Road and Area Maintenance	Remove woody plants and maintain surface in drivable condition	Annually
Sediment and Pollutant Removal	Pump out sedimentation chamber. If water has an oil skim, it should be removed by a firm specializing in oil recovery and recycling. Remove sediments and dispose of them properly in an appropriate landfill. Refill the first chamber with water to restore the water seal.	Semiannually (midway between semiannual inspection events)
Component Repair and Replacement	Remove and replace filter cloth and ballast gravel to restore filtering capacity when filter will no longer draw down within 40-hours.	Varies depending on the efficiency of the pretreatment device

14.3.11 Grassed Swale

See VA BMP Clearinghouse specifications for use of grassed swales as a BMP. For grassed swale maintenance guidance, see Table 14.11.

Table 14.11
Grassed Swale Maintenance

Required Action	Maintenance Objective	Frequency of Action
Inspections	Check for uniformity of vegetative cover or for structural repair needed for concrete linings. Check for sediment and debris accumulation and for erosion problems or bank sloughing.	• Weekly, until vegetation is established. • Thereafter, semi-annually. • In addition, inspect grassed swale for damage after major rain events.
Vegetation Management	Objective is to maintain a healthy uniform vegetative growth: Use proper mowing techniques. • Mow grass to a height of 6 inches. • Collect and remove grass clippings. • Periodic weeding of invasive species and weeds. • Fertilize or treat with pesticide or herbicide when needed to maintain plant health (do not over fertilize). • Reseed and mulch any bare areas.	Mow grass periodically. Reseed as necessary.
Slope, Embankment, and Outlet Stabilization	Regrade, repair, and revegetate eroded and slumped areas. Repair channel lining, outlet protection and rip rap where required.	As needed based on damage observed.
Debris and Litter Control	Keep the channel clean to reduce litter and floatables being washed downstream.	During inspections or mowing
Mechanical Components	Not applicable	Not applicable
Insect Control	Not applicable	Not applicable
Access Road and Area Maintenance	Not applicable	Not applicable
Sediment and Pollutant Removal	Remove accumulated sediment in channels, behind check dams, and at outfalls and culverts to maintain flow capacity and drainage. Repair any damage that occurs during sediment removal.	Depends on site conditions perform annually at a minimum.
Component Repair and Replacement	Repair or replace check dams to maintain temporary ponding and to maintain filtered flow through check dams.	Annually or as needed

14.3.12 Vegetated Filter Strip

See VA BMP Clearinghouse specifications for use of vegetated filter strips as a BMP. For vegetated filter strip maintenance requirements, see Table 14.12.

Table 14.12
Vegetated Filter Strip

Required Action	Maintenance Objective	Frequency of Action
Inspections	Check the vegetation for uniformity of cover, sediment and debris accumulation, and erosion. Check for proper operation of level spreader, if present.	• Weekly, until vegetation is established. • Thereafter, semi-annually. • In addition, inspect filter strip for damage after major rain events.
Vegetation Management	Objective is to maintain a healthy uniform vegetative growth: • If the area is maintained as lawn use proper mowing techniques. Collect and remove grass clippings. • Periodic weeding of invasive species and weeds. • Periodic pruning of woody vegetation to stimulate grown. • Fertilize, lime, or treat with pesticide or herbicide when needed to maintain plant health (do not over fertilize).	As dictated by conditions.
Slope, Embankment, and Outlet Stabilization	Regrade, repair, and revegetate eroded ground surface.	As needed based on damage observed during inspection
Debris and Litter Control	Keep the vegetated strip clean to reduce litter and floatables being washed downstream.	During inspections or mowing
Mechanical Components	Not Applicable.	Not Applicable.
Insect Control	Not Applicable.	Not Applicable
Access Road and Area Maintenance	Not Applicable.	Not Applicable
Sediment and Pollutant Removal	Remove accumulated sediment and reestablish vigorous vegetation cover. Dispose of sediments in an upland area and stabilize with vegetation. If necessary, obtain erosion and sediment control permit, prior to performing land disturbance.	Depends on site conditions perform annually at a minimum.
Component Repair and Replacement	If level spreader is used, replace rigid lip when necessary.	Infrequently

14.3.13 Manufactured BMP Systems

Several manufacturers have developed filter and screening devices which are gaining acceptability from the regulators as suitable BMPs for meeting stormwater quality requirements. These devices filter debris and sediment and other pollutants, such as metals and hydrocarbons from stormwater.

Specific maintenance requirements for manufactured BMPs shall be in accordance with the manufacturer's specifications and warranty requirements. **Provide the Manufacturer's specified guidelines for maintenance activities.** See Table 14.13 for general maintenance guidance.

Table 14.13
Manufactured BMP Maintenance

Required Action	Maintenance Objective	Frequency of Action
Inspections	Inspect structure and inlets and outlets to ensure structural integrity and proper functioning of the facility.	Semiannual or as specified by the manufacturer.
Vegetation Management	Not applicable	Not applicable
Slope, Embankment, and Outlet Stabilization	Not applicable	Not applicable
Debris and Litter Control	Remove debris and litter that interferes with proper operation.	As needed based on impacts observed during semiannual inspection.
Mechanical Components	Provide routine maintenance to valves, sluice gates, pumps or other mechanical devices per manufacturer's instructions.	Per manufacturer's instructions.
Insect Control	Not applicable	Not applicable
Access Road and Area Maintenance	Not applicable	Not applicable
Sediment and Pollutant Removal	Clean manufactured screen or filter vault of debris, litter and floatable materials. Remove any sediment and pollutant build-up from the vault.	Annually or as required.
Component Repair and Replacement	Repair or replace tank or vault structure if leaks or cracks develop. Replace filtering media when necessary for proper functioning.	As recommended by the manufacturer and as needed.

14.3.14 Conservation Areas

Conservation areas are naturally vegetated areas used to provide a measure of stormwater quality control as open space or forested areas. Conservation Areas should be maintained in their natural condition or can be planted to meet the VA BMP Clearinghouse specifications. Conservation areas require an easement.

For Conservation Areas maintenance guidance, see Table 14.14.

Table 14.14 Conservation Areas Maintenance

Required Action	Maintenance Objective	Frequency of Action
Inspections	Check the vegetation for uniformity of cover and growth, sediment and debris accumulation, and erosion.	• Quarterly, until vegetation is established. • Thereafter, annually. • In addition, inspect area for damage after major storm events.
Vegetation Management	(1) Weed control to promote survival and rapid growth of trees and shrubs.	If establishing new vegetation, continuous over first two years until vegetation is established. Vegetation shall be undisturbed after it has become established.
Slope, Embankment, and Outlet Stabilization	(2) Regrade, repair, and revegetate eroded and slumped banks.	As needed, based on damage observed during inspections.
Debris and Litter Control	Keep the area clean to reduce litter and floatables being washed downstream.	Annually, and after major storm events, clean debris and litter which has accumulated.
Mechanical Components	Not Applicable	Not applicable
Insect Control	Normally not applicable.	Normally not applicable.
Access Road and Area Maintenance	Normally not applicable.	Normally not applicable.
Sediment and Pollutant Removal	Normally not applicable. If heavy accumulations of sediment occur, then either remove sediment accumulation or stabilize sediment accumulation in place with top soil and additional vegetation plantings.	Infrequent
Component Repair and Replacement	Normally not applicable. If major areas lose trees due to fire, disease, or other cause, then replanting may be needed.	Rare

(1) Note that most herbicides are very toxic to aquatic organisms. Follow listed instructions and never allow spray to enter waterways.

(2) If maintenance work is required along the banks of jurisdictional streams or in wetlands, a permit may be required from the U.S. Army Corps of Engineers and the Virginia Department of Environmental Quality.

14.3.15 Underground Detention Facilities

Underground detention facilities are facilities that provide detention in underground pipes or chambers.

For underground detention maintenance guidance, see Table 14.15.

Table 14.15
Underground Detention Maintenance

Required Action	Maintenance Objective	Frequency of Action
Inspections	Inspect condition of storage facility, outlet structure, and presence of sediment and debris.	Semiannually
Vegetation Management	Not applicable	Not applicable
Slope, Embankment, and Outlet Stabilization	Not applicable	Not applicable
Debris and Litter Control	Remove debris and litter.	As needed based on observations during semiannual inspection.
Mechanical Components	Not applicable	Not applicable
Insect Control	Not applicable	Not applicable
Access Road and Area Maintenance	Not applicable	Not applicable
Sediment and Pollutant Removal	Remove accumulated sediments and dispose of them in an upland location and stabilize with vegetation.	Varies, depending on the effectiveness of the pretreatment device.
Component Repair and Replacement	Replace failed pipe, storage chambers, or other components.	Rare

14.4 Additional Maintenance and Repairs

The routine maintenance items listed in the Maintenance Agreement are the minimum measures. If actual conditions demonstrate that additional maintenance or repairs are necessary for proper functioning of the stormwater management systems, they shall be provided by the responsible party.

14.5 Inspection and Maintenance Records

The responsible party or property owner shall maintain records of stormwater management facilities' inspections and maintenance activities, and submit copies to the County, when requested.

14.6 References

The VA SWM Handbook and VA BMP Clearinghouse website contain information on maintenance of all VA DEQ approved nonproprietary BMPs.

APPENDIX 14A

MAINTENANCE AGREEMENTS

Stormwater Management/BMP Facilities – Sample Maintenance Agreement can be found at http://www.roanokecountyva.gov/index.aspx?NID=331

Maintenance Agreements shall be submitted to:

Department of Community Development
Roanoke County Administration Center
5204 Bernard Drive
P.O. Box 29800
Roanoke, VA 24018-0798

Procedures for submitting agreements:

- Type all information on the agreement form.
- Authorized property owner must sign form in black ink.
- Signature must be properly notarized (black ink).
- Attach a check for the recordation fee.
- The Department of Community Development will coordinate the County Attorney and County Executive signatures, and recordation.
- Maintenance agreements are required to be submitted, approved, and executed prior to the pre-construction meeting.