Village of Germantown
Stormwater Maintenance Manual for Private Facilities

March 2011 Edition

Acknowledgment:

This manual is an adaptation from the
Pierce County Stormwater Maintenance Manual for Private Facilities
provided by Pierce County WA.

SECTION PAGE

1.0 Introduction: Maintaining Your Stormwater Facilites

The intent of this stormwater maintenance manual is to assist private stormwater management system owners in performing proper maintenance of these facilities.

Stormwater management facilities consist of a series of collection and conveyance systems, detention systems, and treatment facilities. They are typically a combination of landscape and structural components that slow, filter, detain, or infiltrate stormwater runoff on-site after a rainfall event. Properly designed, installed and maintained stormwater management facilities protect water quality and reduce flooding.

Village of Germantown Code Chapter 27.11 Maintenance Declaration states that private property owners are responsible for maintaining stormwater management structures that they own. Owners should have a maintenance program that addresses every component of the stormwater system, to ensure the system does not lose its intended capability to manage stormwater. Village of Germantown's Chapter 27 and "Stormwater Management Requirements" require that owners of private stormwater management facilities applying for development after the effective date of the Stormwater Manual conduct routine and non-routine inspection and maintenance of their stormwater system and prepare an annual inspection report to be kept onsite with a copy submitted to the Village of Germantown annually.

Property owners with private systems constructed prior to the effective date of the *Stormwater Manual* are also required to maintain their stormwater facilities. Inspection reports shall be kept onsite with a copy submitted to the Village annually.

1.1 How to Apply this Manual

Private owners should review this manual for understanding of the general function of their stormwater management facilities. After determining the type of facilities associated with the owner's site, the owner should download or copy the checklists for each facility and utilize them in facility inspection and maintenance.

It is important to note that there may be more than one facility associated with an individual site. For example, your site may include catch basins, a detention pond, and a control structure/flow restrictor. In this case, all three checklists should be utilized for inspection and maintenance.

1.2 Why Manage Stormwater Runoff?

When it rains or snows in urban areas, the stormwater runs off impervious surfaces (such as roofs and paved areas) instead of soaking into the ground. In the past, stormwater runoff has mainly been directed into drains and pipes that carry it off-site for eventual discharge into a river or stream.

The past approach to stormwater management has a number of harmful effects:

- Impervious areas and residential lawns generate large volumes of runoff relatively quickly. The increased volume and rate of runoff can cause flooding and erosion of natural waterways, damage to roads and other manmade structures, and destroy natural wildlife habitat.
- The stormwater runoff picks up oil, pesticides, metals, chemicals, sediment, and other pollutants that harm water quality and fish habitat.
- During warm weather, the runoff absorbs heat from the impervious surfaces. This increases the temperature of the receiving waters, with negative impacts on fish and other aquatic life.
- Less water is able to infiltrate into the ground. This reduces groundwater recharge which reduces summer base flow in streams.

The current approach to stormwater management is for facilities to be designed to help mitigate for these negative effects of stormwater runoff by a combination of reducing/eliminating runoff, treatment of runoff, and/or retention/detention of runoff with a metered release through actions called “Best Management Practices”.

1.3 Frequently Asked Questions

1. **Q.** What are Best Management Practices (BMPs)?

   A. BMPs are a series of actions that are designed to reduce stormwater pollution, prevent discharging contaminants to natural water bodies and reduce stormwater facility maintenance costs. These actions can take several different forms. Examples of these are:

   Behavioral--For example, sweeping a driveway instead of hosing it into the storm drain.

   Procedural--Such as implementing an inventory control program for hydraulic oil or other lubricants to identify changes in consumption. This type of program can be used to identify maintenance problems, and save the business owner money on equipment down-time and lubricant costs.

   Structural--Such as building a roof over a production area, or installing an oil/water separator.

   In general, behavioral and procedural type BMPs will cost the least to implement initially and may save money over time. Structural BMPs typically cost more to construct, operate, and maintain.

   BMPs are separated into two broad categories, namely *source control* and *treatment BMPs*. As the name implies, source control BMPs prevent contaminants from entering stormwater runoff by controlling them at the source. Treatment BMPs are utilized to treat stormwater that is already contaminated. Most treatment BMPs require planning, designing, permitting, and construction, and none can remove 100% of the contaminants in stormwater. These factors, added to the typical expense of treatment BMPs, makes source control BMPs the preferred choice.

2. **Q.** There is a ditch in front of my home. Who is responsible for maintaining it?

   A. If you are in a private development with private streets: you and your neighbors will have to maintain the drainage. If you are on a street/road with public right-of-way: contact the Public Works Department at (262)250-4721.

3. **Q**. What methods should we use to control unwanted pests and vegetation?

A. Village of Germantown encourages the use of an Integrated Pest Management (IPM) approach to control unwanted pests. Pests are any plant or animal life that adversely interferes with the function, safety, and aesthetics of the stormwater facility. IPM is a coordinated decision-making and action process that uses the most appropriate control methods and strategy in an environmentally and economically sound manner.

The IPM approach emphasizes physical, mechanical, cultural, and biological tactics to keep pests and vegetation problems low enough to limit or eliminate the use of chemical control. The major elements of IPM include:

- Preventing pest problems;
- Monitoring for the presence of pests and pest damage;
- Establishing a level of pest population that can be tolerated without being detrimental to the stormwater facilities' functions or aesthetics of the facility.
- Treating pest problems to reduce populations below those established levels by using the most environmentally-sensitive and safe method to control the pest; and
- Evaluating the effects and effectiveness of the pest treatment.

Monitoring of pest populations is key to successful IPM implementation. Pest problems are easier to control if the problem is discovered early. With IPM, pesticides are used only as a last resort in order to protect water quality and human health.

More information on IPM is available from the Environmental Protection Agency (EPA) at www.epa.gov/opp00001/factsheets/ipm.htm .

4. **Q.** There is tall grass and debris in the pond/creek near my house. Who takes care of this?

A. Publicly-owned stormwater drainage ponds and some drainage ways are maintained by the Village of Germantown. Call the Department of Public Works at (262) 250-4721 to report your concern. Your call will be routed to a member of our maintenance team for inspection and the scheduling of a work crew if needed. Privately-owned storm drain systems must be maintained by the property owner or homeowner's association.

5. **Q.** What plants should we avoid planting?

A. Non-native, invasive plants are prohibited per Wisconsin DNR codes. Early detection and control of these plants are important to prevent future maintenance problems and increased maintenance costs. Some native plants can increase maintenance costs due to leaf fall into BMPs causing clogging problems.

6. **Q.** How can we make the stormwater facility more attractive?

   A. Village of Germantown recommends native plants be used around stormwater facilities. Native plants require less water once they are established, resist pests and diseases better, require less fertilizer and pesticides, and provide wildlife habitat.

   Plants differ in their ability to cope with different soils, moisture levels, and sun exposure. When planting next to the stormwater facility, consider future maintenance requirements such as grass mowing and watering requirements. Avoid planting deciduous trees and shrubs adjacent to the facility as their falling leaves may cause blocking problems and their roots may provide a way for water to leak through berms. Avoid plants with invasive root systems, such as willows, and plants that can blow over easily.

   To reduce maintenance costs and prevent future water flow problems, the planting shrubs or trees in stormwater ponds below the maximum designed water level is prohibited. Planting grass or low-growing, non-invasive, native plants within the facility may be appropriate but it should be done cautiously so as to not interfere with the functions of the facility. Promptly replant any bare soil areas that could contribute sediments to the stormwater system or cause erosion of the facility.

7. **Q.** We have a limited maintenance budget. What are the most important vegetation maintenance activities we should do?

   A. The inlets and outlets should be kept clear of vegetation and other potentially blocking material. The pond should not be allowed to become overgrown with noxious or invasive vegetation. Routine maintenance can help keep overall cost down by addressing problems before they require costly attention.

8. **Q.** Where do I find more information on the cost of stormwater maintenance?

   A. Estimates can be requested from qualified contractors and landscapers.

9. **Q.** Why can't I dump used motor oil and other wastes into the stormwater inlet on my street?

   A. Stormwater inlets lead to stormwater management systems that discharge to natural water bodies (e.g. lakes or stream) or to the groundwater. Excessive contaminants, such as motor oils dumped into the storm system, will create the need for more frequent maintenance and higher maintenance costs.

10. **Q.** I wash my own car, how can I be environmentally responsible?

A. The best option is to use a commercial car wash where the wash water is recycled and does not drain to the storm system. Improper disposal of wash water will increase the required maintenance frequency resulting in higher maintenance costs. The Village of Germantown Public Works Department provides literature at Village Hall for washing vehicles on private property.

11. **Q.** Can you make the flooding go away?

A. Not once the flooding has started, but we might be able to help keep it from flooding again. We use input from residents to figure out the best solution to flood problems and to prioritize which projects get constructed first. If a blocked catch basin, pipe, or ditch in the public system is the cause of your flooding, call the Public Works Department at (262) 250-4721.

12. **Q.** Where do I find information on the West Nile virus?

A. West Nile virus is a mosquito-borne virus that can cause encephalitis or meningitis in humans and animals. Preventing mosquito bites and reducing mosquito-breeding habitat around your home are the best ways to protect your family. You should empty containers that hold standing water, such as old tires, buckets, and planters. Also, change the water in your birdbaths, fountains, wading pools and animal troughs weekly, and clean out your rain gutters so that they drain properly. Poorly maintained private stormwater drainage facilities can increase breeding sites for mosquitoes in your community or property.

To report a sick or dead bird
Please call the West Nile Virus Hotline at 1-800-433-1610.
Additional information on West Nile Virus is available by going to the Wisconsin Department of Health Services website http://dhs.wisconsin.gov/data/index.htm and clicking on West Nile Virus under Topics A-Z. If after reporting the sick or dead bird to the West Nile Virus Hotline it is determined that the bird should be tested, please call the Washington County Health Department at 262-335-4462, press zero and ask to speak with an Environmental Health Specialist.

2.0 STORMWATER MANAGEMENT FACILITIES

To help understand stormwater facility maintenance requirements, it is useful to have a general knowledge of how they function. Some maintenance needs are common to all types of facilities, while others depend on the specific facility.

The four major components of stormwater management include stormwater runoff prevention, stormwater collection/conveyance, stormwater quantity control (detention/retention) and stormwater quality control (treatment). This section describes general stormwater management theories and goals. Specific stormwater facility descriptions and maintenance requirements are provided in Section 5.0.

2.1 Stormwater Runoff Prevention

Preventing stormwater runoff or "zero discharge" means implementing site improvements that result in no off-site runoff compared to pre-developed conditions. This is achieved by implementing low-impact development techniques and practices to achieve no increase in offsite runoff.

2.2 Stormwater Collection and Conveyance Systems

Collection and conveyance systems intercept and transport stormwater and typically consist of inlets that collect water and pipes and/or open channels (ditches). Stormwater conveyance systems are designed to provide capacity for a specific maximum flow rate. Typical failures include reduced capacity due to clogged surface grates and pipes. Plugging commonly occurs due to sediment and large debris washed from adjacent surfaces. Reduced conveyance system capacity results in localized flooding and possible property damage.

2.3 Stormwater Quantity Control (Detention/Retention)

The intent of stormwater quantity control facilities is to slow down stormwater flow discharged to the environment from developed sites. Impervious surfaces, such as roads, roofs, and lawns, accelerate the rate of stormwater runoff into natural streams which can create flooding. Stormwater quantity control facilities mitigate the increased runoff by providing temporary storage and controlling the release rate from the site to prevent flooding and erosion. Detention and retention facilities may be designed as ponds or underground facilities.

Detention facilities function by providing temporary storage of stormwater runoff to be released at a controlled rate. The intent of the detention facility is to match mandated Milwaukee Metropolitan Sewerage District (MMSD) runoff rate restrictions for several specific storm events in the developed condition.

Retention facilities are typically located in areas where water soaks easily into the ground. Retention facilities provided temporary storage while allowing the water to soak into the ground, mimicking natural conditions. There is typically no release of stormwater to other pipes or water bodies.

2.4 Stormwater Quality Control (Treatment)

There are a several Best Management Practices (BMPs) utilized for stormwater quality control. These systems provide stormwater treatment through a combination of filtration, sediment settling, plant nutrient uptake, and physical separation. The most common treatment systems include biofiltration swales, filter strips, wetponds, and occasionally sandfilters. There are also some proprietary structural treatment systems including Stormfilters®, Stormceptors®, oil/water separators, and Vortech® treatment units. The intent of all stormwater treatment facilities is to remove oils, chemicals, metals, and sediment from stormwater runoff prior to being discharged to ground or surface waters.

Stormwater treatment facilities have a limited pollutant removal capability and are not intended to replace proper site management. The most effective technique for reducing pollutant discharge from the site is to provide good housekeeping through source control Best Management Practices (BMPs) as provided through a Stormwater Pollution Prevention Plan (SWPPP), model available at http://dnr.wi.gov/runoff/pdf/stormwater/sampleSWPPP.pdf .

3.0 Vegetation Management

General Goals and Philosophy

Village of Germantown recognizes the special importance of rivers, streams, wetlands, ponds, and stormwater control and treatment facilities. The sensitive nature of such habitats, their plant and animal communities, and their direct link with other waterways require that we establish specific policies to ensure their health.

All landscape management decisions for controlling unwanted vegetation, diseases, and pests should follow Integrated Pest Management principles and decision-making rationale, which include the following:

- Proper planning and management decisions initiate the IPM process;
- Cultural methods of vegetation and pest control are preferred and are first employed;
- Mechanical means of vegetation and pest control are next in line of preference, and are utilized where feasible;
- Biological methods of vegetation and pest control are considered before chemical means, where they are feasible;
- Botanical and synthetic pesticides are used only when no other feasible methods exist.

General Practices

Use Only Appropriate Plants

Village of Germantown Landscaping Standards and Guidelines are available through the Planning Department. Comply with all Wisconsin DNR invasive species control rules.

Vegetation and Pest Management in Stormwater Control Facilities

Stormwater control facilities include biofiltration treatment swales, treatment wetlands, treatment ponds, detention ponds, open channels, and infiltration basins. Stormwater control facilities discharge to surface water or groundwater either directly or through pipes or ditches. Many facilities are built to remove pollutants from stormwater.

Generally, vegetation should be maintained to blend into surrounding areas. Stormwater facilities can provide habitat for aquatic life and birds. Promoting natural vegetation where feasible improves habitat. Swales often blend into intensively managed landscapes. Pond perimeters can include natural vegetation.

The use of pesticides and, in most cases fertilizer, is not compatible with the task of pollutant removal or the direct connection of stormwater facilities to streams and groundwater.

Features of Stormwater Facilities:

- Use native species whenever possible;
- Generally not used by the public;
- Include areas managed to promote design function, such as turf in swales;
- Managed landscapes may be nearby;
- May be used by fish and wildlife.

Objectives for Stormwater Facilities:

- Maintain healthy plant communities;
- Avoid or minimize need for chemical intervention;
- Control invasive plants where feasible;
- No bare soil areas are allowed;
- Tolerance for natural appearance and weeds.

Practices

The vegetation management focus is establishing and maintaining healthy low-maintenance native plantings and sustaining the design function of vegetated filters such as biofiltration swales. This includes controlling invasive plants where feasible, and planting cover on bare soils.

See Village of Germantown Landscaping Standards and Guidelines available through the Planning Department.

In some cases, the original plantings may not be appropriate for the actual condition at a facility. One example is a frequently flooded swale that cannot support normal turf. In cases like this, replace turf with appropriate wetland plants if the underlying drainage problem cannot be fixed.

Consider the use of soil amendments such as compost before using fertilizer.

Limit mulch use to covering bare soil while establishing plantings.

Chemical use should be avoided within 25 feet of any area that holds or conveys surface water or stormwater. This includes the base of a biofiltration swale.

Trees or shrubs that block access roads may be trimmed (or removed if within the access road) when access is required for maintenance by heavy equipment. Trees that pose a risk to stormwater structures due to root growth may be removed and replaced by smaller shrubs.

4.0 Developing a Maintenance Program

A stormwater maintenance program is essential to ensure that the facilities continue to function as designed to prevent possible flooding, property damage, water quality problems and expensive future repairs. The maintenance program consists of inspections and repairs as detailed in the maintenance checklists provided in Section 5.0.

Stormwater management facilities are most effective coupled with good housekeeping procedures. Good housekeeping includes educating facility users of proper storage and disposal of chemicals and potential pollutants, procedures for spill cleanup, proper use of fertilizers and other lawn care products, and maintenance of equipment to prevent release of pollutants to the stormwater system. Guidelines for establishing good housekeeping procedures (i.e., Source Control BMPs) can be found through the Wisconsin Department of Natural Resources website at dnr.wi.gov .

4.1 Who Should Perform Maintenance Duties?

Private stormwater facility owners are responsible for ensuring that the facilities are maintained and continue to function as designed. Some activities such as litter removal and mowing can be effectively undertaken by facility owners; however, it is usually worth the cost to have a professional do the more difficult tasks. Filling eroded areas and soil disturbing activities, such as reseeding or re-planting vegetation, are tasks that a professional landscaping firm should manage. If these tasks are not performed properly, erosion may occur resulting in accelerated sedimentation of stormwater facilities. Grading and sediment removal are tasks that are best left to professional contractors with the equipment and experience to safely perform the task(s) and who are also able to identify potential problems early when it is most cost-effective to make repairs or alterations.

4.2 Working with Maintenance Contractors

The following is a guideline for researching and choosing a qualified contractor to meet your maintenance needs.

Start your search for a contractor the right way - be informed. The information provided below will help you in your search for the right contractor for your job.

- Landscape maintenance contractors are typically capable of providing most routine maintenance for stormwater facilities. Special, non-routine maintenance may require an earthwork contractor or vactor company. Recently, several contractors have started specializing in stormwater facility maintenance. Private owners can choose to hire contractors when individual maintenance needs arise, or enter into annual maintenance agreements where the contractor monitors and provides routine maintenance throughout the year as needed.

- Develop a list of potential contractors. Look in the Yellow Pages and/or ask friends, neighbors, relatives, and coworkers who they have used. Find out if their experiences were good or bad and why. Ask if they would use the contractor again.

- Ask contractors for references. Call your potential contractors and ask for a list of their customers or locations of completed jobs. Call references and ask whether they were satisfied with the job done, if the contractor kept to the agreed-upon schedule, and whether they would hire the same contractor again.

- Ask to which trade associations the contractor belongs. Membership in a professional association is one sign the contractor recognizes the responsibilities of being a professional.

- Make sure to obtain and evaluate bids. Ask for a free written estimate of the work you want done. Be sure everyone is bidding on the same exact scope of work and include the exact materials you want. Be sure all quotes include everything you want and that there is a clear understanding of work to be performed by owner and work to be performed by contractor.

- Remember *"you get what you pay for."* A higher bid may be worth the price for better workmanship and contractor reliability.

- Make sure you understand the different types of bids you may receive. Be careful about hiring a contractor on an hourly time-and-materials, or cost-plus basis. Although the price may seem high at first, a fixed-price bid may give you the best protection and price. Also beware of "special deals," "demonstration projects," or *"a great deal from a friend of a friend."* Completely review and understand the contract prior to authorizing work.

Questions to Ask Before Hiring a Contractor

- What experience, expertise and/or certification do you have? What is your specialty?
- Who will be doing the actual work: you personally, your employees, or subcontractors?
- Who will oversee the day-to-day job? (You may really like the contractor, but that person may not be the one performing or supervising the work.)
- How many other jobs will you be working on at the same time as mine? (If there are several, yours may not get the attention you want. On the other hand, the contractor's business may be large and he may be able to handle several jobs.)
- How long will the job take? What kind of mess, noise, and inconvenience should I expect? What problems may come up? (Asking questions before the job starts helps prevent surprises later.)
- Where will you dispose of material removed from storm drainage facilities? Is there an extra fee for contaminated materials?
- Does hiring this contractor feel right? (Use intuition - if you do not feel comfortable, find someone else.)
- Do I have rapport with this contractor? Am I confident in his expertise and ideas? Does he care about my concerns? Will he be reliable, keep his appointments, and return my telephone calls?
- Can I communicate with this person? Does he seem honest and forthright? (The contractor may be top-notch at the trade, but if the final product is not what you expected, you will not be happy.)
- Am I willing to be reasonable about unexpected costs that arise and to let my contractor make a profit?

- Am I ready for the unexpected, such as digging into solid rock, major replacement, etc.?
- Can I be flexible when the job takes longer than expected?
- Are my expectations so high that I will never be satisfied with my contractor?

4.3 How much will it Cost to Maintain a Stormwater Management System?

Specific maintenance costs depend on the characteristics of the facility, the site, and the area that contributes runoff to the facility. The general rule of thumb is that annual maintenance costs will be 5 to 10% of the facility's total capital cost. Routine, scheduled maintenance can help keep overall costs down by addressing problems before they require major attention.

The cost and intensity of maintenance activities for vegetative practices are usually higher during the initial two-year growing period than after the facility has established a mature plant community.

You need to determine how you will finance your maintenance needs. A healthy reserve should be put into place for both capital maintenance procedures (e.g., facility replacement and non-routine maintenance such as sediment removal, facility component repair or replacement, major replanting, or safety structure construction) and operating maintenance procedures (routine activities such as facility inspection, debris removal, and vegetation management).

The best recommendation is to establish a facility maintenance fund. For homeowner associations, this could be a portion of homeowner fees or a specific assessment. The fund should include:

- Ten percent of the facility's capital cost for annual routine maintenance per year.
- A percentage of the non-routine maintenance costs per year (i.e., for sediment removal, vegetation replacement) based on the frequency of removal. For example, if the facility needs mechanical sediment removal every 10 years, 10 percent of the total cost should be put aside each year.
- An additional 3 to 5% of the facility's capital cost per year for eventual facility replacement, based on the facility's life expectancy. Most of these facilities have a life expectancy of 25 to 50 years.

5.0 FACILITY DESCRIPTIONS AND MAINTENANCE CHECKLISTS

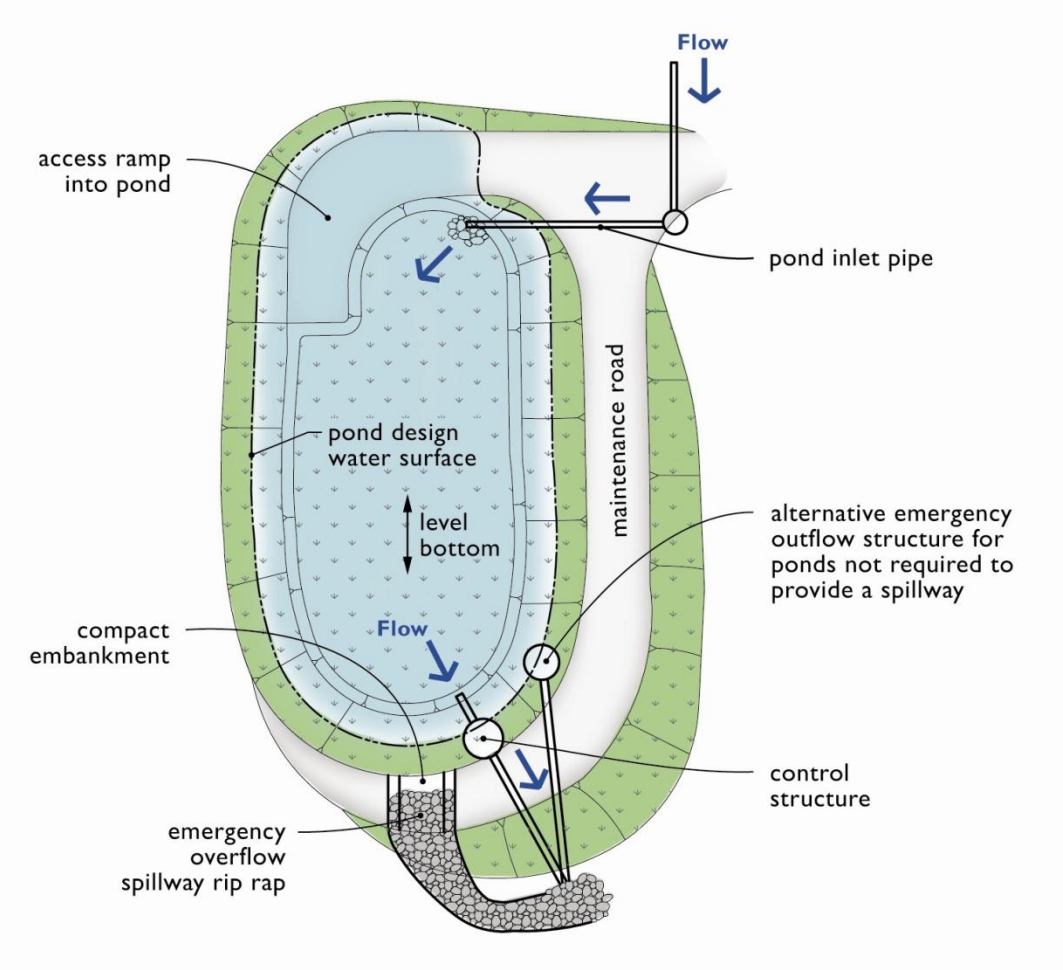
Each of the following subsections includes a facility description, illustrated exhibit, and maintenance checklist for 29 common stormwater facilities/components utilized in Village of Germantown. These include:

1. Detention Pond
2. Infiltration/Retention Pond
3. Closed Detention Systems (Tanks/Vaults)
4. Control Structure/ Flow Restrictor
5. Catch Basins and Manholes
6. Debris Barriers (e.g. Trash Racks)
7. Energy Dissipaters
8. Typical Biofiltration Swale
9. Wet Biofiltration Swale
10. Filter Strips
11. Wetponds
12. Wet Vaults
13. Sand Filters (Above Ground/Open)
14. Sand Filters (Below Ground/Enclosed)
15. Oil/Water Separator (API Type)
16. Coalescing Plate Oil/Water Separator
17. Catch Basin Insert
18. Fencing/Shrubbery Screen/Other Landscaping
19. Gates
20. Grounds (Landscaping)
21. Ecology Embankment
22. Stormceptor® Stormwater Treatment System
23. Treatment Wetland
24. Inlet/Outlet Stormwater Pipe
25. Infiltration Trench
26. CDS Media Filtration System
27. Cisterns/ Rain Barrels
28. Compost Amended Soils
29. Pervious Pavements

Private stormwater facility owners should print the checklists that apply to their facilities and follow the inspection recommendations and frequencies. The checklists should be used for the maintenance report kept on file at each site as required by maintenance agreement.

5.1 Detention Pond

Stormwater detention ponds are open basins built by excavating below existing ground or by constructing above-ground berms (embankments). The detention pond temporarily stores stormwater runoff during rain events and slowly releases it through an outlet (control structure). Detention ponds are typically designed to completely drain within 24-48 hours after the completion of a storm event. Components that are typically associated with a detention pond include the following: control structure/flow restrictor, debris barrier (e.g., trash rack), energy dissipaters, access road, and fence (if applicable).



5.1 Detention Pond Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY, STORM	General					Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold, all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.
ANNUAL	General					Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Complete eradication of noxious weeds may not be possible. Compliance with State eradication policies required.)
MONTHLY, STORM	General					Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants	No contaminants or pollutants present. (Coordinate removal/cleanup with local water quality response agency).
MONTHLY	General					Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired. (Compliance with State and Local eradication policies required)
MONTHLY	General					Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)
ANNUAL	General					Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies.
ANNUAL	General					Tree Growth and Hazard Trees	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). Trees shall not grow on top of berm or inside of berm. If trees are not interfering with access, maintenance, or stability, do not remove.	Trees do not hinder maintenance activities or do not compromise stability of berm. Harvested trees should be recycled into mulch or other beneficial uses.
ANNUAL	General						If dead, diseased, or dying trees are identified (Use a certified Arborist to determine health of tree or removal requirements)	Remove hazard Trees

Detention Pond Checklist (Continued)

Frequency	Drainage System Feature	Date ✓	Date ✓	Date ✓	Date ✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	Side Slopes of Pond					Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.
MONTHLY, STORM	Side Slopes of Pond						Any erosion observed on a compacted berm embankment.	If erosion is occurring on compacted berms, a licensed civil engineer should be consulted to resolve source of erosion.
MONTHLY	Storage Area					Sediment	Accumulated sediment that reaches 3-½ feet of water depth, unless otherwise specified or affects inletting or outletting condition of the facility.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
MONTHLY	Storage Area					Liner (If Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
ANNUAL	Pond Berms (Dikes)					Settlements	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
ANNUAL	Pond Berms (Dikes)					Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.

Detention Pond Checklist (Continued)

Frequency	Drainage System Feature	Date ✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
ANNUAL	Emergency Overflow/ Spillway					Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.
ANNUAL	Emergency Overflow/ Spillway					Emergency Overflow/ Spillway	Erosion around or on emergency overflow, spillway, or inside berm may cause berm failure. Repair with high performance turf reinforcement matting (overflow), turf reinforcement matting (inside berm), or erosion control revegetative matting (top and outside bern). For rock overflows: Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of outflow path of spillway. (Rip-rap on inside slopes need not be replaced.)	All overflow areas are restored to original pad depth and restored to design standards. (or) Rocks and pad depth are restored to design standards.

If you are unsure whether a problem exists, please contact a Professional Engineer.

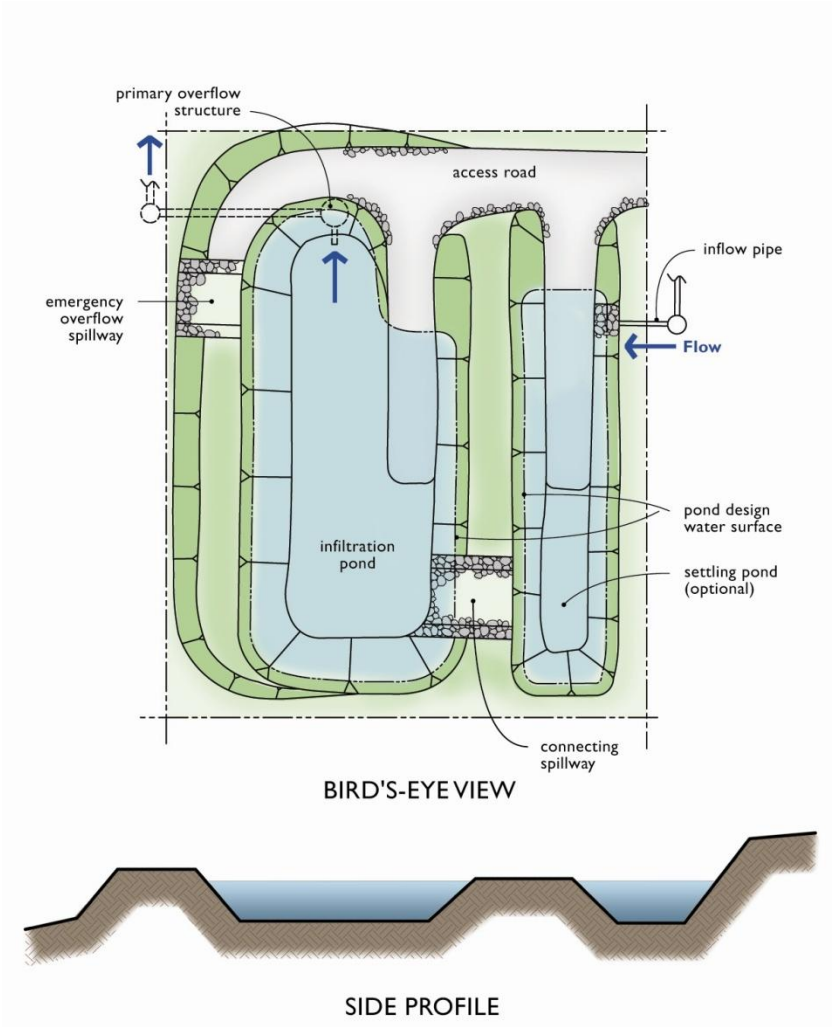
Comments:

Key:

(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect between 3-5 days after a storm of 5 inches in 24 hours.

5.2 Infiltration/Retention Pond

Stormwater infiltration ponds are open basins built by excavating below existing ground or by constructing above-ground berms (embankments). Like the detention pond, the infiltration pond temporarily stores stormwater runoff during rain events, but unlike the detention pond, the infiltration pond does not discharge to a downstream conveyance system or nearby surface water. Instead, the infiltration pond relies on the ability of the site's soils to absorb the stormwater into the ground. Components that are typically associated with a retention pond include the following: energy dissipaters, access road, and fence (if applicable).



5.2 Infiltration/ Retention Pond Checklist

Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY, STORM	General					Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet . In general, there should be no visual evidence of dumping. If less than threshold, all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.
ANNUAL	General					Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. Complete eradication of noxious weeds may not be possible. Compliance with State eradication policies required.
MONTHLY, STORM	General					Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants	No contaminants or pollutants present. (Coordinate removal/cleanup with local water quality response agency).
MONTHLY	General					Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired. (Compliance with State and Local eradication policies required)
MONTHLY	General					Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)
ANNUAL	General					Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies.
MONTHLY	Storage Area					Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. (A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. If two inches or more sediment is present, remove).	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.
MONTHLY	Filter Bags (if applicable)					Filled with Sediment and Debris	Sediment and debris fill bag more than ½ full.	Filter bag is replaced or system is redesigned.

Infiltration/ Retention Pond Checklist (Continued)

Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY, STORM	Rock Filters					Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
MONTHLY	Side Slopes of Pond					Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.
ANNUAL	Pond Berms (Dikes)					Settlements	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
ANNUAL	Pond Berms (Dikes)					Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
ANNUAL	Emergency Overflow/ Spillway					Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.

Infiltration/ Retention Pond Checklist (Continued)

Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
ANNUAL	Emergency Overflow/ Spillway					Emergency Overflow/ Spillway	Erosion around or on emergency overflow, spillway, or inside berm may cause berm failure. Repair with high performance turf reinforcement matting (overflow), turf reinforcement matting (inside berm), or erosion control revegetative matting (top and outside bern). For rock overflows: Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of outflow path of spillway. (Rip-rap on inside slopes need not be replaced.)	All overflow areas are restored to original pad depth and restored to design standards. (or) Rocks and pad depth are restored to design standards.
MONTHLY	Pre-settling Ponds and Vaults					Facility or sump filled with Sediment and/or debris	6" or designed sediment traps depth of sediment.	Sediment is removed.

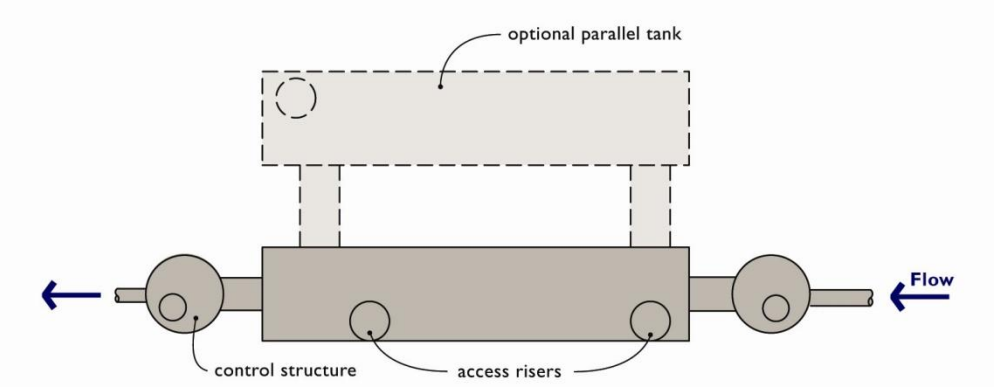
If you are unsure whether a problem exists, please contact a Professional Engineer.
Comments:

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect between 3-5 days after a storm of 5 inches in 24 hours.

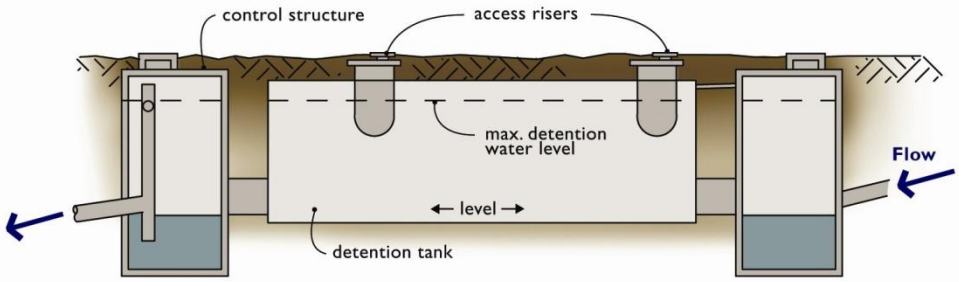
5.3 Closed Detention Systems (Tanks/Vaults)

Closed detention systems function similar to detention ponds with the temporary storage volume provided by an underground structure to regulate the storm discharge rate from the site. The structure is typically constructed of large diameter pipe (48" diameter or greater) or a concrete box (Vault). These systems are typically utilized for sites that do not have space available for an above-ground system and are more commonly associated with commercial sites.

Underground detention systems are an enclosed space where harmful chemicals and vapors can accumulate. Therefore, the inspection and maintenance of these facilities shall be conducted by an individual with training and certification in working in hazardous confined spaces.



BIRD'S-EYE VIEW



Note:
Closed detention systems will contain water during rainfall events, bus should be empty during dry periods.

SIDE PROFILE

5.3 Closed Detention Systems (Tanks/Vaults) Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	Storage Area					Plugged Air Vents	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Vents open and functioning.
MONTHLY	Storage Area					Debris and Sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for ½ length of storage vault or any point depth exceeds 15% of diameter. (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)	All sediment and debris removed from storage area.
ANNUAL	Storage Area					Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into facility. (Will require engineering analysis to determine structural stability).	All joint between tank/pipe sections are sealed.
ANNUAL	Storage Area					Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape. (Review required by engineer to determine structural stability).	Tank/pipe repaired or replaced to design.
ANNUAL	Storage Area					Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound.	Vault replaced or repaired to design specifications and is structurally sound.
ANNUAL	Storage Area						Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls	No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.
MONTHLY	Manhole					Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.
ANNUAL	Manhole					Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
ANNUAL	Manhole					Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
ANNUAL	Manhole					Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.

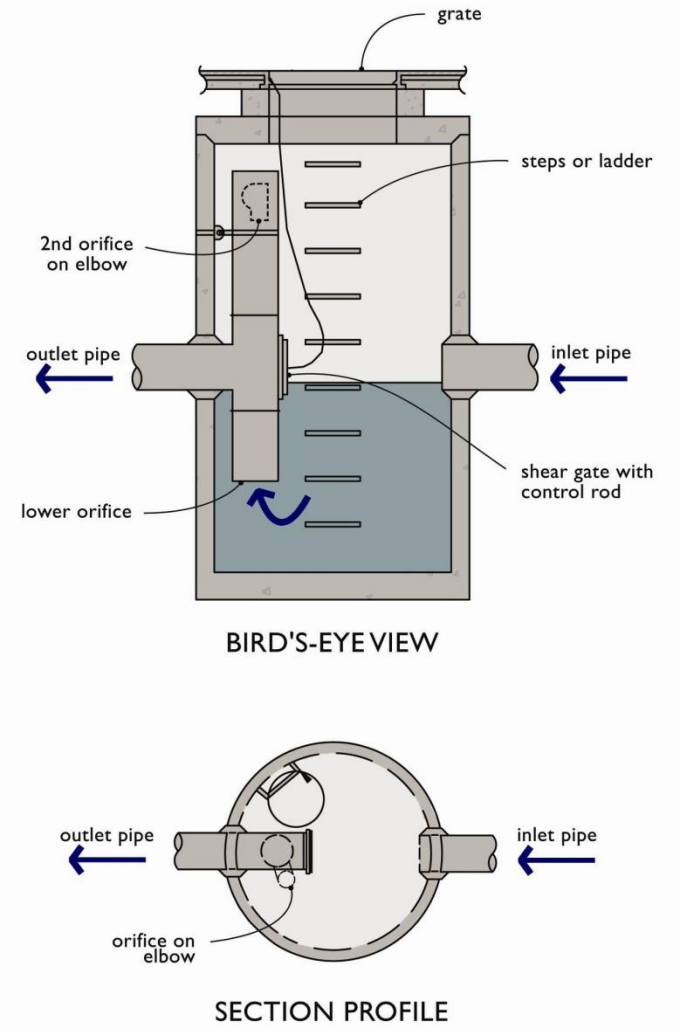
If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect between 3-5 days after a storm of 5 inches in 24 hours.

5.4 Control Structure/Flow Restrictor

Control structures/flow restrictors are located on the outlet pipe of a detention system. The control structure is typically a Type 2 concrete catch basin (see Section 5.5 for catch basin description) with a riser (vertical pipe). The control structure reduces the discharge rate of stormwater from a detention facility. The flow is regulated by a combination of orifices (holes with specifically sized diameters) and weirs (plates with rectangular or vee-shaped notch). Lack of maintenance of the control structure can result in the plugging of an orifice. This can result in flooding of the stormwater system and/or an increase in the rate of discharge from the site potentially damaging downstream property.



5.4 Control Structure/Flow Restrictor Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
ANNUAL	General					Structural Damage	Structure is not securely attached to manhole wall.	Structure securely attached to wall and outlet pipe.
ANNUAL	General					Structural Damage	Structure is not in upright position (allow up to 10% from plumb).	Structure in correct position.
ANNUAL	General					Structural Damage	Connections to outlet pipe are not watertight and show signs of rust.	Connections to outlet pipe are water-tight; structure repaired or replaced and works as designed.
ANNUAL	General					Structural Damage	Any holes--other than designed holes--in the structure.	Structure has no holes other than designed holes.
ANNUAL	Cleanout Gate					Damaged or Missing	Cleanout gate is not watertight or is missing.	Gate is watertight and works as designed.
ANNUAL	Cleanout Gate					Damaged or Missing	Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
ANNUAL	Cleanout Gate					Damaged or Missing	Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
ANNUAL	Cleanout Gate					Damaged or Missing	Gate is rusted over 50% of its surface area.	Gate is repaired or replaced to meet design standards.
ANNUAL	Orifice Plate					Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
MONTHLY , STORM	Orifice Plate					Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
MONTHLY STORM	Overflow Pipe					Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
MONTHLY	Manhole					Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.

Control Structure/Flow Restrictor Checklist (Continued)

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
ANNUAL	Manhole					Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
ANNUAL	Manhole					Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
ANNUAL	Manhole					Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

Key:

(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 3 -5 days after a storm of 5 inches in 24 hours.

5.5 Catch Basins and Manholes

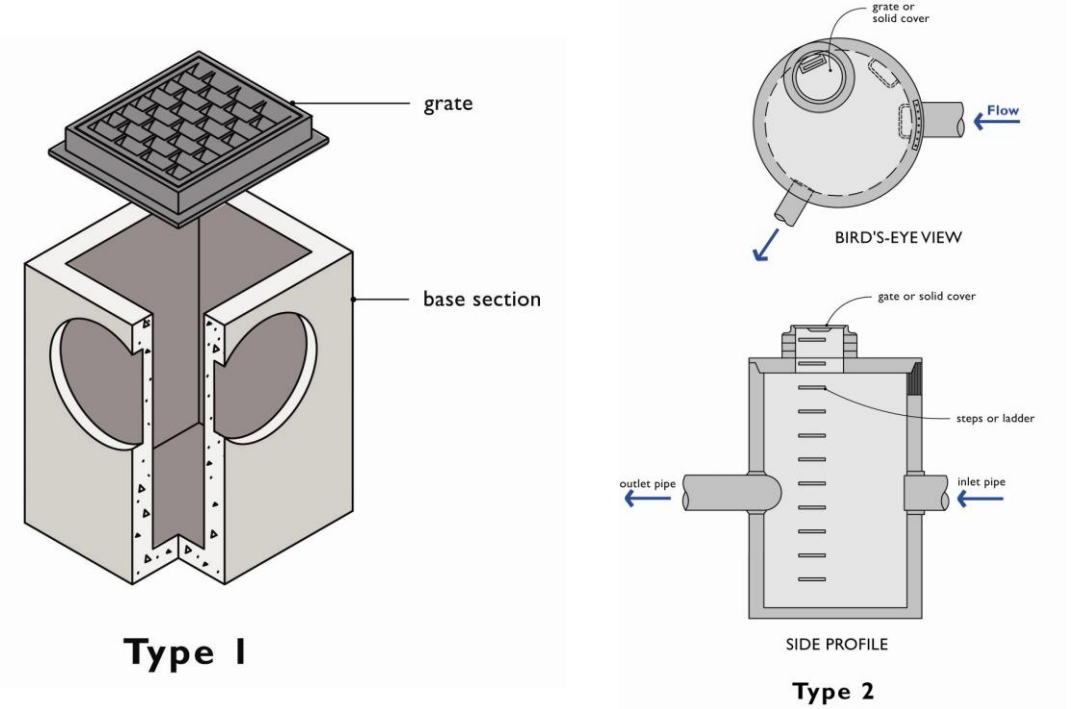
Catch basins are underground concrete or plastic structures typically provided with a slotted grate to collect stormwater runoff and route it through underground pipes. Catch basins can also be used as a junction in a pipe system and may have a solid lid. There are two catch basin types.

A Type 1 catch basin is a rectangular box with approximate dimensions of 3'x2'x5'. Type 1 catch basins are utilized when the connected conveyance pipes are less than 18 inches in diameter and the depth from the gate to the bottom of the pipe is less than 5 feet.

Type 2 catch basins, also commonly referred to as storm manholes, are round concrete structures ranging in diameter of 4 feet to 8 feet. Type 2 catch basins are used when the connecting conveyance pipe is 18 inches or greater or the depth from grate to pipe bottom exceeds 5 feet. Type 2 catch basins typically have manhole steps mounted on the side of the structure to allow for access.

Both catch basin types typically provide a storage volume (sump) below the outlet pipe to allow sediments and debris to settle out of the stormwater runoff. Some catch basins are also provided with a spill control device (inverted elbow on outlet pipe) intended to contain large quantities of grease or oils.

The most common cleaning method for catch basins is to utilize a truck with a tank and vacuum hose (vactor truck) to remove sediment and debris from the sump. Catch basins may be an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a catch basin, it shall be conducted by an individual with training and certification in working in hazardous confined spaces.



5.5 Catch Basins and Manholes Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
ANNUAL	General					"Dump no pollutants " Stencil or stamp not visible (if applicable)	Stencil or stamp should be visible and easily read	Warning signs (e.g., "Dump No Waste-Drains to Stream") can be painted or embossed on or adjacent to all storm drain inlets.
M**ONTHLY , STORM**	General					Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.	No trash or debris located immediately in front of catch basin or on grate opening.
MONTHLY	General					Trash & Debris	Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
MONTHLY	General					Trash & Debris	Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
MONTHLY	General					Trash & Debris	Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
MONTHLY	General					Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
ANNUAL	General					Structure Damage to Frame and/or Top Slab	Top slab (deck) has holes larger than 2 square inches or cracks wider than 1/4 inch (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks.

Catch Basins and Manholes Checklist (Continued)

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
ANNUAL	General					Structure Damage to Frame and/or Top Slab	Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached.	Frame is sitting flush on the riser rings or top slab and firmly attached.
ANNUAL	General					Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
ANNUAL	General					Fractures or Cracks in Basin Walls/ Bottom	Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is re-grouted and secure at basin wall.
ANNUAL	General					Settlement / Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
MONTHLY	General					Vegetation	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.
MONTHLY	General					Vegetation	Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.
MONTHLY	General					Contamination and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants (Coordinate removal/cleanup with local water quality response agency).	No contaminants or pollutants present.
MONTHLY	Catch Basin Cover					Cover Not in Place	Cover is missing or only partially in place.	Any open catch basin requires maintenance. Catch basin cover is closed
ANNUAL	Catch Basin Cover					Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
ANNUAL	Catch Basin Cover					Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is to keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.

Catch Basins and Manholes Checklist (Continued)

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
ANNUAL	Ladder					Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
ANNUAL	Grates					Grate opening Unsafe	Grate with unsafe opening.	Grate opening meets design standards.
MONTHLY, STORM	Grates					Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
MONTHLY	Grates					Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

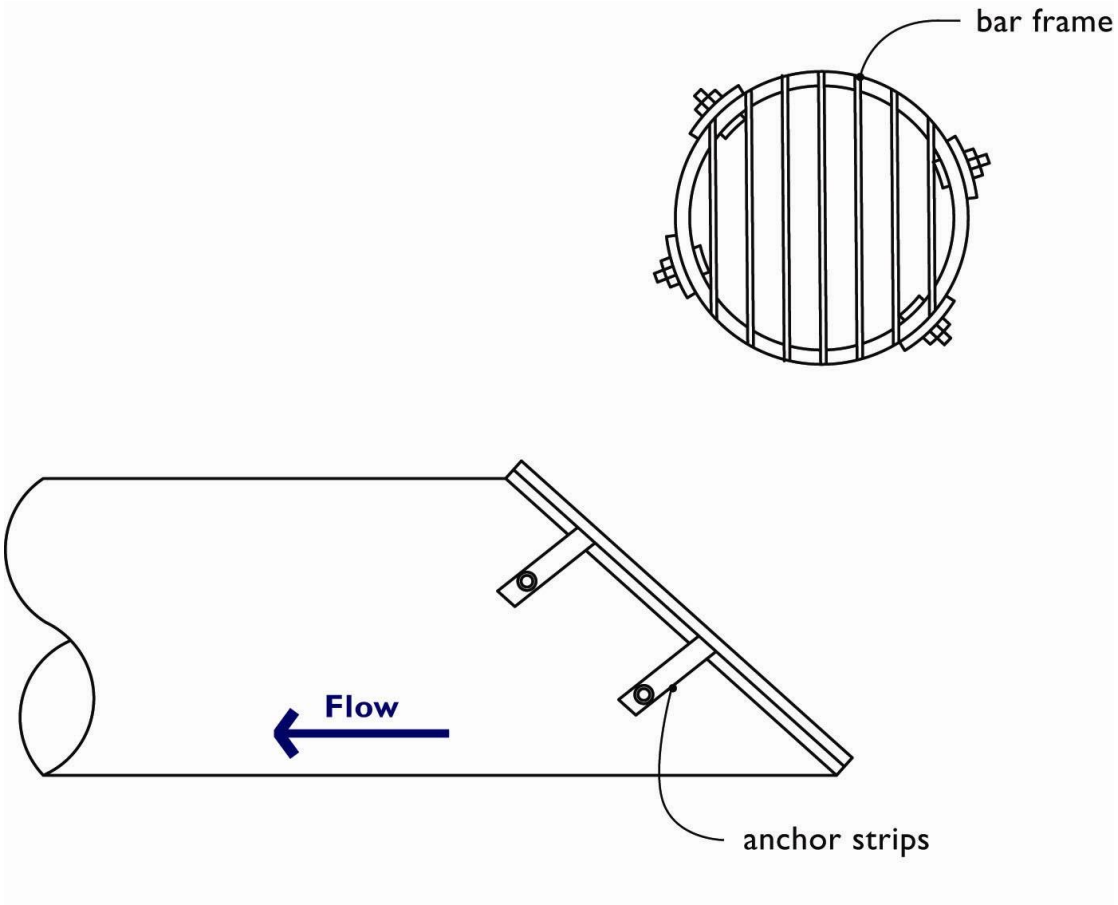
Key:

(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

5.6 Debris Barriers (e.g. Trash Racks)

Debris barriers consist of bar grates over the open end of a culvert or conveyance pipe. Debris barriers are typically vertical on inlet pipe and horizontal on outlet pipes. The intent of a debris barrier is to prevent large materials from entering a closed pipe system. Debris barriers are typically located on the outlet pipe from a detention pond to the control structure. If a debris barrier is not located on the outlet pipe, one should be provided to prevent plugging of the control structure and possible flooding.

Access barriers are similar to debris barriers but are included on all pipe ends that exceed 18 inches in diameter. Their function is to prevent debris and unauthorized access into the storm conveyance pipe. Removing debris and maintenance to the debris barrier when there is flow through the conveyance pipe should be performed by qualified personnel only.



5.6 Debris Barriers (e.g. Trash Racks) Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY, STORM	General					Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
ANNUAL	General					Damaged/Missing Bars.	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4 inch.
ANNUAL	General					Damaged/Missing Bars.	Bars are missing or entire barrier missing.	Bars in place according to design.
ANNUAL	General					Damaged/Missing Bars.	Bars are loose and rust is causing 50% deterioration to any part of barrier.	Barrier replaced or repaired to design standards.
ANNUAL	General					Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe.	Barrier firmly attached to pipe.

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

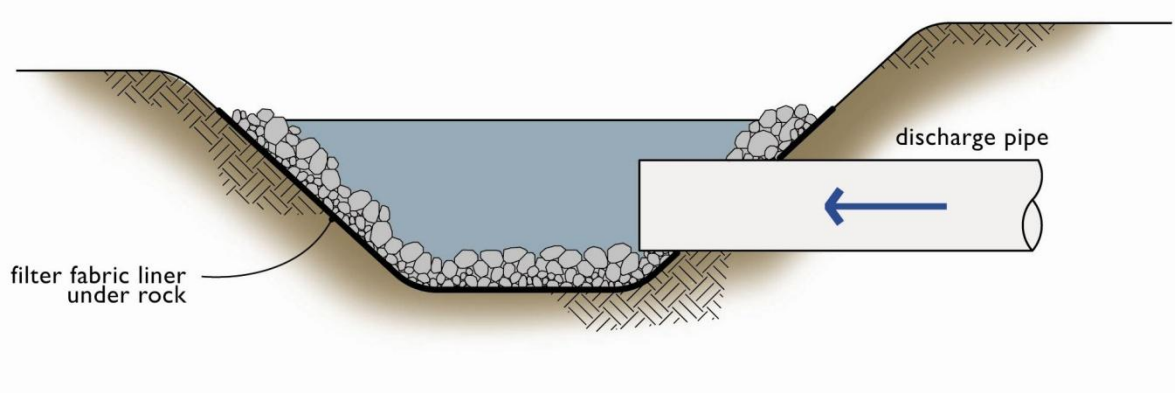
Key:

(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

5.7 Energy Dissipaters

Energy dissipaters are provided on the inlet and outlet to a closed pipe system to prevent erosion at these locations. Design of an energy dissipater can vary significantly from highly engineered systems (concrete or rock gabion structures) to the more commonly used rock pad. The rock pad is typically constructed of 4 to 12-inch diameter rocks a minimum of 12 inches thick and is often lined with filter fabric. The rock pad should extend above the top of the pipe a minimum of 1 foot.

Manholes may be an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a manhole, it shall be conducted by an individual with training and certification in working in hazardous confined spaces.



5.7 Energy Dissipaters Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
External:								
MONTHLY	Rock Pad					Missing or Moved Rock	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.	Rock pad replaced to design standards.
MONTHLY	Rock Pad					Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.
MONTHLY	Dispersion Trench					Pipe Plugged with Sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.
MONTHLY	Dispersion Trench					Not Discharging Water Properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a “sheet flow” of water along trench). Intent is to prevent erosion damage.	Trench redesigned or rebuilt to standards.
MONTHLY	Dispersion Trench					Perforations Plugged.	Over 1/2 of perforations in pipe are plugged with debris and sediment.	Perforated pipe cleaned or replaced.
MONTHLY	Dispersion Trench					Water Flows Out Top of “Distributor” Catch Basin.	Maintenance person observes or receives credible report of water flowing out during any storm less than the design storm or its causing or appears likely to cause damage.	Facility rebuilt or redesigned to standards.
MONTHLY	Dispersion Trench					Receiving Area Over-saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
Internal:								
MONTHLY	Manhole/ Chamber					Worn or Damaged Post, Baffles, Side of Chamber	Structure dissipating flow deteriorates to 1/2 of original size or any concentrated worn spot exceeding one square foot which would make structure unsound.	Structure replaced to design standards.
MONTHLY	Manhole/ Chamber					Trash& Debris	Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
MONTHLY	Manhole/ Chamber					Trash& Debris	Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
MONTHLY	Manhole/ Chamber					Trash& Debris	Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.

Energy Dissipaters Checklist (Continued)

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
Internal (Continued):								
MONTHLY	Manhole/ Chamber					Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe. There shall be a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
ANNUAL	Manhole/ Chamber					Structure Damage to Frame and/or Top Slab (deck)	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks.
ANNUAL	Manhole/ Chamber					Structure Damage to Frame and/or Top Slab	Frame not sitting flush on top slab/deck, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Frame is sitting flush on the riser rings or top slab and firmly attached.
ANNUAL	Manhole/ Chamber					Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
ANNUAL	Manhole/ Chamber					Fractures or Cracks in Basin Walls/ Bottom	Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is re-grouted and secure at basin wall.
ANNUAL	Manhole/ Chamber					Settlement / Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
MONTHLY	Manhole/ Chamber					Contamination and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants (Coordinate removal/cleanup with local water quality response agency).	No contaminants or pollutants present.
MONTHLY	Catch Basin Cover					Cover Not in Place	Cover is missing or only partially in place.	Any open catch basin requires maintenance. Catch basin cover is closed

Energy Dissipaters Checklist (Continued)

		Date						
Frequency	**Drainage System Feature**	✓	✓	✓	✓	**Problem**	**Conditions to Check For**	**Conditions That Should Exist**
Internal (Continued):								
ANNUAL	Catch Basin Cover					Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
ANNUAL	Catch Basin Cover					Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is to keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.

If you are unsure whether a problem exists, please contact a Professional Engineer.

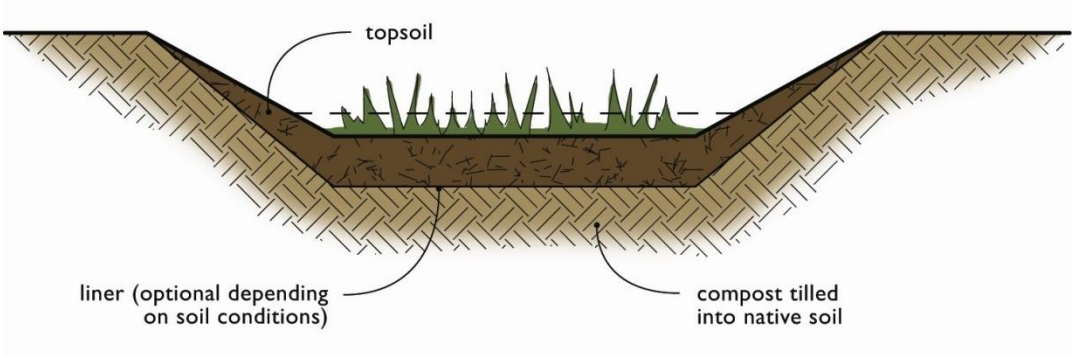
Comments:

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 3-5 days after storm of 5 inches in 24 hours.

5.8 Typical Biofiltration Swale

Biofiltration swales are engineered grass-lined open channels with moderate centerline slope similar in appearance to typical ditches. Biofiltration uses vegetation in conjunction with slow and shallow-depth flow for runoff treatment. As runoff passes through the vegetation, pollutants are removed through the combined effects of filtration, infiltration, and settling. These effects are aided by the reduction of the velocity of stormwater as it passes through the biofilter.

Biofiltration swales provide stormwater quality control (treatment), but do not provide stormwater quantity control (detention/retention).



5.8 Typical Biofiltration Swale Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits on grass treatment area of the bio-swale. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased.
MONTHLY	General					Standing Water	When water stands in the swale between storms and does not drain freely.	Any of the following may apply: remove sediment or trash blockages, improve grade from head to foot of swale, remove clogged check dams, add underdrains or convert to a wet biofiltration swale.
MONTHLY	General					Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire swale width.	Level the spreader and clean so that flows are spread evenly over entire swale width.
MONTHLY	General					Constant Baseflow	When small quantities of water continually flow through the swale, even when it has been dry for weeks and an eroded, muddy channel has formed in the swale bottom.	Add a low-flow pea-gravel drain the length of the swale or by-pass the baseflow around the swale.
MONTHLY	General					Poor Vegetation Coverage	When grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.	Determine why grass growth is poor and correct that condition. Re-plant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals. Or re-seed into loosened, fertile soil.
MONTHLY	General					Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Mow vegetation or remove nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings.

Typical Biofiltration Swale Checklist (Continued)

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Excessive Shading	Grass growth is poor because sunlight does not reach swale.	If possible, trim back over-hanging limbs and remove brushy vegetation on adjacent slopes.
MONTHLY	General					Inlet/Outlet	Inlet/outlet areas clogged with sediment and/or debris.	Remove material so that there is no clogging or blockage in the inlet and outlet area.
MONTHLY	General					Trash and Debris Accumulation	Trash and debris accumulated in the bio-swale.	Remove trash and debris from bioswale.
MONTHLY	General					Erosion/Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, the swale should be re-graded and re-seeded. For smaller bare areas, over-seed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.

If you are unsure whether a problem exists, please contact a Professional Engineer.

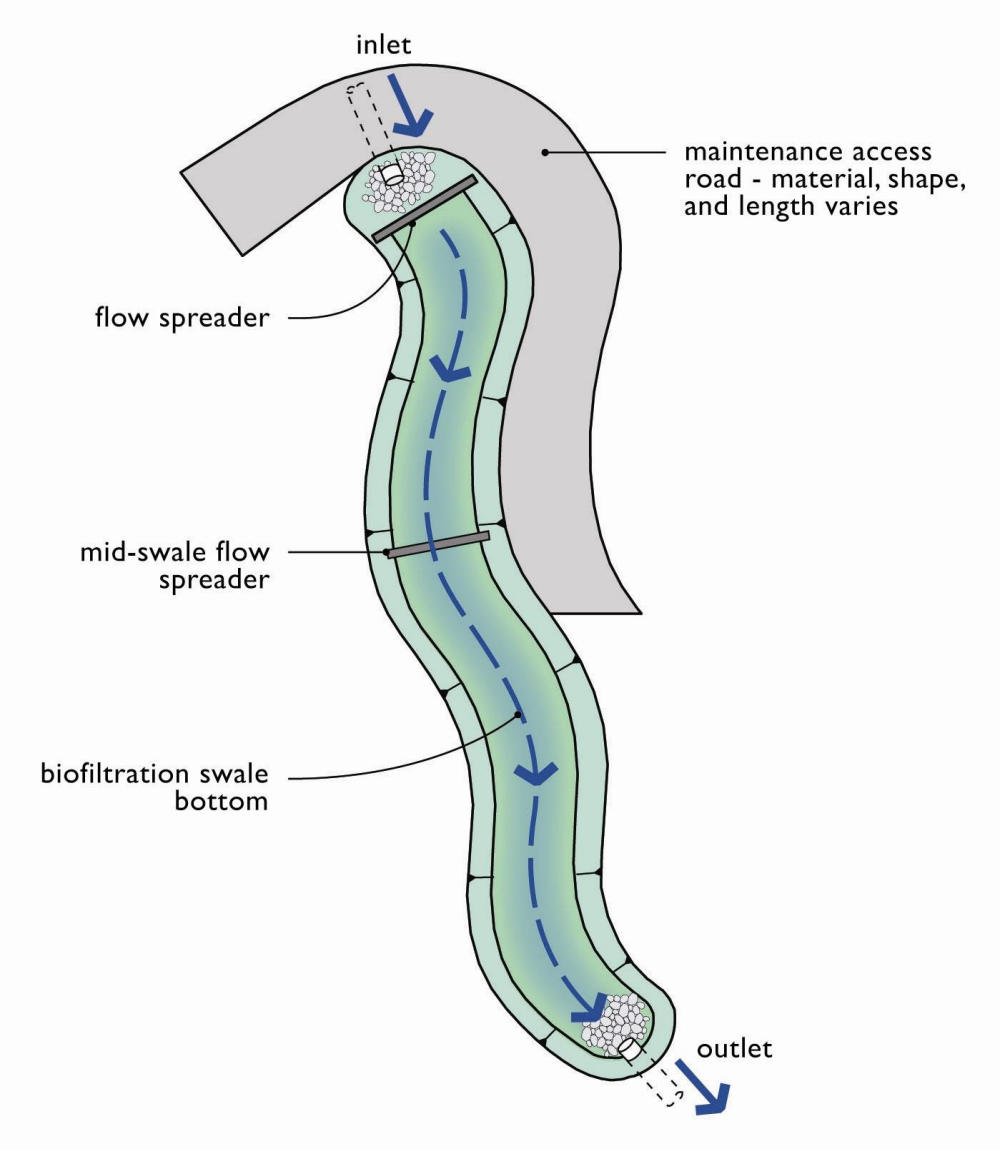
Comments:

Key:

(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

5.9 Wet Biofiltration Swale

A wet biofiltration swale is a variation of a basic biofiltration swale for use where the centerline slope is slight, groundwater tables are high, or a continuous low base flow is likely to result in wet soil conditions for long periods of time. Where continuously wet soil conditions exceeds about 2 weeks, typical grasses will die. Thus, vegetation specifically adapted to wet soil conditions is needed. Additional turf-reinforcement matting (TRM) may also be needed. Different vegetation in turn requires modification of several of the design and maintenance requirements from the basic biofiltration swale.



5.9 Wet Biofiltration Swales Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Sediment Accumulation	Sediment depth exceeds 2-inches in 10% of the swale treatment area.	Remove sediment deposits in treatment area.
MONTHLY	General					Water Depth	Water not retained to a depth of about 4 inches during the wet season.	Build up or repair outlet berm so that water is retained in the wet swale.
MONTHLY	General					Wetland Vegetation	Vegetation becomes sparse and does not provide adequate filtration, OR vegetation is crowded out by very dense clumps of cattail, which do not allow water to flow through the clumps.	Determine cause of lack of vigor of vegetation and correct. Replant as needed. For excessive cattail growth, cut cattail shoots back and compost off-site. Note: normally wetland vegetation does not need to be harvested unless die-back is causing oxygen depletion in downstream waters.
MONTHLY	General					Inlet/Outlet	Inlet/outlet area clogged with sediment and/or debris.	Remove clogging or blockage in the inlet and outlet areas.
MONTHLY	General					Trash and Debris Accumulation	Any trash and debris which exceed 1 cubic feet per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size garbage can). In general, there should be no visual evidence of dumping. If less than threshold, all trash and debris will be removed as part of next scheduled maintenance.	Remove trash and debris from wet swale.

Wet Biofiltration Swales Checklist (Continued)

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Matting	Matting seams have separated or matting has torn.	Seamless matting without separation or tears.
MONTHLY	General					Erosion/Scouring	Swale has eroded or scoured due to flow channelization, or higher flows.	Check design flows to assure swale is large enough to handle flows. By-pass excess flows or enlarge swale. Replant eroded areas with fibrous-rooted plants in dryer areas.

If you are unsure whether a problem exists, please contact a Professional Engineer.

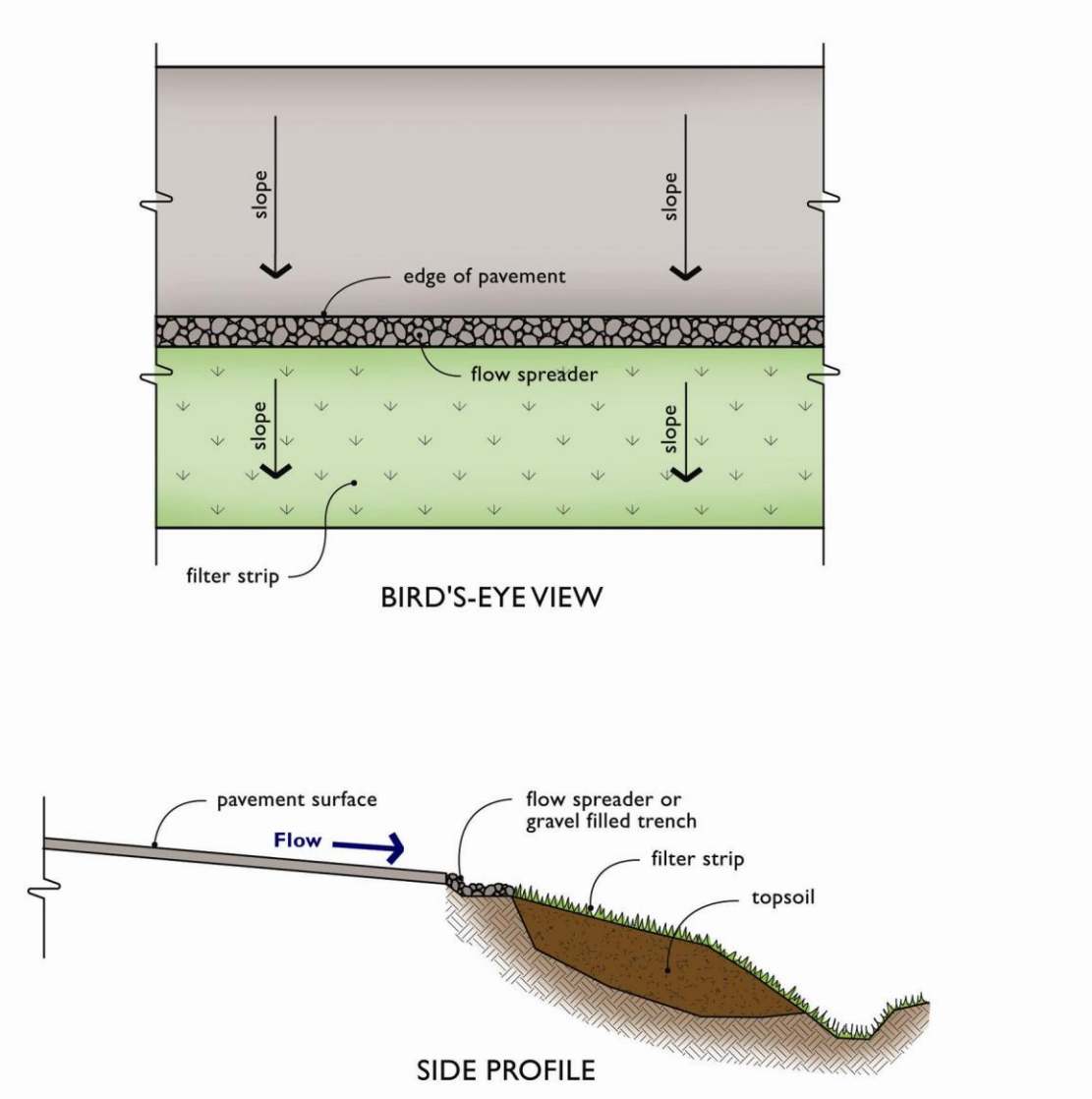
Comments:

Key:

(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 3-5 days after storm of 5 inches in 24 hours.

5.10 Filter Strips

A basic filter strip consists of a vegetated slope area that provides the same treatment functions as a biofiltration swale. Contaminated stormwater runoff is distributed as shallow flow across the top width of a biofilter strip through a level-spreader device or curb cuts at the edge of a paved area. The level-spreader device typically consists of a gravel trench with a board or concrete curb with a level top to evenly distribute the stormwater runoff across the entire length of the filter strip. Most filter strips have a collection ditch at its base to collect and route the treated runoff to a detention/retention facility or downstream conveyance system.



5.10 Filter Strips Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits, re-level so slope is even and flows pass evenly through strip.
MONTHLY	General					Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Mow grass, control nuisance vegetation, such that flow not impeded. Grass should be mowed to a height between 3-4 inches.
MONTHLY	General					Trash and Debris Accumulation	Trash and debris accumulated on the filter strip.	Remove trash and Debris from filter.
MONTHLY	General					Erosion/Scouring	Eroded or scoured areas due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the filter strip should be re-graded and re- seeded. For smaller bare areas, overseed when bare spots are evident.
MONTHLY	General					Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width

If you are unsure whether a problem exists, please contact a Professional Engineer.

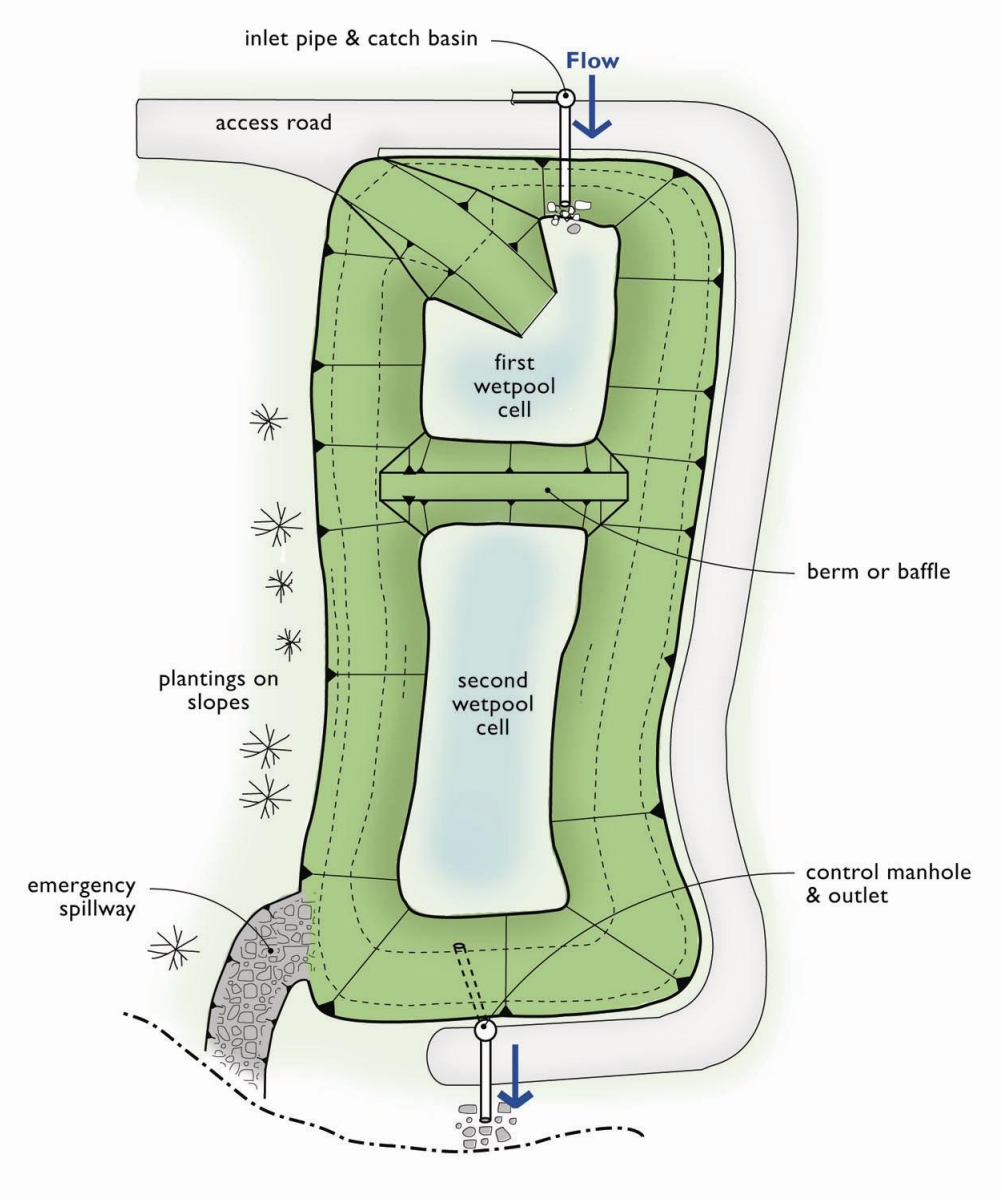
Comments:

Key:

(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

5.11 Wetponds

A wetpond is an open basin that retains a permanent pool of water (wetpool) year round. The volume of the wetpool allows sediment and other pollutants to settle out of the runoff. Wetland vegetation is typically planted within the wetpond to provide additional treatment through nutrient (i.e. nitrogen) removal. Detention quantity control can be provided with additional temporary storage volume above the permanent pool elevation.



5.11 Wetponds Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Water level	First cell is empty, doesn't hold water.	Line the first cell with impervious liner to maintain at least 5 feet of water.
MONTHLY						Trash and Debris	Accumulation that exceeds 1 cubic yard per 1000-SF of pond area.	Trash and debris removed from pond
MONTHLY						Inlet/Outlet Pipe	Inlet/Outlet pipe clogged with sediment and/or debris material	No clogging or blockage in the inlet and outlet piping.
MONTHLY						Sediment Accumulation in Pond Bottom	Sediment accumulations in pond bottom that exceeds the depth of sediment zone plus 6-inches, usually in the first cell.	Sediment removed from pond bottom.
MONTHLY						Oil Sheen on Water	Prevalent and visible oil sheen.	Oil removed from water using oil- absorbent pads or vactor truck. Source of oil located and corrected. If chronic low levels of oil persist, plant wetland plants which can uptake small concentrations of oil.
ANNUAL						Erosion	Erosion of the pond's side slopes and/or scouring of the pond bottom, which exceeds 6-inches, or where continued erosion is prevalent.	Slopes stabilized using proper erosion control measures and repair methods.
ANNUAL						Settlement of Pond Dike/Berm	Any part of these components which has settled 4-inches or lower than the design elevation, or inspector determines dike/berm is unsound.	Dike/berm is repaired to specifications

Wetponds Checklist (Continued)

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
ANNUAL						Internal Berm	Berm dividing cells should be level.	Berm surface is leveled so that water flows evenly over entire length of berm.
ANNUAL	Pond Berms (Dikes)					Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
ANNUAL	Emergency Overflow/ Spillway					Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.
ANNUAL	Emergency Overflow/ Spillway					Emergency Overflow/ Spillway	Erosion around or on emergency overflow, spillway, or inside berm may cause berm failure. Repair with high performance turf reinforcement matting (overflow), turf reinforcement matting (inside berm), or erosion control revegetative matting (top and outside bern). For rock overflows: Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. (Rip-rap on inside slopes need not be replaced.)	All overflow areas are restored to original pad depth and restored to design standards. (or) Rocks and pad depth are restored to design standards.

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

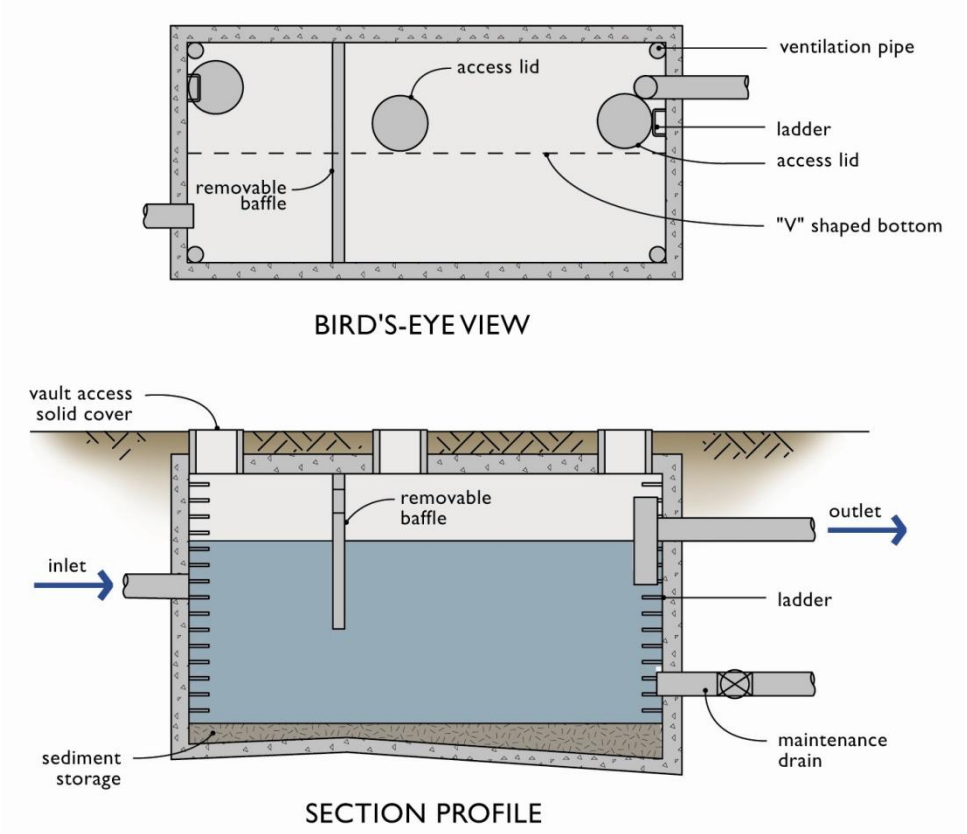
Key:

(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 3-5 days after storm of 5 inches in 24 hours.

5.12 Wet Vaults

A wet vault is an underground structure similar in appearance to a detention vault, except that a wet vault has a permanent pool of water (wetpool) which dissipates energy and improves the settling of sediment and other pollutants. Being underground, the wet vault lacks the nutrient removal ability of vegetation.

As discussed in the underground detention systems, wet vaults are a closed space where harmful chemicals and gasses can accumulate. Therefore, the inspection and maintenance of these facilities shall be conducted by an individual with training and certification in working in hazardous confined spaces.



5.12 Wet Vaults Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Trash/Debris Accumulation	Trash and debris accumulated in vault, pipe or inlet/outlet (includes floatables and non-floatables).	Remove trash and debris from vault.
MONTHLY	General					Sediment Accumulation in Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6-inches.	Remove sediment from vault.
ANNUAL	General					Damaged Pipes	Inlet/outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.
ANNUAL	General					Access Cover Damaged/Not Working	Cover cannot be opened or removed, especially by one person.	Pipe repaired or replaced to proper working specifications.
MONTHLY	General					Ventilation	Ventilation area blocked or plugged.	Blocking material removed or cleared from ventilation area. A specified % of the vault surface area must provide ventilation to the vault interior (see design specifications).
ANNUAL	Vault Structure					Damage - Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab	Maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
ANNUAL	Vault Structure					Damage - Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
ANNUAL	Vault Structure					Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection staff.	Baffles repaired or replaced to specifications.

Wet Vaults Checklist (Continued)

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
ANNUAL	Access Ladder					Damage	Ladder is corroded or deteriorated, not functioning properly, not attached to structure wall, missing rungs, has cracks and/or misaligned. Confined space warning sign missing.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel. Replace sign warning of confined space entry requirements.

If you are unsure whether a problem exists, please contact a Professional Engineer.

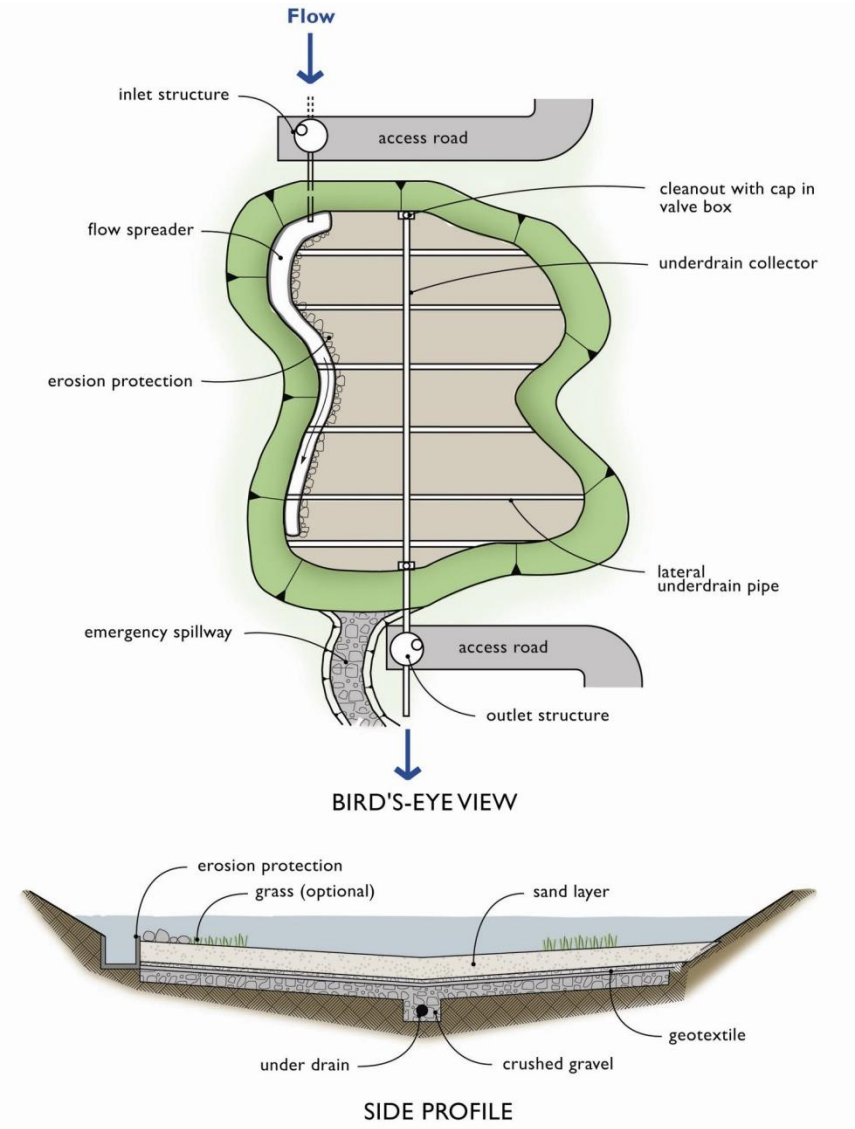
Comments:

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 3-5 days after storm of 5 inches in 24 hours.

5.13 Sand Filters (Above Ground/Open)

Sand filters function by filtering stormwater runoff through a sand bed typically 18 inches in depth. The treated runoff is collected in the underdrain system and routed to a detention/retention facility or a downstream conveyance system. A typical sand filtration system consists of, a pretreatment system for removing larger sediment and debris from the runoff, a flow spreader, a sand bed, and an underdrain piping system. The sand filter bed typically includes a woven (geotextile) fabric between the sand bed and the underdrain system.

Open, above-ground sand filters have a physical appearance similar to a detention pond with the main difference being the sand lined bottom.



5.13 Sand Filters (above ground/open) Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	Above Ground (open sand filter)					Sediment Accumulation on top layer	Sediment depth exceeds 1/2-inch.	No sediment deposit on grass layer of sand filter that would impede permeability of the filter section.
MONTHLY	Above Ground (open sand filter)					Trash and Debris Accumulations	Trash and debris accumulated on sand filter bed.	Trash and debris removed from sand filter bed.
MONTHLY	Above Ground (open sand filter)					Sediment/ Debris in Clean-Outs	When the clean-outs become full or partially plugged with sediment and/or debris.	Sediment removed from clean-outs.
MONTHLY	Above Ground (open sand filter)					Sand Filter Media	Drawdown of water through the sand filter media takes longer than 24-hours, and/or flow through the overflow pipes occurs frequently.	Top several inches of sand are scraped. May require replacement of entire sand filter depth depending on extent of plugging (a sieve analysis is helpful to determine if the lower sand has too high a proportion of fine material).
MONTHLY	Above Ground (open sand filter)					Prolonged Flows	Sand is saturated for prolonged periods of time (several weeks) and does not dry out between storms due to continuous base flow or prolonged flows from detention facilities.	Low, continuous flows are limited to a small portion of the facility by using a low wooden divider or slightly depressed sand surface.
MONTHLY	Above Ground (open sand filter)					Short Circuiting	When flows become concentrated over one section of the sand filter rather than dispersed.	Flow and percolation of water through sand filter is uniform and dispersed across the entire filter area.
MONTHLY	Above Ground (open sand filter)					Erosion Damage to Slopes	Erosion over 2-inches deep where cause of damage is prevalent or potential for continued erosion is evident.	Slopes stabilized using proper erosion control measures.
ANNUAL	Above Ground (open sand filter)					Rock Pad Missing or Out of Place	Soil beneath the rock is visible.	Rock pad replaced or rebuilt to design specifications.

Sand Filters (above ground/open) Checklist (Continued)

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	Above Ground (open sand filter)					Flow Spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed across sand filter.	Spreader leveled and cleaned so that flows are spread evenly over sand filter.
MONTHLY	Above Ground (open sand filter)					Damaged Pipes	Any part of the piping that is crushed or deformed more than 20% or any other failure to the piping.	Pipe repaired or replaced.

If you are unsure whether a problem exists, please contact a Professional Engineer.

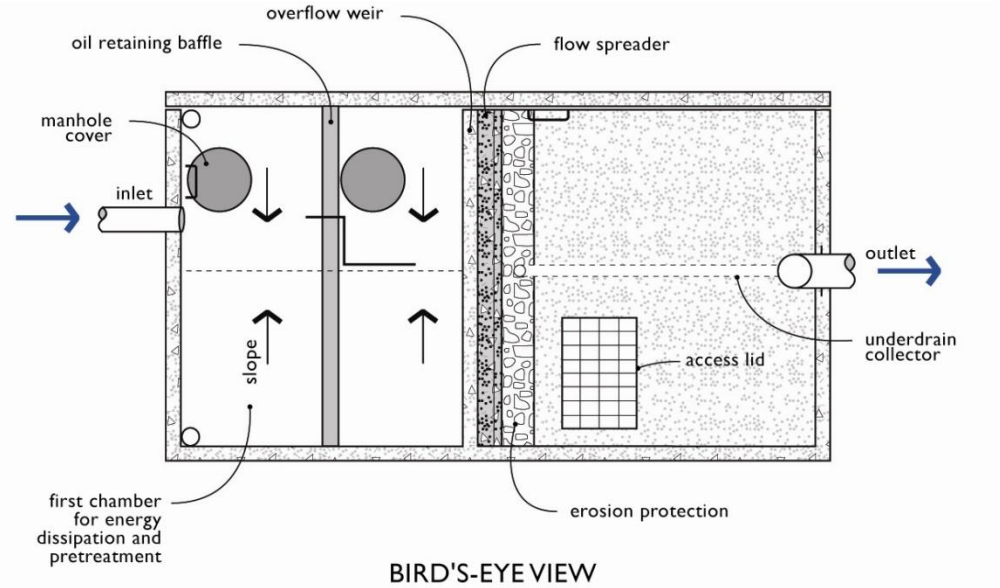
Comments:

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

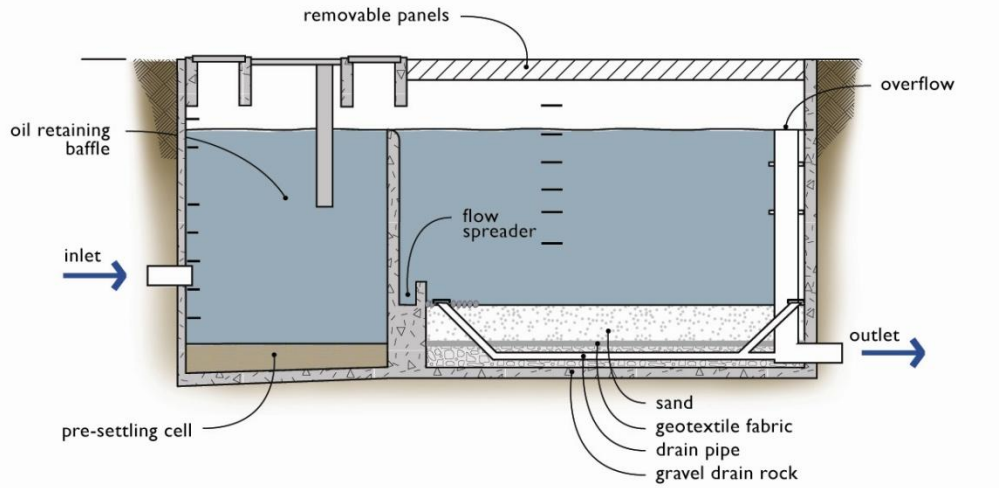
5.14 Sand Filters (Below Ground/Enclosed)

A sand filter vault is similar to an open sand filter except that the sand layer and underdrains are installed below ground in a vault. It consists of presettling and sand filtration cells and functions by filtering stormwater runoff through a sand bed. Treated runoff is collected in the underdrain system and routed to a detention/retention facility or a downstream conveyance system.

Sand filters below ground are a closed space where harmful chemicals and gasses can accumulate. Therefore, the inspection and maintenance of these facilities shall be conducted by an individual with training and certification in working in hazardous confined spaces.



BIRD'S-EYE VIEW



SIDE PROFILE

5.14 Sand Filters (below ground/enclosed) Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	Below Ground Vault.					Sediment Accumulation on Sand Media Section	Sediment depth exceeds 1/2-inch.	No sediment deposits on sand filter section that would impede permeability of the filter section.
MONTHLY	Below Ground Vault.					Sediment Accumulation in Pre-Settling Portion of Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6-inches.	No sediment deposits in first chamber of vault.
MONTHLY	Below Ground Vault.					Trash/Debris Accumulation	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault and inlet/outlet piping.
MONTHLY	Below Ground Vault.					Sediment in Drain Pipes/Cleanouts	When drain pipes, cleanouts become full with sediment and/or debris.	Sediment and debris removed.
MONTHLY	Below Ground Vault.					Short Circuiting	When seepage/flow occurs along the vault walls and corners. Sand eroding near inflow area.	Sand filter media section re-laid and compacted along perimeter of vault to form a semi-seal. Erosion protection added to dissipate force of incoming flow and curtail erosion.
ANNUAL	Below Ground Vault.					Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.
ANNUAL	Below Ground Vault.					Access Cover Damaged/Not Working	Cover cannot be opened, corrosion/deformation of cover. Maintenance person cannot remove cover using normal lifting pressure.	Cover repaired to proper working specifications or replaced.
MONTHLY	Below Ground Vault.					Ventilation	Ventilation area blocked or plugged.	Blocking material removed or cleared from ventilation area. A specified % of the vault surface area must provide ventilation to the vault interior (see design specifications).
ANNUAL	Below Ground Vault.					Vault Structure Damaged; Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab.	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.

Sand Filters (above ground/open) Checklist (Continued)

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
ANNUAL	Below Ground Vault.					Vault Structure Damaged; Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab.	Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
ANNUAL	Below Ground Vault.					Baffles/Internal walls	Baffles or walls corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
ANNUAL	Below Ground Vault.					Access Ladder	Damaged Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel.

If you are unsure whether a problem exists, please contact a Professional Engineer.

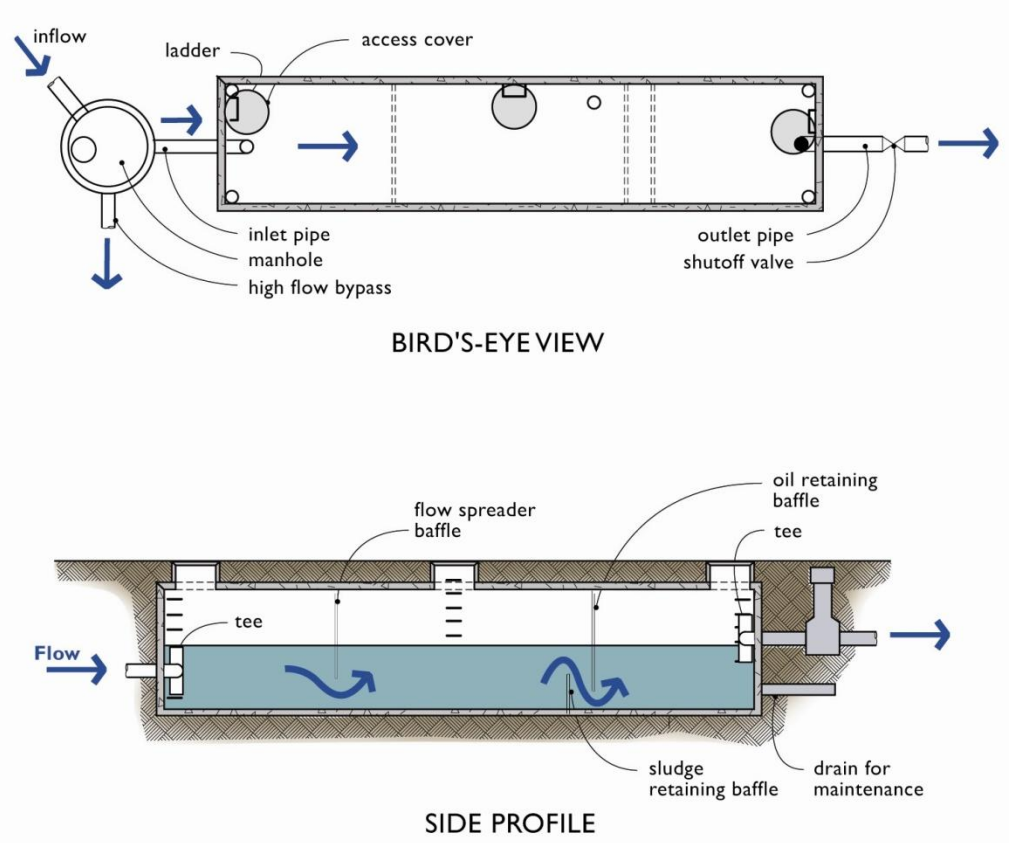
Comments:

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 3-5 days after storm of 5 inches in 24 hours.

5.15 Oil/Water Separator (API Type)

American Petroleum Institute (API) oil water separators consist of an underground vault separated into three bays by a series of partial divider walls (baffles). The three bays consist of a forebay, separator section, and the afterbay. Oil/water separators are typically utilized in locations where high oil concentrations in the stormwater runoff are anticipated (i.e., service and fuel stations). Oil/water separators are most commonly used as the first pre-treatment facility in a series of stormwater management facilities ('treatment train').

Below ground vaults are a closed space where harmful chemicals and gasses can accumulate. Therefore, the inspection and maintenance of these facilities shall be conducted by an individual with training and certification in working in hazardous confined spaces.



5.15 Baffle Oil/Water Separators (API Type) Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY, STORM	Monitoring					Inspection of discharge water for obvious signs of poor water quality.	Sheen, obvious oil present.	Effluent discharge from vault should be clear without thick visible sheen.
MONTHLY, STORM	Monitoring					Sediment Accumulation	Sediment depth in bottom of vault exceeds 6-inches in depth.	No sediment deposits on vault bottom that would impede flow through the vault and reduce separation efficiency.
MONTHLY, STORM	Monitoring					Trash and Debris Accumulation	Trash and debris accumulation in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault, and inlet/outlet piping.
MONTHLY, STORM	Monitoring					Oil Accumulation	Oil accumulations that exceed 1-inch, at the surface of the water.	Extract oil from vault by vactoring. Dispose in accordance with state and local rules and regulations.
ANNUAL	Structure					Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired or replaced.
ANNUAL	Structure					Access Cover Damaged/Not Working	Cover cannot be opened, corrosion/deformation of cover.	Cover repaired to proper working specifications or replaced.
ANNUAL	Structure					Vault Structure Damage Includes Cracks in Walls or Bottom, Damage to Frame and/or Top Slab	Maintenance person judges that structure is unsound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
ANNUAL	Structure					Vault Structure Damage Includes Cracks in Walls or Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
ANNUAL	Structure					Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
ANNUAL	Structure					Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

If you are unsure whether a problem exists, please contact a Professional Engineer.

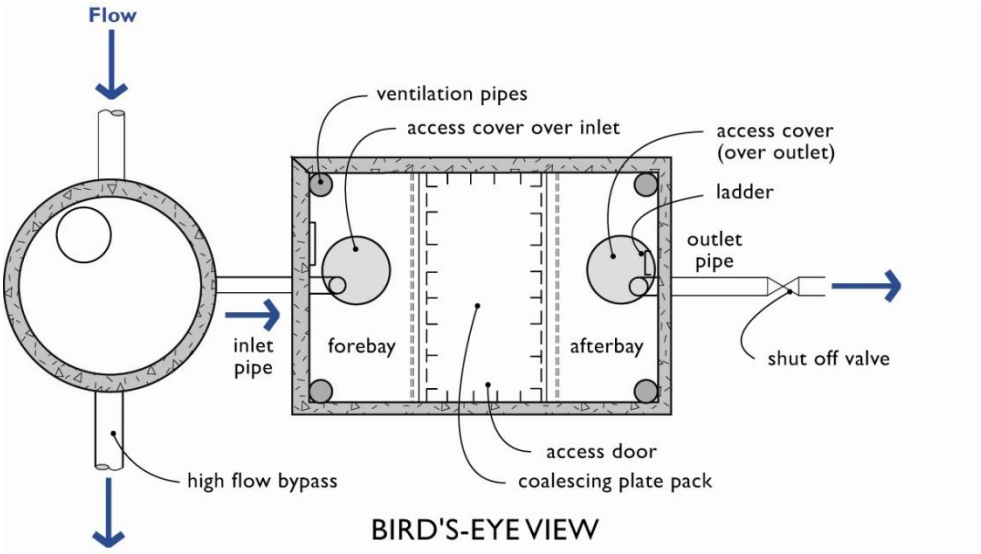
Comments:

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

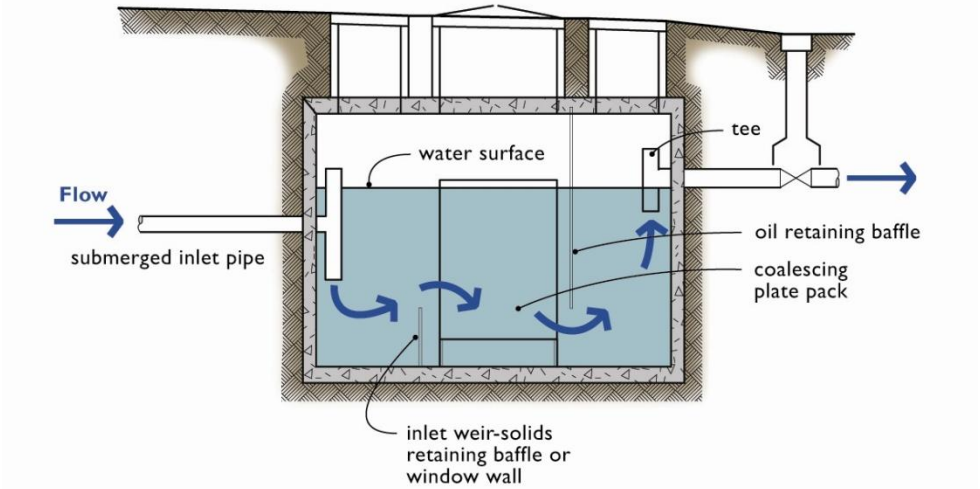
5.16 Coalescing Plate Oil/Water Separator

Coalescing plate oil water separators are generally the same as the API type. The main difference is that coalescing plate separators include a series of parallel plates in the separation bay (2nd bay) that increase the oil removal efficiency of the separator.

Below ground vaults are a closed space where harmful chemicals and gasses can accumulate. Therefore, the inspection and maintenance of these facilities shall be conducted by an individual with training and certification in working in hazardous confined spaces.



BIRD'S-EYE VIEW



SIDE PROFILE

5.16 Coalescing Plate Oil/Water Separators Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY, STORM	General					Monitoring	Inspection of discharge water for obvious signs of poor water quality.	Effluent discharge from vault should be clear with no thick visible sheen.
MONTHLY, STORM	General					Sediment Accumulation	Sediment depth in bottom of vault exceeds 6-inches in depth and/or visible signs of sediment on plates.	No sediment deposits on vault bottom and plate media, which would impede flow through the vault and reduce separation efficiency.
MONTHLY, STORM	General					Trash and Debris Accumulation	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault, and inlet/outlet piping.
MONTHLY, STORM	General					Oil Accumulation	Oil accumulation that exceeds 1- inch at the water surface.	Oil is extracted from vault using vactoring methods. Coalescing plates are cleaned by thoroughly rinsing and flushing. Should be no visible oil depth on water. Dispose in accordance with state and local rules and regulations.
ANNUAL	Structure					Damaged Coalescing Plates	Plate media broken, deformed, cracked, and/or showing signs of failure.	A portion of the media pack or the entire plate pack is replaced depending on severity of failure.
ANNUAL	Structure					Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and or replaced.
ANNUAL	Structure					Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
ANNUAL	Structure					Vault Structure Damage - Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.

Coalescing Plate Oil/Water Separators Checklist (Continued)

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
ANNUAL	Structure					Vault Structure Damage - Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
ANNUAL	Structure					Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

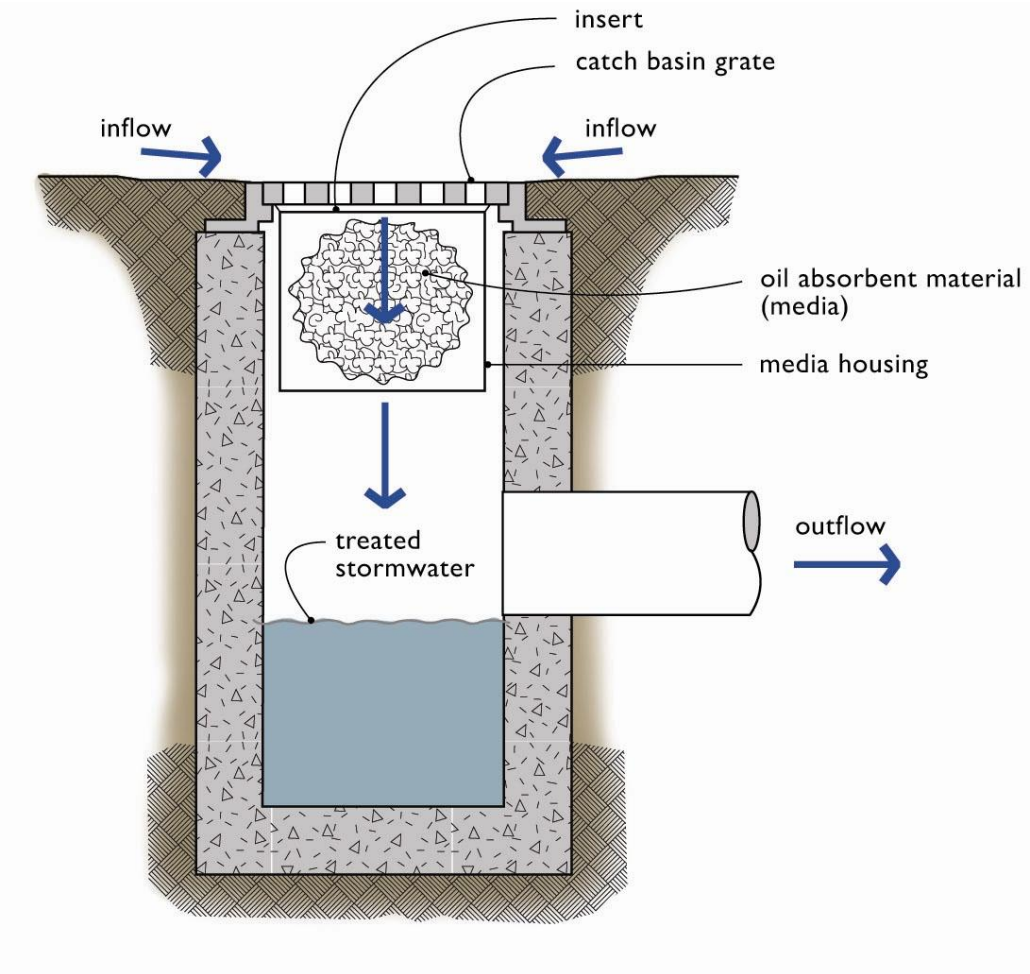
Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

5.17 Catch Basin Insert

Catch basin inserts have been under development for many years. They function similarly to media filtration except that they are typically limited by the size of the catch basin. They also are likely to be maintenance intensive.

Catch basin inserts typically consist of the following components:

- A structure (screened box, brackets, etc.) which contains a pollutant removal medium
- A means of suspending the structure in a catch basin
- A filter medium such as sand, carbon, fabric, etc.
- A primary inlet and outlet for the stormwater
- A secondary outlet for bypassing flows that exceed design flow



5.17 Catch Basin Insert Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Sediment Accumulation	When sediment forms a cap over the insert media of the insert and/or unit.	No sediment cap on the insert media and its unit.
MONTHLY	General					Trash and Debris Accumulation	Trash and debris accumulates on insert unit creating a blockage/restriction.	Trash and debris removed from insert unit. Runoff freely flows into catch basin.
MONTHLY	General					Media Insert Not Removing Oil	Effluent water from media insert has a visible sheen.	Effluent water from media insert is free of oils and has no visible sheen.
MONTHLY	General					Media Insert Water Saturated	Catch basin insert is saturated with water and no longer has the capacity to absorb.	Remove and replace media insert
MONTHLY	General					Media Insert-Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.	Remove and replace media insert.
MONTHLY	General					Media Insert Use Beyond Normal Product Life	Media has been used beyond the typical average life of media insert product.	Remove and replace media at regular intervals, depending on insert product.

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

5.18 Fencing/Shrubbery Screen/Other Landscaping

Fencing and shrubbery screens are provided around open stormwater management facilities to limit unauthorized access for safety purposes and to minimize the visual impact of the facility.

5.18 Fencing/Shrubbery Screen/Other Landscaping Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Missing or broken parts/dead shrubbery	Any defect in the fence or screen that permits easy entry to a facility.	Fence is mended or shrubs replaced to form a solid barrier to entry.
MONTHLY, STORM	General					Erosion	Erosion has resulted in an opening under a fence that allows entry by people or pets.	Replace soil under fence so that no opening exceeds 4 inches in height.
MONTHLY	General					Unruly vegetation	Shrubbery is growing out of control or is infested with weeds.	Shrubbery is trimmed and weeded to provide appealing aesthetics. Do not use chemicals to control weeds.
ANNUAL	Fences					Damaged parts	Posts out of plumb more than 6 inches.	Posts plumb to within 1-1/2 inches of plumb.
ANNUAL	Fences					Damaged parts	Top rails bent more than 6 inches.	Top rail free of bends greater than 1 inch.
ANNUAL	Fences					Damaged parts	Any part of fence (including posts, top rails, and fabric) more than 1 foot out of design alignment.	Fence is aligned and meets design standards.
ANNUAL	Fences					Damaged parts	Missing or loose tension wire.	Tension wire in place and holding fabric.
ANNUAL	Fences					Damaged parts	Missing or loose barbed wire that is sagging more than 2-1/2 inches between posts.	Barbed wire in place with less than 3/4-inch sag between posts.
ANNUAL	Fences					Damaged parts	Extension arm missing, broken, or bent out of shape more than 1-1/2 inches.	Extension arm in place with no bends larger than 3/4 inch.
ANNUAL	Fences					Deteriorated paint or protective coating	Part or parts that have a rusting or scaling condition that has affected structural adequacy.	Structurally adequate posts or parts with a uniform protective coating.
MONTHLY	Fences					Openings in fabric	Openings in fabric are such that an 8-inch diameter ball could fit through.	No openings in fabric.

If you are unsure whether a problem exists, please contact a Professional Engineer.

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

5.19 Gates

Gates typically consist of a chain link gate for fenced stormwater facilities to provide safety and allow vehicle and/or personnel access to the facility.

5.19 Gates Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Damaged or missing components	Gate is broken, jammed, or missing.	Pond has a functioning gate to allow entry of people and maintenance equipment such as mowers and backhoe. If a lock is used, make sure the Village DPW, Fire and Police Depts. have a key.
MONTHLY	General					Damaged or missing components	Broken or missing hinges such that gate cannot be easily opened and closed by a maintenance person.	Hinges intact and lubed. Gate is working freely.
ANNUAL	General					Damaged or missing components	Gate is out of plumb more than 6 inches and more than 1 foot out of design alignment.	Gate is aligned and vertical.
ANNUAL	General					Damaged or missing components	Missing stretcher bands, and ties.	Stretcher bar, bands, and ties in place.

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

Key:

(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

5.20 Grounds (Landscaping)

Landscaping is an essential component of stormwater management. Bare soil areas generate higher levels of stormwater runoff and sedimentation in stormwater facilities. The following check list gives some general guidance for landscape management.

5.20 Grounds (Landscaping) Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Weeds (nonpoisonous)	Weeds growing in more than 20% of the landscaped area (trees and shrubs only).	Weeds present in less than 5% of the landscaped area.
MONTHLY	General					Poisonous Vegetation or Insect hazard	Any presence of poison ivy or other poisonous vegetation or insect nests.	No poisonous vegetation or insect nests present in landscaped area.
MONTHLY, STORM	General					Trash or litter	Accumulations that exceed 1 cubic yard per 1000 SF of ground.	Trash and debris removed from site.
MONTHLY, STORM	General					Erosion of Ground Surface	Noticeable rills are seen in landscaped areas.	Causes of erosion are identified and steps taken to slow down/spread out the water. Eroded areas are filled, contoured, and seeded.
ANNUAL	Trees and shrubs					Damage	Limbs or parts of trees or shrubs that are split or broken which affect more than 25% of the total foliage of the tree or shrub.	Trim trees/shrubs to restore shape. Replace trees/shrubs with severe damage.
MONTHLY	Trees and shrubs					Damage	Trees or shrubs that have been blown down or knocked over.	Replant tree, inspecting for injury to stem or roots. Replace if severely damaged.
ANNUAL	Trees and shrubs					Damage	Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots.	Place stakes and rubber-coated ties around young trees/shrubs for support.

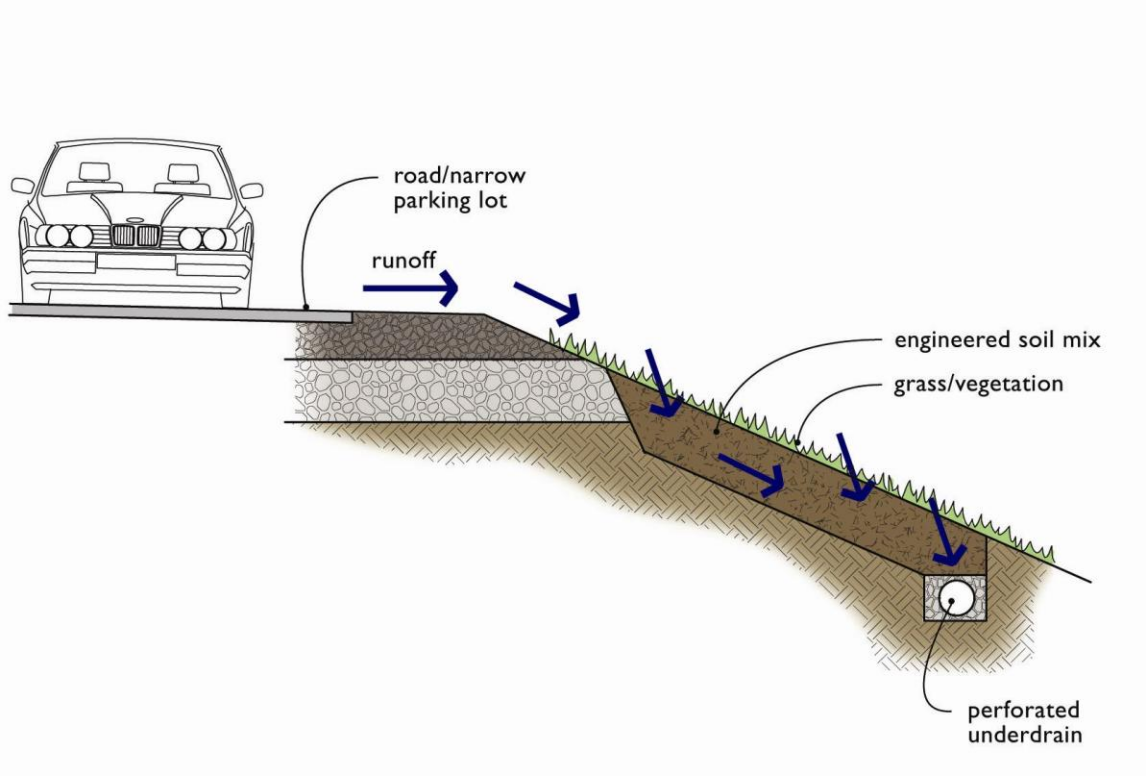
If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

5.21 Ecology Embankment

An ecology embankment is a filter strip designed for impervious areas with flow paths of 30 feet or less that can drain along their widest dimension to grassy areas. Typical applications of ecology embankments are for roads with limited right-of-way widths or for narrow parking strips.



5.21 Ecology Embankment Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	No Vegetation Zone adjacent to pavement					Erosion, scour, or vehicular damage	Vegetation zone is uneven or clogged so that flows are not uniformly distributed.	Level the area and clean so that flows are spread evenly.
MONTHLY	No Vegetation Zone adjacent to pavement					Sediment accumulation on edge of pavement	Flows no longer sheeting off of roadway. Sediment accumulation on pavement edge exceeds top of pavement elevation.	Remove sediment deposits such that flows can sheet off of roadway.
MONTHLY	Vegetated Filter					Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits, re-level so slope is even and flows pass evenly through Ecology Embankment.
MONTHLY	Vegetated Filter					Excessive vegetation or undesirable species.	When the grass becomes excessively tall; when nuisance weeds and other vegetation starts to take over or shades out desirable vegetation growth characteristics.	Mow grass, control nuisance vegetation, such that flow not impeded. Grass should be mowed to a height that encourages dense even herbaceous growth.
MONTHLY	Vegetated Filter					Erosion, scour, or vehicular damage.	Eroded or scoured areas due to flow channelization, high flows, or vehicular damage.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with suitable topsoil. (The grass will creep in over the rock in time). If bare areas are large, generally greater than 12 inches wide, the filter strip should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident.
MONTHLY	Media Bed					Erosion, scour, or vehicular damage.	Eroded or scoured areas due to flow channelization, high flows, or vehicular damage.	For ruts or areas less than 12 inches wide, repair the damaged area by filling with suitable media. If bare areas are large, generally greater than 12 inches wide, the media bed should be re-graded.
MONTHLY	Media Bed					Sediment Accumulation on Media Bed.	Sediment depth inhibits free infiltration of water.	Remove sediment deposits, re-level so slope is even and flows pass freely through Media Bed.
MONTHLY	Underdrains					Sediment	Depth of sediment within perforated pipe exceeds 0.5”.	Flush underdrains through access ports and collect flushed sediment.

Ecology Embankment Checklist (Continued)

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Trash and Debris Accumulation	Trash and debris which exceed 1 cubic feet per 1,000 square feet . In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Remove trash and debris.
MONTHLY	General					Flows are bypassing Ecology Embankment	Evidence of significant flows down-slope (rills, sediment, vegetation damage, etc.) of Ecology Embankment.	Remove sediment deposits, re-level so slope is even and flows pass evenly through Ecology Embankment. If Ecology Embankment is completely clogged it may require more extensive repair or replacement.

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

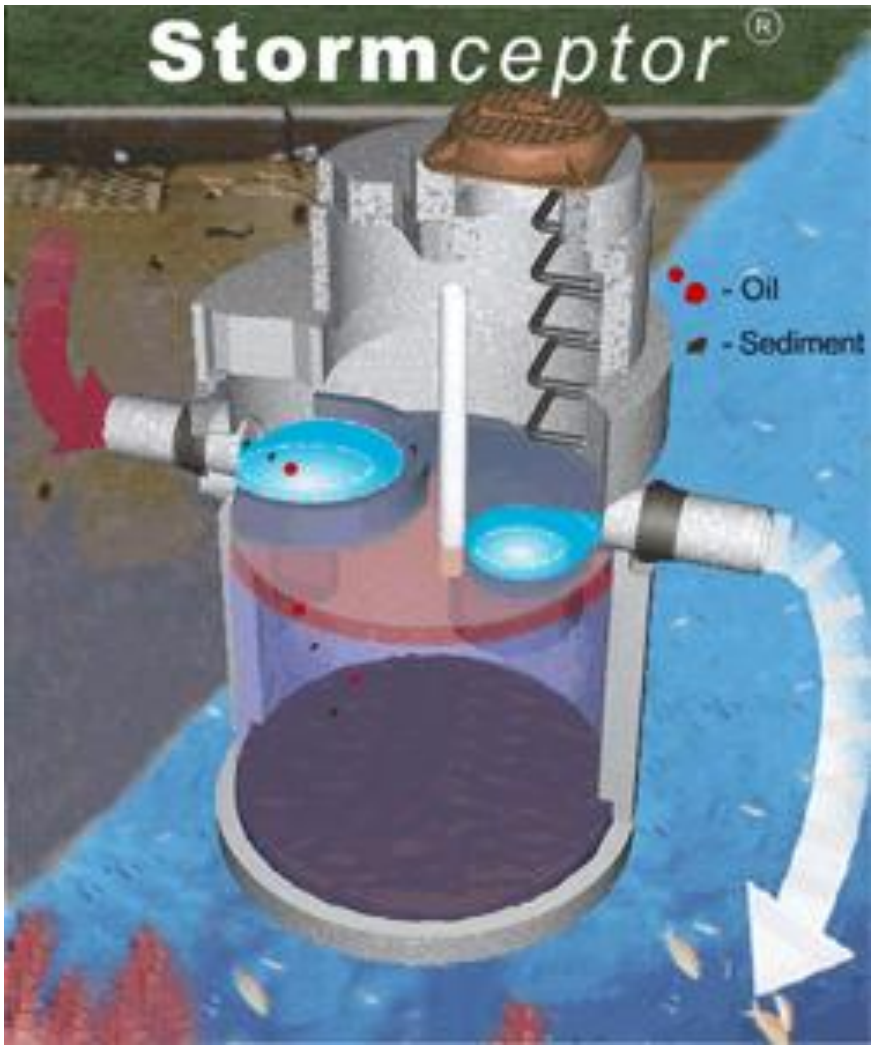
Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

5.22 Stormceptor ® Stormwater Treatment System

Vortex-enhanced Sedimentation consists of a cylindrical vessel where the inlet flow spirals around the perimeter in a vortex-type action causing the heavier particles to settle out of the stormwater. It uses a vortex-enhanced settling mechanism (swirl-concentration) to capture settleable solids, floatables, and oil and grease.

Stormceptor® treatment units are a proprietary manufactured system. See manufacturer's publications for additional maintenance information.

Below ground vaults are a closed space where harmful chemicals and gasses can accumulate. Therefore, the inspection and maintenance of these facilities shall be conducted by an individual with training and certification in working in hazardous confined spaces.



5.22 Stormceptor® Stormwater Treatment System Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY, STORM	General					Sediment accumulation	Sediment depth is within 6" of dry weather water surface elevation.	Accumulated sediment should be removed.
MONTHLY, STORM	General					Trash and Debris Accumulation	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault, and inlet/outlet piping.
MONTHLY, STORM	General					Oil Accumulation	Oil accumulation that exceeds 1- inch at the water surface.	Oil is extracted from vault using vactoring methods. Coalescing plates are cleaned by thoroughly rinsing and flushing. Should be no visible oil depth on water. Dispose in accordance with state and local rules and regulations.
ANNUAL	Structure					Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and or replaced.
ANNUAL	Structure					Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
ANNUAL	Structure					Vault Structure Damage - Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
ANNUAL	Structure					Vault Structure Damage - Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.

If you are unsure whether a problem exists, please contact a Professional Engineer.

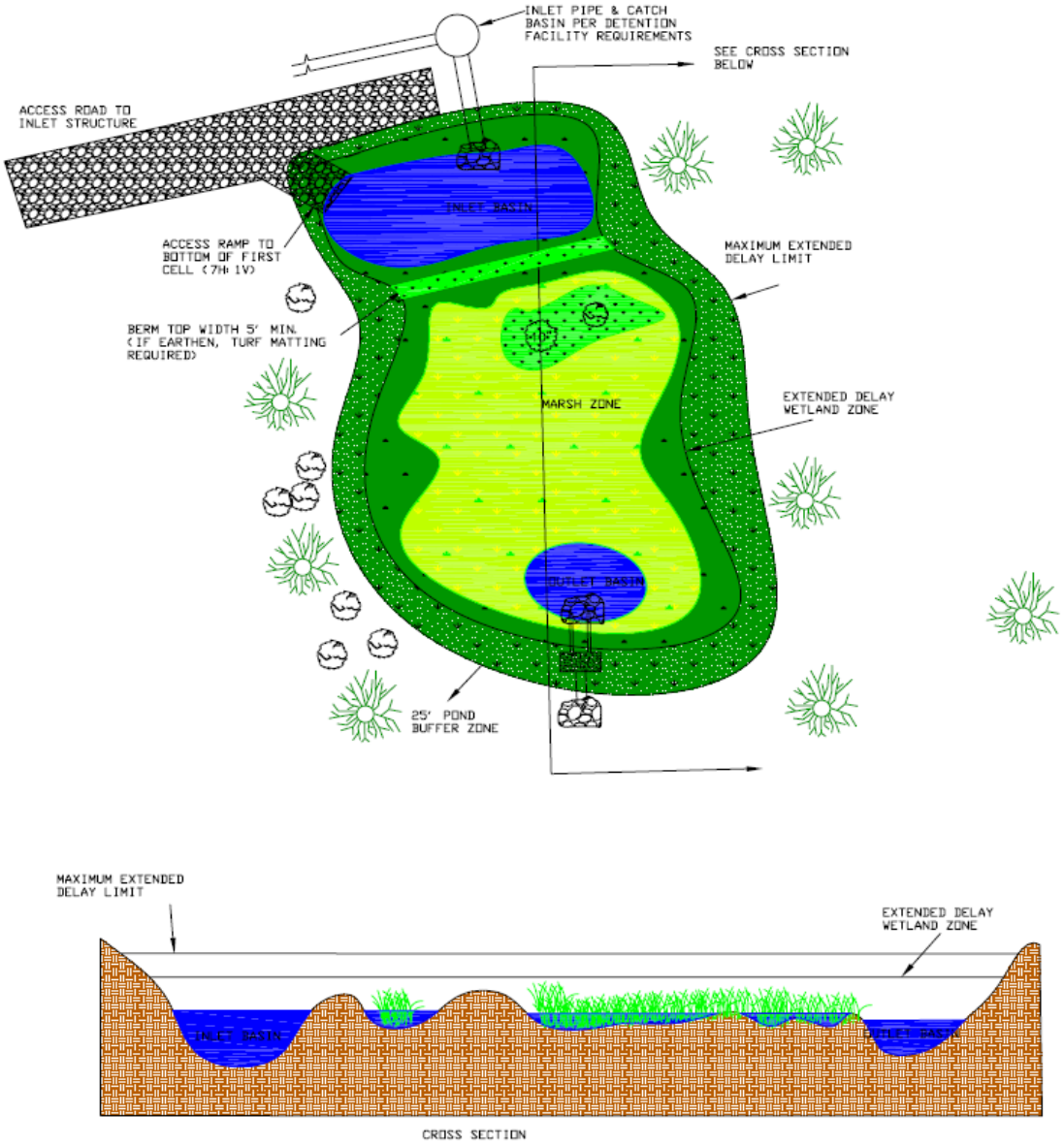
Comments:

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

5.23 Treatment Wetland

A stormwater treatment wetland is a shallow man-made pond that is designed to treat stormwater through the biological processes associated with emergent aquatic plants. These facilities use dense wetland vegetation and settling to filter sediment and oily materials out of stormwater.

Stormwater treatment wetlands are used to capture pollutants in a managed environment so that they will not reach natural wetlands and other ecologically important habitats. Vegetation must occasionally be harvested and sediment dredged in stormwater treatment wetlands. In general, stormwater wetlands perform well to remove sediment, metals, and pollutants that bind to organic soils.



5.23 Treatment Wetland Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Sediment Accumulation	Sediment depth exceeds 2-inches in 10% of the wet pool cell area.	Remove sediment deposits in treatment area.
MONTHLY	General					Water Depth	Water not retained to a depth of 18 inches during the wet season.	Build or repair outlet berm so that water is retained in the wetland.
MONTHLY	General					Wetland Vegetation	Vegetation becomes sparse and does not provide adequate filtration, OR vegetation is crowded out by very dense clumps of cattail, which do not allow water to flow through the clumps.	Determine cause of lack or vigor of vegetation and correct. For excessive cattail growth, cut cattail shoots back and compost off-site. Note: normally wetland vegetation does not need to be harvested unless die-back is causing oxygen depletion in downstream waters.
MONTHLY	General					Trash and Debris Accumulation	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold, all trash and debris will be removed as part of next scheduled maintenance.	Remove trash and debris from wetland.
MONTHLY	General					Erosion/Scouring	Any erosion or scouring due to flow channelization, or higher flows.	Check design flows to assure wetland is large enough to handle flows. Bypass excess flows or enlarge swale. Replant eroded areas with fibrous-rooted plants in drier areas.

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

5.24 Inlet/Outlet Stormwater Pipe

The inlet and outlet stormwater pipes convey stormwater in, through, and out of stormwater facilities.

Storm sewer pipes convey stormwater. Pipes are built from many materials and are sometimes perforated to allow stormwater to infiltrate into the ground. Stormwater pipes are cleaned to remove sediment or blockages when problems are identified. Stormwater pipes must be clear of obstructions and breaks to prevent localized flooding. All stormwater pipes should be in proper working order and free of the possible defects listed below.

In addition, outlet stormwater pipes should be inspected to make sure stormwater exits the facility without causing any negative impacts to the drainage area.

5.24 Inlet/Outlet Storm Pipe Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Obstructions including roots	Storm pipe- root enters or deforms pipe, reducing flow.	Use mechanical methods to remove root. Do not put root-dissolving chemicals in storm sewer pipes. If necessary, remove the vegetation over the storm sewer pipe/line.
MONTHLY	General					Pipe dented or broken	Inlet/outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.
MONTHLY	General					Pipe rusted or deteriorated	Any part of the piping that is crushed or deformed more than 20% or any other failure to the piping.	Pipe repaired and/or replaced.
MONTHLY	Erosion					Erosion	Eroded or scoured areas due to flow channelization, high flows, or vehicular damage.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, the damaged area should be re-graded and re-seeded. For smaller bare areas, overseed.
MONTHLY	Pipe outfall					Missing or removed rock	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.	Rock pad replaced to design standards.
MONTHLY	Pipe outfall					Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.

Inlet/Outlet Storm Pipe Checklist (Continued)

		Date						
Frequency	**Drainage System Feature**	✓	✓	✓	✓	**Problem**	**Conditions to Check For**	**Conditions That Should Exist**
MONTHLY	Pipe outfall					Erosion/Scouring	Eroded or scoured ditch or stream banks due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, damaged area should be re-graded and re-seeded. For smaller bare areas, overseed.
MONTHLY	Pipe Outfall					Missing or Moved Rock	Only one layer of rock exists above native soil area in area five square feet or larger, or any exposure of native soil.	Rock pad replaced to design standards.
MONTHLY	Pipe Outfall					Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.

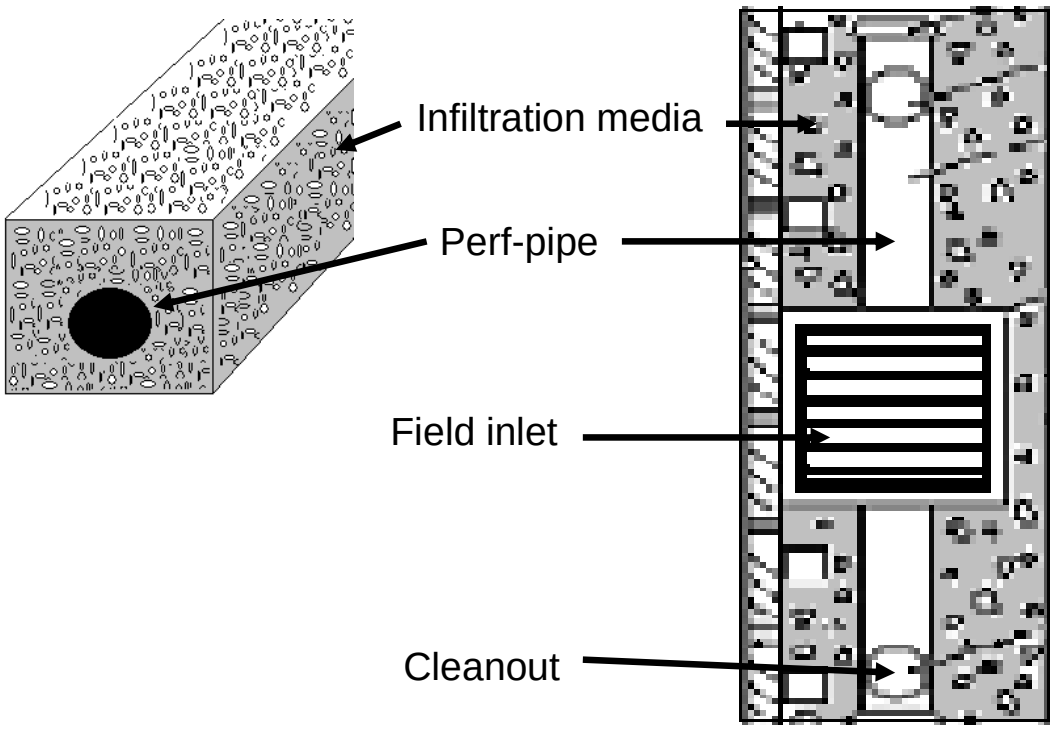
If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

5.25 Infiltration Trench

A stormwater infiltration trench is a closed basin built by excavating below existing ground. Infiltration trenches temporarily store stormwater runoff during rain events. Infiltration trenches do not discharge to a downstream conveyance system or nearby surface water. Instead, infiltration trenches rely on the ability of the site's soils to absorb the stormwater into the ground.



5.25 Infiltration Trench Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	General					Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants in or around facility.	Remove. (Coordinate removal and cleanup with local water quality response agency).
MONTHLY	General					Drainage Slow	Drainage Trench - decreased capacity that indicates slow drainage.	Verify facility design rate. Clean perforated drain pipe. Do not allow removed sediment and water to discharge back into the storm sewer.
MONTHLY	General					Sediment & Debris	Sediment depth is greater than 20% of pipe diameter.	Clean pipe and remove material.
MONTHLY	General					Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.	No Trash or debris located immediately in front of catch basin or on grate opening.
MONTHLY	General					Trash & Debris	Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the trench.
MONTHLY	General					Trash & Debris	Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
MONTHLY	General					Trash & Debris	Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

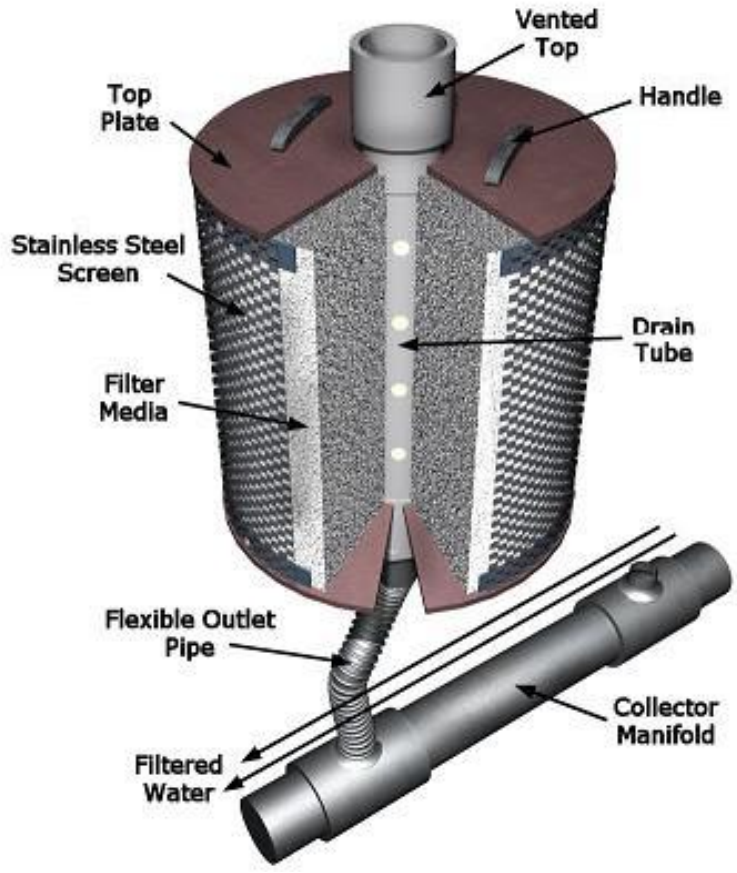
Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

5.26 CDS Media Filtration System

The CDS Media Filtration System is an engineered cartridge type filter system consisting of a weir and vault beneath the cartridge where larger solids will settle and be captured. The system operates by filtering the stormwater through media filled cartridges.

Filtered water enters a perforated drain tube located in the center of the cartridge and flows to the collector manifold through a flexible pipe. The manifold is plumbed to a float controlled slide gate that sets the overall operational control of the Media Filtration System to achieve a balance between flow and driving head level. The float is designed to fully open the slide gate as the water level reaches the top of the cartridges. The float control valve ensures that a uniform vertical pressure distribution is developed from the bottom to the top of each cartridge, which ensures even hydraulic loading and maximum exposure of the perlite media within each cartridge filter at the same time and hydraulic loading rate.

Below ground vaults are a closed space where harmful chemicals and gasses can accumulate. Therefore, the inspection and maintenance of these facilities shall be conducted by an individual with training and certification in working in hazardous confined spaces.



5.26 CDS Media Filtration System (MFS) ® Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	Media filter vault					Sediment accumulation on top of filter cartridges	Sediment accumulation exceeds ½ inch on top of cartridges.	Minimal sediment deposits on top of cartridges. Excess sediment on cartridges likely indicates that cartridges are plugged and require maintenance.
MONTHLY	Media filter vault					Sediment accumulation in vault	Sediment accumulation in vault exceeds 6 inches.	Sediment in vault should be removed.
MONTHLY	Media filter vault					Trash and floatable debris accumulation	Excessive trash and floatable debris accumulation in vault.	Minimal trash or other floatable debris in filter vault.
MONTHLY	Media filter cartridges					Filter cartridges full	Filter cartridge media appears dark. Check should be performed on a dry day. Requires entry to vault. See comments below.	Filter media checked and replaced if needed. If cartridges are plugged with oil additional treatment or source control BMP may be needed.
MONTHLY	Media filter cartridges					Filter cartridges full	Area around cartridges has standing water and cartridges are submerged 24 hours after a storm.	Filter media checked and replaced if needed. If cartridges are plugged with oil additional treatment or source control BMP may be needed.
MONTHLY	Media filter cartridges					Filter cartridges full	Water flowing over the head control box during light storm events and over one inch of floatables have accumulated in the cartridge vent pipe.	Filter media checked and replaced if needed. If cartridges are plugged with oil additional treatment or source control BMP may be needed.
MONTHLY	Access Cover					Access cover Damaged/ Not working	One maintenance person cannot remove lid after applying 80 pounds of lift, corrosion of deformation of cover.	Cover repaired to proper working specifications or replaced.
ANNUAL	Collector manifold					Damaged Piping	Any part of the pipes are crushed or damaged due to corrosion and/or settlement.	Pipe repaired or replaced.
ANNUAL	Vault					Vault structure has cracks in wall, bottom, and damage to frame and/or top slab.	Cracks wider than ½ inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault repaired or replaced so that vault meets design specifications and is structurally sound.
ANNUAL	Vault					Vault structure has cracks in wall, bottom, and damage to frame and/or top slab.	Cracks wider than ½ inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks	Vault repaired so that no cracks exist at the joint of inlet/outlet pipe.

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
ANNUAL	Baffles					Baffles	Baffles corroding, cracking, warping, and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to design specifications.
ANNUAL	Access Ladder					Ladder rungs unsafe	Maintenance person judges that ladder is unsafe due to missing rungs, misalignment, rust, or cracks. Ladder must be fixed or secured immediately.	Ladder meets design standards and allows maintenance persons safe access.

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

CDS MFS system vault is a confined space. Visual inspections should be performed above ground. If entry is required it should be performed by qualified personnel.

Default maintenance is annual.

Configuration options include precast or cast in place concrete vaults or precast manhole structures.

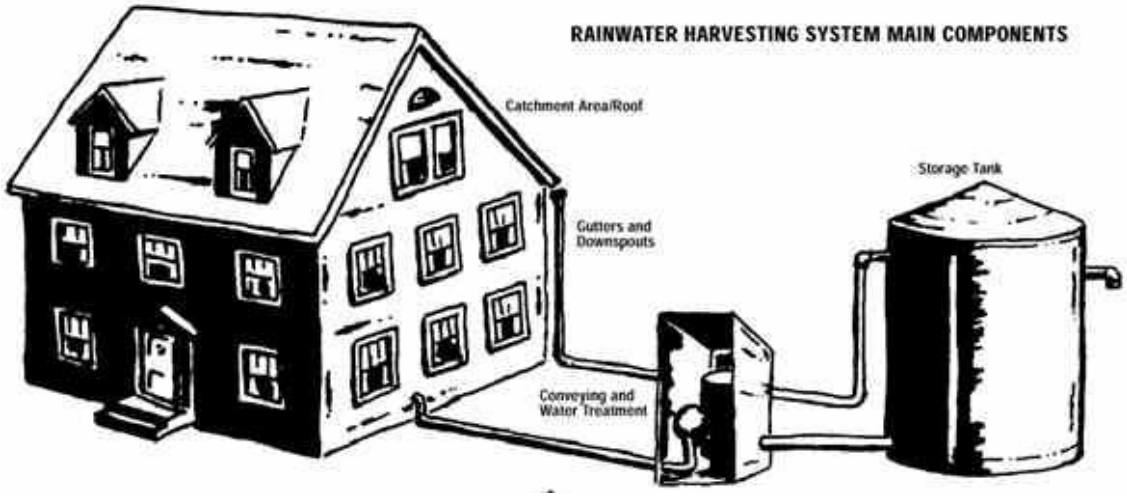
Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.

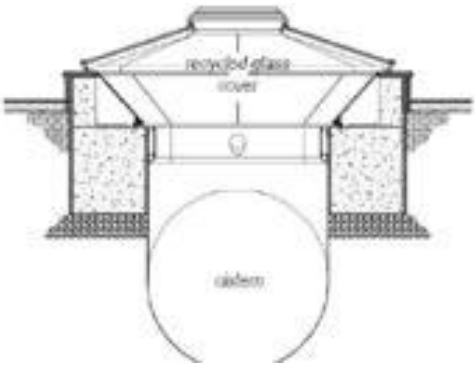
5.27 Cisterns/Rain Barrels

Cisterns are often used to supplement irrigation water. Cisterns capture and store stormwater runoff to be used later for irrigation systems or filtered and reused for household activities such as toilet flushing and clothes washing. Cisterns can be constructed of any water-retaining material and their size can vary from hundreds of gallons for residential uses to tens of thousands of gallons for commercial and/or industrial uses. They can be located either above or below ground and can be constructed on-site or pre-manufactured.

Maintenance requirements for cisterns are relatively low if they are only providing a supplemental supply of irrigation water. Cisterns designed for potable water supply have much higher maintenance requirements, such as biannual testing for water quality and filtering systems. Cisterns, along with all their components and accessories, should undergo regular inspection at least twice a year. Replacement or repair of the unit as a whole, and any of its constituent parts and accessories, should subsequently be undertaken if needed.

Below ground vaults are a closed space where harmful chemicals and gasses can accumulate. Therefore, the inspection and maintenance of these facilities shall be conducted by an individual with training and certification in working in hazardous confined spaces.





5.27 Cistern/Rain Barrels

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
BIANNUAL	Collection Facilities					Roof	Debris has accumulated.	Remove debris
BIANNUAL	Collection Facilities					Gutter	Debris has accumulated.	Clean gutters (the most critical cleaning is in mid- to late-spring to flush the pollen deposits from surrounding trees)
ANNUAL	Collection Facilities					Screens at the top of downspout and cistern inlet	Screen has deteriorated.	Replace
MONTHLY	Collection Facilities					Screens at the top of downspout and cistern inlet	None. Preventative maintenance. .	Clear screen of any accumulated debris
MONTHLY	Collection Facilities					Low flow orifice	None. Preventative maintenance.	Clean low flow orifice
BIANNUAL	Collection Facilities					Overflow pipe	Pipe is damaged.	Repair/replace
BIANNUAL	Collection Facilities					Overflow pipe	Pipe is clogged.	Remove debris
ANNUAL	Collection Facilities					Cistern	Debris has accumulated at bottom of tank	Remove debris
At startup	Training and Documentation					Training / written guidance	Training / written guidance is required for proper operation and maintenance.	Provide property owners and tenants with proper training and a copy of the O&M manual.
BIANNUAL	Safety					Access and Safety	Access to cistern required for maintenance or cleaning.	Any cistern detention systems opening that could allow the entry of people must be marked: “DANGER—CONFINED SPACE"
BIANNUAL	Pest Control					Mosquitoes	Screens allow mosquitoes access to water	Replace or repair screens.

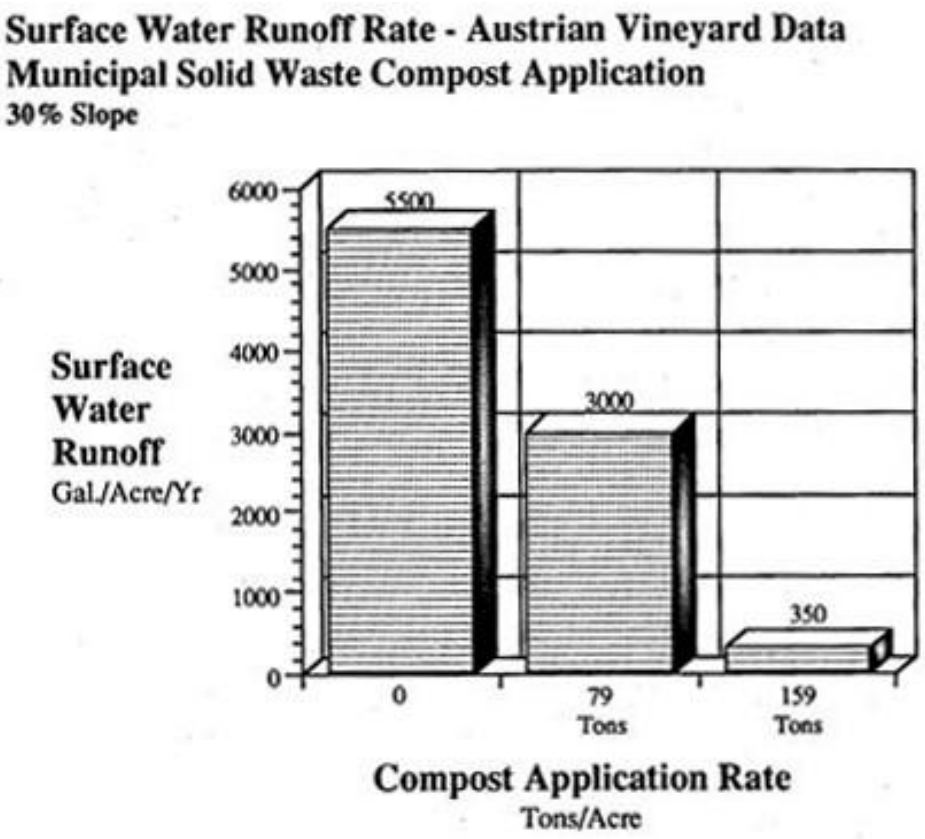
If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner’s discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.
(BIANNUALLY) Twice per year in the spring and fall.

5.28 Compost Amended Soils

Amending soil with compost increases the soil's permeability and water holding capacity, which delays and often reduces the peak stormwater run-off flow rate and decreases irrigation water requirements. Amending soils will also enhance the lawn's long-term aesthetics while reducing fertilizer and pesticide requirements.



5.28 Compost Amended Soil

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
ANNUAL	General Facility Requirements					Soil media (maintain high organic soil content)	Vegetation not fully covering ground surface.	Re-mulch landscape beds with 2-3 inches of mulch until the vegetation fully closes over the ground surface
Ongoing	General Facility Requirements					Soil media (maintain high organic soil content)	None. Preventative maintenance	Return leaf fall and shredded woody materials from the landscape to the site as mulch.
Ongoing	General Facility Requirements					Soil media (maintain high organic soil content)	None. Preventative maintenance	On turf areas, “grass cycle” (mulch-mow or leave the clippings) to build turf health
Ongoing	General Facility Requirements					Soil media (maintain high organic soil content)	None. Preventative maintenance .	Avoiding broadcast use of pesticides (bug and weed killers) like “weed & feed,” which damage the soil life.
ANNUAL	General Facility Requirements					Soil media (maintain high organic soil content)	None. Preventative maintenance	Where fertilization is needed (mainly turf and annual flower beds), a moderate fertilization program which relies on natural organic fertilizers (like compost) or slow release synthetic balanced fertilizers.
ANNUAL	General Facility Requirements					Compaction	Soils become waterlogged, do not appear to be infiltrating.	To remediate, aerate soil, till or further amend soil. If drainage is still slow, consider investigating alternative causes (e.g., high wet-season groundwater levels, low permeability soils). Also consider land use and protection from compacting activities. If areas are turf, aerate compacted areas and top dress them with ¼-½ inch of compost to renovate them.
ANNUAL	General Facility Requirements					Erosion/scouring	Areas of potential erosion are visible.	Take steps to repair or prevent erosion. Identify and address the causes of erosion.
ANNUAL	General Facility Requirements					Grass/vegetation	Less than 75% of planted vegetation is healthy with a generally good appearance.	Take appropriate maintenance actions (e.g., remove/replace plants)
MONTHLY	General Facility Requirements					Noxious weeds	Listed noxious vegetation is present. See Wisconsin DNR invasive species reports.	Noxious weeds or invasive species must be removed and disposed immediately. It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality.

Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
QUARTERLY	General Facility Requirements					Weeds	Weeds are present.	Remove and dispose of weed material. It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality.

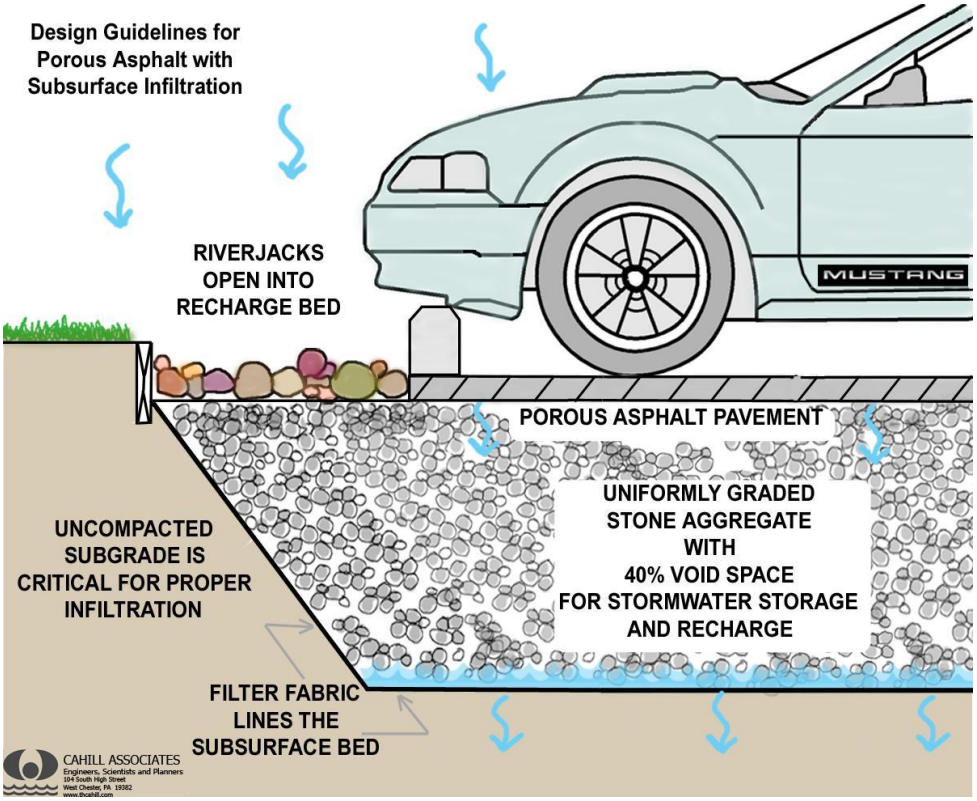
If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.
(BIANNUALLY) Twice per year in the spring and fall.
(QUARTERLY) 4 times per year.

5.29 Pervious Pavement

Pervious paving allows water to infiltrate into layers of gravel placed below the paving and then into soil and groundwater below. By infiltrating most of the storm water on-site, the amount of water and pollution flowing into storm sewers and directly to rivers and streams is greatly reduced. This, in turn, protects water quality, maintains more stable base flows to streams, reduces flood peaks, and reduces stream bank erosion. With infiltration, groundwater is recharged and streams are replenished with cool, clean groundwater in a more natural way. Pervious paving is one component of Low Impact Development (LID).



5.29 Pervious Pavement

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
BIANNUAL	Surface					Pervious asphalt or cement concrete	None. Maintenance to prevent clogging with fine sediment.	Use conventional street sweepers equipped with vacuums, water, and brushes or pressure washer to restore permeability. Vacuum or pressure-wash the pavement two to three times annually.
Ongoing	Surface					Pervious asphalt or cement concrete	None. Maintenance to prevent clogging with fine sediment.	Prohibit use of sand and sealant application and protect from construction runoff.
ANNUAL	Surface					Pervious asphalt or cement concrete	Major cracks or trip hazards.	Fill with patching mixes. Large cracks and settlement may require cutting and replacing the pavement section.
As needed	Surface					Pervious asphalt or cement concrete	Utility cuts.	Replace utility cuts in-kind.
BIANNUAL	Surface					Fallen leaves / debris	Fallen leaves or debris.	Remove/dispose.
BIANNUAL	Surface					Interlocking concrete paver blocks.	Interlocking paver block missing or damaged.	Replace damaged paver block.
ANNUAL	Surface					Interlocking concrete paver blocks	Settlement of surface.	May require resetting
BIANNUAL	Surface					Interlocking concrete paver blocks	Sediment or debris accumulation between paver blocks.	Remove/dispose
ANNUAL	Surface					Interlocking concrete paver blocks	Loss of void material between paver blocks.	Refill per manufacturer's recommendations.
Varies	Surface					Interlocking concrete paver blocks	Varied conditions.	Perform O&M per manufacturer's recommendations.
BIANNUAL	Surface					Open-celled paving grid with gravel	Sediment or debris accumulation in grid voids.	Remove/dispose
ANNUAL	Surface					Open-celled paving grid with gravel	Loss of soil and/or grass material in grid.	Refill and/or replant per manufacturer's recommendations.
Varies	Surface					Open-celled paving grid with gravel	Varied conditions.	Perform O&M per manufacturer's recommendations.

BIANNUAL	Surface					Open-celled paving grid with grass	Sediment or debris accumulation in grid voids.	Remove/dispose
ANNUAL	Surface					Open-celled paving grid with grass	Loss of soil and/or grass material in grid.	Refill and/or replant per manufacturer's recommendations.
Varies	Surface					Open-celled paving grid with grass	Varied conditions.	Perform O&M per manufacturer's recommendations.
BIANNUAL	Overflows and Emergency Spillways					Obstructions / debris	Obstructions or debris block 30% or more of outlet structure.	Remove/dispose
BIANNUAL	Overflows and Emergency Spillways					Erosion	Native soil is exposed or other signs of erosion damage are present.	Repair erosion and stabilize surface of spillway
Ongoing	Spill Prevention and Response					Spill prevention	Storage or use of potential contaminants in the vicinity of facility.	Exercise spill prevention measures whenever handling or storing potential contaminants
As needed	Spill Prevention and Response					Spill response	Release of pollutants. Call to report any spill to the Village of Germantown Police Department at (262) 253-7780.	Cleanup spills as soon as possible to prevent contamination of stormwater.

If you are unsure whether a problem exists, please contact a Professional Engineer

Comments:

Key:
(MONTHLY) Monthly from April through November.
(ANNUAL) At owner's discretion, but no later than October.
(STORM) Inspect within 1-3 days after storm of 5 inches in 24 hours.
(BIANNUALLY) Twice per year in the spring and fall.
(QUARTERLY) 4 times per year.

6.0 Additional Information/Resources

For more information on operation and maintenance of your stormwater management system contact:

- Village of Germantown Department of Public Works and Utilities, (262) 250-4721.
- Milwaukee Metropolitan Sewerage District (MMSD), Chapter 13, http://v3.mmsd.com/AssetsClient/Documents/rules/Chapter13Oct2010.pdf
- MMSD, Surface Water and Storm Water Rules, Technical Guidance, http://v3.mmsd.com/AssetsClient/Documents/stormwaterweb/PDFs/MSSD_Vol2Nov2010.pdf
- Wisconsin Department of Natural Resources Technical Standards, http://dnr.wi.gov/runoff/stormwater/techstds.htm
- Wisconsin Administrative Code, NR 151, http://legis.wisconsin.gov/rsb/code/nr/nr151.pdf
- Wisconsin Administrative Code, NR 216, http://legis.wisconsin.gov/rsb/code/nr/nr216.pdf

Or refer to information provided in the following resources:

Village of Germantown Stormwater Pollution Prevention Manual,
Available for viewing at Village Hall, N112 W17001 Mequon Rd, at the Public Works counter.

Additional information will be added as available.

7.0 Glossary

Applicant - The person, party, firm, corporation, or other legal entity that proposes to develop property in Village of Germantown by submitting an application.

Appurtenances - Machinery, appliances, or auxiliary structures attached to a main structure, (but not considered an integral part thereof), for the purpose of enabling it to function.

Aquifer - A geologic stratum containing groundwater that can be withdrawn and used for human purposes.

As-built or Record Drawings - As-constructed engineering plans that include all changes made to a project during construction. All drawing changes shall be certified by a Wisconsin Professional Engineer.

Backwater - Water upstream from an obstruction which is deeper than it would normally be without the obstruction.

Base Flood - The flood having a one percent chance of being equaled or exceeded in any given year, also referred to as the "100-year flood".

Base Flood Elevation - The water surface elevation, in feet, above mean sea level for the base flood (Referenced to the National Geodetic Vertical Datum of 1929).

Basin - An area from which surface runoff is concentrated, usually to a single point such as the mouth of a stream.

Bench - A relatively level step excavated into natural earth or fill material.

Berm - A constructed barrier of compacted earth.

Best Management Practice (BMP) - Physical, structural, and/or managerial practices approved by the Wisconsin Department of Natural Resources (DNR) that, when used singly or in combination, prevent or reduce pollution of water.

Biofilter - A designed, vegetated treatment facility where the more or less simultaneous processes of filtration, infiltration, adsorption and biological uptake of pollutants in stormwater takes place during the conveyance of concentrated or sheet flowing stormwater.

Biofiltration - The process of reducing pollutant concentrations in water by filtering the polluted water through biological materials.

Bollard - A post (may or may not be removable) used to prevent vehicular access.

Buffer - The zone contiguous with a sensitive area that is required for the continued maintenance, function, and structural stability of the sensitive area.

Glossary (Continued)

Catch Basin - A form of connection between the surface of the ground and a drain or sewer for the admission of surface and stormwater runoff containing a minimum 1 foot sump for the collection of sediment.

Catchment - Surface drainage area.

Catch line - The point where a severe slope intercepts a different, gentler slope.

Certification - A written engineering opinion, stamped, signed, and dated by a Wisconsin Professional Engineer, concerning the progress or completion of work.

Channel - A surface feature that conveys surface water and is open to the air.

Channel, constructed - Channels or ditches constructed (or reconstructed natural channels) to convey surface water.

Channel, natural - Streams, creeks, or swales that convey surface/groundwater and have existed long enough to establish a stable route and/or biological community.

Check Structure - A dam (e.g., rock, earthen, log) used in channels to reduce water velocities, promote sediment deposition, and/or enhance infiltration.

Clearing - The removal of vegetative material such as timber (including stumps), brush, sod, etc.

Closed Basin - A basin for which there is no surface water outlet.

Closed Depression - An area which is low lying and either has no or such a limited surface water outlet that during storm events the area acts as a retention basin.

Compaction - The consolidation of fill by mechanical means.

Constructed Wetland - Those wetlands intentionally created on sites previously without wetlands for the primary purpose of stormwater treatment and managed as such. Constructed wetlands are normally considered as part of the stormwater collection and treatment system and are subject to maintenance requirements. (These wetlands are not the same as wetlands created for mitigation purposes, which are typically viewed in the same manner as natural, regulated wetlands).

Conveyance - A mechanism for transporting water from one point to another, including pipes, ditches, channels, culverts, gutters, manholes, weirs, man-made and natural channels, water quality filtration systems, dry wells, etc.

Conveyance System - The drainage facilities, both natural and man-made, which collect, contain, and provide for the flow of surface and stormwater from the highest points on the land down to a receiving water body.

County, The - "County" means the Washington County Executive or designee; also Washington County, its duly authorized representatives, and the jurisdictional boundaries of Washington County.

Critical Areas - As defined by the Wisconsin Department of Natural Resources.

Glossary (Continued)

Critical Habitat - Habitat necessary for survival of endangered, threatened, rare, sensitive, or monitored species.

Culvert - Pipe or concrete box structure which drains open channels, swales, or ditches under a roadway or embankment. There are typically no catch basins or manholes along its length.

Dead Storage - The volume available in a depression in the ground below any conveyance system, or surface drainage pathway, or outlet invert elevation that could allow the discharge of surface and stormwater runoff.

Dedication - Is the deliberate appropriation of land by an owner for any general and public uses, reserving to himself no other rights than those compatible with the full exercise and enjoyment of the public uses to which the property has been devoted. To show the intent to dedicate, the owner shall file or final plat showing the land to be dedicated. Public acceptance shall be shown by the approval of the plat for filing by the appropriate governmental unit.

Design Engineer (Project Engineer) - The professional civil engineer licensed in the State of Wisconsin who prepares the analysis, design, and engineering plans for an applicant's permit or approval submittal.

Design Event - A synthetic precipitation event (storm) represented by the Southeast Wisconsin Regional Planning Commission (SEWRPC) designated hyetograph for use in designing a drainage facility.

Detention Facility - A facility (e.g., pond, vault, pipe) in which surface and stormwater is temporarily stored and released at a controlled rate.

Detention Time - The theoretical time required to displace the contents of a stormwater treatment facility at a given rate of discharges (i.e., drawdown time).

Detention Pond - A detention facility in the form of an open pond.

Developer - The person or legal entity who holds title to the property or has a sufficient interest in the project to propose the project. The developer of the project.

Development - Any man-made change to improved or unimproved real estate including, but not limited to, buildings or other structures, placement of manufactured home/mobile home, mining, dredging, clearing, filling, grading, paving, excavation, drilling operations, or the subdivision of property. See also the definitions for new development, redevelopment and land disturbing activities.

Dispersed discharge - The release of surface and storm water runoff from a drainage facility system that allows the runoff to spread over a wide area. The area is located so the flow does not concentrate anywhere upstream of an erodible drainage channel.

Disturbed Area - An area inside project boundaries disturbed and/or altered from its natural state.

Glossary (Continued)

Ditch - A long narrow excavation dug in the earth for drainage with its top width less than 10 feet at design flow.

Drainage - Refers to the collection, conveyance, containment, and/or discharge of surface and storm water runoff.

Drainage Basin - A geographic and hydrologic sub unit of a watershed.

Drainage Channel - A drainage pathway with well-defined bed and banks indicating frequent conveyance of surface and storm water runoff.

Drainage Course - A pathway for watershed drainage characterized by wet soil vegetation; often intermittent in flow.

Drainage Easement - A legal encumbrance that is placed against a property's title in perpetuity to reserve specified privileges for the users and beneficiaries of the drainage facilities contained within the boundaries of the easement.

Drainage Pathway - The route that surface and stormwater runoff follows down slope when leaving any part of the site.

Drainage System - Refers to the combination of Best Management Practices, collection, conveyance, retention, detention, treatment and outfall features or structures on a project.

Drop Structure - A structure for dropping water to a lower level and dissipating its surplus energy; a fall. A drop may be vertical or inclined.

Dry Pond - A detention facility which drains dry after a storm.

Earth/Earth Material - Means naturally occurring rock, soil, stone, dirt, or a combination thereof.

Earthwork - Any operation involving the excavation, grading, filling, or moving of earth materials.

Easement - The legal right to use a described piece of land for a particular purpose. It does not include fee ownership, but may restrict the owner's use of the land. All easements granted pursuant to the Manual shall be legally recorded with the County Register of Deeds via the Village Clerk.

Easement, Private - An interest in the land of someone else, usually for the benefit of one or more individuals, and constitutes an encumbrance on another's land in perpetuity.

Embankment – A structure of earth, gravel, or similar material raised to form a pond bank or foundation for a road, building pad, or similar fill for a particular use.

Energy Dissipater - Any means by which the total energy of flowing water is reduced. In stormwater design, they are usually mechanisms that reduce velocity prior to, or at, discharge from an outfall in order to prevent erosion. They include rock splash pads, drop manholes, concrete stilling basins or baffles, and check dams.

Glossary (Continued)

Engineer - A Wisconsin Professional Engineer, retained by and acting on behalf of the Applicant. The term "Engineer" also means design engineer and project engineer working under a Wisconsin Professional Engineer.

Environmentally Sensitive Area (sensitive area) - As defined by the Wisconsin Department of Natural Resources.

Erosion - Detachment of soil or rock fragments by water, wind, ice, gravity and foot/vehicular traffic.

Erosion/Sedimentation Control - Any temporary or permanent measures taken to reduce erosion, control siltation and sedimentation, and control/reduce sediment concentrations in water leaving the site.

Erosion/Sedimentation Control Facility - A type of drainage facility designed to hold water for a period of time to allow sediment contained in the surface and storm water runoff directed to the facility to settle out so as to improve the quality of the runoff.

ESC - Erosion and Sediment Control (Plan) - See Drainage and Erosion/Sediment Control Plan.

Eutrophication - Refers to the process where nutrient over-enrichment of water leads to excessive growth of aquatic plants.

Experimental Best Management Practice (BMP) - A BMP that has not been tested and evaluated by the Wisconsin Department of Natural Resources in unison with local governments and technical experts.

Filter Fabric - A woven or non-woven, water-permeable material, generally made of synthetic products such as polypropylene and used in stormwater management and erosion and sediment control applications to trap sediment or prevent the clogging of aggregates by fine soil particles. See the Wisconsin DOT State Standard Specifications for Highway and Structure Construction, specifically, Section 645 Geotextiles Fabrics.

Filter Fabric Fence or Silt Fence - A temporary sediment barrier consisting of filter fabric stretched across and attached to supporting posts and entrenched. The filter fence is constructed of stakes and synthetic filter fabric with a rigid wire fence backing where necessary for support.

Flow Control Manhole - A manhole with a flow regulating device or system such as weirs and orifice plates.

Freeboard - The vertical distance between the design water surface elevation and the elevation of the barrier which contains the water.

Frequency of Storm (Design Storm Frequency) - The anticipated period in years that will elapse, based on average probability of storms in the design region, before a storm of a given intensity and/or total volume will recur.

Grading - Any excavating, filling, clearing, or creating of impervious surfaces, or combination thereof.

Glossary (Continued)

Groundwater - The underground water usually found in aquifers. Groundwater usually originates from infiltration. Wells tap the groundwater for water supply uses.

Grubbing - The removal and disposing of all unwanted vegetative matter from underground, such as sod, stumps, roots, buried logs, or other debris.

Gully - A channel caused by the concentrated flow of surface and stormwater runoff over unprotected erodible land.

Habitat - The specific area or environment in which a particular type of plant or animal lives. The sum total of all environmental factors of a specific place that is occupied by an organism, a population, or a community. An organism's habitat must provide all of the basic requirements for life.

Hardpan - A cemented or compacted and often clay-like layer of soil that is impenetrable by roots.

Harmful Pollutant - A substance that has adverse effects to an organism including immediate death, chronic poisoning, impaired reproduction, cancer or other effects.

Hyetograph - A graph of percentages of total precipitation for a series of time steps representing the total time in which precipitation occurs.

Illicit Discharge - All non-stormwater discharges to stormwater drainage systems that cause or contribute to a violation of state water quality, sediment quality or ground water quality standards.

Impervious - A surface which cannot be easily penetrated (i.e., rain does not readily penetrate paved surfaces).

Impervious Surface - A hard surface area which either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development. A hard surface area which causes water to run off the surface in greater quantities or at an increased rate of flow than the flow present under natural conditions prior to development. Common impervious surfaces include, but are not limited to, roof tops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt pavements, gravel roads, gravel parking lots, packed earthen materials, and oiled, macadam or other surfaces which similarly impede the natural infiltration of stormwater.

Impoundment - A natural or man-made containment for surface water.

Improved Property - Land from which runoff has been permanently increased through the actions of man.

Improvement - Anything or structure constructed for the benefit of all or some residents of the subdivision or the general public such as but not limited to roads, alleys, storm drainage systems and ditches, sanitary sewer pipes or main lines, and storm drainage containment facilities.

Infiltration - The downward movement of water from the surface to the subsoil.

Glossary (Continued)

Infiltration Facility (or System) - A drainage facility designed to use the hydrologic process of surface and stormwater runoff soaking into the ground, commonly referred to as percolation, to dispose of surface and stormwater runoff.

Ingress/egress - The points of access to and from a property.

Inlet - A form of connection between the surface of the ground and a drain or sewer for the admission of surface and stormwater runoff.

Junction - Point where two or more drainage pipes or channels converge (e.g., manhole).

Land Disturbing Activity - Any activity that results in a change in the existing soil cover (both vegetative and non vegetative) and/or the existing soil topography. Land disturbing activities include, but are not limited to, demolition, construction, clearing, grading, filling and excavation.

Landscaping - The improvement or installation on a parcel or portion thereof of objects or vegetation for decorative or ornamental effect. Examples include: trees, bushes, shrubs, flowers, grass, weeds, ornamental rocks or figures, and low-lying ground cover, sprinkler systems, sidewalks, and lighting fixtures.

Lined Pond, Conveyance - A lined pond or conveyance system is one in which the bottom and sides of the facility have been made impervious to the transmission of liquids.

Live Storage - The amount of storage in a detention facility that is intended to completely drain after a storm event.

MMSD – Milwaukee Metropolitan Sewerage District.

Natural Buffer Area (NBA) - A parcel or strip of land that is designated to permanently remain in an undisturbed and untouched condition. No building, clearing, filling, or grading is permitted within this area, except for minor firewood harvest and watercourse maintenance when applicable. Roads, septic tank drain field areas, and reserved drain field areas are not permitted in natural buffer areas.

Natural Channel - Stream, creek, river, lake, wetland, estuary, gully, swale, ravine, or any open conduit where water will concentrate and flow intermittently or continuously.

Natural Location - The location of those channels, swales, and other non-manmade conveyance systems as defined by the first documented topographic contours existing for the subject property, either from maps or photographs, or such other means as appropriate.

Non-Stormwater Discharge - Wash down water and other wastewater that enters the drainage system.

Nutrients - Essential chemicals needed by plants or animals for growth. Excessive amounts of nutrients can lead to degradation of water quality and the growth of excessive numbers of algae. Some nutrients can be toxic at high concentrations.

Glossary (Continued)

Off-site - Any area lying upstream of the site that drains onto the site and any area lying downstream of the site to which the site drains. Any area not located on the legally described property.

Oil Water Separator - A structure or device used to remove oil and greasy solids from water.

On-site - The entire property that includes the proposed development.

Orifice - An opening with closed perimeter, usually sharp-edged, and of regular form in a plate, wall, or partition through which water may flow, generally used for the purpose of measurement or control of such water.

Outfall - The point where water flows from a manmade conduit, channel, or drain into a water body or other natural drainage feature. (See Natural Channel)

Overtopping - To flow over the limits of a containment or conveyance element.

Perviousness - Related to the size and continuity of void spaces in soils; related to a soil's infiltration rate.

Post-Development Conditions - The condition of site after the project has been constructed.

Professional Civil Engineer - A person registered with the State of Wisconsin as a Professional Engineer.

Public Storm Drainage Facility - A conveyance, system of conveyances, or stormwater control facility(ies) (including roads with drainage systems, catch basins, curbs, gutter, ditches, man-made channels, storm drains, retention/detention facilities and infiltration facilities) owned and operated by the Village, which is (are) designed or used for collection, storage, conveyance and treatment of storm water.

Recharge - The flow to groundwater from the infiltration of surface and stormwater runoff.

Record or As-built Drawings - As-constructed engineering plans that include all changes made to a project during construction. All drawing changes shall be certified by a Wisconsin Professional Engineer.

Regional Detention and/or Retention Facility - Stormwater detention and/or retention or water quality control facility designed to manage runoff from large tracts of land.

Retention - The process of collecting and holding surface and stormwater runoff with no surface outflow.

Retention/Detention Facility - A facility with an outlet to surface water but which is intended to primarily discharge to groundwater and evaporation.

Retention Facility - A facility with no outlet to surface water and which is intended to discharge to groundwater and/or evaporation.

Retention Pond - A retention facility that is an open pond.

Glossary (Continued)

Retrofitting - The improvement or renovation of an existing structure or facility to meet changed conditions or to improve performance.

Riprap - A facing layer or protective mound of stones placed to prevent erosion or sloughing of a structure or embankment due to flow of surface and stormwater runoff.

Runoff - Water originating from rainfall and other precipitation that is found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes and wetlands as well as shallow ground water.

Scour - Erosion of channel banks due to excessive velocity of the flow of surface and stormwater runoff.

Sediment - Fragmented material that originated from weathering and erosion of rocks or unconsolidated deposits, and is transported by, suspended in, or deposited by water.

Sedimentation - The depositing or formation of sediment.

SEWRPC – Southeast Wisconsin Regional Planning Commisssion.

Sheet Erosion - The relatively uniform removal of soil from an area without the development of conspicuous water channels.

Silt Fence or Filter Fabric Fence- A temporary sediment barrier consisting of filter fabric stretched across and attached to supporting posts and entrenched. The filter fence is constructed of stakes and synthetic filter fabric with a rigid wire fence backing where necessary for support.

Site - Any parcel or combination of contiguous parcels where grading, filling, clearing, or creation of an impervious surface is proposed, and which may be controlled by more than one property owner.

Site Development Plan - Site development plans as determined by the Village Planning or Engineering Departments.

Slope - An inclined earth surface, the inclination of which is expressed as the ratio of horizontal distance to vertical distance. The gradient in feet per feet or expressed as percent.

Sloughing - The sliding of overlying material. It is the same effect as caving, but it usually occurs when the bank or an underlying stratum is saturated or scoured.

Soil Permeability - The ease with which gases, liquids, or plant roots penetrate or pass through a layer of soil.

Standard Plans and Standard Specifications - The requirements or standards of the latest edition of the Village of Germantown Standard Specifications for Development and Construction.

Steep Slope - Slopes of 33% gradient or steeper.

Glossary (Continued)

Storm Drain System - The system of gutters, pipes, streams, or ditches used to carry surface and storm water from surrounding lands to streams, lakes, or other surface water source.

Storm Drains - The enclosed conduits that transport surface and stormwater runoff toward points of discharge (sometimes called storm sewers).

Stormwater - That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, channels or pipes into a defined surface water channel, or a constructed infiltration facility.

Stormwater Management Requirements - The manual as prepared by the Village of Germantown Engineering Department requiring compliance with Village, WDNR, and MMSD stormwater quantity and quality standards.

Structure - A catch basin or manhole in reference to a storm drainage system.

Stub-out - A short length of pipe provided for future connection to the storm drainage system.

Sub-basin - A drainage area which drains to a point contained within a larger basin.

Suspended Solids - Organic or inorganic particles that are suspended in and carried by the water. The term includes sand, mud, and clay particles (and associated pollutants) as well as solids in stormwater.

Swale - A shallow drainage conveyance with relatively gentle side slopes, generally with flow depths less than one foot.

Toe of Slope - A point or line of slope in an excavation or cut where the lower surface changes to horizontal or meets the existing ground slope.

Top of Slope - A point or line on the upper surface of a slope where it changes to horizontal or meets the original surface.

Treatment BMP - A BMP that is intended to remove pollutants from stormwater.

Village, The - "Village" means the Village of Germantown Board or designee; also Village of Germantown, its duly authorized representatives, and the jurisdictional boundaries of Village of Germantown.

Water Quality - The chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

Water Quality BMP - A BMP specifically designed to control the quality of runoff.

Water Quantity BMP - A BMP specifically designed to control the quantity of runoff.

Watershed - A geographic region within which water drains into a particular river, stream, or body of water.

Glossary (Continued)

Wetlands – An area inundated or saturated by ground or surface water at a frequency and duration sufficient to support, and that under normal conditions do support, a prevalence of vegetation typically adapted for living in saturated soil conditions.

Wet Pond - A stormwater treatment pond designed to maintain a continuous or seasonal water level below the pond outlet elevation.

WDNR – Wisconsin Department of Natural Resources.

WDOT Specifications - The requirements or standards of the latest edition of the State of Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction.