**Bioretention System**

**Basin #\_\_\_ on the Location Map**

Development Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Township, County: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Location of Basin: X: \_\_\_\_\_\_; Y: \_\_\_\_\_\_ (or N: \_\_\_\_\_\_; E :\_\_\_\_\_)

Location Description: e.g., Northwest corner of the development, near County RT 531

Location Map

|  |
| --- |
| N  E  County Route 531  **Discharge**  Grass Swale #1  Basin #1  Drywell #1  Corporation Road  Building  Parking  Lot    Vegetative Filter strip #1  Drywell #2  Access  Grass Swale #2 |

Example Map: Use aerial photo, site plan, or other graphics showing the locations of BMPs

**NOTE**

**This Field Manual is intended to be editable and adjustable in accordance with the design of stormwater management measures, the site conditions, and the special needs of responsible party. The Engineer should supplement information and best management practice to assist the responsible party to perform maintenance.**

Blue text indicates information may be deleted and or replaced as necessary.

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# Bioretention System Overview

**Functionality**

Bioretention systems are used to remove a wide range of pollutants, such as suspended solids, nutrients, metals, hydrocarbons, and bacteria from stormwater runoff. They can also be used to reduce peak runoff rates and increase stormwater infiltration when designed as a multi-stage, multi-function facility.

A bioretention system can be configured as either a bioretention basin or a longer, narrower bioretention swale. In general, a bioretention basin has a flat bottom while a bioretention swale may have sloping bottom. Runoff storage depths above the soil bed surface are typically shallow. The TSS removal rate for bioretention systems is 80 or 90 percent, depending upon the thickness of the soil planting bed and the type of vegetation grown in the bed.

**Proper care and attention in the long-term maintenance of the stormwater management measure is critically important to the safety and health of the public.**

**Type of BMP – Dry Basin / Infiltration**

A bioretention system is a type of **dry** basin. Dry basins must fully drain within 72 hours of the most recent rainfall. Standing water in excess of 72 hours is a sign of basin failure. It may also contribute to mosquito breeding and other health and safety issues. The design drain time shall be closely monitored to ensure that potential failure is recognized early.

A bioretention system with infiltration can also be designed for extended detention, in which case it will attenuate peak flows from storms larger than the Water Quality Design Storm.

# Basic Design Information

This section shall be filled out by the design engineer.

**Hydrology Design Targets**

1. The bioretention system is designed as an (online, offline) system.
2. The design drain time is \_\_\_\_\_\_\_\_\_\_ hours.
3. The elevation of the seasonal high water table of this basin was observed on

(MM) / (DD) / (YYYY) and it was \_\_\_\_\_\_\_\_\_ feet below the basin bottom surface, at EL.\_\_\_\_\_\_\_ feet. (Applicable if the system has no underdrain)

1. This system is designed with a subsoil permeability rate of \_\_\_\_\_\_\_\_\_ inches/hour (pre-construction) and \_\_\_\_\_\_\_\_\_\_ inches/hour (post-construction - tested on

(MM) / (DD) / (YYYY) ).

**Hydraulic Design Targets**

1. Design parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Water Quality Design Storm** | **2-year**  **storm** | **10-year**  **storm** | **100-year**  **storm** |
| **Rainfall Depth (inches)** | 1.25 inch  in 2 hours | \_\_\_ inches  in 24 hours | \_\_\_ inches  In 24 hours | \_\_\_ inches  In 24 hours |
| **Runoff Volume (cubic feet)** |  |  |  |  |
| **Peak Flow Rate**  **(cfs)** |  |  |  |  |
| **Water Surface Elevation**  **(feet)** |  |  |  |  |

Note: The design engineer shall fill out the table in accordance with the design of the stormwater management measure. If the item is not applicable, enter **N/A** in the table.

1. The emergency spillway is at EL. \_\_\_\_\_\_\_\_\_\_\_ feet (if applicable).

**Basin Configuration Targets**

1. Pretreatment is provided by a (forebay with a depth of \_\_\_\_\_\_\_\_\_ feet / BMP Type: \_\_\_\_\_\_\_\_\_\_, BMP No.). A perforated riser (is / is not) used.
2. Planting Soil Bed
   * The depth of the soil planting bed is \_\_\_\_\_\_ feet.
   * Mixture of the planting soil consists of \_\_\_\_\_% of sand. (with no more than 25% of the sands as fine or very fine sands; no more than 15% silt and clay with 2% to 5% clay content). The organic matter shall be within \_\_\_\_\_ % to \_\_\_\_\_%.
   * The pH of the planting soil should be in the range of \_\_\_\_\_\_ and \_\_\_\_\_\_\_.
   * Filter fabric (is / is not) placed along the sides of the soil planting bed.
   * The system is designed with a planting soil permeability rate of \_\_\_\_\_\_\_\_\_ inches/hour (pre-construction) and \_\_\_\_\_\_\_\_\_\_ inches/hour (post-construction – tested on (MM) / (DD) / (YYYY) ).
3. Outlet Information:

|  |  |  |  |
| --- | --- | --- | --- |
| **Outlet Description** | **Outlet Type** | **Orifice Size / Weir Length** | **Invert Elevation** |
| Water Quality Orifice |  |  |  |
| Outlet #1 |  |  |  |
| Outlet #2 |  |  |  |
| (Other) |  |  |  |

1. Vegetation
   * The vegetation type to be used in this bioretention system is (site-tolerant grasses, terrestrial forested community). A Landscaping Plan should be included in the Reference Documents section of this field manual.

**For a bioretention system designed with an underdrain, the following also applies.**

1. Underdrain
   * The perforated laterals are \_\_\_\_\_\_\_\_ inches in diameter, at a slope of \_\_\_\_\_\_%.
   * There are \_\_\_\_\_ lateral pipes in the basin. Each lateral is \_\_\_\_\_\_ feet long.
   * The perforations are \_\_\_\_\_ inches in diameter and are arranged \_\_\_\_\_ inches center to center, \_\_\_\_\_\_ perforations per row, and \_\_\_\_\_\_\_ rows of perforations per pipe.
   * The manifold pipe is \_\_\_\_\_\_ inches in diameter, (perforated / not perforated), at a slope of \_\_\_\_\_\_\_\_\_%, and \_\_\_\_\_\_\_ feet in length.

(Note: The cleanout pipe shall **not** be perforated.)

* + Filter fabric is installed to wrap around the laterals. The material used for the filter fabric is \_\_\_\_\_\_\_\_\_\_\_\_\_, and has a permeability rate of \_\_\_\_\_\_\_\_\_ inches per hour.
  + The gravel layer surrounding the underdrain consists of \_\_\_\_\_\_\_ inches of gravel above the underdrain and \_\_\_\_\_\_\_ inches of gravel below the underdrain.

**Critical Maintenance Features**

1. No heavy equipment on the basin surface.
2. Remove vegetation strictly in accordance with the landscaping plan.
3. Grass clippings shall be collected from the basin and properly disposed.
4. Keep the appearance of the basin aesthetic.
5. (Others to be added by the design engineer, if necessary)

**Attach the following Disturbance Notices, if applicable to the site:**

**Wetland Disturbance Notice**:

Maintenance of this BMP may disturb a wetland area. Contact NJDEP Division of Land Use Regulation for guidance and any required permit(s) before performing maintenance.

**Wildlife Disturbance Notice**:

Maintenance of this BMP may disturb or remove vegetation in an area designated to endangered and/or threatened species. Contact NJDEP Division of Fishing and Wildlife for guidance and any required permit(s) before performing maintenance.

# Visual Aid for Bioretention System Inspection

**No photos are currently available. Photos will be updated upon availability.**

# Reference Documents

Documents to be placed in this field manual should include the following:

* As-built Drawings with Drainage Plans
* Soil Boring Logs
* Permeability Test (Pre-construction)
* Permeability Test (Post-construction)
* Groundwater Mounding Analysis
* Underdrain Piping Specification
* Filter Fabric Information

**Attach Reference Documents Here**

# Inspection Checklist / Maintenance Actions

**Bioretention System**

**Checklist** (circle one)**:** Quarterly / Annual / Monthly / Special Event Inspection

**Checklist No.** \_\_\_\_\_\_\_\_\_\_\_\_\_\_  **Inspection Date:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Date of most recent rain event: \_\_\_\_\_\_\_\_\_\_**

**Rain Condition** (circle one):

Drizzle / Shower / Downpour / Other \_\_\_\_\_\_\_\_\_\_\_\_\_

**Ground Condition** (circle one):

Dry / Moist / Ponding / Submerged / Snow accumulation

**The inspection items and preventative/corrective maintenance actions listed below represent general requirements. The design engineer and/or responsible party shall adjust the items and actions to better meet the conditions of the site, the specific design targets, and the requirements of regulatory authorities.**

|  | **For Inspector** | | | **For Maintenance Crew** |
| --- | --- | --- | --- | --- |
| **Component No. Component Name** | **Inspection Item and Inspection Item No.** | | **Result** | **Preventative / Corrective Maintenance Actions** |
| A1  Pretreatment  (Forebay) | 1 | Scouring or erosion is present at inlet structure and/or riprap apron | Y\_\_  N\_\_ | Check the flow diversion device before the inlet pipe and whether the bypass flow channel is clogged  Work Order # \_\_\_\_\_\_\_\_\_\_ |
| 2 | Clogged pipes or excessive sediment in the forebay | Y\_\_  N\_\_ | Remove sediment or debris |
| 3 | Damaged outlet structure (e.g.,  cracking, subsidence, spalling, erosion, or deterioration) | Y\_\_  N\_\_ | Repair or replace the outlet structure  Work Order # \_\_\_\_\_\_\_\_\_\_ |
| A2  Pretreatment  (MTD) | 1 | MTD inspection (if installed) | Y\_\_  N\_\_ | (If a MTD is used for pretreatment, see Maintenance Manual Provided by the manufacturer) |
| A3  Pretreatment  (Structural BMP) | 1 | BMP inspection | Y\_\_  N\_\_ | (See BMP No. \_\_\_\_\_\_\_\_ Field Manual) |
| Note: | | | | |
| B  Basin Bed | 1 | Standing water is present after the design drain time  The observed drain time is approximately \_\_\_\_\_\_\_\_\_ hours. | Y\_\_  N\_\_ | Recheck to determine if there is standing water after 72 hours  If standing water is present longer than 5 days, report to mosquito commission. |
| Remove any sediment buildup  Check the soil permeability  Till the soil bed with rotary tiller or disc harrow  Replace the planting soil, if necessary  Work Order # \_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| 2 | Excessive sediment, silt, or trash accumulation on basin bed | Y\_\_  N\_\_ | Clean pretreatment system  Remove silt, sediment, and trash |
| 3 | Erosion or channelization is present | Y\_\_  N\_\_ | Check whether the flow bypass or diversion device is clogged  Re-grade the infiltration bed  Work Order # \_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| 4 | Animal burrows/rodents are present | Y\_\_  N\_\_ | Pest control  Work Order # \_\_\_\_\_\_\_\_\_\_ |
| Note: | | | | |
| B  Basin Bed | 5 | Uneven bed | Y\_\_  N\_\_ | Use light equipment to resurface the bed  Work Order # \_\_\_\_\_\_\_\_\_ |
| 6 | Evidence of sinkholes or subsidence | Y\_\_  N\_\_ | Monitor for sinkhole development |
| C  Vegetation | 1 | Large spot(s) showing bare soil | Y\_\_  N\_\_ | Vegetative cover must be maintained at 85%. Revegetate the entire basin if 50% or more vegetation has been lost.  Check Landscaping plan for guidance (if available)  Work Order # \_\_\_\_\_\_\_\_\_\_ |
| 2 | Invasive plants are present | Y\_\_  N\_\_ | Remove the invasive plants and restore the vegetation in accordance with the landscaping plan  Work Order # \_\_\_\_\_\_\_\_\_\_ |
| 3 | The vegetation in the basin has been mowed or removed | Y\_\_  N\_\_ | Revegetate the system in accordance with the vegetation plan  Work Order # \_\_\_\_\_\_\_\_\_\_  Note: The vegetation in a bioretention system should **not** be mowed or removed |
| Note: | | | | |
| D  Bioretention System Embankment and Side Slopes | 1 | Signs of erosion, soil slide or bulges, seeps and wet spots, loss of vegetation, or erosion on the basin slope | Y\_\_  N\_\_ | Check for excessive overland runoff flow through the embankment.  Check for any sink hole development  Direct the overland runoff to the forebay or pretreatment area  Restabilize the bank  Work Order # \_\_\_\_\_\_\_\_\_\_ |
| 2 | Overgrown perimeter vegetation | Y\_\_  N\_\_ | Mow the vegetation on the perimeter of the embankment  Work Order # \_\_\_\_\_\_\_\_\_\_  Note: Mowing of vegetation should only take place in the area **outside** the basin. Dense vegetation must be maintained in the basin. |
| E  Outlet | 1 | Trash or debris accumulation more than 20% | Y\_\_  N\_\_ | Clean and remove  Determine source of trash and address to reduce future maintenance costs or basin failure |
| 2 | Trash rack is damaged or rusted greater than 50%  Trash rack is bent, loose, or missing parts | Y\_\_  N\_\_ | Repair or replace trash rack  Work Order #\_\_\_\_\_\_\_\_\_\_ |
| 3 | Outlet components (e.g., orifice plates or weir plate) skewed, misaligned, or missing | Y\_\_  N\_\_ | Repair or replace component  Work Order #\_\_\_\_\_\_\_\_\_\_ |
| 4 | Discharge pipe apron is eroded or scoured | Y\_\_  N\_\_ | Restabilize the discharge riprap apron  Work Order #\_\_\_\_\_\_\_\_\_\_ |
| Note: | | | | |
| F  Emergency  Spillway | 1 | Trees or excessive vegetation present | Y\_\_  N\_\_ | Remove trees and roots, and restore berms if necessary  Work Order #\_\_\_\_\_\_\_\_ |
| 2 | Damaged structure | Y\_\_  N\_\_ | Repair  Work Order #\_\_\_\_\_\_\_\_ |
| G  Miscellaneous | 1 | Fence: broken or eroded parts | Y\_\_  N\_\_ | Repair or replace  Work Order #\_\_\_\_\_\_\_\_\_\_ |
| 2 | Gate: missing gate or lock | Y\_\_  N\_\_ | Repair or replace  Work Order #\_\_\_\_\_\_\_\_\_\_ |
| 3 | Sign/plate: tiled, missing, or faded | Y\_\_  N\_\_ | Repair or replace  Work Order #\_\_\_\_\_\_\_\_\_\_ |
| 4 | Excessive or overgrown vegetation blocking access to the basin | Y\_\_  N\_\_ | Clear, trim, or prune the vegetation to allow access for inspection and maintenance  Work Order #\_\_\_\_\_\_\_\_ |
| Note: | | | | |

**Follow Up Items (Component No. / Inspection Item No.):**

(e.g., B/1, C/2)

**Associated Work Orders: # \_\_\_\_\_\_, # \_\_\_\_\_\_, # \_\_\_\_\_\_, # \_\_\_\_**\_\_**, # \_\_\_\_\_**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Inspector Name Signature Date**

**Report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.**

**File this checklist in the Maintenance Log after performing maintenance.**

# Preventative Maintenance Record

Corresponding Checklist No. \_\_\_\_\_\_\_\_

Component No.\_\_\_\_\_\_\_, Inspection Item No.\_\_\_\_\_\_\_\_

**Work Logs**

|  |  |  |
| --- | --- | --- |
| **Activities** | **Components** | **Date Completed** |
| Sediment/debris removal  **Sediment removal should be taken place when the basin is thoroughly dry.** | A1/A2/A3 – Pretreatment |  |
| B – Basin Bed |  |
| D – Bioretention System Embankment and Side Slopes |  |
| E – Outlet |  |
|  |  |  |
| Vegetation removal | A1/A2/A3 – Pretreatment |  |
| B – Basin Bed |  |
| D – Basin Embankment and Side Slopes |  |
| E – Outlet |  |
| F – Emergency Spillway |  |
|  |  |  |
| (List additional tasks, if applicable) |  |  |

Vegetation is removed by \_\_\_\_\_\_\_\_\_\_\_\_\_ (type of equipment) with minimum disruption to the remaining vegetation.

All use of fertilizers, pesticides, mechanical treatments, and other means to ensure optimum vegetation health must not compromise the intended purpose of the stormwater management measure. The fertilizer applied is \_\_\_\_\_\_\_\_\_\_\_\_ (type), and \_\_\_\_\_\_\_\_\_ (quantity per usage) is applied \_\_\_\_\_\_\_\_\_\_\_\_\_ (frequency of use).

Debris, sediment, and trash are handled (onsite / by \_\_\_\_\_\_\_\_\_\_\_\_ (contractor name) to disposal site \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_). (See Part I: Maintenance Plan – Disposal Plan Section)

**Crew member:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_**

(name/ signature)

**Supervisor:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_**

(name/ signature)

**File this Preventative Maintenance Record in the Maintenance Log after performing maintenance.**

# Corrective Maintenance Record

1. **Work Order #** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **Date Issued** \_\_\_\_\_\_\_\_\_\_\_\_\_
2. **Issue to be resolved**:

(e.g., orifice plate is loose and bent)

1. The issue was from **Corresponding Checklist \_\_\_\_\_\_\_\_, Component No.** (e.g., E – Outlet), **Inspection Item No.**  (e.g., 2, 3) **.**
2. **Required Actions**

|  |  |  |
| --- | --- | --- |
| **Actions** | **Planned Date** | **Date Completed** |
| Install new bolts to fix the orifice plate |  |  |
| Repair/replace the trash rack |  |  |
| Restabilize side slope (indicate location) |  |  |
| Repair riprap apron with 100 cubic yards of aggregate |  |  |
| Revegetate |  |  |
| (If there are additional tasks, list them here.) |  |  |

1. **Responsible person(s):**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **Special requirements**
   * Time of the season or weather condition :\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * Tools/equipment:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * Subcontractor (name or specific type):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Approved by** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **Date** \_\_\_\_\_\_\_\_\_\_\_\_\_

(name/signature)

**Verification of completion by** \_\_\_\_\_\_\_\_\_\_\_\_/\_\_\_\_\_\_\_\_ **Date \_\_\_\_\_\_\_\_\_\_\_\_\_**

(name/signature)

**File this Corrective Maintenance Record in the Maintenance Log after performing maintenance.**