Stormwater Management Measures
Maintenance Plan & Field Manuals

Development Name: Proposed Warehouses

Address: 96-104 Schoolhouse Road

Block(s) / Lot(s): Block 514, Lots 1, 2, 3 & 60

Township, County: Township of Franklin, Somerset County

Party Responsible for Maintenance:

B9 Schoolhouse Owner, LLC

Address: 602 W Office Center Drive, Suite 200
Ft. Washington, PA 19034

Contact Person(s): Liz Gabor
Phone: 267-705-6222

Prepared by: Kyle C. Kavinski, PE
Date: November 18, 2022

This plan is recorded in

Deed Book # _____ Page # ____ with _____ County Clerk on Date _____

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Part I- Maintenance

Part II- Field Manuals and Maintenance Records

Part I- Maintenance Plan

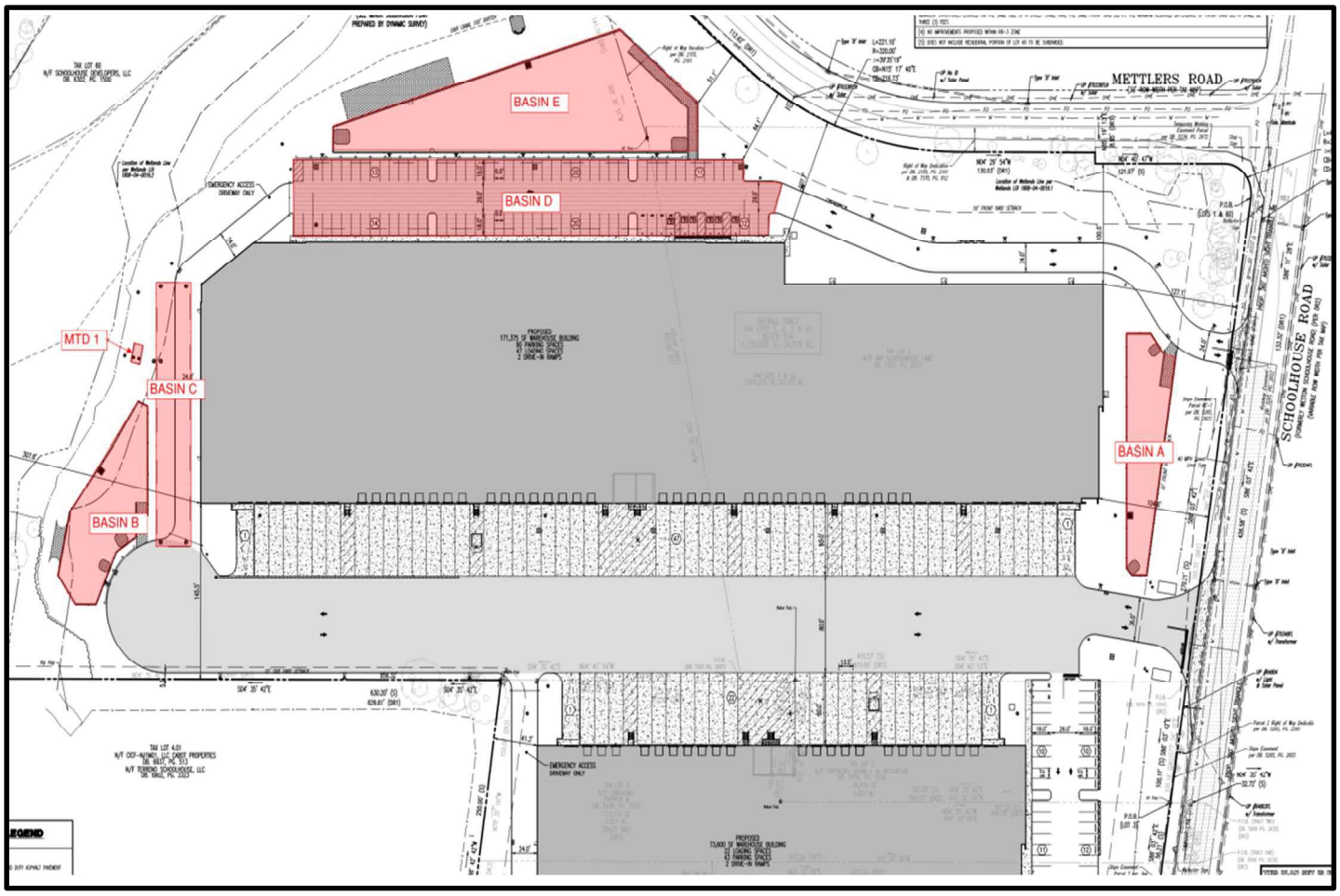
List of Stormwater Management Measures

The stormwater management measures incorporated into this development are listed below. The corresponding Field Manuals for the stormwater management measures are located in Part II of the Maintenance Plan.

Type of Stormwater Management Measure	BMP No.	Location Description	State Plane Coordinates
Aboveground Bioretention Basin	Basin A	Northerly portion of the site, adjacent to Schoolhouse Road	N: 617,524 E: 474,601
Aboveground Bioretention Basin	Basin B	Southerly portion of the site, south of the proposed cul-de-sac	N: 616,734 E: 474,636
Underground Detention Basin	Basin C	Southerly portion of the site, below the grass paver accessway	N: 616,799 E: 474,650
Porous Pavement System	Basin D	Westerly portion of the site, below the westerly parking area	N: 616,943 E: 474,457
Constructed Wetlands	Basin E	Westerly portion of the site, adjacent to Mettlers Road	N: 616,936 E: 474,317
Filterra MTD w/ Tree	MTD 1	Southerly portion of the property, south of the proposed UG Detention Basin	N: 616,878 E: 474,657

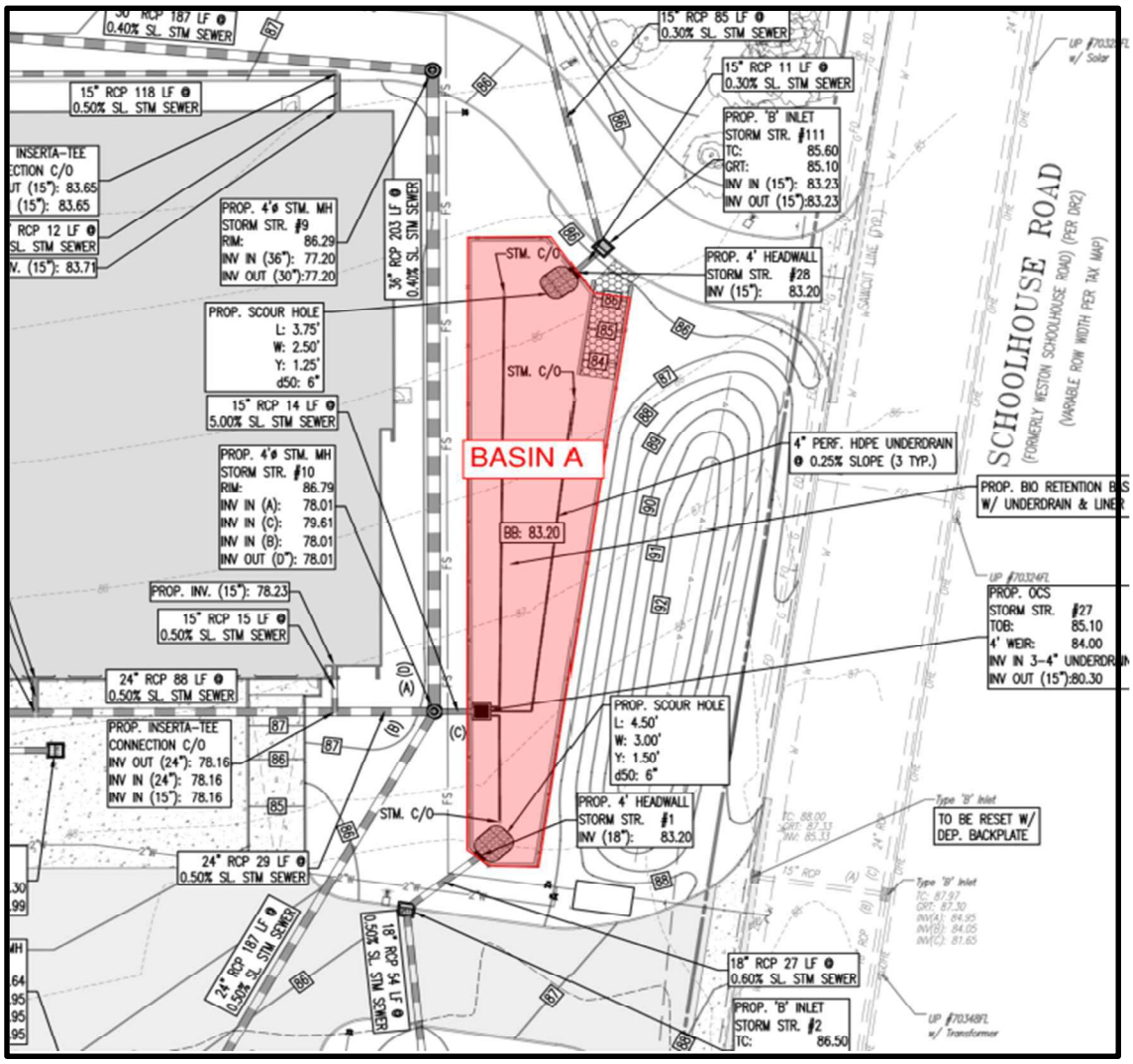
Stormwater BMP's may not be used for stockpiling of plowed snow and ice, compost, or any other material

Overall Location Map

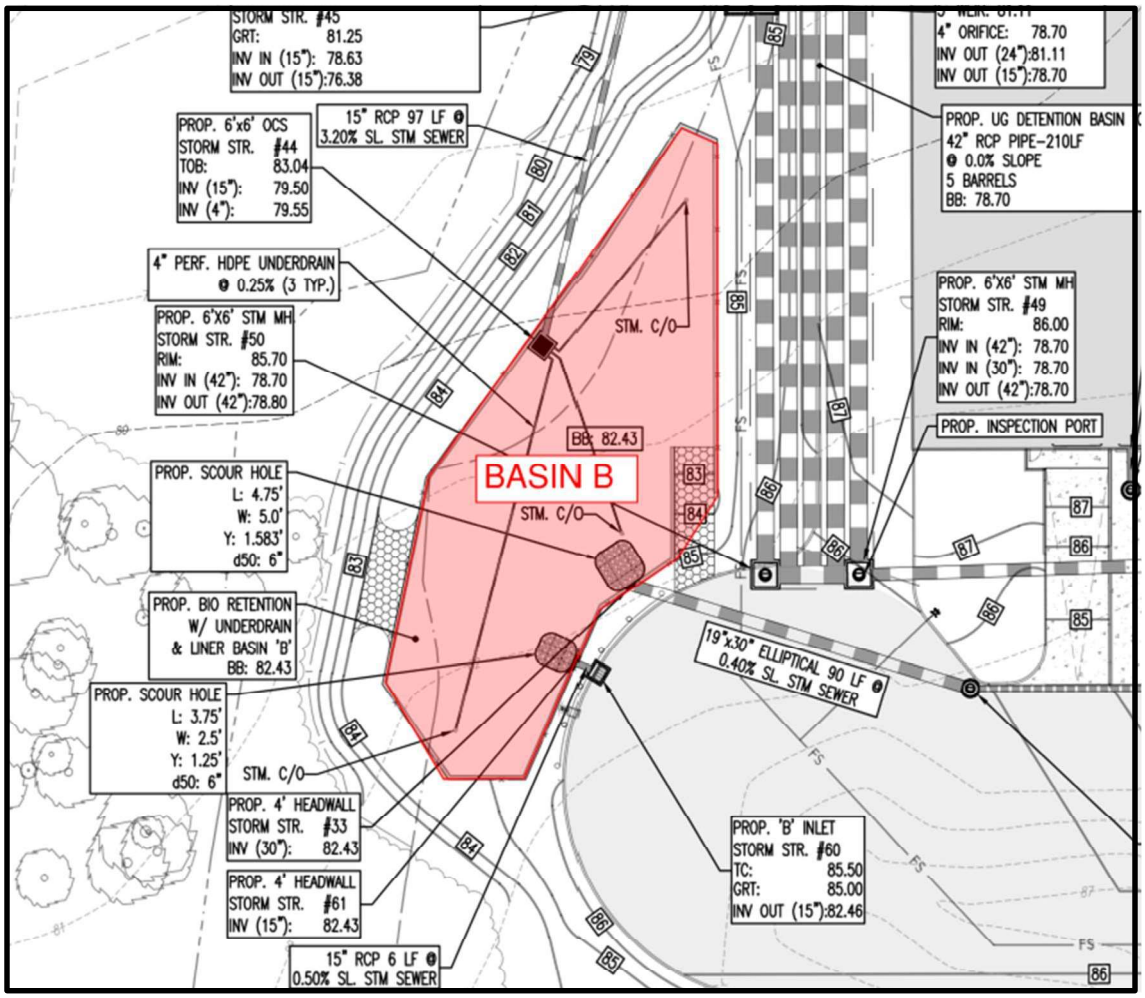


No.	Type of Stormwater Management Measure
Basin A	Aboveground Bioretention Basin
Basin B	Aboveground Bioretention Basin
Basin C	Underground Detention Basin
Basin D	Porous Pavement System
Basin E	Constructed Wetlands
MTD 1	Filterra MTD w/ Tree

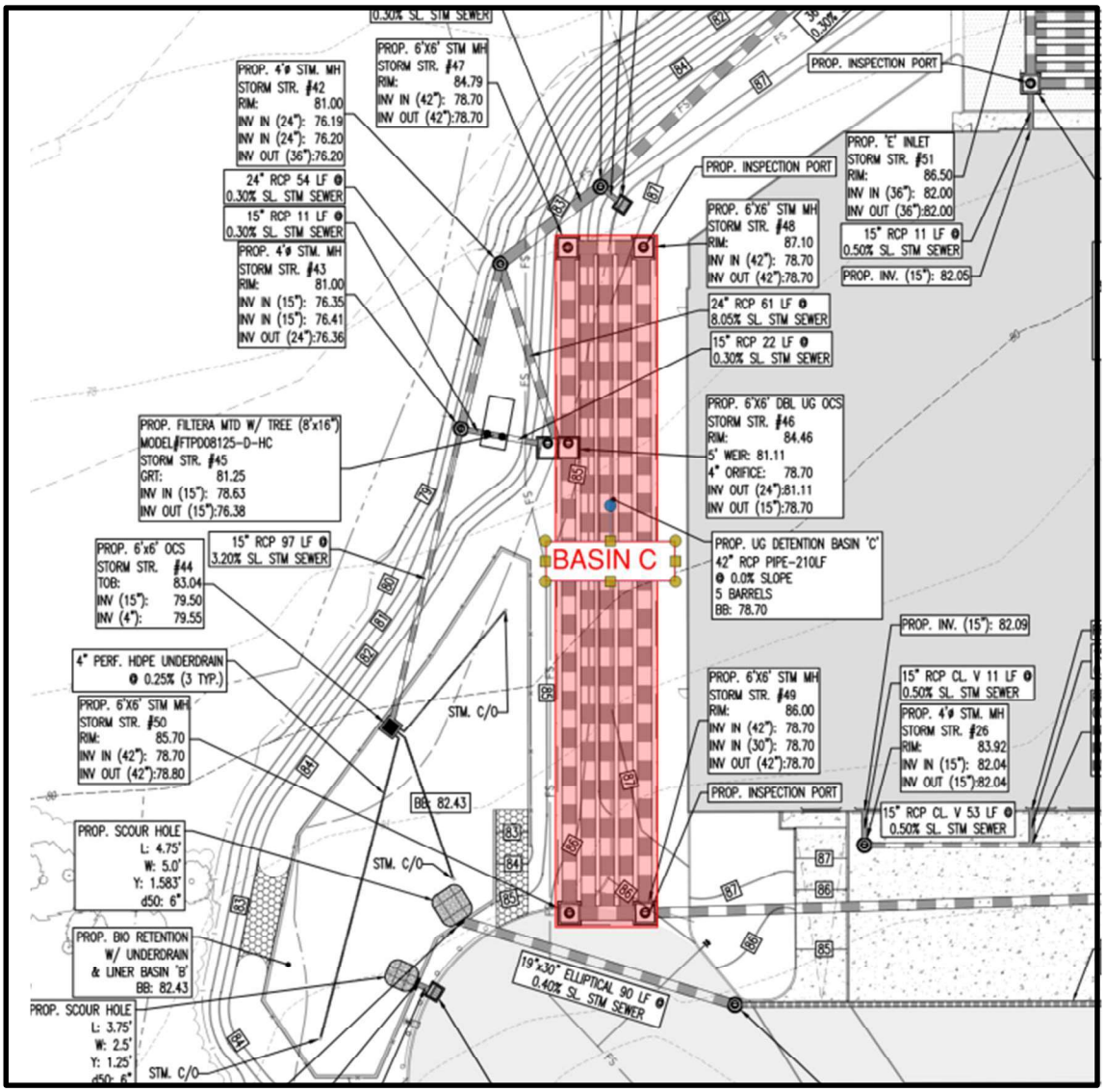
Aboveground Bioretention Basin A
Location Map



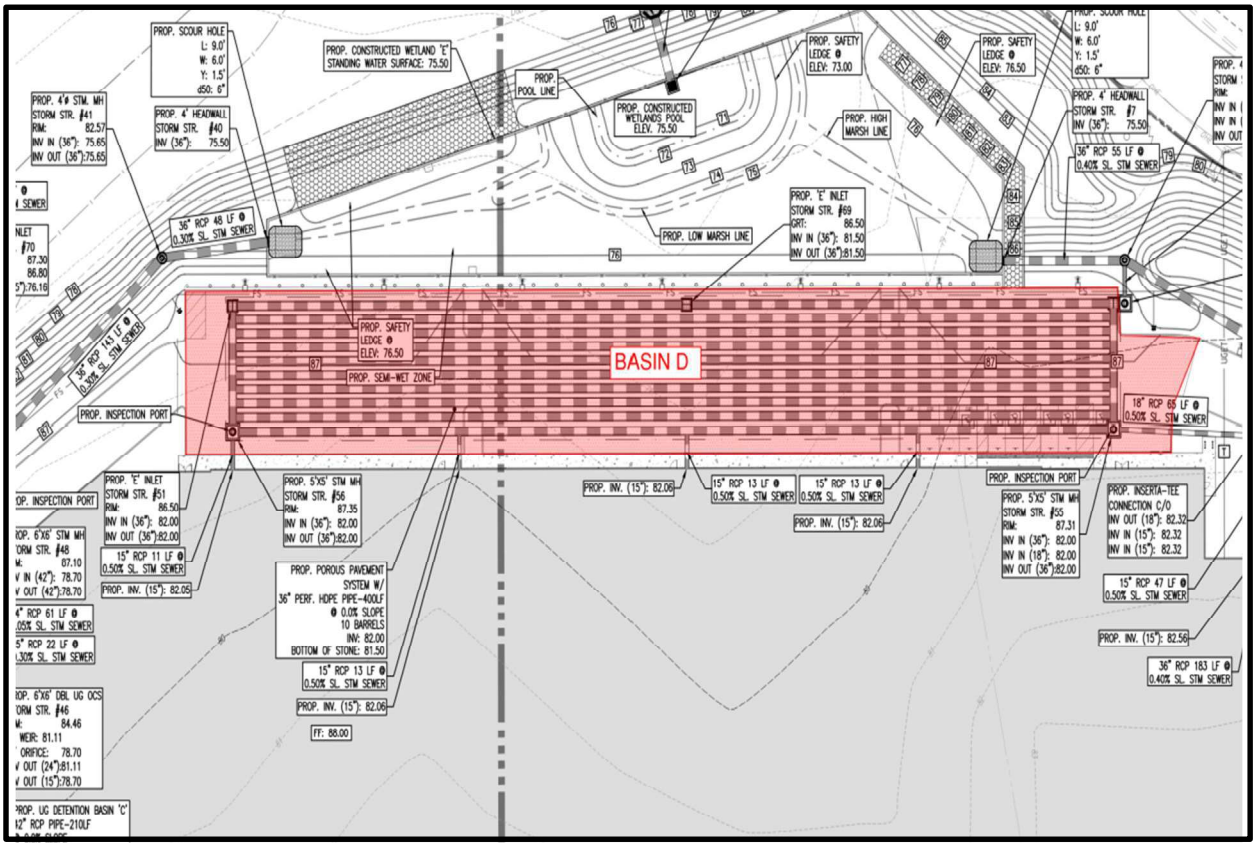
Aboveground Bioretention Basin B
Location Map



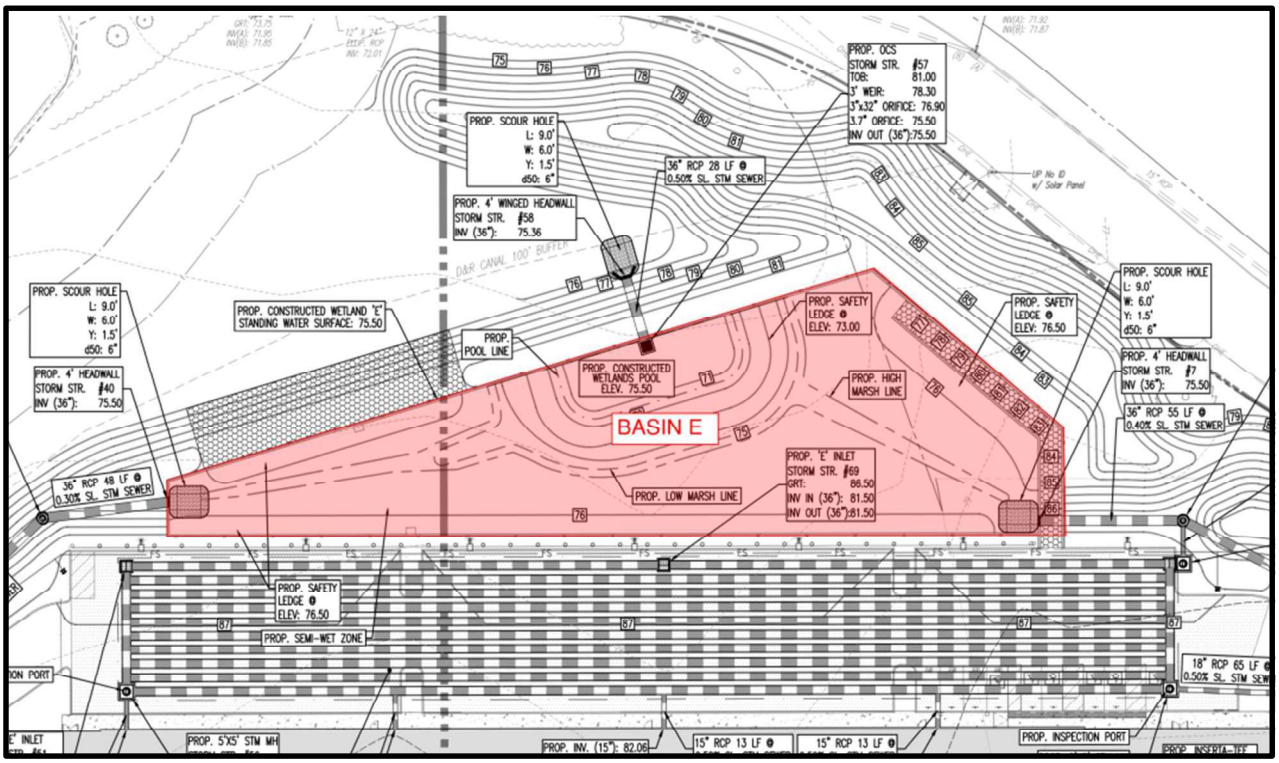
Underground Detention Basin C
Location Map



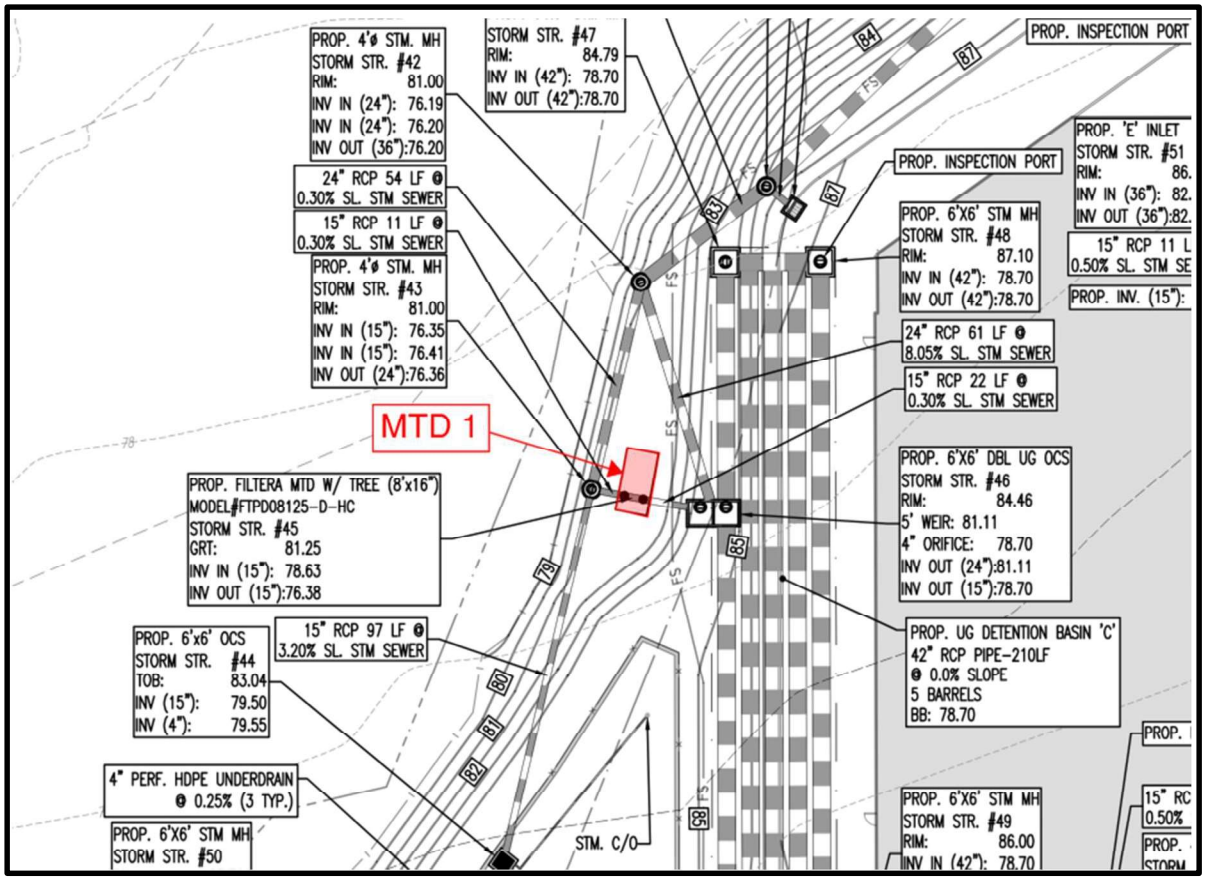
Porous Pavement System (Basin D)
Location Map



Constructed Wetland (Basin E)
Location Map



Filterra MTD w/ Tree (MTD 1)
Location Map



Description of Stormwater Management Measures

Aboveground Bioretention Basin A

Design storm: Water Quality Design Storm, 2-year, 10-year & 100-year

- Design Purposes:
    - Water Quality, Water Quantity
    - 1.25 inches in 2 hours
    - 2-year storm (3.29 inches);
    - 10-year storm (4.98 inches);
    - 100-year storm (8.29 inches)
- Dimensions: 198 ft x 34 ft x 2 ft

Aboveground Bioretention Basin B

Design storm: Water Quality Design Storm, 2-year, 10-year & 100-year

- Design Purposes:
    - Water Quality, Water Quantity
- Dimensions: 175 ft x 64 ft x 1 ft

Underground Detention Basin C

Design storm: Water Quality Design Storm, 2-year, 10-year & 100-year

- Design Purposes:
    - Attenuation to Water Quantity MTD
- Dimensions: 33 ft x 220 ft x 3.5 ft

Porous Pavement System (Basin D)

Design storm: Water Quality Design Storm, 2-year, 10-year & 100-year

- Design Purposes:
    - Water Quality, Water Quantity
- Dimensions: 60 ft x 455 ft x 3.0 ft

Constructed Wetland (Basin E)

Design storm: Water Quality Design Storm, 2-year, 10-year & 100-year

- Design Purposes:
    - Water Quality, Water Quantity
- Dimensions: 345 ft x 78 ft x 5.5 ft

Filterra MTD w/ Tree (MTD 1)

Design storm: Water Quality Design Storm

- Design Purposes:
    - Water Quality
- Dimensions: 8 ft x 16 ft

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Preventative and Corrective Maintenance Action Plan

As per N.J.A.C. 7:8-5.8(b) & (e), preventative and corrective maintenance shall be performed to maintain the function of the stormwater management measure, including, but not limited to, repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of non-vegetated linings.

As per NJDEP BMP Manual (Ch. 8 Feb. 2004), maintenance plans should include specific preventative and corrective maintenance tasks such as removal of sediment, trash, and debris; mowing, pruning, and restoration of vegetation; restoration of eroded areas; elimination of mosquito breeding habitats; control of aquatic vegetation; and repair or replacement of damaged or deteriorated components.

As per NJDEP BMP Manual Ch. 8 (Feb. 2004), the maintenance plan should address the maintenance of access points to the stormwater management measures in accordance with the following:

- all components of the stormwater management measures must be readily accessible for inspection and maintenance;
- trees, shrubs, and underbrush must be pruned or trimmed as necessary to maintain access to the stormwater management measure via roadways, paths, and ramps, including paths through perimeter vegetation to permanent pools, aquatic benches, and safety ledges to allow for the inspection and control of mosquito breeding; and
- the exact limits of inspection and maintenance easements and rights-of-way should be specified on stormwater management measure plans and included in the maintenance plan.

In accordance with NJAC 7:8-5.B(g), this manual shall be evaluated by the person responsible for maintenance for updates and effectiveness at least once per year. The O&M manual shall be updated and recorded in the deed as needed at that time

Preventative Maintenance Actions Schedule:

Frequency	Preventative Maintenance Actions
Monthly	Removal and disposal of trash and debris (Bioretention Basins A & B, Detention Basin C, Porous Pavement System D, Constructed Wetland Basin E)
Quarterly	Quarterly inspection (Bioretention Basins A & B, Detention Basin C, Porous Pavement System D, Constructed Wetland Basin E)
	Elimination of potential mosquito breeding habitats (Bioretention Basins A & B, Detention Basin C, Porous Pavement System D, Constructed Wetland Basin E)
	Inspection and sediment removal if accumulation is 6 inches or greater. If less than 6 inches of accumulation, inspection schedule should be modified to semiannual. (All BMP's)
Semiannual	Sediment removal (Bioretention Basins A & B, Detention Basin C, Porous Pavement System D, Constructed Wetland Basin E)
Annual	Basin Structural Inspection (Bioretention Basins A & B, Detention Basin C, Porous Pavement System D, Constructed Wetland Basin E)
Unscheduled	Quick inspection after every 1" rain (Bioretention Basins A & B, Detention Basin C, Porous Pavement System D, Constructed Wetland Basin E)
(Other)	Specific maintenance schedules manufactured treatment devices as described in the respective manuals (Filterrra MTD)

Corrective Maintenance Actions

Depending on many factors, such as the performance of preventative maintenance actions, weather, or unexpected incidents, corrective maintenance requirements may not be precisely anticipated; however, a list of potential corrective maintenance actions may assist the responsible party in planning and estimating costs in advance.

Potential Corrective Maintenance Actions
- Repair/replacement of eroded or damaged outlet protection
- Parking Area Maintenance
- Repair/Replacement of outlet pipes or orifices

Inspection and Logs of All Preventative and Corrective Maintenance

As per N.J.A.C. 7:8-5.8(f), the person responsible for maintenance shall maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance-related work orders.

As per NJDEP BMP Manual Ch. 8 (Feb, 2004), a maintenance plan shall include a schedule of regular inspections and tasks, and detailed logs of all preventative and corrective maintenance performed on the stormwater management measure, including all maintenance-related work orders. The person with maintenance responsibility must retain and, upon request, make available the maintenance plan and associated logs and other records for review by a public entity with administrative, health, environmental, or safety authority over the site.

The logs of all inspections, and both preventative and corrective maintenance performed should be attached in the "**Maintenance Logs and Inspection Records** " section. See Part II of the Maintenance Plan

Maintenance Personnel, Equipment, Tools, and Supplies

As per NJDEP BMP Manual Ch. 8 (Feb. 2004), maintenance plans should include equipment, tools, and supplies necessary to perform the various preventative and corrective maintenance tasks specified in the plan. Sources of specialized, proprietary, and nonstandard equipment, tools, and supplies should also be provided.

This section applies to both maintenance tasks that are performed by in-house personnel or are outsourced. The design engineer has to list the required amount of maintenance personnel, equipment, tools, and supplies necessary to perform the various preventative and corrective maintenance tasks specified in the plan. In addition, the sources of specialized, proprietary, and nonstandard equipment, tools and supplies for specific measures, such as manufactured treatment devices should also be listed.

Maintenance Personnel/Equipment/Tools/Supplies

Personnel/Equipment/Tools Name
General Maintenance Crew
Geotechnical Engineer
Lawn Mowers, Trimmers & Edgers
Seed and Fertilizer Spreaders
Hedge Trimmers
Lightweight Backhoe
Portable Pump for Dewatering
Shovels
Rakes

Warranty and parts information should be attached to the Documents section.

Specialized, proprietary or nonstandard equipment, tools and supplies, if applicable

Name of the specialized, proprietary or nonstandard equipment, tools and supplies	Source
Filterra MTD	Contech - 800-338-1122

Disposal Plan

As per NJDEP BMP Manual Ch. 8 (Feb. 2004), the maintenance plan should include approved disposal and recycling sites and procedures for sediment, trash, debris and other material removed from stormwater management measures during maintenance operations.

Disposal/Recycling Procedures

Any sediment, trash, debris and other material removed from stormwater management measures during maintenance operations shall be removed from the site by the maintenance crew and disposed of utilizing a private disposal company to an approved recycling center or disposal center in accordance with all local, state and federal laws.

Cost Estimate

As per N.J.A.C.7:8-5.8(b), cost estimates of maintenance tasks, including, but not limited to, sediment, trash and debris removal must be included in the maintenance plan. Below is an illustration of a cost breakdown and estimation for maintenance of stormwater management measures. The design engineer should estimate the cost based on the expected maintenance required for each stormwater management measure. The actual costs may vary with factors such as local requirements, equipment, personnel, weather, and maintenance methods.

COST ESTIMATES

Cost Overview

Cost Type	Cost
Cost of sediment, trash, and debris removal	$1,000.00
General cost for routine maintenance	$4,500.00
General cost – unscheduled maintenance	$1,000.00
Total cost	$6,500.00

Safety Measures and Procedures

As per NJDEP BMP Manual Ch. 8 (Feb. 2004), maintenance plans should include procedures and equipment required to protect the safety of inspection and maintenance personnel.

Safety Tools, Equipment and Garments

Safety Tools and Equipment	Responsible Person
Gloves	Maintenance Crew Supervisor
Safety Glasses	Maintenance Crew Supervisor
Hearing Protection	Maintenance Crew Supervisor

Safety Training

Maintenance providers shall be responsible for ensuring applicable safety training has been completed in accordance with applicable OSHA guidelines.

Safety Procedures

Maintenance providers shall be responsible for performing all work in accordance with applicable OSHA guidelines.

Emergency Procedures

Township of Franklin Police/Emergency Services: (732)-873-5333
Fire Prevention: (732)-873-2500 Ext. 6303

Training Plan and Records

As per NJDEP BMP Manual Ch. 8 (February 2004), maintenance training begins with a basic description of the purpose and function of the overall stormwater management measure and its major components. Such understanding will enable maintenance personnel to provide more effective component maintenance and more readily detect maintenance-related problems. Depending on the size, character, location, and components of each stormwater management measure, maintenance personnel may also require training in specialized inspection and maintenance tasks and/or the operation and care of specialized maintenance equipment. Training should also be provided in the need for and use of all required safety equipment and procedures.

I. Training Plan

Types of Training

- Mandatory Stormwater Management Basic Training and Field Manual Usage Training for new maintenance crews
- Occupational Safety Training
- Subcontractor training, if applicable

Content of Training

- **Stormwater Management Basic Training**
    - Purposes and Functions of BMPs

      Example Training Material
        - NJDEP Stormwater BMP Manual, Chapter Nine: Structural Stormwater Management Measures

More training information is available at NJ Stormwater.org (http://www.nj.gov/dep/stormwater/training.htm)

- Field Manual Usage Training
    - Field Manuals attached to this Maintenance Plan

- Equipment and Tools Operation Training
    - Equipment or tool manufacturer's Operation & Maintenance Manual

- Occupational Safety Training
    - OSHA Training
    - Equipment or tool manufacturer's Operation & Maintenance Manual

II. Training Records

Training attendance sheets should be attached by the responsible party after each training.

Attach training attendance sheets from each training

Annual Evaluation of the Effectiveness of the Plan

As per N.J.A.C. 7:8-5.8(g), the person responsible for maintenance shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed.

The responsible party should evaluate the effectiveness of the maintenance plan by comparing the maintenance plan with the actual performance of the maintenance. The items to evaluate may include, but not limited to,

- Whether the inspections have been performed as scheduled;
- Whether the preventive maintenance has been performed as scheduled;
- Whether the frequency of preventative maintenance needs to increase or decrease;
- Whether the planned resources were enough to perform the maintenance;
- Whether the repairs were completed on time;
- Whether the actual cost was consistent with the estimated cost;
- Whether the inspection, maintenance, and repair records have been kept.

If actual performance of those items has been deviated from the maintenance plan, the responsible party should find the causes and implement solutions in a revised maintenance plan.

Annual Evaluation Records

Evaluator(s)	Date of Evaluation	Decision
		__Maintain current version OR __Revise current version Revision date _____ (also update the last revision date on the cover page) __Requires a new deed recording (also update the last recording information on the cover page)
		__Maintain current version OR __Revise current version Revision date _____ (also update the last revision date on the cover page) __Requires a new deed recording (also update the last recording information on the cover page)
		__Maintain current version OR __Revise current version Revision date _____ (also update the last revision date on the cover page) __Requires a new deed recording (also update the last recording information on the cover page)

Part II- Field Manuals

Attachment of Field Manuals
for Stormwater Management Measures on this Site

As per N.J.A.C. 7:8-5.8(b)&(e), preventative and corrective maintenance shall be performed to maintain the function of stormwater management measures, including repair or replacement of the structure; removal of sediment, debris or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; repair or replacement of non-vegetated linings, and removal of rodent/wildlife and repair/restoration to damaged affected areas caused by them.

Each Field Manual attached to this Maintenance Plan is a separate document pertaining to one specific stormwater management measure, and should be used by inspections and maintenance crews in order to carry out the maintenance work required by N.J.A.C. 7:8-5.8(e).

Field Manual - AG Bioretention Basins A & B

Field Manual – UG Detention Basin C

Field Manual – Porous Pavement System (Basin D)

Field Manual – Constructed Wetland (Basin E)

Field Manual – Filterra MTD w/ Tree (MTD 1)

Maintenance Logs and Inspection Records

As per N.J.A.C. 7:8-5.8(e), preventative and corrective maintenance shall be performed to maintain the function of the stormwater management measure(s), including repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of non-vegetated linings.

As per N.J.A.C. 7:8-5.8(f), the person responsible for maintenance shall maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance-related work orders.

The responsible party shall maintain a record of all maintenance actions performed, including:

- Inspection checklists from each performed inspection
- Preventative maintenance logs
- Corrective maintenance logs, including work orders
- Other maintenance records

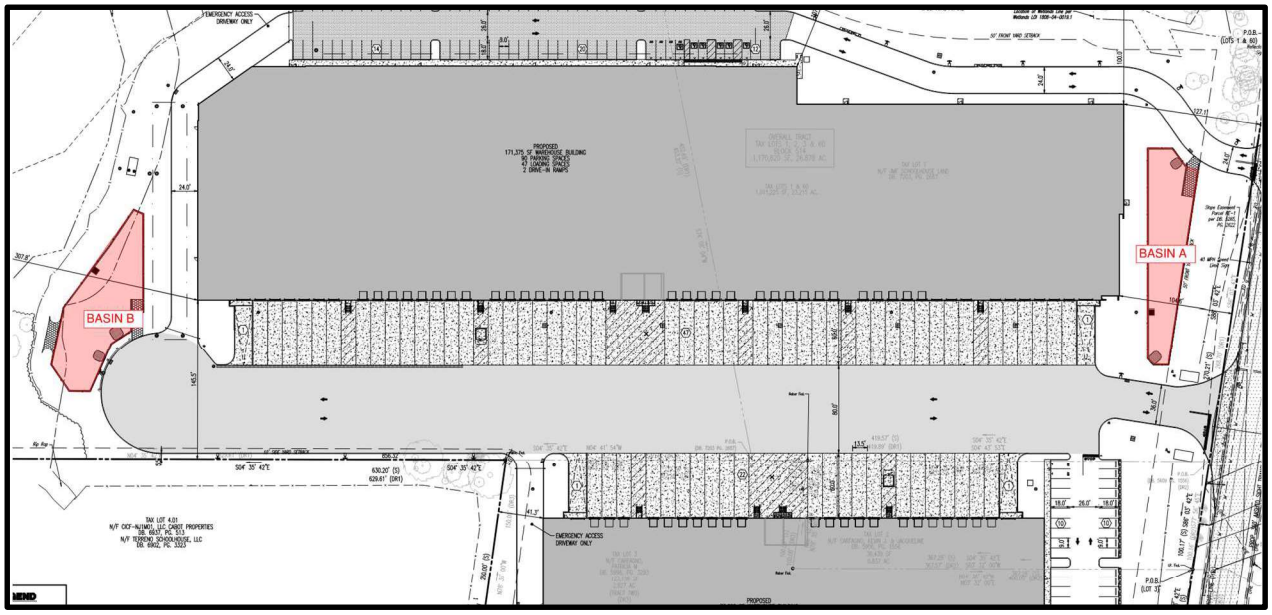
Aboveground Bioretention Basins A & B

Development Name: Proposed Warehouses

Township, County: Franklin Township, Somerset County

Location of Basin A: N: 617,524; E: 474,601
Location of Basin B: N: 616,734; E: 474,636

Location Map



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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. This bioretention basin is designed with an underdrain piping system. Therefore, runoff leaves the system via infiltration into the underlying perforated pipes.

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

A bioretention system is a type of **dry** basin. The design drain time shall be closely monitored to ensure that potential failure is recognized early.

Aboveground Walled Bioretention Basin (Basin A)
Basic Design Information

Hydrology Design Targets

1. The bioretention system is designed as an online system.
2. Basin Bottom is elevation 83.20

Hydraulic Design Targets

1. Design parameters

	Water Quality Design Storm	2-year storm	10-year storm	100-year storm
Rainfall Depth (inches)	1.25 inches in 2 hours	3.29 inches in 24 hours	4.98 inches in 24 hours	8.2 inches in 24 hours
Runoff Volume (cubic feet)	4,871	7,446	9,089	11,570
Peak Flow Rate (cfs)	3.28	3.56	7.27	14.10
Water Surface Elevation (feet)	84.00	84.43	84.69	85.09

Basin Configuration Targets

1. Outlet Information (OCS #44):

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Outlet #1	Weir	4'	84.00
Outlet #2	Weir (TOB)	16'	85.10

1. Vegetation
    - The vegetation type to be used in this bioretention system is (site-tolerant grasses, terrestrial forested community). Please reference the Landscape Plan included with this submission.
2. Underdrain
    - The perforated lateral is 4 inches in diameter (3 typ).

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.

Aboveground Walled Bioretention Basin (Basin B)
Basic Design Information

Hydrology Design Targets

3. The bioretention system is designed as an online system.
4. Basin Bottom is elevation 82.43

Hydraulic Design Targets

2. Design parameters

	Water Quality Design Storm	2-year storm	10-year storm	100-year storm
Rainfall Depth (inches)	1.25 inches in 2 hours	3.29 inches in 24 hours	4.98 inches in 24 hours	8.29 inches in 24 hours
Runoff Volume (cubic feet)	4,418	5,517	5,950	6,659
Peak Flow Rate (cfs)	3.37	3.84	6.31	11.12
Water Surface Elevation (feet)	83.04	83.19	83.25	83.35

Basin Configuration Targets

2. Outlet Information (OCS #44):

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Outlet #1	Weir (TOB)	20'	83.04

2. Vegetation
    - The vegetation type to be used in this bioretention system is (site-tolerant grasses, terrestrial forested community). Please reference the Landscape Plan included with this submission.
3. Underdrain
    - The perforated lateral is 4 inches in diameter (3 Typ).

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.

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

	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 scour hole	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 # _____
A3 Pretreatment (Structural BMP)	1	BMP inspection	Y__ N__	(See BMP No. _____ Field Manual)
Note:				

	For Inspector			For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
B Basin Bed	1	Standing water is present after 72 hours The observed drain time is approximately _____ hours.	Y__ N__	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:				

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
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:				

	For Inspector			For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
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:				

	For Inspector			For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
G Miscellaneous	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.):

_____

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	

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** :

3. The issue was from **Corresponding Checklist** _____, **Component No.** _____, **Inspection Item No.** _____.

4. **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)		
Revegetate		
(If there are additional tasks, list them here.)		

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

   _____

6. **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)

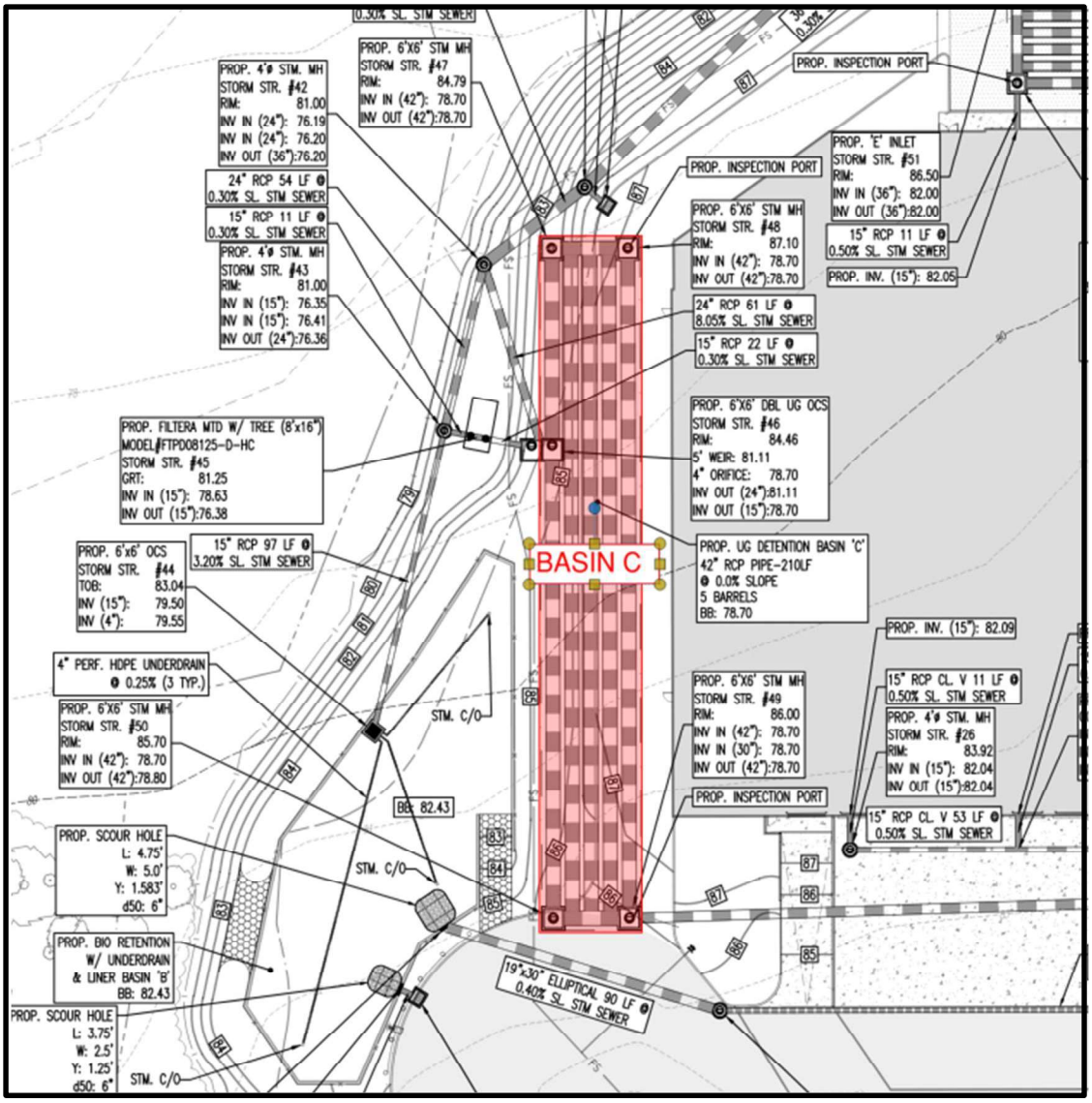
File this Corrective Maintenance Record in the Maintenance Log after performing maintenance.

Underground Detention Basin C

Development Name: Proposed Warehouses

Township, County: Franklin Township, Somerset County

Location of Basin: N: 616,799; E: 474,650



Location Map

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Extended Detention Basin Overview

Functionality

An extended detention basin is a stormwater management facility that temporarily stores and attenuates stormwater runoff.

Type of BMP – Dry Basin / Extended Detention Only

An extended detention basin is a type of **dry** basin. This extended detention basin is designed for **detention only** and is **not** designed to infiltrate runoff; therefore, the basin may not be completely dry after the **design detention time** (see the Hydrology Design Targets in the Basic Design Information section). However, 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. Therefore, all dry basins must fully drain within 72 hours of the most recent rainfall. The design drain time shall be closely monitored to ensure potential failure is recognized early.

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.

Basic Design Information

Hydrology Design Targets

1. The **design detention time** of this basin will be less than 72 hours.
2. This basin will be discharged to the Filterra MTD and proposed constructed wetlands.

Hydraulic Design Targets

1. Design Parameters

	Water Quality Design Storm	2-year storm	10-year storm	100-year storm
Rainfall Depth (inches)	1.25 inches in 2 hours	3.29 inches in 24 hours	4.98 inches in 24 hours	8.29 inches in 24 hours
Runoff Volume (cubic feet)	6,488	8,018	9,228	10,294
Peak Flow Rate (cfs)	0.64	4.97	11.52	20.50
Water Surface Elevation (feet)	81.11	81.52	81.88	82.28

Basin Configuration Targets

1. Outlet Information (OCS #46):

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Outlet #1	Orifice	4"	78.70
Outlet #2	Weir	5'	81.11

Critical Maintenance Features

1. Trash racks and discharge outlet shall be cleaned frequently.

Inspection Checklist / Maintenance Actions
Extended Detention Basin

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

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
A Pretreatment (MTD, if installed)	1	MTD inspection	Y__ N__	See manufacturer's maintenance manual
Note:				
B Basin	1	Observed detention time is longer than the design detention time. Observed detention time is approximately _____ hours.	Y__ N__	Check if outlets are clogged
	2	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 Check if the outlet is clogged
	3	Excessive sediment, silt, or trash accumulation	Y__ N__	Clean pretreatment system Remove silt, sediment, and trash
Note:				

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
C 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	Standing water is present in the outlet structure longer than 72 hours	Y__ N__	Pump out the standing water Work Order # _____
Note:				

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

_____

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**	A– Pretreatment	
	B – Basin	
	C – Outlet	

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 _____).

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** :

3. The issue was from **Corresponding Checklist** _____, **Component No.**_____ , **Inspection Item No.** _____.

4. **Required Actions**

Actions	Planned Date	Date Completed

5. **Responsible person(s):**
   _____

6. **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.

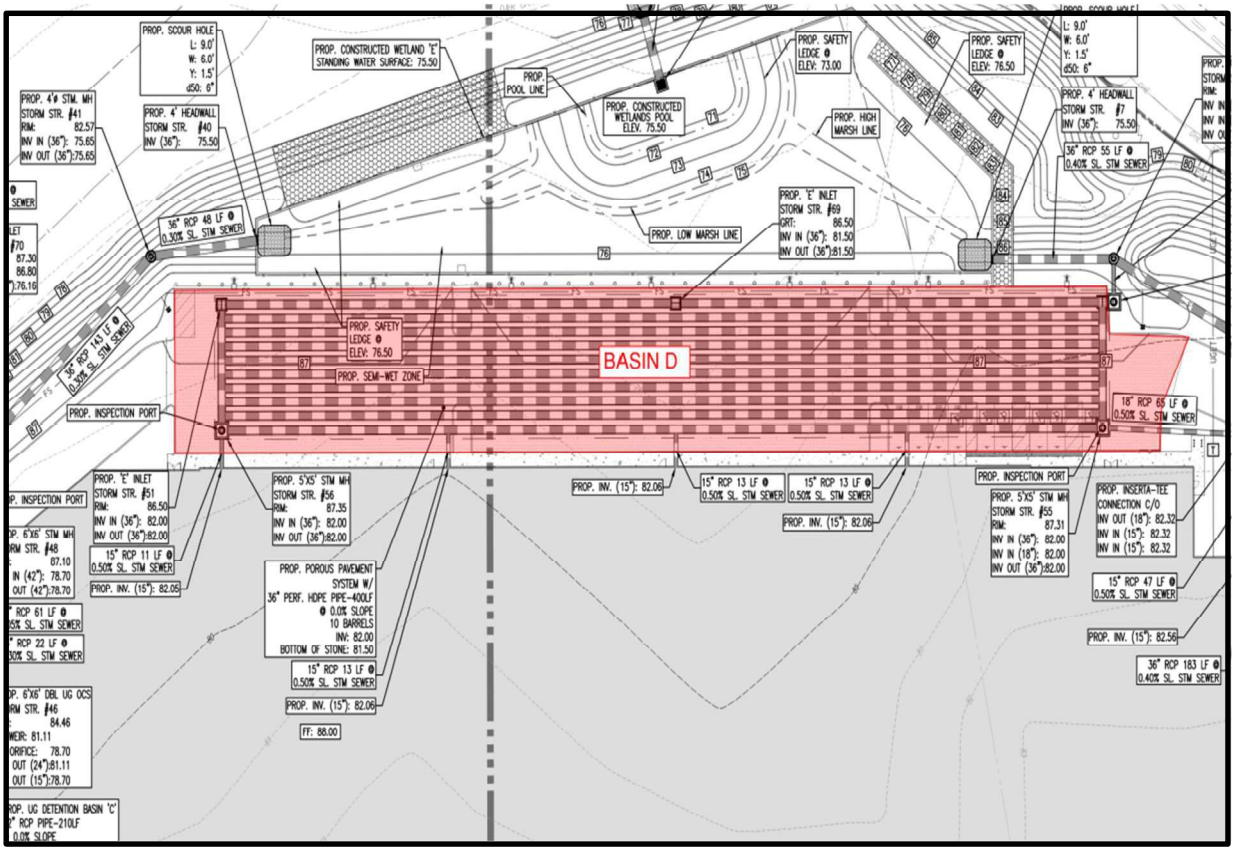
Porous Pavement System (Basin D)

Development Name: Proposed Warehouses

Township, County: Franklin Township, Somerset County

Location of System: N: 616,943; E: 474,457

Location Map



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Pervious Pavement System Overview

Functionality

Pervious paving systems are paved areas that produce less stormwater runoff than areas paved with conventional paving. This reduction is achieved primarily through the infiltration of a greater portion of the rain falling on the area than would occur with conventional paving. This increased infiltration occurs either through the paving material itself or through void spaces between individual paving blocks known as pavers.

Pervious paving systems are divided into two general types. Each type depends primarily upon the nature of the pervious paving surface course and the presence or absence of a runoff storage bed beneath the surface course. Porous paving and permeable paver with storage bed systems treat the stormwater quality design storm runoff through storage and infiltration. Therefore, these systems have adopted TSS removal rates similar to infiltration structures. The adopted TSS removal rate for each type of pervious paving system is from 80%.

Pervious paving systems are used to reduce runoff rates and volumes from paved, on-grade surfaces such as patios, walkways, driveways, fire lanes, and parking spaces. Pervious paving systems with runoff storage beds achieve these reductions through storage of runoff and eventual infiltration into the subgrade soils. Through this infiltration process, these types of pervious paving systems also achieve stormwater quality requirements.

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 Stormwater Management Measure

The pervious pavement system shall fully drain within 72 hours of the most recent rainfall. Standing water in excess of 72 hours is a sign of the porous pavement failure. It may also contribute to mosquito breeding and other health and safety issues. At no time shall there be ponding on the surface of the pavement.

Pervious Pavement System
Basic Design Information

Hydrology Design Targets

1. The system is pervious pavement with a basin bottom at EL. 81.50 feet.
2. The pervious pavement system ultimately drains to the constructed wetlands.

Hydraulic Design Targets

1. Design Parameters

	Water Quality Design Storm	2-year storm	10-year storm	100-year storm
Rainfall Depth (inches)	1.25 inches in 2 hours	3.29 inches in 24 hours	4.98 inches in 24 hours	8.29 inches in 24 hours
Runoff Volume (cubic feet)	8,127	16,268	26,060	44,269
Peak Flow Rate (cfs)	0.37	0.49	0.60	1.50
Water Surface Elevation (feet)	82.45	83.05	83.68	84.90

Basin Configuration Targets

1. Outlet Information (OCS #46):

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Outlet #1	Orifice	4"	81.50
Outlet #2	Weir	4'	84.75

System Configuration Targets

1. The system has no pretreatment.
2. The top of the system is not vegetated.

Critical Maintenance Features

1. Avoid sand or silt onto the pervious pavement area.
2. Sweep and vacuum the pervious pavement area often to prevent clog.
3. Do not apply sealant to cracks or entire surface.

Inspection Checklist / Maintenance Actions
Porous Pavement 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

	For Inspector			For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
A Pavement Surface (Porous Pavement)	1	Standing water is present after the design drain time The observed drain time is approximately _____ hours. Excessive sediment or mud accumulation on top of the pavement	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. If excessive sediment is present, the system may be clogged - Sweep the surface - Power wash (at 45 degree angle to the top) - Vacuum the surface - Excavate to inspect the storage bed for clogging, replace the storage bed material if it is severely clogged - Check the permeability rate of the subsoil Work Order # _____
B Outlet	1	Clogged overflow outlet	Y__ N__	Clear and remove sediment
Note:				

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

_____

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
	A – Pavement Surface (Porous Pavement)	
	B – Outlet	

Debris, sediment, and trash are handled (onsite / by _____ (contractor name) to disposal site _____).

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** :

3. The issue was from **Corresponding Checklist No. _____, Component No. _____, Inspection Item No.** _____.

4. **Required Actions**

Actions	Planned Date	Date Completed

5. **Responsible person(s):**
   _____

6. **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.

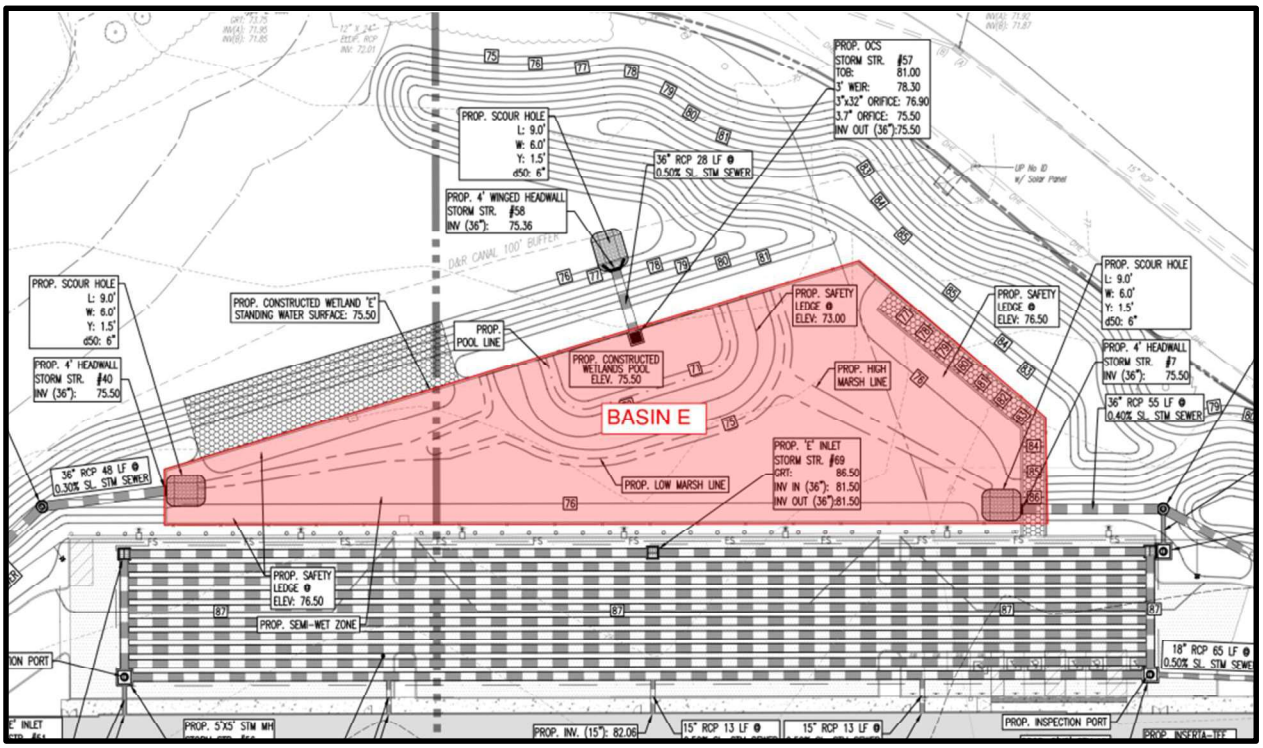
Constructed Wetland (Basin E)

Development Name: Proposed Warehouses

Township, County: Franklin Township, Somerset County

Location of System: N: 616,943; E: 474,457

Location Map



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Standard Constructed Wetland Overview

Functionality

Standard constructed wetlands are stormwater management systems design to maximize the removal of pollutants from stormwater runoff. Flow is directed through an engineered, open marsh system where pollutants are removed through settling and vegetative uptake/filtration. The total suspended solids (TSS) removal rate is 90%.

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 – Wet Basin / Extended Detention of Runoff and Settlement of TSS

A constructed wetland is a type of **wet** basin, in which water is retained in a permanent pool. This standard constructed wetland is designed for **extended detention of runoff** and **settlement of TSS** . It is **not** design to infiltrate the runoff.

Standard constructed wetlands shall have a water surface elevation approximately at the design water surface elevation year round. Standard constructed wetlands consist of a combination of two or more of the following components: pool zone, marsh zone and semi-wet zone. The different zones of the constructed wetland require different water depths, shapes, and vegetation; therefore, it is normal to see varying water depths throughout the system.

Basic Design Information

Hydrology Design Targets

1. This standard constructed wetland is designed as a extended detention constructed wetland consisting of the following zones and water depths:

Marsh Constructed Wetland Design Specifications	
Drainage Area	13.82 Acres
Standing Water Depth: High Marsh Zone	Max 6″
Standing Water Depth: Low Marsh Zone	6″ – 18″
Standing Water Depth: Pool Zone	4.5 Feet
Standing Water Depth: Semi-Wet Zone	Only inundated during storm events

2. This basin will be discharged to the south.

Hydraulic Design Targets

1. Design parameters

	Water Quality Design Storm	2-year storm	10-year storm	100-year storm
Rainfall Depth (inches)	1.25 inches in 2 hours	3.29 inches in 24 hours	4.98 inches in 24 hours	8.29 inches in 24 hours
Runoff Volume (cubic feet)	23,936	52,995	74,600	106,493
Peak Flow Rate (cfs)	0.56	4.60	16.72	42.70
Water Surface Elevation (feet)	76.96	78.39	79.44	80.99

Basin Configuration Targets

1. Outlet Information:

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Outlet #1	Orifice	3.7″	75.50
Outlet #2	Orifice	3″ X 32″	76.90
Outlet #3	Weir	3′	78.30
Outlet #4 (TOB)	Weir	16′	81.00

2. The basin is lined. The liner is constructed of geotextile.
3. The wet pond intercepts groundwater.
4. The pond is designed without a bottom drain pipe to empty the pond.
5. Safety ledges are installed at Elevation 73.00 and Elevation 76.50.

Critical Maintenance Features

1. Floatables need to be cleaned and removed from the wetland.
2. Remove dead vegetation to prevent mosquito problem.
3. Water depth in each different zone must be maintained at design level.
4. Sediment level in the Pool Zone needs to be checked and cleaned frequently to ensure sufficient storage space and detention time.

Class IV Dam:

The proposed constructed wetland is considered a Class IV Dam and therefore regular inspection if required a min of every 4 years (or as needed). The following maintenance shall be provided:

There are three (3) categories of maintenance: immediate maintenance, corrective maintenance, and continuing maintenance. Accordingly, each of the maintenance conditions will be determined during the inspection. This portion of the report also contains a section on technical guidance describing corrective action.

1. Immediate maintenance demands immediate attention, requires notification of the Bureau of Dam Safety, and must be performed under the supervision of a New Jersey licensed professional engineer. Immediate maintenance usually requires construction equipment and professional guidance. Immediate maintenance is characterized by the following:
    a. A severe slope failure.
    b. A breach or near breach caused by severe progressive erosion.
    c. Overtopping of the crest by upstream or downstream waters.
    d. Deterioration of the outlet culvert.
    e. Increasing uncontrolled seepage through the embankment.
    f. A blocked spillway or outlet channel.
2. Corrective maintenance should be performed as soon as possible after an inspection, and may require a Dam Safety Permit. Corrective maintenance consist of the following:
    a. Clearing of trees, shrubs and underbrush on the dam embankment, crest,or near the spillway.
    b. Filling eroded areas or gullies and seeding to stabilize the area.
    c. Repairing or greasing the stem of the outlet gate.
    d. Removal of burrowing animals and filling the holes

3. Continuing maintenance will occur on a regular basis and can be performed during the informal inspections or in accordance with maintenance schedule outlined in Part II, Section G of this manual. Continuing maintenance includes:
    a. Observation of any wet areas, springs or potential seepage in the embankment:
    b. Removing small shrubs or underbrush on the dam embankment:
    c. Filling small eroded gullies:
    d. Filling of ruts caused by pedestrian traffic along the crest:
    e. Removing accumulated trash and debris:
    f. Monitoring upstream development within the watershed:
    g. Operating and greasing the stem at the outlet gate:
    h. Removal of burrowing animals and their dens from the dam.
    i. Fertilizing and overseeding grassed area.
    j. Mowing grass areas.

Visual Aid for Wet Type Stormwater Basin Inspection

Note: Basins shown here include various types of wet basins, not limited to the category of basin in this field manual.

Issues: The forebay has not drained. Note the sediment accumulation in the forebay.

Corrective Action: Clear and remove sediment. Check if the drain hole is clogged.

Preventative Action: Routine inspection and maintenance to remove sediment. If sediment accumulates too fast, find the source of sediment and method to reduce the sediment.

Issues: Algae blooming.

Corrective Action: Remove algae.

Preventative Action: Routine inspection and aeration of the pond. Remove algae before blooming. A finding of the nutrient source and method to reduce the nutrient loading may be needed.

Issues:	The outlet grating is covered by trash. Excessive trash in the pond.
Corrective Action:	Clear and remove trash.
Preventative Action:	Routine inspection and removal of trash. A finding of the trash source and method to reduce the trash may be needed.

Issues:	The water level in the wet pond is significantly below the design water surface elevation.
Corrective Action:	Check if the outlet structure or the liner is damaged. Repair any damage.
Preventative Action:	Routine inspection of the basin and the liner.

Issues: Erosion on the embankment.

Corrective Action: Repair the embankment. Report to local authority and DEP Dam Safety as required by the local and DEP rules.

Preventative Action: Construct a riprap apron on the slope. Routine inspection before erosion becomes severe.

Issues: This basin was designed as a detention basin (dry basin), but now looks like a constructed wetland (wet basin). If the maintenance crews do not refer back to the original design information, they may perform the wrong maintenance work.

Note: The maintenance crew must refer to the as-built drawings and design information to avoid confusion and inappropriate maintenance work.

If the original design information is not available, the pond configuration may signal whether it was designed as a wet basin or dry basin. As shown here, the water level is at the invert elevation of the outlet (orifice behind the trash rack). If the water level is at the first outlet from the basin bottom (this can be determined by checking the inside the outlet box), then it is a wet basin and is at correct water surface level. However, if there is another outlet below the water, then it may signal that it is a failed dry basin now filled with water.

Also the pond has a circle of riprap (also known as an energy dissipater) around the edge at the water level. A dry basin will generally not have this configuration; therefore, it suggests a wet pond.

Inspection Checklist / Maintenance Actions
Standard Constructed Wetland

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, if installed)	1	MTD inspection	Y__ N__	(If a MTD is used for pretreatment, see manufacturer's maintenance manual)
A3 Pretreatment (Structural BMP)	1	BMP No. _____ inspection	Y__ N__	(See BMP No. _____ Field Manual)
Note:				

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
B1 Marsh Zone	1	The water depth in the marsh zone is significantly above or below the design water depth Dry spot(s) appearing in the marsh zone Growth of trees or bushes in the marsh zone	Y__ N__	Check for: * Damages to the liner (if applicable) * Changes in inflow patterns (less runoff, lower groundwater table) Repair any structural damages Remove sediment, reconfigure the marsh zone, remove trees, or repair the liner (if necessary) Work Order # _____
	2	Vegetation loss in the high marsh zone	Y__ N__	Check whether the water level is higher than the design level Check the Landscaping Plan for remedial actions Work Order # _____
	3	Significant changes of the sinuous path pattern from the original design Channelization in the wetland	Y__ N__	Check whether the incoming flow is larger than the design inflow Check if excessive sediment has accumulated in the marsh zone Remove sediment and reconfigure the flow path, if necessary Work Order # _____
Note:				

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
B2 Pond Zone	1	The water depth in the marsh zone is significantly above or below the design water depth	Y__ N__	Check for: - Changes in inflow patterns (less runoff, lower groundwater table) - Damages to the outlet structure - Damages to the liner (if applicable) Repair any structural damages Work Order # _____
	2	Islands or shallow marsh emerging out of the pond zone	Y__ N__	Check whether there is excessive sediment in the pond Check whether the incoming flow has excessive sediment Remove excessive sediment Find the source of excessive sediment and method to reduce the source Work Order # _____

Note: If emptying the pond is required before sediment removal, it shall be noted that a permit may be required before discharging the pond water. Contact NJDEP Division of Land Use Regulation before discharge.

Other Note:

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
B2 Pond Zone	3	The observed detention time is longer than the design detention time. The observed detention time is approximately _____ hours.	Y__ N__	Check whether the outlets are clogged, see section E-Outlet of this checklist
	4	Debris or trash floating on the water	Y__ N__	Remove debris and trash If trash and debris are excessive, find the source and the method to reduce the source.
	5	Excessive dead vegetation in the pond	Y__ N__	Clear and remove vegetation
	6	Mosquitoes breeding	Y__ N__	Remove dead vegetation Consult local mosquito commission for guidance Work Order # _____
	7	Subsidence of safety ledge	Y__ N__	Drain the pond and repair the safety ledge Work Order # _____

Note: If emptying the pond is required, a permit may be required before discharging the pond water. Contact NJDEP Division of Land Use Regulation before discharge.

Other Note:

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
B3 Semi-Wet Zone	1	Erosion on the side slopes	Y__ N__	See D – Pond Embankment and Side Slopes
	2	Overgrown trees and bushes	Y__ N__	Clear, trim, or prune the trees according to the original Landscaping Plan Inspect to determine if the tree roots caused any structural damage Work Order # _____
C Vegetation	1	Invasive plants are present	Y__ N__	Remove the invasive plants and restore the vegetation in accordance with the landscaping plan Work Order # _____
	2	Algae blooming	Y__ N__	Remove algae Find the nutrient source and the solution to reduce the nutrient loading Work Order # _____
Note:				

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
D Pond 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 # _____
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 #_____
	5	Standing water is present in the outlet structure longer than 72 hours	Y__ N__	Pump out the standing water Work Order # _____
Note:				

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
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 (if applicable)	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	Check if finished
Sediment/debris removal **Sediment removal should take place when the pond zone is thoroughly dry.**	A1/A2/A3 – Pretreatment	
	B2 – Pond Zone	
	D – Pond Embankment and Side Slopes	
	E – Outlet	
Vegetation removal	A1/A2/A3 – Pretreatment	
	B1 – Marsh Zone	
	B2 – Pond Zone	
	B3 – Semi-Wet Zone	
	D – Pond 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:** _____

A permit may be required to discharge when emptying the pond. Contact NJDEP Division of Land Use Regulation before discharging.

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)

3. The issue was from **Corresponding Checklist No. _____, Component No.** (e.g., E – Outlet), **Inspection Item No.** ___ (e.g., 2, 3) _.

4. **Required Actions**

Actions	Planned Date	Date Completed
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.)		

5. **Responsible person(s):**
_____

6. **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.

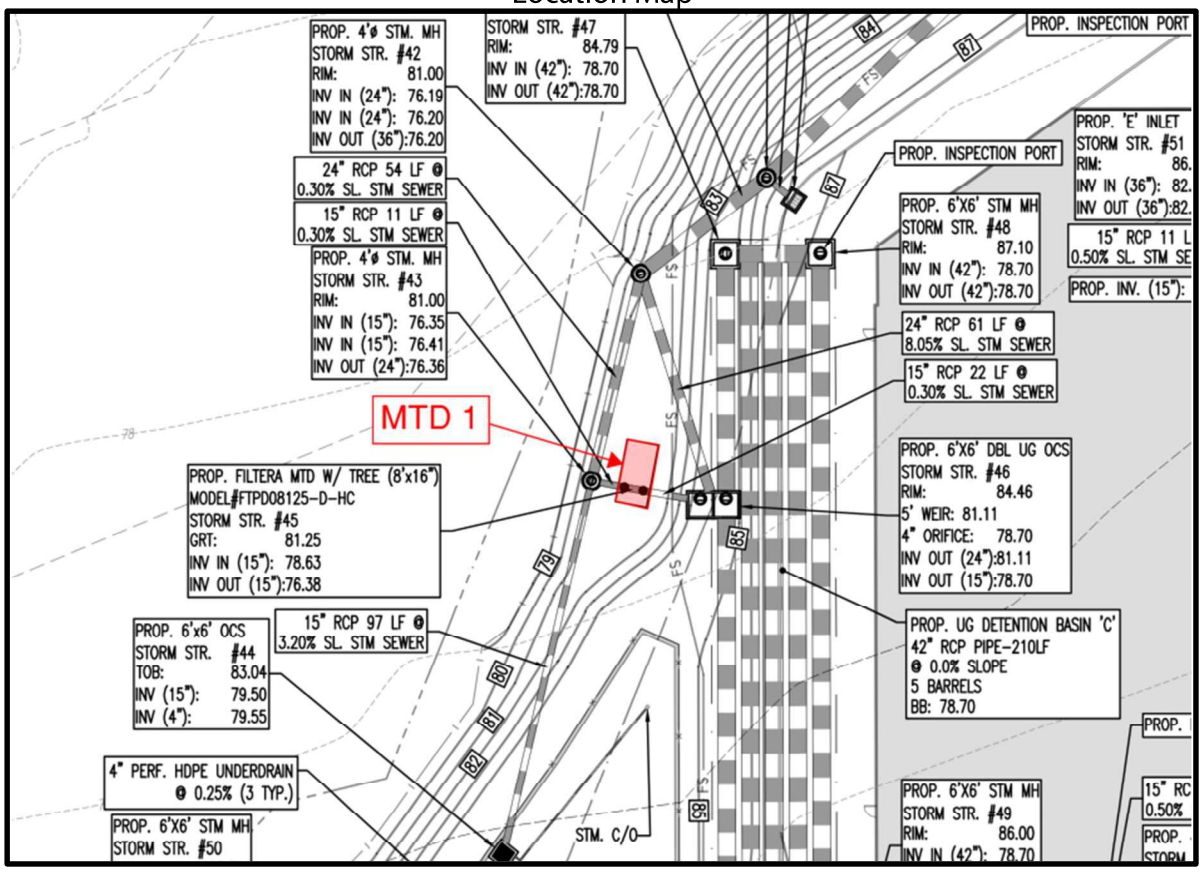
Filterra MTD w/ Tree (MTD 1)

Development Name: Proposed Warehouses

Township, County: Franklin Township, Somerset County

Location of MTD: N: 616,878; E: 474,657

Location Map



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MTD Overview

Functionality

A Manufactured Treatment Device (MTD) is a pre-fabricated stormwater treatment structure utilizing settling, filtration, absorptive/adsorptive materials, vortex separation, vegetative components, and/or other appropriate technology to remove pollutants from stormwater runoff.

Manufactured treatment devices are intended to capture sediments, metals, hydrocarbons, floatables, and/or other pollutants in stormwater runoff before being conveyed to a storm sewer system, additional stormwater quality treatment measure, or waterbody.

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.

Basic Design Information

Hydrology Design Targets

1. The MTD is designed as an offline system.
2. The maximum design storm is Water Quality Design Storm, which corresponds to 1.25 inches of rain in 2 hours.

Hydraulic Design Targets

1. Design parameters

	Water Quality Design Storm
Rainfall Depth (inches)	1.25 inch in 2 hours
Runoff Volume (cubic feet)	6,488
Peak Flow Rate (cfs)	0.64
Water Surface Elevation (feet)	N/A

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

Configuration Targets

1. The name of the MTD is STR #45, Filterra MTD w/ Tree.
2. The manufacturer of the MTD is Contech

Maintenance Procedures

1. Filterra HC Bioretention System by Contech 800-338-1122

Manufacturer Maintenance Guidelines

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER QUALITY
Bureau of Stormwater Permitting
401 East State Street
P.O. Box 420 Mail Code 401-02B
Trenton, NJ 08625-0420
Tel. (609) 633-7021 • Fax (609) 777-0432
www.nj.gov/dep/dwq/bnpc_home.htm

PHILIP D. MURPHY
Governor

SHEILA Y. OLIVER
Lt. Governor

SHAWN M. LATOURETTE
Acting Commissioner

February 12, 2021

Derek M. Berg
Director – Stormwater Regulatory Management - East
Contech Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: MTD Lab Certification
Filterra® HC Bioretention System
Off-line Installation Approved

TSS Removal Rate 80%

Dear Mr. Berg:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Contech Engineered Solutions LLC has requested a Laboratory Certification for the Filterra® HC Bioretention System (Filterra® HC.)

The project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix (dated January 2021) for this device is published online at http://www.njcat.org/uploads/newDocs/NJCATFilterraTechnologyVerificationReportFinal._.pdf.

The NJDEP certifies the use of the Filterra® HC stormwater treatment unit by Contech Engineered Solutions LLC at a TSS removal rate of 80% when designed, operated, and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 3.12 gpm/ft^2 of effective filtration treatment area.

2. The Filterra® HC stormwater treatment unit shall be installed using the same configuration reviewed by NJCAT, and sized in accordance with the criteria specified in item 7 below.

3. This device cannot be used in series with another MTD or a media filter (such as a sand filter) to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual, which can be found online at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the Filterra® HC. A copy of the maintenance plan is attached to this certification. However, it is recommended to review the maintenance website at https://www.conteches.com/Portals/0/Documents/Maintenance%20Guides/Filterra%20HC%20OM%20Packet.pdf for any changes to the maintenance requirements.

6. For an MTD to be considered "green infrastructure" (GI) in accordance with the March 2, 2020 amendments to the Stormwater Management rules at N.J.A.C. 7:8, the MTD must meet the GI definition noted at amended N.J.A.C. 7:8-1.2. Specifically, the MTD shall (1) treat stormwater runoff through infiltration into subsoil; and/or (2) treat stormwater runoff through filtration by vegetation or soil; or (3) store stormwater runoff for reuse.

   The Filterra® HC filters stormwater runoff through an engineered biofiltration soil media and, thus, meets the definition of GI. Filterra® HC can be configured with or without a precast vault. Installations that will not include a precast vault will additionally need to comply the NJDEP Stormwater BMP Manual conditions regarding separation from the seasonal high water table and, if infiltration is proposed as an outlet, minimum vertical saturated hydraulic conductivity of the subsoil. Installations without a precast vault that do not rely on infiltration are required to maintain at least a one-foot separation from the seasonal high water table measured from the lowest point of the system. Installations without a precast vault that utilize infiltration are required to have the most hydraulically restrictive soil layer below the MTD meet the minimum tested vertical saturated hydraulic conductivity of one inch per hour and have at least two feet of separation from the seasonal high water table measured from the lowest point of the system.

7. Sizing Requirement:

   The example below demonstrates the sizing procedure for the Filterra® HC:

   Example: A 0.25-acre impervious site is to be treated to 80% TSS removal using the Filterra® HC. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

   The selection of the appropriate model of Filterra® HC is based upon both the maximum inflow drainage area and the MTFR. It is necessary to calculate the required model using both methods and to use the largest model determined by the two methods.

   Inflow Drainage Area Evaluation:

   The drainage area to the Filterra® HC in this example is 0.25 acres. Included in Table 1 below, all of the Filterra® HC models are designed with a maximum allowable drainage area greater than 0.25 acres. Specifically, the Filterra® HC with a 4'x4' media bay and a maximum allowable drainage area of 0.40 acres would be the smallest model able to treat runoff without exceeding the maximum allowable drainage area.

   Maximum Treatment Flow Rate (MTFR) Evaluation:

   The site runoff (Q) was based on the following:
   time of concentration = 10 minutes
   i = 3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
   c = 0.99 (runoff coefficient for impervious)
   $Q = ciA = 0.99 \times 3.2 \times 0.25 = 0.79$ cfs

   Given the site runoff is 0.79 cfs and based on the MTFR's listed in Table 1 below, the Filterra® HC with a 16'x8' media bay and an MTFR of 0.889 cfs would be the smallest model that could be used to treat the impervious area without exceeding the MTFR. If using more than one unit for treating runoff, the units should be configured such that the flowrate to each unit does not exceed the design MTFR for each unit and ensuring the entire 0.25 acre area is treated.

The MTFR evaluation results will be used since that method results in the highest minimum configuration determined by the two methods.

The sizing table corresponding to the available system models is noted below:

Table 1. Filterra® HC MTFRs and Maximum Allowable Drainage Areas

	Available Filterra® Media Bay Sizes (feet)	Effective Filtration Treatment Area (ft^2)	Treatment Flow Rate (cfs)	Maximum Allowable Drainage Area (ac)
Standard Configuration Filterra and Filterra Biosape Vaults	4x4	16	0.111	0.40
	4x6 or 6x4	24	0.167	0.60
	4.5x7.83 or 7.83x4.5 (Nominal 4x8/8x4)	35.24	0.245	0.89
	6x6	36	0.250	0.91
	6x8 or 8x6	48	0.333	1.21
	6x10 or 10x6	60	0.417	1.51
	6x12 or 12x6	72	0.500	1.81
	7x13 or 13x7	91	0.632	2.29
	14x8	112	0.778	2.82
	16x8	128	0.889	3.22
	18x8	144	1.000	3.62
	20x8	160	1.111	4.03
	22x8	176	1.222	4.43
Peak Diversion Filterra Vaults	4x4	16	0.111	0.40
	4.5x5.83 (Nominal 4x6)	26.24	0.182	0.66
	6x4	24	0.167	0.60
	6x6	36	0.250	0.91
	6x8	48	0.333	1.21
	6x10 or 10x6	60	0.417	1.51
	7x10	70	0.486	1.76
	8x10.5	84	0.583	2.11
	8x12.5	100	0.694	2.52
	Custom and/or Filterra Bioscape	Media Area in ft^2	0.00694 * (Media Area in ft^2)	0.0252 * (Media Area in ft^2)

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management rules, N.J.A.C. 7:8. The plan must include all of the items identified in the Stormwater Management rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact me at (609) 633-7021.

Sincerely,

Gabriel Mahon, Chief
Bureau of Stormwater Permitting

Attachment: Maintenance Plan
cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP – Water & Land Management
Nancy Kempel, NJDEP– BSTP
Keith Stampfel, NJDEP – DLRP
Dennis Contois, NJDEP – DLRP

Filterra HC
Owner's Manual

filterra®

Bioretention Systems

CONTECH®
ENGINEERED SOLUTIONS

filterra®
Bioretention Systems

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CONTECH®
ENGINEERED SOLUTIONS

Introduction

Thank you for your purchase of the Filterra® HC Bioretention System. Filterra HC is a specially engineered stormwater treatment system incorporating high performance biofiltration media to remove pollutants from stormwater runoff. All components of the system work together to provide a sustainable long-term solution for treating stormwater runoff.

The Filterra HC system has been delivered to you with protection in place to resist intrusion of construction related sediment which can contaminate the biofiltration media and result in inadequate system performance. These protection devices are intended as a best practice and cannot fully prevent contamination. It is the purchaser's responsibility to provide adequate measures to prevent construction related runoff from entering the Filterra HC system.

Included with your purchase is Activation of the Filterra HC system by the manufacturer as well as a 1-year warranty from delivery of the system and 1-year of routine maintenance (mulch replacement, debris removal, and pruning of vegetation) up to twice during the first year after activation.

Design and Installation

Each project presents different scopes for the use of Filterra HC systems. Information and help may be provided to the design engineer during the planning process. Correct Filterra HC box sizing (per local regulations) is essential to predict pollutant removal rates for a given area. The engineer shall submit calculations for approval by the local jurisdiction. The contractor is responsible for the correct installation of Filterra HC units as shown in approved plans. A comprehensive installation manual covering all Filterra configurations is available at www.ContechES.com.

Activation Overview

Activation of the Filterra HC system is a procedure completed by the manufacturer to place the system into working condition. This involves the following items:

- Removal of construction runoff protection devices
- Planting of the system's vegetation
- Placement of pretreatment mulch layer using mulch certified for use in Filterra HC systems.

Activation MUST be provided by the manufacturer to ensure proper site conditions are met for Activation, proper installation of the vegetation, and use of pretreatment mulch certified for use in Filterra HC systems.

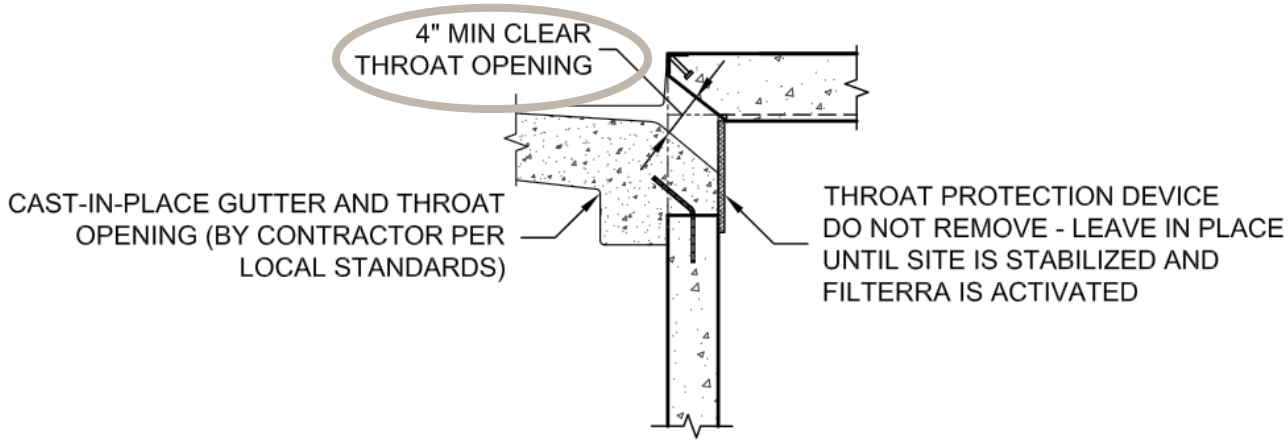
Minimum Requirements

The minimum requirements for Filterra HC Activation are as follows:

1. The site landscaping must be fully stabilized, i.e. full landscaping installed and some grass cover (not just straw and seed) is required to reduce sediment transport. Construction debris and materials should be removed from surrounding area.

2. Final paving must be completed. Final paving ensures that paving materials will not enter and contaminate the Filterra HC system during the paving process, and that the plant will receive runoff from the drainage area, assisting with plant survival for the Filterra HC system.

3. Filterra HC throat opening (if applicable) should be at least 4" in order to ensure adequate capacity for inflow and debris.



An Activation Checklist is included on page 12 to ensure proper conditions are met for Contech to perform the Activation services. A charge of $500.00 will be invoiced for each Activation visit requested by Customer where Contech determines that the site does not meet the conditions required for Activation.

Filterra HC Plant Selection Overview

Plant Lists are available on the Contech website highlighting recommended plants for Filterra systems in your area. Keep in mind that plants are subject to availability due to seasonality and required minimum size for the Filterra HC system. Plants installed in the Filterra HC system are container plants (max 15 gallon) from nursery stock and will be immature in height and spread at Activation.

It is the responsibility of the owner to provide adequate irrigation when necessary to the plant of the Filterra HC system.

The "Planting Requirements for Filterra HC Systems" document is included as an appendix and discusses proper selection and care of the plants within Filterra HC systems.

Warranty Overview

Refer to the Contech Engineered Solutions LLC Stormwater Treatment System LIMITED WARRANTY for further information. The following conditions may void the Filterra HC system's warranty and waive the manufacturer provided Activation and Maintenance services:

- Unauthorized activation or performance of any of the items listed in the activation overview
- Any tampering, modifications or damage to the Filterra HC system or runoff protection devices
- Removal of any Filterra HC system components
- Failure to prevent construction related runoff from entering the Filterra HC system
- Failure to properly store and protect any Filterra HC components (including media and underdrain stone) that may be shipped separately from the vault

Routine Maintenance Guidelines

Routine maintenance is included by the manufacturer on all Filterra HC systems for the first year after activation. This includes a maximum of 2 visits to remove debris, replace pretreatment mulch, and prune the vegetation. More information is provided in the Operations and Maintenance Guidelines. Some Filterra HC systems also contain diversion bypass or outlet bays. Depending on site pollutant loading, these bays may require periodic removal of debris, however this is not included in the first year of maintenance and would likely not be required within the first year of operation.

These services, as well as routine maintenance outside of the included first year, can be provided by certified maintenance providers listed on the Contech website. Training can also be provided to other stormwater maintenance or landscape providers.

Why Maintain?

All stormwater treatment systems require maintenance for effective operation. This necessity is often incorporated in your property's permitting process as a legally binding BMP maintenance agreement. Other reasons to maintain are:

- Avoiding legal challenges from your jurisdiction's maintenance enforcement program.
- Prolonging the expected lifespan the media in the Filterra HC system.
- Avoiding more costly media replacement.
- Helping reduce pollutant loads leaving your property.

Simple maintenance of the Filterra HC is required to continue effective pollutant removal from stormwater runoff before discharge into downstream waters. This procedure will also extend the longevity of the living biofilter system. The Filterra HC system is also subjected to various materials entering the inlet, including trash, silt, leaves, etc. which will be contained above the mulch layer. Too much silt may inhibit the Filterra HC system flow rate, which is the reason for site stabilization before activation. Regular replacement of the mulch stops accumulation of such sediment.

If the system is not maintained on regular intervals, is subject to a catastrophic spill or other event, or subject to unusual pollutant loading, full media bed replacement could be required. Please contact Contech for further evaluation if you feel this may be necessary.

When to Maintain?

Contech includes a 1-year maintenance plan with each system purchase. Annual included maintenance consists of a maximum of two (2) scheduled visits. Additional maintenance may be necessary depending on sediment and trash loading (by Owner or at additional cost). The start of the maintenance plan begins when the system is activated.

Maintenance visits are scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands while the fall visit helps the system by removing excessive leaf litter.

It has been found that in regions which receive between 30-50 inches of annual rainfall, (2) two visits are generally required; regions with less rainfall often only require (1) one visit per annum. Varying land uses can affect maintenance frequency;

e.g. some fast food restaurants require more frequent trash removal. Contributing drainage areas which are subject to new development wherein the recommended erosion and sediment control measures have not been implemented may require additional maintenance visits.

Some sites may be subjected to extreme sediment or trash loads, requiring more frequent maintenance visits. This is the reason for detailed notes of maintenance actions per unit, helping the Supplier and Owner predict future maintenance frequencies, reflecting individual site conditions.

Owners must promptly notify the (maintenance) Supplier of any damage to the plant(s), which constitute(s) an integral part of the bioretention technology. Owners should also advise other landscape or maintenance contractors to leave all maintenance to the Supplier (i.e. no pruning or fertilizing) during the first year.

Exclusion of Services

Clean up due to major contamination such as oils, chemicals, toxic spills, etc. will result in additional costs and are not covered under the Supplier maintenance contract. Should a major contamination event occur the Owner must block off the outlet pipe of the Filterra HC (where the cleaned runoff drains to, such as drop inlet) and block off the inlet of the Filterra HC. The Supplier should be informed immediately.

Maintenance Visit Summary

Each maintenance visit consists of the following simple tasks (detailed instructions below).

1. Inspection of Filterra HC and surrounding area
2. Removal of tree grate and erosion control stones
3. Removal of debris, trash and mulch
4. Mulch replacement
5. Plant health evaluation & pruning or replacement as necessary
6. Clean area around Filterra HC
7. Complete paperwork

Maintenance Tools, Safety Equipment and Supplies

Ideal tools include camera, bucket, shovel, broom, pruners, hoe/rake, and tape measure. Appropriate Personal Protective Equipment (PPE) should be used in accordance with local or company procedures. This may include impervious gloves where the type of trash is unknown, high visibility clothing and barricades when working near traffic and also safety hats and shoes. A T-Bar or crowbar should be used for moving the tree grates (up to 170 lbs ea.). Most visits require minor trash removal and a full replacement of mulch. See below for actual number of bagged mulch that is required in each media bay size. Mulch should be a double shredded, hardwood variety. Some visits may require additional Filterra engineered soil media for the Filterra HC system, available from the Supplier.

	Available Filterra® HC Media Bay Sizes (feet)	Filter Surface Area (ft^2)	Mulch Volume at 3" Depth (ft^2)	# of 2 ft^2 Mulch Bags
Standard Configuration Filterra and Filterra Biosape Vaults	4x4	16	4	2
	4x6 or 6x4	24	6	3
	4.5x7.83 or 7.83x4.5 (Nominal 4x8/8x4)	35.24	9	5
	6x6	36	9	5
	6x8 or 8x6	48	12	6
	6x10 or 10x6	60	15	8
	6x12 or 12x6	72	18	9
	7x13 or 13x7	91	23	12
	14x8	112	28	14
	16x8	128	32	16
	18x8	144	36	18
	20x8	160	40	20
	22x8	176	44	22
Peak Diversion Filterra Vaults	4x4	16	4	2
	4.5x5.83 or 5.83x4.5 (Nominal 4x6/6x4)	26.24	7	4
	6x6	36	9	5
	6x8	48	12	6
	6x10 or 10x6	60	15	8
	7x10	70	18	9
	8x10.5	84	21	11
	8x12.5	100	25	13
	Custom and/or Filterra Bioscape	Media Area in ft^2	0.25 x (Media Area in ft^2)	0.125 x (Media Area in ft^2)

Maintenance Visit Procedure

Keep sufficient documentation of maintenance actions to predict location specific maintenance frequencies and needs. An example Maintenance Report is included in this manual.

1. Inspection of Filterra HC and surrounding area

- Record individual unit before maintenance with photograph (numbered). Record on Maintenance Report (see example in this document) the following:

Record on Maintenance Report the following:

Standing Water	yes | no
Damage to Box Structure	yes | no
Damage to Grate	yes | no
Is Bypass Clear	yes | no

If yes answered to any of these observations, record with close-up photograph (numbered).

2. Removal of tree grate and erosion control stones

- Remove cast iron grates for access into Filterra HC box.
- Dig out silt (if any) and mulch and remove trash & foreign items.

3. Removal of debris, trash and mulch

Record on Maintenance Report the following:

Silt/Clay	yes | no
Cups/ Bags	yes | no
Leaves	yes | no
Buckets Removed	_____

- After removal of mulch and debris, measure distance from the top of the Filterra engineered media soil to the top of the top slab. Compare the measured distance to the distance shown on the approved Contract Drawings for the system. Add Filterra media (not top soil or other) to bring media up as needed to distance indicated on drawings.

Record on Maintenance Report the following:

Distance to Top of Top Slab (inches)	_____
Inches of Media Added	_____

4. Mulch replacement

- Add double shredded mulch evenly across the entire unit to a depth of 3".
- Refer to Filterra Mulch Specifications for information on acceptable sources.
- Ensure correct repositioning of erosion control stones by the Filterra HC inlet to allow for entry of trash during a storm event.
- Replace Filterra HC grates correctly using appropriate lifting or moving tools, taking care not to damage the plant.

5. Plant health evaluation and pruning or replacement as necessary

- Examine the plant's health and replace if necessary.
- Prune as necessary to encourage growth in the correct directions

Record on Maintenance Report the following:

Height above Grate	_____ (ft)
Width at Widest Point	_____ (ft)
Health	healthy | unhealthy
Damage to Plant	yes | no
Plant Replaced	yes | no

6. Clean area around Filterra HC

- Clean area around unit and remove all refuse to be disposed of appropriately.

7. Complete paperwork

- Deliver Maintenance Report and photographs to appropriate location (normally Contech during maintenance contract period).
- Some jurisdictions may require submission of maintenance reports in accordance with approvals. It is the responsibility of the Owner to comply with local regulations.

Maintenance Checklist

Drainage System Failure	Problem	Conditions to Check	Condition that Should Exist	Actions
Inlet	Excessive sediment or trash accumulation.	Accumulated sediments or trash impair free flow of water into Filterra HC.	Inlet should be free of obstructions allowing free distributed flow of water into Filterra HC HC.	Sediments and/or trash should be removed.
Mulch Cover	Trash and floatable debris accumulation.	Excessive trash and/or debris accumulation.	Minimal trash or other debris on mulch cover.	Trash and debris should be removed and mulch cover raked level. Ensure bark nugget mulch is not used.
Mulch Cover	"Ponding" of water on mulch cover.	"Ponding" in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils.	Stormwater should drain freely and evenly through mulch cover.	Recommend contact manufacturer and replace mulch as a minimum.
Vegetation	Plants not growing or in poor condition.	Soil/mulch too wet, evidence of spill. Incorrect plant selection. Pest infestation. Vandalism to plants.	Plants should be healthy and pest free.	Contact manufacturer for advice.
Vegetation	Plant growth excessive.	Plants should be appropriate to the species and location of Filterra HC.		Trim/prune plants in accordance with typical landscaping and safety needs.
Structure	Structure has visible cracks.	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through the cracks.		Vault should be repaired.
Maintenance is ideally to be performed twice annually.				

Filterra HC Inspection & Maintenance Log

Filterra HC System Size/Model: _____ **Location:** _____

Date	Mulch & Debris Removed	Depth of Mulch Added	Mulch Brand	Height of Vegetation Above Grate	Vegetation Species	Issues with System	Comments
1/1/17	*5 – 5 gal Buckets*	*3″*	*Lowe's Premium Brown Mulch*	*4′*	*Galaxy Magnolia*	*- Standing water in downstream structure*	*- Removed blockage in downstream structure*

Appendix 1 – Filterra® Activation Checklist

Project Name:______________________________ Company:______________________________

Site Contact Name: ______________________________ Site Contact Phone/Email: ____________________

Site Owner/End User Name:____________________ Site Owner/End User Phone/Email: ____________________

Preferred Activation Date: ______________________________(provide 2 weeks minimum from date this form is submitted)

Site Designation	System Size	Final Pavement / Top Coat Complete	Landscaping Complete / Grass Emerging	Construction materials / Piles / Debris Removed	Throat Opening Measures 4" Min. Height	Plant Species Requested
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	

Attach additional sheets as necessary.

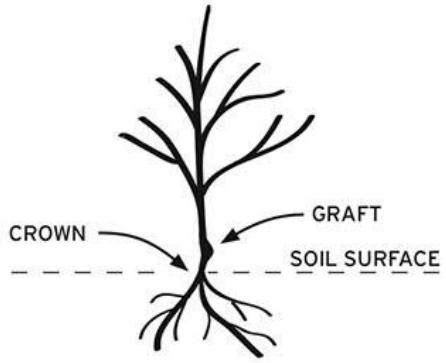
NOTE: A charge of $500.00 will be invoiced for each Activation visit requested by Customer where Contech determines that the site does not meet the conditions required for Activation. ONLY Contech authorized representatives can perform Activation of Filterra HC systems; unauthorized Activations will void the system warranty and waive manufacturer supplied Activation and 1st Year Maintenance.

______________________________ ____________________

Signature Date

Appendix 2 – Planting Requirements for Filterra® HC Systems

Plant Material Selection



- Select plant(s) as specified in the engineering plans and specifications.
- Select plant(s) with full root development but not to the point where root bound.
- Use local nursery container plants only. Ball and burlapped plants are not permitted.
- For precast Filterra HC systems with a tree grate, plant(s) must not have scaffold limbs at least 14 inches from the crown due to spacing between the top of the mulch and the tree grate. Lower branches can be pruned away provided there are sufficient scaffold branches for tree or shrub development.
- For precast Filterra HC systems with a tree grate, at the time of installation, it is required that plant(s) must be at least 6" above the tree grate opening at installation for all Filterra configurations. This DOES NOT apply to Full Grate Cover designs.
- Plant(s) shall not have a mature height greater than 25-30 feet.
- A 7-15 gallon container size shall be used.
- For precast Filterra HC systems, plant(s) should have a single trunk at installation, and pruning may be necessary at activation and maintenance for some of the faster growing species, or species known to produce basal sprouts

Plant Installation

- During transport protect the plant leaves from wind and excessive jostling.
- Prior to removing the plant(s) from the container, ensure the soil moisture is sufficient to maintain the integrity of the root ball. If needed, pre-wet the container plant.
- Cut away any roots which are growing out of the container drain holes. Plants with excessive root growth from the drain holes should be rejected.
- Plant(s) should be carefully removed from the pot by gently pounding on the sides of the container with the fist to loosen root ball. Then carefully slide out. Do not lift plant(s) by trunk as this can break roots and cause soil to fall off. Extract the root ball in a horizontal position and support it to prevent it from breaking apart. Alternatively, the pot can be cut away to minimize root ball disturbance.
- Remove any excess soil from above the root flare after removing plant(s) from container.
- Excavate a hole with a diameter 4" greater than the root ball, gently place the plant(s).
- If plant(s) have any circling roots from being pot bound, gently tease them loose without breaking them.
- If root ball has a root mat on the bottom, it should be shaved off with a knife just above the mat line.
- Plant the tree/shrub/grass with the top of the root ball 1" above surrounding media to allow for settling.
- All plants should have the main stem centered in the tree grate (where applicable) upon completion of installation.
- With all trees/shrubs, remove dead, diseased, crossed/rubbing, sharply crotched branches or branches growing excessively long or in wrong direction compared to majority of branches.
- To prevent transplant shock (especially if planting takes place in the hot season), it may be necessary to prune some of the foliage to compensate for reduced root uptake capacity. This is accomplished by pruning away some of the smaller secondary branches or a main scaffold branch if there are too many. Too much foliage relative to the root ball can dehydrate and damage the plant.
- Plant staking may be required.

Mulch Installation

- Only mulch that has been meeting Contech Engineered Solutions' mulch specifications can be used in the Filterra HC system.
- Mulch must be applied to a depth of 3" evenly over the surface of the media.

Irrigation Requirements

- Each Filterra HC system must receive adequate irrigation to ensure survival of the living system during periods of drier weather.
- Irrigation sources include rainfall runoff from downspouts and/or gutter flow, applied water through the tree grate or in some cases from an irrigation system with emitters installed during construction.
- At Activation: Apply about one (cool climates) to two (warm climates) gallons of water per inch of trunk diameter over the root ball.
- During Establishment: In common with all plants, each Filterra HC plant will require more frequent watering during the establishment period. One inch of applied water per week for the first three months is recommended for cooler climates (2 to 3 inches for warmer climates). If the system is receiving rainfall runoff from the drainage area, then irrigation may not be needed. Inspection of the soil moisture content can be evaluated by gently brushing aside the mulch layer and feeling the soil. Be sure to replace the mulch when the assessment is complete. Irrigate as needed**.
- Established Plants: Established plants have fully developed root systems and can access the entire water column in the media. Therefore, irrigation is less frequent but requires more applied water when performed. For a mature system assume 3.5 inches of available water within the media matrix. Irrigation demand can be estimated as 1" of irrigation demand per week. Therefore, if dry periods exceed 3 weeks, irrigation may be required. It is also important to recognize that plants which are exposed to windy areas and reflected heat from paved surfaces may need more frequent irrigation. Long term care should develop a history which is more site specific.

** Five gallons per square yard approximates 1 inch of water. Therefore, for a 6' by 6' Filterra HC approximately 20-60 gallons of water is needed. To ensure even distribution of water it needs to be evenly sprinkled over the entire surface of the filter bed, with special attention to make sure the root ball is completely wetted. NOTE: if needed, measure the time it takes to fill a five-gallon bucket to estimate the applied water flow rate then calculate the time needed to irrigate the Filterra HC system. For example, if the flow rate of the sprinkler is 5 gallons/minute then it would take 12 minutes to irrigate a 6' by 6' filter.

Notes

filterra®
Bioretention Systems

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ENGINEERED SOLUTIONS

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Stormwater Management Measures
Maintenance Plan

Maintenance Logs and Inspection Records

NOTE

This Maintenance Logs and Inspection Records are 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.

Inspection Checklist Log

1. The responsible party shall report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.
2. The maintenance crew should fill out the checklist in the field manual when performing each inspection/maintenance task.
3. After the maintenance task is performed, the checklist should be filed in the Maintenance Plan and recorded in the log below.

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection

Attach the Inspection Checklist after each inspection

Preventative Maintenance Log

Maintenance Schedule	Stormwater Management Measure No.	Preventative Maintenance Record No.	Date(s) of Maintenance

Attach the Preventative Maintenance Record after each maintenance task performed

Corrective Maintenance Log

Maintenance Schedule	Stormwater Management Measure No.	Corrective Maintenance Record No.	Date(s) of Maintenance

Attach the Corrective Maintenance Record after each maintenance task performed