

STORMWATER MANAGEMENT MEASURES OPERATION AND MAINTENANCE MANUAL

For

**Harlingen Associates, LLC
Block 6001, Lot 33, 34, 34.01, 35, 35.01 & 36
Montgomery Township
Somerset County, New Jersey**

PREPARATION DATE: JANUARY 17, 2023

PREPARED BY

**VAN CLEEF ENGINEERING ASSOCIATES, LLC
32 Brower Lane
Hillsborough, NJ 08844**

INTRODUCTION

The purpose of this manual is to provide guidelines for the operation and maintenance of the stormwater management measures that are utilized on this property. This manual has been prepared for the use of the manager of the site to ensure that the stormwater management measures will be properly maintained in order to function as intended. The primary function of these stormwater management measures is to control the quantity and quality of runoff. The stormwater management measures on this property are listed below:

- Pond Constructed Wetland
- Manufactured Treatment Device

RESPONSIBLE PARTY

The maintenance of the stormwater management facilities on this property along with all of the associated logs and records, in accordance with this manual, is the responsibility of:

**Harlingen Associates, LLC
Scott Van Cleef
36 Brower Lane
Hillsborough, NJ 08844
908-359-3276
vscott@country-classics.com**

This responsibility may be transferred to another party if the appropriate agencies are notified. Montgomery Township and Somerset County shall be granted emergency access and maintenance rights – but are not obligated to handle all required responsibilities – in the circumstance where emergency maintenance must be performed to ensure public safety. The responsible party listed above shall cover the costs of any emergency maintenance and/or operation performed by Montgomery Township or Somerset County.

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Field Manual for Pond Constructed Wetland (PCW)
Field Manual for Manufactured Treatment Devices

Part III - Maintenance and Inspection Logs

Inspection Checklist Log
Preventative Maintenance Log
Corrective Maintenance Log

Part I - Maintenance

List of Stormwater Management Measures

Type of Stormwater Management Measure	Stormwater Management Measure No.	Location Description	State Plane Coordinates
Pond Constructed Wetland	PCW	East of Buildings 5 & 6	X = 447838 Y = 589030
Manufactured Treatment Devices	MTD	Near CB-1-1, 1-2, 1-4, 1-5, 2-2, 2-2A, 2-2B and 2-3 to 2-13	

Location Map



Description of Stormwater Management Measures

PCW

Design Storms:

- 2-Year Storm (3.34 inches)
- 10-Year Storm (5.01 inches)
- 100-Year Storm (8.21 inches)

Design Purpose: Water Quantity

Manufactured Treatment Devices – Filterra

Design Storm: Water Quality Design Storm (1.25 inches in 2 hours)

Design Purpose: Runoff Quality

Manufacturer: Contech Engineered Solutions

Preventative and Corrective Maintenance Action Plan

Preventative Maintenance Actions

Preventative Maintenance		
Frequency	Action	Stormwater Management Measure
Monthly	<ul style="list-style-type: none"> • Mow Perimeter Grass During Growing Season 	Pond Constructed Wetland
Quarterly	<ul style="list-style-type: none"> • Inspect and Clean Leaf Screens 	Pond Constructed Wetland
Semiannual	<ul style="list-style-type: none"> • Remove Sediment • Remove and Dispose of Trash and Debris • Assess Types and Distribution of Dominant Plants • Inspect Components Expected to Receive and/or Trap Debris for Clogging 	Pond Constructed Wetland
Annually	<ul style="list-style-type: none"> • Inspect Components for Cracking, Subsidence, Spalling, Erosion and Deterioration • Inspect Vegetated Areas for Erosion, Scour and Unwanted Growth 	Pond Constructed Wetland
Unscheduled	<ul style="list-style-type: none"> • Inspect Components Expected to Receive and/or Trap Debris for Clogging After Every Storm Exceeding 1" of Rainfall 	Pond Constructed Wetland
Other	<ul style="list-style-type: none"> • Refer to Cascade Separator Inspection and Maintenance Guide • Refer to Filterra HC Owner's Manual 	Manufactured Treatment Devices

Corrective Maintenance Actions

Potential Corrective Maintenance Actions	Stormwater Management Measure
<ul style="list-style-type: none"> • Repair/Replace Missing or Damaged Trash Racks • Repair/Replace Outlet Pipes or Orifices • Vegetate Eroded Side Slopes or Basin Bottom • Remove Unwanted Growth • Achieve Appropriate Balance Between Original and Volunteer Species in Accordance with the Intent of the System's Original Design 	Pond Constructed Wetland
<ul style="list-style-type: none"> • Refer to Cascade Separator Inspection and Maintenance Guide • Refer to Filterra HC Owner's Manual 	Manufactured Treatment Devices

Cost Estimate

Pond Constructed Wetland:

Removed Sediment: \$240/Year

Remove Trash and Debris: \$124/Year

Mow Perimeter Grass: \$250/Year

Total: \$614/Year

Manufactured Treatment Device (Filterra HC):

Replace Mulch/Remove Trash: \$2,000/Year

Overall Total: \$2,614/Year

Part II - Field Manuals

POND CONSTRUCTED WETLAND PCW FIELD MANUAL

Block 6001 Lot 33, 34, 34.01, 35, 35.01 & 36
Montgomery Township
Somerset County
Location of Pond Constructed Wetland: X: 447838 Y: 589030
Location Description: East of Buildings 5 & 6

Location Map

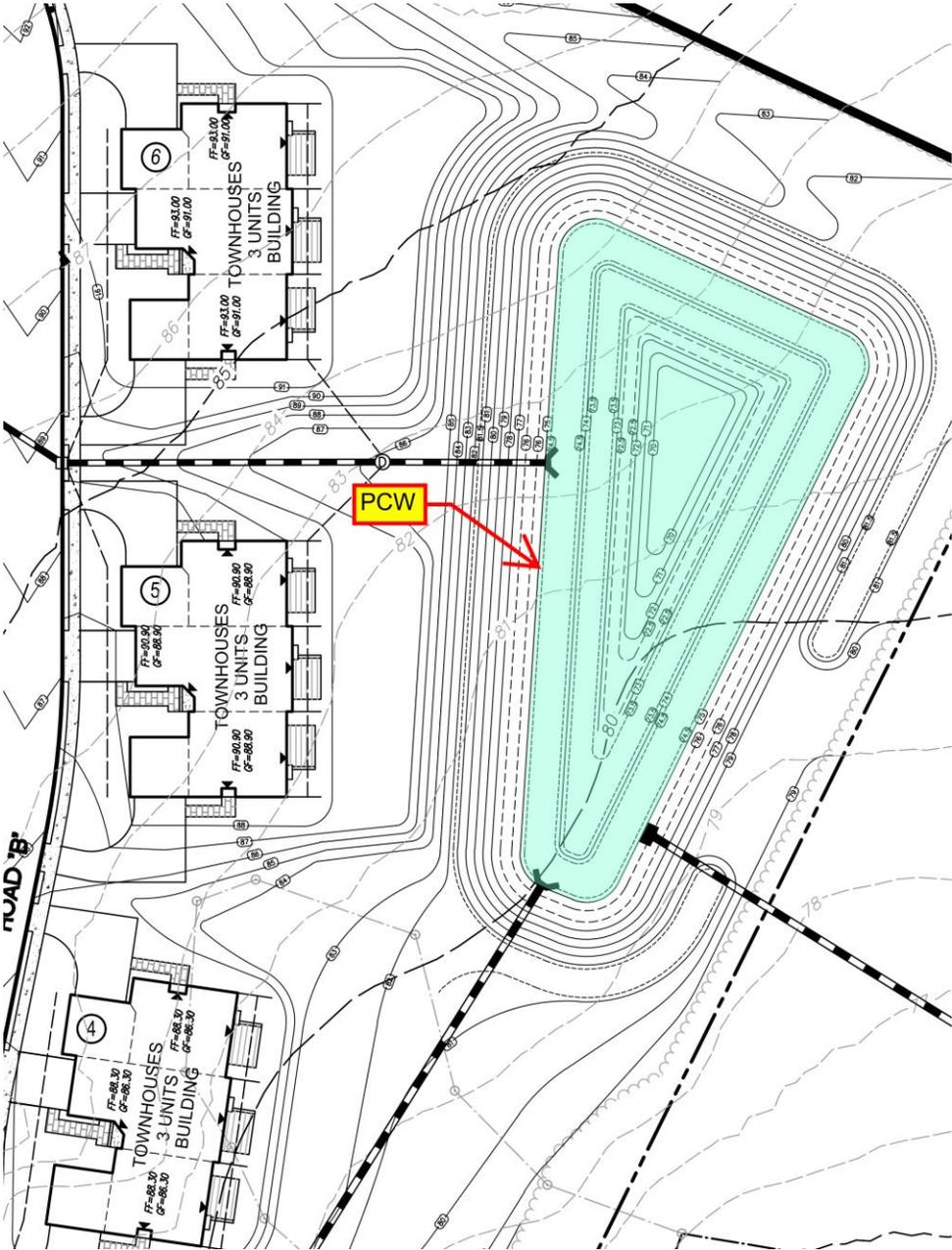


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Standard Constructed Wetland Overview

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 pond constructed wetland consisting of the following zones:

Pond Constructed Wetlands Design Specifications	
Drainage Area	8.95 Acres
Standing Water Depth: High Marsh Zone	6 Inches
Standing Water Depth: Low Marsh Zone	6-18 Inches
Standing Water Depth: Pool Zone	5 Feet

2. This pond will discharge runoff to the existing 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	3.34 inches in 24 hours	5.01 inches in 24 hours	8.21 inches in 24 hours
Runoff Volume (cubic feet)	18,910	72,553	122,834	221,967
Peak Flow Rate (cfs)	0.15	0.26	2.48	16.93
Water Surface Elevation (feet)	76.01	77.81	78.60	79.88

2. The emergency spillway is at EL. 80.00 feet.

Basin Configuration Targets

1. Pretreatment is provided by manufactured treatment devices.
2. Outlet Information:

Outlet Type	Orifice Size / Weir Length	Invert Elevation
Orifice	2.5"	75.00
Weir	18"	78.00
Weir	24"	79.00

3. The basin is lined.
4. The pond does not intercept groundwater.
5. The pond is designed without a drawdown conduit.
6. Safety ledges are installed 2.5 feet below the permanent water surface elevation and 1 foot above the permanent water surface elevation.

Critical Maintenance Features

1. Floatables need to be cleaned and removed from the wetland.
2. Remove dead vegetation to prevent mosquito problems.
3. Water depth in each zone must be maintained at design level.
4. Sediment level in the pool zone needs to be checked and sediment needs to be frequently removed to ensure sufficient storage volume and detention time.
5. Native species are preferred during revegetation.

Inspection Checklist / Maintenance Actions Pond 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

	For Inspector		For Maintenance Crew	
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
A2 Pretreatment (MTD)	1	MTD Inspection	Y__ N__	Refer to Filterra HC Owner's Manual
Note:				
B1 Marsh Zone	1	<p>The water depth in the marsh zone is significantly above or below the design water depth</p> <p>Dry spot(s) appearing in the marsh zone</p> <p>Growth of trees or bushes in the marsh zone</p>	Y__ N__	<p>Check for:</p> <ul style="list-style-type: none"> * Damages to the liner * Changes in inflow patterns <p>Repair any structural damages</p> <p>Remove sediment, reconfigure the marsh zone, remove trees, or repair the liner</p> <p>Work Order # _____</p>

	For Inspector		For Maintenance Crew	
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
	2	Vegetation loss in the high marsh zone	Y__ N__	<p>Check whether the water level is higher than the design level</p> <p>Check the Landscaping Plan for remedial actions</p> <p>Work Order # _____</p>
	3	Channelization in the wetland	Y__ N__	<p>Check whether the incoming flow is larger than the design inflow</p> <p>Check if excessive sediment has accumulated in the marsh zone</p> <p>Work Order # _____</p>
Note:				
B2 Pond Zone	1	The water depth in the marsh zone is significantly above or below the design water depth	Y__ N__	<p>Check for:</p> <ul style="list-style-type: none"> - Changes in inflow patterns - Damages to the outlet structure - Damages to the liner <p>Repair any structural damages</p> <p>Work Order # _____</p>

	For Inspector		For Maintenance Crew	
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
	2	Islands or shallow marsh emerging out of the pond zone	Y__ N__	<p>Check whether there is excessive sediment in the pond</p> <p>Check whether the incoming flow has excessive sediment</p> <p>Remove excessive sediment</p> <p>Find the source of excessive sediment and method to reduce the source</p> <p>Work Order # _____</p>
<p>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.</p> <p>Other Note:</p>				
B2 Pond Zone	3	<p>The observed detention time is longer than the design detention time.</p> <p>The observed detention time is approximately _____ hours.</p>	Y__ N__	Check whether the outlets are clogged, see section E-Outlet of this checklist

	For Inspector		For Maintenance Crew	
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
	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 # _____
<p>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.</p> <p>Other Note:</p>				
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 # _____

	For Inspector		For Maintenance Crew	
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
	2	Algae blooming	Y__ N__	Remove algae Find the nutrient source and the solution to reduce the nutrient loading Work Order # _____
Note:				
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 Restabilize the bank Work Order # _____

Component No. Component Name	For Inspector		For Maintenance Crew	
	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions	
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%	Y__	Repair or replace trash rack
		Trash rack is bent, loose, or missing parts	N__	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:				
F Emergency Spillway	1	Trees or excessive vegetation present	Y__ N__	Remove trees and roots, and restore berms if necessary Work Order # _____
	2	Damaged structure	Y__ N__	Repair Work Order # _____
G Miscellaneous	1	Fence: broken or eroded parts	Y__ N__	Repair or replace Work Order # _____

	For Inspector		For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.		Result Preventative / Corrective Maintenance Actions
	2	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	Check if finished
Sediment/debris removal Sediment removal should take place when the pond zone is thoroughly dry.	A2 – Pretreatment	
	B2 – Pond Zone	
	D – Pond Embankment and Side Slopes	
	E – Outlet	
Vegetation removal	A2 – Pretreatment	
	B1 – Marsh Zone	
	B2 – Pond Zone	
	D – Pond Embankment and Side Slopes	
	E – Outlet	
	F – Emergency Spillway	

Vegetation shall be removed 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.

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:**

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

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)		
Revegetate		

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.

MANUFACTURED TREATMENT DEVICE FIELD MANUAL

Block 6001 Lot 33, 34, 34.01, 35, 35.01 & 36
Montgomery Township
Somerset County

Location Map

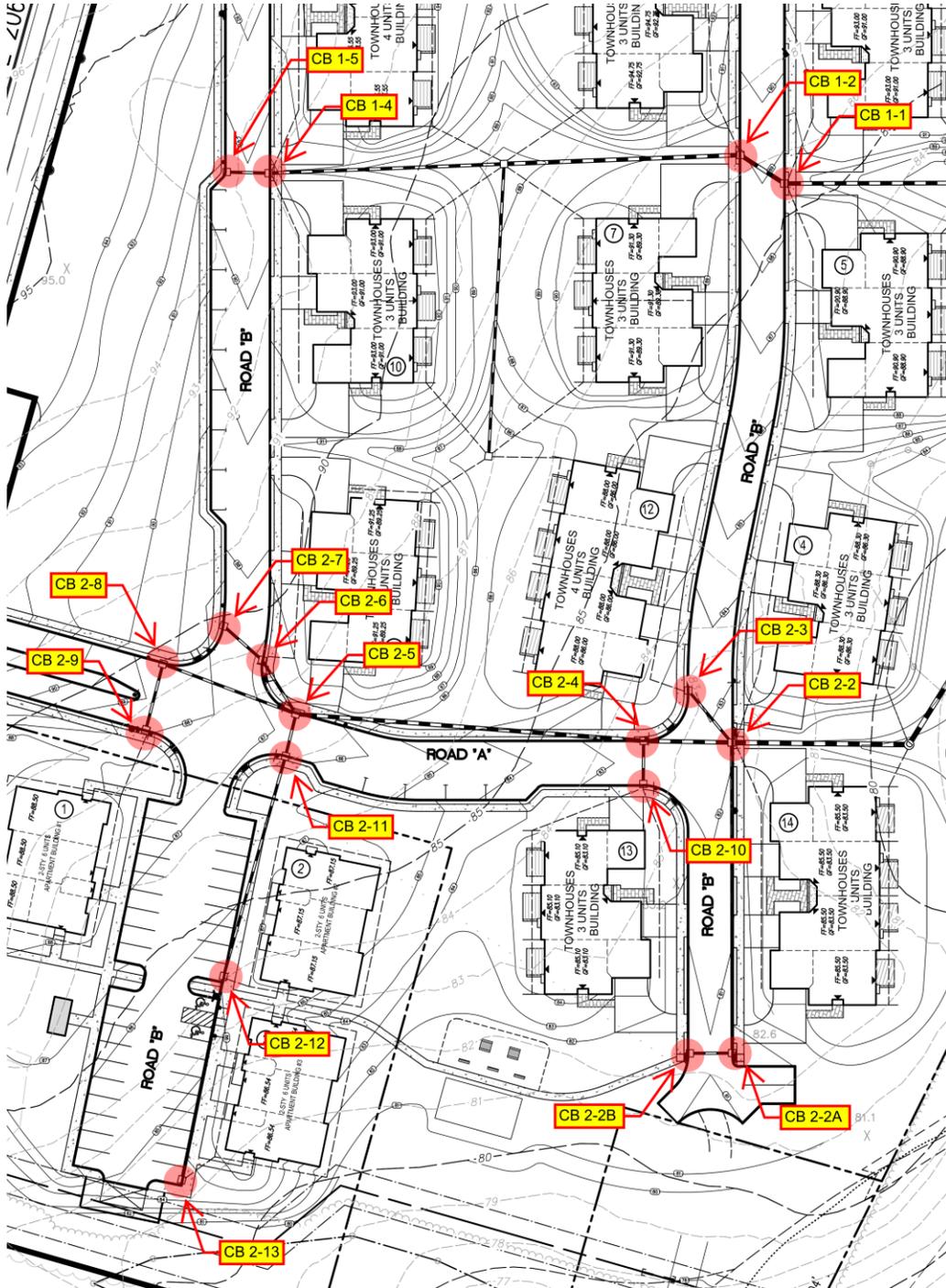


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MTD Overview

A Manufactured Treatment Device (MTD) is a prefabricated 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 body of water.

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

The MTDs that are utilized on this property are designed to remain dry between storm events. These MTDs are designed to remove 80% of the TSS that are found in the inflow generated by the Water Quality Design Storm. These MTDs are not designed to attenuate peak flows or recharge groundwater.

The MTDs that are utilized on this property qualify as green infrastructure since they runoff to infiltrate into the subsoil and treat stormwater runoff through filtration by vegetation/soil.

Basic Design Information

Hydrology Design Targets

1. The maximum design storm is the Water Quality Design Storm which corresponds to 1.25 inches of rainfall in 2 hours.
2. The TSS removal rate is 80%.

Configuration Targets

1. The name of the MTD is Filterra.
2. The manufacturer of the MTD is Contech Engineered Solutions.

Critical Maintenance Features

The maintenance procedures associated with the MTDs are described in the Filterra HC Owner's Manual which is attached to this Field Manual.

Reference Documents

Filterra HC Owner's Manual



filterra[®]
Bioretention Systems

C **NTECH**[®]
ENGINEERED SOLUTIONS

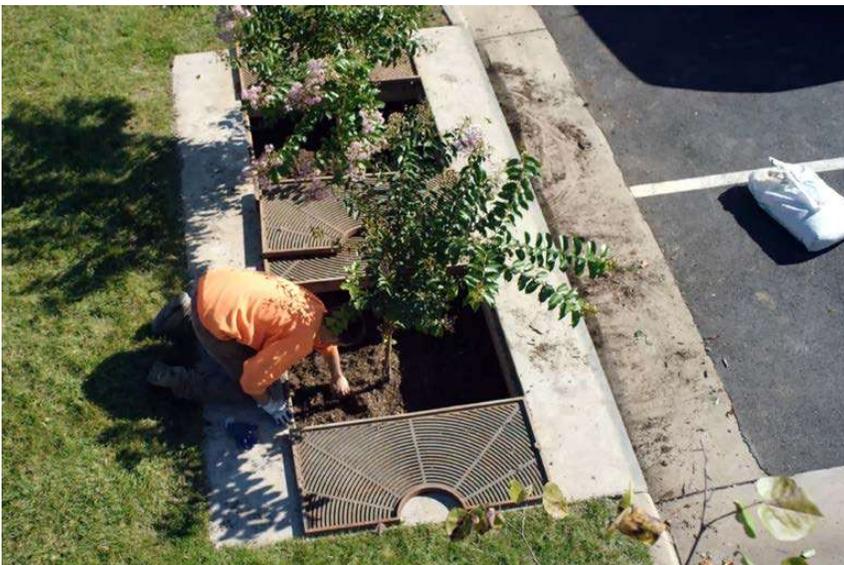




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Introduction

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:

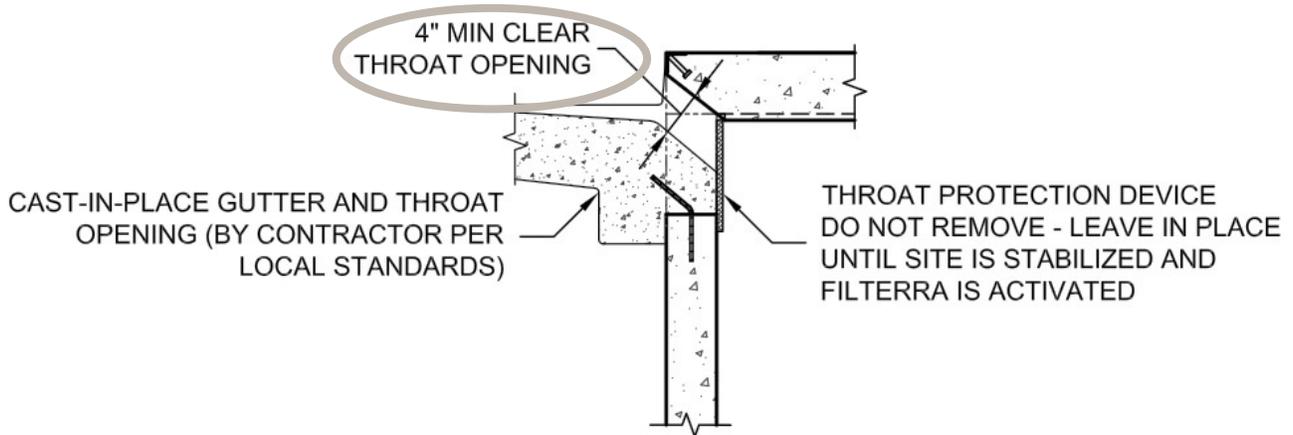
1. The site landscaping must be fully stabilized, i.e. full landscaping installed and some grass cover (not just straw and seed) is required to reduce sediment transport. Construction debris and materials should be removed from surrounding area.



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 Filtrerra and Filterra Bioscape 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 Filtrerra 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
		<input type="checkbox"/> Yes <input type="checkbox"/> No				
		<input type="checkbox"/> Yes <input type="checkbox"/> No				
		<input type="checkbox"/> Yes <input type="checkbox"/> No				
		<input type="checkbox"/> Yes <input type="checkbox"/> No				
		<input type="checkbox"/> Yes <input type="checkbox"/> No				
		<input type="checkbox"/> Yes <input type="checkbox"/> No				
		<input type="checkbox"/> Yes <input type="checkbox"/> No				
		<input type="checkbox"/> Yes <input type="checkbox"/> No				
		<input type="checkbox"/> Yes <input type="checkbox"/> 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.

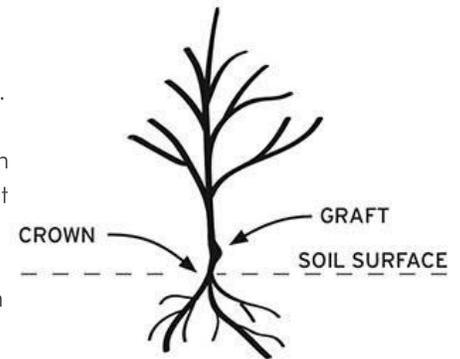
Signature

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.

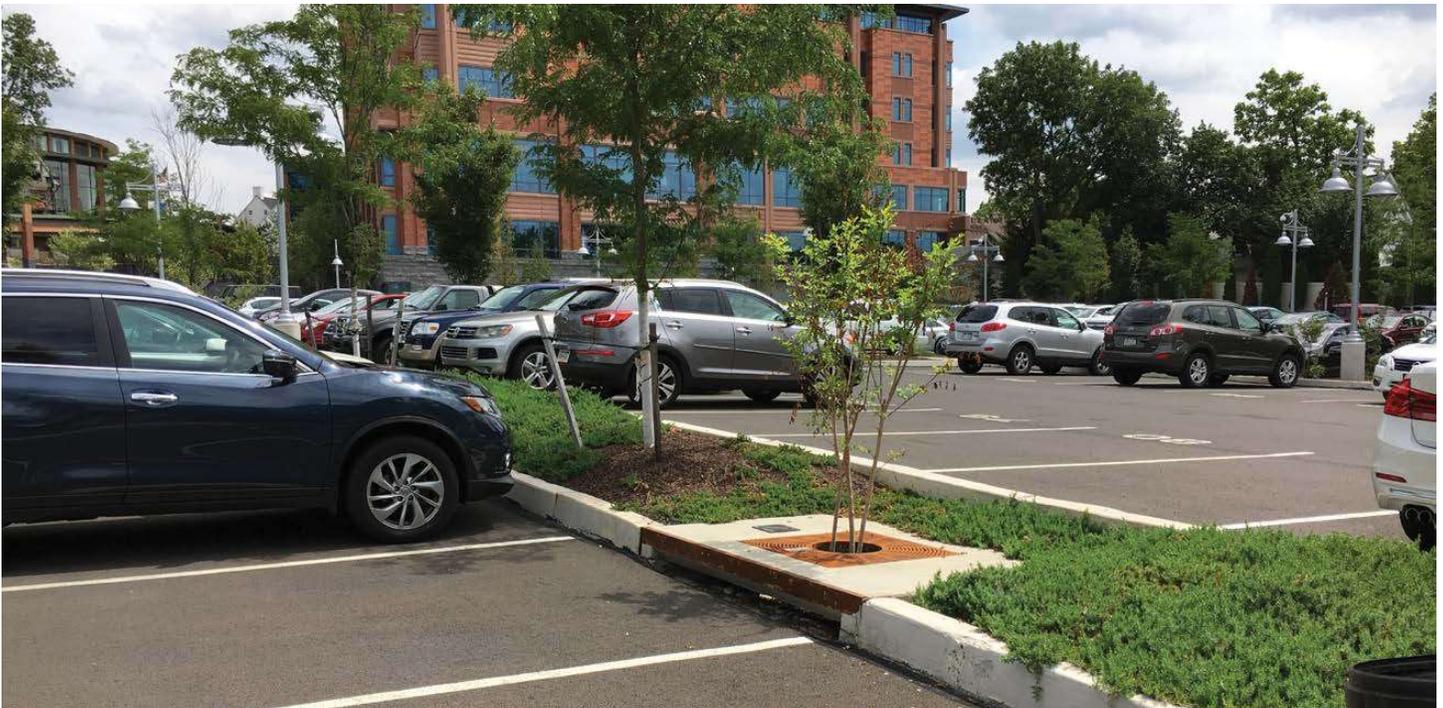
Mulch Installation

- 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.





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Inspection Checklist and Maintenance Actions Manufactured Treatment Device

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

Component No. Component Name	For Inspector		For Maintenance Crew
	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions
A Conveyance System	1	Pipes are clogged	Y__ N__ Clean and clear clogged pipes
	2	Runoff is present more than 48 hours after the last storm event	Y__ N__ Perform maintenance procedures described in the Filterra HC Owner's Manual
B Filter System	1	Flows are below design levels	Y__ N__ Perform maintenance procedures described in the Filterra HC Owner's Manual

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
Perform Maintenance Procedures Described in the Filterra HC Owner's Manual	A – Conveyance System	
	B – Filter System	

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
Repair/Replace Grates		
Replace Media Treatment Cell		
Replace Plants		

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.

Part III - Maintenance and Inspection Logs

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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

Continue the Table When Necessary

Preventative Maintenance Log

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

Continue the Table When Necessary

