

Stormwater Management Operations & Maintenance Manual

Alpha Warehouse
Block 100.02, Lots 1, 1.08 and 1.09
Alpha Borough
Warren County, New Jersey
Project No. 19004898B

March 1, 2022

Prepared for:

Woodhill Alpha, LLC
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Prepared by:



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Stormwater Management Measures Maintenance Plan & Field Manuals

Development Name: Alpha Warehouse

Address: New Brunswick Ave, Alpha, NJ 08865

Block(s) / Lot(s): 100.02 / 1, 1.08, 1.09

Borough, County: Alpha, Warren

Party Responsible for Preventative and Corrective Maintenance:

Woodhill Alpha, LLC

Address: 100 Passaic Avenue, Suite 240, Fairfield, NJ 07004

Contact Person(s): Steve Varneckas Phone: 973-316-9400

This plan is recorded in

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

Last Revised on ____/____/____

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Part II- Field Manuals

Field Manuals for Stormwater Management Measures on this site

Field Manual for Above Ground Detention Basin 1

Above Ground Detention Basin Overview

Basic Design Information

Visual Aid for Dry Type Stormwater Basin Inspection (Refer to section for Bioretention System)

Inspection Checklist / Maintenance Actions

Preventative Maintenance Record

Corrective Maintenance Record

Field Manual for Bioretention System 2

Bioretention System Overview

Basic Design Information

Visual Aid for Dry Type Stormwater Basin Inspection

Inspection Checklist / Maintenance Actions

Preventative Maintenance Record

Corrective Maintenance Record

Field Manual for Subsurface Detention System 3B & 4

Subsurface Detention System Overview

Basic Design Information

Inspection Checklist / Maintenance Actions

Preventative Maintenance Record

Corrective Maintenance Record

Field Manual for Contech Filterra HC MTD (GI)

MTD Overview

Basic Design Information

Manufacturer Maintenance Material

Reference Documents

Maintenance Logs and Inspection Records

Inspection Checklist Log

Preventative Maintenance Log

Corrective Maintenance Log

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Stormwater Maintenance Plan

Part I– Maintenance Plan

Introduction and Description of Facilities

This Stormwater Management Report is being submitted as part of the development application known as "Preliminary/Final Major Site Plan for Woodhill Alpha, LLC". The site is located on Block 100.02, Lots 1, 1.08 and 1.09, in the Borough of Alpha, Warren County, New Jersey. This report was prepared in accordance with the New Jersey Department of Environmental Protection (NJDEP) regulations and the Alpha Borough stormwater management regulations. The project will disturb approximately 11.3 acres. The purpose of this report is to summarize the stormwater management design as it pertains to the stormwater rules and to provide calculations to support the design. The stormwater management measures proposed for the site have been designed to meet erosion control, groundwater recharge, stormwater runoff quantity and water quality standards as set forth by N.J.A.C. 7:8.

The project consists of demolition of existing residences, barns and wooded areas. The proposed development consists of a 134,400 SF warehouse building including 3,000 SF of office space. In addition, associated car parking, a truck court and trailer staging areas are proposed. The development also proposes site lighting, landscape, storm sewers, sanitary, water, utility laterals and two (2) above-ground detention basins.

Stormwater Facilities:

The proposed stormwater management facilities consist of one (1) small-scale bioretention, one (1) above-ground basins, two (2) subsurface basins and thirteen (13) manufactured treatment devices.

Project Contacts

Borough of Alpha Planning Department:

Address:	1001 East Blvd., Alpha, NJ 08865
Attn:	Stanley Schrek, Township Engineer
Tel:	908-454-3080

Design Engineer:

Company:	Colliers Engineering & Design, Inc.
Address:	53 Frontage Road, Suite 110, Hampton, NJ 08827
Attn:	Richard Roseberry, P.E.
Tel:	484-240-8219

Party Responsible for Preventative and Corrective Maintenance (including replacement):

Property Owner:	Woodhill Alpha, LLC
Address:	100 Passaic Avenue, Suite 240, Fairfield, NJ 07004
Attn:	Steve Varneckas
Tel:	973-316-9400

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	Lat. (N); Long. (E)
Above Ground Detention Basin	#1	Along New Brunswick Ave frontage.	40° 40' 15.95"N 075° 9' 05.95"W
Small Scale Bioretention Basin	#2	West truck loading docks and Industrial Drive frontage	40° 40' 13.52"N 075° 9' 04.64"W
Subsurface Detention	#3B	East side parking stalls along driveway	40° 40' 13.02"N 075° 8' 58.57"W
Subsurface Detention	#4	East of building along Edge Road frontage within banked parking area.	40°40'10.63"N 75° 8'57.50"W
Filtterra MTD (GI)	(Multiple)	Upstream of bypass structures which discharge to Subsurface of above ground detention systems	Multiple Locations on Site

Description of Stormwater Management Measures

Name of the Stormwater Management Measure: (At Grade Detention Basin)

Design Storm:

- Design Purposes: Volume and Rate Control
 - o Water Quality & Quantity (1.25 inches)
 - o 2-Year Storm (2.98 inches)
 - o 10-Year Storm (4.70 inches)
 - o 25-Year Storm (5.74 inches)
 - o 100-Year Storm (7.47 inches)

For more detailed information regarding each specific measure, please see the Field Manual in Part II of this manual.

Preventative and Corrective Maintenance Action Plan

Routine maintenance of these facilities should be separated into two basic types: Functional Maintenance and Aesthetic Maintenance. Functional Maintenance is further broken down into two categories: Preventative and Corrective. Aesthetic Maintenance, which is necessary to maintain the visual appeal and aesthetic quality of the facilities, should be incorporated on the same schedule as the preventative maintenance efforts. Listed below are the Preventative and Corrective Maintenance Procedures to be performed on a routine basis.

PREVENTATIVE MAINTENANCE

The purpose of Preventative Maintenance is to ensure that the stormwater management aspects of the facilities remain operational and safe at all times, and to minimize the need for emergency or corrective maintenance. These procedures are as follows:

1. Maintenance of Adjacent Areas

Grass areas, trees, and shrubs adjacent to the basin require periodic fertilizing, de-thatching and soil conditioning in order to maintain healthy growth and to provide bank stabilization. The application of fertilizers should follow manufacturer's instructions to reduce run-off of these compounds into the basin. Additionally, provisions should be made to re-seed and re-establish grass cover in areas damaged by sediment accumulation, stormwater flow, or other causes. These tasks should be performed, or at least evaluated, on a quarterly basis.

2. Removal and Disposal of Trash and Debris

A regularly scheduled program of debris and trash removal will prevent possible damage to vegetated areas and eliminate potential mosquito breeding habitats. Debris and trash must be properly hauled off the site and transferred to an approved disposal site. These tasks should be performed on a quarterly basis and after any major storm event.

3. Sediment Removal and Disposal

The basins should be evaluated for excessive deposition of sediment. Accumulated sediment should be removed before it threatens the storage volume of the basins. Before desalting activities are performed, consideration should be given to evacuating all standing water from the basin if necessary. This may be accomplished by pumping the water out of the basins and into the outlet structure. Disposal of sediment must comply with all local, county, state, and federal regulations. Only suitable disposal sites should be utilized. These tasks should be performed as needed. If stable soil conditions exist around the basin, sediment deposition should not be a problem. Should a recurrent problem develop, the inspector should identify the upstream sources of sediment and recommend required stabilization measures.

4. Detention and Bioretention Basin

There are three (3) detention basins (one above-ground and two subsurface) and one (1) bioretention basin for this site. All detention basin components expected to receive and/or trap debris and sediment must be inspected for clogging and excessive debris and sediment accumulation at least four times annually as well as after every storm exceeding 1-inch of rainfall. Such components may include bottoms, riprap, and inflow points. Sediment removal should take place when the basin is thoroughly dry. Disposal of debris, trash, sediment, and

other waste material should be done at suitable disposal/recycling sites and in compliance with all applicable local, state, and federal waste regulation. All structural components must be inspected, at least once annually, for cracking, subsidence, spalling, erosion and deterioration. All basins are designed to approximately drain within 72 hours.

5. Water Quality Devices

There are thirteen (13) Conteh Filterra HC Offline Green Infrastructure – Manufactured Treatment Devices associated with this project located upstream of the proposed detention basins. With the development of the property, pollutants are introduced into the stormwater run-off leaving the property. These pollutants include increased silt and sedimentation (soil particles carried by surface runoff), debris (paper, trash, etc.) and various pollutants associated with occupancy of the site (for example, petroleum products deposited by vehicular traffic).

Improving water quality before it leaves the site is accomplished by a number of methods, “trapping” materials, slowing down water flows so that impurities settle out, and allowing surface run-off to move through vegetation which can remove impurities.

Failure to properly maintain these devices can result in additional pollutant loads being discharged from the site. Under severe conditions, accumulated pollutants can be discharged in large quantities to the downstream environment.

Surface run-off from ground and paved surfaces is directed through a water quality “cleansing” devices shown on the plans. This removes impurities and petroleum from the stormwater flowing through the device.

To ensure proper operation, this device requires inspection and maintenance on a regular basis, and removal of trapped pollutants. If not inspected and maintained on a regular basis, these impurities may be “flushed” from the system during a major storm event.

CORRECTIVE MAINTENANCE

1. Removal of Debris and Sediment

Sediment, debris and trash which threaten the storage capacity of the basin should be removed immediately and properly disposed. As noted previously, it is recommended that all water be evacuated from the basin before any significant amount of sediment, settled debris or trash is removed from the basin. The lack of an available disposal site should not delay the removal of trash, debris, and sediment. Temporary disposal sites should be utilized if necessary.

2. Structural Repairs

Structural damage to outlet and inlet structures, trash racks and headwalls, as a result of vandalism, flood events, or other causes, must be repaired promptly. The urgency of the repairs will depend upon the nature of the damage and its effects on the safety and operation

of the facility. The analysis of structural damage and the design and performance of structural repairs should only be undertaken by a licensed professional engineer.

3. Embankment, and Slope Repairs

Damage to embankments, and side slopes must be repaired promptly. This damage can be the result of rain or flood events, vandalism, animals, vehicles, or neglect. Typical problems include settlement, scouring, sloughing and seepage. The urgency of the repairs will depend upon the nature of the damage and its effect on the safety and operation of the facility. The analysis of damage and the design and performance of geotechnical repairs should only be undertaken by qualified personnel at the direction of a licensed professional engineer.

4. Extermination of Mosquitoes

If neglected, basins can readily become an ideal mosquito breeding area. The extermination of mosquitoes will usually require the services of the County Mosquito Commission. If mosquito control in the facility becomes necessary, the preventative maintenance program should be re-evaluated, and more emphasis should be placed on control of mosquito breeding habitats.

5. Erosion Repair

Vegetative cover or other protective measures are necessary to prevent the loss of soil due to the forces of wind and water. Where a re-seeding program has not been effective in maintaining a non-erosive vegetative cover, or other factors have exposed soils to erosion, corrective steps should be initiated to prevent further loss of soil that may result in danger to the stability of the facility. Soil loss can be controlled by a variety of materials and methods, including gabion lining, sod, seeding and regrading.

6. Elimination of Trees, Brush, Roots and Animal Burrows

The stability of embankment can be impaired by large roots and animal burrows. Additionally, burrows can present a safety hazard for maintenance personnel. Trees and brush with extensive, woody root systems should be completely removed from the embankment to prevent destabilization and the creation of seepage routes. Roots should also be completely removed to prevent decomposition within the embankment. Root voids and burrows should be filled with material similar to the existing material, and capped just below grade with stone or other material. If the filling of the burrows does not discourage the animals from returning, further measures should be taken to either remove the animal population or to make critical areas of the facility unattractive to them.

7. Snow and Ice Removal

Accumulations of snow and ice can threaten the functioning of the inlet, outlet and emergency spillway. Provision of the equipment, material and personnel to monitor and remove snow and ice from critical areas will assure the function of the facility during the winter months.

8. Detention and Bioretention Basins

During storm events, the basin is designed to detain surface water from the property and release it at a rate less than the peak flow of water that discharged from the property before development. This release rate is controlled by the design of the Outlet Structure, located at the embankment.

This structure is designed to allow water during storm events to continuously enter the outlet when the design water surface elevation of the basin is exceeded. This outlet (drain) is restricted, so that if water enters the basin at an accelerated rate (during a storm), the flow rate leaving the basin is limited. This will cause the water elevation of the basin to rise.

As the water rises, water is released at an increased rate, with the elevation of the basin (determined by the intensity of the storm) controlling the amount (the higher the basin elevation, the greater the rate or amount).

If a storm event results in water entering the basin in quantities that exceeds the 100-year storm, the Outlet Structure is designed with an overflow capability. In these infrequent, severe storm conditions, the water level of the basin reaches the top elevation of the Outlet Structure. Water then flows into the top of the Outlet Structure and passes through the pipes located beneath the embankment.

The design of the Outlet Structure is intended to prevent clogging of the various openings. However, if not inspected and cleaned, it is possible for the Outlet Structure to become blocked and to limit basin discharge.

The drains or openings that restrict the normal discharge or the discharge during a normal storm can become clogged or plugged. These should be inspected annually, and after every major storm event. In addition, if the basin elevation reaches the elevation of the top of the Outlet Structure, debris can be carried onto the protective grate. If not removed, this can prevent water from entering the Outlet Structure at the overflow elevation. **When the Outlet Structure is checked after a major storm event, it is imperative that this grate be cleaned if debris has collected on the grate.**

Preventative Maintenance Actions

The frequency of the preventative maintenance actions listed here is adopted from Chapter 9, BMP Manual of Structural Stormwater Management Measures.

Frequency	Preventative Maintenance Actions	Stormwater Measures/ No.
Quarterly	<ul style="list-style-type: none">- Maintenance of adjacent areas- Removal and disposal of trash and debris- Sediment removal and disposal	e.g., Above ground basin, bioretention area, subsurface detention and Filterra devices
Semi-Annual	<ul style="list-style-type: none">- Inspection during the growing season and non growing season of vegetation along any side slopes and landscape areas	e.g., Above ground basin, bioretention area, subsurface detention and Filterra devices
Annual	<ul style="list-style-type: none">- Elimination of potential mosquito breeding Habitats	e.g., Above ground basin, bioretention area, subsurface detention and Filterra devices
Unscheduled	<ul style="list-style-type: none">Quick inspection after every 1" rain- Removal and disposal of trash and debris- Sediment removal and disposal- Elimination of potential mosquito breeding habitats	e.g., Above ground basin, bioretention area, subsurface detention and Filterra devices

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	Stormwater Management Measures/No.
<ul style="list-style-type: none">- Removal of debris and sediment- Structure repairs- Embankment and slope repairs- Extermination of mosquitoes- Erosion repair- Elimination of trees, brush, roots and animal burrows- Snow and ice removal as necessary	e.g, Above ground basin, bioretention area, subsurface detention and Filterra devices

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.

Inspection Checklists in the Field Manual for the stormwater management measures on this site include:

- Field Manual for Field Manual for Above Ground Infiltration Basin
- Field Manual for Bioretention System
- Field Manual for Subsurface Detention System
- Field Manual for Manufactured Treatment Devices (Green Infrastructure)

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.

Maintenance Personnel/Equipment/Tools/Supplies

Personnel/Equipment/Tools Name	Quantity
Grass Maintenance Equipment	
- Riding mowers	As needed
- Hand mowers	As needed
- Gas-powered trimmers	As needed
- Gas-powered edgers	As needed
- Seed spreaders	As needed
- Fertilizer spreaders	As needed
- De-thatching equipment	As needed
- Pesticide and herbicide application equipment	As needed
- Grass clipping and leaf collection equipment	As needed
Transportation Equipment	
- Trucks for transportation of materials	As needed
- Trucks for transportation of equipment	As needed
- Vehicles for transportation of Personnel	As needed
Debris, Trash and Sediment Removal Equipment	
- Shovels	As needed
- Rakers	
- Picks	As needed
- Wheel barrows	As needed
- Fence repair tools	As needed
- Painting equipment	As needed
- Gloves	As needed
Standard Mechanics Tools	As needed
Tools for Maintenance of Equipment	As needed
Materials	
- Topsoil	As needed
- Fill	As needed
- Seed	As needed
- Soil amenities (fertilizer, lime, etc.)*	As needed
- Chemicals (pesticides, herbicides, etc.)*	As needed
- Sand	As needed
- Spare parts and warranty to be provided by the manufacturer for equipment.	As needed

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

Upon approval of the contract, the contractor will submit their procedures for disposal of sediment, debris and trash to the Township.

Description of the Offsite Disposal:

Disposal of sediment, debris and trash must comply with all local, state and federal regulation. Debris and trash must be properly hauled off the site and transferred to an approved disposal site. Upon approval of the contract, the hauling company will submit the location of the disposal site to the Township Engineer.

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 Regulations and Requirements

This Maintenance Manual shall comply with the safety standards set forth in the New Jersey Stormwater Management regulations NJAC: 7:8-6.

Safety Tools, Equipment and Garments

List required safety tools and equipment, their location, the responsible person and the contact number. List first aid tools to be carried to field.

Safety Tools and Equipment	Location	Responsible Person/Contact #
Grass Maintenance Equipment		
Riding mowers	Brought to site	Contractor
Hand mowers	Brought to site	Contractor
Gas powered trimmer	Brought to site	Contractor
Seed spreaders	Brought to site	Contractor
Fertilizer spreaders	Brought to site	Contractor
De-thatching equipment	Brought to site	Contractor
Pesticide and herbicide application equipment	Brought to site	Contractor
Grass clipping and leaf collection equipment	Brought to site	Contractor
Transportation Equipment		
Trucks for transportation of materials	Brought to site	Contractor
Trucks for transportation of equipment	Brought to site	Contractor
Vehicles for transportation of personnel	Brought to site	Contractor
Debris, Trash and Sediment Removal Equipment		
Shovels	Brought to site	Contractor
Rakers	Brought to site	Contractor
Picks	Brought to site	Contractor
Wheel barrows	Brought to site	Contractor
Fence repair tools	Brought to site	Contractor
Standard Mechanics tools	Brought to site	Contractor
Tools for Maintenance of Equipment	Brought to site	Contractor
Materials		
Topsoil	Brought to site	Contractor
Fill	Brought to site	Contractor
Seed	Brought to site	Contractor
Soil amenities (fertilizer, lime, etc.)	Brought to site	Contractor
Chemicals (pesticides, herbicides, etc.)	Brought to site	Contractor
Mulch	Brought to site	Contractor
Spare parts for equipment	Brought to site	Contractor
Garments		
Hearing protection	Brought to site	Contractor
Safety glasses	Brought to site	Contractor
Hand protection	Brought to site	Contractor
Safety shoes	Brought to site	Contractor
Lime green Class 2 vest	Brought to site	Contractor

Safety Training

The inspector will be trained to:

- Use the proper tools
- Maintain tools in good, safe working condition
- Use the right tool for the job
- Inspect tools for damage/defects prior to use
- Immediately remove damaged/defective tools from service. Tag the damaged/defective equipment as such and cut power cord if it is not possible to lock out the controls.
- Verify that safety mechanism/guards are in place prior to use
- Operate tools in accordance with manufacturers' instructions
- Use required PPE properly

Safety Procedures

1. Hand Tools

Inspectors may be required to use a variety of hand tools, including but not limited to hammers, screwdrivers, machetes, and brush knives and box knives.

Cutting tools:

- Inspection
 - Handle (securely attached to blade, free of splintering or cracks)
 - Blade (sharp, free of nicks)
- Use & handling
 - Cut away from oneself and other people
 - Cover cutting blades during transport
 - Do not carry unprotected cutting tools in pockets or backpacks
 - Store cutting tools with blade points / edge down

Impact tools:

- Inspection
 - Handle (securely attached to head, free of splintering or cracks)
 - Head (not mushroomed, free of cracks)
- Use
 - Keep hands and fingers clear of the strike area
 - Check that the wing is clear

Hand tools with special safety properties may be required in some situations

- Non-sparking hand tools in potentially flammable atmospheres
- Electrically insulated tools when working on or near energized electrical equipment.

2. Gasoline Powered Tools

Gasoline powered tools may include brush clearing and demolition equipment (chainsaws, jackhammers). Some gas-powered tools use gasoline, while others use a gasoline/oil mixture. Consult the manufacturer for fuel requirements prior to fueling.

Gas powered tools should be used in well ventilated areas only due to potential buildup of exhaust gases (i.e. carbon monoxide). If a gas-powered tool must be used in an enclosed space, air monitoring and/or respiratory protection may be required.

Prior to making adjustments, cleaning, or performing maintenance or repairs, gas powered tools will be powered off.

Gas powered tools can generate a high level of noise. Hearing protection should be worn when operating these tools.

Gas powered tools can also vibrate, which can lead to injury over time. To minimize vibration exposure, Maser personnel should:

- Choose tools with effective, proven anti-vibration features
- Keep tools properly maintained
- Limit the amount of time using the tool
- Take frequent breaks
- Grip the handles only as tightly as necessary to control the tool
- Avoid using tools on the highest speed or throttle

2.1. Fuel Storage and Handling

Gasoline will be stored in approved containers and will be handled and transported according to proper procedures for flammable liquids. Containers should be equipped with a funnel or flexible hose for fueling operations.

Fueling operations will be conducted in well ventilated areas at least 10 feet from any source of ignition. Smoking is prohibited during fueling operations.

During fueling operations, gasoline power tools will be:

- Powered off and cool
- Properly grounded and bonded to the fuel container

After fueling is completed, wipe any spilled fuel from the tool. Move to a different location prior to starting the tool.

2.2. Maintenance and Servicing

Gas powered tools will be serviced and maintained in accordance with the manufacturer's requirements. Services and repair will be conducted by manufacturer authorized personnel.

Emergency Procedures

Borough of Alpha

Emergency (Police, Fire & Medical):	911
Police, Fire or Medical Non-Emergency:	Police: (908) 835-2002
	Fire: (908) 454-2878
	Medical: (908) 859-5218
JCP&L:	(800) 662-3115
Utilities Operations (Public Works):	(908) 235 2373

Training Records

Depending on the size, character, location and components of the stormwater management measure, maintenance personnel may require training in specialized inspection and maintenance tasks.

I. Training Plan

Contents of training:

Refer to the below site for more information on training on each stormwater BMP.

(<http://www.nj.gov/dep/stormwater/training.htm>.)

- Vegetation Care
 - Refer to Preventive & Corrective Procedures in this Manual
- Field Manual Usage Training
 - Field Manuals attached to this Maintenance Plan
- Equipment and Tools Operation Training
 - Equipment or tool manufacturer's Operation & Maintenance Manual (provided by the contractor after the contract is awarded)
- Occupational Safety Training
 - Equipment or tool manufacturer's Operation & Maintenance Manual (provided by the contractor after the contract is awarded)

II. Training Records

Training attendance sheets should be attached by the responsible party after 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
		<input type="checkbox"/> Maintain current version OR <input type="checkbox"/> Revise current version Revision date _____ (also update the last revision date on the cover page) <input type="checkbox"/> Requires a new deed recording (also update the last recording information on the cover page)
		<input type="checkbox"/> Maintain current version OR <input type="checkbox"/> Revise current version Revision date _____ (also update the last revision date on the cover page) <input type="checkbox"/> Requires a new deed recording (also update the last recording information on the cover page)
		<input type="checkbox"/> Maintain current version OR <input type="checkbox"/> Revise current version Revision date _____ (also update the last revision date on the cover page) <input type="checkbox"/> Requires a new deed recording (also update the last recording information on the cover page)

Documents

1. Site Evaluation

- Preliminary & Final Major Site Plan prepared by Colliers Engineering & Design dated March 28, 2022.

2. Preliminary Geotechnical Evaluation

- "Stormwater Infiltration Evaluation for Bev-Graph Packaging International, Alpha Borough, NJ Warren County New Jersey", prepared by Philip E. Gauffreau, PE. of Maser Consulting P.A., dated June 18, 2017

3. Landscaping Plan for the Stormwater Management Measures

As per NJDEP BMP Manual Ch. 8 (Feb., 2004), the Landscaping Plan for the stormwater management measures, is included in this Maintenance Plan. Landscape Plan prepared by Colliers Engineering & Design is included.

4. As-Built Drawings with Drainage Plans

The As-Built plans to be included upon receipt after completion of construction.

5. Local, State, Federal Permits

- Alpha Borough Resolution of Approval (to be provided upon receipt)
- Warren County Site Plan Approval (to be provided upon receipt)
- Upper Delaware SCD Letter (to be provided upon receipt)

6. Safety Regulations and Requirements

See safety regulations and requirements under Safety Measures and Procedures Section.

7. Devices/Tools/Equipment Operation and Maintenance Manual and Warranties

Equipment or tool manufacturers' operation and maintenance manual to be provided by the contractor after the contract is awarded.

8. Stormwater Maintenance Plan

Stormwater Maintenance Plan prepared by Colliers Engineering & Design is included.

Documents

Part II- Field Manuals

Attachment for 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 maintenance of adjacent areas; removal of sediment, debris or trash; disposal of sediment, debris and trash; elimination of potential mosquito breeding habitats; restoration of eroded areas; snow and ice removal; structural repair or replacement; restoration of embankment and slopes; 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 for Above Ground Detention Basin,
Field Manual for Bioretention System,
Field Manual for Subsurface Detention Basin,
Field Manual for Filterra MTD System
Maintenance Logs and Inspection Records.

Field Manual for Above ground Detention Basin 1

Development Name: Alpha Warehouse

Borough, County: Alpha, Warren

Location of Basin: 40° 40' 15.95"N 075° 9' 05.95"W

Location Description: Along New Brunswick Avenue frontage

Location Map

See Stormwater Management Facilities Plan (Inside Back Cover)

Above ground Detention Basin Overview

Functionality

An at-grade detention basin stores stormwater and attenuates stormwater runoff to provide capacity in the existing downstream storm sewer.

Type of BMP – Detention Basin

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

Basin 1 Basic Design Information

Hydrology Design Targets

1. Groundwater was encountered on one of three test pits, noted as trapped water at a depth of 10' from surface elevation of 273.5.
2. This basin will be discharged to an existing municipal storm sewer on New Brunswick Ave and off-site.
3. The **design drain time** is 43 hours (WQ Storm)

Hydraulic Design Targets

1. Design parameters

	Water Quality Design Storm	2-year storm	10-year storm	100-year storm
Rainfall Depth (inches)	1.25 inch in 2 hours	2.98	4.70	7.47
Runoff Volume (cubic feet)	13,876 cu. ft	31,305 cu. ft.	55,302. ft.	84,726 cu. ft.
Peak Flow Rate (cfs)	1.01 cfs	1.62 cfs	4.07 cfs	14.65 cfs
Water Surface Elevation (feet)	269.96	271.06	272.44	273.94

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

2. The emergency spillway is at EL. . 274.00 feet.

Basin Configuration Targets

1. Outlet Information:

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Outlet #1	Circular	18"	268.90
Orifice #1	Rectangular	6" W x 6" H	269.00
Weir #2	Rectangular	6" W x 6" H	271.50
Weir #2	Rectangular	12" W x 12" H	272.00
Grate	Rectangular	48" x 48"	273.75
Broad Crested Weir	Em. Spillway	20' W x 1' Deep	274.00

Critical Maintenance Features

1. No heavy equipment on the basin surface.
2. Trash racks and discharge outlet shall be cleaned frequently.
3. Grass clippings shall be collected from the basin and properly disposed.

Wildlife Disturbance Notice:

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

Inspection Checklist / Maintenance Actions

Surface Detention Basins

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 following 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.

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

(e.g., A, B, C, D, E, F & G)

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 take place when the basin is thoroughly dry.	A – Pretreatment	
	B – Basin Bed	
	D – Basin Embankment and Side Slopes	
	E – Outlet	
Vegetation removal	A – Pretreatment	
	B – Infiltration Bed	
	D – Basin Embankment and Side Slopes	
	E – Outlet	
	F – Emergency Spillway	
(List additional tasks, if applicable)		

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

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

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

If a sand layer is installed, replacement of the sand will occur according to the scheduled frequency (see Basin Configuration Targets above). The next scheduled replacement is _____ (date).

Crew member: _____ / _____ Date: _____
(name/ signature)

Supervisor: _____ / _____ Date: _____
(name/ signature)

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

Corrective Maintenance Record

1. **Work Order #** _____ **Date Issued** _____
2. **Issue to be resolved:**
(e.g., orifice plate is loose and bent)
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		
(List additional tasks, if applicable)		

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.

Field Manual for Bioretention Basin 2

Development Name: Alpha Warehouse

Borough, County: Alpha, Warren

Location of Basin: 40° 40' 13.52"N 075° 9' 04.64"W

Location Description: Below truck loading docks and Industrial Drive frontage

Location Map

See Stormwater Management Facilities Plan (Inside Back Cover)

Bioretention System Overview

Functionality

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

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

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

Type of BMP – Dry Basin / Infiltration

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

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

Basic Design Information

Hydrology Design Targets

1. The system is a bioretention with storage bed with underdrains.
2. The design drain time is 12 hours.
3. Groundwater was encountered on one of three test pits, noted as trapped water at a depth of 10' from surface elevation of 273.5.
4. The TSS removal rate is 80%.

Hydraulic Design Targets

1. Design parameters

	Water Quality Design Storm	2-year storm	10-year storm	100-year storm
Rainfall Depth (inches)	1.25 inch in 2 hours	2.98	4.70	7.47
Runoff Volume (cubic feet)	4,029 cu. ft	6,106 cu. ft.	8,612 cu. ft.	12,453 cu. ft.
Peak Flow Rate (cfs)	0.55 cfs	1.31 cfs	3.17 cfs	5.87 cfs
Water Surface Elevation (feet)	287.66	288.14	288.72	289.97

2. The emergency spillway is at EL 280.00.

Basin Configuration Targets

1. Pretreatment is provided by a (forebay with a depth of _____ feet / BMP Type: _____, BMP No.). A perforated riser (is / is not) used.
2. Planting Soil Bed
 - a. The depth of the soil planting bed is 1.5 feet.
 - b. Mixture of the planting soil consists of 85-95% of sand. (with no more than 25% of the sands as fine or very fine sands; no more than 15% silt and clay with 2% to 5% clay content). The organic matter shall be within 3 % to 7%
 - c. The pH of the planting soil should be in the range of 5.5 and 6.5.
 - d. Filter fabric is placed along the sides of the soil planting bed.
 - e. The system is designed with a planting soil permeability rate of _____ inches/hour (pre-construction) and _____ inches/hour (post-construction – tested on (MM) / (DD) / (YYYY)).

3. Outlet Information:

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Outlet #1	Circular	18"	272.00
Orifice #1	Rectangular	6" W x 12" H	276.00
Orifice #2	Rectangular	12" W x 12" H	277.00
Orifice #3	Rectangular	4' x 4'	278.50
Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation

4. Vegetation

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

5. Underdrain

- a. The perforated laterals are 4" inches in diameter, at a slope of 0.0%
- b. There are ____ lateral pipes in the basin. Each lateral is ____ feet long.
- c. The perforations are ____ inches in diameter and are arranged ____ inches center to center, ____ perforations per row, and ____ rows of perforations per pipe.
- d. The manifold pipe is 4" inches in diameter not perforated at a slope of 0.0% and ____ feet in length.
- e. Note: The cleanout pipe shall not be perforated.)
- f. Filter fabric is installed to wrap around the laterals. The material used for the filter fabric is _____, and has a permeability rate of _____ inches per hour.
- g. The gravel layer surrounding the underdrain consists of ____ inches of gravel above the underdrain and ____ inches of gravel below the underdrain.

Critical Maintenance Features

1. No heavy equipment on the basin surface
2. Remove vegetation strictly in accordance with the landscaping plan.
3. Grass clippings shall be collected from the basin and properly disposed.
4. Keep the appearance of the basin aesthetic.

Wildlife Disturbance Notice:

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

Visual Aid for Dry Type Stormwater Basin Inspection

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



Issue:	The inlet is not properly drained, assuming it has not rained within 72 hours.
Corrective Action:	Clear and remove sediment. Check whether the water table is at or above the bottom of the forebay. Also check the permeability of the underlying soil, if necessary.
Preventative Action:	Routine inspections and removal of sediment from the forebay.



Issue:	The Inflow pipe is clogged by sediment and vegetation.
Corrective Action:	Clear and remove sediment and unwanted vegetation.
Preventative Action:	Routine inspection and removal of sediment and unwanted vegetation.



Issue: The Inflow pipe is entirely clogged by sediment and trees.

Corrective Action: Clear and remove sediment and trees.

Preventative Action: Routine inspection & removal of sediment and unwanted vegetation.



Issue: The excessive sediment in inflow pipe (shown above) might be caused by a blockage of flow to the basin due to excessive vegetation and overgrown trees.

Corrective Action: Clear and remove trees and vegetation. If necessary, re-grade the bottom slope to ensure the flow properly spreads over the basin bottom.

Preventative Action: Routine inspection and removal of sediment and unwanted vegetation.



Issue: Eroded inflow apron.

Corrective Action: Repair apron.

Preventative Action: Routine inspection and rehabilitation, if necessary.



Issue: The vegetation loss and the blackish soil may indicate frequent inundation.

Corrective Action: Check the permeability rate of the soil and the water table elevation.
Replace the soil if necessary.

Preventative Action: Routine inspection and tilling/aeration, if necessary.



Issue: The low flow channel has excessive accumulation of sediment and debris. The outflow orifice is clogged by a trash bag and debris. Note that there is no trash rack installed.

Corrective Action: Check the permeability rate of the soil and the water table elevation. Replace the soil if necessary.

Preventative Action: Routine inspection and cleaning.



Issue: Trash rack is damaged.

Corrective Action: Repair the trash rack.

Preventative Action: Routine inspection, especially after large storm events. Tighten any loose bolts and repair structural flaws.



A well maintained detention basin

Inspection Checklist / Maintenance Actions

Bioretention System

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

Checklist No. _____

Inspection Date: _____

Date of most recent rain event: _____

Rain Condition (circle one):

Drizzle / Shower / Downpour / Other _____

Ground Condition (circle one):

Dry / Moist / Ponding / Submerged / Snow accumulation

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

	For Inspector		For Maintenance Crew	
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
B Basin Bed	1	Standing water is present after the design drain time The observed drain time is approximately _____ hours.	Y__ N__	Recheck to determine if there is standing water after 72 hours If standing water is present longer than 5 days, report to mosquito commission. Remove any sediment buildup Check the soil permeability Till the soil bed with rotary tiller or disc harrow Replace the planting soil, if necessary Work Order # _____
	2	Excessive sediment, silt, or trash accumulation on basin bed	Y__ N__	Clean pretreatment system Remove silt, sediment, and trash
	3	Erosion or channelization is present	Y__ N__	Check whether the flow bypass or diversion device is clogged Re-grade the infiltration bed Work Order # _____
	4	Animal burrows/rodents are present	Y__ N__	Pest control Work Order # _____
Note:				

	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% Y__ N__ Trash rack is bent, loose, or missing parts	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
F Emergency Spillway	1	Trees or excessive vegetation present	Y__ N__	Remove trees and roots, and restore berms if necessary Work Order #_____
	2	Damaged structure	Y__ N__	Repair Work Order #_____
G Miscellaneous	1	Fence: broken or eroded parts	Y__ N__	Repair or replace Work Order #_____
	2	Gate: missing gate or lock	Y__ N__	Repair or replace Work Order #_____
	3	Sign/plate: tiled, missing, or faded	Y__ N__	Repair or replace Work Order #_____
	4	Excessive or overgrown vegetation blocking access to the basin	Y__ N__	Clear, trim, or prune the vegetation to allow access for inspection and maintenance Work Order #_____
Note:				

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

(e.g., A, B, C, D, E, F & G)

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 take place when the basin is thoroughly dry.	A – Pretreatment	
	B – Basin Bed	
	D – Bioretention System Embankment and Side Slopes	
	E – Outlet	
Vegetation removal	A – Pretreatment	
	B – Sand Bed	
	D – Basin Embankment and Side Slopes	
	E – Outlet	
	F – Emergency Spillway	
(List additional tasks, if applicable)		

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

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

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

Crew member: _____ / _____ Date: _____
(name/ signature)

Supervisor: _____ / _____ Date: _____
(name/ signature)

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

Corrective Maintenance Record

1. **Work Order #** _____ **Date Issued** _____
2. **Issue to be resolved:**
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)		
Repair riprap apron with 100 cubic yards of aggregate		
Revegetate		
(List additional tasks, if applicable)		

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.

Field Manual for

Subsurface Detention Basin 3B

Development Name: Alpha Warehouse

Borough, County: Alpha, Warren

Location of Basin: 40° 40' 13.02"N 075° 8' 58.57"W

Location Description: Along Edge Road frontage with future banked parking area

Location Map

See Stormwater Management Facilities Plan (Inside Back Cover)

Subsurface Detention Basin Overview

Functionality

A subsurface detention basin is a stormwater management facility that is usually situated below a proposed parking lot due to inadequate space on site for an at-grade detention basin. This basin stores stormwater and attenuates stormwater runoff to provide capacity in the existing downstream storm sewer.

Type of BMP – Dry Basin

A subsurface detention basin is a type of **dry** basin. This 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.**

Underground Basin 3.B

Basic Design Information

Hydrology Design Targets

1. The **design detention time** of this basin is 12 hours.
2. Water Quality for water collected in the subsurface basin is provided by upstream MTD. Runoff is collected and conveyed to the subsurface basin via underdrain and collection manifold connected the storm sewer.

Hydraulic Design Targets

1. Design parameters

	Water Quality Design Storm	2-year storm	10-year storm	100-year storm
Rainfall Depth (inches)	1.25 inch in 2 hours	2.98	4.70	7.47
Runoff Volume (cubic feet)	1,171 cu. ft	1,543 cu. ft.	2,096. ft.	2,767 cu. ft.
Peak Flow Rate (cfs)	0.44 cfs	0.85 cfs	2.00 cfs	4.11 cfs
Water Surface Elevation (feet)	284.78	285.03	285.39	285.85

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

Basin Configuration Targets

2. Outlet Information:

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Outlet #1	Circular	24"	284.00
Orifice #1	Circular	3" Dia	284.00
Orifice #2	Rectangular	6"x6"	284.50
Orifice #3	Rectangular	12"x12"	285.00
Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation

Critical Maintenance Features

1. No heavy equipment on the basin surface.
2. Trash racks and discharge outlet shall be cleaned frequently.
3. Grass clippings shall be collected from the basin and properly disposed.

Field Manual for Subsurface Detention Basin 4

Development Name: Alpha Warehouse

Borough, County: Alpha, Warren

Location of Basin: 40°40'10.63"N 75° 8'57.50"W

Location Description: Along Rear Trailer Parking Area

Location Map

See Stormwater Management Facilities Plan (Inside Back Cover)

Subsurface Detention Basin Overview

Functionality

A subsurface detention basin is a stormwater management facility that is usually situated below a proposed parking lot due to inadequate space on site for an at-grade detention basin. This basin stores stormwater and attenuates stormwater runoff to provide capacity in the existing downstream storm sewer.

Type of BMP – Dry Basin

A subsurface detention basin is a type of **dry** basin. This 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.**

Underground Basin 4

Basic Design Information

Hydrology Design Targets

1. The **design detention time** of this basin is 29 hours.
2. Water Quality for water collected in the subsurface basin is provided by upstream MTD. Runoff is collected and conveyed to the subsurface basin via underdrain and collection manifold connected the storm sewer.

Hydraulic Design Targets

2. Design parameters

	Water Quality Design Storm	2-year storm	10-year storm	100-year storm
Rainfall Depth (inches)	1.25 inch in 2 hours	2.98	4.70	7.47
Runoff Volume (cubic feet)	4,029 cu. ft	6,106 cu. ft.	8,612 cu. ft.	12,453 cu. ft.
Peak Flow Rate (cfs)	0.55 cfs	1.31 cfs	3.17 cfs	5.87 cfs
Water Surface Elevation (feet)	287.66	288.14	288.72	289.97

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

Basin Configuration Targets

3. Outlet Information:

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Outlet #1	Circular	24"	286.75
Orifice #1	Circular	5" Dia	286.75
Orifice #2	Rectangular	9" W x 12" H	287.75
Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation

Critical Maintenance Features

4. No heavy equipment on the basin surface.
5. Trash racks and discharge outlet shall be cleaned frequently.
6. Grass clippings shall be collected from the basin and properly disposed.

Wildlife Disturbance Notice:

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

Inspection Checklist / Maintenance Actions

Subsurface - Extended Detention Basin 3/4

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
A3 Pretreatment (Structural BMP)	1	BMP inspection	Y__ N__	(See BMP No. 1.1 Field Manual)
Note:				

	For Inspector		For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions
B Infiltration Bed	1	<p>Standing water is present after the design drain time</p> <p>Y__</p> <p>The observed drain time is approximately _____ hours</p> <p>N__</p>	<p>Recheck to determine if there is standing water after 72 hours. If standing water is present longer than 5 days, report to mosquito commission.</p> <p>Remove any sediment buildup</p> <p>Replace the sand layer (if sand layer is installed; volume of replacement sand is specified in the Basin Configuration Targets in the Basic Design Information Section of this Manual)</p> <p>Work Order # _____</p>
	2	<p>Excessive sediment, silt, or trash accumulation on basin bed</p> <p>Y__</p> <p>N__</p>	<p>Clean pretreatment system Remove silt, sediment, and trash</p> <p>Work Order # _____</p>
	3	<p>Erosion or channelization is present</p> <p>Y__</p> <p>N__</p>	<p>Check whether the flow bypass or diversion device is clogged</p> <p>Re-grade the infiltration bed</p> <p>Work Order # _____</p>
	4	<p>Animal burrows/rodents are present</p> <p>Y__</p> <p>N__</p>	<p>Pest control</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
	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
Note:				
C Vegetation	1	Large spot(s) showing bare soil	Y__ N__	Vegetative cover must be maintained at 85%. Revegetate if 50% or more vegetation has been lost Work Order # _____
	2	Overgrown vegetation	Y__ N__	Mow/trim the vegetation Work Order # _____

	For Inspector		For Maintenance Crew	
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
	3	Tree growth in the basin	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 # _____
Note:				

	For Inspector		For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions
D Basin 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 # _____
	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 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 # _____
E Outlet	4	Discharge pipe apron is eroded or scoured	Y__ N__ Restabilize the discharge riprap apron Work Order # _____

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

	For Inspector		For Maintenance Crew	
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
	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., A, B, C, D, E, F & G)

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 take place when the basin is thoroughly dry.	A – Pretreatment	
	B – Sand Bed	
	D – Basin Embankment and Side Slopes	
	E – Outlet	
Vegetation removal	A – Pretreatment	
	B – Sand Bed	
	D – Basin Embankment and Side Slopes	
	E – Outlet	
	F – Emergency Spillway	
(List additional tasks, if applicable)		

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

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

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

Replacement of the sand layer will occur according to the scheduled frequency (see Basin Configuration Targets above). The next scheduled replacement is _____ (date).

Crew member: _____ / _____ **Date:** _____
(name/ signature)

Supervisor: _____ / _____ **Date:** _____
(name/ signature)

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

Corrective Maintenance Record

7. **Work Order #** _____ **Date Issued** _____

8. **Issue to be resolved:**
(e.g., orifice plate is loose and bent)

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

10. 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		
(List additional tasks, if applicable)		

11. Responsible person(s):

12. 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

Field Manual for Contech Filterra HC MTD (GI)

Development Name: Alpha Warehouse

Borough, County: Alpha, Warren

Location of Basin: 40° 40' 13.52"N 075° 9' 04.64"W

Location Description: Various Locations

Location Map

See Stormwater Management Facilities Plan (Inside Back Cover)

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.

A copy of the manufacturers Maintenance Documentation is provided below:

Filterra HC Owner's Manual



filterra®
Bioretention Systems

C NTECH®
ENGINEERED SOLUTIONS

This Owner's Manual applies to all precast Filterra Configurations, including Filterra Bioscape Vault.

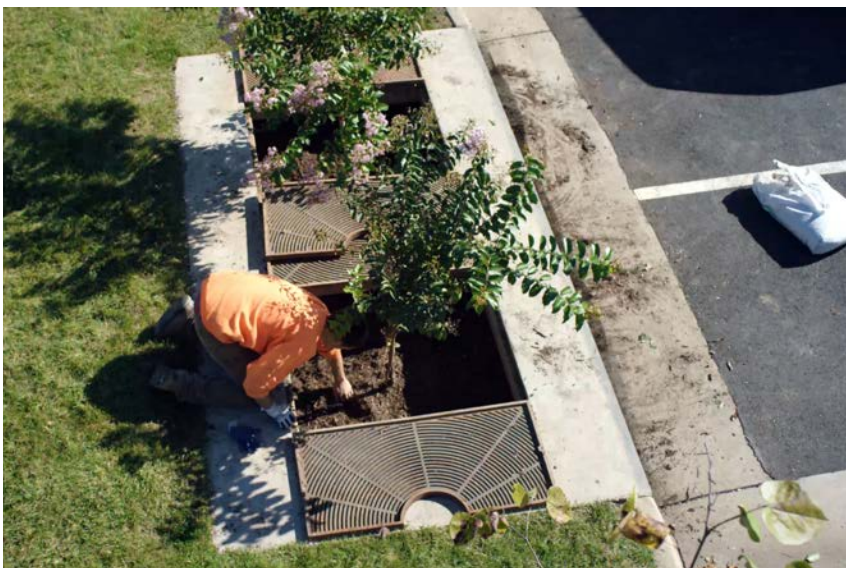




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Introduction

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:

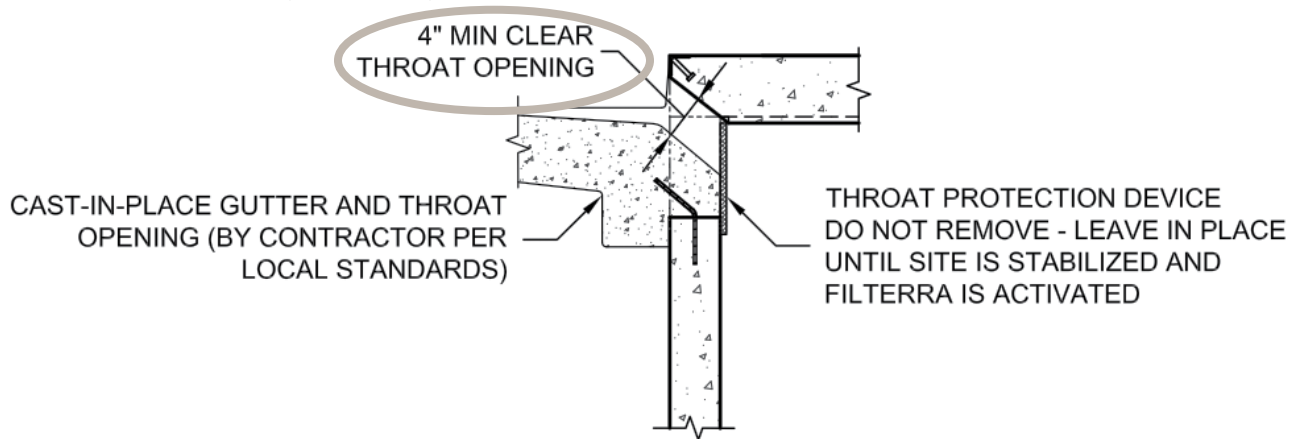
1. The site landscaping must be fully stabilized, i.e. full landscaping installed and some grass cover (not just straw and seed) is required to reduce sediment transport. Construction debris and materials should be removed from surrounding area.



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 typically 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 provider 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 (where applicable) 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 each) where applicable. Most visits require minor trash removal and a full replacement of mulch. If tree grate opening expansion is necessary, safety glasses/goggles and a 3lb or greater mini sledgehammer are required. 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 (ft²)	Mulch Volume at 3" Depth (ft²)	# of 2 ft² Mulch Bags
Standard Configuration Filterra 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 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 ft²	0.25 x (Media Area in ft²)	0.125 x (Media Area in ft²)	

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 (if applicable)	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 (if applicable) and erosion control stones

- Remove cast iron grates, if applicable, 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 (if applicable) correctly using appropriate lifting or moving tools, taking care not to damage the plant.
- Where applicable, if 6" tree grate opening is too close to plant trunk, the grate opening may be expanded to 12" using a mini sledgehammer. Refer to instructions in Appendix 3.



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 top of Filterra Unit	_____ (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 Top of Vault	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"/> N/A	
		<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"/> N/A	
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		<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"/> N/A	
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		<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"/> N/A	
		<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"/> N/A	

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.

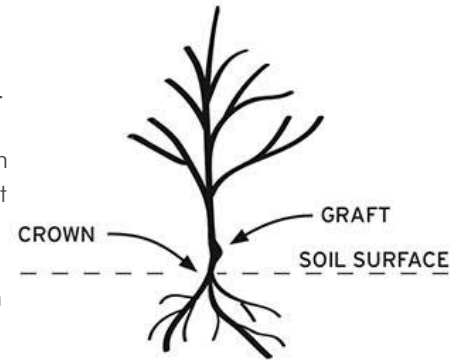
Signature _____

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 with a tree grate of the faster growing species, or species known to produce basal sprouts



Plant Installation

- During transport protect the plant foliage 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 meets 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 top/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.



Appendix 3 – Filterra® Tree Grate Opening Expansion Procedure

The standard grates used on all Filterra configurations that employ Tree Grates are fabricated with a 6" opening that is designed with a breakaway section that can be removed, allowing the grate opening to be expanded to 12" as the tree matures and the trunk widens.

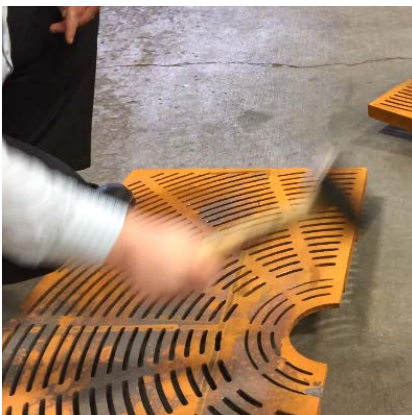
The following tools are required to expand the opening:

- Mini sledgehammer (3 lb. or greater)
- Safety Glasses / Goggles

The following guidelines should be followed to properly expand the tree opening from 6" to 12":



1. Remove the grate from the Filterra frame, place it flat on a hard surface, and support the grate by stepping on the edge or using other weighted items such as a few mulch bags if this is being done during a Filterra maintenance event. Put on safety glasses/goggles. Align the mini sledgehammer as shown in the figure to the left. The head of the sledgehammer should be aimed just inside the wide cast iron bar between the larger grate section and the breakaway section.



2. Repeatedly hit the grate at this spot with the mini sledgehammer.



3. After several hits, the breakaway section should snap cleanly off of the larger grate section. Reinstall the grate into the Filterra grate frame. Recycle or dispose of the breakaway section per local guidelines.



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Reference Documents

Following Municipal and agency approval the below documents to be placed in this field manual should include the following:

- As-built Drawings with Drainage Plans
- Soil Boring Logs
- Permeability Test – Subsoil (Pre-construction)
- Permeability Test – Subsoil (Post-construction)
- Landscaping Plan

Attach Approved Reference Documents Here

Maintenance Logs and Inspection Records

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
(1st Quarter) MM/DD/YYYY	(#1A, #1B)		
(2nd Quarter) MM/DD/YYYY			
(3rd Quarter) MM/DD/YYYY			
(4th Quarter) MM/DD/YYYY			
(Unscheduled Inspection; e.g., after 1" rain) MM/DD/YYYY			
(1st Quarter) MM/DD/YYYY			
(2nd Quarter) MM/DD/YYYY			
(3rd Quarter) MM/DD/YYYY			
(4th Quarter) MM/DD/YYYY			
(Unscheduled Inspection; e.g., after 1" rain) MM/DD/YYYY			
(1st Quarter) MM/DD/YYYY			
(2nd Quarter) MM/DD/YYYY			
(3rd Quarter)			

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection
MM/DD/YYYY			
(4th Quarter) MM/DD/YYYY			
(Unscheduled Inspection; e.g., after 1" rain) MM/DD/YYYY			
(1st Quarter) MM/DD/YYYY			
(2nd Quarter) MM/DD/YYYY			
(3rd Quarter) MM/DD/YYYY			
(4th Quarter) MM/DD/YYYY			
(Unscheduled Inspection; e.g., after 1" rain) MM/DD/YYYY			
(1st Quarter) MM/DD/YYYY			
(2nd Quarter) MM/DD/YYYY			
(3rd Quarter) MM/DD/YYYY			
(4th Quarter) MM/DD/YYYY			
(Unscheduled Inspection; e.g., after 1" rain) MM/DD/YYYY			

Continue the table when necessary.

Attach the Inspection Checklist after each inspection

Preventative Maintenance Log

Maintenance Schedule	Stormwater Management Measure No.	Preventative Maintenance Record No.	Date(s) of Maintenance
(1st Quarter) MM/DD/YYYY	(#1A, #1B)		
(2nd Quarter) MM/DD/YYYY			
(3rd Quarter) MM/DD/YYYY			
(4th Quarter) MM/DD/YYYY			
(Unscheduled Maintenance work; e.g., after 1" rain) MM/DD/YYYY			
(1st Quarter) MM/DD/YYYY			
(2nd Quarter) MM/DD/YYYY			
(3rd Quarter) MM/DD/YYYY			
(4th Quarter) MM/DD/YYYY			
(Unscheduled Inspection; e.g., after 1" rain) MM/DD/YYYY			

Continue the table when necessary.

**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
(1st Quarter) MM/DD/YYYY	(#1A, #1B....)		
(2nd Quarter) MM/DD/YYYY			
(3rd Quarter) MM/DD/YYYY			
(4th Quarter) MM/DD/YYYY			
(Unscheduled Maintenance work; e.g., after 1" rain) MM/DD/YYYY			
(1st Quarter) MM/DD/YYYY			
(2nd Quarter) MM/DD/YYYY			
(3rd Quarter) MM/DD/YYYY			
(4th Quarter) MM/DD/YYYY			
(Unscheduled Inspection; e.g., after 1" rain) MM/DD/YYYY			

Continue the table when necessary

**Attach the Corrective Maintenance Record after
each maintenance task performed**



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