Notice of Intent for a Stormwater Biofiltration Unit on Lake Quinsigamond
Worcester, MA

February, 2020

Prepared By

The Department of Public Works & Parks
Water Operations Division
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A. General Information

1. Project Location (Note: electronic filers will click on button to locate project site):
   Opposite 616 Plantation on N Lake Ave
   a. Street Address
   b. City/Town
   c. Zip Code
   Worcester 01605
   d. Latitude
   e. Longitude
   46-044
   f. Assessors Map/Plat Number
   00001
   g. Parcel/Lot Number

2. Applicant:
   a. First Name
   Jaquay
   b. Last Name
   Bremeister
   c. Organization
   Worcester DPW&P
   d. Street Address
   18 E Worcester St
   e. City/Town
   Worcester
   f. State
   MA
   g. Zip Code
   01605
   h. Phone Number
   i. Fax Number
   j. Email Address

3. Property owner (required if different from applicant):
   a. First Name
   b. Last Name

4. Representative (if any):
   a. First Name
   b. Last Name
   c. Company
   d. Street Address
   e. City/Town
   f. State
   g. Zip Code
   h. Phone Number
   i. Fax Number
   j. Email address

5. Total WPA Fee Paid (from NOI Wetland Fee Transmittal Form):
   a. Total Fee Paid
   b. State Fee Paid
   c. City/Town Fee Paid
A. General Information (continued)

6. General Project Description:

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

1. ☐ Single Family Home 2. ☐ Residential Subdivision
2. ☐ Commercial/Industrial 4. ☐ Dock/Pier
3. ☐ Utilities 5. ☐ Coastal engineering Structure
4. ☐ Agriculture (e.g., cranberries, forestry) 6. ☐ Transportation
5. ☐ Other

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration Limited Project) subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

1. ☐ Yes  ☐ No If yes, describe which limited project applies to this project. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

8. Property recorded at the Registry of Deeds for:

City of Worcester DPW&P 00000
a. County  b. Certificate # (if registered land)
NA NA
c. Book  d. Page Number

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

1. ☐ Buffer Zone Only – Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.

2. ☐ Inland Resource Areas (see 310 CMR 10.54-10.58; if not applicable, go to Section B.3, Coastal Resource Areas).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.
### B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

<table>
<thead>
<tr>
<th>Resource Area</th>
<th>Size of Proposed Alteration</th>
<th>Proposed Replacement (if any)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.  ■ Bank</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>b.  □ Bordering Vegetated Wetland</td>
<td>1. linear feet</td>
<td>2. linear feet</td>
</tr>
<tr>
<td>c.  □ Land Under Waterbodies and Waterways</td>
<td>1. square feet</td>
<td>2. square feet</td>
</tr>
<tr>
<td>c.  □ Land Under Waterbodies and Waterways</td>
<td>1. square feet</td>
<td>2. square feet</td>
</tr>
<tr>
<td>c.  □ Land Under Waterbodies and Waterways</td>
<td>3. cubic yards dredged</td>
<td></td>
</tr>
<tr>
<td>d.  □ Bordering Land Subject to Flooding</td>
<td>750</td>
<td>0</td>
</tr>
<tr>
<td>e.  □ Isolated Land Subject to Flooding</td>
<td>1. square feet</td>
<td>2. square feet</td>
</tr>
<tr>
<td>e.  □ Isolated Land Subject to Flooding</td>
<td>3. cubic feet of flood storage lost</td>
<td>4. cubic feet replaced</td>
</tr>
<tr>
<td>f.  □ Riverfront Area</td>
<td>1. Name of Waterway (if available)</td>
<td></td>
</tr>
</tbody>
</table>

2. Width of Riverfront Area (check one):

- [ ] 25 ft. - Designated Densely Developed Areas only
- [ ] 100 ft. - New agricultural projects only
- [ ] 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: 750 square feet

4. Proposed alteration of the Riverfront Area:

- total square feet
- square feet within 100 ft.
- square feet between 100 ft. and 200 ft.

5. Has an alternatives analysis been done and is it attached to this NOI?  
   - [ ] Yes   - [ ] No

6. Was the lot where the activity is proposed created prior to August 1, 1996?  
   - [ ] Yes   - [ ] No

3. [ ] Coastal Resource Areas: (See 310 CMR 10.25-10.35)
### B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

<table>
<thead>
<tr>
<th>Resource Area</th>
<th>Size of Proposed Alteration</th>
<th>Proposed Replacement (if any)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. [ ] Designated Port Areas</td>
<td>Indicate size under Land Under the Ocean, below</td>
<td></td>
</tr>
<tr>
<td>b. [ ] Land Under the Ocean</td>
<td>1. square feet</td>
<td>2. cubic yards dredged</td>
</tr>
<tr>
<td>c. [ ] Barrier Beach</td>
<td>Indicate size under Coastal Beaches and/or Coastal Dunes below</td>
<td></td>
</tr>
<tr>
<td>d. [ ] Coastal Beaches</td>
<td>1. square feet</td>
<td>2. cubic yards beach nourishment</td>
</tr>
<tr>
<td>e. [ ] Coastal Dunes</td>
<td>1. square feet</td>
<td>2. cubic yards dune nourishment</td>
</tr>
<tr>
<td>f. [ ] Coastal Banks</td>
<td>1. linear feet</td>
<td></td>
</tr>
<tr>
<td>g. [ ] Rocky Intertidal Shores</td>
<td>1. square feet</td>
<td></td>
</tr>
<tr>
<td>h. [ ] Salt Marshes</td>
<td>1. square feet</td>
<td>2. sq ft restoration, rehab., creation</td>
</tr>
<tr>
<td>i. [ ] Land Under Salt Ponds</td>
<td>1. square feet</td>
<td></td>
</tr>
<tr>
<td>j. [ ] Land Containing Shellfish</td>
<td>1. square feet</td>
<td>2. cubic yards dredged</td>
</tr>
<tr>
<td>k. [ ] Fish Runs</td>
<td>Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above</td>
<td></td>
</tr>
<tr>
<td>l. [ ] Land Subject to Coastal Storm Flowage</td>
<td>1. cubic yards dredged</td>
<td></td>
</tr>
</tbody>
</table>

4. [ ] Restoration/Enhancement
If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.2.b or B.3.h above, please enter the additional amount here.

| a. square feet of BW | b. square feet of Salt Marsh |

5. [ ] Project Involves Stream Crossings

| a. number of new stream crossings | b. number of replacement stream crossings |
C. Other Applicable Standards and Requirements

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Notice of Intent – Required Actions (310 CMR 10.11).

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in Estimated Habitat of Rare Wildlife as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the Massachusetts Natural Heritage Atlas or go to http://www.mass.gov/dfw/index/npms/nhesp/regulatory_review/priority_habitat/online_viewer.htm.

   a. ☐ Yes  ☐ No

   If yes, include proof of mailing or hand delivery of NOI to:

   Natural Heritage and Endangered Species Program
   Division of Fisheries and Wildlife
   1 Rabbit Hill Road
   Westborough, MA 01581

   b. Date of map

If yes, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.C, and include requested materials with this Notice of Intent (NOI); OR complete Section C.1.d, if applicable. If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).

1c. Submit Supplemental Information for Endangered Species Review*

   1. ☐ Percentage/acreage of property to be altered:
      (a) within wetland Resource Area
      (b) outside Resource Area

   2. ☐ Assessor’s Map or right-of-way plan of site

2. ☐ Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work **

   (a) ☐ Project description (including description of impacts outside of wetland resource area & buffer zone)
   (b) ☐ Photographs representative of the site

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* Some projects not in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see http://www.mass.gov/dfw/index/npms/nhesp/index.htm, regulatory review tab). Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.

** MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.
C. Other Applicable Standards and Requirements (cont’d)

(c) ☐ MESA filing fee (fee information available at [http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/mesa/mesa_fee_schedule.htm](http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/mesa/mesa_fee_schedule.htm)). Make check payable to “Commonwealth of Massachusetts - NHESP” and mail to NHESP at above address.

Projects altering **10 or more acres** of land, also submit:

(d) ☐ Vegetation cover type map of site

(e) ☐ Project plans showing Priority & Estimated Habitat boundaries

(f) OR Check One of the Following

1. ☐ Project is exempt from MESA review. Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, [http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/mesa/mesa_exemptions.htm](http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/mesa/mesa_exemptions.htm); the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)

2. ☐ Separate MESA review ongoing.  
   a. NHESP Tracking #  
   b. Date submitted to NHESP

3. ☐ Separate MESA review completed. Include copy of NHESP “no Take” determination or valid Conservation & Management Permit with approved plan.

3. For coastal projects only, is any portion of the proposed project located below the mean high water line or in a fish run?
   a. ☐ Not applicable – project is in inland resource area only
   b. ☐ Yes ☐ No  
      If yes, include proof of mailing or hand delivery of NOI to either:

      South Shore - Cohasset to Rhode Island, and the Cape & Islands:
      Division of Marine Fisheries - Southeast Marine Fisheries Station  
      Attn: Environmental Reviewer  
      1213 Purchase Street – 3rd Floor  
      New Bedford, MA 02740-8694

      North Shore - Hull to New Hampshire:  
      Division of Marine Fisheries - North Shore Office  
      Attn: Environmental Reviewer  
      30 Emerson Avenue  
      Gloucester, MA 01930

Also if yes, the project may require a Chapter 91 license. For coastal towns in the Northeast Region, please contact MassDEP’s Boston Office. For coastal towns in the Southeast Region, please contact MassDEP’s Southeast Regional Office.
C. Other Applicable Standards and Requirements (cont'd)

4. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?
   a. ☐ Yes ☐ No
      If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). Note: electronic filers click on Website.

b. ACEC

5. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?
   a. ☐ Yes ☐ No

6. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?
   a. ☐ Yes ☐ No

7. Is this project subject to provisions of the MassDEP Stormwater Management Standards?
   a. ☐ Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:
      1. ☐ Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)
      2. ☐ A portion of the site constitutes redevelopment
      3. ☐ Proprietary BMPs are included in the Stormwater Management System.

b. ☐ No. Check why the project is exempt:
      1. ☐ Single-family house
      2. ☐ Emergency road repair
      3. ☐ Small Residential Subdivision (less than or equal to 4 single-family houses or less than equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

D. Additional Information

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department.

1. ☐ USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)

2. ☐ Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.
F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

1. Signature of Applicant

2. Date

3. Signature of Property Owner (if different)

4. Date

5. Signature of Representative (if any)

6. Date

For Conservation Commission:
Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:
One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a copy of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:
If the applicant has checked the "yes" box in any part of Section C, Item 3, above, refer to that section and the instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.
Notice to Abutters

Notification to Abutters under the Massachusetts Wetlands Protection Act

In Accordance with the second paragraph of Massachusetts General Laws Chapter 131, Section 40, you are hereby notified of the following:

A. The name of the applicant is City of Worcester Department of Public Works and Parks

B. The applicant has filed a Notice of Intent with the Worcester Conservation Commission seeking permission to remove, fill, dredge, or alter an Area Subject to Protection Under the Wetlands Protection Act (General Laws Chapter 131, Section 40)

C. The address of the lot where the activity is proposed is a lot associated with 616 Plantation Street

D. Copies of the Notice of Intent may be examined at the Worcester Conservation Commission office located at Division of Planning & Regulatory Services, City Hall Room 404, 455 Main Street, Worcester, MA 01608 between the hours of 8:30 am and 5:00 pm, Monday-Friday.

E. Further information regarding the date, time and place of the public hearing may be obtained from the Worcester Conservation Commission office by calling (508) 799-1400 x31436 between the hours of 8:30 am and 5:00 pm, Monday-Friday.

Note: Notice of the public hearing including date, time, and place will be published at least 5 days in advance in the Worcester Telegram.

Note: Notice of the public hearing including date, time, and place will be posted in City Hall not less than forty-eight (48) hours in advance.

Note: You may also contact your local conservation commission or the nearest Department of Environmental Protection Regional Office for more information about this application of the Wetlands Protection Act. To contact DEP, call

Central Region: 508-792-7650
Southwest Region: 508-946-2800

Northwest Region: 617-935-2160
Western Region: 412-784-1100
Abutter Notification List
CITY OF WORCESTER, MASSACHUSETTS

Edward M. Augustus, Jr.  
City Manager

John H. Valade, MAA  
Acting City Assessor

Administration and Finance  
Division of Assessing

Certified Abutters List

A list of ‘parties in interest’ shall be attached to the application form and shall include the names and addresses. All such names and addresses shall be obtained from the most recent applicable tax list maintained by the City’s Assessing Department. The Assessing Department certifies the list of names and addresses.

Total Count: 2  
X Abutters

Owner:  
Lake Quinsigamond Commission

Owner Mailing:

Petitioner (if other than owner):  
Jacquelyn Burmeister  
Petitioner Mailing Address:  
18 East Worcester Street

Petitioner Phone:  
508-929-1300

Parcel Address:  
Coal Mine Brook outlet (south)

Geographical Coordinates:  
42.290710, -71.758445

Assessor’s Map-Block-Lot(s):

Variance:  
Special Permit:  
Planning:  
Definitive Plan:  
Liquor:  
ConComm:  
X  
Hist:  
Other (Specify):

46-044-00001  
CITY OF WORCESTER DPW  
455 MAIN ST  
WORCESTER MA 01608

MA-DEP-QUINS  
LAKE QUINSIGAMOND COMMISSION  
PO BOX 4476  
SHREWSBURY MA 01545

This is to certify that the above is a list of abutters to the Coal Mine Brook outlet area south of the Coal Mine Brook outlet as cited above.

Certified by:  
John H. Valade  
1/31/2020

Signature  
Date
Cole Mine Brook outlet abutters map
Attachment A. Figures
Attachment B. Project Description

I. Overview

This Notice of Intent (NOI) is being submitted on behalf of the City of Worcester Department of Public Works and Parks (DPW&P) for work related to the construction of a FocalPoint biofiltration system at 616 Plantation Street in Worcester, MA. The proposed project will alter approximately 350 square feet of buffer zone to treat the stormwater generated from 7,000 square feet of impervious surface on Lake Ave North that drains to the associated catch basin. A site Locus Plans are included in Appendix A. The completed Notice of Intent (WPA Form 3) is included in Appendix B. Abutter notification information is included in Appendix C.

The purpose of this project is to improve water quality in Lake Quinsigamond at Coal Mine Brook. Stormwater in the catchment area of the basin associated with the proposed unit is presently untreated prior to exiting the outfall. The proposed FocalPoint design should provide filtration of this stormwater for up to 91% of total suspended solids, 72% of total phosphorus, and 77% of total nitrogen in up to a 1 inch storm. The project will also allow for the repair of the present catch basin so that excess stormwater in a high intensity event will not cause erosion of the stream bank.

The proposed project is located on the east side of North Lake Ave, on the south side of Coal Mine Brook, and on the DPW&P-owned parcel associated with 616 Plantation Ave. The project is within the jurisdiction of the Massachusetts Wetland Protection Act (WPA) as a portion of the project falls within the 100 foot buffer zone of Lake Quinsigamond and a portion of the project fall within the 25 foot riverfront area associated with Coal Mine Brook. In addition, the project is under jurisdiction of the Worcester Wetland Protection Ordinance (WWPO) due to proximity within the 15 ft and 30 ft WWPO buffer zones of Lake Quinsigamond.

DPW&P is requesting a waiver of Performance Standards 4.24 for work in the 15 ft WWPO buffer zone and construction in a 30 ft WWPO buffer zone. Because the final project outcome will be an improvement on existing stormwater conditions, DPW&P is also requesting a waiver of the Stormwater Report. However, the Stormwater Checklist and an Operation and Maintenance Plan for this device are included in this application.

II. Project Description

The proposed project is located at 616 Plantation Street and is comprised of installing a FocalPoint biofiltration system in the proposed location to reduce TSS and nutrient levels in stormwater entering the lake. The FocalPoint is an ultra-efficient, modular biofiltration system that treats and drains large volumes of stormwater runoff in a small footprint to meet post construction stormwater treatment requirements. The system can be installed along the edge of a roadway behind curb line, in landscaped stormwater basins and be incorporated into an urban green infrastructure streetscape.

The system is comprised of installing a geotextile or liner envelope, followed by a nine (9) inch tall box underdrain. The box underdrain is wrapped with an open mesh geotextile fabric. This is an open grid mesh, not a restrictive 8 oz. fabric (which is commonly a primary source of premature failure of bioretention and biofiltration systems). The purpose of the open grid is to prevent the 6 inch bridging stone layer from entering the box underdrain. Above the bridging stone is an 18 inch layer of high rate
biofiltration media followed by a 3 inch layer of clean shredded hardwood mulch. Plants will then be placed in the unit.

From the mulch surface to the bottom of the modular underdrain represents a vertical drop of three (3) feet from surface (inlet) to the invert out (outlet).

A. Proposed Construction

The project includes the following proposed activities:

Vegetation removal – Vegetation, including the invasive knotweed, within the area will be removed in preparation of focal point installation. However, no tree above 4 in in diameter will be removed.

Excavation– The approximate 750 square foot project area will be graded as shown on the attached Site Plan to properly accommodate the 30 square foot FocalPoint unit. Excavation of an area measuring 4" wide by 12' long to a depth of 3" will be required for the installation of the unit itself within the graded area.

Installation- Geo-textile will be cut and placed over the base and up the sides of the excavation and held in place with pins, staples, sandbags or other ballast. Modular underdrain units will be laid on top. Inspection ports will be made from pipe long enough to extend from the bottom of the Modular Underdrain to a point slightly above finished grade and installed directly into the underdrain. Microgrid Mesh will then be fit over the top and down both sides of the modular underdrain system. Adjacent strips of Mesh will overlap at least 12" or as shown on plans. Rock bags or other ballast will be used to temporarily secure overlaps. Outlet and inlet pipes will then be connected. Rip rap at the outlet pipe will be placed by hand. Backfill will then be added to the trench and a trench roller, plate compactor, or hand tamper will be used to compact backfill. After backfill is level, 6” of bridging stone, then 6” of high performance soils will be added. Following installation of soils, plants will be added per the plans specifications.

Repair of catch basin- The catch basin will undergo structural repairs and the roadway surrounding the basin will be resurfaced to repair erosion and damage resulting from high intensity rain events.

B. Project Alternatives

Section 3.1 of the Worcester Wetlands Protection Regulations requires that the reasonableness of alternatives be considered for the project.

No action- Doing nothing will allow the current situation to continue, permitting more potential erosion of the stream bank, and not provide reduction flow of nitrogen and phosphorus into the lake.

We believe that the water quality benefits of the installation of a biofiltration unit at this location far outweigh any minor impacts of siting the installation within the 15 foot and 30 foot WWPO buffer zones. The installation will provide additional TSS removal and greatly reduce nutrient loads from stormwater passing through the system.
III. Resource Areas

This section summarizes the temporary and permanent alterations to resource areas and Buffer Zones in close proximity to the proposed project area.

The resource areas and Buffer Zones that apply to this project include the 100-foot Buffer Zone for the Bordering Vegetated Wetlands (BVWs), the 30 ft buffer zone, and the 15ft non-disturbance zone.

C. Buffer Zone

The entire project area falls within the 100-foot WPA buffer zone of Lake Quinsigamond and the 30-foot WWPO buffer zone. Approximately 325 square feet of the project area is located within the 15-foot WWPO buffer zone of Lake Quinsigamond. The buffer zones are shown on the Site Plan in Appendix A.

IV. Mitigation Measures

Siltation barriers consisting of haybales and silt fence will be installed between the work area and resource areas to protect resource areas.

Any stockpiling of loose material will take place off-site outside the 100 foot buffer zone. Proprietary material (stone, sand, mulch) used in construction of the 30 SF biofilter will be delivered to the site by the manufacturer in bags and will remain in bags until being directly placed in the excavation.
FOCAL POINT SYSTEM PROPOSAL FOR
NORTH LAKE AVE SWM RETROFIT

WORCESTER, MA

Prepared for:
City of Worcester
Prepared by: ACF
Environmental
(800) 448-3636
Date: 12/12/19
Stormwater Quality Retrofit – North Lake Avenue
Worcester Massachusetts

STORMWATER TREATMENT ENGINEERING DESIGN SKETCHBOOK

Prepared by: Robert Woodman – ACF Environmental
Prepared for: Jacquelyn Burmeister – City of Worcester, MA.
Date: December 12, 2019

Introduction:

Based on a site visit earlier in the year, recent survey data, and correspondence with the City of Worcester, ACF Environmental has developed this “Engineering Design Sketchbook” for consideration to provide a high performance stormwater quality treatment solution on North Lake Avenue adjacent to Coal Mine Brook in Worcester, MA.

ACF is proposing the use of “FocalPoint” high rate biofiltration systems in this location to provide water quality treatment (TSS, Phosphorus and Nitrogen etc) for the first 1.0 inch of runoff from the tributary roadway area.

Reference Materials:

- Email correspondence with Jacquelyn Burmeister (City of Worcester)
- Site Visit with ACF and City staff
- Site Survey performed by the City of Worcester dated 11/21/2019
- Available web-based aerial photography (google.com, bing.com etc)

Stormwater Best Management Practices Considered:

- FocalPoint Biofiltration System (for treatment of roadways)
- ACF Beehive Overflow Filter – (major storm overflow structures)

Proposed BMP Technical Data Summary:

As listed above, ACF Environmental proposes the use of FocalPoint biofiltration system for treatment with a Beehive Overflow Filter riser of conveyance of major storm overflows. The treated runoff will be conveyed to Coal Mine Brook before entering Lake Quinsigamond.

A summary of these technologies is provided on the following pages:
FocalPoint:

Product Overview:

The FocalPoint is an ultra-efficient, modular biofiltration system that treats and drains large volumes of stormwater runoff in a small footprint to meet post construction stormwater treatment requirements. The system can be installed along the edge of a roadway behind curb line, in landscaped stormwater basins and be incorporated into an urban green infrastructure streetscape. Some examples of the system are illustrated below:

![FocalPoint Images](image1.png)

Figure 1 (below) shows the basic cross section of the FocalPoint unit.

![FocalPoint Cross Section](image2.png)

Figure 1: FocalPoint Cross Section

As shown the system (from bottom up) consists of a geotextile or liner envelope, followed by a nine (9) inch tall box underdrain (R-Tank). The box underdrain in more efficient at collecting and conveying the runoff than a typical crushed stone and pipe configuration. This is important when considering the rate at which the runoff is passing through the media (discussed below). The box underdrain is wrapped with an open mesh geotextile fabric. This is an open grid mesh, not a restrictive 8 oz. fabric (which is commonly a primary source of premature failure of bioretention and biofiltration systems). The purpose of the open grid is to prevent the 6 inch bridging stone layer from entering the box underdrain. Above the bridging stone is an 18 inch layer of high rate biofiltration media followed by a 3 inch layer of clean shredded hardwood mulch. Plants can then be placed in the unit.

From the mulch surface to the bottom of the modular underdrain represents a vertical drop of three (3) feet from surface (inlet) to the invert out (outlet).
The high flow media infiltrates at a rate of 100 inches per hour. As such, the size and volume of the engineered media beds can be reduced by 80% or more, when compared to typical bioretention systems that infiltrate at rates of less than five (5) inches per hour. Reducing system size brings multiple benefits, including reduced and simplified maintenance procedures, savings in the amount of excavation (great benefit when working with contaminated soils), reduction in quantity of impermeable liner, stone, underdrain, materials to name a few. FocalPoint assures performance by providing media testing reports prior to shipment and performing an in-situ test after installation to confirm the infiltration rate. A product specification is provided in Attachment A.

FocalPoint Sizing:

The FocalPoint is sized to treat the entire “water quality volume” prior to overflow (typically set six (6) to eight (8) inches above the FocalPoint). FocalPoint sizing is iterative and site specific based on the available space above the unit for temporary storage of the water quality volume prior to overflow. For example, on a site with little available space for the water quality volume above the unit, the FocalPoint may need to be increased in size to utilize the 100 inch/hr. infiltration rate to ensure the entire water quality volume passes through the unit. Based on the third party field testing a minimum FocalPoint bed area ratio was established at 174 sf of FocalPoint per acre of impervious tributary area. A key design parameter is having the system draw down within 48 hours from the commencement of the storm.

HydroCAD or similar modelling program can be used to refine the size and configuration of the FocalPoint system and to confirm that the volume associated with the water quality rainfall event (based on a Type III 24hr storm distribution) is treated prior to activation of the overflow.

If beyond the treatment component of the design, extended major storm detention or infiltration into native soil is the goal (i.e. quantity control), the R-Tank box underdrain can be expanded to store the runoff and slowly release through outlet control or infiltrate through the native soils. This provides engineers and designers the ability to handle both quality and quantity control in a space efficient footprint.

The high flow media provides removal of phosphorus, Nitrogen, TSS, Metals, Oils and Grease and Bacteria. Third lab testing and Field (TAPE/TARP level) have been conducted on the FocalPoint and the results for TSS, P and N are provided on the next page.

Copies of both the third party lab and field test protocols and results can be provided upon request.
<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Lab Based % Removal</th>
<th>(CONC) TAPE Field Test % Removal</th>
<th>(MASS) TAPE Field Test % Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Suspended Solids:</td>
<td>91%</td>
<td>84.4%</td>
<td>91.4%</td>
</tr>
<tr>
<td>Total Phosphorus</td>
<td>66%</td>
<td>52%</td>
<td>72.5%</td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>48%</td>
<td>58.7%</td>
<td>77.9%</td>
</tr>
</tbody>
</table>

**FocalPoint Installation:**

An installation guide is enclosed as Attachment B. A typical engineering drawing/detail is enclosed in Attachment C providing all critical dimensions and elevations.

Protecting the FocalPoint Biofiltration System during construction is of the utmost importance. The sediment contained in the runoff from a non-stabilized drainage area may contaminate the biofiltration media and reduce the effectiveness of the FocalPoint system.

Excess filter fabric is provided for each unit to allow for the side wall fabric to be extending up and over the top of the entire unit. The fabric should be wrapped over the mulch with at least a 6” overlap, much like wrapping a present. With a torch, the two fabrics are tack-welded together by melting the top layer with the bottom layer. Non-woven geotextiles are flammable and extreme caution must be taken while doing this. This procedure will create a perfect seam that will prevent sediment entering the system. If the fabric is cut too short, a patch can be made for the uncovered area with another piece of geotextile, welding it all the way around. This fabric should be left in place until the tributary areas are stabilized.

**FocalPoint Maintenance:**

Maintenance of the FocalPoint units is simple. Annual removal and replacement of mulch is the main task at hand. This can be performed by public works/maintenance/Landscape contractor as part of regular streetscape maintenance or by local arborist/horticulturist. As it is an open system, it is easy to access the entire surface. Any winter sand gets caught by the mulch and can be easily raked out with the mulch. The first year of maintenance is provided at no charge and ACF Environmental can provide training to the identified maintenance party if needed.

A complete operations and maintenance manual is included as Attachment D.
ACF Beehive Overflow Filter:

Product Overview:

The Beehive Overflow Filter utilizes a Harco drain with beehive grate and a ACF "Stormsok" filter insert within the opening to the structure. The Stormsok is a highly-effective catch basin insert that utilizes a woven geotextile bag to capture sediment, trash and other debris in stormwater runoff.

This solution is effective as an overflow device for any bioretention/biofiltration system to capture mulch, trash and other floatables that wash into the system.

The Bioretention Overflow Filter is available in several sizes: 12", 15" 18", 24" and 30" diameter. Typical engineering details are provided in Attachment E. Figure 2 provides some images of the Fabco StormSok and Stormsok/Harco drain unit. A basic maintenance guide is included in Attachment F.

*Figure 2: StormSok and Harco Drain with Beehive Grate*
**Preliminary Sizing and Design Concept:**

Based on information from the City, the approximate tributary area to the FocalPoint is as follows:

- FocalPoint #1  
  Trib Impervious Area = 7,000 sf (0.161 acres)

Based on the 3rd party field test that was conducted – a min FocalPoint bed area of 174 sf per impervious tributary acre is used to determine the minimum FocalPoint size.

Based on this ratio, the min FocalPoint bed area required for this system is as follows:

- FocalPoint #1  
  FocalPoint Size = 28 sf

**A 30 sf FocalPoint system (3’ x 10’) was selected for this project**

HydroCAD is then used to determine if the minimum FocalPoint bed area is sufficient to treat the water quality volume prior to activation of the beehive overflow – set 6 inches above the FocalPoint mulch surface.

To perform this analysis a Water Quality (WQ) Rainfall event (Type III 24hr distribution) is created with a rainfall amount that generates a 1.0 inch +/- runoff volume.

Assuming a 1 inch runoff depth for the WQ volume – the WQ volume for this project was found to be 583 CF

HydroCAD was used to confirm that the 30 sf FocalPoint and the surface ponding was capable of treating the WQ Volume prior to bypass.

A sketch of the proposed system and layout is provided on the following page:
Preliminary Opinion of Materials Cost:

The data table below provides a preliminary opinion of cost for the materials associated with the proposed design:

**FOCALPOINT #1**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Material Cost ($) / Unit</th>
<th>Quantity</th>
<th>Delivered Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FocalPoint</td>
<td>SF</td>
<td>$175.00</td>
<td>30</td>
<td>$5,250.00</td>
</tr>
<tr>
<td>12” Harco Drain w Domed Cover and filter insert</td>
<td>EACH</td>
<td>$1,200.00</td>
<td>1</td>
<td>$1,200.00</td>
</tr>
<tr>
<td>Excavation and Export</td>
<td>CY</td>
<td>-</td>
<td>-</td>
<td>By City</td>
</tr>
<tr>
<td>Horizontal Piping</td>
<td>LS</td>
<td>-</td>
<td>-</td>
<td>By City</td>
</tr>
<tr>
<td>Riprap/rounded river stone</td>
<td>SY</td>
<td>-</td>
<td>-</td>
<td>By City</td>
</tr>
<tr>
<td>Plantings</td>
<td>LS</td>
<td>$250.00</td>
<td>1</td>
<td>$250.00</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>$6,700.00</strong></td>
</tr>
</tbody>
</table>

**Closure:**

ACF Environmental appreciates the opportunity to provide the above information regarding the North Lake Avenue/Coal Mine Brook stormwater quality retrofit project in Worcester, MA and looks forward to supporting the City on this project.

Sincerely,

[Signature]

Robert J Woodman, 
Senior Stormwater Engineer

Cc: Lee Jones, ACF Environmental

Enclosures
SPECIFICATION
HIGH PERFORMANCE MODULAR BIOFILTRATION SYSTEM (HPMBS)
Material, Performance and Installation Specification

I. Summary

The following general specifications describe the components and installation requirements for a volume based High Performance Modular Biofiltration System (HPMBS) that utilizes physical, chemical and biological mechanisms of a soil, plant and microbe complex to remove pollutants typically found in urban storm water runoff. The modular treatment system in which the biologically active biofiltration media is used shall be a complete, integrated system designed to be placed in Square Foot or Linear Foot increments per the approved drawings to treat contaminated runoff from impervious surfaces.

The High Performance Modular Biofiltration System (HPMBS) is comprised of the following components:

A. Plant Component

1. Supplier shall provide a regionalized list of acceptable plants.

2. Plants, as specified in the approved drawings/supplier's plant list, shall be installed at the time the HPMBS is commissioned for use.

3. Plants and planting are typically included in landscape contract.

B. Biofilter Component

1. This component employs a high performance cross-section in which each element is highly dependent on the others to meet the performance specification for the complete system. It is important that this entire cross-section be provided as a complete system, and installed as such.

2. As indicated in the approved drawings, the elements of the Biofilter include:

   A. A mulch protective layer (if specified).

   B. An advanced high infiltration rate biofiltration planting media bed which utilizes physical, chemical and biological mechanisms of the soil, plant, and microbe complex, to remove pollutants found in storm water runoff.

   C. A separation layer which utilizes the concept of 'bridging' to separate the biofiltration media from the underdrain without the use of geotextile fabrics.
D. A *wide aperture mesh layer* utilized to prevent bridging stone from entering the underdrain/storage element.

E. A *modular, high infiltration rate flat pipe* style underdrain/storage system which is designed to directly infiltrate or exfiltrate water through its surface. The modular underdrain must provide a minimum of 95% void space.

C. **Energy Dissipation Component**

1. An Energy Dissipation Component is typically specified to slow and spread out water as it enters the system. This component is dependent upon the design in the approved drawings, but typically consists of a rock gabion, rock filter dam or dense vegetation element, such as native grasses, either surrounding the Biofiltration Component or located immediately upstream of it.

D. **Pretreatment Component**

1. Pretreatment, when specified, is typically accomplished by locating the Biofiltration Component within a traditional vegetated BMP such as a vegetated swale, vegetated depression, traditional bioretention system, vegetated filter strip, sediment forebay, etc. These BMPs provide primary TSS removal when desirable.

E. **Observation and Maintenance Component**

1. An Observation and Maintenance Port shall be installed per the approved drawings to provide for easy inspection of the underdrain/storage element, and cleanout access if needed.

F. **Extreme Event Overflow (by others)**

1. An Extreme Event Overflow should be located external to, but near the Biofiltration element to provide bypass when needed. This may be an overland flow bypass structure, beehive overflow grate structure, or equivalent that serves the purpose. If a beehive overflow structure is utilized it should include a removable filter insert to provide for effective control of gross pollutants, trash and floatables.

II. **Quality Assurance and Performance Specifications**

The quality and composition of all system components and all other appurtenances and their assembly process shall be subject to inspection upon delivery of the system to the work site.

Installation is to be performed only by skilled work people with satisfactory record of performance on earthworks, pipe, chamber, or pond/landfill construction projects of
comparable size and quality.

A. Plants

1. Plants must be compatible with the HPMBS media and the associated highly variable hydrologic regime. Plants are typically facultative with fibrous roots systems such a native grasses and shrubs.

2. Supplier shall provide a regionalized list of acceptable plants.

3. All plant material shall comply with the type and size required by the approved drawings and shall be alive and free of obvious signs of disease.

B. Mulch

1. Mulch, typically double shredded hardwood (non-floatable), shall comply with the type and size required by the approved drawings, and shall be screened to minimize fines.

C. Biofiltration Media

1. Biologically active biofiltration media shall be visually inspected to ensure appropriate volume, texture and consistency with the approved drawings, and must bear a batch number marking from the supplier which certifies performance testing of the batch to meet or exceed the required infiltration rate (100 in/hr). A third party laboratory test must be provided to certify the 100 in/hr rate.

2. Within 90 days after project completion, the infiltration rate shall be confirmed at the supplier’s expense, by a wetted condition hydraulic conductivity test.
   a. *Failure to pass this test will result in removal and replacement of all media in the system at no cost to the project owner/operator.*
   b. *Test must utilize the equipment and follow the standard operating procedures found in the Harris County Texas manual entitled, Low Impact Development & Green Infrastructure Design Criteria for Storm Water Management (2011).*
   c. *Replacement media, if required, must be taken from a different batch than the original.*

3. Supplier shall provide, at no additional cost to the project owner/operator, maintenance of the biofiltration system for a period of one year.

4. Pollutant Removal performance, composition and characteristics of the Biofiltration Media must meet or exceed the following minimum standards as
demonstrated by testing acceptable to the project engineer:

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Removal Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSS</td>
<td>&gt; 90%</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>≥ 60%</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>≥ 48%</td>
</tr>
</tbody>
</table>

**Composition and Characteristics**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand - Fine</td>
<td>&lt; 5%</td>
</tr>
<tr>
<td>Sand - Medium</td>
<td>10% - 15%</td>
</tr>
<tr>
<td>Sand - Coarse</td>
<td>15% - 25%</td>
</tr>
<tr>
<td>Sand - Very Coarse</td>
<td>40% - 45%</td>
</tr>
<tr>
<td>Gravel</td>
<td>10% - 20%</td>
</tr>
<tr>
<td>Infiltration Rate</td>
<td>&gt; 100 inches per hour</td>
</tr>
<tr>
<td>Peat Moss*</td>
<td>5% - 15%</td>
</tr>
</tbody>
</table>

*Peat Moss Specification*

- Listed by Organic Materials Review Institute
- 100% natural peat (no composted, sludge, yard or leaf waste)
- Total Carbon > 85%
- Carbon to Nitrogen Ratio 15:1 to 23:1
- Lignin Content 49% to 52%
- Humic Acid > 18%
- pH 6.0 to 7.0
- Moisture Content 30% to 50%
- 95% to 100% passing 2.0mm sieve
- > 80% passing 1.0mm sieve

D. **Underdrain/Storage System**

1. Underdrain/storage components shall be manufactured in an ISO certified facility and be manufactured from at least 90% post consumer recycled materials.

2. Underdrain/storage components shall meet or exceed the following characteristics:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Void Area</td>
<td>≥ 85%</td>
</tr>
<tr>
<td>Unit Weight</td>
<td>3.25 lbs/cf</td>
</tr>
<tr>
<td>Service Temperature</td>
<td>-14° to 167°</td>
</tr>
<tr>
<td>Unconfined Crush Strength</td>
<td>32.48 psi</td>
</tr>
</tbody>
</table>

**180 Day Creep Test**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load Applied – Initial and Sustained</td>
<td>11.16 psi</td>
</tr>
<tr>
<td>Creep Sustained – After 180 Days</td>
<td>0.20 inches</td>
</tr>
<tr>
<td>Creep Sustained – After 180 Days</td>
<td>1.13 %</td>
</tr>
<tr>
<td>Projected Creep – 40 years</td>
<td>1.72%</td>
</tr>
</tbody>
</table>
E. Separation Mesh

1. Separation Mesh shall be composed of high-tenacity monofilament polypropylene yarns that are woven together to produce an open mesh geotextile which shall be inert to biological degradation and resistant to naturally encountered chemicals, alkalis and acids. The mesh shall meet or exceed the following characteristics:

<table>
<thead>
<tr>
<th>Properties</th>
<th>Test Method</th>
<th>Unit</th>
<th>Min Ave Roll Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>MD</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM D4595</td>
<td>kN/m (lbs/ft)</td>
<td>21 (1440)</td>
</tr>
<tr>
<td>Creep Reduced Strength</td>
<td>ASTM D5262</td>
<td>kN/m (lbs/ft)</td>
<td>6.9 (471)</td>
</tr>
<tr>
<td>Long Term Allowable Design Load</td>
<td>GRI GG-4</td>
<td>kN/m (lbs/ft)</td>
<td>5.9 (407)</td>
</tr>
<tr>
<td>UV Resistance (at 500 hours)</td>
<td></td>
<td>% strength</td>
<td>90</td>
</tr>
<tr>
<td>Aperture Size (machine direction)</td>
<td>-</td>
<td>mm (in)</td>
<td>2 (0.08)</td>
</tr>
<tr>
<td>Aperture Size (cross machine direction)</td>
<td>-</td>
<td>mm (in)</td>
<td>2 (0.08)</td>
</tr>
<tr>
<td>Mass/Unit Area</td>
<td>ASTM D5261</td>
<td>g/m² (oz/yd²)</td>
<td>197 (5.8)</td>
</tr>
</tbody>
</table>

F. Bridging Stone

1. Bridging Stone shall be 3/8" pea gravel, or other diameter sized to prevent migration of filter media, as specified by supplier.

2. Stone must be washed and free from sediment, soil and contaminants.

III. Delivery, Storage and Handling

A. Protect all materials from damage during delivery and store UV sensitive materials under tarp to protect from sunlight including all plastics, when time from delivery to installation exceeds one week. Storage should occur on smooth surfaces, free from dirt, mud and debris.

B. Biofiltration media shall be segregated from any other aggregate materials and shall be protected against contamination, including contamination from any stormwater runoff from areas of the site which are not stabilized.
IV. Submittals

A. Product Data

1. Submit supplier's product data and approved Installation Manual as well as supplier's Operations and Maintenance Manual for the system. It will be the responsibility of the system owner/operator or their contractor to ensure the system is operated and maintained in accordance with the manual.

B. Certification

1. Supplier shall submit a letter of certification that the complete system meets or exceeds all technical and packaging requirements. Biofiltration media packaging must bear a batch number marking from the supplier which matches a letter from the supplier certifying performance testing of the batch to meet or exceed the required infiltration rate.

C. Drawings

1. Supplier shall provide dimensional drawings including details for construction, materials, specifications and pipe connections.

D. Warranty

1. Supplier shall provide a warranty for all components of the HPMBS for a period of one year provided the unit is installed, operated and maintained in accordance with the manual. Improper operation, maintenance or accidental or illegal activities (i.e. dumping of pollutants, vandalism, etc.) will void the warranty. Biofiltration media shall be warranted to pass the post-installation infiltration test described in this document.

E. Design Computations

1. The HPMBS must be sized using a volume based sizing criteria and demonstrate, using a SCS stormwater modeling software/spreadsheet calculator that the required water quality volume (defined by the Engineer of Record) passes through the HPMBS prior to activation of the overflow device (set no lower higher than six (6) inches above the top elevation of the HPMBS (typically defined as top of mulch)). Design computations must be provided as part of the submittal process. Sizing based solely on a filter surface area to drainage area ratio method will not be accepted.

F. Substitutions

1. Any proposed equal alternative product substitution to this specification must be submitted for review and approved prior to bid opening. Review package should include third party reviewed performance data of the biofiltration media that includes saturated conductivity measurements and pollutant removal efficiency. Pollutant removal data must follow specified protocols. All components must meet or exceed Quality Assurance and Performance Criteria indicated herein.
V. Project Conditions

A. Review supplier's recommended installation procedures and coordinate installation with other work affected, such as grading, excavation, utilities, construction access and erosion control to prevent all non-installation related construction traffic over the completed HPBMS.

B. Cold Weather

1. Do not use frozen materials or materials mixed or coated with ice or frost.
2. Do not build on frozen ground or wet, saturated or muddy subgrade.
3. Care must be taken when handling plastics when air temperature is at 40 degrees or below as plastic becomes brittle.

C. Protect partially completed installation against damage from other construction traffic when work is in progress and following completion of backfill by establishing a perimeter with highly visible construction tape, fencing, or other means until construction is complete.

D. Soil stabilization of the surrounding site must be complete before the Biofiltration System can be brought online. Soil stabilization occurs when 90% of the site has been paved or vegetated. Temporary erosion control and/or sedimentation prevention measures shall be implemented to reduce the possibility of sediments being transported into the Biofiltration System prior to full stabilization of the site. Significant sediment loads can damage the HPBMS and lead to failure if not prevented or remediated promptly.

VI. PRODUCTS

A. Acceptable HPBMS

FocalPoint High Performance Biofiltration System

B. Acceptable Beehive Overflow Grate Structure (Optional)

Beehive Overflow Grate Structure with removable StormSack

C. Acceptable System Supplier

Convergent Water Technologies, Inc. 
(800) 711-5428 
www.convergentwater.com
D. Authorized Value Added Reseller

ACF Environmental
2831 Cardwell Road
Richmond, VA 23234
(800 448-3636
www.acfenvironmental.com

VII. Packaging

A. HPMBS is assembled on site.

B. Modular underdrain/storage unit is shipped flat and modules are assembled prior to installation.

C. Biofiltration media is delivered in one ton super sacks each labeled with supplier's batch number and/or in bulk with accompanying supplier's certification.

D. Other components are delivered in bulk or super sacks

VIII. Execution

A. Excavation and Backfill

1. Base of excavation shall be smooth, level and free of lumps or debris, and compacted unless infiltration of storm water into subgrade is desired. A thin layer (3") of compacted base material is recommended to establish a level working platform (may not be needed in sandy soils). If the base of the excavation is pumping or appears excessively soft, a geotechnical engineer should be consulted for advice. In many cases, a stabilization geotextile and 6" of compactable material that drains well will be sufficient to amend the bearing capacity of the soil.

2. Most applications require 8 oz Non-Woven Geotextile or equivalent nonwoven geotextile with a nominal weight of 8 oz per square yard to line the excavation to separate in situ soils and the HPMBS. (Applications requiring water to infiltrate the in situ sub-soils should use a bridging stone rather than geotextile to provide a separation layer between the HPMBS and the in situ soils). Geotextile, when utilized, should be placed on the bottom and up the sides of the excavation. Absolutely no geotextiles should be used in the water column. If an impermeable liner is specified, it shall be installed according to supplier's instructions and recommendations.

3. Specified backfill material must be free from lumps, debris and any sharp objects that could penetrate the geotextile. Material is used for backfill along the sides of the system as indicated in engineering detail drawings.
B. Inspection

1. Examine prepared excavation for smoothness, compaction and level. Check for presence of high water table, which must be kept at levels below the bottom of the under drain structure at all times. If the base is pumping or appears excessively soft, a geotechnical engineer should be consulted for advice.

2. Installation commencement constitutes acceptance of existing conditions and responsibility for satisfactory performance. If existing conditions are found to be unsatisfactory, contact Project Manager or Engineer for resolution prior to installation.

IX. Cleanup and Protection during Ongoing Construction Activity

A. Perform cleaning during the installation and upon completion of the work.

B. Remove from site all excess materials, debris, and equipment. Repair any damage to adjacent materials and surfaces resulting from installation.

C. If surrounding drainage area is not fully stabilized, a protective covering of geotextile fabric should be securely placed to protect the Biofiltration Media.

D. Construction phase erosion and sedimentation controls shall be placed to protect the inlet(s) to the Biofiltration System. Excessive sedimentation, particularly prior to establishment of plants may damage the HPMBS.

E. Strictly follow supplier's guidelines with respect to protection of the HPMBS between Installation and Commissioning phases.

X. Commissioning

A. Commissioning should only be carried out once the contributing drainage area is fully stabilized. If Commissioning must be carried out sooner, it is imperative that appropriate erosion and sediment controls be placed to prevent the entry of excessive sediment/pollutant loads into the system.

B. Commissioning entails removing the protective covering from the Biofiltration Media, planting the plant material in accordance with the approved drawings, and placing mulch if specified.

1. Dig planting holes the depth of the root ball and two to three times as wide as the root ball. Wide holes encourage horizontal root growth that plants naturally produce.

2. With trees, you must ensure you are not planting too deep. Don’t dig holes deeper than root balls. The media should be placed at the root collar, not above the root collar. Otherwise the stem will be vulnerable to disease.

C. Cover the exposed root ball top with mulch. Mulch should not touch the plant base because it can hold too much moisture and invite disease and insects. Evenly place 3 inches of double-shredded hardwood mulch (if specified) on the surface of the media.

D. Plantings shall be watered-in at installation and temporary irrigations shall be provided, if specified.

XI. Using the HPMBS

A. Maintenance Requirements

1. Each correctly installed HPMBS is to be maintained by the supplier for a minimum period of one year. The cost of this service is to be included in the supplier's price of the system.

2. Annual maintenance consists of two (2) scheduled visits unless otherwise specified.

3. Each maintenance visit consists of the following:
   1. Complete system inspection
   2. Removal of foreign debris, silt, plant material, trash and mulch (if needed)
   3. Evaluation of biofiltration media
   4. Evaluation of plant health
   5. Inspection of underdrain/storage system via Observation/Maintenance Port
   6. Properly dispose of all maintenance refuse items (trash, mulch, etc.)
   7. Take photographs documenting plant growth and general system health
   8. Update and store maintenance records
   9. To ensure long term performance of the HPMBS, continuing annual maintenance should be performed per the supplier's Operations and Maintenance Manual.

4. If sediment accumulates beyond an acceptable level in the underdrain/storage system, it will be necessary to flush the underdrain. This can be done by pumping
water into the Observation/Maintenance Port or adjacent overflow structure, allowing the turbulent flows through the underdrain to re-suspend the fine sediments. If multiple Observation/Maintenance Ports have been installed, water should be pumped into each port to maximize flushing efficiency.

Sediment-laden water can be pumped out and either captured for disposal or filtered through a Dirtbag filter bag, if permitted by the locality.

XII. Measurement and Payment

Given the integrated nature of the HPMBS, measurement and payment will be based not on the individual component prices, but on the size of the Biofiltration Media bed. The external dimension as indicated in the approved plans and executed in the installation will be measured in Square Feet and payment will be made per HPMBS system.

Measurement and payment of beehive overflow grate structure with removable filter insert will be based on per unit price.
Stormwater Treatment Proposal
Attachment B
FocalPoint
BIOFILTRATION SYSTEMS

High Performance Modular Biofiltration System (HPMBS)
Installation Guide
Summary

FocalPoint High Performance Modular Biofiltration System (HPMBS) is a scalable biofiltration system which combines the efficiency of high flow rate engineered soils with the durability and modularity of an open cell underdrain/storage/infiltration system.

The following contents of this Installation Guide are the necessary steps required for FocalPoint HPMBS installation, and activation. In this guide you’ll find detailed chapters with corresponding photos for each step, to improve ease of installation and your profitability on the project. You’ll be advised about specific steps which require extra attention.

ALL STEPS MUST BE COMPLETED IN THE ORDER OUTLINED TO ENSURE A SUCCESSFUL FOCALPOINT INSTALLATION AND ACTIVATION.

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- 5. Install Modular Underdrain
- 6. Install Inspection/Maintenance Port(s)
- 7. Install Microgrid Mesh
- 8. Backfill Sides & Top with Bridging Aggregate
- 9. Place High Performance Biofiltration Soil
- 10. Place & Fill Gabion (If Specified)
- 11. Protect the System to be Activated Later
- 12. Activate the System (REQUIRED)
- 13. Plantings & Mulch
- 14. Performance Verification
General Notes

Be sure to contact your local Convergent Water Technologies Value Added Reseller (VAR) at least two weeks prior to installation. We will provide you with onsite installation support AT NO CHARGE in order to facilitate a successful installation.

All pictures, illustrations and instructions have been included to guide you through a typical installation. The approved engineering drawing should ALWAYS take precedence over these instructions.

It is advised that the FocalPoint HPMBS be installed after site stabilization, or when other landscaping is being done. The components of the FocalPoint system include an engineered, high-flow media that must be protected from site erosion and sediment. The easiest way to prevent this is to not install it until the final phase of construction.

However, if it is necessary that the system be installed prior to final stabilization, this guide provides instructions for our 'cap & seal' procedure that will protect the integrity of the system until activation is deemed appropriate (i.e., after the site is at least 90% stabilized). Failure to adequately protect the system will result in premature contamination and possible system failure.

Throughout this document you will see three types of notes:

**TIP:** Ideas to improve your efficiency and profitability on the installation

**IMPORTANT:** Steps that require extra attention

**WARNING:** Critical issues that MUST be handled correctly to ensure a successful installation

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Pre-Construction Checklist

TOOLS YOU WILL NEED:
- Laser or Transit
- Measuring Tape (Long enough to mark FocalPoint HPMBS footprint)
- Razor Knife
- Screw Driver / Nut Driver Set
- String Line
- Marking Paint
- Reciprocating Saw (To cut Inspection & Maintenance Port and Receiving Holes)
- Dead Blow Mallet
- Worktable (3/4" plywood placed on saw horses works well)
- Hog Ring Gun and Rings for Gabion (if specified)
- Level
- Torch (etc) to "weld" geotextile for 'cap & seal' step

MATERIALS YOU WILL NEED:
- Modular Underdrain Panels
- 8oz Non-Woven Geotextile to line excavation
- Microgrid Mesh
- Washed Bridging Stone (Typically 3/8" - 1/2" pea gravel)
- High Flow Biofiltration Media
- Base Material (95% compactable angular stone (1/2" - 1 1/2") or coarse sand
- Pipe Boot Kits (If not using kits, you will need duct tape and a stainless steel band clamp for each inlet and outlet pipe, and for each inspection or maintenance port.)
- Pipe for Inspection and Maintenance Ports (Typically 6" or 12" SCH 40 PVC)
- Pipe Cap & Serialized FocalPoint Identification Cover
- Gabion basket(s) or other energy dissipation device (If Specified)
- Rock (For Gabions or Flow Dissipation, if Specified)
- Aged, Double Shredded Hardwood Bark Mulch, which has been screened to remove fines
- 10-33mm EPDM, or other impermeable material sized to cover the surface of the media bed, if the system will not be immediately activated.

EQUIPMENT YOU WILL NEED:
- Forklift and other equipment/tools needed to unload box truck
- Walk behind trench roller (plate compactor may also work)

Note: This list does not include equipment or tools needed to excavate or level the floor of the excavation
ASSEMBLE MODULAR UNDERDRAIN

If Modular Underdrain units arrive on your project in flat panels they will need to be assembled on-site. Assembling the units should take 2-3 minutes per module. This is a conservative estimate used to approximate the total man hours needed for assembly. The estimate includes the workers doing the assembly as well as material handling people to keep the assembly workers moving.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Mini</th>
<th>Single</th>
<th>Double</th>
<th>Triple</th>
<th>Quadruple</th>
<th>Penta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>2-3 minutes</td>
<td>2-3 minutes</td>
<td>4-6 minutes</td>
<td>6-9 minutes</td>
<td>8-12 minutes</td>
<td>10-15 minutes</td>
</tr>
</tbody>
</table>

Assembly Instructions – following the drawings in Fig. 2: Connect four small panels (B) into one large panel (A) using the short pegs (not the long pegs). Attach small panels onto the large panel at the locations marked in red on Fig. 1. Do NOT use the row of pin holes directly in the center or the two interior rows nearest the edges, as marked in red on Fig. 1. Next, working from one end to the other, attach a second large plate (A) on the opposite side of the first. Once the top and bottom large plates are attached, two more side plates (A) are attached to complete the sides of the Modular Underdrain unit. The picture in figure 2 shows is a SINGLE MINI Modular Underdrain. A single modular underdrain unit will be assembled in the same manner.

To build a DOUBLE unit (or larger), follow the directions above, starting at “Assembly Instructions:” using the top of the existing unit as the large plate. Bottom of the next module.

TIP: To increase the speed of the installation, many contractors choose to assemble the Modular Underdrain units prior to or during excavation (Step 2) and base preparation (Step 3) (Fig. 3). Other contractors wait until these steps are completed and then perform the assembly IN THE EXCAVATION allowing completed units to be placed into their final location as they are assembled. Consider which option will work best for your project.
2 EXCAVATE

Excavate the designated area according to plans. Typical excavations should include:

- One foot perimeter around underdrain modules to allow for proper compaction of backfill
- Enough depth to accommodate a minimum 3" base (if required) below the underdrain modules

Level the bottom of the excavation (Fig. 4) as shown on plans. Most excavations have a flat bottom while some will slightly slope toward the outlet pipe.

Prepare the subgrade according to plans. This could require compaction for stability or prohibit compaction to promote infiltration.

If the subgrade is pumping or appears excessively soft, the design engineer should be consulted for advice. In many cases a stabilization geotextile and 6" of compactable material that drains well will be sufficient to amend the bearing capacity of the soil.

3 PREPARE BASE

Standing water in the excavation will prevent proper base preparation and must be removed, if present. In regions with sandy soils meeting the requirements noted and where the subgrade elevation is above the groundwater table, imported base materials may not be needed.

Base materials must be:

| Compaction | 95% Compaction (if infiltration is not a primary goal) |
| Shape | Angular |
| Size | Not larger than 1.5" in diameter |
| Consistency | Free of lumps, debris, and sharp objects that could cut geotextile |
| Applicability | Stone or coarse sand is acceptable if it meets requirements; In no case shall clays be used |

Grade and level base as shown on plans.

TIP: Creating a smooth, level platform will allow for faster installation of Modular Underdrain, as units will fit together evenly, eliminating detail work that can delay your progress (Figure 5)

Figure 5: Base must be smooth to ensure units fit together without gaps
4 PLACE GEOTEXTILE ENVELOPE

Geotextile will be required on all FocalPoint HPMB System installations to separate the surrounding in-situ soils from the FocalPoint System. Check your plans to ensure that geotextile is to line your entire excavation, or will only be placed on the sides (if infiltration is a primary goal).

Cut full-width strips of Geotextile to the proper length and place them over the base and up the sides of the excavation, covering the floor and beyond walls of the excavation. This will be important in fulfilling step 11.

**IMPORTANT:** Allow enough geotextile to wrap the top of the system. This will aid in protecting the system until the site is completely stabilized and ready for activation.

Geotextiles are flammable. No smoking should be permitted on the geotextile.

Adjacent panels of material should be overlapped by 12” or more, as shown on the plans (Fig. 6).

Use pins, staples, sandbags or other ballast to hold the geotextile in place, preventing it from blowing or sliding out of position.

**TIP:** A prefabricated geotextile envelopes are available for smaller systems. This helps cut down waste and speeds up the installation process (Fig. 7).

5 INSTALL MODULAR UNDERDRAIN

Determine the starting location. It is often helpful to use an inlet or outlet pipe to guide you. Using a string line, establish two adjacent edges of the Modular Underdrain footprint. Ensure that your corner is square. Mark these two edges with marking paint and remove the string line (Fig. 8).
Begin placing Modular Underdrain in the corner of the marked area. Do NOT place units on their sides, as this will void the warranty. Check your plans to ensure correct orientation of the Modular Underdrain (Fig. 9).

Check the plans to ensure the Modular Underdrain is running in the correct direction (North/South vs. East/West) to match the footprint shown.

Figure 9: Make sure the tanks are oriented properly in the excavation.

Figure 8: Place modular underdrain in specified configuration within geotextile envelope.

Modular Underdrain units should fit together evenly. Minor gaps between units (< 1/4") or variations in the height of the units (< 1/2") are acceptable (Fig. 9A), but reasonable efforts should be made to minimize these variations. Minor gaps will be eliminated during compaction of side backfill material.

No lateral connections between adjacent underdrains modules are required.

Figure 9A: Minor Variations (less than width of top plate) in tank height are acceptable.
6 INSTALL INSPECTION/MAINTENANCE PORTS

All ports should be made from pipe long enough to extend from the bottom of the Modular Underdrain to a point slightly above finished grade of the FocalPoint HPMBS. Taller is better, as the pipes can be trimmed on completion of the system installation. They are typically Schedule 40 PVC pipe, but can be formed from other types of pipe, as well.

Identify the location of all ports as specified on the approved drawings and remove the Underdrain Module(s) which will receive the port from each location.

Cut the pipe to length, leaving enough excess to trim the top when final grade is reached.

Cut several horizontal slots in the pipe starting at the bottom (Fig. 11). Slots should extend as high as the height of the lowest underdrain module being used. No perforations or slots should be visible above the top of the Modular Underdrain once the port is in place.

Using a reciprocating saw, cut the horizontal underdrain module plates in the center, between the two internal vertical plates, to receive the port (Fig. 12). Cut the openings for a tight fit around the port pipe. If the pipe specified will not fit between the two interior plates, one or both plates may be moved to the outer connection locations on the large plate. All horizontally oriented plates will need to be cut EXCEPT FOR THE BOTTOM PLATE. In total you will need to cut:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Cut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini &amp; Single</td>
<td>1 plate</td>
</tr>
<tr>
<td>Double</td>
<td>2 plates</td>
</tr>
<tr>
<td>Triple</td>
<td>3 plates</td>
</tr>
<tr>
<td>Quadruple</td>
<td>4 plates</td>
</tr>
<tr>
<td>Penta</td>
<td>5 plates</td>
</tr>
</tbody>
</table>

**TIP:** If the location of the inspection ports is not shown on your plans, use a single inspection port located in the middle of the underdrain field. Install a port for every X sf of the underdrain system.

**IMPORTANT:** Do not over-cut the Modular Underdrain plates. Minimize the gaps between the pipe and the Modular Underdrain plates. This is particularly important with the top plate.

For all units larger than a Single or Mini Underdrain Module, you will need to disassemble the Underdrain module in order to cut the interior horizontal plates. Reassemble the Underdrain Module when cutting is completed, and replace the Underdrain Module into the proper location.

**TIP:** If using Prefabricated Pipe Boot Kits, install them onto the pipe now, leaving the band clamps loose so that final adjustments may be made in Step 7.

Install the pipe into the Underdrain Modules.

Place the port pipe with pre-cut slots into hole. (Fig. 13). Be sure to cut the top of the pipe so that once the FocalPoint HPMBS Inspection Port Cap is placed onto the top of the pipe, the top of the Inspection Port Cap will be flush with or just above the finished grade. Once the pipe is in place, put the FocalPoint Inspection port Cap or a temporary cap on the port to prevent debris from entering the system during backfill procedures (Fig. 14).
7 INSTALL MICROGRID MESH

Clean off any debris that may be lying on top of the exposed geotextile around the perimeter of the Modular Underdrain.

Cut strips of Microgrid Mesh to fit over the top and down both sides of the modular underdrain system. Adjacent strips of Mesh should overlap at least 12" or as shown on plans. Use rock bags or other ballast to temporarily secure overlaps (Fig. 15).

Where Modular underdrain intersects an Inspection or Maintenance Port, cut an "X" into the geotextile and pull it over the pipe. The flaps of the "X" should point AWAY from the Modular Underdrain (Fig. 16). Use stainless steel band clamp to seal the flaps to the pipe, being careful not to leave gaps that will allow bridging stone to enter the underdrain.

**IMPORTANT:** Take special care with Inside Corners on the footprint of the system. Cut Microgrid Mesh as needed to ensure that it lays flat against the Modular Underdrain. Use additional pieces to seal the corner and any cuts that are made (12" overlap).

Fold Mesh for outside corners similar to sheets on a bed, and lay excess material flat against Modular Underdrain. Leave corners loose to avoid creating weak spots in the material. Temporarily secure excess fabric with duct tape (Fig. 17 left).

**TIP:** If using Prefabricated Pipe Boot Kits, install them onto the Inlet and Outlet Pipes, leaving the band clamps loose so that final adjustments may be made.

**Figure 15** (Above): 12" overlap of Biaxial Mesh on top of underdrain module

**Figure 16** (Below): Cut an "X" into Biaxial Mesh to accommodate pipe penetration

**Figure 17:** fold corners flat against the tank

**Connect Inlet & Outlet Pipes**

Where the inlet and outlet pipes connect to an underdrain module or exits the excavation, cut an "X" into the Microgrid Mesh or geotextile so that the pipe runs through the Microgrid and makes DIRECT contact with the underdrain module (Fig: 18). Pull the flaps of the "X" cloth over the pipe so that the flaps of the "X" point AWAY from underdrain module. Use a stainless steel band clamp to seal the flaps to the pipe, being careful not to leave gaps that will allow bridging stone to enter the underdrain.

**Figure 18:** Cut "X" in Biaxial Mesh and Geotextile to accommodate outlet pipes and seal with stainless steel band clamps

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**FocalPoint**

**BIOPURIFICATION SYSTEMS**

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8 BACKFILL SIDES & TOP WITH PEAGRAVEL

Backfill bridging stone material around perimeter of the underdrain modules, distributing the material evenly to prevent shoving of the underdrain modules.

Use a trench roller, plate compactor, or hand tamper to compact backfill. When using taller underdrain modules, this placement and compaction should be done in 12” lifts.

Continue placing and compacting backfill around underdrain modules until the bridging stone reaches the top of the underdrain modules. Once bridging stone is level with the top of the underdrain, place 6” of bridging stone (or as specified) on top of underdrain modules (Fig 20).

9 PLACE HIGH PERFORMANCE BIOFILTRATION SOILS

Level bridging stone and, place 6" of high flow media on top. Use marked stakes to ensure elevations. Once 6" of media has been placed, set Gabions (if applicable). Once Gabions have been installed, continue placing media until it is at the specified depth, (typically 18”). The top of the media should be 6” below the top of the gabion wall (if specified).

TIP: Before you place bridging stone use your inspection port to mark the different levels of fill as specified (Figure 20)

WARNING High Flow Media is a highly engineered soil - do not mix media with any other site, fill or excavated soils.
PLACE & FILL GABION (IF SPECIFIED)

(If gabion surround or leading edge is not specified continue to step 11)

Gabions are an optional feature that may not be included on your installation. If they are not included, skip this step and proceed to Step 11.

The gabion baskets are 12” tall. The interior dimensions of the gabion baskets needs to be equal to the exterior diameter of the underdrain unless specified otherwise. The top of the gabion should rise 6” above the top of the high flow media and 3” above the bark mulch.

Place a geotextile separation barrier between the gabion and existing site soils as well as the gabion and media so that soil will not migrate into the rock creating a void. (Figure 24).

Once the gabion baskets are placed, overfill the gabions with 3” x 5” washed bull rock, or other specified material. Once filled, seal the baskets with hog rings placed every three inches so that rock cannot be removed.

Figure 24: Place gabion wall so that it is square and level

Figure 25: Overfill rock into gabion and seal tight to prevent sagging. Rock will settle over time.
CAP & SEAL

This step protects the system if it is not to be immediately activated. The system should not be activated (plantings and mulch placed, and stormwater allowed to flow into the system) until the surrounding drainage area reaches at least 90% stabilization. Premature activation and/or failure to carry out this 'cap & seal' step may invalidate the warranty on this system.

Protecting the FocalPoint HPMBS during construction is of the utmost importance. The sediment contained in the runoff from an un-stabilized drainage area may contaminate the biofiltration media, reduce the effectiveness of the FocalPoint HPMBS or cause failure.

Cut an appropriately sized piece of impermeable material (10-33mm) to fit the surface of the media bed. If multiple pieces are required, weld/glue them together to create an impermeable seal over the media bed.

Place the impermeable cover over the media bed.

Pull excess Geotextile Excavation Liner (see step 4) over the top of the FocalPoint System, fully cover the impermeable seal, overlapping the geotextile to fully prevent silt and sediment from reaching the seal and underlying media. Using a portable blow torch to 'heat weld' the geotextile and prevent the geotextile from moving or opening. You should practice this procedure on scrap material away from the system prior to attempting to do it over the system. Non-woven geotextiles are flammable and you must take extreme caution in doing this so that you do not leave the torch on the geotextile for too long. This procedure will create a perfect seam that will prevent sediment from bypassing the geotextile (Figure 29). If you cut your fabric too short, just make a patch for the uncovered area with another piece of geotextile, welding it all the way around.

Once the system is capped and sealed, use a sign or any other warning mechanism to warn other contractors not to remove the cover until activation is authorized (Figure 31). This will protect the system until final stabilization. Other erosion control mechanisms may be required upstream of the FocalPoint HPMBS such as check dams, erosion control blankets, wattles or other best management practices. Please contact your local Convergent Value Added Reseller for suggestions.

WARNING
FAILURE TO INSTALL AND MAINTAIN ADEQUATE ESC PROTECTION FOR THE FOCALPOINT MAY VOID THE WARRANTY AND PERFORMANCE GUARANTEES.

TIP: If you add a hose extension onto the torch, it makes the procedure much easier.

Figure 30: A hose extension added to a blow torch.

Figure 29: Geotextile being melted together with a torch.

Figure 31: FocalPoint Warning Sign

CAUTION: BIOFILTRATION SYSTEM DO NOT REMOVE GEOTEXTILE COVER OR SYSTEM WITHOUT AUTHORIZATION DO NOT PLACE SOIL ON TOP OF ENGINEERED MEDIA OR COVER DO NOT STORE CORROSIVE MATERIALS OR MATERIALS THAT GENERATE EXCESSIVE HEAT OR SMOKE DO NOT PLACE DEBRIS OR MUD ON TOP OF THE BIODRUMS OR BIOFILTERS DRAINAGE OR INFILTRATION SYSTEMS MUST BE MAINTAINED IN GOOD ORDER TO PREVENT INFILTRATION INTO THE GROUND OR RUNOFF INTO STORMWATER DRAINAGE SYSTEMS
12 ACTIVATE THE SYSTEM

Once 90% stabilization has been achieved, contact your local Convergent Water Technologies Value Added Reseller (www.convergentwater.com) for activation. Activation includes removing the protective 'cap and seal' cover on the biofiltration media bed and in situ testing of the media to insure that it meets performance specifications by means of an hydraulic conductivity test. This activation is provided by Convergent's VAR at no additional charge. At this time you may add specified plants to the media bed and the 3" non-floatable mulch layer if indicated (typical).

IMPORTANT:
The FocalPoint HPMBS should always remain capped until 90% stabilization is achieved and be the last thing planted to ensure that construction sediment does not enter the system.

Figure 32: Protected FocalPoint HPMBS

WARNING
Failure to conform to this step may void the warranty and performance guarantee. For the FocalPoint HPMBS activation checklist, contact your value added reseller.

Figure 33: Planted FocalPoint HPMBS
PLANTINGS & MULCH

Placing the Plants:

1. Dig planting holes the depth of the root ball and two to three times as wide as the root ball. Wide holes encourage horizontal root growth that plants naturally produce.

2. With trees, you must ensure you are not planting too deep! Don’t dig holes deeper than root balls. The media should be placed at the root collar, not above the root collar; otherwise the stem will be vulnerable to disease.

Planting:

1. Remove plastic containers from container-grown plants. For plants in fiber pots, break away the top or remove the pot entirely.

2. If roots are circling around the root ball exterior, cut through the roots in a few places and remove the first inch of roots and planting material around the root ball. Cutting helps prevent circling roots from eventually girdling the trunk. If roots are not circling, the root ball should still be rubbed to loosen roots and promote growth into the media.

3. Remove tags and labels from plants.

4. Prune broken branches or suckers.

5. Only stake trees with large crowns, or those situated on windy sites or where people may push them over. Stake for a maximum of one year. Allow trees a slight amount of flex rather than holding them rigidly in place. Use guying or attach material that won’t damage the bark. To prevent trunk girdling, remove all guying material after one year. Insure that stakes do not penetrate the bridging stone or underlying modular drainage system.

6. Plants should be watered at planting, especially during drought periods.

<table>
<thead>
<tr>
<th>Type of Planting</th>
<th>Rootball Size</th>
<th>Spacing on Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrub</td>
<td>&lt; 1 gallon</td>
<td>24 inches</td>
</tr>
<tr>
<td>Shrub</td>
<td>5 gallons</td>
<td>42 inches</td>
</tr>
<tr>
<td>Shrub</td>
<td>15 gallon</td>
<td>60 inches</td>
</tr>
<tr>
<td>Clump Grasses</td>
<td></td>
<td>24 inches</td>
</tr>
<tr>
<td>Small Trees</td>
<td></td>
<td>12 feet</td>
</tr>
</tbody>
</table>

DO NOT:
- Mulch in excess of 3 inches
- Compact media around the root ball
- Do not use annuals
- Keep in mind that some perennials (i.e. daylilies, hostas, etc...) die back in fall and re-emerge in spring. If you want greenery year round, be mindful of the perennials used.

Mulching:
Cover the exposed root ball top with mulch. No mulch volcanoes! Mulch should not touch the plant base because it can hold too much moisture and invite disease and insects. Evenly place 3 inches of double shredded, aged hardwood mulch which has been screened to remove fines, on the surface of the media (if specified).

Erosion Control:
Where water is entering a focal point in one location, be sure to place erosion control stones or other scour prevention BMP to prevent scouring.
PERFORMANCE VERIFICATION

The Rub-I Infiltrometer is the most effective way to field verify engineered soil performance, construction and long term verification of performance. The Rub-I was designed to test the effectiveness of high flow soils and to ensure post control. Current ASTM standards for infiltration testing are not valid for flow rates exceeding 16 in/hr. To ensure the highest level of effectiveness, Convergent specifies that the FocalPoint HPMBS be tested within 60 days of installation and we recommend the system be tested annually thereafter to provide ongoing quality assurance.

Objective:
To provide as-built confirmation of proper installation and hydraulic performance, to meet minimum high flow rate Infiltration rate requirements, of bioretention media on newly-placed bioretention systems. This procedure measures the entire media profile under saturated conditions to insure a reliable and accurate result.

Example Site Test Layout and Design Schematic:
(FSA = filter surface area, DA = drainage area)

For bioretention systems with a surface area less than 538 sf, in situ hydraulic testing should be conducted at one to three points that are spatially distributed. For systems with a surface area greater than 50 sf, an extra monitoring point should be added for every additional 1076 sf. (Values are based on recommendations from the Facility for Advancing Water Biofiltration.) Testing should be performed near the perimeter since this is the area most likely to be impacted by sediment in the runoff.

Test Methodology:
In an area near the location you plan to test, gently scrape away any material covering (e.g. mulch, gravel, leaves) filter media surface and confirm media profile depth by using a shovel to dig to under drain stone and place measuring tape in hole to determine depth from top of under drain stone to top of media bed. A flash light may be needed to ensure the under drain stone has been reached before a depth measurement is taken. Make every effort to minimize disturbance of surrounding media and underlying bridging stone.
1. At the test location carefully clear away mulch without disturbing the underlying media and place base component of the Rub-I Infiltrometer, a 6" PVC pipe (beveled end down), on the surface of the media. Ensure testing is not too close to vegetation. Place the wooden board over the pipe and then gently pound with the sledge hammer on top of the board (Figure 3). Hammer the PVC pipe into the entire media profile based on the depth previously determined, until it just breaches into the bridging stone. Drive the pipe straight down, avoiding tilt in any direction (Figure 4). Check with level. Note: It is important that the pipe is driven in slowly and carefully to minimize disturbance of the filter media profile. The media may slightly move downward in the pipe during hammering, but not more than 1 inch, and will not significantly affect hydraulic performance.

2. If pipe is less than 3 inches from media surface, remove media around outside of pipe so that the pipe has 3 inches of freedom from the media bed so that the infiltrometer gate valve coupling will properly slide onto the pipe.

3. Remove board and rub mineral oil on outside of PVC pipe above media (Figure 5).

4. Place 2 inch dissipater stones into pipe (Figure 6).

5. Slide gate valve with clear PVC cylinder down onto the PVC pipe in the media (Figure 7). Note: Disregard black coupling on clear pipe as well as pipe plug in this image.

6. Measure from the original surface of the media within the column to 1 ft, 2 ft, 3 ft, 4 ft and 5 ft gradations, and mark them on the clear PVC cylinder (Figure 8). The 1 ft and 5 ft marks are the critical marks, since the time to fall between these two intervals will provide the pass/fail time for the test. (The time at other intervals between 1 ft and 5 ft can be recorded for additional information, but will not be used in the pass/fail criteria).

7. Fill a 5 gallon bucket with 3 gallons of water.

8. Ensure the gate valve to the infiltrometer is closed. Fill with the 3 gallons of water (Figure 9). To create a worst case flow rate scenario (i.e. saturated condition), an initial wetting of the media using the infiltrometer is conducted by opening up the gate valve completely. The gate valve should be slowly opened by tapping on the handle with a hammer or wrench to prevent disturbance of the media surface by a sudden high flow of water. Pulling open by hand tends to force the valve open too quickly.

9. After the water level disappears from the clear column, a drain down time of 25 minutes is allowed to ensure free water has drained through the media.

10. After 25 minutes, ensure the gate valve is closed. Fill the 5 gallon bucket with water and continue to fill the column until water level reaches the very top of the clear pipe. Water is then re-introduced by opening the gate valve slowly by tapping the handle. A stopwatch should be started as the water level reaches 5 ft gradation and recorded at every 1 ft gradation. The stopwatch is stopped when the water level reaches the 1 ft mark.

11. Pass/fail criteria is based on maximum drawdown times (Table 1). For example, a media profile depth of 12 inches should not exceed a drawdown time of 18 seconds between the 5 ft and 1 ft gradations. For bioretention systems with a surface area less than 538 sf, in situ hydraulic testing should be conducted at one to three points that are spatially distributed. For systems with a surface area greater than 50 sf, an extra monitoring point should be added for every additional 1076 sf. These values are based on recommendations from the Facility.
Stormwater Treatment Proposal

Attachment C
FocalPoint
BIOFILTRATION SYSTEMS

HIGH PERFORMANCE MODULAR BIOFILTRATION SYSTEM (HPMBS)
Operations & Maintenance
GENERAL DESCRIPTION

The following general specifications describe the general operations and maintenance requirements for the FocalPoint® High Performance Modular Biofiltration System (HPMBS). The system utilizes physical, chemical and biological mechanisms of a soil, plant and microbe complex to remove pollutants typically found in urban stormwater runoff. The treatment system is a fully equipped, modular, constructed in place system designed to treat contaminated runoff.

Stormwater enters the FocalPoint® HPMBS, is filtered by the High Flow Biofiltration Media and passes through to the underdrain/storage system where the treated water is detained, retained or infiltrated to sub-soils, prior to discharge to the storm sewer system of any remaining flow.

Higher flows bypass the FocalPoint® HPMBS via a downstream inlet or other overflow conveyance. Maintenance is a simple, inexpensive and safe operation that does not require confined space entry, pumping or vacuum equipment, or specialized tools. Properly trained landscape personnel can effectively maintain FocalPoint® HPMBS by following instructions in this manual.
BASIC OPERATIONS

FocalPoint® is a modular, high performance biofiltration system that often works in tandem with other integrated management practices (IMP). Contaminated stormwater runoff enters the biofiltration bed through a conveyance swale, planter box, or directly through a curb cut or false inlet. Energy is dissipated by a rock or vegetative dissipation device and is absorbed by a 3-inch layer of aged, double shredded hardwood mulch, with fines removed, (when specified) on the surface of the biofiltration media.

As the water passes through the mulch layer, most of the larger sediment particles and heavy metals are removed through sedimentation and chemical reactions with the organic material in the mulch. Water passes through the biofiltration media where the finer particles are removed and numerous chemical reactions take place to immobilize and capture pollutants in the soil media.

The cleansed water passes into the underdrain/storage system and remaining flows are directed to a storm sewer system or other appropriate discharge point. Once the pollutants are in the soil, bacteria begin to break down and metabolize the materials and the plants begin to uptake and metabolize the pollutants. Some pollutants such as heavy metals, which are chemically bound to organic particles in the mulch, are released over time as the organic matter decomposes to release the metals to the feeder roots of the plants and the cells of the bacteria in the soil where they remain and are recycled. Other pollutants such as phosphorus are chemically bound to the soil particles and released slowly back to the plants and bacteria and used in their metabolic processes. Nitrogen goes through a variety of very complex biochemical processes where it can ultimately end up in the plant/bacteria biomass, turned to nitrogen gas or dissolves back into the water column as nitrates depending on soil temperature, pH and the availability of oxygen. The pollutants ultimately are retained in the mulch, soil and biomass with some passing out of the system into the air or back into the water.

DESIGN AND INSTALLATION

Each project presents different scopes for the use of FocalPoint® HPMBS. To ensure the safe and specified function of this stormwater BMP, Convergent Water Technologies and/or its Value Added Resellers (VAR) review each application before supply. Information and design assistance is available to the design engineer during the planning process. Correct FocalPoint® sizing is essential to optimum performance. The engineer shall submit calculations for approval by the local jurisdiction when required. The contractor and/or VAR is responsible for the correct installation of FocalPoint® HPMBS units as described in approved plans. A comprehensive installation manual is available at www.convergentwater.com.
MAINTENANCE

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 for maintenance include:

- Avoid legal challenges from your jurisdiction's maintenance enforcement program.
- Prolong the lifespan of your FocalPoint® HPMBS.
- Avoid costly repairs.
- Help reduce pollutant loads leaving your property.

Simple maintenance of the FocalPoint® HPMBS is required to continue effective pollutant removal from stormwater runoff before any discharge into downstream waters. This procedure will also extend the longevity of the living biofiltration system. The unit will recycle and accumulate pollutants within the biomass, but may also subjected to other materials entering the surface of the system. This may include trash, silt and leaves etc. which will be contained above the mulch and/or biofiltration media layer. Too much silt may inhibit the FocalPoint's® HPMBS flow rate, which is a primary reason for system maintenance. Removal of accumulated silt/sediment and/or replacement of the mulch layer (when specified), is an important activity that prevents over accumulation of such silt/sediment.

When to Maintain?

Convergent Water Technologies and/or its VAR includes a 1-year maintenance plan with each system purchased. Annual included maintenance consists of two (2) scheduled maintenance 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 for full operation. Full operation is defined as when the site is appropriately stabilized, the unit is installed and activated (by VAR), i.e., when mulch (if specified) and plantings are added.

Activation should be avoided until the site is fully stabilized (full landscaping, grass cover, final paving and street sweeping completed). Maintenance visits are scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands. The fall visit helps the system by removing excessive leaf litter.

A first inspection to determine if maintenance is necessary should be performed at least twice annually after storm events of greater than (1) one inch total depth (subject to regional climate). Please refer to the maintenance checklist for specific conditions that indicate if maintenance is necessary.

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.
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 VAR/Maintenance contractor and Owner predict future maintenance frequencies, reflecting individual site conditions.

Owners must promptly notify the VAR/Maintenance contractor of any damage to the plant(s), which constitute(s) an integral part of the biofiltration technology. Owners should also advise other landscape or maintenance contractors to leave all maintenance of the FocalPoint® HPMBS to the VAR/Maintenance contractor (i.e. no pruning or fertilizing).

EXCLUSION OF SERVICES

It is the responsibility of the owner to provide adequate irrigation when necessary to the plant(s) in the FocalPoint® HPMBS.

Clean up due to major contamination such as oils, chemicals, toxic spills, etc. will result in additional costs and are not covered under the VAR/Maintenance contractor maintenance contract. Should a major contamination event occur, the Owner must block off the outlet pipe of the FocalPoint® (where the cleaned runoff drains to, such as drop-inlet) and block off the point where water enters of the FocalPoint® HPMBS. The VAR/Maintenance contractor should be informed immediately.

MAINTENANCE VISIT SUMMARY

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

1. Inspection of FocalPoint® HPMBS and surrounding area
2. Removal of debris, trash and mulch
3. Mulch replacement
4. Plant health evaluation (including measurements) and pruning or replacement as necessary
5. Clean area around FocalPoint® HPMBS
6. Complete paperwork, including date stamped photos of the tasks listed above.

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 in close proximity to traffic and also safety hats and shoes.
# Maintenance Visit Procedure

## Inspection of FocalPoint® HPMBS and Surrounding Area

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Yes</th>
<th>No</th>
<th>Parameter</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing Water</td>
<td></td>
<td></td>
<td>Damage to HPMBS System to Overflow conveyance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is Bypass Inlet Clear?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Removal of Silt / Sediment / Clay

Dig out silt (if any) and mulch and remove trash & foreign items.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Yes</th>
<th>No</th>
<th>Volume of Material Removed (volume or weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silt / Clay Found?</td>
<td></td>
<td></td>
<td>Leaves?</td>
</tr>
<tr>
<td>Cups / Bags Found?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Removal of Debris, Trash and Mulch

After removal of mulch and debris, measure distance from the top of the FocalPoint® HPMBS engineered media soil to the flow line elevation of the adjacent overflow conveyance. If this distance is greater than that specified on the plans (typ. 6” - 12”), add media (not top soil or other) to recharge to the distance specified.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance to Media Surface to Overflow Conveyance (inches)</td>
<td></td>
</tr>
<tr>
<td># of Buckets of Media Added</td>
<td></td>
</tr>
</tbody>
</table>

## Mulch Replacement

Most maintenance visits require only replacement mulch (if utilized) which must be, aged, double shredded hardwood mulch with fines removed. For smaller projects, one cubic foot of mulch will cover four square feet of biofiltration bed, and for larger projects, one cubic yard of mulch will cover 108 square feet of biofiltration bed. Some visits may require additional FocalPoint® HPMBS engineered soil media available from the VAR/Contractor.

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add double shredded, aged hardwood mulch which has been screened to remove fines, evenly across the entire biofiltration media bed to a depth of 3”</td>
<td></td>
</tr>
<tr>
<td>Clean accumulated sediment from energy dissipation system at the inlet to the FocalPoint® HPMBS to allow for entry of trash during a storm event.</td>
<td></td>
</tr>
</tbody>
</table>

## Plant Health Evaluation and Pruning or Replacement as Necessary

Examine the plant’s health and replace if dead or dying. Prune as necessary to encourage growth in the correct directions.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height above Grate (feet)</td>
<td></td>
</tr>
<tr>
<td>Width at Widest Point (feet)</td>
<td></td>
</tr>
<tr>
<td>Health</td>
<td>alive</td>
</tr>
<tr>
<td>Damage to Plant</td>
<td>yes</td>
</tr>
</tbody>
</table>

## Clean Area Around FocalPoint® HPMBS

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

## Complete Paperwork

- Deliver Maintenance Report and photographs as appropriate.
- Some jurisdictions may require submission of maintenance reports in accordance with approvals.
- It is the responsibility of the Owner to comply with local regulations.
FocalPoint Warranty

Seller warrants goods sold hereunder against defects in materials and workmanship only, for a period of (1) year from date the Seller activates the system into service. Seller makes no other warranties, express or implied.

Seller's liability hereunder shall be conditioned upon the Buyer's installation, maintenance, and service of the goods in strict compliance with the written instructions and specifications provided by the Seller. Any deviation from Seller's instructions and specifications or any abuse or neglect shall void warranties.

In the event of any claim upon Seller's warranty, the burden shall be upon the Buyer to prove strict compliance with all instructions and specifications provided by the Seller.

Seller's liability hereunder shall be limited only to the cost or replacement of the goods. Buyer agrees that Seller shall not be liable for any consequential losses arising from the purchase, installation, and/or use of the goods.
## Maintenance Checklist

<table>
<thead>
<tr>
<th>Element</th>
<th>Problem</th>
<th>What To Check</th>
<th>Should Exist</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inlet</strong></td>
<td>Excessive sediment or trash accumulation</td>
<td>Accumulation of sediment or trash impair free flow of water into FocalPoint</td>
<td>Inlet free of obstructions allowing free flow into FocalPoint System</td>
<td>Sediments or trash should be removed</td>
</tr>
<tr>
<td><strong>Mulch Cover</strong></td>
<td>Trash and floatable debris accumulation</td>
<td>Excessive trash or debris accumulation.</td>
<td>Minimal trash or other debris on mulch cover</td>
<td>Trash and debris should be removed and mulch cover raked level. Ensure that bark nugget</td>
</tr>
<tr>
<td><strong>Mulch Cover</strong></td>
<td>Ponding of water on mulch cover</td>
<td>Ponding in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils</td>
<td>Stormwater should drain freely and evenly over mulch cover.</td>
<td>Contact VAR for advice.</td>
</tr>
<tr>
<td><strong>Plants</strong></td>
<td>Plants not growing, or in poor condition</td>
<td>Soil/mulch too wet, evidence of spill. Pest infestation. Vandalism to plants.</td>
<td>Plants should be healthy and pest free.</td>
<td>Contact VAR for advice.</td>
</tr>
<tr>
<td><strong>Plants</strong></td>
<td>Plant growth excessive</td>
<td>Plants should be appropriate to the species and location of FocalPoint</td>
<td></td>
<td>Trim/prune plants in accordance with typical landscaping and</td>
</tr>
</tbody>
</table>
Stormwater Treatment Proposal

Attachment F
The following recommendations are included for guidance only. Actual maintenance schedules should be developed based on site conditions. These specific schedules assume a 75% impervious surface (parking lots or urban streets), limited trees and vegetation, very little slope and an annual rain fall of approximately 40".

<table>
<thead>
<tr>
<th>Product</th>
<th>Recommended service schedule</th>
<th>Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>StormSack</td>
<td>Available storage volume depending on model selected ranges from 2.2 to 7.3 cubic feet.</td>
<td>Disposal: Under typical local and state regulations, the collected material in the StormSack is considered equivalent to material collected during street sweeping operations. This material is normally considered contaminated non-hazardous solid waste. However, as with all waste products intended for disposal, it is up to the generator to properly characterize the waste prior to disposal. After proper characterization, the generator can proceed with disposal under the guidance of local, state and federal regulations.</td>
</tr>
<tr>
<td>StormSok - round</td>
<td>Available storage volumes: bag only 24&quot;, 26&quot;, 28&quot;, 30&quot; sizes – 3.6 cubic feet. Recommended cleanout 2 – 3* times per year. * The larger shrouds used on the 26&quot;-30&quot; StormSoks allow for the collection of significantly more debris than the 24&quot; size. This can extend the service interval especially when used for primarily trash collection.</td>
<td></td>
</tr>
<tr>
<td>StormSok-square</td>
<td>Available storage volume: bag only 24&quot; – 26&quot; sizes – 3.6 cubic feet. Recommended cleanout 3 – 4 times per year.</td>
<td></td>
</tr>
</tbody>
</table>
Attachment D. Post Construction Operation and Maintenance and Stormwater Checklist

Operation and Maintenance Plan

The Post Construction Maintenance Plan was developed by the manufacturer, and found in Attachment C, and will be followed by the City of Worcester DPW&P, the management system owners, and party responsible for operation and maintenance. Maintenance will occur on at least a twice yearly basis, in which personnel will utilize the manufacturers provided Operation and Maintenance Log Form. The site will be accessed from Lake Ave North on the footpath, from which maintenance crews will have safe access to the entire maintenance area.
A. Introduction

A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.\(^1\) This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8\(^2\)
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

\(^1\) The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

\(^2\) For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.
B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

*Note*: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

**Registered Professional Engineer’s Certification**

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

[Signature and Date]

---

**Checklist**

**Project Type:** Is the application for new development, redevelopment, or a mix of new and redevelopment?

- [ ] New development
- [x] Redevelopment
  - [ ] Mix of New Development and Redevelopment
Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

☐ No disturbance to any Wetland Resource Areas

☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:
  ☐ Credit 1
  ☐ Credit 2
  ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☒ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☐ Other (describe):

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☐ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.
Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☐ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

*No new impervious surface*

Standard 3: Recharge

☐ Soil Analysis provided.

☐ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☐ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☐ Simple Dynamic ☐ Dynamic Field

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is not discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume only to the maximum extent practicable for the following reason:

☐ Site is comprised solely of C and D soils and/or bedrock at the land surface

☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000

☐ Solid Waste Landfill pursuant to 310 CMR 19.000

☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☐ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

*No new impervious surface*

1 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.
Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:
- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☐ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
  ☐ is within the Zone II or Interim Wellhead Protection Area

  ☐ is near or to other critical areas

  ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)

  ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☐ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.
Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☐ The BMP is sized (and calculations provided) based on:
  ☐ The ½" or 1" Water Quality Volume or
  ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted prior to the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does not cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has not been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.
Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

☐ Limited Project

☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.

☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area.

☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff.

☐ Bike Path and/or Foot Path

☐ Redevelopment Project

☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☒ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.
Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has not been included in the Stormwater Report but will be submitted before land disturbance begins.

☐ The project is not covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☑ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
  ☑ Name of the stormwater management system owners;
  ☑ Party responsible for operation and maintenance;
  ☑ Schedule for implementation of routine and non-routine maintenance tasks;
  ☑ Plan showing the location of all stormwater BMPs maintenance access areas;
  ☑ Description and delineation of public safety features;
  ☑ Estimated operation and maintenance budget; and
  ☑ Operation and Maintenance Log Form.

☐ The responsible party is not the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
  ☐ A copy of the legal instrument (deed, homeowner’s association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
  ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☑ An Illicit Discharge Compliance Statement is attached; *will not create illicit discharges*

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted prior to the discharge of any stormwater to post-construction BMPs.