STORMWATER MANAGEMENT REPORT

for

COUNCIL ON AGING COMMUNITY CENTER
8 ANDREW AVENUE
WAYLAND, MASSACHUSETTS

Prepared for:

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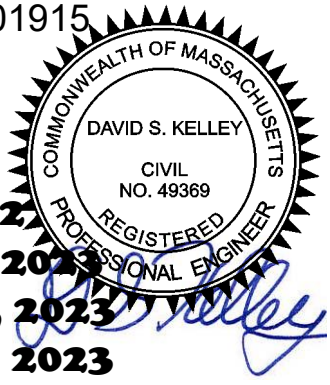

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MERIDIAN ASSOCIATES

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STORMWATER NARRATIVE

Project Narrative:

The former Raytheon facility in Wayland occupied approximately 83 acres of land at 430 Boston Post Road from circa 1955 through 1996. It was developed into the 'Wayland Town Center' between 2012 and 2015. The subject property is located at 8 Andrew Avenue and is located within the "Wayland Town Center'. The subject property includes four (4) individual parcels with a combined total area of approximately 4.16 acres The project site previously contained two buildings used for radar equipment testing. The buildings were demolished in 1999 and the current 10,472 sf building was constructed in 2000. The intention was to use this building as a daycare center for the tenants of Raytheon's former main building but the building was never completed or occupied. The unoccupied building is connected to sanitary sewer, domestic and fire water services, natural gas, electric, telephone and data service connections.

The project site also includes several easements for existing sanitary sewer and stormwater drainage utilities. The western portion of the project site is adjacent to the Sudbury River and the one hundred (100) foot and two hundred (200) foot riverfront Riparian Zones extend onto the site. There are bordering vegetated wetlands downhill of the project site adjacent to the Sudbury River and there is a small area of bordering vegetated wetlands between the building and the Boston Post Road. A portion of the project site contains priority habitats of rare species as mapped by Natural Heritage and is partially located within the one hundred (100) year flood plain. Per the Town of Wayland Zoning Map, the project site is located within the Limited Commercial District Zoning District and the Aquifer Protection District (Zone IIs Wellhead Protection Area).

The topography on the eastern and northern portions of the project site gradually slopes towards the Sudbury River while the topography west of the building slopes more steeply towards the Sudbury River. The area surrounding the building and to the west towards the Sudbury River contains woods. The area on the eastern and northern portions of the project site is covered by grass. There is an existing drainage basin between the project site and the Boston Post Road that collects the stormwater runoff flowing from the Boston Post Road.

The Town of Wayland is proposing renovations and additions to the existing unoccupied building and other improvements including parking areas, sidewalks that connect to Andrew Avenue and Lillian Way, patios, stormwater management system, site grading, utility connections, stone dust walkways, landscaping, hardscaping and site lighting.

The project site utilizes several different stormwater management techniques. There are proposed deep sump hooded catch basins, proprietary filter media unit and subsurface infiltration facility that will be used for the treatment, recharge and mitigation of the stormwater runoff.

The proposed project will remove trees within the limits of work. A detailed description of the size, types and quantities of these trees are listed on the Record Conditions and Demolition Plan, sheet C 1.0 of the Site Plan and the Landscape Plan, sheet L 1.0 of the Site Plan set.

The following lists and describes how the DEP Stormwater Standards outlined in the Wetlands Regulations are met with the proposed project:

Standard 1: No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

There are no new untreated stormwater discharges for the proposed project. There are no new untreated stormwater discharges for the proposed project. The stormwater runoff from the existing building rooftop is considered clean stormwater runoff and does not need to be treated. The stormwater runoff from the building rooftop will be collected with gutters and discharged to a level spreader.

The Town of Wayland stormwater regulations require removing 50% total phosphorous and 80% TSS for redevelopment projects. The stormwater runoff from the parking areas, patio and some walkways will be collected with deep sump catchbasins and then flow through a storm drain system to a proprietary filter media unit that shall remove 50% minimum total phosphorous and 44% minimum TSS and then flow to a subsurface infiltration facility and then discharge to a level spreader.

Standard 2: Peak Rate Attenuation - Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

One design point has been utilized for the purpose of analyzing pre and post development stormwater peak rates and volumes of stormwater runoff. The design point in the existing conditions is the same design point in the proposed conditions. Comparison values for pre and post development stormwater peak rates and volumes have been calculated for the design point.

The storm events that were used to calculate peak stormwater runoff rates for pre and post construction conditions have been taken from Northeast Regional Climate Center "Atlas of Precipitation Extremes for the Northeastern United States and Southeastern Canada". Full details of peak rate and volume attenuation along with supplemental stormwater calculations utilizing HydroCAD as well as pre and post development drainage plans can be found in the Stormwater Analysis and Calculations. The details of this report show that the peak rates and volumes of stormwater runoff for the 1 Inch, 2, 10, 25 and 100 year events have been matched or reduced from pre to post conditions. The tables below illustrates the calculated stormwater runoff flows at the design point for the existing and proposed storm events.

Peak Flow Rates Design Point #1

Storm Event	Existing Conditions (Pre) Peak Flow (CFS)	Proposed Conditions (Post) Peak Flow (CFS)
1 Inch	0.0	0.0
2-Year (3.14 in/hr)	1.0	0.9
10-Year (4.70 in/hr)	4.1	3.1
25-Year (5.91 in/hr)	7.2	5.2
100-Year (8.39 in/hr)	14.7	11.9

Peak Volumes Design Point #1

Storm Event	Existing Conditions (Pre) Peak Volume (Acre-feet)	Proposed Conditions (Post) Peak Volume (Acre-feet)
1 Inch	0.00	0.00
2-Year (3.14 in/hr)	0.15	0.10
10-Year (4.70 in/hr)	0.41	0.25
25-Year (5.91 in/hr)	0.68	0.43
100-Year (8.39 in/hr)	1.30	0.98

The peak stormwater runoff rates and volumes have been matched or reduced for the design point. We therefore anticipate no adverse impacts or downstream flooding with the completion of this project.

Standard 3: Recharge - Loss of annual recharge to groundwater shall be eliminated or minimized…at a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This standard is met when the stormwater management system is designed to infiltrate the required recharge volume in accordance with the Mass Stormwater Handbook.

The stormwater runoff from the parking areas, patio and some walkways are recharged with the proposed subsurface infiltration facility.

Based on soil maps provided by the Natural Resources Conservation Service the project site is mostly urban land with a small portion of saco mucky silt loam. Urban land doesn't have a hydrologic soil group rating but soil testing found that the soil is similar to a hydrologic soil group rating of B. Saco mucky silt loam has a hydrologic soil group rating of B. Refer to the hydrologic soil group report in the appendix.

Utilizing the Stormwater Handbook the proposed project will meet standard 3 as supported by the calculations below:

Recharge Volume for Subsurface Infiltration Facility:

Rv = Fx
Rv = Required Recharge Volume
F = Target Depth Factor associated with hydrologic soil groups located in table 2.3.2 in Volume 3 of the Stormwater Management Handbook
x = Total impervious area proposed

Impervious area directed to the subsurface infiltration facility: 49,965 sf
F for hydrologic group B soils: 0.35 inches
Therefore Rv = (49,965 sf)(0.35 inches/12 inches per foot)
Rv = 1,457 cubic feet (cf)

The Town of Wayland stormwater regulations require retaining 0.8 inches of stormwater runoff for redevelopment projects which is larger than the recharge requirement from the Stormwater Handbook. The project site also meets this requirement as shown below.

Recharge = (49,965 sf)(0.8 inches/12 inches per foot)
Recharge = 3,331 cubic feet (cf)

The proposed subsurface infiltration facility provides a total recharge storage volume of 7,649 cf below the outlet pipe inverts.

The Stormwater Handbook also requires recharge facilities to be constructed in soils capable of absorbing the recharge volume with the ability to drain within 72 hours. The formula for drawdown is as follows:

General Formula:

$$T_{DR} = \frac{required storage volume *}{(RawlsRate)(BottomSurfaceAreaofSystem)}$$

(*Required storage volume is equal to the larger of the calculated required recharge or water quality treatment volumes. In this case, the water quality treatment volume is larger.)

Subsurface Infiltration Facility:

Volume to Recharge = 7,649 *cf*

T_{DR} = *(7,649 cf)/((8.27 in/hr/12 in/ft)(5,592 sf)) = 1.98 hrs*

1.98 *hrs* < 72 *hrs*

In accordance with the Stormwater Handbook, a capture area adjustment calculation is required when stormwater runoff from only a portion of the proposed impervious area on a site is directed to one or more infiltration BMPs. The following are steps of the capture area adjustment calculation to demonstrate the required minimum 65% of the impervious area onsite is being directed to an infiltration BMP. The calculation also determines the increase in storage capacity of the infiltration BMPs to ensure they are able to capture sufficient stormwater runoff from the impervious surfaces within the contributing drainage area to infiltrate the required recharge volume.

1. Calculate Rv for the project:
   From above Rv = 3,331 cf

2. Calculate the impervious area draining to the subsurface infiltration facility:
   Area = 49,965 sf

3. Divide total proposed impervious area by the impervious area draining to the subsurface infiltration facility:
   Total proposed impervious area = 62,813 sf
   62,813 sf/49,965 sf = 1.25

4. Multiply quotient from step 3 by the original Rv to determine the adjusted minimum storage volume needed to meet the recharge requirement:
   1.25 x 3,331 = 4,164 cf
   Subsurface infiltration facility provide 7,649 cf of storage.

5. Insure minimum of 65% of the site impervious area is being directed to the subsurface infiltration facility:
   49,965 sf/62,813 sf = 79.6%

Subsurface Infiltration System Storage Volume Table:

Elevation (feet)	Surface (sf)	Storage (cf)	Elevation (feet)	Surface (sf)	Storage (cf)
119.0	5,592	0	120.6	5,592	6,347
119.1	5,592	224	120.7	5,592	6,791
119.2	5,592	447	120.8	5,592	7,225
119.3	5,592	671	120.9	5,592	7,649
119.4	5,592	895	121.0	5,592	8,062
119.5	5,592	1,118	121.1	5,592	8,463
119.6	5,592	1,617	121.2	5,592	8,849
119.7	5,592	2,109	121.3	5,592	9,217
119.8	5,592	2,597	121.4	5,592	9,561
119.9	5,592	3,083	121.5	5,592	9,869
120.0	5,592	3,566	121.6	5,592	10,135
120.1	5,592	4,042	121.7	5,592	10,367
120.2	5,592	4,514	121.8	5,592	10,591
120.3	5,592	4,980	121.9	5,592	10,814
120.4	5,592	5,440	122.0	5,592	11,038
120.5	5,592	5,896	122.1	5,592	11,262
			122.2	5,592	11,485

In summary, the subsurface infiltration facility provides a total recharge storage volume of 7,649 cf which is greater than the adjusted minimum storage volume calculated by the capture area adjustment. The project also directs a minimum 65% of the proposed impervious area into the subsurface infiltration facility which will provide sufficient stormwater runoff to infiltrate the required recharge volume. This ensures the post development annual recharge rate will approximate the annual rate from pre development conditions.

Standard 4: Water Quality – Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). The standard is met with pollution prevention plans, stormwater BMP's sized to capture required water quality volume, and pretreatment measures.

There are no new untreated stormwater discharges for the proposed project. The stormwater runoff from the existing building rooftop is considered clean stormwater runoff and does not need to be treated. The stormwater runoff from the building rooftop will be collected with gutters and discharged to a level spreader.

The Town of Wayland stormwater regulations require removing 50% total phosphorous and 80% TSS for redevelopment projects. The stormwater runoff from the parking areas, patio and some walkways will be collected with deep sump catch basins and then flow through a storm drain system to a proprietary filter media unit that shall remove 50% minimum total

phosphorous and 44% minimum TSS and then flow to a subsurface infiltration facility and then discharge to a level spreader.

Documentation from the manufacturers of two (2) different proprietary filter media products have been included in the Appendix of this report. The documents outline the treatment capabilities of the devices and how they conform to the requirements above.

The proposed stormwater management system has been designed to remove a minimum of 80% of the average annual post-construction load of Total Suspended Solids (TSS). TSS Removal Calculation Worksheet is included in the calculation appendix of this report.

The Stormwater Management Handbook assigns TSS removal percentages to each treatment BMP. Each treatment BMP is sized to capture the required water quality volume as calculated in accordance with the Handbook in order to achieve the assigned TSS removal rates.

The following are water quality treatment calculations:

General Equation from Stormwater Management Handbook

Vwq = (Dwq)(A)
Vwq = required water quality volume
Dwq = water quality depth (1" for critical areas, 0.5" for non-critical areas)
A = impervious area

A water quality depth of 1 inch has been used in the calculations because the soils have a rapid infiltration rate greater than 2.4 in/hr and the project site is within the Aquifer Protection District (Zone IIs Wellhead Protection Area).

The following are treatment sizing calculations for the proposed subsurface infiltration facility:

Impervious area directed to Subsurface Infiltration Facility:

Vwq = (49,965)(1"/12) = 4,164 cf

The proposed subsurface infiltration facility provides a total water quality storage volume of 7,649 cf under the outlet pipe inverts. See the Subsurface Infiltration System Storage Volume Table above for more information pertaining to the storage volumes of the subsurface infiltration system.

A separate document entitled “Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan and Long Term Operation and Maintenance Plan” are provided under separate cover. Suitable practices for source control and long term pollution prevention have been identified and shall be implemented as discussed.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs) – Source control and pollution prevention shall be implemented in accordance with the Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

Stormwater Standard 5 is not applicable to this project. The proposed development will not be subject to the higher potential pollutant loads as defined in the Massachusetts Department of Environmental Protection Wetlands and Water Quality Regulations.

LUHPPLs are identified in 310 CMR 22.20B(2) and C(2)(a)-(k) and (m) and CMR 22.21(2)(a)(1)-(8) and (b)(1)-(6), areas within a site that are the location of activities that are subject to an individual National Pollutant Discharge Elimination System (NPDES) permit or the NPDES Multi-Sector General Permit; auto fueling facilities, exterior fleet storage areas, exterior vehicle service and equipment cleaning areas; marinas and boatyards; parking lots with high-intensity-use; confined disposal facilities and disposal sites.

Standard 6: Critical Areas – Stormwater discharges to critical areas require the use of specific source control and pollution prevention measures and specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas.

Stormwater Standard 6 is applicable to this project. Critical areas being Outstanding Resource Waters and Special Resource Waters as designated in 314 CMR 4.0, recharge areas for public water supplies as defined in 310 CMR 22.02, bathing beaches as defined in 105 CMR 445.000, cold-water fisheries and shellfish growing areas as defined in 314 CMR 9.02 and 310 CMR 10.04.

The project site is located within the Aquifer Protection District (Zone IIs Wellhead Protection Area). The project site is meeting this standard by providing recharge utilizing a subsurface infiltration facility, treating the 1" water quality volume and providing 44% TSS removal prior to discharging to the subsurface infiltration facility.

Standard 7: Redevelopments – A redevelopment project is required to meet Standards 1-6 only to the maximum extent practicable. Remaining standards shall be met as well as the project shall improve the existing conditions.

Stormwater Standard 7 is applicable to this project. Within the Stormwater Handbook (volume 1 chapter 1 page 20), the definition of a redevelopment project includes, "development, rehabilitation, expansion and phased projects on previously developed sites, provided the redevelopment results in no net increase in impervious area". The project site is meeting all of the stormwater standards. The Town of Wayland Conservation Commission is treating this project as a redevelopment due to the previous land use by Ratheon, as described in the beginning of this document. It should be noted that the project complies, to the greatest extent practicable, to the new development standards of these regulations.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan shall be implemented.

A *Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan and Long Term Operation and Maintenance Plan* is included under separate cover with this report. The erosion and sediment control section of the program details the construction period operation and maintenance plan and sequencing for pollution prevention measures and erosion and sedimentation controls. Locations of erosion control measures for the project are depicted on the site plan set accompanying this report.

Standard 9: A long term Operation and Maintenance Plan shall be implemented.

A *Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan and Long Term Operation and Maintenance Plan* are included under separate cover with this report. The long term operation and maintenance section of the program provides details and the schedule for routine and non-routine maintenance tasks to be implemented at the completion of the project.

Standard 10: Prohibition of Illicit Discharges – Illicit discharges to the stormwater management system are prohibited.

Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Discharges to the stormwater management system from the following activities or facilities are permissible: Firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents. All other illicit discharges are prohibited.

There are no known illicit discharges anticipated through the completion of this project. During construction and post construction procedures are provided to dissipate the potential for illicit discharges to the drainage system. Post construction preventions of illicit discharges are described in the Inspection and Maintenance Plan under the Good Housekeeping Practices section of the report. An illicit discharge compliance statement has been included in the appendix of this report.

LID Measures / Requirements

The project, as proposed, attempts to best implement LID Stormwater Management Devices as is applicable for this redevelopment project. LID options were investigated and explored, but the results yielded, mainly due to poor soils on a majority of the site, that the site was primarily conducive to the implementation of pervious pavers, a geo-grid grass system and a subsurface stormwater infiltration system. The implementation of the pervious pavers system allow for the introduction of a patio in proximity to the building, and in proximity to sensitive resource areas without creating a significant amount of runoff or impervious 'paved' surfaces. The geo-grid grass system allows for the construction of two (2) areas for emergency vehicles to access portions of the site that are not accessible to everyday users of the site while still giving the appearance of grass and allowing clean stormwater to infiltrate into the property and yet still providing strong and safe access to non-paved portions of the site. The subsurface stormwater infiltration system allows for a significant amount of groundwater recharge while not requiring an expanded footprint of disturbance, that would be required with an open air basin, on a site that is encumbered by several resource area buffer zones associated with adjacent resource areas.

The implementation of these devices helps to reduce the footprint of the project while providing environmental benefits to the project site.

APPENDIX

TSS REMOVAL CALCULATION WORKSHEETS

INSTRUCTIONS:
1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structureal BMP Table
2. The calcualtions must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

TSS Removal Calculation Worksheet

Location: Council on Aging Community Center, 8 Andrew Avenue, Wayland, MA

Train 1: Proposed parking areas

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Catchbasin	25%	1.00	0.25	0.75
Filter Media Unit	44%	0.75	0.33	0.42
Subsurface Infiltration Facility	80%	0.42	0.34	0.08

Total TSS Removal = 91.6%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 6452

Prepared By: Meridian Associates, Inc.

Date: 12/7/2022

*Equals remaining load from previous BMP(E) which enters the BMP

** See portion of STEP Fact Sheet for removal rate

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

DISCHARGE VELOCITIES FROM STORMWATER PIPE OUTLETS

DISCHARGE VELOCITIES FROM STORMWATER PIPE OUTLETS

Discharge Velocities from Subsurface infiltration Basin

2-Year Storm:	0.0 fps
10-Year Storm:	0.0 fps
25-Year Storm:	2.8 fps
100-Year Storm:	6.1 fps

Discharge Velocities from Roof Drain

2-Year Storm:	1.3 fps
10-Year Storm:	1.5 fps
25-Year Storm:	1.6 fps
100-Year Storm:	1.8 fps

The velocities above reference the velocities of the stormwater as it enters the level spreader from the stormwater pipe outlets. The acceptable maximum velocities to prevent scour on slopes of approximately 5% is 5 feet per second (fps). Only in the 100 year storm event does the velocity entering the level spreader exceed 5 fps. The level spreader has been designed and sized in accordance with Mass DEP Volume 2Chapter 2: Structural BMP Specifications for the Massachusetts Stormwater Handbook to reduce discharge velocities. As designed, the level spreader should reduce velocities to a rate of less than 5 fps which in turn will prevent scouring down stream of the level spreader.

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GROUNDWATER MOUNDING CALCULATIONS

Ground Water Mounding Analysis:

In accordance with Volume 3 Chapter 1 of the Massachusetts Stormwater Handbook a ground water mounding analysis is required when "the vertical separation from the bottom of an exfiltration system to seasonal high groundwater is less than 4' *and* the recharge system is proposed to attenuate the peak discharge…" from large storm events. The proposed project utilizes a subsurface infiltration facility design to meet the DEP Stormwater Standards for Peak Rate Attenuation, Recharge and Water quality.

The Stormwater Handbook references the Hantush method as the standard method for conducting groundwater mounding calculations. This method "predicts the maximum height of the groundwater mound beneath a rectangular of circular recharge area" as related to an aquifer.

Hantush (1967) presented the following equations for predicting the maximum height of the water table beneath a rectangular recharge area:

$$h_m^2 - h_i^2 = Zm(t) = (2w/K)ntS*(0.5A/(4nt)1/2,0.5B/(4nt)1/2) \ldots\ldots (1)$$

$$n = Kb/e \ldots\ldots (2)$$

$$b = 0.5[h_i(0) + h(t)] \ldots\ldots (3)$$

where hm is maximum height of mound above aquifer base (i.e., maximum saturated thickness of aquifer beneath recharge area); h_i is initial height of water table above aquifer base (i.e., initial saturated thickness of aquifer); K and e are hydraulic conductivity and storativity (specific yield) of aquifer, respectively; w is constant rate of percolation from rectangular recharge area of length A and width B; b is a constant of linearization; and the function S* is an integral expression (see Hantush 1967). The aquifer is unconfined and assumed to have infinite extent.

If infiltration ends at time t=t0, Hantush (1967) applied the principle of superposition to compute the decay of the mound as follows:

$$h_m^2 - h_i^2 = Zm(t) - Zm(t-t0) \ldots\ldots (4)$$

Equation (1) is nonlinear owing to the definition of b in Equation (3); however, the solution is readily obtained by successive approximation utilizing the attached spreadsheet developed by the USGS.

Proposed Subsurface Infiltration Facility:

The input parameters for the proposed subsurface infiltration facility are as follows:

Hydraulic Conductivity (K) = 40 ft/day (USGS SIR 2010-5102/Freeze and Cherry 1979, see attached)

Specific Yield (e) = 33% = 0.33 (sand, fine, Morris and Johnson 1967)

Initial Saturated Thickness (hi) = 10' (based on USGS surficial geology mapping)

Length of Recharge Area (A) = 70 ft (square root of total area for infiltration facility because it is not rectangular)

Width of Recharge Area (B) = 70 ft (square root of total area for infiltration facility because it is not rectangular)

Recharge Rate (R):

Exfiltration volume from 100yr Storm event (from HydroCAD analysis) = 35,833 ft^3
Duration = 25.0 hours event (from HydroCAD analysis including drawdown)
Basin horizontal floor area = 6,290 sf
35,833 ft^3 / (25.0 hours / 24 hours/day) / 6,290 sf = **5.47 ft/day**

Time (t):

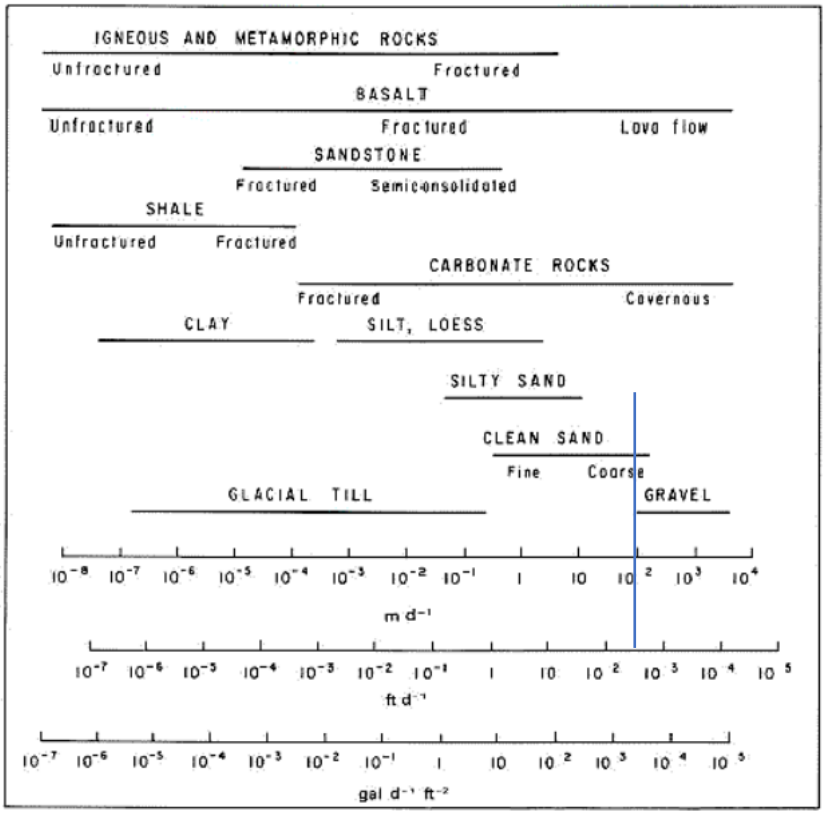
25.0 hrs / 24 hrs/day = **1.04 days** (from HydroCAD analysis including drawdown)

Conclusion:

As shown on the attached spreadsheet, the mounding analysis predicts a theoretical groundwater mound beneath the subsurface infiltration facility creating a localized maximum water-table rise of 1.5 feet in the center of the subsurface infiltration facility. Therefore, the groundwater mound will not intercept the bottom of the subsurface infiltration facility.

The following table shows representative values of specific yield for various geologic materials (from Morris and Johnson 1967):

Material	Specific Yield (%)
Gravel, coarse	21
Gravel, medium	24
Gravel, fine	28
Sand, coarse	30
Sand, medium	32
Sand, fine	33
Silt	20
Clay	6
Sandstone, fine grained	21
Sandstone, medium grained	27
Limestone	14
Dune sand	38
Loess	18
Peat	44
Schist	26
Siltstone	12
Till, predominantly silt	6
Till, predominantly sand	16
Till, predominantly gravel	16
Tuff	21



Hydraulic conductivity of selected consolidated and unconsolidated geologic materials (from Heath 1983).

Per USGS SIR 2010-5102, horizontal hydraulic conductivity shall be assumed to be 10 times vertical conductivity. Therefore, from the above chart, horizontal conductivity, **Kh = 5.7 ft/day * 10 = 57.0 ft/day**

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

inch/hour	feet/day
hours	days

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

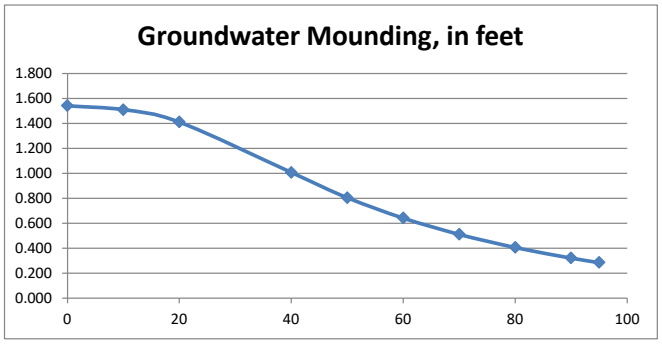
Input Values

4.1350	***R***	**Recharge (infiltration) rate (feet/day)**
0.760	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
57.00	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
35.000	**x**	**1/2 length of basin (x direction, in feet)**
35.000	**y**	**1/2 width of basin (y direction, in feet)**
1.040	**t**	**duration of infiltration period (days)**
50.000	**hi(0)**	**initial thickness of saturated zone (feet)**

51.543	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
1.543	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
1.543	0
1.511	10
1.412	20
1.007	40
0.805	50
0.642	60
0.511	70
0.406	80
0.322	90
0.286	95

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

FILTER MEDIA DOCUMENTATION

BayFilter™

The Exact System Needed for Large & Small Sites

*The Most **Advanced** Name in Drainage Systems®*

ADS

ADS BAYFILTER™ STORMWATER FILTRATION SYSTEM

With over seven years in research and development, BayFilter is the most efficient, effective, economical, and easy-to use stormwater treatment filter on the market today. The BayFilter system utilizes well proven sand filter principles to remove pollutants such as sediments, oil, metals, organics and nutrients. The modular design allows the units to be sized based on site conditions providing the exact system needed for both large and small sites.

FILTER OPERATION:

The BayFilter system consists of modular cartridges placed in vaults for stormwater treatment. The cartridge consists of a spiral wound media filter cartridge utilizing a proprietary sand mix with over 43 square feet of active filtration area. During a storm event, water will begin to enter the vault at the inlet pipe and fill the structure where the filters are housed. When the water surface elevation reaches the operation level, water is forced through the cartridges via hydrostatic head. Water enters the cartridge through the inlet drainage material and is forced through the media filter into the outlet drainage material. Once operation level is reached the filtered stormwater exits the system via the center drain tube into the drainage manifold. During storm subsidence the filters still operate under siphon conditions until the siphon is released and backwash occurs. The remaining water in the vault is evacuated through filtered draindown modules located in the vault. The cartridge system operates in four phases of flow which are:

1. Vault Fill and Air Release

2. Uniform Bed load hydrodynamic filtration

3. Uniform Bed load siphon filtration

4. Siphon break and hydrodynamic backwash.

Due the backwash cycle of the treatment process, sediment is deposited on the vault floor. The back wash provides an additional level of filter cleaning not provided in other modular filter systems. This extends the life of the filter and reduces maintenance. In addition the filter retains some minor amount of sediment as well.

DESIGN

BayFilter systems are designed to be offline systems and can be designed for the water quality flow or volume. Each configuration should be evaluated to determine the best utilization.

When the water quality flow rate is used the treatment flows will be less than the peak discharge from the site. A bypass structure allows the filter system to be placed offline with lower flows routed to it while higher peak storms are bypassed around the system. Use of a BaySeparator as a pretreatment device can prevent the filters from treating many larger particles which are more easily removed by gravity separation. Use of pretreatment can extend the life of the more costly filter system.

In flow based design there is usually a higher flow rate treated per cartridge but reduced treated sediment load per cartridge. Flow based configurations are generally limited by flow capacity and not sediment loading.

It is advisable for these configurations to utilize a BaySeparator prior to the detention system as pretreatment. For volume-based systems the BayFilter is used on the outlet side of the detention system. This provides not only the detention for the site but the ability to route the water quality volume through the BayFilter. These types of designs are generally fewer cartridges with higher sediment loads.

The offline design of the systems provides for control of sediment scour and resuspension. The larger storms which could scour and remove sediment from the structure are routed around the structure and prevent introduction of flow which could deposit sediments downstream.

HOW MANY CARTRIDGES

Each BayFilter system relies on a collection of individual cartridges to achieve the desired removal efficiency so the correct number of cartridges is important. Too few cartridges will result in a system that does not meet performance or requires frequent maintenance while too many results in a system that is too large and overly expensive. To determine the number of cartridges three factors must be considered:

- The flow capacity of the system
- Treated sediment load
- Jurisdiction

In general BayFilter cartridges are designed to handle 30gpm (0.067cfs) per cartridge. When combined with treated sediment load and jurisdiction requirements the minimum number of cartridges necessary can be determined. More complete design parameters and guidelines are available upon request.

CONFIGURATION

There are several different options available for the BayFilter configurations but the most common are the Manhole filter, precast vault filter, and cast-in-place filter. The Manhole configuration is the most economical version of the system. Treatment Capacities are as follows:

Treatment Capacities	Manhole Size (inches)	Maximum Number of Filter Cartridges	Maximum Treatment Flow gpm (cfs)
	60	3	90 (0.20)
	72	4	120 (0.27)
	84	5	150 (0.037)
	96	7	210 (0.47)

Manhole BayFilters are ideal for installation on the downstream side of a detention system. Precast vaults are used on larger sites with more impervious area. The precast BayFilter system is larger than the manhole BayFilter. It has a treatment capacity as follows:

Treatment Capacities	Vault Size (ft x ft)	Maximum Number of Filter Cartridges	Maximum Treatment Flow gpm (cfs)
	8' x 10'	10	300 (0.67)
	8' x 12'	13	390 (0.87)
	8' x 14'	15	450 (1.00)
	8' x 16'	18	540 (1.20)
	10' x 16'	21	630 (1.40)
	10' x 20'	27	810 (1.80)
	10' x 26'	33	990 (2.21)
	10' x 32'	42	1260 (2.81)
	10' x 38'	51	1530 (3.41)
	10' x 40'	54	1620 (3.61)

Installations of Precast BayFilter systems can be used independently or in conjunction with a detention system. Pretreatment with a BaySeparator should be considered to extend the filter life.

The last option available is the cast-in-place BayFilters. On sites that require more the 54 cartridges or where the precast and manhole

system is not practical, a cast in place vault can provide the solution. High flow rates, shallow installations, very flat sites, and limited footprints can all be reasons for a cast in place system.

INSTALLATION:

Installation of the BayFilter system can be performed by the same contractor performing the installation of piping and underground utilities. The installation process is very simple and consistent whether installing the system in a manhole, precast vault, or cast in place vault. Once the containment system has been installed the filter system is placed inside the vault. The installation consists of the drainage manifold, energy dissipater/level spreader, and cartridges. Because the BayFilters are modular the system can be installed very quickly. The cartridges should be installed after the site has been stabilized to avoid unnecessary filter replacements from construction related activities.

MAINTENANCE:

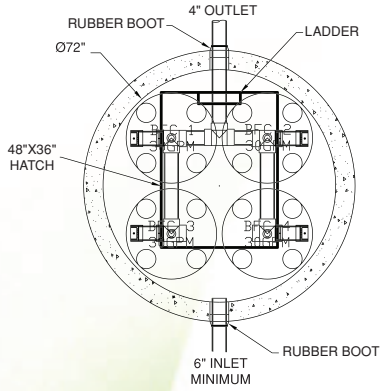
As with all stormwater treatment devices the BayFilter systems requires periodic maintenance to continue operating at the design flow rate and efficiency. Maintenance involves the removal and replacement of each cartridge and cleaning of the containment system with a vacuum truck. Maintenance should be performed by trained personnel.

The maintenance cycle of the system will be driven mostly by the actual solids load on the filter. The system should be monitored periodically to make certain that the system is operating correctly. Maintenance cycles can be variable depending on storm events and sediment loads. For complete maintenance instructions and guidelines contact your ADS representative.

SPECIFICATIONS

INTERNAL COMPONENTS

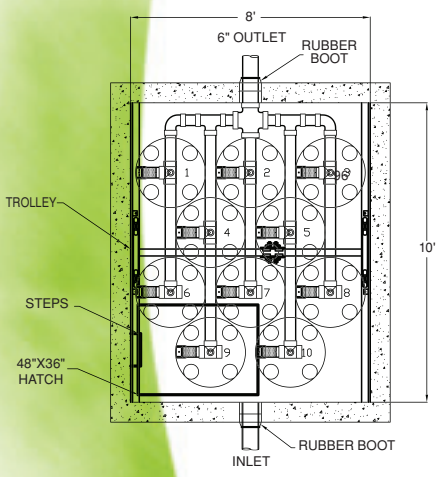
- Precast Concrete Vault: Shall be provided according to ASTM C478, C858, and C1433. Precast concrete vaults shall be provided by BaySaver Technologies, Inc.
- PVC Manifold Piping: All internal PVC pipe and fittings shall meet ASTM D1785. Manifold piping shall be provided to the contractor partially pre–cut and pre-assembled.
- Filter Cartridges: External shell of the filter cartridges shall be substantially constructed of polyethylene or equivalent material. Filtration media shall be arranged in a layered fashion to maximize available filtration area. An orifice plate shall be supplied with each cartridge to restrict flow rate to a maximum of 30 gpm.
- Filter Media: Filter media shall be by BaySaver Technologies Inc. Filter media shall consist of the following mix. Sand media shall have an effective particle size of not more than 0.49 mm, it shall have an angular grain shape, a hardness of 7, be 99% silica, and not leach nutrients. The media shall also include a blend of Perlite and Activated Alumina.
- Flow Spreader/Energy Dissipator: Shall be constructed of polyethylene or equivalent material.



Manhole Configuration

PERFORMANCE

- The stormwater filter system shall be an offline design capable of treating 100% of the required treatment flow at full sediment load conditions.
- The stormwater filter system's cartridge units shall have no moving parts.
- The stormwater treatment unit shall be designed to remove at least 85% of total suspended solids, 65% of total phosphorus, 65% of turbidity, 60% of total copper and 60% of total zinc based on field data collected in compliance with the Technology Acceptance Reciprocity Partnership Tier II test protocol.
- The stormwater filtration system shall reduce incoming turbidity (measured as NTUs) by 65% or more and shall not have any components that leach nitrates or phosphates.
- The stormwater filtration cartridge shall be equipped with a hydrodynamic backwash mechanism to extend the filter's life and optimize its performance. Inlet flow shall be upflow.
- The stormwater filtration system shall be designed to remove a minimum of 65% of the incoming Total Phosphorus (TP) load.
- The stormwater filtration system's cartridge units shall have the following minimum flow and sediment load capacities:



Vault Configuration

INSTALLATION

Design Flow per BFC—gmp Nominal	30	23	20	15
Treated Sediment Load for 80% Sediment Removal—lbs.	150	200	250	300

Installation of the BayFilter System(s) shall be performed per manufacturer's Installation Instructions.

For more information on BayFilter Stormwater Filtration System and other ADS products, please contact our Customer Service Representatives at 1–800–821–6710

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1–800–821–6710 www.ads–pipe.com

SECTION (_____)
JELLYFISH® MEMBRANE FILTRATION SYSTEM
STORMWATER QUALITY – MEMBRANE FILTRATION SYSTEM STANDARD SPECIFICATION

1. GENERAL

1.1. The Contractor shall furnish and install the Jellyfish, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents. The water quality treatment flow shall be as determined and approved by the Engineer of Record. The Jellyfish system removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2. The Jellyfish shall be of a type that has been installed and in use for a minimum of five (5) consecutive years preceding the date of installation of the system. The manufacturer shall have been, during the same consecutive five (5) year period, engaged in the engineering design and production of systems deployed for the treatment of storm water runoff and which have a history of successful production, acceptable to the Engineer of Record and/or the approving Jurisdiction. The manufacturer of the Jellyfish shall be, without exception:

Contech Engineered Solutions
9100 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

1.3. Submittals: Shop drawings for the structure and performance are to be submitted with each order to the contractor. Contractor shall forward shop drawing submittal to the consulting engineer for approval. Shop drawings are to detail the structure precast concrete and call out or note the internals/components.

1.4. Product Substitutions: Any proposed product substitution to this specifications must be submitted for review and approved 10 days prior to project bid date by the Engineer of Record. Review package should include third party reviewed performance data for both flow rate and pollutant removal. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

1.5. American Society for Testing and Materials (ASTM) Reference Specifications:

1.5.1. ASTM C891: Standard Specification for Installation of Underground Precast Concrete Utility Structures

1.5.2. ASTM C478: Standard Specification for Precast Reinforced Concrete Manhole Sections

1.5.3. ASTM C858: Standard Specification of Underground Precast Concrete Utility Structures

1.5.4. ASTM C857: Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

1.5.5. ASTM C990: Standard Specification for Joints for Concrete Manholes Using Preformed Flexible Joint Sealants

1.5.6. ASTM D4101: Standard Specification for Copolymer steps construction

1.5.7. ASTM D4097: Standard Specification for Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant

2. MATERIALS

2.1. Precast Concrete Structure: The device shall be an all concrete structure (including risers), constructed from precast concrete riser and slab components or monolithic precast structure(s). Precast concrete vault shall be provided according to ASTM C857 and C858 and manholes shall be provided according to ASTM C478. Both structure types shall be installed to conform to ASTM C891 and to any required state highway, municipal or local specifications; whichever is more stringent. All precast concrete components shall be manufactured to a minimum live load of HS-20 truck loading or greater based on local regulatory specifications, unless otherwise modified or specified by the design engineer.

2.2. Gaskets: Gaskets and/or sealants shall be used to seal between concrete joints. Joints shall be sealed with preformed joint sealing compound conforming to ASTM C990.

2.3. Internal Components:

2.3.1. Cartridge Deck: The deck insert shall be bolted and sealed inside the precast concrete chamber. The insert shall serve as: (a) a horizontal divider between the lower treatment zone and the upper treated effluent zone; (b) a deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone; (c) a platform for maintenance workers to service the filter cartridges; (c) a conduit for conveyance of treated water to the effluent pipe.

2.3.1.1. Fiberglass: In cylindrical configurations, the fiberglass portions of the filter device shall be constructed in accordance with the following standard: ASTM D4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks.

2.3.1.2. Aluminum: In rectangular configurations, the aluminum cartridge deck shall be ¼" thick, 5052-H32 Aluminum with all welds to be 100% continuous waterproof weld using 5356 filler.

2.3.2. Membrane Filter Cartridges: Filter cartridges shall be comprised of reusable cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge shall be a minimum of eleven 2.75-inch (70-mm) or greater diameter elements. The length of each filter element

shall be a minimum 15 inches (381 mm). Each cartridge shall be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck. Each cartridge shall be secured by a cartridge lid that is threaded onto the receptacle, or similar mechanism to secure the cartridge into the deck. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid, or on the individual cartridge itself, and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum design flux rate shall be 0.21 gpm/ft^2 (0.142 lps/m^2).

2.3.3. Each membrane filter cartridge shall allow for manual installation and removal. Each filter cartridge shall contain no less than 7 ft^2 of surface area per inch of length and have filtration membrane surface area and dry installation weight as follows (if length of filter cartridge is between those listed below, the surface area and weight shall be proportionate to the next length shorter and next length longer as shown below):

Filter Cartridge Length (in)	Minimum Filtration Membrane Surface Area (ft^2 / m^2)	Maximum Filter Cartridge Dry Weight (lbs / kg)
15 / 381	106 / 9.8	10.0 / 4.5
27 / 686	190 / 17.7	14.5 / 6.6
40 / 1016	282 / 26.2	19.5 / 8.9
54 / 1372	381 / 35.4	25.0 / 11.4

2.3.4. Backwashing Cartridges: The filter device shall have a weir extending above the cartridge deck, or other mechanism, that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir, or other mechanism, shall collect a pool of filtered water during inflow events that backwashes the high flow rate cartridges when the inflow event subsides. All filter cartridges and membranes shall be reusable and allow for the use of filtration membrane rinsing procedures to restore flow capacity and sediment capacity; extending cartridge service life.

2.3.5. Maintenance Access to Captured Pollutants: The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the deck. Access shall have a minimum clear height over all of the filter cartridges (length of cartridge + 6 inches), or be accessible by a hatch or other mechanism that provides vertical clear space over all of the filter cartridges such that the cartridges can be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

2.3.6. Baffle: The filter device shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle shall serve to protect the membrane filter elements from

contamination by floatables and coarse sediment. The baffle shall be flexible and continuous in cylindrical configurations, and shall be a straight concrete or aluminum wall in rectangular configurations.

2.3.7. Sump: The device shall include a minimum 24 inches (610 mm) of sump below the bottom of the cartridges for sediment accumulation, unless otherwise specified by the design engineer. Depths less than 24 inches may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

2.3.8. Steps: Steps shall be constructed according to ASTM D4101 of copolymer polypropylene, and be driven into preformed or pre-drilled holes after the concrete has cured, installed to conform to applicable sections of state, provincial and municipal building codes, highway, municipal or local specifications for the construction of such devices.

2.3.9. Double-Wall Containment of Hydrocarbons: The cylindrical precast concrete device shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 inches (305 mm) below the cartridge deck, and the precast vessel wall.

2.4. Bend Structure: The device shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.

2.5. Frame and Cover: Frame and covers must be manufactured from cast-iron or other composite material tested to withstand H-20 or greater design loads, and as approved by the local regulatory body. Frames and covers must be embossed with the Contech or the Jellyfish brand name.

2.6. Doors and Hatches: If provided shall meet designated loading requirements or at a minimum for incidental vehicular traffic.

3. PERFORMANCE

3.1. Function: The Jellyfish filter shall function to remove pollutants by the following unit treatment processes; sedimentation, floatation, and membrane filtration.

3.2. Pollutants: The Jellyfish filter shall remove oil, debris, trash, coarse and fine particulates, particulate-bound pollutants, metals and nutrients from stormwater during runoff events.

3.3. Bypass: The Jellyfish filter shall typically utilize an external bypass to divert excessive flows. Where an internal bypass is utilized, systems shall be equipped with a floatables baffle, and bypass water shall not pass through the treatment sump or cartridge filtration zone.

3.4. Treatment Flux Rate (Surface Loading Rate): The Jellyfish filter shall treat 100% of the required water quality treatment flow based on a maximum design flux rate (surface

loading rate) across the membrane filter cartridges not to exceed 0.21 gpm/ft^2 (0.142 lps/m^2).

3.5. Field Testing: At a minimum, the Jellyfish filter shall have been field tested and verified with a minimum 25 qualifying storm events and field monitoring conducted according to the TARP Tier II or TAPE field test protocol, and have received NJCAT verification.

3.6. Suspended Solids Removal: The Jellyfish filter shall have demonstrated a minimum median TSS removal efficiency of 85% and a minimum median SSC removal efficiency of 95%.

3.7. Fine Particle Removal: The Jellyfish filter shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, an effluent d_{50} of 15 microns or lower for all monitored storm events, and an effluent turbidity of 15 NTUs or lower.

3.8. Nutrient (Total Phosphorus & Total Nitrogen) Removal: The Jellyfish filter shall have demonstrated a minimum median Total Phosphorus removal of 55%, and a minimum median Total Nitrogen removal of 50%.

3.9. Metals (Total Zinc & Total Copper) Removal: The Jellyfish filter shall have demonstrated a minimum median Total Zinc removal of 50%, and a minimum median Total Copper removal of 75%.

4. EXECUTION

4.1. Handling and Storage: Prevent damage to materials during storage and handling.

4.2. Precast Concrete Structure: The installation of the precast concrete device should conform to ASTM C891 and to any state highway, municipal or local specification for the installation of underground precast concrete structures, whichever is more stringent. Selected sections of a general specification that are applicable are summarized below.

4.2.1. The precast concrete device is installed in sections in the following sequence:

- aggregate base
- base slab
- treatment chamber and cartridge deck riser section(s)
- bypass section
- connect inlet and outlet pipes
- concrete riser section(s) and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

4.2.2. The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with Contech's recommendations.

4.2.3. Adjustment of the Jellyfish filter can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary to restore original condition and seals. Once the Jellyfish filter has been constructed, any/all lift holes must be plugged with mortar or non-shrink grout.

4.3. Inlet and Outlet Pipes: Inlet and outlet pipes should be securely set into the device using approved pipe seals (flexible boot connections, where applicable), and such that any pipe intrusion into the device does not impact the device functionality.

4.4. Frame and Cover Installation: Adjustment units (e.g. grade rings) should be installed to set the frame and cover at the required elevation. The adjustment units should be laid in a full bed of mortar with successive units being joined using sealant recommended by Contech. Frames for the cover should be set in a full bed of mortar at the elevation specified.

4.5. In some instances the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation of these components shall be performed according to instructions provided by Contech.

5. ACTIVATION, INSPECTION AND MAINTENANCE

5.1. Filter cartridges shall be installed in the cartridge deck in accordance with the manufacturer's guidelines and recommendations. Contractor to contact the manufacturer to schedule cartridge delivery and review procedures/requirements to be completed to the device prior to installation of the cartridges and activation of the system.

5.2. Manufacturer shall coordinate delivery of filter cartridges and other internal components with contractor. Filter cartridges shall be installed after site is stabilized and/or unit is isolated from construction influent and ready to accept cartridges. Unit is ready to accept cartridges after it has been cleaned out and any standing water, debris, and other materials have been removed. Contractor shall take appropriate action to protect the filter cartridge receptacles and filter cartridges from damage during construction, and in accordance with the manufacturer's recommendations and guidance. For systems with cartridges installed prior to full site stabilization, the contractor shall plug inlet and outlet pipes to prevent stormwater and other influent from entering the device. Plugs are to be removed once the site is stabilized and unit is ready to receive stormwater runoff.

5.3. Durability of membranes are subject to good handling practices during inspection and maintenance (removal, rinsing, and reinsertion) events, and site specific conditions that may have heavier or lighter loading onto the cartridges, and pollutant variability that may impact the membrane structural integrity. Membrane maintenance and replacement shall be in accordance with Contech's recommendations.

5.4. Inspection; which includes trash and floatables collection, sediment depth determination, and visible determination of backwash pool depth; shall be easily conducted from grade (outside the structure).

5.5. Manual rinsing of the reusable filter cartridges shall promote restoration of the flow capacity and sediment capacity of the filter cartridges, extending cartridge service life.

5.6. The filter device shall have a minimum 12 inches (610 mm) of sediment storage depth, and a minimum of 12 inches between the top of the sediment storage and bottom of the filter cartridge tentacles, unless otherwise specified by the design engineer. Variances may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

5.7. Sediment removal from the filter treatment device shall be able to be conducted using a standard maintenance truck and vacuum apparatus, and a minimum one point of entry to the sump that is unobstructed by filter cartridges.

5.8. Maintenance access shall have a minimum clear height over all of the filter cartridges (length of cartridge + 6 inches), or be accessible by a hatch or other mechanism that provides vertical clear space over all of the filter cartridges such that the cartridges can be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

5.9. After construction and installation, and during operation, the device shall be inspected and cleaned as necessary based on Contech's recommended inspection and maintenance guidelines and the local regulatory agency/body.

5.10. When replacement membrane filter elements and/or other parts are required, only membrane filter elements and parts approved by Contech for use with the Jellyfish filter shall be installed.

5.11. Filter cartridges shall be able to be maintained without the use of additional lifting equipment.

5.12. Contech shall provide an Owner's Manual upon request.

END OF SECTION

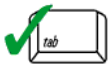
CHECKLIST FOR STORMWATER REPORT

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



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.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

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

D S Kelley March 17, 2023

Signature and Date

Checklist

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

☐ New development

☒ 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.

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[1]

☐ 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.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

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.

** The calculations utilize the half-inch rule for BMP's (as noted in the treatment calculations provided).

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;

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

ILLICIT DISCHARGE COMPLIANCE STATEMENT

MERIDIAN ASSOCIATES
100% employee owned

ILLICIT DISCHARGE COMPLIANCE STATEMENT

Responsibility

The Owner is responsible for ultimate compliance with all provisions of the Massachusetts Stormwater Management Policy and responsible for identifying and eliminating illicit discharges (as defined by the USEPA).

Owner's Name: Town of Wayland
Address: 41 Cochituate Road
Wayland, MA 01778
Telephone Number:

Project Address: 8 Andrew Avenue, Wayland, MA 01778

Owner's Signature: Michael McCall

Engineer's As-built Compliance Statement

To the best of my knowledge, the project referenced above meets the requirements of Standard 10 of the Massachusetts Stormwater Handbook regarding illicit discharges to the stormwater management system and that no detectable illicit discharges exist on the site.

Included with this statement is a plan entitled: "Utility Plan", drawn to scale, that identifies the locations of systems for conveying stormwater on the site and show that these systems do not allow the entry of any illicit discharges into the stormwater management system. The plans also show any systems for conveying wastewater on the site and show that there are no connections between the stormwater and wastewater systems. All documents and attachments were prepared under my direction and qualified personnel properly gathered and evaluated the information submitted, to the best of my knowledge.

The responsible parties for implementing the Long Term Pollution Prevention Plan are accountable to ensure no illicit discharges take place.

Signature: D S Kelley
David S. Kelley, PE for Meridian Associates, Inc.

P:\6452_10 Andrew Ave, Wayland, Ma\ADMIN\Reports\Stormwater\6452 Illicit Discharge Compliance Stmt.doc