Stormwater Management Policy
For
The Winsor At Millbrook Village
Railroad Avenue, Duxbury, MA

Checklist for Stormwater Report
Stormwater Management Form
Summary of Peak Runoffs &Volumes
Water Quality and Recharge Calculations
TSS Removal Calculation Worksheets
Infiltration System/Detention Basins Hydrographs
Infiltration System Mounding Analysis
Illicit Discharge Compliance Statement
Operation & Maintenance Plan

Report prepared for
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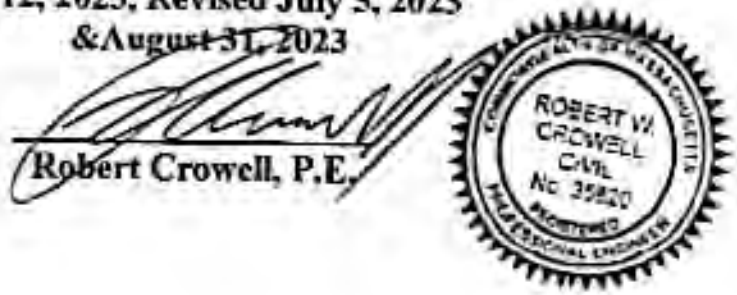

Robert Crowell, P.E.

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.

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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

Signature and Date

8/31/23
6/12/23 R 7/5/23

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:

- [x] 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

- [x] No new untreated discharges
- [x] Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- [x] 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.

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.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Appendix C – Stormwater Management Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

A. Property Information

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

1. The proposed project is:

New development ☒ Yes ☐ No

Redevelopment ☐ Yes ☐ No

Combination ☐ Yes (If yes, distinguish redevelopment components from new development components on plans). ☐ No

Note: This November 2000 version of the Stormwater Management Form supersedes earlier versions including those contained in DEP's Stormwater Handbooks.

2. Stormwater runoff to be treated for water quality are based on which of the following calculations:

☐ 1 inch of runoff x total impervious area of post-development site for discharge to **critical areas** (Outstanding Resource Waters, recharge areas of public water supplies, shellfish growing areas, swimming beaches, cold water fisheries).

☒ 0.5 inches of runoff x total impervious area of post-development site for other resource areas.

3. List all plans and documents (e.g. calculations and additional narratives) submitted with this form:

Site Plan - The Winsor at Millbrook Village, Railroad Avenue, Duxbury MA dated 6/12/23, rev. 7/5/23 & 8/31/23

Drainage Analysis for The Winsor at Millbrook Village, Railroad Avenue, Duxbury MA dated 6/12/23, rev. 7/5/23 & 8/31/23

Stormwater Management Policy for The Winsor At Millbrook Village, Railroad Avenue, Duxbury MA dated 6/12/23, rev. 7/5/23 & 8/31/23

B. Stormwater Management Standards

DEP's Stormwater Management Policy (March 1997) includes nine standards that are listed on the following pages. Check the appropriate boxes for each standard and provide documentation and additional information when applicable.

Standard #1: Untreated stormwater

☒ The project is designed so that new stormwater point discharges do not discharge untreated stormwater into, or cause erosion to, wetlands and waters.

B. Stormwater Management Standards (cont.)

Standard #2: Post-development peak discharges rates

☐ Not applicable – project site contains waters subject to tidal action.

Post-development peak discharge does not exceed pre-development rates on the site at the point of discharge or downgradient property boundary for the 2-yr, 10-yr, and 100-yr, 24-hr storm.

☐ without stormwater controls

☒ with stormwater controls designed for the 2-yr, and 10-yr storm, 24-hr storm.

☒ the project as designed will not increase off-site flooding impacts from the 100-yr, 24-hr storm.

Standard #3: Recharge to groundwater

Amount of impervious area (sq. ft.) to be infiltrated: 12,779 SF

Volume to be recharged is based on:

☒ The following Natural Resources Conservation Service hydrologic soils groups (e.g. A, B, C, D, or UA) or any combination of groups:

49.8%	A	49.7%	C
(% of impervious area)	(Hydrologic soil group)	(% of impervious area)	(Hydrologic soil group)
0.5%	D		
(% of impervious area)	(Hydrologic soil group)	(% of impervious area)	(Hydrologic soil group)

☒ Site specific pre-development conditions: 0.60"(A), 0.25"(C), 0"(D) (Recharge rate) 390.0 C.F. (Volume)

Describe how there calculations were determined:

See attached- Water Quality and Recharge Calculations

List each BMP or nonstructural measure used to meet Standard #3. (e.g. dry well, infiltration trench).

One inground infiltration system

Does the annual groundwater recharge for the post-development site approximates the annual recharge from existing site conditions?

☒ Yes

☐ No

B. Stormwater Management Standards (cont.)

Standard #4: 80% TSS Removal

☒ The proposed stormwater management system will remove 80% of the post-development site's average annual Total Suspended Solids (TSS) load.

Identify the BMP's proposed for the project and describe how the 80% TSS removal will be achieved.

Two deep sump hooded catch basins - 25%, two water quality stormceptors - 87%,
one inground infiltration system - 70%, two detention basins - 70%
Total TSS Removal = 96% - 97%

If the project is redevelopment, explain how much TSS will be removed and briefly explain why 80% removal cannot be achieved.

Standard #5: Higher potential pollutant loads

See Stormwater Policy Handbook Vol. I, page I-23, for land uses of high pollutant loading

Does the project site contain land uses with higher potential pollutant loads

☐ Yes If yes, describe land uses

☒ No

Identify the BMPs selected to treat stormwater runoff. If infiltration measures are proposed, describe the pretreatment. (Note: If the area of higher potential pollutant loading is upgradient of a critical area, infiltration is not allowed.

Standard #6: Protection of critical areas

See Stormwater Policy Handbook Vol. I, page I-25, for critical areas.

Will the project discharge to or affect a critical area?

☐ Yes If yes, describe areas:

☒ No

WPA Appendix C – Stormwater Management Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Stormwater Management Standards (cont.)

Identify the BMPs selected for stormwater discharges in these areas and describe how BMPs meet restrictions listed on pages I-27 and I-28 of the Stormwater Policy Handbook – Vol. I:
N.A.

Note: components of redevelopment projects which plan to develop previously undeveloped areas do not fall under the scope of Standard 7.

Standard #7: Redevelopment projects

Is the proposed activity a redevelopment project?

☐ Yes If yes, the following stormwater management standards have been met:

☒ No

The following stormwater standards have not been met for the following reasons:

☐ The proposed project will reduce the annual pollutant load on the site with new or improved stormwater control.

Standard #8: Erosion/sediment control

☒ Erosion and sediment controls are incorporated into the project design to prevent erosion, control sediments, and stabilize exposed soils during construction or land disturbance.

Standard #9: Operation/maintenance plan

☒ An operation and maintenance plan for the post-development stormwater controls have been developed. The plan includes ownership of the stormwater BMPs, parties responsible for operation and maintenance, schedule for inspection and maintenance, routine and long-term maintenance responsibilities, and provision for appropriate access and maintenance easements extending from a public right-of-way to the stormwater controls.

Operation & Maintenance Plan - The Winsor at Millbrook Village, Railroad Avenue, Duxbury MA	6/12/23, rev.7/5/23 & 8/31/23
Plan/Title	Date

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Appendix C – Stormwater Management Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

C. Submittal Requirements

DEP recommends that applicants submit this form, as well as, supporting documentation and plans, with the Notice of Intent to provide stormwater management information for Commission review consistent with the wetland regulations (310 CMR 10.05 (6)(b)) and DEP's Stormwater Management Policy (March 1997). If a particular stormwater management standard cannot be met, information should be provided to demonstrate how equivalent water quality and water quantity protection will be provided. DEP encourages engineers to use this form to certify that the project meets the stormwater management standards as well as acceptable engineering standards. For more information, consult the Stormwater Management Policy.

D. Signatures

50 RR AVE DUC LLC
Applicant

Date

Signature

Robert Crowell P.E.
Representative (if any)

6/12/23 7/5/23 8/31/23
Date

Signature

Summary of Peak Runoffs & Volumes

The following are summary tables of the pre- and post-development peak runoff rates and of the total runoff volumes from the site.

TABLE 1: Total Peak Flows From Site

DESIGN STORM (YEAR)	TOTAL PEAK RUNOFF FROM SITE		
	PRE DEVELOP. (CFS)	POST DEVELOP. (CFS)	NET CHANGE (CFS)
2	**0.65**	**0.62**	-0.03
10	1.54	1.07	-0.47
25	2.29	1.43	-0.86
100	3.52	1.98	-1.54

TABLE 2: Total Runoff Volumes From Site

DESIGN STORM (YEAR)	TOTAL RUNOFF VOLUME		
	PRE DEVELOP. (Ac Ft)	POST DEVELOP. (Ac Ft)	NET CHANGE (Ac Ft)
2	0.082	0.157	**+0.075**
			(+91.5 %)
10	0.181	0.271	+0.090
			(+49.7 %)
25	0.258	**0.360**	+0.102
			(+39.5 %)
100	0.381	0.512	+0.131
			(+34.4 %)

TABLE 3: Total Peak Flows From Site At Wetlands

DESIGN STORM (YEAR)	TOTAL PEAK RUNOFF FROM SITE		
	PRE DEVELOP. (CFS)	POST DEVELOP. (CFS)	NET CHANGE (CFS)
2	**0.64**	0.62	**-0.02**
10	**1.38**	**1.03**	**-0.35**
25	**1.90**	**1.29**	**-0.61**
100	**2.70**	1.66	**-1.04**

TABLE 4: Total Runoff Volumes From Site At Wetlands

DESIGN STORM (YEAR)	TOTAL RUNOFF VOLUME		
	PRE DEVELOP. (Ac Ft)	POST DEVELOP. (Ac Ft)	NET CHANGE (Ac Ft)
2	0.071	**0.155**	+0.084
			(+118.3%)
10	0.142	0.259	**+0.117**
			(+82.4 %)
25	**0.192**	**0.340**	**+0.148**
			(+77.1 %)
100	**0.271**	**0.477**	+0.206
			(+76.0 %)

TABLE 5: Total Peak Flows To Railroad Avenue & Alden Street

DESIGN STORM (YEAR)	TOTAL PEAK RUNOFF FROM SITE		
	PRE DEVELOP. (CFS)	POST DEVELOP. (CFS)	NET CHANGE (CFS)
2	**0.03**	**0.004**	**-0.026**
10	**0.21**	0.06	-0.15
25	0.40	**0.11**	-0.29
100	0.74	0.31	-0.43

TABLE 6: Total Runoff Volumes To Railroad Avenue & Alden Street

DESIGN STORM (YEAR)	TOTAL RUNOFF VOLUME		
	PRE DEVELOP. (Ac Ft)	POST DEVELOP. (Ac Ft)	NET CHANGE (Ac Ft)
2	0.010	**0.002**	-0.008
			(-80.0%)
10	**0.035**	0.011	-0.024
			(-68.6%)
25	0.056	0.019	-0.037
			(-66.1%)
100	**0.092**	0.033	-0.059
			(-64.1%)

TABLE 7: Total Peak Flows To 114 Alden Street

DESIGN STORM (YEAR)	TOTAL PEAK RUNOFF FROM SITE		
	PRE DEVELOP. (CFS)	POST DEVELOP. (CFS)	NET CHANGE (CFS)
2	0	0	0
10	0.02	0.003	-0.017
25	0.05	0.01	-0.04
100	0.14	0.02	-0.12

TABLE 8: Total Runoff Volumes To 114 Alden Street

DESIGN STORM (YEAR)	TOTAL RUNOFF VOLUME		
	PRE DEVELOP. (Ac Ft)	POST DEVELOP. (Ac Ft)	NET CHANGE (Ac Ft)
2	0	0	0
			(0%)
10	0.005	0.001	-0.002
			(-40.0%)
25	0.010	0.001	-0.009
			(-90.0%)
100	0.018	0.002	-0.016
			(-88.9 %)

WATER QUALITY AND RECHARGE CALCULATIONS

The DEP Stormwater Management Policy requires that stormwater management systems for development sites be properly sized to control stormwater runoff at the Project Site. This section presents the basic calculations necessary to design the most appropriate best management practices (BMPs) for the Project. A summary of the projected TSS removal rates expected from the implementation of the BMPs is presented below. Calculations for determining the projected volume of stormwater runoff to be treated for water quality and the projected volume of stormwater runoff that is to be recharged to groundwater is also provided.

Projected TSS Removal Efficiency

The DEP Stormwater Management Policy shall apply to this project. For this Project four buildings (12 units) are proposed. The Site is not located within an Area of Critical Environmental Concern (ACEC). The Project includes provisions for the implementation of best management practices (BMPs) for the proposed stormwater management system. For this Project, BMPs were selected which includes two Deep Sump Hooded Catch Basins, two Water Quality Stormceptors, two Detention Basins and one Inground Infiltration System. The Stormwater Management Policy requires 80% of the average annual load of Total Suspended Solids (TSS) for the post-development condition. A TSS Removal Efficiency of 96% to 97% is projected after the construction and implementation of the above BMPs (refer to attached TSS Removal Calculation Worksheet).

Water Quality Volume

The volume of stormwater runoff that is to be treated on-site is necessary for determining the Water Quality Volume.
The projected Water Quality Volume is required to address Standard 4 included in the DEP Stormwater Management Policy.

Total Developed Site Drainage Area: 75,408 S.F. (1.7311 Acres)

Total Post-Development Impervious Area (including roofs):	33,018 S.F. (0.7580 Acres)
Total Post-Development Tributary Impervious Area to Inf System:	12,779 S.F. (0.2933 Acres)
Total Post-Development Tributary Impervious Area to Basin 1:	13,315 S.F. (0.3057 Acres)
Total Post-Development Tributary Impervious Area to Basin 2:	3179 S.F. (0.0730 Acres)
Total Post-Development Tributary Impervious Area to Wetland:	2086 S.F. (0.0479 Acres)
Total Post-Development Tributary Impervious Area to Streets:	1659 S.F. (0.0381 Acres)
	33,018 S.F. (0.7580 Acres)

Total Post-Development Tributary Impervious Area to Stormceptor 1: 13,315 S.F. (0.306 Acres)

Total Post-Development Tributary Impervious Area to Stormceptor 2: 12,779 S.F. (0.293 Acres)

Determine the projected Water Quality Volume (WQV) to be treated. Since the site is not located within a Critical Area or a well protection district, the projected stormwater runoff volume to the Stormceptors is based on 0.5-Inches of Runoff x Total Post-Development Tributary Area .

To Stormceptor 1

$$WQV = \frac{0.5 \text{ Inches} \times 13{,}315 \text{ S.F.}}{12 \text{ Inches/Foot}} = 554.8 \text{ C.F. } (4150.4 \text{ Gal})$$

The Total WQV is provided in the Stormceptor

To Stormceptor 2

$$WQV = \frac{0.5 \text{ Inches} \times 12{,}779 \text{ S.F.}}{12 \text{ Inches/Foot}} = 532.5 \text{ C.F. } (3983.3 \text{ Gal})$$

The Total WQV is provided in the Stormceptor

Stormwater Recharge

The Project includes measures to minimize the loss of annual recharge to groundwater from the development of the Site.

The volume of stormwater runoff that is to be recharged to groundwater is presented below. This calculation is based on the existing site (pre-development) soil conditions determined from the Plymouth County Soils Survey (USDA SCS data), the 2020 updated soil maps, soil observation holes and corresponding recharge rates for specific Hydrologic Groups soils.

The projected Stormwater Recharge Volume (ReV) is required to address Standard 3 included in the DEP Stormwater Management Policy.

Pre-Development Impervious Area= 8760 S.F.
Post-Development Impervious Area = 33,018 S.F.

Change in Area +24,258 S.F.

In accordance with the DEP Stormwater Management Policy, Hydrologic Group D soils are not used to calculate the projected Stormwater Recharge Volume

Existing Conditions

Soil Group	Impervious Area		Required Recharge		Volume
A	7231 S.F.	x	0.60-Inches of Runoff /12 Inches/Ft	=	361.6 C.F.
C	1365 S.F.	x	0.25-Inches of Runoff /12 Inches/Ft	=	28.4 C.F.
D	164 S.F.	x	0-Inches of Runoff /12 Inches/Ft	=	0 C.F.
Total = 8760 S.F. (0.2011 Acres)				Total =	390.0 C.F.

Proposed Conditions

Soil Group	Impervious Area		Required Recharge		Volume
A	16,703 S.F.	x	0.60-Inches of Runoff /12 Inches/Ft	=	835.2 C.F.
C	16,151 S.F.	x	0.25-Inches of Runoff /12 Inches/Ft	=	336.5 C.F.
D	164 S.F.	x	0-Inches of Runoff /12 Inches/Ft	=	0 C.F.
Total = 33,018 S.F. (0.7580 Acres)				Total =	1171.7 C.F.

The Total Recharge Volume of 1171.7 C.F. – 390.0 C.F. = 781.7 C.F. is required for the Project.

Recharge in Proposed Infiltration System & Proposed Infiltration/Detention Basins

The volume to be recharged for the 2 year storm event is shown in the Drainage Analysis report.
2 year storm
Infiltration System Recharge Volume = 3354.1 C.F. (0.077 af)

Total Recharge (2 year storm event)

The Total Recharge Volume required for the Project = 781.7 C.F.
The Total Recharge Volume provided for the Project = 3354.1 C.F.
3354.1 / 781.7 = 4.2908 x 100% = 429.1% increase in the recharge volume

Summary for Pond 7P: INFILTRATION SYSTEM

Inflow Area = 0.351 ac, 83.57% Impervious, Inflow Depth = 2.64" for 2 Year Storm event
Inflow = 1.05 cfs @ 12.07 hrs, Volume= 0.077 af
Outflow = 0.03 cfs @ 15.70 hrs, Volume= 0.077 af, Atten= 97%, Lag= 217.6 min
Discarded = 0.03 cfs @ 15.70 hrs, Volume= 0.077 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-85.00 hrs, dt= 0.05 hrs
Peak Elev= 16.73' @ 15.70 hrs Surf.Area= 2,673 sf Storage= 1,939 cf

Plug-Flow detention time= 526.4 min calculated for 0.077 af (100% of inflow)
Center-of-Mass det. time= 526.6 min (1,316.2 - 789.7)

Volume	Invert	Avail.Storage	Storage Description
#1	15.50'	1,595 cf	**Custom Stage Data (Conic)** Listed below (Recalc) 7,137 cf Overall - 3,149 cf Embedded = 3,988 cf x 40.0% Voids
#2	15.83'	2,683 cf	**24.0" Round CMP_Round 24"** Inside #1 L= 854.0' 3,149 cf Overall - 1.0" Wall Thickness = 2,683 cf
		4,278 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
15.50	2,673	0	0	2,673
15.83	2,673	882	882	2,733
16.00	2,673	454	1,337	2,765
17.00	2,673	2,673	4,010	2,948
17.83	2,673	2,219	6,228	3,100
18.00	2,673	454	6,683	3,131
18.17	2,673	454	7,137	3,162

Device	Routing	Invert	Outlet Devices
#1	Discarded	15.50'	**0.520 in/hr Exfiltration over Wetted area** Phase-In= 0.01'
#2	Primary	17.68'	**6.0" Round PVC_Round 6"** L= 30.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 17.68' / 15.95' S= 0.0577 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.03 cfs @ 15.70 hrs HW=16.73' (Free Discharge)
↑—1=Exfiltration (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=15.50' (Free Discharge)
↑—2=PVC_Round 6" (Controls 0.00 cfs)

TSS Removal Calculation Worksheet

Project: THE WINSOR AT MILLBROOK VILLAGE
RAILROAD AVENUE
DUXBURY, MA

Subject: Stormwater Management Policy

Prepared by: Crowell Engineering **Date:** July 5, 2023

Sheet 1

A Best Management Practices Description	B TSS Removal Rate%	C Starting TSS Load*	D Projected TSS Removed	E Remaining TSS Load
Two Deep Sump Hooded Catch Basins	0.25	1.00	0.25	0.75
Stormceptor 1 / DMH	0.87	0.75	0.65	0.10
Detention Basin 1	0.70	0.10	0.07	0.03

Total TSS Removal = **0.97**

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

TSS Removal Calculation Worksheet

Project: THE WINSOR AT MILLBROOK VILLAGE
RAILROAD AVENUE
DUXBURY, MA

Subject: Stormwater Management Policy

Prepared by: Crowell Engineering **Date:** July 5, 2023

Sheet 2

A Best Management Practices Description	B TSS Removal Rate%	C Starting TSS Load*	D Projected TSS Removed	E Remaining TSS Load
Stormceptor 2 / CB	0.87	1.00	0.87	0.13
Inground Infiltration System	0.70	0.13	0.09	0.04

Total TSS Removal = **0.96**

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

Hydrograph for Pond 7P: INFILTRATION SYSTEM

Drains in less than 72 HOURS

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	15.50	0.00	0.00	0.00
2.50	0.00	0	15.50	0.00	0.00	0.00
5.00	0.02	12	15.51	0.01	0.01	0.00
7.50	0.04	32	15.53	0.03	0.03	0.00
10.00	**0.10**	327	15.82	0.03	0.03	0.00
12.50	**0.45**	**4,152**	**18.05**	**0.32**	**0.04**	**0.29**
15.00	0.09	**3,938**	**17.84**	**0.10**	**0.04**	**0.06**
17.50	0.06	3,852	17.76	0.06	0.04	0.02
20.00	0.03	3,777	17.71	0.04	0.04	0.00
22.50	0.03	3,697	17.65	0.04	0.04	0.00
25.00	0.00	3,496	17.53	0.04	0.04	0.00
27.50	0.00	3,168	17.35	0.04	0.04	0.00
30.00	0.00	2,844	17.18	0.04	0.04	0.00
32.50	0.00	2,522	17.02	0.04	0.04	0.00
35.00	0.00	2,204	16.86	0.04	0.04	0.00
37.50	0.00	1,889	16.71	0.03	0.03	0.00
40.00	0.00	1,577	16.55	0.03	0.03	0.00
42.50	0.00	1,268	16.40	0.03	0.03	0.00
45.00	0.00	962	16.24	0.03	0.03	0.00
47.50	0.00	660	16.06	0.03	0.03	0.00
50.00	0.00	361	15.85	0.03	0.03	0.00
52.50	0.00	67	15.56	0.03	0.03	0.00
55.00	0.00	0	15.50	0.00	0.00	0.00
57.50	0.00	0	15.50	0.00	0.00	0.00
60.00	0.00	0	15.50	0.00	0.00	0.00
62.50	0.00	0	15.50	0.00	0.00	0.00
65.00	0.00	0	15.50	0.00	0.00	0.00
67.50	0.00	0	15.50	0.00	0.00	0.00
70.00	0.00	0	15.50	0.00	0.00	0.00
72.50	0.00	0	15.50	0.00	0.00	0.00
75.00	0.00	0	15.50	0.00	0.00	0.00
77.50	0.00	0	15.50	0.00	0.00	0.00
80.00	0.00	0	15.50	0.00	0.00	0.00
82.50	0.00	0	15.50	0.00	0.00	0.00
85.00	0.00	0	15.50	0.00	0.00	0.00

Hydrograph for Pond 5P: DETENTION BASIN 1

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	13.75	0.00
2.50	0.00	0	13.75	0.00
5.00	0.01	28	13.76	0.00
7.50	0.03	154	13.82	0.01
10.00	**0.12**	442	13.94	0.06
12.50	**1.29**	**4,902**	**15.56**	**0.51**
15.00	0.29	**5,168**	**15.64**	**0.53**
17.50	0.12	2,697	14.62	0.38
20.00	0.07	984	14.13	0.19
22.50	0.05	408	13.93	0.07
25.00	0.01	256	13.86	0.03
27.50	0.00	143	13.81	0.01
30.00	0.00	95	13.79	0.00
32.50	0.00	74	13.78	0.00
35.00	0.00	59	13.78	0.00
37.50	0.00	47	13.77	0.00
40.00	0.00	37	13.77	0.00
42.50	0.00	28	13.76	0.00
45.00	0.00	22	13.76	0.00
47.50	0.00	17	13.76	0.00
50.00	0.00	13	13.76	0.00
52.50	0.00	10	13.75	0.00
55.00	0.00	7	13.75	0.00
57.50	0.00	5	13.75	0.00
60.00	0.00	4	13.75	0.00
62.50	0.00	3	13.75	0.00
65.00	0.00	2	13.75	0.00
67.50	0.00	2	13.75	0.00
70.00	0.00	1	13.75	0.00
72.50	0.00	1	13.75	0.00
75.00	0.00	1	13.75	0.00
77.50	0.00	1	13.75	0.00
80.00	0.00	0	13.75	0.00
82.50	0.00	0	13.75	0.00
85.00	0.00	0	13.75	0.00

Drains in less than 72 Hours

Hydrograph for Pond 8P: DETENTION BASIN 2

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	14.50	0.00
2.50	0.00	0	14.50	0.00
5.00	0.00	0	14.50	0.00
7.50	0.01	28	14.52	0.00
10.00	**0.04**	149	14.59	0.02
12.50	**0.35**	**1,327**	**15.22**	**0.31**
15.00	0.05	**360**	**14.72**	**0.09**
17.50	0.03	217	14.63	0.04
20.00	0.02	164	14.60	0.02
22.50	0.01	142	14.58	0.02
25.00	0.00	98	14.56	0.01
27.50	0.00	55	14.53	0.00
30.00	0.00	38	14.52	0.00
32.50	0.00	27	14.52	0.00
35.00	0.00	19	14.51	0.00
37.50	0.00	14	14.51	0.00
40.00	0.00	10	14.51	0.00
42.50	0.00	7	14.50	0.00
45.00	0.00	5	14.50	0.00
47.50	0.00	3	14.50	0.00
50.00	0.00	2	14.50	0.00
52.50	0.00	2	14.50	0.00
55.00	0.00	1	14.50	0.00
57.50	0.00	1	14.50	0.00
60.00	0.00	1	14.50	0.00
62.50	0.00	0	14.50	0.00
65.00	0.00	0	14.50	0.00
67.50	0.00	0	14.50	0.00
70.00	0.00	0	14.50	0.00
72.50	0.00	0	14.50	0.00
75.00	0.00	0	14.50	0.00
77.50	0.00	0	14.50	0.00
80.00	0.00	0	14.50	0.00
82.50	0.00	0	14.50	0.00
85.00	0.00	0	14.50	0.00

Drains in less than 72 Hours

Infiltration System

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. Mor
Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwat

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensi
thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a s
rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short
user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. /
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 t
"Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iteration
values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

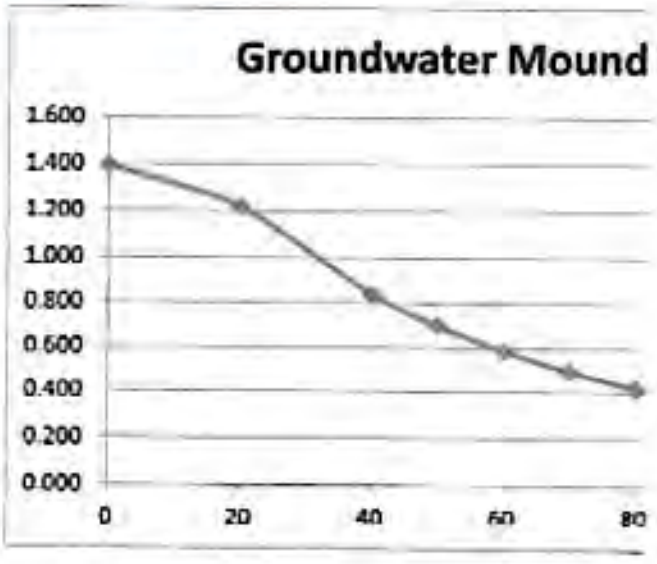
use consistent units (e.g. feet & days or inches & hours)

Input Values		
1.0800	R	Recharge (infiltration) rate (feet/day)
0.200	Sy	Specific yield, Sy (dimensionless, between 0 and 1)
10.80	K	Horizontal hydraulic conductivity, Kh (feet/day)*
24.300	x	1/2 length of basin (x direction, in feet)
27.500	y	1/2 width of basin (y direction, in feet)
2.292	t	duration of infiltration period (days)
60.000	hi(0)	initial thickness of saturated zone (feet)

61.2[illegible]	h(max)	maximum thickness of saturated zone (beneath center of basi
1.[illegible]	Δh(max)	maximum groundwater mounding (beneath center of basin at

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
1.[illegible]	0
1.2[illegible]	20
0.8[illegible]	40
0.[illegible]	50
0.[illegible]	60
0.[illegible]	70
0.[illegible]	80
0.[illegible]	90
0.[illegible]	100
0.[illegible]	120

Re-Calculate Now



Disclaimer

Infiltration System

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 consistant units for all input values (for example, feet and days)

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

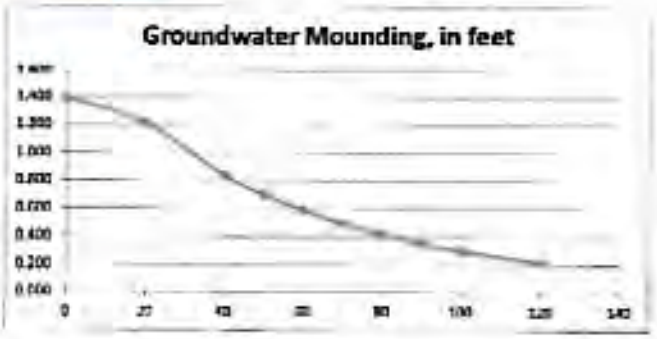
Input Values			Conversion Table	
			inch/hour	feet/day
1.0800	R	Recharge (infiltration) rate (feet/day)	0.67	1.33
0.200	Sy	Specific yield, Sy (dimensionless, between 0 and 1)		
10.80	K	Horizontal hydraulic conductivity, Kh (feet/day)*	2.00	4.00
24.300	x	1/2 length of basin (x direction, in feet)		
17.500	y	1/2 width of basin (y direction, in feet)	hours	days
2.292	t	duration of infiltration period (days)	36	1.50
60.000	hi(0)	initial thickness of saturated zone (feet)		

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

[redacted]	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
[redacted]	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)

Groundwater Mounding, in feet	Distance from center of basin in x direction, in feet
[redacted]	0
[redacted]	20
[redacted]	40
[redacted]	60
[redacted]	80
[redacted]	100
[redacted]	120

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.

MassDEP

Well Completion Report

WELL LOCATION

GPS North: 42.048763 GPS West: -70.683001 Assessors Map:

Address: 77 Alden Street Assessors Lot:

Sub Division: Permit Number: 06-0405

City/Town: DUXBURY Date Issued: 12/15/2006

Board Of Health Permit Obtained: Y

Work Performed	Well Type	Drilling Method Overburden	Drilling Method Bedrock
New Well	Irrigation	Auger	

ADDITIONAL WELL INFORMATION

Developed: Yes

Disinfected:

Total Well Depth: 80.00

Fracture Enhancement:

Well Seal Type:

Depth to Bedrock: 0.00

PERMANENT PUMP (IF AVAILABLE)

Pump Description:

Type:

Nominal Pump Capacity:

Intake Depth:

Horsepower:

Comments:

CASING

From(ft)	To(ft)	Type	Thickness	Diameter
0.00				
0.00	71.00	PVC	Schedule 40	4

SCREEN

From(ft)	To(ft)	Type	slotsize	Diameter
71.00	75.00	Stainless Steel Vee Wire	0.02	4
75.00	80.00	Stainless Steel Vee Wire	0.02	4

WELL SEAL / FILTER PACK / ABANDONMENT MATERIAL

From(ft)	To(ft)	Material Description	Purpose

STATIC WATER LEVEL (ALL WELLS)

Date Measured	Depth Below Ground Surface
01/02/2007	24.00

WELL TEST DATA (ALL SECTIONS MANDATORY FOR PRODUCTION WELLS)

Date	Method	Yield(GPM)	Time Pumped (hrs & min)	Pumping Level (ft. BGS)	Time To Recover (hrs & min)	Recovery
01/02/2007	Constant Rate Pump	30.00	2:00	31	:10	24

OVERBURDEN

From(ft)	To(ft)	Lithology	Color	Comment	Water Zone	Loss / Add. of Fluid	Drill Stem Drop	Drill Rate
0.00	10.00	Medium Sand	Brown					
10.00	25.00	Cobbles	Brown					
25.00	35.00	Gravel	Brown	& sand				Slow
35.00	50.00	Silty Sand and Gravel	Dark Gray					Slow
50.00	65.00	Clay	Light Grey					
65.00	75.00	Medium Sand	Reddish Brown		Yes			
75.00	82.00	Coarse Sand	Brown		Yes			

BEDROCK

From(ft)	To(ft)	Lithology	Comment	Water Zone	Drill Stem Drop	Extra Large	Drill Rate	Rust Stain	Loss / Add. Of Fluid	# of Fract. Per Ft

Illicit Discharge Compliance Statement

THE WINSOR AT MILLBROOK VILLAGE
RAILROAD AVENUE, DUXBURY, MA

Responsibility:

The Developer is responsible for ultimate compliance with all provisions of the Massachusetts Stormwater Management Policy, the USEPA NPDES Construction General Permit (if applicable) and responsible for identifying and eliminating illicit discharges (as defined by the USEPA).

DEVELOPER NAME: 50 RR AVE DUX LLC
ADDRESS: 272 St. George Street
Duxbury, MA 02332
TEL. NUMBER: 781-934-8502

Developer Compliance Statement:

To the best of my knowledge, the attached plans, computations and specifications meet 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. 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.

Included with this statement are site plans, drawn to scale, that identify the location 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 and/or groundwater on the site and show that there are no connections between the stormwater and wastewater systems.

For this project, all actions taken to identify and remove illicit discharges, including without limitation, visual screening, dye or smoke testing, and the removal of any sources of illicit discharges to the stormwater management system are documented and included with this statement.

Signature Matt Welch

STORMWATER MANAGEMENT SYSTEM

OPERATION & MAINTENANCE PLAN

THE WINSOR AT MILLBROOK VILLAGE
Railroad Avenue
Duxbury, MA

Prepared for:

50 RR AVE DUX LLC
272 St. George Street
Duxbury, MA 02332
781-934-8502

Prepared by:

Crowell Engineering
981 Long Pond Road
Plymouth, MA 02360
774-283-0443

June 12, 2023, Revised July 5, 2023 & August 31, 2023

Robert Crowell, P.E.

ROBERT W. CROWELL CIVIL No. 35820 PROFESSIONAL ENGINEER

OPERATION AND MAINTENANCE PLAN
STORMWATER MANAGEMENT SYSTEM-DURING CONSTRUCTION

June 12, 2023, revised July 5, 2023 & August 31, 2023

THE WINSOR
AT
MILLBROOK VILLAGE
Railroad Avenue
Duxbury, MA 02332

Owner:

50 RR AVE DUX LLC
272 St. George Street
Duxbury, MA 02332
781-934-8502

Party Responsible for Operation and Maintenance during construction:

50 RR AVE DUX LLC
272 St. George Street
Duxbury, MA 02332
781-934-8502

Source of Funding:

Operation and Maintenance of this stormwater management system will be the responsibility of the owner to include its successor and/or assigns, as the same may appear on record with the appropriate registry of deeds.

During Construction:

Construction activities for the project shall be as shown on plans entitled, The Winsor At Millbrook Village, Duxbury, Massachusetts dated June 12, 2023, revised July 5, 2023 & August 31, 2023. During periods of active construction the stormwater management system shall be inspected on a weekly basis and within 24 hours of a storm event of greater than ½". Maintenance tasks shall be performed monthly or after significant rainfall events of 1" of rain or greater. During construction, silt-laden runoff shall be prevented from entering the existing wetlands and off-site properties. Hay bales shall be installed in advance of construction along the edge of all disturbed areas within the buffer and shall be maintained throughout the project. The location of the hay bales are shown on the approved plans.

During dewatering operations, all water pumped from the dewatering shall be directed to a "dirt bag" pumped sediment removal system (or approved equal) as manufactured by ACF Environmental. The unit shall be placed on a crushed stone blanket. Disposal of such "dirt bag" shall occur when the device is full and can no longer effectively filter sediment or allow water to pass at a reasonable flow rate. Disposal of this unit shall be the responsibility of the contractor and shall be as directed by the owner in accordance with applicable local, state, and federal guidelines and regulations.

A stabilized construction entrance shall be placed at the Railroad Avenue entrance and shall consist of ¾" to 1 ½ "stone and be constructed as shown on the approved plans.

All erosion and sedimentation control measures shall be in place prior to the commencement of any site work or earthwork operations, shall be maintained during construction, and shall remain in place until all site work is complete and ground cover is established.

Once each structure is in place, it should be maintained in accordance with the procedures described in the post-construction Operations and Maintenance Plan.

Inspections

50 RR AVE DUX LLC shall be responsible to secure the services of a Professional Engineer to perform inspections as required. Inspections during periods of active construction shall be weekly and within 24 hours of a storm event of greater than ½ ". The Professional Engineer shall perform inspections to insure that the approved plan is being followed with particular attention to the Conservation Commission Order of Conditions and Planning Board Approval. The Engineer shall be responsible for inspecting the driveway and parking area construction and the construction of the stormwater management system. The Engineer shall prepare and submit to the Conservation Commission and Planning Board, the Inspection Schedule and Evaluation Checklist (see attached) and, if necessary, request that the required maintenance and/or repair of the necessary items. This form shall be stamped by the Engineer and the Owner shall be notified that specific changes and/or repairs are necessary.

STORMWATER MANAGEMENT
BEST MANAGEMENT PRACTICES

INSPECTION SCHEDULE AND EVALUATION CHECKLIST – CONSTRUCTION PHASE

PROJECT LOCATION: THE WINDSOR AT MILLBROOK VILLAGE
RAILROAD AVENUE, DUXBURY, MA

Latest Revision: August 31, 2023

Stormwater Control Manager: ___ **Stamp**

Best Management Practice	Inspection Frequency (1)	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/ Repair Needed yes/no List Items	Date of Cleaning/Repair	Performed By	Water Level in Detention System
Silt Socks Erosion Control	After every major storm event							
Deep Sump Hooded Catch Bains	Weekly or after major storm event							
Drain Lines & Manholes	Weekly or after major storm event							
Stormceptors	After every major storm event							
Infiltration System & Detention Basins	After every major storm event							
Dewatering Operations	Daily during actual dewatering							
Temporary Construction Entrance	Daily or as needed							

(1) Refer to the Massachusetts Stormwater Management, Volume Two: Stormwater Technical Handbook (March 1997) for recommendations regarding frequency for inspection and maintenance of specific BMPs.

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended. Slow release fertilizer recommended.
Other notes:(Include deviations from: Con Com Order of Conditions, PB Approval, Construction Sequence and Approved Plan)

L:Forms/Templates/MAL/Stormwater Management

OPERATION AND MAINTENANCE PLAN
STORMWATER MANAGEMENT SYSTEM – POST CONSTRUCTION

June 12, 2023, Revised July 5, 2023 & August 31,2023

THE WINSOR
AT
MILLBROOK VILLAGE
Railroad Avenue
Duxbury, MA 02332

Owner:

50 RR AVE DUX LLC
272 St. George Street
Duxbury, MA 02332
781-934-8502

Party Responsible for Operation and Maintenance after construction:

50 RR AVE DUX LLC
272 St. George Street
Duxbury, MA 02332
781-934-8502

Note: Items to be considered under "Stormwater Management System" are: Drainage infiltration system, detention basins, stormceptors, catch basins, manholes and drain lines.

Source of Funding:

Operation and Maintenance of this Stormwater Management System will be the responsibility of the Owner to include its successor and/or assigns, as the same may appear on record with the appropriate registry of deeds.

Post Construction Inspection and Maintenance:

Parking Lot and Driveway Sweeping
Note: Parking lot and driveway sweeping shall be conducted at the frequencies stated below.

Parking lot and driveway shall be swept twice per year. Sweeping shall be completed during the early spring, no later than May 1st.

before sediment from winter sanding operations is washed into the drainage system and in the fall, no later than November 30th. Disposal of the accumulated sediment shall be in accordance with applicable local, state, and federal guidelines and regulations.

Deep Sump and Hooded Catch Basins

Note: Catch basin cleaning shall be conducted at the frequencies stated below.

The deep sump and hooded catch basins shall be inspected after every major storm event during construction and cleaned when sediment exceeds 18" depth. After construction when all slopes have been stabilized, the catch basin sumps shall be cleaned, at a minimum, annually in the Spring. The integrity of the catch basins and hoods should be checked 2 times a year. Disposal of the accumulated sediment and hydrocarbons shall be in accordance with applicable local, state, and federal guidelines and regulations.

Stormceptors (Water Quality Inlets)

Note: Stormceptor (Water Quality Inlet-(WQI) cleaning shall be conducted at the frequencies stated below.

New Installations

The condition of the unit shall be checked after every runoff event for the first 30 days. The visual inspection shall ascertain that the unit is functioning properly (inlet and outlet pipes are not blocked) and shall measure the amount of sediment that has accumulated in the separation chamber. At a minimum, the chamber should be cleaned annually in the Spring.

Cleanout and Disposal

Standard vactoring operations shall be employed in the cleanout of the Water Quality Inlets. Disposal of material from the Water Quality Inlets shall be in accordance with applicable local, state, and federal guidelines and regulations. Disposal of the decant material to a POTW is recommended. Field decanting to the storm drainage system shall not be permitted. Solids can be disposed similar to normal practices for materials collected from catch basin cleaning.

Drainage Infiltration System

Note: Runoff recharge system cleaning shall be conducted at the frequencies stated below.

After construction, the drainage infiltration system should be inspected for standing water 1-2 days after any significant rainfall exceeding 1" of rainfall in 24 hours. Drainage Infiltration systems

should be inspected in the Spring and Fall to ensure that the systems are operating as intended. Check water level in system during every inspection (via inspection ports.

Detention Basins

Note: Inspection and maintenance of the Detention Basins shall be conducted at the frequencies stated below.

Inspections of the Detention Basins shall be conducted in the spring and fall. At a minimum, the vegetative/infiltration retention basin should cleaned annually in the Spring. Additional removal of sediments/debris should be conducted based upon inspections Inspections should ensure that inlet structures and the outlet overflow structure are free of debris. Eroded or barren spots should be reseeded/replanted immediately.

Drain Lines

Note: Inspection and cleaning of the drain lines shall be conducted at the frequencies stated below

After construction, the drain lines shall be inspected after every major storm for the first few months to ensure proper functions. Presence of accumulated sand and silt would indicate more frequent maintenance of the pre-treatment devices is required. Thereafter, the drain lines shall be inspected at least once per year. Accumulated silt shall be removed.

Snow Removal

Snow removal will be the responsibility of the Owner and shall be conducted at the frequencies stated below.

After installation of pavement, snow removal should be conducted during any storm event as needed. Snow shall not be pushed into the detention basins. All excess snow is to be removed from the site.

Landscaping and Permanent Ground Cover

Note: Maintenance of the landscaping and permanent ground cover shall be conducted at the frequencies stated below.

During the growing season from spring to fall, the grass shall be mowed every 3 weeks or as needed. The permanent ground cover shall be inspected and maintained monthly during the growing season and any damaged plants replaced.

Inspections

Yearly inspections of the stormwater management system shall be performed and an Inspection Schedule and Evaluation Checklist shall be filed with the Planning Board and Conservation Commission. Copies of the receipts for cleaning of the systems shall also be provided to the Planning Board and Conservation Commission.

The Owner shall be responsible to secure the services of a Licensed Engineer on an on-going basis. The inspector shall review the project with respect to the following:

- Proper installation and performance of the Stormwater Management System.
- Review of the controls to determine any damaged or ineffective controls.
- Corrective actions.

The Engineer shall prepare, stamp and submit to the Conservation Commission and Planning Board, a report documenting the findings and should request the required maintenance or repair for the pollution prevention controls when the inspector finds that it is necessary for the control to be effective (see attached Inspection Schedule and Evaluation Checklist). The Inspector shall notify the Owner to make the changes.

All site uses shall comply with Stormwater Management Policy standards (Standard 5) as amended. Higher potential pollutant load type uses are not proposed for this site. Prior to implementation of higher pollutant load types, the site owner shall notify the Conservation Commission in writing.

For additional information, refer to Performance, Standards and Guidelines for Stormwater Management in Massachusetts, published by the Department of Environmental Protection.

STORMWATER MANAGEMENT
BEST MANAGEMENT PRACTICES

INSPECTION SCHEDULE AND EVALUATION CHECKLIST – POST CONSTRUCTION PHASE

PROJECT LOCATION: THE WINDSOR AT MILLBROOK VILLAGE
RAILROAD AVE, DUXBURY, MA

Latest Revision: August 31, 2023

Best Management Practice	Inspection Frequency (1)	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/ Repair Needed yes/no List items	Date of Cleaning/Repair	Performed By	Water Level in Infiltration Basins
Deep Sump Hooded Catch Basins	Spring and Fall							
Drain Lines & Manholes	Once per year							
Stormceptors	Spring and Fall							
Infiltration System & Detention Basins	Spring and Fall							
Parking Lot / Driveway Sweeping	Spring (April)							
Landscaping & Permanent Ground Cover	Mow grass as needed in Spring to Fall. Inspect ground cover in Spring to Fall and maintain & replace as needed.							

(1) Refer to the Massachusetts Stormwater Management, Volume Two: Stormwater Technical Handbook (March 1997) for recommendations regarding frequency for inspection and maintenance of specific BMPs.

Spill Management Plan – June 12, 2023, Revised 7/5/23 & 8/31/23
The Winsor At Millbrook Village, Railroad Avenue, Duxbury, MA

Party Responsible for Spill Control/Response:

50 RR AVE DUX LLC
272 St. George Street
Duxbury, MA 02332
781-934-8502

Emergency Response Phone Numbers:

Duxbury Fire Department:	1-781-934-5691
DEP Southeast Region	1-508-946-2700

Environmental Coordinator:

An environmental coordinator fully trained in spill response/management shall be designated for The Winsor At Millbrook Village. All spills shall be immediately reported to the Environmental Coordinator. The Environmental Coordinator shall be responsible for assessing all spills, coordinating all cleanups and/or notifying the appropriate emergency response personnel (Fire Department/DEP)

Types of materials present on-site which could potentially spill may include but are not limited to:

1. Winter salt $CaC1_2$ blend
2. Paints and related products
3. Small quantities of household/industrial cleaners for facility maintenance
4. Aerosol products (cleaners)

Areas where spills may potentially occur include:

1. Within the facility, at the building sidewalks, at the loading areas.

Measures used to minimize the possibility of spills include:

1. Spill prevention and response procedures in place (see below).

Spill cleanup equipment kept in the facility includes:

1. Bales of absorbent pads
2. Bags of loose inorganic non-floating universal absorbent
3. Boxes of medium 6 mil. poly bags and ties
4. 23' X 24' X 12 mil poly tarp
5. Pair heavy duty neoprene or vinyl gloves
6. Rolls heavy nylon twine
7. Long handle shovel square point
8. Pair of chemical goggles
9. Pair of rubber over-shoe boots
10. First aid kit
11. Fire extinguisher
12. Sand

The Environmental Coordinator will be responsible for the locations of the clean-up equipment and in the proper use of the equipment with training to be conducted annually. The equipment shall be stored in a neat and well organized manner. The Environmental Coordinator will ensure that the equipment is well maintained and restocked after use.

- The Environmental Coordinator will be advised immediately of all spills of hazardous materials, regardless of quantity.

- The spill will be evaluated to determine the necessary responses. If there is a health hazard or fire or explosion potential, 911 will be called. If the spill is large or threatens surface water systems (including stormwater structures) the Massachusetts DEP will be notified (508-946-2700).

- The spill will be contained as close to the source as possible with a dike of absorbent materials from the spill clean-up equipment (such as socks, pads, pillows of "pigs"). Additional dikes will be constructed to protect swales or other stormwater conveyances or streams and stormwater structures such as catch basins.

- All waste material will be disposed properly including used absorbent materials. The DEP will be called for any questions about proper disposal of hazardous or regulated wastes.

- Use of disposable granule or powder absorbents will be minimized to the extent possible. When appropriate spill material will be neutralized as prescribed in Material Safety Data Sheets (MSDS) and be collected, handled and disposed in accordance with federal and state regulations.

- Spill Prevention and Response Procedures:

1. **Practice Good Housekeeping**: Keep chemical products neat and sorted in a stable manner.
2. **Stable Stacking**: Do not overload shelves.
3. **Be Prepared**: Every employee should know where spill clean-up equipment is kept and where the Spill Control/Clean-up and Waste Disposal Quick Reference Wall chart is located.
4. **Know Your Products**: Learn in advance how to handle chemical spills in your department.

- Spill Prevention and Response Procedures (for all tenant owners):

1. When you discover a spill, personally guard the spill so people cannot walk though the spilled chemical. Avoid contact with the spill material; do not touch or walk into the material or inhale gases, fumes or smoke. Get other tenants to help prevent access to the area. Notify the Environmental Coordinator to bring spill clean-up equipment to the area.
2. If strong odors are present, open doors and use fans to ventilate the area.
3. Determine the identity of the spilled material and what hazards are present. Read the container label. Refer to the MSDS or the Spill Control/Clean-Up and Waste Disposal Quick Reference Wall Chart for guidance.
4. Use proper personal protective equipment. Before cleaning up the spill, refer to the Spill Control/Clean-Up and Waste Disposal Quick Reference Wall Chart for guidance.
5. If you experience shortness of breath, dizziness, headache or other abnormal physical condition as a result of fumes or vapors, immediately leave the area and notify the Environmental Coordinator.
6. Properly store the spilled chemical and contaminated materials in a labeled poly bas provided in the spill clean-up equipment kit.
7. Wash your hands and remove contaminated clothing after the spill clean up is finished.
8. Please remember:
   a. Extra caution is required when cleaning up spills of pesticides, acids, oil-based paints and flammable chemicals. Refer to Resource Manuals for spill control procedures, and use the Spill Control/Clean-Up and Waste Disposal Quick Reference Wall chart for guidance.
   b. Chemicals in Leaking Containers should be transferred into replacement containers or poly lined containers whenever possible to minimize the spill. Keep products separated to avoid potential reactions between chemicals.
9. When disposing of spilled chemicals and contaminated materials:
   a. Do not pour anything on the ground except water.
   b. Do not put hazardous chemicals in the sewer, dumpster or trash compactor (examples: flammable products, pesticides, auto batteries, pain, roof coating)
   c. Consult the Resource Manual or Return Center Manual for proper disposal instructions.
   d. THINK! If you are uncertain about disposal of a product, ask for help from the Environmental Coordinator or other members of the Pollution Prevention Team.
   e. If the spills are large, call the Massachusetts DEP. Any questions on pollution potential could also be directed to the