STORMWATER MANAGEMENT REPORT

Nashoba Satellite Emergency Facility

490 Main Street, Groton MA 01450

PREPARED FOR

UMass Memorial Health Care, Inc.
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Worcester, MA 01605

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June 2025

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

Checklist for Stormwater Report

A. Introduction

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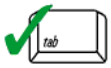


A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here 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.

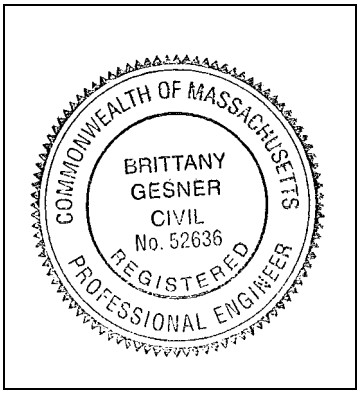
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the 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



Brittany Gesner June 23, 2025

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.

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.

Stormwater Report Narrative

This Stormwater Report has been prepared to demonstrate compliance with the Massachusetts Stormwater Management Standards in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00). This report also demonstrates compliance with the Town of Groton Town Code Chapter 198 Stormwater Management – Low Impact Development and Chapter 352 Earth Removal Stormwater Advisory Committee.

Project Description

The Applicant, UMass Memorial Health Care, is proposing to construct a satellite emergency facility and a potential future medical office building (the Project). As proposed, the Project consists of 34,200 square feet of building footprint, a helipad, surface parking lot, access drives, stormwater and utility improvements, and ancillary landscape and pedestrian improvements to support this use.

At full build, the Project will entail the construction of a parking lot generating more than 1,000 daily vehicular trips and is therefore considered a Land Use with Higher Potential Pollutant Loads (LUHPPL).

Site Description

The Project Site is a 6.9-acre parcel of land (the Site) located at 490 Main Street in Groton, Massachusetts. The Site lies within the surface watershed of the Nashua River and is bounded by a former office park (proposed for redevelopment into a residential neighborhood) to the north, Main Street to the southwest, and residential homes abutting Taylor Road to the southeast. See Figure 1, Site Locus Map.

There is one jurisdictional bordering vegetated wetland located within the center of the Site. For detailed information regarding the wetland resource areas present on the site see the Project Notice of Intent prepared for the Project.

According to the Natural Resources Conservation Service (NRCS), surface soils on the Site include Montauk, Newport, Charlton, Deerfield, and Merrimack-Urban Land Complex. On-site soils are classified as Hydrologic Soil Groups (HSG) A, B, C, and D. Based on the soil evaluation included in Appendix C, the Site *is* considered to be within an area of rapid infiltration (soils with a saturated hydraulic conductivity greater than 2.4 inches per hour).

Existing Drainage Conditions

Under existing conditions, the Site is generally undeveloped with gradually sloping topography. Figure 2 illustrates the existing drainage patterns on the Site. Currently, the Site is divided into 3 drainage areas as stormwater runoff flows to 3 Design Points, which have been identified as "Existing Wetland", "Existing Adjacent Swale", and "Main Street Drainage System". Table 1 below provides a summary of the existing conditions hydrologic data.

Table 1 Existing Conditions Hydrologic Data

Drainage Area	Discharge Location	Design Point	Area (Acres)	Curve Number	Time of Concentration (min)
EX-1	Existing Wetland	DP-1	9.2	79	14.2
EX-2	Existing Adjacent Swale	DP-2	2.2	79	8.9
EX-3	Main Street Drainage System	DP-3	3.0	78	13.8

Total = 14.4 acres

Proposed Drainage Conditions

Figure 3 illustrates the proposed "post construction" drainage conditions for the project. As shown, the Site will be divided into 6 drainage areas that discharge treated stormwater to the 3 existing Design Points. Table 2 below provides a summary of the proposed conditions hydrologic data.

Table 2 Proposed Conditions Hydrologic Data

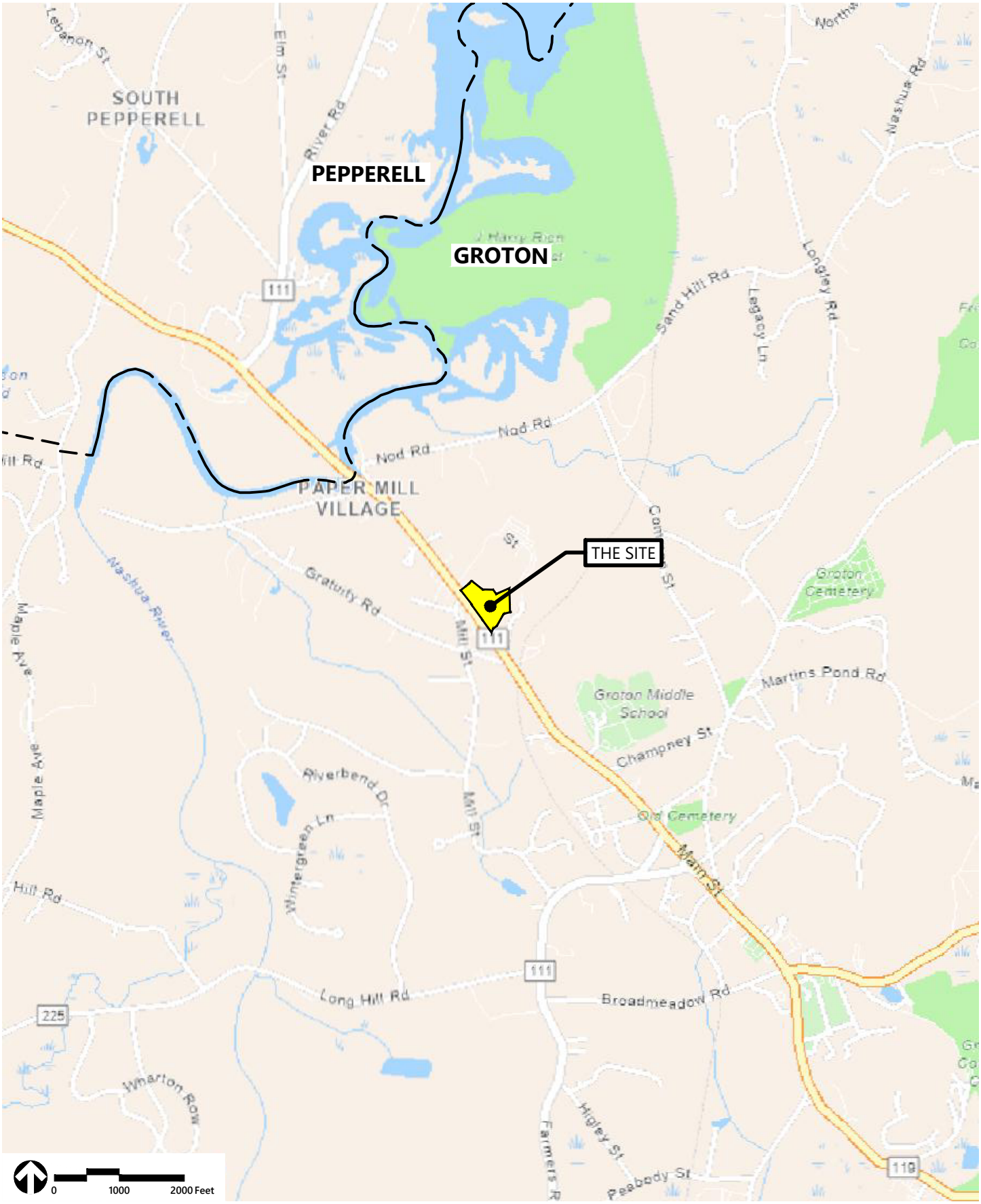
Drainage Area	Discharge Location	Design Point	Area (Acres)	Curve Number	Time of Concentration (min)
PR-1A	Existing Wetland	DP-1	0.7	87	5.0
PR-1B	Existing Wetland	DP-1	7.7	78	11.3
PR-2A	Existing Adjacent Swale	DP-2	0.2	69	8.9
PR-2B	Infiltration Basin 1P	DP-2	4.6	89	5.0
PR-2C	Infiltration Basin 1P	DP-2	0.8	98	5.0
PR-3	Main St. Drainage System	DP-3	0.4	87	5.0

Total = 14.4 acres

The site design integrates a comprehensive stormwater management system that has been developed in accordance with the Massachusetts Stormwater Handbook and the Town of Groton Town Code. Because the Project is considered a LUHPPL and located within areas of rapidly infiltrating soils the proposed stormwater management system has been designed to treat the one-inch Water Quality Volume and provide 44% Total Suspended Solids (TSS) pretreatment prior to infiltration.

Environmentally Sensitive and Low Impact Development (LID) Techniques

Low Impact Development (LID) techniques and stormwater Best Management Practices (BMPs) implemented into the site design include no disturbance to wetland resource areas and implementation of an infiltration basin. In general, stormwater from the proposed impervious surfaces will be collected in deep-sump and hooded catch basins, pretreated further in a sediment forebay, and infiltrated to the underlying aquifer in infiltration basin 1P.



Source: USGS

Figure 1

Site Location Map
Nashoba Satellite Emergency Facility
Groton, MA

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Existing Drainage Conditions
Nashoba Satellite Emergency Facility
490 Main Street
Groton, MA

Figure 2

June 2025

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Legend

SYMBOLS

- **DESIGN POINT**
- **DRAINAGE AREA DESIGNATION**
- **POND**

LINETYPES

- **DRAINAGE AREA BOUNDARY**
- **TIME OF CONCENTRATION FLOW LINE**
- **100' BUFFER ZONE**
- **WETLAND BOUNDARY** (4–220 to 4–219)

0 30 60 120 Feet

Proposed Drainage Conditions
Nashoba Satellite Emergency Facility
490 Main Street
Groton, MA

Figure 3

June 2025

Regulatory Compliance

Massachusetts Department of Environmental Protection (DEP) – Stormwater Management Standards

As demonstrated below, the proposed Project fully complies with the DEP Stormwater Management Standards.

Standard 1: No New Untreated Discharges or Erosion to Wetlands

The Project has been designed to comply with Standard 1.

The Best Management Practices (BMPs) included in the proposed stormwater management system have been designed in accordance with the Massachusetts Stormwater Handbook. Supporting information and computations demonstrating that no new untreated discharges will result from the Project are presented through compliance with Standards 4 through 6.

All proposed Project stormwater outlets and conveyances have been designed to not cause erosion or scour to wetlands or receiving waters. Outlets from closed drainage systems have been designed with flared end sections and stone protection to dissipate discharge velocities. Overflows from BMP's that impound stormwater have been designed to protect downgradient areas from erosion.

Computations and supporting information for the sizing and selection of materials used to protect from scour and erosion are included in Appendix A.

Standard 2: Peak Rate Attenuation

The Project has been designed to comply with Standard 2.

The rainfall-runoff response of the Site under existing and proposed conditions was analyzed for storm events with recurrence intervals of 1, 2, 5, 10, 25, and 100 years. The results of the analysis, as summarized in Table 3 and 4 below, indicate that there is no increase in peak discharge rates or peak discharge volumes between the existing and proposed conditions for all storm events.

Computations and supporting information regarding the hydrologic modeling are included in Appendix B.

Table 3 Peak Discharge Rates (cfs*)

Design Point	1-year	2-year	5-year	10-year	25-year	100-year
Design Point DP-1: Existing Wetland						
Existing	6.9	10.3	16.4	21.6	29.2	41.0
Proposed	6.5	9.8	15.6	20.7	27.9	39.3
Design Point DP-2: Existing Adjacent Swale						
Existing	1.9	2.9	4.6	6.0	8.1	11.4
Proposed	0.1	0.1	0.3	0.4	0.6	10.5
Design Point DP-3: Main Street Drainage System						
Existing	2.1	3.2	5.2	6.9	9.4	13.2
Proposed	0.6	0.8	1.2	1.5	1.9	2.5

Table 4 Peak Discharge Volumes (af*)

Design Point	1-year	2-year	5-year	10-year	25-year	100-year
Design Point DP-1: Existing Wetland						
Existing	0.7	1.0	1.5	2.0	2.7	3.8
Proposed	0.6	0.9	1.4	1.8	2.4	3.4
Design Point DP-2: Existing Adjacent Swale						
Existing	0.2	0.2	0.4	0.5	0.6	0.9
Proposed	0.0	0.0	0.0	0.0	0.0	0.4
Design Point DP-3: Main Street Drainage System						
Existing	0.2	0.3	0.5	0.6	0.9	1.2
Proposed	0.0	0.1	0.1	0.1	0.1	0.2

Standard 3: Stormwater Recharge

The Project has been designed to comply with Standard 3.

In accordance with the Stormwater Handbook, the Required Recharge Volume for the Project is 3,820 cubic feet.

Recharge of stormwater has been provided through the use of one surface infiltration basin, which has been sized using the static method, and has been designed to drain completely within 72 hours. Table 5 below provides a summary of the proposed infiltration BMP utilized for the Project.

Table 5 Summary of Recharge Calculations

Infiltration BMP	Provided Recharge Volume (cubic feet)
Infiltration Basin #1P	37,088
Total Provided Recharge	**37,088**
Total Required Recharge	**3,820**

In some locations, vertical separation from the infiltrative BMPs and estimated seasonal high groundwater is less than four feet and therefore a mounding analysis has been completed for those basins.

Soil evaluation (including Geotechnical Report), computations, and supporting information are included in Appendix C.

Standard 4: Water Quality

The Project has been designed to comply with Standard 4.

The proposed stormwater management system implements a treatment train of BMPs that has been designed to provide 80% TSS removal of stormwater runoff from all proposed impervious surfaces as well as 44% pretreatment prior to infiltration BMPs.

Computations and supporting information, including the Long-Term Pollution Prevention Plan, are included in Appendix D.

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

The Project proposes a parking lot that, at full build out, will generate more than 1,000 vehicular trips per day and is therefore considered a LUHPPL. Accordingly, the Project has been designed with suitable BMPs sized to treat the 1-inch Water Quality Volume and provide the pretreatment requirement of 44% TSS removal prior to infiltration. Proposed source controls and pollution prevention measures have been identified in the Long-Term Pollution Prevention Plan included in Appendix D.

For computations and supporting information regarding the sizing of BMPs suitable for treatment of runoff from LUHPPLs, see Appendix D.

Standard 6: Critical Areas

The Project will not discharge stormwater near or to a critical area.

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the Maximum Extent Practicable

The Project is not considered a redevelopment has been designed to comply with all ten of the Stormwater Management Standards.

Refer directly to each Standard for applicable computations and supporting information demonstrating compliance with each.

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

The Project will disturb more than 1 acre of land and is therefore required to obtain coverage under the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit. As required under this permit, a Stormwater Pollution Prevention Plan (SWPPP) will be developed and submitted before land disturbance begins. Recommended construction period pollution prevention and erosion and sedimentation controls to be finalized in the SWPPP are included in Appendix F. The Erosion and Sedimentation Control Measures included in the report address all requirements outlined in Chapter 253-19 Erosion Control, in the Town of Groton Bylaws.

Standard 9: Operation and Maintenance Plan

In compliance with Standard 9, a Post Construction Stormwater Operation and Maintenance (O&M) Plan has been developed for the Project. The O&M Plan addresses all requirements outlined in Chapter 352-22 Operations and Maintenance Plans, in the Town of Groton Bylaws.

To Note: There are no easements or public safety features to delineate on site, per the Town of Groton Parcel date and MassGIS respectively. Thus addressing 352-22 A(9) and 352-22 A(11).

The O&M Plan is included in Appendix D as part of the Long-Term Pollution Prevention Plan.

Standard 10: Prohibition of Illicit Discharges

Sanitary sewer and storm drainage structures which were part of the previous development on this site are to be completely removed during the site redevelopment. The design plans submitted with this report have been designed in full compliance with current standards. The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges.

Town of Groton Chapter 198 Stormwater Management – Low-Impact Development

As demonstrated below, the proposed Project fully complies with Town of Groton Chapter 198 Stormwater Management – Low-Impact Development.

198-7B. Standards

The Project has been designed to meet the Massachusetts Stormwater Management Standards as thoroughly outlined previously herein.

198-8 Operation and Maintenance Plans

A Post Construction Stormwater Operation and Maintenance (O&M) Plan has been developed for the Project and is included in Appendix D as part of the Long-Term Pollution Prevention Plan.

Town of Groton Chapter 352 Earth Removal Stormwater Advisory Committee

As demonstrated below, the proposed Project fully complies with Town of Groton Chapter 352 Earth Removal Stormwater Advisory Committee.

352-9 Site Planning

Low-impact development (LID) techniques are incorporated into the Project by use of two surface infiltration basins. Figures 2 and 3 included herein document the site drainage conditions under existing and proposed conditions. The Project proposed site layout minimizes total impervious area by developing in a phased manner, follows the existing topography of the Site, and protects the existing on-Site wetland.

352-10 No Untreated Discharges

See response to Massachusetts Stormwater Standard 1 included previously herein.

352-11 Stormwater Recharge

See response to Massachusetts Stormwater Standard 3 included previously herein. No underground recharge systems are proposed as part of the Project. The Project requests a waiver from 352-11(C)(7), which requires at least 80% of TSS removal required prior to discharge in areas with rapid infiltration rates. Stormwater runoff tributary to Basin #1P receives 44% pretreatment prior to recharge as required by the Massachusetts Stormwater Standards.

352-12 Pretreatment

Infiltration #1P has been preceded by deep sump hooded catch basins and a sediment forebay.

The sediment forebay has been designed to accommodate a minimum of one year's worth of sediment and includes a grass buffer or transition zone between the forebay and the basin.

Infiltration Basin #1P annual sediment loading: 2.2 (acres) x 500 pounds/Acre-Storm ÷ 90 pounds/ft3 x 10 storms/year = 122 cubic feet of sediment/year

Infiltration Basin #1P sediment forebay provided volume: 1,211 cubic feet

352-13 Peak Control

See response to Massachusetts Stormwater Standard 2 included previously herein.

352-14 Channel Protection

The one-year, twenty-four-hour return frequency storm event (one-year storm) shall be detained for an additional 24 hours longer than the predevelopment runoff discharge time. The Project is designed such that both of the infiltration basins proposed for the Project will fully recharge the one-year storm with no overflow discharge runoff from the Site.

352-15 Water Quality Volume

See response to Massachusetts Stormwater Standard 4 included previously herein.

352-16 Pollutant Removal

See response to Massachusetts Stormwater Standard 4 included previously herein. The project is tributary to the Nashua River. There is no established TMDL for the Nashua River.

352-17 Critical Areas

See response to Massachusetts Stormwater Standard 6 included previously herein.

352-18 Redevelopment

See response to Massachusetts Stormwater Standard 7 included previously herein.

352-19 Erosion Control

See response to Massachusetts Stormwater Standard 8 included previously herein.

352-20 Stormwater Pollution Prevention Plan

See response to Massachusetts Stormwater Standard 8 included previously herein.

352-21 Illicit Discharges

See response to Massachusetts Stormwater Standard 10 included previously herein.

352-22 Operations and Maintenance Plans

See response to Massachusetts Stormwater Standard 9 included previously herein.

352-23 Additional Requirements for Driveways

The two driveways for the Project have been designed such that there is a high point at the property line and all stormwater runoff impervious areas on the Site will drain back into the Site

and into the Project's stormwater management system. No stormwater runoff from impervious areas on the Property will discharge into the public right-of-way.

352-25 Additional Requirements for Projects Involving Wetland Resources

As demonstrated in response to Massachusetts Stormwater Standard 2 above, the Project minimizes changes in site hydrology from pre-project to post-project. See response to Massachusetts Stormwater Standard 2 for hydrological calculations. There are no turtle or amphibian protected habitats on site.

352-26 Specific System Design Guidelines

The Project proposes a surface, vegetated infiltration basin. The basin is easily accessed for maintenance with an appropriately sized forebay. Notes are provided on the Site Plans to prevent soil compaction during construction.

Appendix A: Standard 1 Computations and Supporting Information

- Pipe Sizing Calculations (25-year storm)

  The closed drainage system was designed for the 25-year storm event in accordance with the Town of Groton stormwater requirements for subdivisions.

  Drainage pipes were sized using Manning's Equation for full-flow capacity and the Rational Method. The performance of the system was analyzed using StormCAD, a HEC-22 based program.

- Stone outlet protection for pipe ends (See Virginia Erosion and Sediment Control Handbook, Chapter 3.18)

NOAA Atlas 14, Volume 10, Version 3
Location name: Groton, Massachusetts, USA*
Latitude: 42.6216°, Longitude: -71.5856°
Elevation: 228 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**3.89** (3.10-4.86)	**4.58** (3.65-5.74)	**5.72** (4.54-7.18)	**6.66** (5.26-8.39)	**7.97** (6.06-10.4)	**8.95** (6.65-11.9)	**9.98** (7.19-13.7)	**11.2** (7.57-15.6)	**12.9** (8.38-18.5)	**14.3** (9.05-20.9)
10-min	**2.75** (2.19-3.44)	**3.25** (2.58-4.06)	**4.05** (3.21-5.08)	**4.72** (3.71-5.94)	**5.65** (4.29-7.37)	**6.34** (4.70-8.42)	**7.07** (5.09-9.71)	**7.90** (5.35-11.0)	**9.12** (5.92-13.1)	**10.1** (6.41-14.8)
15-min	**2.16** (1.72-2.70)	**2.55** (2.02-3.18)	**3.18** (2.52-3.99)	**3.70** (2.92-4.66)	**4.43** (3.37-5.78)	**4.97** (3.69-6.61)	**5.54** (3.99-7.62)	**6.20** (4.20-8.64)	**7.15** (4.65-10.3)	**7.94** (5.03-11.6)
30-min	**1.47** (1.17-1.84)	**1.73** (1.38-2.17)	**2.17** (1.72-2.71)	**2.52** (1.99-3.18)	**3.02** (2.29-3.94)	**3.39** (2.52-4.50)	**3.78** (2.72-5.19)	**4.22** (2.86-5.88)	**4.87** (3.16-6.99)	**5.41** (3.42-7.89)
60-min	**0.931** (0.741-1.16)	**1.10** (0.873-1.37)	**1.37** (1.09-1.72)	**1.60** (1.26-2.01)	**1.91** (1.45-2.49)	**2.14** (1.59-2.85)	**2.39** (1.72-3.28)	**2.67** (1.81-3.72)	**3.08** (2.00-4.42)	**3.42** (2.17-5.00)
2-hr	**0.582** (0.467-0.722)	**0.699** (0.560-0.867)	**0.890** (0.710-1.11)	**1.05** (0.832-1.31)	**1.27** (0.971-1.65)	**1.43** (1.07-1.90)	**1.60** (1.17-2.20)	**1.81** (1.23-2.51)	**2.13** (1.39-3.03)	**2.40** (1.52-3.47)
3-hr	**0.442** (0.356-0.546)	**0.536** (0.431-0.662)	**0.688** (0.551-0.853)	**0.814** (0.649-1.01)	**0.988** (0.761-1.28)	**1.12** (0.842-1.48)	**1.26** (0.920-1.73)	**1.43** (0.972-1.97)	**1.69** (1.10-2.40)	**1.91** (1.22-2.76)
6-hr	**0.280** (0.227-0.343)	**0.341** (0.277-0.419)	**0.441** (0.356-0.543)	**0.524** (0.421-0.648)	**0.638** (0.495-0.824)	**0.723** (0.548-0.951)	**0.815** (0.601-1.11)	**0.928** (0.635-1.27)	**1.10** (0.722-1.55)	**1.25** (0.799-1.80)
12-hr	**0.175** (0.143-0.213)	**0.213** (0.174-0.260)	**0.275** (0.224-0.336)	**0.327** (0.264-0.401)	**0.398** (0.311-0.510)	**0.451** (0.344-0.589)	**0.508** (0.376-0.689)	**0.578** (0.397-0.787)	**0.685** (0.451-0.960)	**0.778** (0.498-1.11)
24-hr	**0.106** (0.087-0.128)	**0.129** (0.106-0.156)	**0.167** (0.137-0.202)	**0.198** (0.161-0.241)	**0.241** (0.189-0.306)	**0.273** (0.210-0.354)	**0.308** (0.229-0.414)	**0.350** (0.242-0.473)	**0.414** (0.274-0.577)	**0.470** (0.302-0.664)
2-day	**0.060** (0.050-0.072)	**0.074** (0.061-0.089)	**0.096** (0.079-0.116)	**0.114** (0.094-0.138)	**0.140** (0.110-0.176)	**0.158** (0.122-0.204)	**0.178** (0.133-0.238)	**0.203** (0.141-0.273)	**0.240** (0.159-0.332)	**0.273** (0.176-0.383)
3-day	**0.044** (0.037-0.053)	**0.054** (0.045-0.064)	**0.069** (0.058-0.083)	**0.083** (0.068-0.099)	**0.101** (0.080-0.126)	**0.114** (0.088-0.146)	**0.128** (0.096-0.170)	**0.146** (0.101-0.195)	**0.172** (0.114-0.237)	**0.194** (0.125-0.272)
4-day	**0.036** (0.030-0.042)	**0.043** (0.036-0.051)	**0.055** (0.046-0.066)	**0.066** (0.054-0.079)	**0.080** (0.063-0.100)	**0.090** (0.070-0.115)	**0.101** (0.076-0.134)	**0.115** (0.080-0.153)	**0.135** (0.089-0.185)	**0.151** (0.098-0.211)
7-day	**0.024** (0.020-0.029)	**0.029** (0.024-0.034)	**0.036** (0.030-0.043)	**0.042** (0.035-0.051)	**0.051** (0.041-0.063)	**0.057** (0.045-0.072)	**0.064** (0.048-0.084)	**0.072** (0.050-0.095)	**0.083** (0.055-0.113)	**0.092** (0.060-0.128)
10-day	**0.020** (0.017-0.023)	**0.023** (0.019-0.027)	**0.028** (0.024-0.034)	**0.033** (0.027-0.039)	**0.039** (0.031-0.048)	**0.043** (0.034-0.055)	**0.048** (0.036-0.063)	**0.054** (0.038-0.071)	**0.061** (0.041-0.083)	**0.068** (0.044-0.093)
20-day	**0.014** (0.012-0.016)	**0.016** (0.013-0.018)	**0.018** (0.016-0.022)	**0.021** (0.017-0.025)	**0.024** (0.019-0.029)	**0.027** (0.021-0.033)	**0.029** (0.022-0.037)	**0.032** (0.022-0.041)	**0.035** (0.023-0.047)	**0.038** (0.024-0.052)
30-day	**0.011** (0.010-0.013)	**0.013** (0.011-0.015)	**0.015** (0.012-0.017)	**0.016** (0.014-0.019)	**0.019** (0.015-0.022)	**0.020** (0.016-0.025)	**0.022** (0.016-0.028)	**0.024** (0.017-0.031)	**0.026** (0.017-0.035)	**0.027** (0.018-0.037)
45-day	**0.009** (0.008-0.011)	**0.010** (0.009-0.012)	**0.012** (0.010-0.014)	**0.013** (0.011-0.015)	**0.014** (0.012-0.017)	**0.016** (0.012-0.019)	**0.017** (0.013-0.021)	**0.018** (0.013-0.023)	**0.019** (0.013-0.026)	**0.020** (0.013-0.028)
60-day	**0.008** (0.007-0.009)	**0.009** (0.008-0.010)	**0.010** (0.008-0.012)	**0.011** (0.009-0.013)	**0.012** (0.010-0.015)	**0.013** (0.010-0.016)	**0.014** (0.010-0.018)	**0.015** (0.011-0.019)	**0.016** (0.011-0.021)	**0.016** (0.011-0.023)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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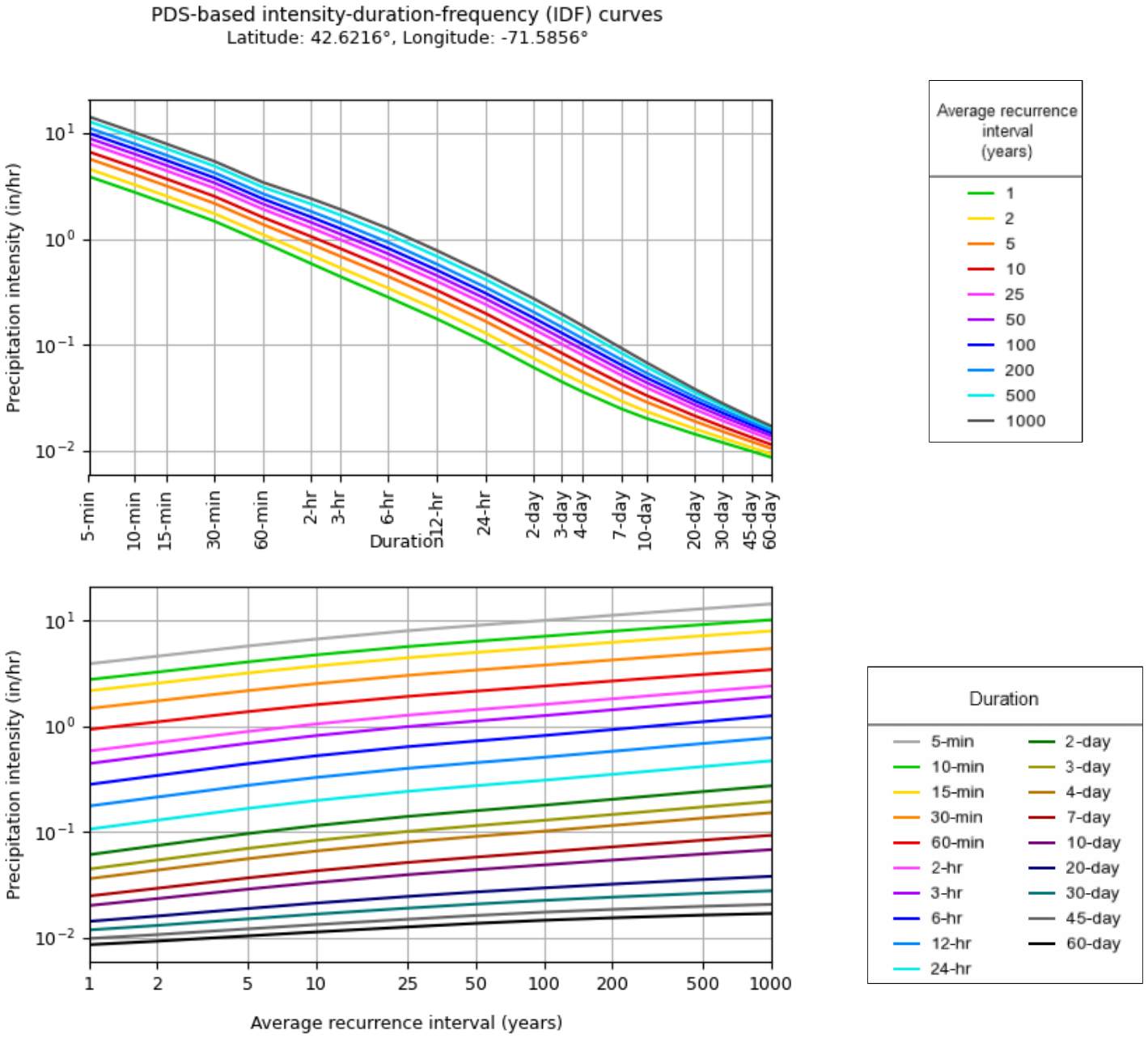
PF graphical



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Created (GMT): Wed Apr 23 15:33:39 2025

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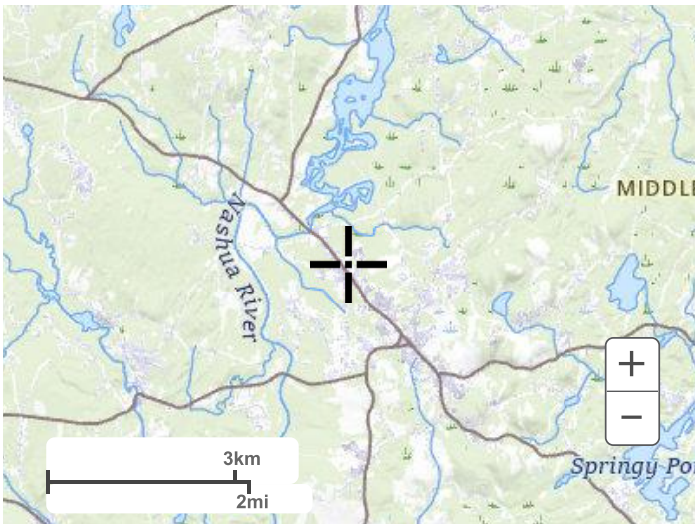
Maps & aerials

Small scale terrain



Large scale terrain

Large scale map

Large scale aerial

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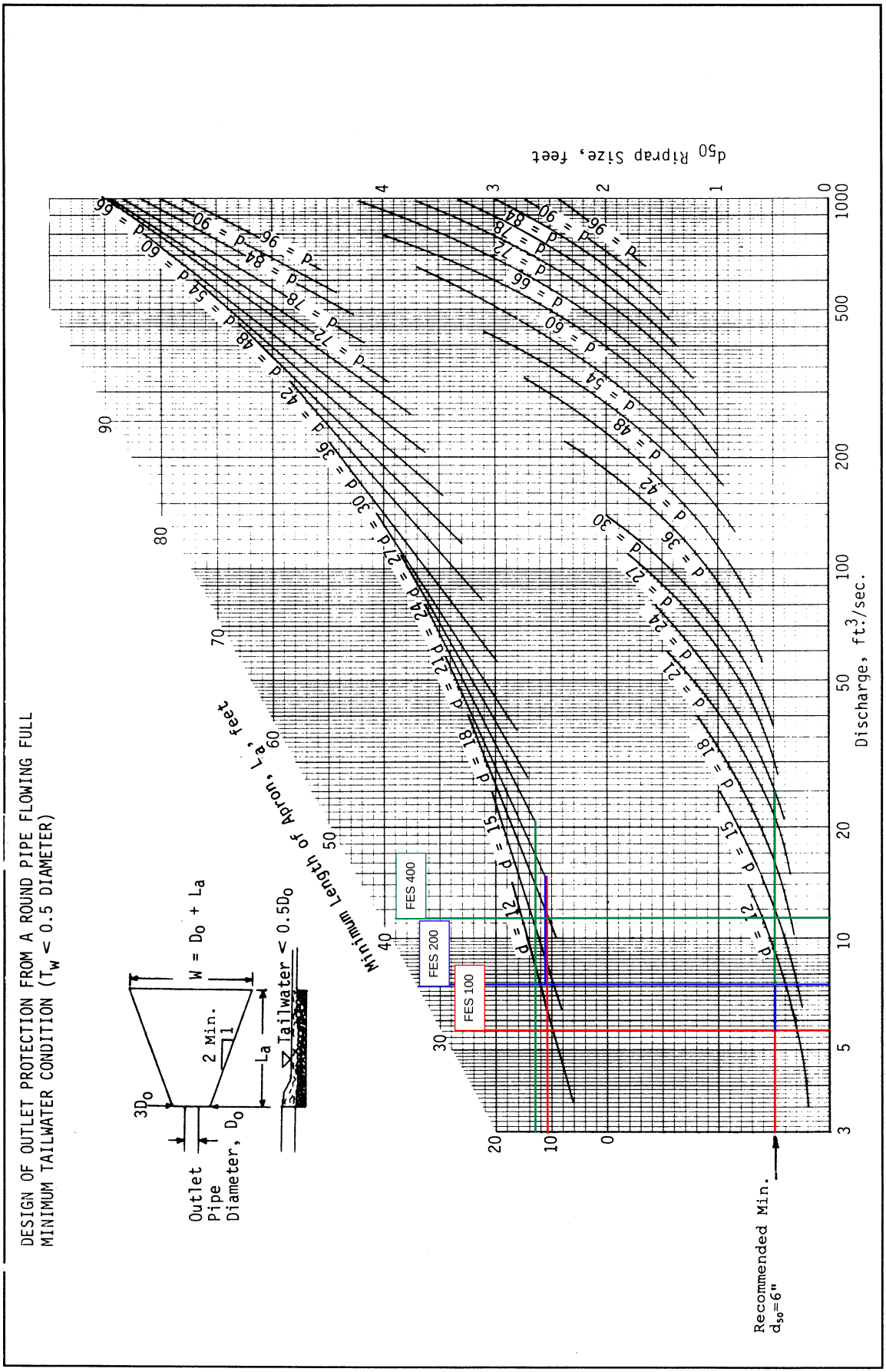
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov



Source: USDA-SCS

Plate 3.18-3

Stormcad Conduit Output Table - Hydraulic Pipe Analysis

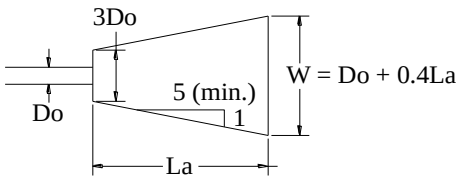
Project	Nashoba SEF	**Project #**	16694.00
Calculated by	CSH	**Date**	6/17/2025
Checked by	MDY	**Date**	6/19/2025

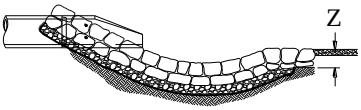
Start Node	Stop Node	Upstream Inlet Area	Upstream Inlet C	System CA	Time of Conc.	Intensity	Pipe Size	Material	Manning's "n"	Slope	Length	Capacity (Full Flow)	Capacity (Design)	Velocity (Average)	Rim (Upper)	Hydraulic Grade Line In	Rim (Lower)	Hydraulic Grade Line Out	Invert (Upper)	Invert (Lower)
-	-	(acres)	-	(acres)	(min)	(in/hr)	(in)	-	-	(ft/ft)	(ft)	(cfs)	(cfs)	(ft/s)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
AD-202	DMH-201	4.8	0.35	1.7	5.0	7.97	18	RCP	0.012	0.017	180.8	14.90	14.90	9.56	233.99	232.37	236.26	229.75	231.00	227.90
DMH-201	FES-200	(N/A)	(N/A)	1.7	0.0	7.82	18	RCP	0.012	0.017	221.0	14.92	14.92	7.54	236.26	229.75	227.81	226.72	227.80	224.00
RL-1	DMH-302	0.4	0.90	0.4	5.0	7.97	12	RCP	0.012	0.014	14.3	4.57	4.57	6.24	235.00	230.75	234.66	230.43	230.00	229.80
DMH-301	DMH-302	(N/A)	(N/A)	0.3	0.0	7.95	12	RCP	0.012	0.010	58.4	3.91	3.91	5.33	233.96	230.39	234.66	229.70	229.70	229.10
AD-410	DMH-408	1.1	0.32	0.4	5.0	7.97	12	RCP	0.012	0.028	67.0	6.44	6.44	7.95	234.36	232.12	233.50	230.00	231.40	229.53
CB-416	DMH-414	0.6	0.77	0.4	5.0	7.97	12	RCP	0.012	0.017	145.2	4.96	4.96	6.85	233.44	230.90	233.04	228.32	230.10	227.70
DMH-414	DMH-413	(N/A)	(N/A)	0.7	0.0	7.81	18	RCP	0.012	0.005	188.0	8.30	8.30	5.06	233.04	226.52	232.02	225.76	225.60	224.60
CB-415	DMH-414	0.4	0.79	0.3	5.0	7.97	12	RCP	0.012	0.026	7.7	6.21	6.21	7.33	232.94	230.55	233.04	230.20	229.90	229.70
AD-102	DMH-101	2.8	0.37	1.0	5.0	7.97	18	RCP	0.012	0.007	274.9	9.21	9.21	5.90	233.00	231.12	232.98	229.32	230.00	228.20
DMH-101	FES-100	(N/A)	(N/A)	1.0	0.0	7.61	18	RCP	0.012	0.007	61.2	9.21	9.21	5.86	232.98	229.19	229.20	228.78	228.10	227.70
CB-409	DMH-408	0.2	0.55	0.1	5.0	7.97	12	RCP	0.012	0.019	9.1	5.26	5.26	4.94	232.72	230.23	233.50	230.25	229.70	229.53
DMH-408	DMH-405	(N/A)	(N/A)	0.5	0.0	7.91	12	RCP	0.012	0.028	123.1	6.44	6.44	8.48	233.50	230.25	229.62	226.54	229.43	226.00
DMH-413	DMH-411	(N/A)	(N/A)	1.4	0.0	7.52	18	RCP	0.012	0.016	183.4	14.20	14.20	8.86	232.02	225.76	226.18	222.63	224.50	221.64
CB-407	DMH-405	0.8	0.81	0.6	5.0	7.97	18	RCP	0.012	0.016	12.7	14.28	14.28	7.38	229.87	227.76	229.62	227.39	226.90	226.70
DMH-405	DMH-403	(N/A)	(N/A)	1.3	0.0	7.79	18	RCP	0.012	0.021	204.6	16.50	16.50	9.76	229.62	225.71	222.73	221.04	224.50	220.20
CB-406	DMH-405	0.2	0.75	0.2	5.0	7.97	12	RCP	0.012	0.014	13.9	4.63	4.63	5.17	229.39	226.90	229.62	226.60	226.40	226.20
CB-412	DMH-411	0.3	0.88	0.3	5.0	7.97	12	RCP	0.012	0.026	7.8	6.19	6.19	7.25	226.25	223.94	226.18	223.59	223.30	223.10
DMH-411	DMH-403	(N/A)	(N/A)	1.7	0.0	7.36	18	RCP	0.012	0.016	90.3	14.39	14.39	9.19	226.18	222.88	222.73	221.20	221.54	220.10
DMH-403	DMH-401	(N/A)	(N/A)	3.2	0.0	7.28	24	RCP	0.012	0.012	81.5	27.14	27.14	9.71	222.73	220.31	220.56	219.05	218.60	217.60
CB-404	DMH-403	0.2	0.80	0.2	5.0	7.97	12	RCP	0.012	0.007	14.1	3.26	3.26	4.09	222.70	220.30	222.73	220.31	219.70	219.60
CB-402	DMH-401	0.2	0.81	0.2	5.0	7.97	12	RCP	0.012	0.005	12.9	2.84	2.84	3.66	219.52	219.05	220.56	219.05	218.30	218.23
DMH-401	FES-400	(N/A)	(N/A)	3.4	0.0	7.22	24	RCP	0.012	0.011	26.1	26.28	26.28	9.50	220.56	219.05	218.46	218.59	217.30	217.00
RL-2	DMH-301	0.4	0.90	0.3	5.0	7.97	12	RCP	0.012	0.014	14.3	4.56	4.56	6.01	235.00	230.69	233.96	230.37	230.00	229.80
DMH-302	DMH-413	(N/A)	(N/A)	0.7	0.0	7.87	18	RCP	0.012	0.025	118.6	18.10	18.10	9.03	234.66	227.91	232.02	225.76	227.00	224.00

Outfall Riprap Sizing and Velocity Calculations

Project	Nashoba SEF	**Project #**	16694.00
Calculated by	CSH	**Date**	6/19/2025
Checked by	KSS	**Date**	6/19/2025

Tw ≥ 0.5Do





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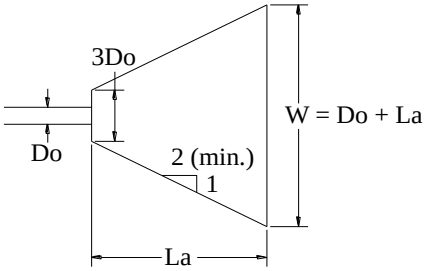

OUTLET DESCRIPTION:		**FES-100**	**FES-200**	**FES-400**
Design Storm	(yr)	25	10	25
Flow / Discharge (Q)	(cfs)	5.5	7.5	11.9
Defined Channel ?	-	NO	NO	NO
Defined Channel Width	(ft)	0	0	0
Outlet Pipe Diameter (D_O)	(in)	18	18	24
Tailwater Condition (T_W)	(ft)	TW < 0.5D	TW < 0.5D	TW ≥ 0.5D
Apron Length (L_A)	(ft)	11.5	11.5	13.5
Apron Width at Outlet ($3D_O$)	(ft)	4.5	4.5	6
Apron Width at End (W)	(ft)	13	13	7.4
Median Stone Diameter (d_{50})	(in)	6	6	6
Largest Stone Diameter	(in)	9	9	9
Apron Depth (Z)	(in)	13.5	13.5	13.5

Apron Length (L_A): *Length = From Virginia DCR Handbook - Plate 3.18-3* *if T_W < 0.5D*

Length = From Virginia DCR Handbook - Plate 3.18-4 *if T_W ≥ 0.5D*

Apron Width at Outlet ($3D_O$): *Width = 3 x pipe dia. (or width of channel)*

Apron Width at End (W): *Width = dia. + apron length* *if T_W < 0.5D*

Width = dia. + 0.4 x apron length *if T_W ≥ 0.5D*

or apron width = channel width if a well defined channel exists

Rock Riprap: *Median Diameter (d_{50}) = From Virginia DCR Handbook - Plate 3.18-3 or 4*

Largest stone dia = 1.5 x d_{50}

Apron Depth (Z): *6" or 1.5 x largest stone dia*

Appendix B: Standard 2 Computations and Supporting Information

The rainfall-runoff response of the Site under existing and proposed conditions was evaluated for storm events with recurrence intervals of 1, 2, 5, 10, 25 and 100-years. Rainfall volumes used for this analysis were based on the Natural Resources Conservation Service (NRCS) Type III, 24-hour storm and NOAA Atlas 14 precipitation depths for the site: 2.55, 3.10, 4.01, 4.76, 5.80, and 7.39 inches, respectively. Runoff coefficients for the pre- and post-development conditions, as previously shown in Tables 2 and 3 respectively, were determined using NRCS Technical Release 55 (TR-55) methodology as provided in HydroCAD. Drainage areas used in the analyses were described in previous sections and shown on Figures 2 and 3. The HydroCAD model is based on the NRCS Technical Release 20 (TR-20) Model for Project Formulation Hydrology.

NOAA Atlas 14, Volume 10, Version 3
Location name: Groton, Massachusetts, USA*
Latitude: 42.6216°, Longitude: -71.5856°
Elevation: 228 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.324 (0.258-0.405)	0.382 (0.304-0.478)	0.477 (0.378-0.598)	0.555 (0.438-0.699)	0.664 (0.505-0.868)	0.746 (0.554-0.992)	0.832 (0.599-1.14)	0.931 (0.631-1.30)	1.07 (0.698-1.54)	1.19 (0.754-1.74)
10-min	0.459 (0.365-0.573)	0.541 (0.430-0.677)	0.675 (0.535-0.846)	0.787 (0.619-0.990)	0.941 (0.715-1.23)	1.06 (0.784-1.40)	1.18 (0.848-1.62)	1.32 (0.892-1.84)	1.52 (0.987-2.18)	1.69 (1.07-2.46)
15-min	0.540 (0.430-0.674)	0.637 (0.506-0.796)	0.795 (0.630-0.997)	0.926 (0.729-1.17)	1.11 (0.842-1.45)	1.24 (0.923-1.65)	1.39 (0.998-1.90)	1.55 (1.05-2.16)	1.79 (1.16-2.57)	1.99 (1.26-2.90)
30-min	0.735 (0.585-0.918)	0.867 (0.690-1.08)	1.08 (0.858-1.36)	1.26 (0.993-1.59)	1.51 (1.15-1.97)	1.69 (1.26-2.25)	1.89 (1.36-2.59)	2.11 (1.43-2.94)	2.44 (1.58-3.49)	2.70 (1.71-3.95)
60-min	0.931 (0.741-1.16)	1.10 (0.873-1.37)	1.37 (1.09-1.72)	1.60 (1.26-2.01)	1.91 (1.45-2.49)	2.14 (1.59-2.85)	2.39 (1.72-3.28)	2.67 (1.81-3.72)	3.08 (2.00-4.42)	3.42 (2.17-5.00)
2-hr	1.16 (0.934-1.44)	1.40 (1.12-1.74)	1.78 (1.42-2.22)	2.10 (1.66-2.62)	2.54 (1.94-3.30)	2.86 (2.14-3.79)	3.21 (2.34-4.41)	3.63 (2.47-5.02)	4.26 (2.77-6.07)	4.80 (3.04-6.95)
3-hr	1.33 (1.07-1.64)	1.61 (1.30-1.99)	2.07 (1.66-2.56)	2.45 (1.95-3.04)	2.97 (2.29-3.85)	3.36 (2.53-4.44)	3.78 (2.76-5.18)	4.28 (2.92-5.91)	5.06 (3.31-7.19)	5.74 (3.65-8.28)
6-hr	1.68 (1.36-2.06)	2.05 (1.66-2.51)	2.64 (2.14-3.25)	3.14 (2.52-3.88)	3.83 (2.97-4.94)	4.33 (3.29-5.70)	4.88 (3.60-6.67)	5.56 (3.80-7.62)	6.60 (4.32-9.31)	7.50 (4.79-10.8)
12-hr	2.12 (1.73-2.58)	2.58 (2.10-3.14)	3.32 (2.71-4.06)	3.95 (3.19-4.84)	4.80 (3.75-6.15)	5.44 (4.15-7.10)	6.12 (4.54-8.30)	6.97 (4.79-9.48)	8.26 (5.44-11.6)	9.38 (6.01-13.3)
24-hr	2.55 (2.10-3.07)	3.10 (2.55-3.75)	4.01 (3.29-4.86)	4.76 (3.88-5.80)	5.80 (4.56-7.36)	6.56 (5.04-8.51)	7.39 (5.50-9.94)	8.41 (5.81-11.4)	9.96 (6.58-13.8)	11.3 (7.26-16.0)
2-day	2.92 (2.43-3.50)	3.57 (2.97-4.28)	4.63 (3.83-5.57)	5.51 (4.53-6.66)	6.72 (5.32-8.48)	7.62 (5.89-9.80)	8.59 (6.43-11.5)	9.77 (6.78-13.1)	11.6 (7.67-16.0)	13.1 (8.46-18.4)
3-day	3.21 (2.68-3.82)	3.90 (3.25-4.66)	5.04 (4.18-6.03)	5.98 (4.93-7.19)	7.27 (5.78-9.12)	8.24 (6.39-10.5)	9.27 (6.95-12.3)	10.5 (7.33-14.1)	12.4 (8.25-17.1)	14.0 (9.06-19.6)
4-day	3.46 (2.90-4.12)	4.18 (3.50-4.98)	5.36 (4.47-6.40)	6.34 (5.25-7.61)	7.69 (6.12-9.61)	8.69 (6.75-11.1)	9.77 (7.33-12.9)	11.0 (7.71-14.7)	13.0 (8.63-17.8)	14.6 (9.44-20.3)
7-day	4.16 (3.51-4.92)	4.93 (4.15-5.83)	6.18 (5.18-7.33)	7.21 (6.01-8.60)	8.64 (6.91-10.7)	9.71 (7.56-12.2)	10.8 (8.14-14.1)	12.1 (8.51-16.1)	14.0 (9.38-19.1)	15.6 (10.1-21.6)
10-day	4.84 (4.10-5.69)	5.62 (4.76-6.63)	6.91 (5.82-8.17)	7.98 (6.67-9.47)	9.45 (7.58-11.6)	10.6 (8.24-13.2)	11.7 (8.79-15.1)	13.0 (9.15-17.1)	14.8 (9.95-20.1)	16.3 (10.6-22.6)
20-day	6.85 (5.85-8.01)	7.69 (6.56-9.00)	9.07 (7.70-10.6)	10.2 (8.60-12.0)	11.8 (9.49-14.3)	13.0 (10.2-16.0)	14.2 (10.6-18.0)	15.4 (10.9-20.1)	17.0 (11.5-23.0)	18.3 (11.9-25.1)
30-day	8.53 (7.32-9.93)	9.42 (8.07-11.0)	10.9 (9.27-12.7)	12.1 (10.2-14.1)	13.7 (11.1-16.5)	15.0 (11.8-18.4)	16.2 (12.2-20.4)	17.4 (12.4-22.7)	18.9 (12.8-25.4)	20.0 (13.1-27.3)
45-day	10.6 (9.16-12.3)	11.6 (9.96-13.4)	13.1 (11.2-15.2)	14.4 (12.2-16.8)	16.1 (13.1-19.3)	17.5 (13.8-21.3)	18.8 (14.1-23.4)	20.0 (14.3-25.9)	21.4 (14.5-28.5)	22.3 (14.6-30.4)
60-day	12.4 (10.7-14.3)	13.4 (11.6-15.4)	15.0 (12.9-17.4)	16.3 (14.0-19.0)	18.2 (14.8-21.7)	19.7 (15.5-23.8)	21.1 (15.8-26.1)	22.2 (15.9-28.6)	23.6 (16.1-31.3)	24.4 (16.1-33.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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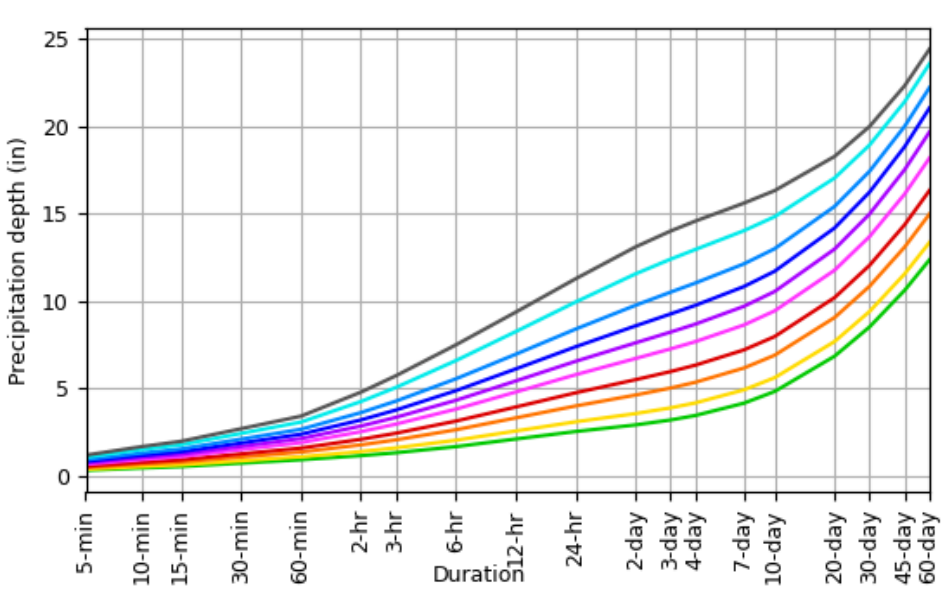
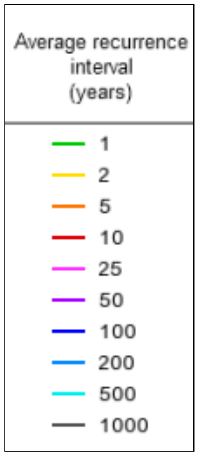
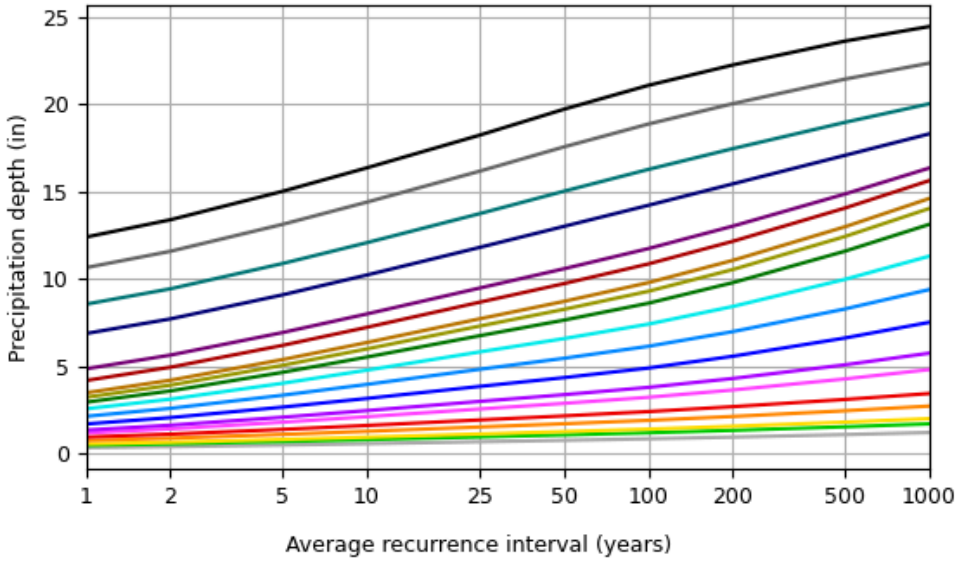
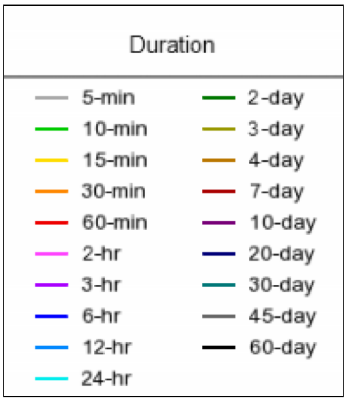
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 42.6216°, Longitude: -71.5856°









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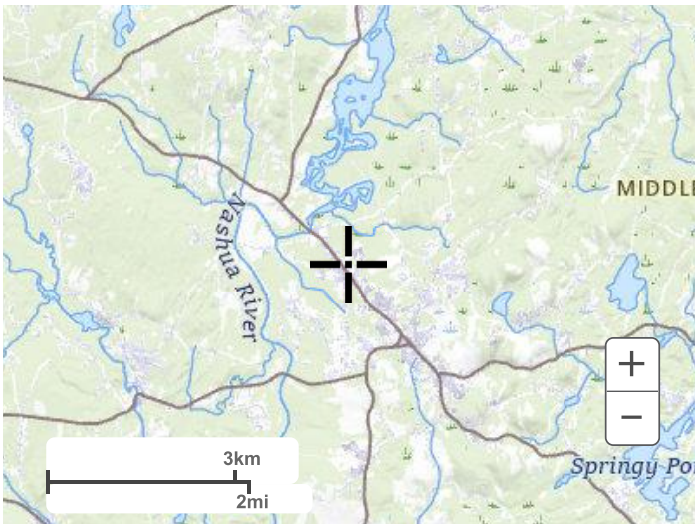
Maps & aerials

Small scale terrain



Large scale terrain

Large scale map

Large scale aerial

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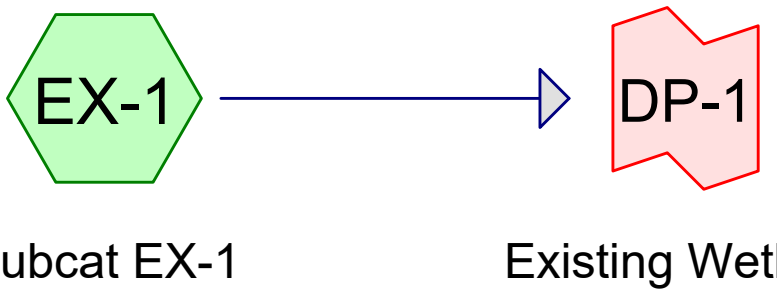
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

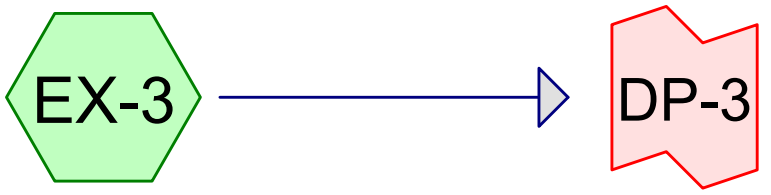


Subcat EX-1

Existing Wetland

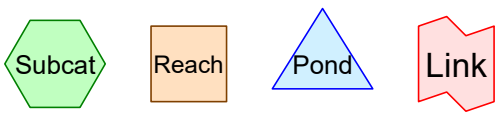
Subcat EX-2

Existing Adjacent Swale



Subcat EX-3

Main Street Drainage System



Routing Diagram for 16694.00-EX
Prepared by VHB, Inc, Printed 6/19/2025

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-Yr	Type III 24-hr		Default	24.00	1	2.55	2
2	2-Yr	Type III 24-hr		Default	24.00	1	3.10	2
3	5-Yr	Type III 24-hr		Default	24.00	1	4.01	2
4	10-Yr	Type III 24-hr		Default	24.00	1	4.76	2
5	25-Yr	Type III 24-hr		Default	24.00	1	5.80	2
6	100-Yr	Type III 24-hr		Default	24.00	1	7.39	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.8	68	<50% Grass cover, Poor, HSG A (EX-2)
3.8	79	<50% Grass cover, Poor, HSG B (EX-1, EX-3)
3.7	86	<50% Grass cover, Poor, HSG C (EX-1, EX-2, EX-3)
0.4	89	<50% Grass cover, Poor, HSG D (EX-1)
0.5	98	Paved parking, HSG B (EX-1, EX-3)
0.5	98	Paved parking, HSG C (EX-1, EX-2, EX-3)
0.1	98	Paved parking, HSG D (EX-1)
0.2	98	Roofs, HSG B (EX-1, EX-3)
0.1	98	Roofs, HSG C (EX-1)
0.0	98	Roofs, HSG D (EX-1)
1.3	55	Woods, Good, HSG B (EX-1, EX-3)
1.8	70	Woods, Good, HSG C (EX-1, EX-2, EX-3)
1.2	77	Woods, Good, HSG D (EX-1)
14.4	**79**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.8	HSG A	EX-2
5.8	HSG B	EX-1, EX-3
6.1	HSG C	EX-1, EX-2, EX-3
1.7	HSG D	EX-1
0.0	Other	
14.4		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.8	3.8	3.7	0.4	0.0	8.7	<50% Grass cover, Poor	EX-1, EX-2, EX-3
0.0	0.5	0.5	0.1	0.0	1.1	Paved parking	EX-1, EX-2, EX-3
0.0	0.2	0.1	0.0	0.0	0.3	Roofs	EX-1, EX-3
0.0	1.3	1.8	1.2	0.0	4.3	Woods, Good	EX-1, EX-2, EX-3
0.8	**5.8**	**6.1**	**1.7**	**0.0**	**14.4**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.03 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1: Subcat EX-1 Runoff Area=9.2 ac 7.75% Impervious Runoff Depth>0.87"
Flow Length=1,000' Tc=14.2 min CN=79 Runoff=6.9 cfs 0.7 af

Subcatchment EX-2: Subcat EX-2 Runoff Area=2.2 ac 9.09% Impervious Runoff Depth>0.87"
Flow Length=639' Tc=8.9 min CN=79 Runoff=1.9 cfs 0.2 af

Subcatchment EX-3: Subcat EX-3 Runoff Area=3.0 ac 16.98% Impervious Runoff Depth>0.82"
Flow Length=823' Tc=13.8 min CN=78 Runoff=2.1 cfs 0.2 af

Link DP-1: Existing Wetland Inflow=6.9 cfs 0.7 af
Primary=6.9 cfs 0.7 af

Link DP-2: Existing Adjacent Swale Inflow=1.9 cfs 0.2 af
Primary=1.9 cfs 0.2 af

Link DP-3: Main Street Drainage System Inflow=2.1 cfs 0.2 af
Primary=2.1 cfs 0.2 af

Total Runoff Area = 14.4 ac Runoff Volume = 1.0 af Average Runoff Depth = 0.86"
90.12% Pervious = 13.0 ac 9.88% Impervious = 1.4 ac

Summary for Subcatchment EX-1: Subcat EX-1

Runoff = 6.9 cfs @ 12.21 hrs, Volume= 0.7 af, Depth> 0.87"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 1-Yr Rainfall=2.55"

Area (ac)	CN	Description
2.5	79	<50% Grass cover, Poor, HSG B
2.3	86	<50% Grass cover, Poor, HSG C
0.4	89	<50% Grass cover, Poor, HSG D
0.3	98	Paved parking, HSG B
0.1	98	Paved parking, HSG C
0.1	98	Paved parking, HSG D
0.2	98	Roofs, HSG B
0.1	98	Roofs, HSG C
0.0	98	Roofs, HSG D
0.7	55	Woods, Good, HSG B
1.5	70	Woods, Good, HSG C
1.2	77	Woods, Good, HSG D
9.2	79	Weighted Average
8.5		92.25% Pervious Area
0.7		7.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	50	0.0740	0.25		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
10.8	950	0.0440	1.47		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
14.2	1,000	Total			

Summary for Subcatchment EX-2: Subcat EX-2

Runoff = 1.9 cfs @ 12.13 hrs, Volume= 0.2 af, Depth> 0.87"
Routed to Link DP-2 : Existing Adjacent Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 1-Yr Rainfall=2.55"

Area (ac)	CN	Description
0.8	68	<50% Grass cover, Poor, HSG A
1.0	86	<50% Grass cover, Poor, HSG C
0.2	98	Paved parking, HSG C
0.0	98	Roofs, HSG C
0.2	70	Woods, Good, HSG C
2.2	79	Weighted Average
2.0		90.91% Pervious Area
0.2		9.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0460	0.20		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
2.4	303	0.0890	2.09		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	127	0.0460	4.35		**Shallow Concentrated Flow, Paved Drive** Paved Kv= 20.3 fps
1.9	159	0.0380	1.36		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
8.9	639	Total			

Summary for Subcatchment EX-3: Subcat EX-3

Runoff = 2.1 cfs @ 12.21 hrs, Volume= 0.2 af, Depth> 0.82"
Routed to Link DP-3 : Main Street Drainage System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 1-Yr Rainfall=2.55"

Area (ac)	CN	Description
1.3	79	<50% Grass cover, Poor, HSG B
0.5	86	<50% Grass cover, Poor, HSG C
0.3	98	Paved parking, HSG B
0.1	98	Paved parking, HSG C
0.1	98	Roofs, HSG B
0.6	55	Woods, Good, HSG B
0.1	70	Woods, Good, HSG C
3.0	78	Weighted Average
2.5		83.02% Pervious Area
0.5		16.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0220	0.15		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
8.3	773	0.0490	1.55		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
13.8	823	Total			

Summary for Link DP-1: Existing Wetland

Inflow Area = 9.2 ac, 7.75% Impervious, Inflow Depth > 0.87" for 1-Yr event
Inflow = 6.9 cfs @ 12.21 hrs, Volume= 0.7 af
Primary = 6.9 cfs @ 12.21 hrs, Volume= 0.7 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: Existing Adjacent Swale

Inflow Area = 2.2 ac, 9.09% Impervious, Inflow Depth > 0.87" for 1-Yr event
Inflow = 1.9 cfs @ 12.13 hrs, Volume= 0.2 af
Primary = 1.9 cfs @ 12.13 hrs, Volume= 0.2 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-3: Main Street Drainage System

Inflow Area = 3.0 ac, 16.98% Impervious, Inflow Depth > 0.82" for 1-Yr event
Inflow = 2.1 cfs @ 12.21 hrs, Volume= 0.2 af
Primary = 2.1 cfs @ 12.21 hrs, Volume= 0.2 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Time span=0.00-24.00 hrs, dt=0.03 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1: Subcat EX-1 Runoff Area=9.2 ac 7.75% Impervious Runoff Depth>1.26"
Flow Length=1,000' Tc=14.2 min CN=79 Runoff=10.3 cfs 1.0 af

Subcatchment EX-2: Subcat EX-2 Runoff Area=2.2 ac 9.09% Impervious Runoff Depth>1.26"
Flow Length=639' Tc=8.9 min CN=79 Runoff=2.9 cfs 0.2 af

Subcatchment EX-3: Subcat EX-3 Runoff Area=3.0 ac 16.98% Impervious Runoff Depth>1.20"
Flow Length=823' Tc=13.8 min CN=78 Runoff=3.2 cfs 0.3 af

Link DP-1: Existing Wetland Inflow=10.3 cfs 1.0 af
Primary=10.3 cfs 1.0 af

Link DP-2: Existing Adjacent Swale Inflow=2.9 cfs 0.2 af
Primary=2.9 cfs 0.2 af

Link DP-3: Main Street Drainage System Inflow=3.2 cfs 0.3 af
Primary=3.2 cfs 0.3 af

Total Runoff Area = 14.4 ac Runoff Volume = 1.5 af Average Runoff Depth = 1.25"
90.12% Pervious = 13.0 ac 9.88% Impervious = 1.4 ac

Summary for Subcatchment EX-1: Subcat EX-1

Runoff = 10.3 cfs @ 12.20 hrs, Volume= 1.0 af, Depth> 1.26"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.10"

Area (ac)	CN	Description
2.5	79	<50% Grass cover, Poor, HSG B
2.3	86	<50% Grass cover, Poor, HSG C
0.4	89	<50% Grass cover, Poor, HSG D
0.3	98	Paved parking, HSG B
0.1	98	Paved parking, HSG C
0.1	98	Paved parking, HSG D
0.2	98	Roofs, HSG B
0.1	98	Roofs, HSG C
0.0	98	Roofs, HSG D
0.7	55	Woods, Good, HSG B
1.5	70	Woods, Good, HSG C
1.2	77	Woods, Good, HSG D
9.2	79	Weighted Average
8.5		92.25% Pervious Area
0.7		7.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	50	0.0740	0.25		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
10.8	950	0.0440	1.47		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
14.2	1,000	Total			

Summary for Subcatchment EX-2: Subcat EX-2

Runoff = 2.9 cfs @ 12.13 hrs, Volume= 0.2 af, Depth> 1.26"
Routed to Link DP-2 : Existing Adjacent Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.10"

Area (ac)	CN	Description
0.8	68	<50% Grass cover, Poor, HSG A
1.0	86	<50% Grass cover, Poor, HSG C
0.2	98	Paved parking, HSG C
0.0	98	Roofs, HSG C
0.2	70	Woods, Good, HSG C
2.2	79	Weighted Average
2.0		90.91% Pervious Area
0.2		9.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0460	0.20		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
2.4	303	0.0890	2.09		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	127	0.0460	4.35		**Shallow Concentrated Flow, Paved Drive** Paved Kv= 20.3 fps
1.9	159	0.0380	1.36		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
8.9	639	Total			

Summary for Subcatchment EX-3: Subcat EX-3

Runoff = 3.2 cfs @ 12.20 hrs, Volume= 0.3 af, Depth> 1.20"
Routed to Link DP-3 : Main Street Drainage System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.10"

Area (ac)	CN	Description
1.3	79	<50% Grass cover, Poor, HSG B
0.5	86	<50% Grass cover, Poor, HSG C
0.3	98	Paved parking, HSG B
0.1	98	Paved parking, HSG C
0.1	98	Roofs, HSG B
0.6	55	Woods, Good, HSG B
0.1	70	Woods, Good, HSG C
3.0	78	Weighted Average
2.5		83.02% Pervious Area
0.5		16.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0220	0.15		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
8.3	773	0.0490	1.55		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
13.8	823	Total			

Summary for Link DP-1: Existing Wetland

Inflow Area = 9.2 ac, 7.75% Impervious, Inflow Depth > 1.26" for 2-Yr event
Inflow = 10.3 cfs @ 12.20 hrs, Volume= 1.0 af
Primary = 10.3 cfs @ 12.20 hrs, Volume= 1.0 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: Existing Adjacent Swale

Inflow Area = 2.2 ac, 9.09% Impervious, Inflow Depth > 1.26" for 2-Yr event
Inflow = 2.9 cfs @ 12.13 hrs, Volume= 0.2 af
Primary = 2.9 cfs @ 12.13 hrs, Volume= 0.2 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-3: Main Street Drainage System

Inflow Area = 3.0 ac, 16.98% Impervious, Inflow Depth > 1.20" for 2-Yr event
Inflow = 3.2 cfs @ 12.20 hrs, Volume= 0.3 af
Primary = 3.2 cfs @ 12.20 hrs, Volume= 0.3 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Time span=0.00-24.00 hrs, dt=0.03 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1: Subcat EX-1 Runoff Area=9.2 ac 7.75% Impervious Runoff Depth>1.97"
Flow Length=1,000' Tc=14.2 min CN=79 Runoff=16.4 cfs 1.5 af

Subcatchment EX-2: Subcat EX-2 Runoff Area=2.2 ac 9.09% Impervious Runoff Depth>1.97"
Flow Length=639' Tc=8.9 min CN=79 Runoff=4.6 cfs 0.4 af

Subcatchment EX-3: Subcat EX-3 Runoff Area=3.0 ac 16.98% Impervious Runoff Depth>1.89"
Flow Length=823' Tc=13.8 min CN=78 Runoff=5.2 cfs 0.5 af

Link DP-1: Existing Wetland Inflow=16.4 cfs 1.5 af
Primary=16.4 cfs 1.5 af

Link DP-2: Existing Adjacent Swale Inflow=4.6 cfs 0.4 af
Primary=4.6 cfs 0.4 af

Link DP-3: Main Street Drainage System Inflow=5.2 cfs 0.5 af
Primary=5.2 cfs 0.5 af

Total Runoff Area = 14.4 ac Runoff Volume = 2.3 af Average Runoff Depth = 1.95"
90.12% Pervious = 13.0 ac 9.88% Impervious = 1.4 ac

Summary for Subcatchment EX-1: Subcat EX-1

Runoff = 16.4 cfs @ 12.20 hrs, Volume= 1.5 af, Depth> 1.97"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 5-Yr Rainfall=4.01"

Area (ac)	CN	Description
2.5	79	<50% Grass cover, Poor, HSG B
2.3	86	<50% Grass cover, Poor, HSG C
0.4	89	<50% Grass cover, Poor, HSG D
0.3	98	Paved parking, HSG B
0.1	98	Paved parking, HSG C
0.1	98	Paved parking, HSG D
0.2	98	Roofs, HSG B
0.1	98	Roofs, HSG C
0.0	98	Roofs, HSG D
0.7	55	Woods, Good, HSG B
1.5	70	Woods, Good, HSG C
1.2	77	Woods, Good, HSG D
9.2	79	Weighted Average
8.5		92.25% Pervious Area
0.7		7.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	50	0.0740	0.25		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
10.8	950	0.0440	1.47		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
14.2	1,000	Total			

Summary for Subcatchment EX-2: Subcat EX-2

Runoff = 4.6 cfs @ 12.13 hrs, Volume= 0.4 af, Depth> 1.97"
Routed to Link DP-2 : Existing Adjacent Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 5-Yr Rainfall=4.01"

Area (ac)	CN	Description
0.8	68	<50% Grass cover, Poor, HSG A
1.0	86	<50% Grass cover, Poor, HSG C
0.2	98	Paved parking, HSG C
0.0	98	Roofs, HSG C
0.2	70	Woods, Good, HSG C
2.2	79	Weighted Average
2.0		90.91% Pervious Area
0.2		9.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0460	0.20		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
2.4	303	0.0890	2.09		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	127	0.0460	4.35		**Shallow Concentrated Flow, Paved Drive** Paved Kv= 20.3 fps
1.9	159	0.0380	1.36		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
8.9	639	Total			

Summary for Subcatchment EX-3: Subcat EX-3

Runoff = 5.2 cfs @ 12.19 hrs, Volume= 0.5 af, Depth> 1.89"
Routed to Link DP-3 : Main Street Drainage System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 5-Yr Rainfall=4.01"

Area (ac)	CN	Description
1.3	79	<50% Grass cover, Poor, HSG B
0.5	86	<50% Grass cover, Poor, HSG C
0.3	98	Paved parking, HSG B
0.1	98	Paved parking, HSG C
0.1	98	Roofs, HSG B
0.6	55	Woods, Good, HSG B
0.1	70	Woods, Good, HSG C
3.0	78	Weighted Average
2.5		83.02% Pervious Area
0.5		16.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0220	0.15		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
8.3	773	0.0490	1.55		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
13.8	823	Total			

Summary for Link DP-1: Existing Wetland

Inflow Area = 9.2 ac, 7.75% Impervious, Inflow Depth > 1.97" for 5-Yr event
Inflow = 16.4 cfs @ 12.20 hrs, Volume= 1.5 af
Primary = 16.4 cfs @ 12.20 hrs, Volume= 1.5 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: Existing Adjacent Swale

Inflow Area = 2.2 ac, 9.09% Impervious, Inflow Depth > 1.97" for 5-Yr event
Inflow = 4.6 cfs @ 12.13 hrs, Volume= 0.4 af
Primary = 4.6 cfs @ 12.13 hrs, Volume= 0.4 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-3: Main Street Drainage System

Inflow Area = 3.0 ac, 16.98% Impervious, Inflow Depth > 1.89" for 5-Yr event
Inflow = 5.2 cfs @ 12.19 hrs, Volume= 0.5 af
Primary = 5.2 cfs @ 12.19 hrs, Volume= 0.5 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Time span=0.00-24.00 hrs, dt=0.03 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1: Subcat EX-1 Runoff Area=9.2 ac 7.75% Impervious Runoff Depth>2.59"
Flow Length=1,000' Tc=14.2 min CN=79 Runoff=21.6 cfs 2.0 af

Subcatchment EX-2: Subcat EX-2 Runoff Area=2.2 ac 9.09% Impervious Runoff Depth>2.59"
Flow Length=639' Tc=8.9 min CN=79 Runoff=6.0 cfs 0.5 af

Subcatchment EX-3: Subcat EX-3 Runoff Area=3.0 ac 16.98% Impervious Runoff Depth>2.50"
Flow Length=823' Tc=13.8 min CN=78 Runoff=6.9 cfs 0.6 af

Link DP-1: Existing Wetland Inflow=21.6 cfs 2.0 af
Primary=21.6 cfs 2.0 af

Link DP-2: Existing Adjacent Swale Inflow=6.0 cfs 0.5 af
Primary=6.0 cfs 0.5 af

Link DP-3: Main Street Drainage System Inflow=6.9 cfs 0.6 af
Primary=6.9 cfs 0.6 af

Total Runoff Area = 14.4 ac Runoff Volume = 3.1 af Average Runoff Depth = 2.57"
90.12% Pervious = 13.0 ac 9.88% Impervious = 1.4 ac

Summary for Subcatchment EX-1: Subcat EX-1

Runoff = 21.6 cfs @ 12.20 hrs, Volume= 2.0 af, Depth> 2.59"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.76"

Area (ac)	CN	Description
2.5	79	<50% Grass cover, Poor, HSG B
2.3	86	<50% Grass cover, Poor, HSG C
0.4	89	<50% Grass cover, Poor, HSG D
0.3	98	Paved parking, HSG B
0.1	98	Paved parking, HSG C
0.1	98	Paved parking, HSG D
0.2	98	Roofs, HSG B
0.1	98	Roofs, HSG C
0.0	98	Roofs, HSG D
0.7	55	Woods, Good, HSG B
1.5	70	Woods, Good, HSG C
1.2	77	Woods, Good, HSG D
9.2	79	Weighted Average
8.5		92.25% Pervious Area
0.7		7.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	50	0.0740	0.25		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
10.8	950	0.0440	1.47		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
14.2	1,000	Total			

Summary for Subcatchment EX-2: Subcat EX-2

Runoff = 6.0 cfs @ 12.13 hrs, Volume= 0.5 af, Depth> 2.59"
Routed to Link DP-2 : Existing Adjacent Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.76"

Area (ac)	CN	Description
0.8	68	<50% Grass cover, Poor, HSG A
1.0	86	<50% Grass cover, Poor, HSG C
0.2	98	Paved parking, HSG C
0.0	98	Roofs, HSG C
0.2	70	Woods, Good, HSG C
2.2	79	Weighted Average
2.0		90.91% Pervious Area
0.2		9.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0460	0.20		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
2.4	303	0.0890	2.09		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	127	0.0460	4.35		**Shallow Concentrated Flow, Paved Drive** Paved Kv= 20.3 fps
1.9	159	0.0380	1.36		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
8.9	639	Total			

Summary for Subcatchment EX-3: Subcat EX-3

Runoff = 6.9 cfs @ 12.19 hrs, Volume= 0.6 af, Depth> 2.50"
Routed to Link DP-3 : Main Street Drainage System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.76"

Area (ac)	CN	Description
1.3	79	<50% Grass cover, Poor, HSG B
0.5	86	<50% Grass cover, Poor, HSG C
0.3	98	Paved parking, HSG B
0.1	98	Paved parking, HSG C
0.1	98	Roofs, HSG B
0.6	55	Woods, Good, HSG B
0.1	70	Woods, Good, HSG C
3.0	78	Weighted Average
2.5		83.02% Pervious Area
0.5		16.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0220	0.15		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
8.3	773	0.0490	1.55		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
13.8	823	Total			

Summary for Link DP-1: Existing Wetland

Inflow Area = 9.2 ac, 7.75% Impervious, Inflow Depth > 2.59" for 10-Yr event
Inflow = 21.6 cfs @ 12.20 hrs, Volume= 2.0 af
Primary = 21.6 cfs @ 12.20 hrs, Volume= 2.0 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: Existing Adjacent Swale

Inflow Area = 2.2 ac, 9.09% Impervious, Inflow Depth > 2.59" for 10-Yr event
Inflow = 6.0 cfs @ 12.13 hrs, Volume= 0.5 af
Primary = 6.0 cfs @ 12.13 hrs, Volume= 0.5 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-3: Main Street Drainage System

Inflow Area = 3.0 ac, 16.98% Impervious, Inflow Depth > 2.50" for 10-Yr event
Inflow = 6.9 cfs @ 12.19 hrs, Volume= 0.6 af
Primary = 6.9 cfs @ 12.19 hrs, Volume= 0.6 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Time span=0.00-24.00 hrs, dt=0.03 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1: Subcat EX-1 Runoff Area=9.2 ac 7.75% Impervious Runoff Depth>3.49"
Flow Length=1,000' Tc=14.2 min CN=79 Runoff=29.2 cfs 2.7 af

Subcatchment EX-2: Subcat EX-2 Runoff Area=2.2 ac 9.09% Impervious Runoff Depth>3.50"
Flow Length=639' Tc=8.9 min CN=79 Runoff=8.1 cfs 0.6 af

Subcatchment EX-3: Subcat EX-3 Runoff Area=3.0 ac 16.98% Impervious Runoff Depth>3.39"
Flow Length=823' Tc=13.8 min CN=78 Runoff=9.4 cfs 0.9 af

Link DP-1: Existing Wetland Inflow=29.2 cfs 2.7 af
Primary=29.2 cfs 2.7 af

Link DP-2: Existing Adjacent Swale Inflow=8.1 cfs 0.6 af
Primary=8.1 cfs 0.6 af

Link DP-3: Main Street Drainage System Inflow=9.4 cfs 0.9 af
Primary=9.4 cfs 0.9 af

Total Runoff Area = 14.4 ac Runoff Volume = 4.2 af Average Runoff Depth = 3.47"
90.12% Pervious = 13.0 ac 9.88% Impervious = 1.4 ac

Summary for Subcatchment EX-1: Subcat EX-1

Runoff = 29.2 cfs @ 12.19 hrs, Volume= 2.7 af, Depth> 3.49"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=5.80"

Area (ac)	CN	Description
2.5	79	<50% Grass cover, Poor, HSG B
2.3	86	<50% Grass cover, Poor, HSG C
0.4	89	<50% Grass cover, Poor, HSG D
0.3	98	Paved parking, HSG B
0.1	98	Paved parking, HSG C
0.1	98	Paved parking, HSG D
0.2	98	Roofs, HSG B
0.1	98	Roofs, HSG C
0.0	98	Roofs, HSG D
0.7	55	Woods, Good, HSG B
1.5	70	Woods, Good, HSG C
1.2	77	Woods, Good, HSG D
9.2	79	Weighted Average
8.5		92.25% Pervious Area
0.7		7.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	50	0.0740	0.25		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
10.8	950	0.0440	1.47		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
14.2	1,000	Total			

Summary for Subcatchment EX-2: Subcat EX-2

Runoff = 8.1 cfs @ 12.13 hrs, Volume= 0.6 af, Depth> 3.50"
Routed to Link DP-2 : Existing Adjacent Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=5.80"

Area (ac)	CN	Description
0.8	68	<50% Grass cover, Poor, HSG A
1.0	86	<50% Grass cover, Poor, HSG C
0.2	98	Paved parking, HSG C
0.0	98	Roofs, HSG C
0.2	70	Woods, Good, HSG C
2.2	79	Weighted Average
2.0		90.91% Pervious Area
0.2		9.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0460	0.20		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
2.4	303	0.0890	2.09		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	127	0.0460	4.35		**Shallow Concentrated Flow, Paved Drive** Paved Kv= 20.3 fps
1.9	159	0.0380	1.36		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
8.9	639	Total			

Summary for Subcatchment EX-3: Subcat EX-3

Runoff = 9.4 cfs @ 12.19 hrs, Volume= 0.9 af, Depth> 3.39"
Routed to Link DP-3 : Main Street Drainage System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=5.80"

Area (ac)	CN	Description
1.3	79	<50% Grass cover, Poor, HSG B
0.5	86	<50% Grass cover, Poor, HSG C
0.3	98	Paved parking, HSG B
0.1	98	Paved parking, HSG C
0.1	98	Roofs, HSG B
0.6	55	Woods, Good, HSG B
0.1	70	Woods, Good, HSG C
3.0	78	Weighted Average
2.5		83.02% Pervious Area
0.5		16.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0220	0.15		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
8.3	773	0.0490	1.55		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
13.8	823	Total			

Summary for Link DP-1: Existing Wetland

Inflow Area = 9.2 ac, 7.75% Impervious, Inflow Depth > 3.49" for 25-Yr event
Inflow = 29.2 cfs @ 12.19 hrs, Volume= 2.7 af
Primary = 29.2 cfs @ 12.19 hrs, Volume= 2.7 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: Existing Adjacent Swale

Inflow Area = 2.2 ac, 9.09% Impervious, Inflow Depth > 3.50" for 25-Yr event
Inflow = 8.1 cfs @ 12.13 hrs, Volume= 0.6 af
Primary = 8.1 cfs @ 12.13 hrs, Volume= 0.6 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-3: Main Street Drainage System

Inflow Area = 3.0 ac, 16.98% Impervious, Inflow Depth > 3.39" for 25-Yr event
Inflow = 9.4 cfs @ 12.19 hrs, Volume= 0.9 af
Primary = 9.4 cfs @ 12.19 hrs, Volume= 0.9 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Time span=0.00-24.00 hrs, dt=0.03 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1: Subcat EX-1 Runoff Area=9.2 ac 7.75% Impervious Runoff Depth>4.93"
Flow Length=1,000' Tc=14.2 min CN=79 Runoff=41.0 cfs 3.8 af

Subcatchment EX-2: Subcat EX-2 Runoff Area=2.2 ac 9.09% Impervious Runoff Depth>4.94"
Flow Length=639' Tc=8.9 min CN=79 Runoff=11.4 cfs 0.9 af

Subcatchment EX-3: Subcat EX-3 Runoff Area=3.0 ac 16.98% Impervious Runoff Depth>4.82"
Flow Length=823' Tc=13.8 min CN=78 Runoff=13.2 cfs 1.2 af

Link DP-1: Existing Wetland Inflow=41.0 cfs 3.8 af
Primary=41.0 cfs 3.8 af

Link DP-2: Existing Adjacent Swale Inflow=11.4 cfs 0.9 af
Primary=11.4 cfs 0.9 af

Link DP-3: Main Street Drainage System Inflow=13.2 cfs 1.2 af
Primary=13.2 cfs 1.2 af

Total Runoff Area = 14.4 ac Runoff Volume = 5.9 af Average Runoff Depth = 4.91"
90.12% Pervious = 13.0 ac 9.88% Impervious = 1.4 ac

Summary for Subcatchment EX-1: Subcat EX-1

Runoff = 41.0 cfs @ 12.19 hrs, Volume= 3.8 af, Depth> 4.93"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=7.39"

Area (ac)	CN	Description
2.5	79	<50% Grass cover, Poor, HSG B
2.3	86	<50% Grass cover, Poor, HSG C
0.4	89	<50% Grass cover, Poor, HSG D
0.3	98	Paved parking, HSG B
0.1	98	Paved parking, HSG C
0.1	98	Paved parking, HSG D
0.2	98	Roofs, HSG B
0.1	98	Roofs, HSG C
0.0	98	Roofs, HSG D
0.7	55	Woods, Good, HSG B
1.5	70	Woods, Good, HSG C
1.2	77	Woods, Good, HSG D
9.2	79	Weighted Average
8.5		92.25% Pervious Area
0.7		7.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	50	0.0740	0.25		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
10.8	950	0.0440	1.47		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
14.2	1,000	Total			

Summary for Subcatchment EX-2: Subcat EX-2

Runoff = 11.4 cfs @ 12.12 hrs, Volume= 0.9 af, Depth> 4.94"
Routed to Link DP-2 : Existing Adjacent Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=7.39"

Area (ac)	CN	Description
0.8	68	<50% Grass cover, Poor, HSG A
1.0	86	<50% Grass cover, Poor, HSG C
0.2	98	Paved parking, HSG C
0.0	98	Roofs, HSG C
0.2	70	Woods, Good, HSG C
2.2	79	Weighted Average
2.0		90.91% Pervious Area
0.2		9.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0460	0.20		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
2.4	303	0.0890	2.09		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	127	0.0460	4.35		**Shallow Concentrated Flow, Paved Drive** Paved Kv= 20.3 fps
1.9	159	0.0380	1.36		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
8.9	639	Total			

Summary for Subcatchment EX-3: Subcat EX-3

Runoff = 13.2 cfs @ 12.19 hrs, Volume= 1.2 af, Depth> 4.82"
Routed to Link DP-3 : Main Street Drainage System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=7.39"

Area (ac)	CN	Description
1.3	79	<50% Grass cover, Poor, HSG B
0.5	86	<50% Grass cover, Poor, HSG C
0.3	98	Paved parking, HSG B
0.1	98	Paved parking, HSG C
0.1	98	Roofs, HSG B
0.6	55	Woods, Good, HSG B
0.1	70	Woods, Good, HSG C
3.0	78	Weighted Average
2.5		83.02% Pervious Area
0.5		16.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0220	0.15		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
8.3	773	0.0490	1.55		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
13.8	823	Total			

Summary for Link DP-1: Existing Wetland

Inflow Area = 9.2 ac, 7.75% Impervious, Inflow Depth > 4.93" for 100-Yr event
Inflow = 41.0 cfs @ 12.19 hrs, Volume= 3.8 af
Primary = 41.0 cfs @ 12.19 hrs, Volume= 3.8 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: Existing Adjacent Swale

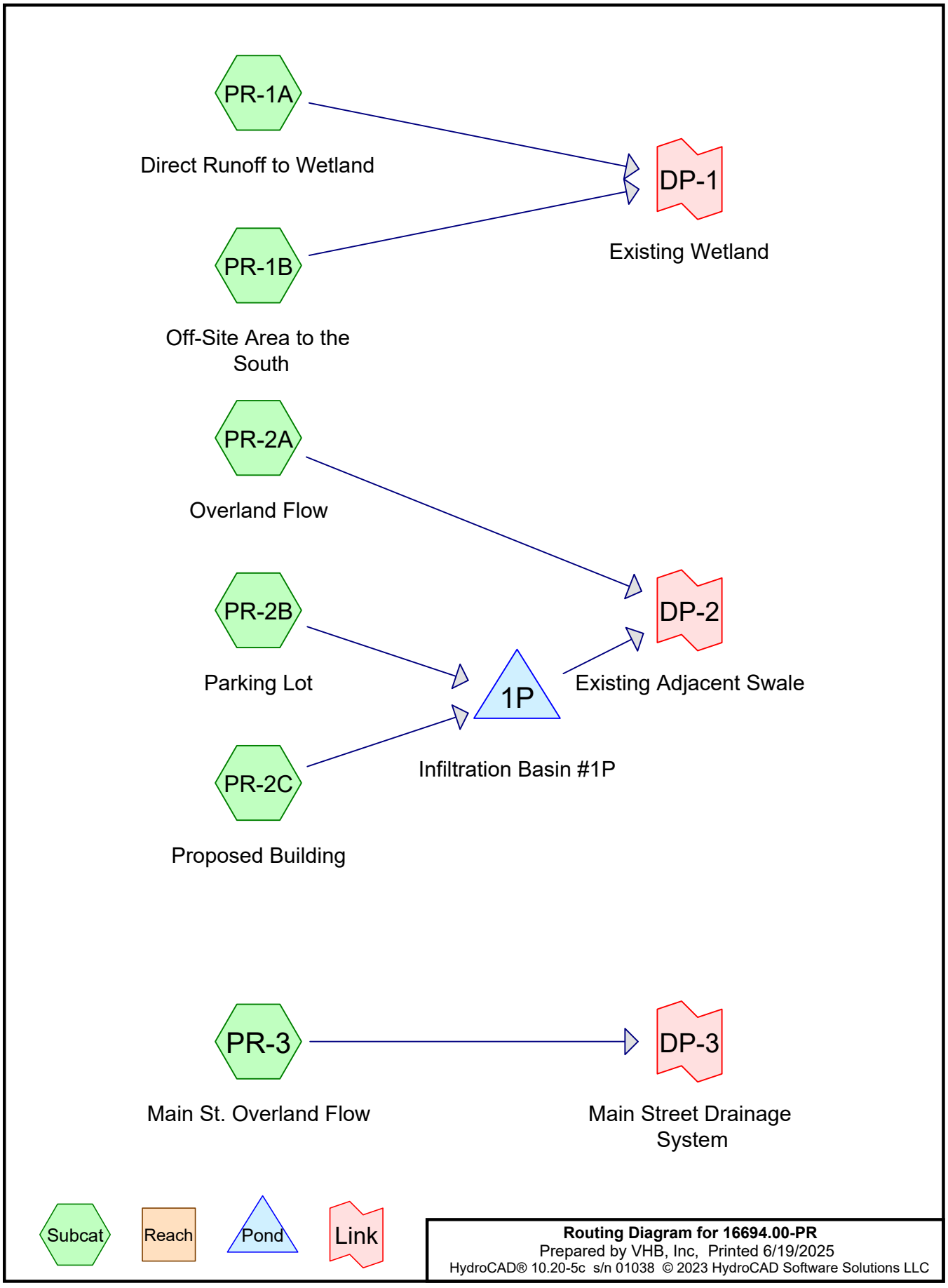
Inflow Area = 2.2 ac, 9.09% Impervious, Inflow Depth > 4.94" for 100-Yr event
Inflow = 11.4 cfs @ 12.12 hrs, Volume= 0.9 af
Primary = 11.4 cfs @ 12.12 hrs, Volume= 0.9 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-3: Main Street Drainage System

Inflow Area = 3.0 ac, 16.98% Impervious, Inflow Depth > 4.82" for 100-Yr event
Inflow = 13.2 cfs @ 12.19 hrs, Volume= 1.2 af
Primary = 13.2 cfs @ 12.19 hrs, Volume= 1.2 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs



Routing Diagram for 16694.00-PR
Prepared by VHB, Inc, Printed 6/19/2025

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-Yr	Type III 24-hr		Default	24.00	1	2.55	2
2	2-Yr	Type III 24-hr		Default	24.00	1	3.10	2
3	5-Yr	Type III 24-hr		Default	24.00	1	4.01	2
4	10-Yr	Type III 24-hr		Default	24.00	1	4.76	2
5	25-Yr	Type III 24-hr		Default	24.00	1	5.80	2
6	100-Yr	Type III 24-hr		Default	24.00	1	7.39	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.6	68	<50% Grass cover, Poor, HSG A (PR-2A, PR-2B, PR-3)
3.9	79	<50% Grass cover, Poor, HSG B (PR-1B)
3.0	86	<50% Grass cover, Poor, HSG C (PR-1A, PR-1B, PR-2A, PR-2B, PR-2C, PR-3)
0.6	89	<50% Grass cover, Poor, HSG D (PR-1B, PR-2B)
0.0	98	Paved parking, HSG A (PR-2B, PR-3)
0.5	98	Paved parking, HSG B (PR-1B)
2.3	98	Paved parking, HSG C (PR-1A, PR-1B, PR-2B, PR-3)
0.1	98	Paved parking, HSG D (PR-1B, PR-2B)
0.2	98	Roofs, HSG B (PR-1B)
0.8	98	Roofs, HSG C (PR-2B, PR-2C)
0.0	98	Roofs, HSG D (PR-1B)
1.2	55	Woods, Good, HSG B (PR-1B)
0.1	70	Woods, Good, HSG C (PR-1B)
1.0	77	Woods, Good, HSG D (PR-1B, PR-2B)
14.4	**83**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.7	HSG A	PR-2A, PR-2B, PR-3
5.8	HSG B	PR-1B
6.2	HSG C	PR-1A, PR-1B, PR-2A, PR-2B, PR-2C, PR-3
1.7	HSG D	PR-1B, PR-2B
0.0	Other	
14.4		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.6	3.9	3.0	0.6	0.0	8.1	<50% Grass cover, Poor	PR-1A, PR-1B, PR-2A, PR-2B, PR-2C, PR-3
0.0	0.5	2.3	0.1	0.0	2.8	Paved parking	PR-1A, PR-1B, PR-2B, PR-3
0.0	0.2	0.8	0.0	0.0	1.1	Roofs	PR-1B, PR-2B, PR-2C
0.0	1.2	0.1	1.0	0.0	2.3	Woods, Good	PR-1B, PR-2B
0.7	**5.8**	**6.2**	**1.7**	**0.0**	**14.4**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.03 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1A: Direct Runoff to Runoff Area=0.7 ac 10.72% Impervious Runoff Depth>1.35"
Tc=5.0 min CN=87 Runoff=1.1 cfs 0.1 af

Subcatchment PR-1B: Off-Site Area to the Runoff Area=7.7 ac 9.91% Impervious Runoff Depth>0.82"
Flow Length=740' Tc=11.3 min CN=78 Runoff=5.8 cfs 0.5 af

Subcatchment PR-2A: Overland Flow Runoff Area=0.2 ac 0.00% Impervious Runoff Depth>0.44"
Flow Length=639' Tc=8.9 min CN=69 Runoff=0.1 cfs 0.0 af

Subcatchment PR-2B: Parking Lot Runoff Area=4.6 ac 48.77% Impervious Runoff Depth>1.50"
Tc=5.0 min CN=89 Runoff=8.4 cfs 0.6 af

Subcatchment PR-2C: Proposed Building Runoff Area=0.8 ac 100.00% Impervious Runoff Depth>2.32"
Tc=5.0 min CN=98 Runoff=2.0 cfs 0.2 af

Subcatchment PR-3: Main St. Overland Flow Runoff Area=0.4 ac 8.03% Impervious Runoff Depth>1.35"
Tc=5.0 min CN=87 Runoff=0.6 cfs 0.0 af

Pond 1P: Infiltration Basin #1P Peak Elev=218.0' Storage=9,325 cf Inflow=10.4 cfs 0.7 af
Discarded=1.8 cfs 0.7 af Primary=0.0 cfs 0.0 af Outflow=1.8 cfs 0.7 af

Link DP-1: Existing Wetland Inflow=6.5 cfs 0.6 af
Primary=6.5 cfs 0.6 af

Link DP-2: Existing Adjacent Swale Inflow=0.1 cfs 0.0 af
Primary=0.1 cfs 0.0 af

Link DP-3: Main Street Drainage System Inflow=0.6 cfs 0.0 af
Primary=0.6 cfs 0.0 af

Total Runoff Area = 14.4 ac Runoff Volume = 1.4 af Average Runoff Depth = 1.15"
72.75% Pervious = 10.5 ac 27.25% Impervious = 3.9 ac

Summary for Subcatchment PR-1A: Direct Runoff to Wetland

Runoff = 1.1 cfs @ 12.08 hrs, Volume= 0.1 af, Depth> 1.35"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 1-Yr Rainfall=2.55"

Area (ac)	CN	Description
0.6	86	<50% Grass cover, Poor, HSG C
0.1	98	Paved parking, HSG C
0.7	87	Weighted Average
0.6		89.28% Pervious Area
0.1		10.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-1B: Off-Site Area to the South

Runoff = 5.8 cfs @ 12.17 hrs, Volume= 0.5 af, Depth> 0.82"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 1-Yr Rainfall=2.55"

Area (ac)	CN	Description
3.9	79	<50% Grass cover, Poor, HSG B
1.0	86	<50% Grass cover, Poor, HSG C
0.3	89	<50% Grass cover, Poor, HSG D
0.5	98	Paved parking, HSG B
0.0	98	Paved parking, HSG C
0.0	98	Paved parking, HSG D
0.2	98	Roofs, HSG B
0.0	98	Roofs, HSG D
1.2	55	Woods, Good, HSG B
0.1	70	Woods, Good, HSG C
0.4	77	Woods, Good, HSG D
7.7	78	Weighted Average
6.9		90.09% Pervious Area
0.8		9.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.19		**Sheet Flow, Grass-Sheet** Grass: Short n= 0.150 P2= 3.10"
2.1	154	0.0300	1.21		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
1.0	148	0.0160	2.57		**Shallow Concentrated Flow, Paved-Concentrated** Paved Kv= 20.3 fps
1.3	116	0.0470	1.52		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	50	0.0600	1.71		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	55	0.0720	1.88		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	17	0.1170	2.39		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	40	0.0375	1.36		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
1.0	110	0.0670	1.81		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
11.3	740	Total			

Summary for Subcatchment PR-2A: Overland Flow

Runoff = 0.1 cfs @ 12.16 hrs, Volume= 0.0 af, Depth> 0.44"
Routed to Link DP-2 : Existing Adjacent Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 1-Yr Rainfall=2.55"

Area (ac)	CN	Description
0.2	68	<50% Grass cover, Poor, HSG A
0.0	86	<50% Grass cover, Poor, HSG C
0.2	69	Weighted Average
0.2		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0460	0.20		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
2.4	303	0.0890	2.09		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	127	0.0460	4.35		**Shallow Concentrated Flow, Paved** Paved Kv= 20.3 fps
1.9	159	0.0380	1.36		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
8.9	639	Total			

Summary for Subcatchment PR-2B: Parking Lot

Runoff = 8.4 cfs @ 12.07 hrs, Volume= 0.6 af, Depth> 1.50"
Routed to Pond 1P : Infiltration Basin #1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 1-Yr Rainfall=2.55"

Area (ac)	CN	Description
0.4	68	<50% Grass cover, Poor, HSG A
1.0	86	<50% Grass cover, Poor, HSG C
0.2	89	<50% Grass cover, Poor, HSG D
0.0	98	Paved parking, HSG A
2.2	98	Paved parking, HSG C
0.0	98	Paved parking, HSG D
0.1	98	Roofs, HSG C
0.7	77	Woods, Good, HSG D
4.6	89	Weighted Average
2.4		51.23% Pervious Area
2.3		48.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-2C: Proposed Building

Runoff = 2.0 cfs @ 12.07 hrs, Volume= 0.2 af, Depth> 2.32"
Routed to Pond 1P : Infiltration Basin #1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 1-Yr Rainfall=2.55"

Area (ac)	CN	Description
0.0	86	<50% Grass cover, Poor, HSG C
0.8	98	Roofs, HSG C
0.8	98	Weighted Average
0.0		0.00% Pervious Area
0.8		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-3: Main St. Overland Flow

Runoff = 0.6 cfs @ 12.08 hrs, Volume= 0.0 af, Depth> 1.35"
Routed to Link DP-3 : Main Street Drainage System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 1-Yr Rainfall=2.55"

Area (ac)	CN	Description
0.0	68	<50% Grass cover, Poor, HSG A
0.3	86	<50% Grass cover, Poor, HSG C
0.0	98	Paved parking, HSG A
0.0	98	Paved parking, HSG C
0.4	87	Weighted Average
0.3		91.97% Pervious Area
0.0		8.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Pond 1P: Infiltration Basin #1P

Inflow Area = 5.4 ac, 56.19% Impervious, Inflow Depth > 1.62" for 1-Yr event
Inflow = 10.4 cfs @ 12.07 hrs, Volume= 0.7 af
Outflow = 1.8 cfs @ 12.54 hrs, Volume= 0.7 af, Atten= 83%, Lag= 28.1 min
Discarded = 1.8 cfs @ 12.54 hrs, Volume= 0.7 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.0 af
Routed to Link DP-2 : Existing Adjacent Swale

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Peak Elev= 218.0' @ 12.54 hrs Surf.Area= 9,191 sf Storage= 9,325 cf

Plug-Flow detention time= 36.4 min calculated for 0.7 af (100% of inflow)
Center-of-Mass det. time= 35.8 min (842.6 - 806.8)

Volume	Invert	Avail.Storage	Storage Description
#1	217.0'	1,428 cf	**Sediment Forebay (Prismatic)** Listed below (Recalc) -Impervious
#2	217.0'	56,735 cf	**Infiltration Bioretention Basin (Irregular)** Listed below (Recalc)
		58,162 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
217.0	383	0	0
218.0	696	540	540
219.0	1,080	888	1,428

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
217.0	7,872	372.6	0	0	7,872
218.0	9,153	403.9	8,504	8,504	9,845
219.0	10,527	435.2	9,832	18,336	11,976
220.0	11,995	466.5	11,253	29,589	14,267
221.0	13,557	497.8	12,768	42,358	16,717
222.0	15,213	529.1	14,377	56,735	19,326

Device	Routing	Invert	Outlet Devices
#1	Primary	220.6'	**20.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#2	Discarded	217.0'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.8 cfs @ 12.54 hrs HW=218.0' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.8 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=217.0' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Link DP-1: Existing Wetland

Inflow Area = 8.4 ac, 9.98% Impervious, Inflow Depth > 0.86" for 1-Yr event
Inflow = 6.5 cfs @ 12.16 hrs, Volume= 0.6 af
Primary = 6.5 cfs @ 12.16 hrs, Volume= 0.6 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: Existing Adjacent Swale

Inflow Area = 5.6 ac, 54.05% Impervious, Inflow Depth > 0.02" for 1-Yr event
Inflow = 0.1 cfs @ 12.16 hrs, Volume= 0.0 af
Primary = 0.1 cfs @ 12.16 hrs, Volume= 0.0 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-3: Main Street Drainage System

Inflow Area = 0.4 ac, 8.03% Impervious, Inflow Depth > 1.35" for 1-Yr event
Inflow = 0.6 cfs @ 12.08 hrs, Volume= 0.0 af
Primary = 0.6 cfs @ 12.08 hrs, Volume= 0.0 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Time span=0.00-24.00 hrs, dt=0.03 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1A: Direct Runoff to Runoff Area=0.7 ac 10.72% Impervious Runoff Depth>1.83"
Tc=5.0 min CN=87 Runoff=1.5 cfs 0.1 af

Subcatchment PR-1B: Off-Site Area to the Runoff Area=7.7 ac 9.91% Impervious Runoff Depth>1.20"
Flow Length=740' Tc=11.3 min CN=78 Runoff=8.8 cfs 0.8 af

Subcatchment PR-2A: Overland Flow Runoff Area=0.2 ac 0.00% Impervious Runoff Depth>0.72"
Flow Length=639' Tc=8.9 min CN=69 Runoff=0.1 cfs 0.0 af

Subcatchment PR-2B: Parking Lot Runoff Area=4.6 ac 48.77% Impervious Runoff Depth>1.99"
Tc=5.0 min CN=89 Runoff=11.1 cfs 0.8 af

Subcatchment PR-2C: Proposed Building Runoff Area=0.8 ac 100.00% Impervious Runoff Depth>2.87"
Tc=5.0 min CN=98 Runoff=2.4 cfs 0.2 af

Subcatchment PR-3: Main St. Overland Flow Runoff Area=0.4 ac 8.03% Impervious Runoff Depth>1.83"
Tc=5.0 min CN=87 Runoff=0.8 cfs 0.1 af

Pond 1P: Infiltration Basin #1P Peak Elev=218.4' Storage=13,572 cf Inflow=13.5 cfs 1.0 af
Discarded=1.9 cfs 1.0 af Primary=0.0 cfs 0.0 af Outflow=1.9 cfs 1.0 af

Link DP-1: Existing Wetland Inflow=9.8 cfs 0.9 af
Primary=9.8 cfs 0.9 af

Link DP-2: Existing Adjacent Swale Inflow=0.1 cfs 0.0 af
Primary=0.1 cfs 0.0 af

Link DP-3: Main Street Drainage System Inflow=0.8 cfs 0.1 af
Primary=0.8 cfs 0.1 af

Total Runoff Area = 14.4 ac Runoff Volume = 1.9 af Average Runoff Depth = 1.58"
72.75% Pervious = 10.5 ac 27.25% Impervious = 3.9 ac

Summary for Subcatchment PR-1A: Direct Runoff to Wetland

Runoff = 1.5 cfs @ 12.07 hrs, Volume= 0.1 af, Depth> 1.83"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.10"

Area (ac)	CN	Description
0.6	86	<50% Grass cover, Poor, HSG C
0.1	98	Paved parking, HSG C
0.7	87	Weighted Average
0.6		89.28% Pervious Area
0.1		10.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-1B: Off-Site Area to the South

Runoff = 8.8 cfs @ 12.16 hrs, Volume= 0.8 af, Depth> 1.20"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.10"

Area (ac)	CN	Description
3.9	79	<50% Grass cover, Poor, HSG B
1.0	86	<50% Grass cover, Poor, HSG C
0.3	89	<50% Grass cover, Poor, HSG D
0.5	98	Paved parking, HSG B
0.0	98	Paved parking, HSG C
0.0	98	Paved parking, HSG D
0.2	98	Roofs, HSG B
0.0	98	Roofs, HSG D
1.2	55	Woods, Good, HSG B
0.1	70	Woods, Good, HSG C
0.4	77	Woods, Good, HSG D
7.7	78	Weighted Average
6.9		90.09% Pervious Area
0.8		9.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.19		**Sheet Flow, Grass-Sheet** Grass: Short n= 0.150 P2= 3.10"
2.1	154	0.0300	1.21		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
1.0	148	0.0160	2.57		**Shallow Concentrated Flow, Paved-Concentrated** Paved Kv= 20.3 fps
1.3	116	0.0470	1.52		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	50	0.0600	1.71		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	55	0.0720	1.88		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	17	0.1170	2.39		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	40	0.0375	1.36		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
1.0	110	0.0670	1.81		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
11.3	740	Total			

Summary for Subcatchment PR-2A: Overland Flow

Runoff = 0.1 cfs @ 12.14 hrs, Volume= 0.0 af, Depth> 0.72"
Routed to Link DP-2 : Existing Adjacent Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.10"

Area (ac)	CN	Description
0.2	68	<50% Grass cover, Poor, HSG A
0.0	86	<50% Grass cover, Poor, HSG C
0.2	69	Weighted Average
0.2		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0460	0.20		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
2.4	303	0.0890	2.09		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	127	0.0460	4.35		**Shallow Concentrated Flow, Paved** Paved Kv= 20.3 fps
1.9	159	0.0380	1.36		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
8.9	639	Total			

Summary for Subcatchment PR-2B: Parking Lot

Runoff = 11.1 cfs @ 12.07 hrs, Volume= 0.8 af, Depth> 1.99"
Routed to Pond 1P : Infiltration Basin #1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.10"

Area (ac)	CN	Description
0.4	68	<50% Grass cover, Poor, HSG A
1.0	86	<50% Grass cover, Poor, HSG C
0.2	89	<50% Grass cover, Poor, HSG D
0.0	98	Paved parking, HSG A
2.2	98	Paved parking, HSG C
0.0	98	Paved parking, HSG D
0.1	98	Roofs, HSG C
0.7	77	Woods, Good, HSG D
4.6	89	Weighted Average
2.4		51.23% Pervious Area
2.3		48.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-2C: Proposed Building

Runoff = 2.4 cfs @ 12.07 hrs, Volume= 0.2 af, Depth> 2.87"
Routed to Pond 1P : Infiltration Basin #1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.10"

Area (ac)	CN	Description
0.0	86	<50% Grass cover, Poor, HSG C
0.8	98	Roofs, HSG C
0.8	98	Weighted Average
0.0		0.00% Pervious Area
0.8		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-3: Main St. Overland Flow

Runoff = 0.8 cfs @ 12.07 hrs, Volume= 0.1 af, Depth> 1.83"
Routed to Link DP-3 : Main Street Drainage System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 2-Yr Rainfall=3.10"

Area (ac)	CN	Description
0.0	68	<50% Grass cover, Poor, HSG A
0.3	86	<50% Grass cover, Poor, HSG C
0.0	98	Paved parking, HSG A
0.0	98	Paved parking, HSG C
0.4	87	Weighted Average
0.3		91.97% Pervious Area
0.0		8.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Pond 1P: Infiltration Basin #1P

Inflow Area = 5.4 ac, 56.19% Impervious, Inflow Depth > 2.12" for 2-Yr event
Inflow = 13.5 cfs @ 12.07 hrs, Volume= 1.0 af
Outflow = 1.9 cfs @ 12.59 hrs, Volume= 1.0 af, Atten= 86%, Lag= 31.0 min
Discarded = 1.9 cfs @ 12.59 hrs, Volume= 1.0 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.0 af
Routed to Link DP-2 : Existing Adjacent Swale

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Peak Elev= 218.4' @ 12.59 hrs Surf.Area= 9,749 sf Storage= 13,572 cf

Plug-Flow detention time= 54.0 min calculated for 1.0 af (100% of inflow)
Center-of-Mass det. time= 53.4 min (853.5 - 800.1)

Volume	Invert	Avail.Storage	Storage Description
#1	217.0'	1,428 cf	**Sediment Forebay (Prismatic)** Listed below (Recalc) -Impervious
#2	217.0'	56,735 cf	**Infiltration Bioretention Basin (Irregular)** Listed below (Recalc)
		58,162 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
217.0	383	0	0
218.0	696	540	540
219.0	1,080	888	1,428

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
217.0	7,872	372.6	0	0	7,872
218.0	9,153	403.9	8,504	8,504	9,845
219.0	10,527	435.2	9,832	18,336	11,976
220.0	11,995	466.5	11,253	29,589	14,267
221.0	13,557	497.8	12,768	42,358	16,717
222.0	15,213	529.1	14,377	56,735	19,326

Device	Routing	Invert	Outlet Devices
#1	Primary	220.6'	**20.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#2	Discarded	217.0'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.9 cfs @ 12.59 hrs HW=218.4' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.9 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=217.0' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Link DP-1: Existing Wetland

Inflow Area = 8.4 ac, 9.98% Impervious, Inflow Depth > 1.25" for 2-Yr event
Inflow = 9.8 cfs @ 12.15 hrs, Volume= 0.9 af
Primary = 9.8 cfs @ 12.15 hrs, Volume= 0.9 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: Existing Adjacent Swale

Inflow Area = 5.6 ac, 54.05% Impervious, Inflow Depth > 0.03" for 2-Yr event
Inflow = 0.1 cfs @ 12.14 hrs, Volume= 0.0 af
Primary = 0.1 cfs @ 12.14 hrs, Volume= 0.0 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-3: Main Street Drainage System

Inflow Area = 0.4 ac, 8.03% Impervious, Inflow Depth > 1.83" for 2-Yr event
Inflow = 0.8 cfs @ 12.07 hrs, Volume= 0.1 af
Primary = 0.8 cfs @ 12.07 hrs, Volume= 0.1 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Time span=0.00-24.00 hrs, dt=0.03 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1A: Direct Runoff to Runoff Area=0.7 ac 10.72% Impervious Runoff Depth>2.64"
Tc=5.0 min CN=87 Runoff=2.2 cfs 0.2 af

Subcatchment PR-1B: Off-Site Area to the Runoff Area=7.7 ac 9.91% Impervious Runoff Depth>1.89"
Flow Length=740' Tc=11.3 min CN=78 Runoff=14.2 cfs 1.2 af

Subcatchment PR-2A: Overland Flow Runoff Area=0.2 ac 0.00% Impervious Runoff Depth>1.27"
Flow Length=639' Tc=8.9 min CN=69 Runoff=0.3 cfs 0.0 af

Subcatchment PR-2B: Parking Lot Runoff Area=4.6 ac 48.77% Impervious Runoff Depth>2.83"
Tc=5.0 min CN=89 Runoff=15.6 cfs 1.1 af

Subcatchment PR-2C: Proposed Building Runoff Area=0.8 ac 100.00% Impervious Runoff Depth>3.77"
Tc=5.0 min CN=98 Runoff=3.2 cfs 0.2 af

Subcatchment PR-3: Main St. Overland Flow Runoff Area=0.4 ac 8.03% Impervious Runoff Depth>2.64"
Tc=5.0 min CN=87 Runoff=1.2 cfs 0.1 af

Pond 1P: Infiltration Basin #1P Peak Elev=219.1' Storage=21,095 cf Inflow=18.8 cfs 1.3 af
Discarded=2.0 cfs 1.3 af Primary=0.0 cfs 0.0 af Outflow=2.0 cfs 1.3 af

Link DP-1: Existing Wetland Inflow=15.6 cfs 1.4 af
Primary=15.6 cfs 1.4 af

Link DP-2: Existing Adjacent Swale Inflow=0.3 cfs 0.0 af
Primary=0.3 cfs 0.0 af

Link DP-3: Main Street Drainage System Inflow=1.2 cfs 0.1 af
Primary=1.2 cfs 0.1 af

Total Runoff Area = 14.4 ac Runoff Volume = 2.8 af Average Runoff Depth = 2.34"
72.75% Pervious = 10.5 ac 27.25% Impervious = 3.9 ac

Summary for Subcatchment PR-1A: Direct Runoff to Wetland

Runoff = 2.2 cfs @ 12.07 hrs, Volume= 0.2 af, Depth> 2.64"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 5-Yr Rainfall=4.01"

Area (ac)	CN	Description
0.6	86	<50% Grass cover, Poor, HSG C
0.1	98	Paved parking, HSG C
0.7	87	Weighted Average
0.6		89.28% Pervious Area
0.1		10.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-1B: Off-Site Area to the South

Runoff = 14.2 cfs @ 12.16 hrs, Volume= 1.2 af, Depth> 1.89"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 5-Yr Rainfall=4.01"

Area (ac)	CN	Description
3.9	79	<50% Grass cover, Poor, HSG B
1.0	86	<50% Grass cover, Poor, HSG C
0.3	89	<50% Grass cover, Poor, HSG D
0.5	98	Paved parking, HSG B
0.0	98	Paved parking, HSG C
0.0	98	Paved parking, HSG D
0.2	98	Roofs, HSG B
0.0	98	Roofs, HSG D
1.2	55	Woods, Good, HSG B
0.1	70	Woods, Good, HSG C
0.4	77	Woods, Good, HSG D
7.7	78	Weighted Average
6.9		90.09% Pervious Area
0.8		9.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.19		**Sheet Flow, Grass-Sheet** Grass: Short n= 0.150 P2= 3.10"
2.1	154	0.0300	1.21		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
1.0	148	0.0160	2.57		**Shallow Concentrated Flow, Paved-Concentrated** Paved Kv= 20.3 fps
1.3	116	0.0470	1.52		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	50	0.0600	1.71		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	55	0.0720	1.88		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	17	0.1170	2.39		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	40	0.0375	1.36		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
1.0	110	0.0670	1.81		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
11.3	740	Total			

Summary for Subcatchment PR-2A: Overland Flow

Runoff = 0.3 cfs @ 12.14 hrs, Volume= 0.0 af, Depth> 1.27"
Routed to Link DP-2 : Existing Adjacent Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 5-Yr Rainfall=4.01"

Area (ac)	CN	Description
0.2	68	<50% Grass cover, Poor, HSG A
0.0	86	<50% Grass cover, Poor, HSG C
0.2	69	Weighted Average
0.2		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0460	0.20		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
2.4	303	0.0890	2.09		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	127	0.0460	4.35		**Shallow Concentrated Flow, Paved** Paved Kv= 20.3 fps
1.9	159	0.0380	1.36		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
8.9	639	Total			

Summary for Subcatchment PR-2B: Parking Lot

Runoff = 15.6 cfs @ 12.07 hrs, Volume= 1.1 af, Depth> 2.83"
Routed to Pond 1P : Infiltration Basin #1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 5-Yr Rainfall=4.01"

Area (ac)	CN	Description
0.4	68	<50% Grass cover, Poor, HSG A
1.0	86	<50% Grass cover, Poor, HSG C
0.2	89	<50% Grass cover, Poor, HSG D
0.0	98	Paved parking, HSG A
2.2	98	Paved parking, HSG C
0.0	98	Paved parking, HSG D
0.1	98	Roofs, HSG C
0.7	77	Woods, Good, HSG D
4.6	89	Weighted Average
2.4		51.23% Pervious Area
2.3		48.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-2C: Proposed Building

Runoff = 3.2 cfs @ 12.07 hrs, Volume= 0.2 af, Depth> 3.77"
Routed to Pond 1P : Infiltration Basin #1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 5-Yr Rainfall=4.01"

Area (ac)	CN	Description
0.0	86	<50% Grass cover, Poor, HSG C
0.8	98	Roofs, HSG C
0.8	98	Weighted Average
0.0		0.00% Pervious Area
0.8		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-3: Main St. Overland Flow

Runoff = 1.2 cfs @ 12.07 hrs, Volume= 0.1 af, Depth> 2.64"
Routed to Link DP-3 : Main Street Drainage System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 5-Yr Rainfall=4.01"

Area (ac)	CN	Description
0.0	68	<50% Grass cover, Poor, HSG A
0.3	86	<50% Grass cover, Poor, HSG C
0.0	98	Paved parking, HSG A
0.0	98	Paved parking, HSG C
0.4	87	Weighted Average
0.3		91.97% Pervious Area
0.0		8.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Pond 1P: Infiltration Basin #1P

Inflow Area = 5.4 ac, 56.19% Impervious, Inflow Depth > 2.97" for 5-Yr event
Inflow = 18.8 cfs @ 12.07 hrs, Volume= 1.3 af
Outflow = 2.0 cfs @ 12.76 hrs, Volume= 1.3 af, Atten= 89%, Lag= 41.3 min
Discarded = 2.0 cfs @ 12.76 hrs, Volume= 1.3 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.0 af
Routed to Link DP-2 : Existing Adjacent Swale

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Peak Elev= 219.1' @ 12.76 hrs Surf.Area= 10,706 sf Storage= 21,095 cf

Plug-Flow detention time= 83.5 min calculated for 1.3 af (100% of inflow)
Center-of-Mass det. time= 82.8 min (874.6 - 791.7)

Volume	Invert	Avail.Storage	Storage Description
#1	217.0'	1,428 cf	**Sediment Forebay (Prismatic)** Listed below (Recalc) -Impervious
#2	217.0'	56,735 cf	**Infiltration Bioretention Basin (Irregular)** Listed below (Recalc)
		58,162 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
217.0	383	0	0
218.0	696	540	540
219.0	1,080	888	1,428

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
217.0	7,872	372.6	0	0	7,872
218.0	9,153	403.9	8,504	8,504	9,845
219.0	10,527	435.2	9,832	18,336	11,976
220.0	11,995	466.5	11,253	29,589	14,267
221.0	13,557	497.8	12,768	42,358	16,717
222.0	15,213	529.1	14,377	56,735	19,326

Device	Routing	Invert	Outlet Devices
#1	Primary	220.6'	**20.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#2	Discarded	217.0'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=2.0 cfs @ 12.76 hrs HW=219.1' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 2.0 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=217.0' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Link DP-1: Existing Wetland

Inflow Area = 8.4 ac, 9.98% Impervious, Inflow Depth > 1.95" for 5-Yr event
Inflow = 15.6 cfs @ 12.15 hrs, Volume= 1.4 af
Primary = 15.6 cfs @ 12.15 hrs, Volume= 1.4 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: Existing Adjacent Swale

Inflow Area = 5.6 ac, 54.05% Impervious, Inflow Depth > 0.05" for 5-Yr event
Inflow = 0.3 cfs @ 12.14 hrs, Volume= 0.0 af
Primary = 0.3 cfs @ 12.14 hrs, Volume= 0.0 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-3: Main Street Drainage System

Inflow Area = 0.4 ac, 8.03% Impervious, Inflow Depth > 2.64" for 5-Yr event
Inflow = 1.2 cfs @ 12.07 hrs, Volume= 0.1 af
Primary = 1.2 cfs @ 12.07 hrs, Volume= 0.1 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Time span=0.00-24.00 hrs, dt=0.03 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1A: Direct Runoff to Runoff Area=0.7 ac 10.72% Impervious Runoff Depth>3.34"
Tc=5.0 min CN=87 Runoff=2.8 cfs 0.2 af

Subcatchment PR-1B: Off-Site Area to the Runoff Area=7.7 ac 9.91% Impervious Runoff Depth>2.50"
Flow Length=740' Tc=11.3 min CN=78 Runoff=18.8 cfs 1.6 af

Subcatchment PR-2A: Overland Flow Runoff Area=0.2 ac 0.00% Impervious Runoff Depth>1.78"
Flow Length=639' Tc=8.9 min CN=69 Runoff=0.4 cfs 0.0 af

Subcatchment PR-2B: Parking Lot Runoff Area=4.6 ac 48.77% Impervious Runoff Depth>3.54"
Tc=5.0 min CN=89 Runoff=19.4 cfs 1.4 af

Subcatchment PR-2C: Proposed Building Runoff Area=0.8 ac 100.00% Impervious Runoff Depth>4.52"
Tc=5.0 min CN=98 Runoff=3.8 cfs 0.3 af

Subcatchment PR-3: Main St. Overland Flow Runoff Area=0.4 ac 8.03% Impervious Runoff Depth>3.34"
Tc=5.0 min CN=87 Runoff=1.5 cfs 0.1 af

Pond 1P: Infiltration Basin #1P Peak Elev=219.7' Storage=27,798 cf Inflow=23.1 cfs 1.7 af
Discarded=2.2 cfs 1.7 af Primary=0.0 cfs 0.0 af Outflow=2.2 cfs 1.7 af

Link DP-1: Existing Wetland Inflow=20.7 cfs 1.8 af
Primary=20.7 cfs 1.8 af

Link DP-2: Existing Adjacent Swale Inflow=0.4 cfs 0.0 af
Primary=0.4 cfs 0.0 af

Link DP-3: Main Street Drainage System Inflow=1.5 cfs 0.1 af
Primary=1.5 cfs 0.1 af

Total Runoff Area = 14.4 ac Runoff Volume = 3.6 af Average Runoff Depth = 3.00"
72.75% Pervious = 10.5 ac 27.25% Impervious = 3.9 ac

Summary for Subcatchment PR-1A: Direct Runoff to Wetland

Runoff = 2.8 cfs @ 12.07 hrs, Volume= 0.2 af, Depth> 3.34"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.76"

Area (ac)	CN	Description
0.6	86	<50% Grass cover, Poor, HSG C
0.1	98	Paved parking, HSG C
0.7	87	Weighted Average
0.6		89.28% Pervious Area
0.1		10.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-1B: Off-Site Area to the South

Runoff = 18.8 cfs @ 12.16 hrs, Volume= 1.6 af, Depth> 2.50"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.76"

Area (ac)	CN	Description
3.9	79	<50% Grass cover, Poor, HSG B
1.0	86	<50% Grass cover, Poor, HSG C
0.3	89	<50% Grass cover, Poor, HSG D
0.5	98	Paved parking, HSG B
0.0	98	Paved parking, HSG C
0.0	98	Paved parking, HSG D
0.2	98	Roofs, HSG B
0.0	98	Roofs, HSG D
1.2	55	Woods, Good, HSG B
0.1	70	Woods, Good, HSG C
0.4	77	Woods, Good, HSG D
7.7	78	Weighted Average
6.9		90.09% Pervious Area
0.8		9.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.19		**Sheet Flow, Grass-Sheet** Grass: Short n= 0.150 P2= 3.10"
2.1	154	0.0300	1.21		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
1.0	148	0.0160	2.57		**Shallow Concentrated Flow, Paved-Concentrated** Paved Kv= 20.3 fps
1.3	116	0.0470	1.52		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	50	0.0600	1.71		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	55	0.0720	1.88		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	17	0.1170	2.39		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	40	0.0375	1.36		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
1.0	110	0.0670	1.81		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
11.3	740	Total			

Summary for Subcatchment PR-2A: Overland Flow

Runoff = 0.4 cfs @ 12.13 hrs, Volume= 0.0 af, Depth> 1.78"
Routed to Link DP-2 : Existing Adjacent Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.76"

Area (ac)	CN	Description
0.2	68	<50% Grass cover, Poor, HSG A
0.0	86	<50% Grass cover, Poor, HSG C
0.2	69	Weighted Average
0.2		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0460	0.20		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
2.4	303	0.0890	2.09		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	127	0.0460	4.35		**Shallow Concentrated Flow, Paved** Paved Kv= 20.3 fps
1.9	159	0.0380	1.36		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
8.9	639	Total			

Summary for Subcatchment PR-2B: Parking Lot

Runoff = 19.4 cfs @ 12.07 hrs, Volume= 1.4 af, Depth> 3.54"
Routed to Pond 1P : Infiltration Basin #1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.76"

Area (ac)	CN	Description
0.4	68	<50% Grass cover, Poor, HSG A
1.0	86	<50% Grass cover, Poor, HSG C
0.2	89	<50% Grass cover, Poor, HSG D
0.0	98	Paved parking, HSG A
2.2	98	Paved parking, HSG C
0.0	98	Paved parking, HSG D
0.1	98	Roofs, HSG C
0.7	77	Woods, Good, HSG D
4.6	89	Weighted Average
2.4		51.23% Pervious Area
2.3		48.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-2C: Proposed Building

Runoff = 3.8 cfs @ 12.07 hrs, Volume= 0.3 af, Depth> 4.52"
Routed to Pond 1P : Infiltration Basin #1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.76"

Area (ac)	CN	Description
0.0	86	<50% Grass cover, Poor, HSG C
0.8	98	Roofs, HSG C
0.8	98	Weighted Average
0.0		0.00% Pervious Area
0.8		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-3: Main St. Overland Flow

Runoff = 1.5 cfs @ 12.07 hrs, Volume= 0.1 af, Depth> 3.34"
Routed to Link DP-3 : Main Street Drainage System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 10-Yr Rainfall=4.76"

Area (ac)	CN	Description
0.0	68	<50% Grass cover, Poor, HSG A
0.3	86	<50% Grass cover, Poor, HSG C
0.0	98	Paved parking, HSG A
0.0	98	Paved parking, HSG C
0.4	87	Weighted Average
0.3		91.97% Pervious Area
0.0		8.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Pond 1P: Infiltration Basin #1P

Inflow Area = 5.4 ac, 56.19% Impervious, Inflow Depth > 3.68" for 10-Yr event
Inflow = 23.1 cfs @ 12.07 hrs, Volume= 1.7 af
Outflow = 2.2 cfs @ 12.88 hrs, Volume= 1.7 af, Atten= 90%, Lag= 48.6 min
Discarded = 2.2 cfs @ 12.88 hrs, Volume= 1.7 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.0 af
Routed to Link DP-2 : Existing Adjacent Swale

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Peak Elev= 219.7' @ 12.88 hrs Surf.Area= 11,585 sf Storage= 27,798 cf

Plug-Flow detention time= 107.2 min calculated for 1.7 af (100% of inflow)
Center-of-Mass det. time= 106.5 min (892.9 - 786.4)

Volume	Invert	Avail.Storage	Storage Description
#1	217.0'	1,428 cf	**Sediment Forebay (Prismatic)** Listed below (Recalc) -Impervious
#2	217.0'	56,735 cf	**Infiltration Bioretention Basin (Irregular)** Listed below (Recalc)
		58,162 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
217.0	383	0	0
218.0	696	540	540
219.0	1,080	888	1,428

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
217.0	7,872	372.6	0	0	7,872
218.0	9,153	403.9	8,504	8,504	9,845
219.0	10,527	435.2	9,832	18,336	11,976
220.0	11,995	466.5	11,253	29,589	14,267
221.0	13,557	497.8	12,768	42,358	16,717
222.0	15,213	529.1	14,377	56,735	19,326

Device	Routing	Invert	Outlet Devices
#1	Primary	220.6'	**20.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#2	Discarded	217.0'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=2.2 cfs @ 12.88 hrs HW=219.7' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 2.2 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=217.0' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Link DP-1: Existing Wetland

Inflow Area = 8.4 ac, 9.98% Impervious, Inflow Depth > 2.57" for 10-Yr event
Inflow = 20.7 cfs @ 12.15 hrs, Volume= 1.8 af
Primary = 20.7 cfs @ 12.15 hrs, Volume= 1.8 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: Existing Adjacent Swale

Inflow Area = 5.6 ac, 54.05% Impervious, Inflow Depth > 0.07" for 10-Yr event
Inflow = 0.4 cfs @ 12.13 hrs, Volume= 0.0 af
Primary = 0.4 cfs @ 12.13 hrs, Volume= 0.0 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-3: Main Street Drainage System

Inflow Area = 0.4 ac, 8.03% Impervious, Inflow Depth > 3.34" for 10-Yr event
Inflow = 1.5 cfs @ 12.07 hrs, Volume= 0.1 af
Primary = 1.5 cfs @ 12.07 hrs, Volume= 0.1 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Time span=0.00-24.00 hrs, dt=0.03 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1A: Direct Runoff to Runoff Area=0.7 ac 10.72% Impervious Runoff Depth>4.32"
Tc=5.0 min CN=87 Runoff=3.5 cfs 0.3 af

Subcatchment PR-1B: Off-Site Area to the Runoff Area=7.7 ac 9.91% Impervious Runoff Depth>3.40"
Flow Length=740' Tc=11.3 min CN=78 Runoff=25.6 cfs 2.2 af

Subcatchment PR-2A: Overland Flow Runoff Area=0.2 ac 0.00% Impervious Runoff Depth>2.55"
Flow Length=639' Tc=8.9 min CN=69 Runoff=0.6 cfs 0.0 af

Subcatchment PR-2B: Parking Lot Runoff Area=4.6 ac 48.77% Impervious Runoff Depth>4.54"
Tc=5.0 min CN=89 Runoff=24.5 cfs 1.8 af

Subcatchment PR-2C: Proposed Building Runoff Area=0.8 ac 100.00% Impervious Runoff Depth>5.56"
Tc=5.0 min CN=98 Runoff=4.6 cfs 0.4 af

Subcatchment PR-3: Main St. Overland Flow Runoff Area=0.4 ac 8.03% Impervious Runoff Depth>4.32"
Tc=5.0 min CN=87 Runoff=1.9 cfs 0.1 af

Pond 1P: Infiltration Basin #1P Peak Elev=220.5' Storage=37,636 cf Inflow=29.1 cfs 2.1 af
Discarded=2.5 cfs 2.1 af Primary=0.0 cfs 0.0 af Outflow=2.5 cfs 2.1 af

Link DP-1: Existing Wetland Inflow=27.9 cfs 2.4 af
Primary=27.9 cfs 2.4 af

Link DP-2: Existing Adjacent Swale Inflow=0.6 cfs 0.0 af
Primary=0.6 cfs 0.0 af

Link DP-3: Main Street Drainage System Inflow=1.9 cfs 0.1 af
Primary=1.9 cfs 0.1 af

Total Runoff Area = 14.4 ac Runoff Volume = 4.7 af Average Runoff Depth = 3.94"
72.75% Pervious = 10.5 ac 27.25% Impervious = 3.9 ac

Summary for Subcatchment PR-1A: Direct Runoff to Wetland

Runoff = 3.5 cfs @ 12.07 hrs, Volume= 0.3 af, Depth> 4.32"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=5.80"

Area (ac)	CN	Description
0.6	86	<50% Grass cover, Poor, HSG C
0.1	98	Paved parking, HSG C
0.7	87	Weighted Average
0.6		89.28% Pervious Area
0.1		10.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-1B: Off-Site Area to the South

Runoff = 25.6 cfs @ 12.16 hrs, Volume= 2.2 af, Depth> 3.40"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=5.80"

Area (ac)	CN	Description
3.9	79	<50% Grass cover, Poor, HSG B
1.0	86	<50% Grass cover, Poor, HSG C
0.3	89	<50% Grass cover, Poor, HSG D
0.5	98	Paved parking, HSG B
0.0	98	Paved parking, HSG C
0.0	98	Paved parking, HSG D
0.2	98	Roofs, HSG B
0.0	98	Roofs, HSG D
1.2	55	Woods, Good, HSG B
0.1	70	Woods, Good, HSG C
0.4	77	Woods, Good, HSG D
7.7	78	Weighted Average
6.9		90.09% Pervious Area
0.8		9.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.19		**Sheet Flow, Grass-Sheet** Grass: Short n= 0.150 P2= 3.10"
2.1	154	0.0300	1.21		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
1.0	148	0.0160	2.57		**Shallow Concentrated Flow, Paved-Concentrated** Paved Kv= 20.3 fps
1.3	116	0.0470	1.52		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	50	0.0600	1.71		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	55	0.0720	1.88		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	17	0.1170	2.39		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	40	0.0375	1.36		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
1.0	110	0.0670	1.81		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
11.3	740	Total			

Summary for Subcatchment PR-2A: Overland Flow

Runoff = 0.6 cfs @ 12.13 hrs, Volume= 0.0 af, Depth> 2.55"
Routed to Link DP-2 : Existing Adjacent Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=5.80"

Area (ac)	CN	Description
0.2	68	<50% Grass cover, Poor, HSG A
0.0	86	<50% Grass cover, Poor, HSG C
0.2	69	Weighted Average
0.2		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0460	0.20		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
2.4	303	0.0890	2.09		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	127	0.0460	4.35		**Shallow Concentrated Flow, Paved** Paved Kv= 20.3 fps
1.9	159	0.0380	1.36		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
8.9	639	Total			

Summary for Subcatchment PR-2B: Parking Lot

Runoff = 24.5 cfs @ 12.07 hrs, Volume= 1.8 af, Depth> 4.54"
Routed to Pond 1P : Infiltration Basin #1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=5.80"

Area (ac)	CN	Description
0.4	68	<50% Grass cover, Poor, HSG A
1.0	86	<50% Grass cover, Poor, HSG C
0.2	89	<50% Grass cover, Poor, HSG D
0.0	98	Paved parking, HSG A
2.2	98	Paved parking, HSG C
0.0	98	Paved parking, HSG D
0.1	98	Roofs, HSG C
0.7	77	Woods, Good, HSG D
4.6	89	Weighted Average
2.4		51.23% Pervious Area
2.3		48.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-2C: Proposed Building

Runoff = 4.6 cfs @ 12.07 hrs, Volume= 0.4 af, Depth> 5.56"
Routed to Pond 1P : Infiltration Basin #1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=5.80"

Area (ac)	CN	Description
0.0	86	<50% Grass cover, Poor, HSG C
0.8	98	Roofs, HSG C
0.8	98	Weighted Average
0.0		0.00% Pervious Area
0.8		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-3: Main St. Overland Flow

Runoff = 1.9 cfs @ 12.07 hrs, Volume= 0.1 af, Depth> 4.32"
Routed to Link DP-3 : Main Street Drainage System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 25-Yr Rainfall=5.80"

Area (ac)	CN	Description
0.0	68	<50% Grass cover, Poor, HSG A
0.3	86	<50% Grass cover, Poor, HSG C
0.0	98	Paved parking, HSG A
0.0	98	Paved parking, HSG C
0.4	87	Weighted Average
0.3		91.97% Pervious Area
0.0		8.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Pond 1P: Infiltration Basin #1P

Inflow Area = 5.4 ac, 56.19% Impervious, Inflow Depth > 4.69" for 25-Yr event
Inflow = 29.1 cfs @ 12.07 hrs, Volume= 2.1 af
Outflow = 2.5 cfs @ 12.99 hrs, Volume= 2.1 af, Atten= 92%, Lag= 55.1 min
Discarded = 2.5 cfs @ 12.99 hrs, Volume= 2.1 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.0 af
Routed to Link DP-2 : Existing Adjacent Swale

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Peak Elev= 220.5' @ 12.99 hrs Surf.Area= 12,817 sf Storage= 37,636 cf

Plug-Flow detention time= 138.4 min calculated for 2.1 af (100% of inflow)
Center-of-Mass det. time= 137.9 min (918.4 - 780.5)

Volume	Invert	Avail.Storage	Storage Description
#1	217.0'	1,428 cf	**Sediment Forebay (Prismatic)** Listed below (Recalc) -Impervious
#2	217.0'	56,735 cf	**Infiltration Bioretention Basin (Irregular)** Listed below (Recalc)
		58,162 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
217.0	383	0	0
218.0	696	540	540
219.0	1,080	888	1,428

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
217.0	7,872	372.6	0	0	7,872
218.0	9,153	403.9	8,504	8,504	9,845
219.0	10,527	435.2	9,832	18,336	11,976
220.0	11,995	466.5	11,253	29,589	14,267
221.0	13,557	497.8	12,768	42,358	16,717
222.0	15,213	529.1	14,377	56,735	19,326

Device	Routing	Invert	Outlet Devices
#1	Primary	220.6'	**20.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#2	Discarded	217.0'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=2.5 cfs @ 12.99 hrs HW=220.5' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 2.5 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=217.0' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Link DP-1: Existing Wetland

Inflow Area = 8.4 ac, 9.98% Impervious, Inflow Depth > 3.47" for 25-Yr event
Inflow = 27.9 cfs @ 12.15 hrs, Volume= 2.4 af
Primary = 27.9 cfs @ 12.15 hrs, Volume= 2.4 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: Existing Adjacent Swale

Inflow Area = 5.6 ac, 54.05% Impervious, Inflow Depth > 0.10" for 25-Yr event
Inflow = 0.6 cfs @ 12.13 hrs, Volume= 0.0 af
Primary = 0.6 cfs @ 12.13 hrs, Volume= 0.0 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-3: Main Street Drainage System

Inflow Area = 0.4 ac, 8.03% Impervious, Inflow Depth > 4.32" for 25-Yr event
Inflow = 1.9 cfs @ 12.07 hrs, Volume= 0.1 af
Primary = 1.9 cfs @ 12.07 hrs, Volume= 0.1 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Time span=0.00-24.00 hrs, dt=0.03 hrs, 801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-1A: Direct Runoff to Runoff Area=0.7 ac 10.72% Impervious Runoff Depth>5.85"
Tc=5.0 min CN=87 Runoff=4.7 cfs 0.3 af

Subcatchment PR-1B: Off-Site Area to the Runoff Area=7.7 ac 9.91% Impervious Runoff Depth>4.82"
Flow Length=740' Tc=11.3 min CN=78 Runoff=36.1 cfs 3.1 af

Subcatchment PR-2A: Overland Flow Runoff Area=0.2 ac 0.00% Impervious Runoff Depth>3.83"
Flow Length=639' Tc=8.9 min CN=69 Runoff=0.9 cfs 0.1 af

Subcatchment PR-2B: Parking Lot Runoff Area=4.6 ac 48.77% Impervious Runoff Depth>6.09"
Tc=5.0 min CN=89 Runoff=32.3 cfs 2.4 af

Subcatchment PR-2C: Proposed Building Runoff Area=0.8 ac 100.00% Impervious Runoff Depth>7.15"
Tc=5.0 min CN=98 Runoff=5.9 cfs 0.5 af

Subcatchment PR-3: Main St. Overland Flow Runoff Area=0.4 ac 8.03% Impervious Runoff Depth>5.85"
Tc=5.0 min CN=87 Runoff=2.5 cfs 0.2 af

Pond 1P: Infiltration Basin #1P Peak Elev=220.9' Storage=42,986 cf Inflow=38.2 cfs 2.8 af
Discarded=2.6 cfs 2.5 af Primary=10.0 cfs 0.4 af Outflow=12.6 cfs 2.8 af

Link DP-1: Existing Wetland Inflow=39.3 cfs 3.4 af
Primary=39.3 cfs 3.4 af

Link DP-2: Existing Adjacent Swale Inflow=10.5 cfs 0.4 af
Primary=10.5 cfs 0.4 af

Link DP-3: Main Street Drainage System Inflow=2.5 cfs 0.2 af
Primary=2.5 cfs 0.2 af

Total Runoff Area = 14.4 ac Runoff Volume = 6.5 af Average Runoff Depth = 5.42"
72.75% Pervious = 10.5 ac 27.25% Impervious = 3.9 ac

Summary for Subcatchment PR-1A: Direct Runoff to Wetland

Runoff = 4.7 cfs @ 12.07 hrs, Volume= 0.3 af, Depth> 5.85"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=7.39"

Area (ac)	CN	Description
0.6	86	<50% Grass cover, Poor, HSG C
0.1	98	Paved parking, HSG C
0.7	87	Weighted Average
0.6		89.28% Pervious Area
0.1		10.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-1B: Off-Site Area to the South

Runoff = 36.1 cfs @ 12.16 hrs, Volume= 3.1 af, Depth> 4.82"
Routed to Link DP-1 : Existing Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=7.39"

Area (ac)	CN	Description
3.9	79	<50% Grass cover, Poor, HSG B
1.0	86	<50% Grass cover, Poor, HSG C
0.3	89	<50% Grass cover, Poor, HSG D
0.5	98	Paved parking, HSG B
0.0	98	Paved parking, HSG C
0.0	98	Paved parking, HSG D
0.2	98	Roofs, HSG B
0.0	98	Roofs, HSG D
1.2	55	Woods, Good, HSG B
0.1	70	Woods, Good, HSG C
0.4	77	Woods, Good, HSG D
7.7	78	Weighted Average
6.9		90.09% Pervious Area
0.8		9.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.19		**Sheet Flow, Grass-Sheet** Grass: Short n= 0.150 P2= 3.10"
2.1	154	0.0300	1.21		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
1.0	148	0.0160	2.57		**Shallow Concentrated Flow, Paved-Concentrated** Paved Kv= 20.3 fps
1.3	116	0.0470	1.52		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	50	0.0600	1.71		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	55	0.0720	1.88		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.1	17	0.1170	2.39		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	40	0.0375	1.36		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
1.0	110	0.0670	1.81		**Shallow Concentrated Flow, Grass-Concentrated** Short Grass Pasture Kv= 7.0 fps
11.3	740	Total			

Summary for Subcatchment PR-2A: Overland Flow

Runoff = 0.9 cfs @ 12.13 hrs, Volume= 0.1 af, Depth> 3.83"
Routed to Link DP-2 : Existing Adjacent Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=7.39"

Area (ac)	CN	Description
0.2	68	<50% Grass cover, Poor, HSG A
0.0	86	<50% Grass cover, Poor, HSG C
0.2	69	Weighted Average
0.2		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.0460	0.20		**Sheet Flow, Grass - Sheet** Grass: Short n= 0.150 P2= 3.10"
2.4	303	0.0890	2.09		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
0.5	127	0.0460	4.35		**Shallow Concentrated Flow, Paved** Paved Kv= 20.3 fps
1.9	159	0.0380	1.36		**Shallow Concentrated Flow, Grass - Concentrated** Short Grass Pasture Kv= 7.0 fps
8.9	639	Total			

Summary for Subcatchment PR-2B: Parking Lot

Runoff = 32.3 cfs @ 12.07 hrs, Volume= 2.4 af, Depth> 6.09"
Routed to Pond 1P : Infiltration Basin #1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=7.39"

Area (ac)	CN	Description
0.4	68	<50% Grass cover, Poor, HSG A
1.0	86	<50% Grass cover, Poor, HSG C
0.2	89	<50% Grass cover, Poor, HSG D
0.0	98	Paved parking, HSG A
2.2	98	Paved parking, HSG C
0.0	98	Paved parking, HSG D
0.1	98	Roofs, HSG C
0.7	77	Woods, Good, HSG D
4.6	89	Weighted Average
2.4		51.23% Pervious Area
2.3		48.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-2C: Proposed Building

Runoff = 5.9 cfs @ 12.07 hrs, Volume= 0.5 af, Depth> 7.15"
Routed to Pond 1P : Infiltration Basin #1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=7.39"

Area (ac)	CN	Description
0.0	86	<50% Grass cover, Poor, HSG C
0.8	98	Roofs, HSG C
0.8	98	Weighted Average
0.0		0.00% Pervious Area
0.8		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment PR-3: Main St. Overland Flow

Runoff = 2.5 cfs @ 12.07 hrs, Volume= 0.2 af, Depth> 5.85"
Routed to Link DP-3 : Main Street Drainage System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Type III 24-hr 100-Yr Rainfall=7.39"

Area (ac)	CN	Description
0.0	68	<50% Grass cover, Poor, HSG A
0.3	86	<50% Grass cover, Poor, HSG C
0.0	98	Paved parking, HSG A
0.0	98	Paved parking, HSG C
0.4	87	Weighted Average
0.3		91.97% Pervious Area
0.0		8.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Pond 1P: Infiltration Basin #1P

Inflow Area = 5.4 ac, 56.19% Impervious, Inflow Depth > 6.24" for 100-Yr event
Inflow = 38.2 cfs @ 12.07 hrs, Volume= 2.8 af
Outflow = 12.6 cfs @ 12.35 hrs, Volume= 2.8 af, Atten= 67%, Lag= 16.5 min
Discarded = 2.6 cfs @ 12.35 hrs, Volume= 2.5 af
Primary = 10.0 cfs @ 12.35 hrs, Volume= 0.4 af
Routed to Link DP-2 : Existing Adjacent Swale

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs
Peak Elev= 220.9' @ 12.35 hrs Surf.Area= 13,462 sf Storage= 42,986 cf

Plug-Flow detention time= 128.0 min calculated for 2.8 af (100% of inflow)
Center-of-Mass det. time= 127.5 min (901.1 - 773.6)

Volume	Invert	Avail.Storage	Storage Description
#1	217.0'	1,428 cf	**Sediment Forebay (Prismatic)** Listed below (Recalc) -Impervious
#2	217.0'	56,735 cf	**Infiltration Bioretention Basin (Irregular)** Listed below (Recalc)
		58,162 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
217.0	383	0	0
218.0	696	540	540
219.0	1,080	888	1,428

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
217.0	7,872	372.6	0	0	7,872
218.0	9,153	403.9	8,504	8,504	9,845
219.0	10,527	435.2	9,832	18,336	11,976
220.0	11,995	466.5	11,253	29,589	14,267
221.0	13,557	497.8	12,768	42,358	16,717
222.0	15,213	529.1	14,377	56,735	19,326

Device	Routing	Invert	Outlet Devices
#1	Primary	220.6'	**20.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#2	Discarded	217.0'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=2.6 cfs @ 12.35 hrs HW=220.9' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 2.6 cfs)

Primary OutFlow Max=9.9 cfs @ 12.35 hrs HW=220.9' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 9.9 cfs @ 1.46 fps)

Summary for Link DP-1: Existing Wetland

Inflow Area = 8.4 ac, 9.98% Impervious, Inflow Depth > 4.91" for 100-Yr event
Inflow = 39.3 cfs @ 12.15 hrs, Volume= 3.4 af
Primary = 39.3 cfs @ 12.15 hrs, Volume= 3.4 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Summary for Link DP-2: Existing Adjacent Swale

Inflow Area = 5.6 ac, 54.05% Impervious, Inflow Depth > 0.93" for 100-Yr event
Inflow = 10.5 cfs @ 12.34 hrs, Volume= 0.4 af
Primary = 10.5 cfs @ 12.34 hrs, Volume= 0.4 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

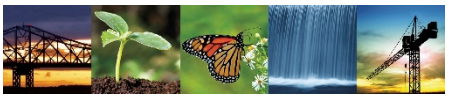
Summary for Link DP-3: Main Street Drainage System

Inflow Area = 0.4 ac, 8.03% Impervious, Inflow Depth > 5.85" for 100-Yr event
Inflow = 2.5 cfs @ 12.07 hrs, Volume= 0.2 af
Primary = 2.5 cfs @ 12.07 hrs, Volume= 0.2 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.03 hrs

Appendix C: Standard 3 Computations and Supporting Documentation

- Soil Evaluation in accordance with Volume 3, Chapter 1 of the Handbook
- Recharge Volume Calculations
- 72-hour drawdown analysis
- Mounding Analysis



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May 28, 2025
Project No. 05.0047465.00

David Neal, AIA
The SLAM Collaborative
80 Glastonbury Boulevard, 3rd Floor
Glastonbury, Connecticut

Re: Preliminary Geotechnical Engineering Report
Proposed Medical Development
500 Main Street
Groton, Massachusetts 01471

Dear Mr. Neal:

GZA GeoEnvironmental, Inc. (GZA) has prepared this preliminary geotechnical engineering report for the proposed Medical Development located at 500 Main Street and adjoining parcels in Groton, Massachusetts (Site). This report summarizes our findings and presents our preliminary geotechnical engineering recommendations for design and construction. Our services were conducted in accordance with the scope of work in our proposal dated March 21, 2025 as accepted April 7, 2025 in accordance the December 11, 2024 SLAM Subcontract for Professional Consulting Services. Report Limitations are attached in **Appendix A**.

The elevations used in this report were interpreted from the survey provided [1] and reference the North American Vertical Datum of 1988 (NAVD88), unless stated otherwise.

EXISTING CONDITIONS

Our understanding of the Project is based on the:

- Drawing titled “Conceptual Massing Plan 1”, dated March 13, 2025, provided by SLAM;
- Drawing titled "Layout and Materials Plan – Phase 1 and Phase 2", prepared by SLAM, 2 sheets, C2.00 through C2.01, pre-dated June 13, 2025; and,
- AutoCAD file titled “16694.00 – PR.dwg”, provided by VHB, transmitted via email on May 5, 2025.

The approximate location of the Site is presented on **Figure 1-Site Locus.**

The Site is located on the northeastern side of the Main Street. The Site consists of four parcels and is bound by Main Street on the west, Taylor Street to the south, and forested areas to the north and east. The parcels range from approximately 1.3 to 9 acres, with a combined area of about 15 acres. The parcels along Main Street are developed with residential buildings. The northern most parcel includes the footprint of a commercial building that was recently razed. We understand that the area proposed for development is about 7.1 acres. Elevations within the proposed development area range from about El. 246

[1] Ground surface elevations were interpolated from drawing titled "Illustrative Site Plan – Phase 1", prepared VHB, Inc., 1 sheets dated May 1, 2025.

at a high knoll in the southeastern area of the Site to El. 216 feet in the western area of the Site. The Site features are shown on **Figure 2- Exploration Location Plan**.

PROPOSED DEVELOPMENT

The proposed development consists of a Stand-Alone Emergency Facility and Medical Office Building, helipad, parking and drive areas, and stormwater detention pond. The proposed Stand-Alone Emergency Facility will have a footprint of approximately 21,650 square feet (sf) and the Medical Office Building will have a footprint of approximately 11,000 square feet. The buildings will be one-story with no below grade spaces, and the proposed finished-floor elevation will be at El. 237 feet. Based on the proposed floor grades, we anticipate cuts and fills on the order of 9 and 10 feet, respectively. A helipad will be located in the northern area of the Site and a stormwater detention pond will be located northwest of the proposed buildings. No other details for the proposed development were provided to GZA. The proposed development is shown on **Figure 2 – Exploration Location Plan.**

SUBSURFACE EXPLORATION PROGRAM

Ten test borings, including one offset boring (GZ-1 through GZ-9 and GZ-3A) were completed by GeoSearch, Inc. of Sterling, Massachusetts and observed by GZA between April 15 and 17, 2025. Test boring GZ-3A was drilled as an offset of GZ-3 due to initial shallow auger drilling refusal in boring GZ-3. Test Borings were advanced with an ATV mounted CME-55LC drill rig and hollow-stem augers. The test borings were drilled to depths between about 6.3 to 23 feet below existing grade. Soil samples were collected with a 1-3/8-inch I.D. split-spoon sampler driven with a 140-pound automatic hammer falling 30 inches. Blows per 6 inches on the sampler were recorded. The number of hammer blows required to drive the split-spoon sampler from 6 to 18 inches is the SPT N-value. The hammer blows and corresponding SPT N-values were recorded on the boring logs.

The subsurface explorations were monitored and logged by GZA personnel. The soils were classified according to the modified Burmister soil classification system. Details of the classification system are provided with the test boring logs in **Appendix B**.

The explorations were located by line of sight and tape measurements from existing site features and with handheld submeter GPS unit. The approximate ground surface elevations referenced on the test boring logs were interpolated from the topographic survey for the project provided to GZA and should be considered approximate. The exploration locations are presented on **Figure 2 – Exploration Location Plan**.

GENERALIZED SUBSURFACE CONDITIONS

Based on the test boring explorations, the generalized subsurface conditions at the Site consist, in order of increasing depth, of: Topsoil, undocumented Fill, naturally deposited Stratified Glacial Deposits, naturally deposited Glacial Till, and Bedrock. The subsurface conditions are presented in the test boring logs attached in **Appendix B** and are summarized below.

- TOPSOIL – Topsoil was encountered at the ground surface in the explorations except GZ-3 and GZ-3A and was observed to be about 2- to 6-inches thick.

- FILL – Undocumented Fill extended from below the topsoil or ground surface and extended up to about 6 feet below existing grade, except in test borings GZ-5 and GZ-8 where Fill was not encountered. The Fill generally consisted of grey and brown, fine to coarse sand with 20% to 50% silt, and 10% to 50% gravel. SPT-N values obtained in the Fill ranged from 3 to 25 blows per foot, indicating a relative density of very loose to medium dense.

- STRATIFIED GLACIAL DEPOSITS – Stratified Glacial Deposits were encountered below the undocumented Fill in test borings GZ-5 through GZ-9. The top of the Stratified Glacial Deposits was encountered at about El. 215 to 238 feet in the test borings, corresponding to about 0.3 to 5 feet below grade. The Stratified Glacial Deposits consisted of tan-brown, grey, fine to medium sand with 10% to 50% gravel and 5% to 35% silt. Test borings GZ-6 through GZ-8 terminated in this layer. SPT-N values within the Stratified Glacial Deposits ranged from 6 to 52 blows per foot indicating a relative density of loose to very dense.

- GLACIAL TILL– Naturally deposited Glacial Till deposits were encountered below the undocumented Fill or Stratified Glacial Deposits at approximately 2 to 13.5 feet below existing grade in GZ-1 through GZ-5 and GZ-9. The top of the Glacial Till was encountered at about El. 205.5 to 230 feet. The Glacial Till consisted of tan-brown, orange, grey, fine to coarse sand with 20% to 50% gravel and 20% to 50% silt. The test borings terminated in this layer at split spoon sampler and auger refusal between El. 199.9 and 223.5 feet. Based on drilling resistance, cobbles and boulders are expected to be present in the glacial till, which is generally consistent with glacial till soils. SPT N values obtained in the Glacial Till ranged from 15 blows per foot to refusal indicating a relative density of medium dense to very dense. However, higher SPT N values may be due to the presence of cobbles and boulders in this strata and may not be representative of the actual relative density.

- BEDROCK –Bedrock or a boulder was encountered in test boring GZ-9 and a 2-foot-long bedrock core collected. The Bedrock or boulder was extremely fractured which jammed in the rock core barrel and prevented further advancement. The top of Bedrock or boulder was encountered at El. 219 feet. The bedrock recovery and RQD were 53% and 0%, respectively. The bedrock consisted of hard, slightly weathered, moderately to extremely fractured, fine to medium grained Schist. Photographs of the bedrock core are included in **Appendix D**.

- GROUNDWATER – Groundwater was measured in the test borings across the Site and observed in the spoon samples within the explorations (except GZ-3 which encounter shallow refusal) at depth ranging from 2 to 10 feet below grade corresponding to elevations between El. 214 and 230 feet. It should be noted that future water levels will vary due to seasonal and climatic fluctuations, and changes caused by construction and stabilization time.

Infiltration Recommendations

Test borings GZ-7 and GZ-8 were performed in the proposed stormwater infiltration area in the northwestern area of the Site. The tests borings encountered the Stratified Glacial Deposits at depths of 3 feet at GZ-7 and 0.6 feet at GZ-8, corresponding to EL. 215 and 215.4 feet, respectively. Groundwater was encountered at 4 feet below grade at GZ-7 and 2 feet below grade at GZ-8, which corresponds to about El. 214 feet in both test borings. Mottling, which may be indicative of the seasonal high groundwater, was observed in GZ-7 at about 3 feet below grade.

GZA attempted borehole infiltration testing at GZ-7 and GZ-8. However, the ASTM D5126 Standard Guide for Comparison of Field Methods for Determining Hydraulic Conductivity in Vadose Zone is only applicable to unsaturated soils. Groundwater was about 2 to 4 feet below grade, and the infiltration tests could not be performed in accordance with the ASTM requirements. In lieu of ASTM D5126, laboratory sieve and hydrometer testing was performed on sample GZ-8 S-2 from 2 to 4 feet below grade. The test results indicated that the soil consists of a fine to medium sand, with 3% silt. Based on this gradation and our observations, the Massachusetts Stormwater Handbook Table 2.3.3 indicates a Rawls Rate of 8.27 inches/hour for this sample. However, the gradation of the Stratified Glacial Deposits are variable and may differ with depth and area of the Site. Other laboratory gradation data in the Stratified Glacial Deposits indicates Rawls Rates as low as 0.52 inch/hour. The Rawls Rates and seasonal high ground water observations presented above are preliminary.

The Massachusetts Stormwater Handbook, Volume 2, includes specific requirements for the design and site documentation for stormwater management systems. The Stormwater Handbook requires a minimum of 3 test borings or test pits for every 5,000 square feet of proposed infiltration basin. Additional investigations and test pits will be needed

to meet the requirements of the Stormwater Quality Manual as the location, size and type of stormwater systems are determined.

Laboratory Testing

Four grain-size analyses by sieve and hydrometer were performed on samples collected in the test borings to aid in our visual classifications of the on-site soils and estimate soil permeability below the infiltration tests. The laboratory test results are included in **Appendix C** and are summarized in the table below.

Boring ID	Sample ID	Sample Depth (ft)	Soil Stratum	% Passing No. 200 Sieve
GZ-2	S-2	2-4	Glacial Till	36.8
GZ-5	S-2	2-4	Stratified Glacial Deposits	1.9
GZ-5	S-6	11-13	Stratified Glacial Deposits	29.1
GZ-8	S-2	2-4	Stratified Glacial Deposits	2.7

PRELIMINARY GEOTECHNICAL DESIGN RECOMMENDATIONS

The geotechnical design recommendations below are consistent with the Tenth Edition of the Massachusetts State Building Code (CMR 780) based on the 2021 International Building Code (IBC) and Massachusetts State Amendments, which together constitute the current State of Massachusetts Building Code effective October 11, 2024.

BUILDING FOUNDATION AND SLABS ON GRADE

General

Undocumented Fill, pavement, utilities, buried foundation remnants, and Topsoil are not suitable for support of new foundations or slabs-on-grade for the proposed buildings. Tree stumps, root balls, and construction debris from site clearing and demolition activities are also considered unsuitable material. GZ-2 was drilled in the proposed building footprint and GZ-1 and GZ-3 were drilled west of the proposed building footprint. Two to six feet of Undocumented Fill was encountered in the three test borings, and the top of naturally deposited, undisturbed Glacial Till was encountered below the Fill at El. 223 to 230 feet.

Existing site grades in the proposed building footprint range between El. 227 and 246 feet, and proposed finished floor elevation will be at El. 237 feet. Based on existing grades, cuts and fills will be on the order of 9 feet and 10 feet, respectively. The location of the proposed building changed between the time that the test borings were drilled and the preparation of this report. Additional test borings are required to assess subsurface conditions in other parts of the proposed building footprint.

Proposed Foundations

Following excavation of unsuitable materials and subgrade preparation, the proposed buildings can be supported on shallow spread footings bearing on the following:

- Naturally deposited, undisturbed Stratified Glacial Deposits or Glacial Till; or
- Compacted Structural Fill overlying naturally deposited, undisturbed Stratified Glacial Deposits or Glacial Till.

Footings should be proportioned on the basis of a net allowable bearing pressure of 4,000 pounds per square foot (psf). Minimum footing widths should be 3 feet for rectangular footings and 2 feet for continuous footings. For smaller footings,

the allowable bearing pressure should be reduced proportionately. All footings exposed to frost should be embedded a minimum of 4-feet below finished grade. Interior footings in heated areas should be embedded a minimum of 18-inches below the slab-on-grade.

If boulders or bedrock are encountered above the proposed footing or slab subgrade elevation, we recommend that the boulders (or bedrock) be over-excavated a minimum of 12-inches below the bottom of footing / slab elevation and backfilled with compacted Structural Fill or Crushed Stone.

For site preparation and foundations designed and constructed in accordance with the recommendations of this report, estimated total building settlements are expected to be less than 1 inch, the majority of which will occur during construction. Maximum anticipated differential settlement between adjacent columns and across the span of foundation walls is expected to be less than ½ inch.

Slabs-on-Grade

Slabs-on-grade should bear on a base course consisting of a minimum of 6 inches of Select Fill or Crushed Stone overlying geotextile fabric over:

- Naturally deposited, undisturbed Stratified Glacial Deposits or Glacial Till; or
- Compacted Structural Fill overlying the naturally deposited, Stratified Glacial Deposits and Glacial Till.

The modulus of subgrade reaction recommended for slab design is 150 pounds per cubic inch (pci). Vapor barrier and waterproofing requirements of the building code should be observed. Subgrades for slabs-on-grade should be prepared in accordance with the construction recommendations presented below.

The proposed site grading has not been provided except for the finished floor Elevation of EL. 237 feet. Groundwater onsite varied from El. 214 to 230 feet. If the proposed building slab-on-grade is below grade, or within proximity to the seasonal high groundwater table, a subslab drainage system may be required to control groundwater below the slab. Additional test borings are required to assess subsurface conditions in the proposed building footprint.

Excavation and Subgrade Preparation for Building Foundations and Slabs-on-Grade

Undocumented Fill, utilities, potential buried foundation remnants, and other unsuitable materials should be removed in their entirety from beneath footings and slabs-on-grade and their zone of influence. The zone of influence is defined by a line extending 1 foot horizontally from bottom of footing and then down at a 1 horizontal by 1 vertical line to the top of naturally deposited Stratified Glacial Deposits or Glacial Till. The exposed subgrade should be evaluated by a Geotechnical Engineer for the potential presence of unsuitable materials. If unsuitable materials are encountered, they should be further over excavated until suitable bearing soils are encountered.

The exposed naturally deposited Stratified Glacial Deposits and Glacial Till should be subjected to proof compaction. Proof compaction consists of a minimum of four passes of a large vibratory roller having a minimum dynamic force of 3,000 pounds per foot of drum width or a large vibratory plate compactor having a minimum static weight of 700 pounds. Any weak or unstable areas identified should be over excavated and replaced with compacted Structural Fill, Crushed Stone wrapped with geotextile fabric, or Select Fill. Vibrations should be discontinued if disturbance or weaving of the subgrade is observed. Proof compaction may be waived or modified if, with the Geotechnical Engineer's concurrence, it is determined that this will disturb an otherwise suitable subgrade based on observed field conditions.

Final excavation to footing subgrade elevations should be performed with a smooth-edged bucket to reduce the potential for subgrade disturbance. Naturally deposited Stratified Glacial Deposits and Glacial Till footing subgrades are also

susceptible to disturbance from water and construction activities and should be protected with a 4-inch thick Crushed Stone Working Mat. Where Crushed Stone is greater than 4-inches thick, it should be wrapped in non-woven geotextile fabric. If the subgrade soils become disturbed during construction, they should be over-excavated and replaced with compacted Structural Fill.

Frozen subgrades should be over excavated and replaced with compacted Structural Fill or crushed stone wrapped in filter fabric. Alternatively, the frozen subgrade may be thawed, scarified, and re-compacted. Soil bearing surfaces below completed foundations and slabs should be protected against freezing before and after concrete placement. If construction is performed during freezing weather, footings on soil should be backfilled to a sufficient depth as soon as possible after they are constructed. Alternatively, insulating blankets or other measures should be used for protection against freezing.

Cobbles and boulders were inferred in the Glacial Till based on sampler and auger refusal encountered in the test borings. Therefore, boulder excavation may be required within the limits of excavation to allow for footing and slab subgrade preparation, and for utility installation. We anticipate that boulder and incidental bedrock excavation can be performed with hoe ramming and ripping with heavy tracked excavators. If required, drilling and chemical splitting may be performed to limit vibrations. Blasting should not be allowed.

Seismic

The on-site soils are generally not considered susceptible to liquefaction during the IBC design earthquake. In accordance with IBC 2021 and ASCE 7-20, the site may be classified as Site Class D "Stiff soil". The Tenth Editon Building Code indicates the site's design response spectra be constructed using the following coefficients:

S_S = 0.343g S_1 = 0.075g

where:

- S_S is the spectral acceleration coefficient at 0.2-sec period, uncorrected for Site Class.
- S_1 is the spectral acceleration coefficient at 1.0-sec period, uncorrected for Site Class

Lateral Pressures

Restrained walls should be designed on the basis of a lateral soil pressure equivalent to a fluid pressure of 55 psf per foot of depth, plus a uniform pressure equal to one half of any vertical surcharge load. Unrestrained walls should be designed on the basis of a lateral soil pressure equivalent to a fluid pressure of 35 psf per foot of depth, plus a uniform pressure equal to one third of any surcharge. These lateral earth pressure recommendations are based on level backfill behind retaining walls. A minimum static vertical surcharge pressure of 250 psf should be used for the design of retaining walls.

The above values of lateral earth pressures do not include hydrostatic pressures on the walls (site retaining walls and foundation walls). To achieve this condition, free draining backfill ("Select Fill") must be used for wall backfill within 3 feet laterally of the back of the wall. Wall drains are required for site retaining walls and for any building walls subject to unbalanced lateral earth pressures. Wall drains should consist of a 4-inch diameter perforated plastic (PVC) pipe surrounded by ¾-inch size Crushed Stone, which is in turn separated from the wall backfill with a non-woven filter fabric (Mirafi 140N or equal) installed at footing grade. The drains that cannot be "daylighted" and drained to the ground surface should discharge to the site stormwater system by gravity or by a sump with duplex pumps. The ground surface adjacent to the foundation walls should be backfilled with at least 6 inches of low permeability soil (topsoil) and roof drains should be diverted away from the structure.

We recommend that lateral loads be resisted by sliding friction between the base of the spread footings and base course layer with an ultimate friction coefficient against base shear of 0.45. The factor of safety against sliding should be at least 1.5. Passive pressure may also be included as a resisting force when analyzing for sliding in locations where the soil will not be removed from in front of the footings. Passive resistance may be computed using an allowable equivalent fluid pressure of 180 pcf, neglecting the upper foot of wall embedment, provided that compacted Structural Fill is used to backfill excavations within 5 feet of the foundation walls.

Existing Utilities

GZA is not aware of any existing utilities in the proposed building footprint. However, any existing utilities present that will not serve the new building or which are not required to remain in their current location should be removed and relocated completely from below the proposed buildings. Any existing utilities within the footprint of the proposed buildings which are proposed to remain, should be reviewed and evaluated by the specifying engineer for such utilities and accounted for in the project design. If existing or proposed utilities extend beneath foundations, the utilities should be designed to accept the foundation loading and installed and backfilled prior foundation construction. Alternatively, foundations can be lowered (stepped) to allow for utilities to extend through the stem walls above the footings.

Temporary Excavation Slopes

Based on GZA's understanding of the project, we anticipate conventional sloped excavations will be feasible and support-of-excavation systems are not anticipated to be required for the proposed construction. The Contractor is responsible for construction site safety and should be aware that slope height, slope inclination and excavation depths should in no case exceed those specified in local, state, or federal safety regulations (e.g. OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926). Temporary cut and fill slopes in soil should be no steeper than 1.5H:1V. As a safety measure, it is recommended that all vehicles and earth stockpiles be kept a lateral distance away from the edge of excavations at least equal to the slope height. Protect slope faces against the weather elements.

Construction Dewatering

Groundwater was observed at depths between 2 and 10 feet below grade and groundwater is anticipated to be encountered during construction. Dewatering should be performed as necessary to allow excavation and observation of the subgrades in the dry. Dewatering should be made ahead of the excavation and to at least 2 feet below the planned subgrades. We anticipate that construction dewatering can be accomplished with sumps and pumps located within excavations. In addition, constructing small temporary earth berms and grading to allow drainage away from excavations is recommended to control surface water runoff. Discharge of accumulated water should be in accordance with all local, State and Federal regulations.

EARTH MATERIALS AND COMPACTION REQUIREMENTS

Recommended earth materials for use as fill and compaction requirements for this project are provided in **Table 2** and **Table 3**.

REUSE OF ON-SITE SOILS

The excavated on-site soils are anticipated to consist of undocumented Fill, Stratified Glacial Deposits, and Glacial Till. Some of the Stratified Glacial Deposits may meet the gradation requirements. The undocumented Fill and Glacial Till are not anticipated to meet the gradation requirements of Structural Fill or Select Fill.

However, the undocumented Fill, Stratified Glacial Deposits (where it does not meet the gradation requirements), and Glacial Till can be used as Structural Fill if it can be properly placed and compacted with the following limitations and recommendations:

- The visual soil descriptions of the undocumented Fill, Stratified Glacial Deposits, and Glacial Till estimated the soil has a fines content (silt and clay) to be up to 50%. The soils will be slow draining and difficult to reuse as engineered fill, particularly during wet and winter weather conditions and when the moisture content is above the optimum compaction water content. Stockpiled material should be covered with either tarps or polyethylene sheeting to protect the soil from precipitation and uncovered during sunny days to allow the material to dry.

- The soils will be susceptible to disturbance when exposed to precipitation and construction traffic. Compaction and maintenance of subgrades will be difficult; in particular if they become wet. Although it may be possible to place and compact this material, it will likely be difficult and will require strict control of moisture. Drying of excessively wet soil may be required and could require excessive time and effort.

- Delays in construction should be anticipated if the Stratified Glacial Deposits, Glacial Till, and undocumented Fill material is proposed to be reused and not properly managed. The construction bid documents should clearly indicate the variable and sometimes high fines content of the material, the expected difficulty re-using the material, and provide the technical specifications for management, placement and compaction. Where feasible, reuse of these materials should occur in drier summer and early fall months.

ADDITIONAL SUBSURFACE EXPLORATIONS

Once the project proceeds into final design, GZA recommends being provided with information that may be required for final design. Additional subsurface explorations are recommended to support the design of foundations and for the design of the stormwater management system.

CONSTRUCTION TESTING AND OBSERVATION

GZA should observe and document key geotechnical components of design and construction, and provide ongoing geotechnical consulting including the following:

- Review or preparation of geotechnical specifications;
- Review Contractor's earthwork material and submittals;
- Preparation of subgrades; and
- Backfill and compaction below the foundations and slabs.

We recommend that GZA be retained to provide observation and services during construction to mitigate potential for delays to the project schedule. Our involvement during construction will: 1) allow evaluation of actual conditions exposed during excavation and foundation installation; and 2) allow for a prompt response should unanticipated conditions be encountered.

We appreciate the opportunity to work for you on this project. If you have any questions, please call the undersigned.

Very truly yours,
GZA GEOENVIRONMENTAL, INC.

Pamela Waters, P.E.[CT]
Project Manager

Jason E. Ressler, P.E.
Consultant Reviewer

David M. Barstow, P.E. [CT]
Associate Principal

Attachments:

Table 1 – Summary of Subsurface Exploration Data
Table 2 - Recommended Use and Gradation Criteria for Fill Materials
Table 3 – Compaction Methods

Figure 1 – Site Locus
Figure 2 – Exploration Location Plan

Appendix A – Limitations
Appendix B – Test Boring Logs
Appendix C – Laboratory Test Results
Appendix D – Rock Core Photographs

Tables

TABLE 1
SUMMARY OF TEST BORING EXPLORATION DATA
Proposed Medical Development
500 Main Street, Groton, Massachusetts

	Subsurface Exploration									
	GZ-1	GZ-2	GZ-3	GZ-3A	GZ-4	GZ-5	GZ-6	GZ-7	GZ-8	GZ-9
Proposed Location	Parking Lot	Building	Parking Lot	Parking Lot	Parking Lot	Site	Parking Lot	Detention Pond	Detention Pond	Site
Depth (ft) to:										
Topsoil	0.0	0.0	NE	NE	0.0	0.0	0.0	0.0	0.0	0.0
Undocumented Fill	0.5	0.4	0.0	0.0	0.2	NE	0.5	0.4	NE	0.5
Stratified Glacial Deposits	NE	NE	NE	NE	NE	0.3	5.0	3.0	0.6	2.0
Glacial Till	6.0	2.0	5.0	5.0	4.5	13.0	NE	NE	NE	13.5
Bedrock or Boulder	NE	NE	NE	NE	NE	NE	NE	NE	NE	21.0
Groundwater[2]	9.0	7.0	NE	10.0	10.0	4.0	6.0	4.0	2.0	10.0
Bottom of Exploration	12 R	15.2 R	6.3 R	13.8 R	20.2 R	18.6 R	14.3 R	10.0	10.0	23.0
Thickness (ft) of:										
Topsoil	0.5	0.4	NE	NE	0.2	0.3	0.5	0.4	0.6	0.5
Undocumented Fill	5.5	1.6	5.0	5.0	4.3	NE	4.5	2.6	NE	1.5
Stratified Glacial Deposits	NE	NE	NE	NE	NE	12.7	>9.3 R	>7.0	>9.4	11.5
Glacial Till	>6 R	>13.2 R	>1.3 R	>8.8 R	>15.7 R	>5.6 R	NE	NE	NE	7.5
Approximate Elevations (ft):										
Ground Surface [3]	235.5	232.0	228.0	228.0	224.0	218.5	221.0	218.0	216.0	240.0
Top of Topsoil	235.5	232.0	NE	NE	224.0	218.5	221.0	218.0	216.0	240.0
Top of Undocumented Fill	235.0	231.6	228.0	228.0	223.8	NE	220.5	217.6	NE	239.5
Top of Stratified Glacial Deposits	NE	NE	NE	NE	NE	218.2	216.0	215.0	215.4	238.0
Top of Glacial Till	229.5	230.0	223.0	223.0	219.5	205.5	NE	NE	NE	226.5
Top of Possible Bedrock	NE	NE	NE	NE	NE	NE	NE	NE	NE	219.0
Groundwater	226.5	225.0	NE	218.0	214.0	214.5	215.0	214.0	214.0	230.0
Bottom of Exploration	223.5	216.8	221.7	214.2	203.8	199.9	206.7	208.0	206.0	217.0

NE - Not encountered, R - Test Boring Ended on Refusal
Notes:
1. Test Borings were performed between April 15-17, 2025 by GeoSearch and observed by GZA personnel.
2. Groundwater measurements noted were based on wet split-spoon sample depths.
3. Ground surface elevations were interpolated from the provided site plan.
4. Test boring GZ-3A was made as an offset of GZ-3. Strata above 10 feet below grade are inferred from GZ-3.

Table 2: Recommended Use and Gradation Criteria For Fill Materials

USE OF FILL MATERIAL

Structural Fill: For use as fill within the structure area, except where Select Fill is specified.

Select Fill: Areas requiring free draining, non-frost susceptible backfill such as retaining walls and slab-on-grade base course.

Crushed Stone: Footing drains, slab-on-grade base course, and in wet conditions to aid in dewatering should consist of 3/8- to ¾-inch minus angular crushed stone and should consist of MASSDOT Standard Specifications for Highways and Bridges, 2024 Edition, Division III, M2.01.0: Crushed Stone, gradation M2.01.4 (3/4") to M2.01.5 (3/8"). Where crushed stone is greater than 4 inches thick, the Crushed Stone must be wrapped with Geotextile Fabric.

Processed Aggregate Base below pavements should consist of MASSDOT Standard Specifications for Highways and Bridges, 2024 Edition, Division III, M1.03.1: Processed Gravel for Subbase.

Pavement Subbase below pavements should consist of MASSDOT Standard Specifications for Highways and Bridges, 2024 Edition, Division III, M1.03.1: Processed Gravel for Subbase.

Geotextile Fabric should be used to separate crushed stone from surrounding soils. The fabric should consist of a filtration-type non-woven geotextile (Mirafi 140N or approved equal).

Ordinary Fill for use as general fill and backfill in landscaped areas should be friable inorganic soil essentially free of trash, ice, snow, tree stumps, roots and organic materials. Ordinary fill shall contain no stone or rubble exceeding two-thirds of the specified loose lift thickness for material placement.

Controlled Low Strength Material for use below structures or with utilities should meet the requirements of MASSDOT Standard Specifications for Highways and Bridges, 2024 Edition, Division III, M4.08.0: Controlled Low-Strength Materials.

GRADATION REQUIREMENTS

Sieve Size	Percent Finer by Weight
Structural Fill — Shall be free from ice and snow, roots, sod, rubbish and other deleterious or organic matter. Structural Fill shall conform to the following gradation requirements:	
3 inch	100
No. 4	40 – 85
No. 40	10 – 50
No. 200	0 – 12
Select Fill — Shall consist of durable sand and gravel and shall be free from ice and snow, roots, sod, rubbish and other deleterious or organic matter. Select Fill shall conform to the following gradation requirements:	
3 inch	100
No. 10	30 – 95
No. 40	10 – 70
No. 200	0 – 6

Table 3: Compaction Methods

The recommended minimum degree of compaction for fill and backfill, based on percentage of maximum dry density as determined by ASTM D1557 (modified Proctor), is:

Below the Foundations and Slab-on-Grade	-	95%
Pavement/Sidewalk Base and Subbase	-	95%
Adjacent to exterior Foundation Walls	-	92%
Within 3ft laterally of Retaining Walls	-	92%
Utility Trenches (within 1½ feet of surface)	-	95%
Utility Trenches (more than 1½ feet below surface)	-	92%
Areas of General Landscape	-	90%

Recommended maximum loose lift thicknesses for soil fill and the minimum number of passes of compaction equipment are summarized on the following table. Specifications should require the contractor to adjust loose lift thicknesses as required to meet the required compaction requirements

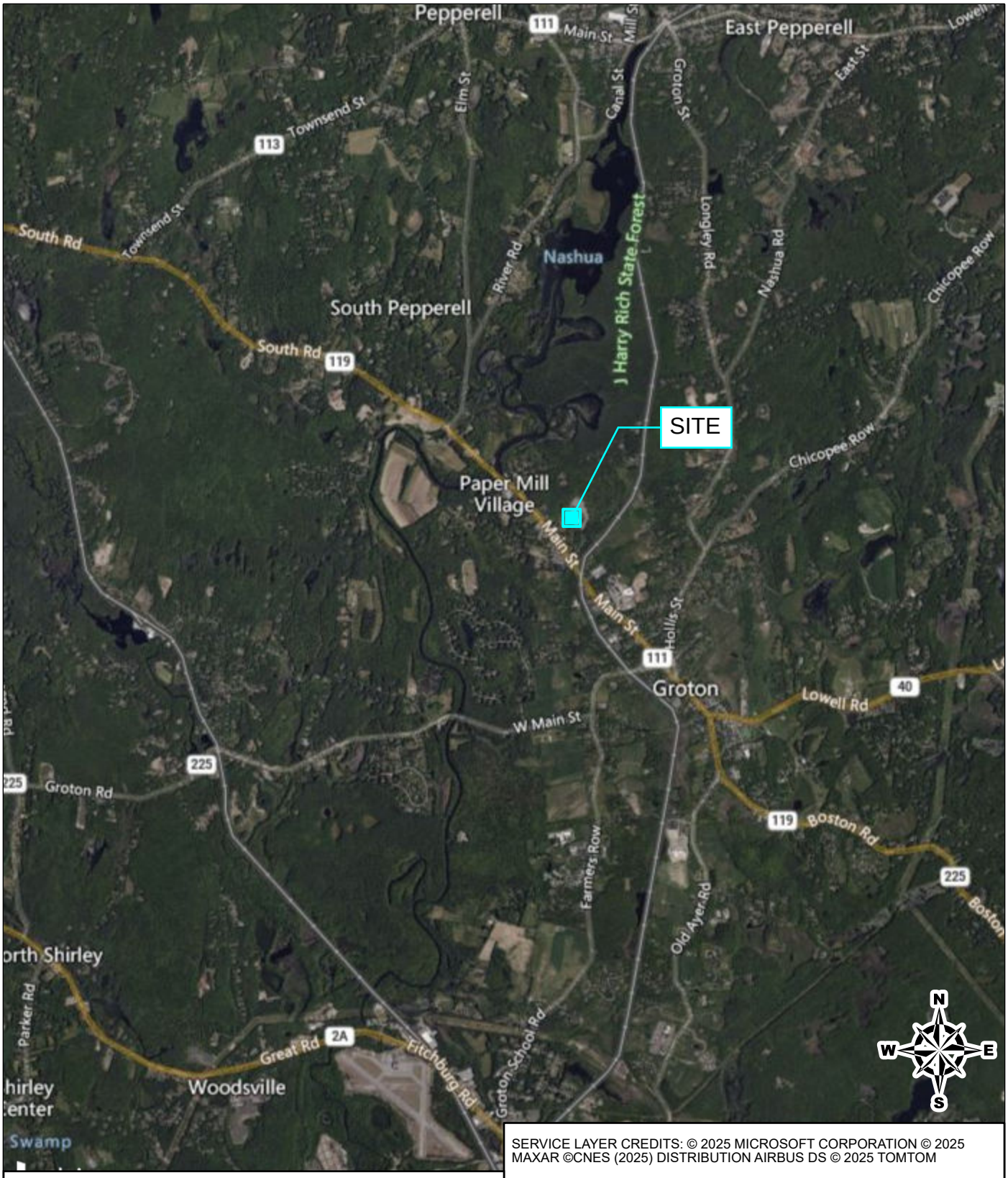
Compaction Method	Max. Stone Size*	Maximum Loose Lift Thickness		Minimum Number of Passes	
		Below Structures and Pavement	Less Critical Area	Below Structures and Pavement	Less Critical Area
STRUCTURAL FILL, SELECT FILL, CRUSHED STONE					
Hand-operated vibratory plate or light roller in confined areas	3”	6”	8”	6	4
Hand-operated vibratory drum rollers weighing at least 1,000# in confined areas	6”	8”	10”	6	4
Light vibratory drum roller, minimum dynamic force 3,000# per foot of drum width	6”	10”	14”	6	4
Medium to heavy vibratory drum roller, minimum dynamic force 5,000# per foot of drum width	8”	12”	18”	6	4

* Indicates not to exceed more than 2/3 the lift thickness

The Contractor should reduce or stop drum vibration if pumping or weaving of the subgrade is observed. Crushed Stone should be compacted to create an unyielding surface.

Compaction within 3-feet of retaining and foundation walls should be performed using hand-operated roller or plate compactors to reduce the potential for construction-induced damage to the walls. Extra care should be used when compacting adjacent to walls.

Figures



Legend

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0 0.42 0.85 1.7

mi

PROPOSED BUILDING

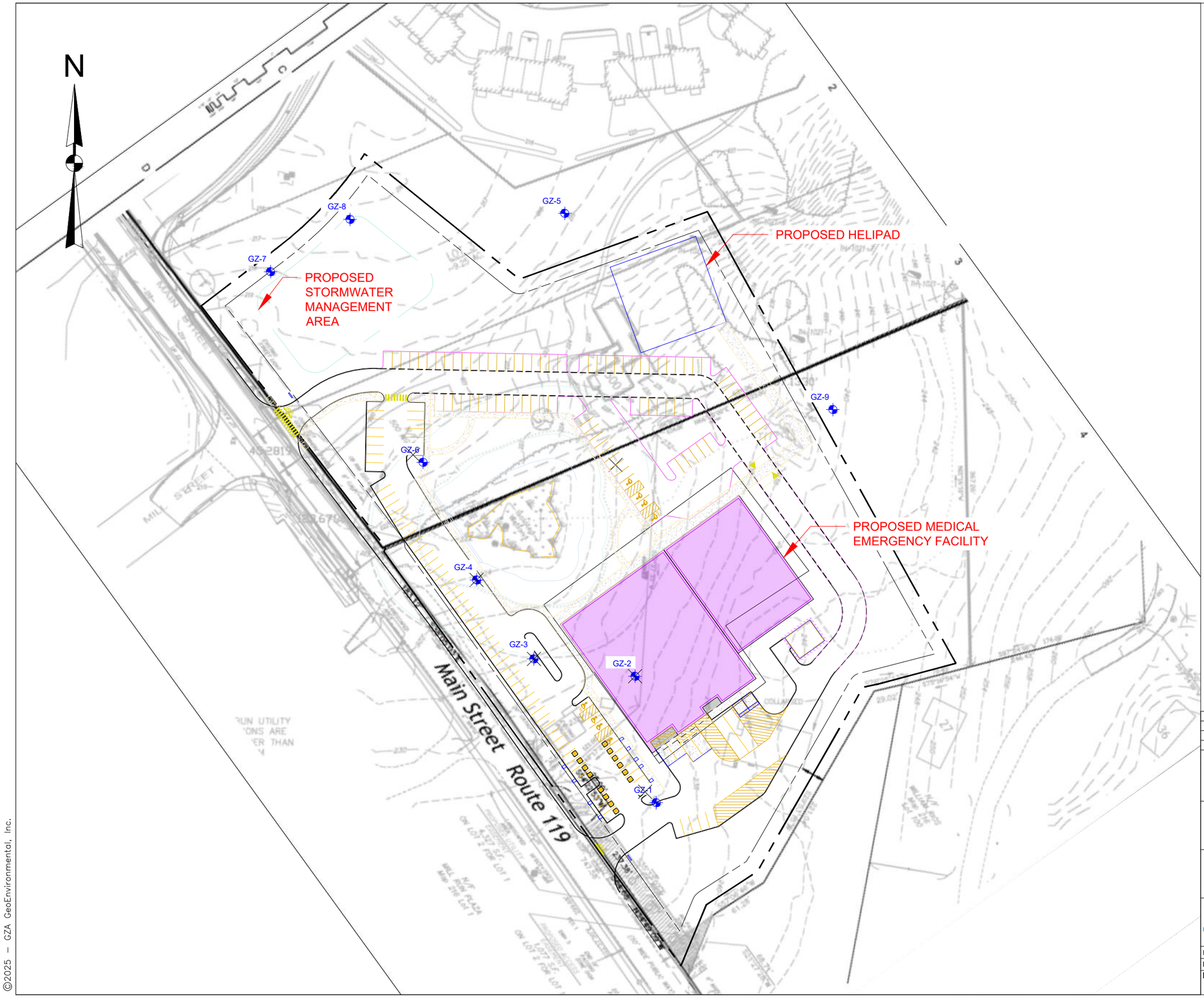
500 MAIN STREET, GROTON, MA

SITE LOCUS

PREPARED BY:
GZA GeoEnvironmental, Inc.
www.gza.com

PREPARED FOR:
THE SLAM COLLABORATIVE
80 GLASTONBURY BLVD., 3RD FLOOR

PROJ MGR: CGE	REVIEWED BY: DMB	CHECKED BY: NR	FIGURE 1
DESIGNED BY: PW	DRAWN BY: PW	SCALE: 1:72,224	
DATE: 05/09/2025	PROJECT NO: 05.0047465.00	REVISION NO:	



GENERAL NOTES

1. BASE MAP DEVELOPED FROM AN AUTOCAD DRAWING TITLED "16694.00 – PR.DWG" PREPARED BY, VHB, TRANSMITTED VIA EMAIL ON MAY 5, 2025.
2. THE LOCATIONS OF THE TEST BORINGS WERE APPROXIMATELY DETERMINED BY GZA PERSONNEL USING LINE OF SIGHT FROM EXISTING SITE FEATURES. THE LOCATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHODS USED.
3. THE PURPOSE OF THIS DRAWING IS TO LOCATE, DESCRIBE, AND REPRESENT THE POSITION OF THE TEST BORINGS IN RELATION TO THE SUBJECT SITE. THIS DRAWING IS NOT CONSIDERED A LAND SURVEY.
4. PARCEL INFORMATION FROM MASSMAPPER PARCEL DATA.
5. SEE TEST BORING LOGS IN APPENDIX B FOR ADDITIONAL INFORMATION.

LEGEND

GZ-1 INDICATES TEST BORINGS PERFORMED BY GEOSEARCH BETWEEN APRIL 15 AND 17, 2025 AND LOGGED BY GZA PERSONNEL.

0 50 100 200
SCALE IN FEET

NO.	ISSUE/DESCRIPTION	BY	DATE

PROPOSED MEDICAL DEVELOPMENT
500 MAIN STREET
GROTON, MASSACHUSETTS

EXPLORATION LOCATION PLAN

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:
THE SLAM COLLABORATIVE

PROJ MGR: CGE	REVIEWED BY: DMB	CHECKED BY: NR	FIGURE 2
DESIGNED BY: AK	DRAWN BY: CGE/PW	SCALE: AS NOTED	
DATE: 9 APRIL 2025	PROJECT NO. 05.0047465.00	REVISION NO. -	SHEET NO. 1 OF 1

Appendix A – Limitations

USE OF REPORT

1. GZA GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of our Client for the stated purpose(s) and location(s) identified in the Proposal for Services and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the contract documents, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in Proposal for Services and/or Report, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. If conditions other than those described in this report are found at the subject location(s), or the design has been altered in any way, GZA shall be so notified and afforded the opportunity to revise the report,as appropriate, to reflect the unanticipated changed conditions .

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, express or implied, is made.

4. In conducting our work, GZA relied upon certain information made available by public agencies, Client and/or others. GZA did not attempt to independently verify the accuracy or completeness of that information. Inconsistencies in this information which we have noted, if any, are discussed in the Report.

SUBSURFACE CONDITIONS

5. The generalized soil profile(s) provided in our Report are based on widely-spaced subsurface explorations and are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs. The nature and extent of variations between these explorations may not become evident until further exploration or construction. If variations or other latent conditions then become evident, it will be necessary to reevaluate the conclusions and recommendations of this report.

6. In preparing this report, GZA relied on certain information provided by the Client, state and local officials, and other parties referenced therein which were made available to GZA at the time of our evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.

7. Water level readings have been made in test holes (as described in this Report) and monitoring wells at the specified times and under the stated conditions. These data have been reviewed and interpretations have been made in this Report. Fluctuations in the level of the groundwater however occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, the presence of subsurface utilities, and/or natural or artificially induced perturbations. The water table encountered in the course of the work may differ from that indicated in the Report.

8. GZA's services did not include an assessment of the presence of oil or hazardous materials at the property. Consequently, we did not consider the potential impacts (if any) that contaminants in soil or groundwater may have on construction activities, or the use of structures on the property.

9. Recommendations for foundation drainage, waterproofing, and moisture control address the conventional geotechnical engineering aspects of seepage control. These recommendations may not preclude an environment that allows the infestation of mold or other biological pollutants.

COMPLIANCE WITH CODES AND REGULATIONS

10. We used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.

COST ESTIMATES

11. Unless otherwise stated, our cost estimates are only for comparative and general planning purposes. These estimates may involve approximate quantity evaluations. Note that these quantity estimates are not intended to be sufficiently accurate to develop construction bids, or to predict the actual cost of work addressed in this Report. Further, since we have no control over either when the work will take place or the labor and material costs required to plan and execute the anticipated work, our cost estimates were made by relying on our experience, the experience of others, and other sources of readily available information. Actual costs may vary over time and could be significantly more, or less, than stated in the Report.

ADDITIONAL SERVICES

12. GZA recommends that we be retained to provide services during any future: site observations, design, implementation activities, construction and/or property development/redevelopment. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.

Appendix B – Test Boring Logs

LOG KEY

GZA
Geo Environmental, Inc.
Engineers and Scientists

BURMISTER SOIL CLASSIFICATION

COMPONENT	NAME	PROPORTIONAL PERCENT BY TERM	WEIGHT
MAJOR	GRAVEL, SAND, FINES*		>50
Minor	Gravel, Sand, Fines*	and	35-50
		some	20-35
		little	10-20
*See identification of fines table.		trace	0-10

IDENTIFICATION OF FINES		
Material	**PI**	**Atterberg Thread Dia.**
SILT	0	Cannot Roll
Clayey SILT	1-5	1/4"
SILT & CLAY	5-10	1/8"
CLAY & SILT	10-20	1/16"
Silty CLAY	20-40	1/32"
CLAY	>40	1/64"

Sieve Size	Description
Passing #200	Silts & Clays
#200 - #40	Fine Sand
#40 - #10	Medium Sand
#10 - #4	Coarse Sand
#4 – ¾"	Fine Gravel
¾" – 3"	Coarse Gravel
3" – 6"	Cobbles
>6"	Boulders

GRADATION DESIGNATION	PROPORTION OF COMPONENT
Fine to coarse	All fractions > 10%
Medium to coarse	<10% fine
Fine to medium	<10% coarse
Coarse	<10% fine and medium
Medium	<10% coarse and fine
Fine	<10% coarse and medium

PLASTIC SOILS		
Consistency	**Blows/Ft. SPT N-Value**	
Very Soft	< 2	
Soft	2 - 4	
Medium Stiff	4 - 8	
Stiff	8 - 15	
Very Stiff	15 - 30	
Hard	>30	

GRAVEL & SAND	
Density	**Blows/Ft. SPT N-Value**
Very Loose	< 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) (ASTM D 2487)

MAJOR DIVISIONS			Group Symbols
Coarse Grained Soils	Gravel	Clean Gravels	GW
More than 50% of material	More than 50%	(Little or no fines	GP
larger than No. 200 sieve.	larger than No. 4 sieve.		
Gravels with Fines			GM
(Appreciable amount of fines)			GC
Sand		Clean Sands	SW
	More than 50%	(Little or no fines)	SP
	smaller than No. 4 sieve.		
Sands with Fines			SM
(Appreciable amount of fines)			SC
			ML
		Silts and Clays Liquid Limit <50	
Fine Grained Soils			CL
More than 50% of material			
smaller than No. 200 sieve.			OL
			MH
Silts and CLays Liquid Limit >50			CH
			OH
Highly Organic Soils			Pt

ORGANIC SOIL CLASSIFICATION

Fibrous PEAT (Pt) - Lightweight, spongy, mostly visible organic matter, water squeezes readily from sample. Typically near top of deposit.
Fine Grained PEAT (Pt) - Lightweight, spongy, little visible organic matter, water squeezes readily from sample. Typically below fibrous peat.
Organic Silt (OL) - Typically gray to dark gray, often has strong H2S odor. Typically contains shells or shell fragments. Lightweight. Usually found near coastal regions. May contain wide range of sand fractions.
Organic Clay (OH) - Typically gray to dark gray, high plasticity. Usually found near coastal regions. May contain wide range of sand fractions. Need organic content test for final identification.

ABBREVIATIONS

MR = Mud Rotary
HSA = Hollow Stem Auger
SSA = Solid Stem Auger
SS = Split Spoon Sampler
U = Undisturbed Sample (Shelby Tube)
MC = Modified California Sampler
V = Vibracore
M = Macrocore

USCS = Unified Soil Classification System (ASTM D2487)
NYCBC = New York City Building Code
WOR = Weight of Rods
WOH= Weight of Hammer
SPT = Standard Penetration Test (ASTM D1586)

Tv = Field Vane Shear Test (Torvane) Shear Strength
PP = Pocket Penetrometer Shear Strength
PI = Plasticity Index
Wn = Moisture Content
CO = Consolidation
UC = Unconfined Compression Test
UU = Unconsolidated Undrained (Triaxial) Test
SI = Sieve Analysis
DS = Direct Shear
PID = Photoionization Detector
ppm = Parts Per Million
REC = Recovery
RQD = Rock Quality Designation
= Measured Water Level

N-Value = Cumulative number of uncorrected blows for the middle two six-inch intervals (blows/foot).

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

500 Main Street
Groton, Massachusetts

EXPLORATION NO.: GZ-1
SHEET: 1 of 1
PROJECT NO: 05.0047465.00
REVIEWED BY: P. Waters

Logged By: L. Pattershall
Drilling Co.: GeoSearch
Foreman: P. McClenchen

Type of Rig: ATV
Rig Model: CME-55LC
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 235.5
Final Boring Depth (ft.): 12
Date Start - Finish: 4/16/2025 - 4/16/2025

H. Datum: Project
V. Datum: NAVD 88

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 3-1/4, 7-1/8

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Core Barrel Size: NA

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab. Time
4/16/25		9'	5 min

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	STRATUM Depth (ft.)	STRATUM Description	STRATUM Elev. (ft.)
		SS-1	0-2	24	10	3 9 11 9	20	SS-1 : Top 6": Dark brown, tan, fine to coarse SAND, some Silt, trace Roots Bottom 4": Grey, fine to coarse SAND, some Gravel, some Silt			0.5	TOPSOIL	235.0
		SS-2	2-4	24	13	2 2 2 1	4	SS-2 : Very loose, dark brown, tan, fine to medium SAND, some Silt, little Gravel				FILL	
5		SS-3	5-7	24	16	6 10 10 18	20	SS-3 : Top 3": Dark brown, fine to medium SAND, some Silt, trace roots			6		229.5
		SS-4	7-9	24	18	15 22 28 40	50	Bottom 13": Brown, tan, fine to coarse SAND and SILT, trace Gravel SS-4 : Top 7": Tan, orange, fine to medium SAND and SILT					
10		SS-5	9-11	24	24	13 66 110 162	R	Bottom 11": Brown, grey, fine to coarse SAND and GRAVEL, some Silt SS-5 : Very dense, dark grey, brown, fine to coarse SAND and GRAVEL, some Silt (wet)	1			GLACIAL TILL	
									2		12		223.5
								End of exploration at 12 feet below grade.	3				
15													
20													
25													
30													

REMARKS

1 - Wet spoon at SS-5.
2 - Auger refusal at 12 feet below ground surface.
3 - Borehole backfilled with spoils.

Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual.

Exploration No.: GZ-1

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

500 Main Street
Groton, Massachusetts

EXPLORATION NO.: GZ-2
SHEET: 1 of 1
PROJECT NO: 05.0047465.00
REVIEWED BY: P. Waters

Logged By: K. Peters
Drilling Co.: GeoSearch
Foreman: P. McClenchen

Type of Rig: ATV
Rig Model: CME-55LC
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 232
Final Boring Depth (ft.): 15.2
Date Start - Finish: 4/15/2025 - 4/15/2025

H. Datum: Project
V. Datum: NAVD 88

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 3-1/4, 7-1/8

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Core Barrel Size: NA

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab. Time
4/15/25		7'	5 min

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	STRATUM Depth (ft.)	STRATUM Description	STRATUM Elev. (ft.)
		SS-1	0-2	24	7	3 1 WOH 1	1	SS-1 : Very loose, brown, fine to medium SAND, some Gravel, some Silt, some Roots			0.4	TOPSOIL	231.6
											2	FILL	230.0
		SS-2	2-4	24	11	4 6 9 12	15	SS-2 : Medium dense, brown, fine to medium SAND and SILT, trace Gravel					
5		SS-3	5-7	24	6	7 11 10 10	21	SS-3 : Medium dense, light brown, fine to coarse SAND and GRAVEL, little Silt					
		SS-4	7-9	24	5	12 11 16 25	27	SS-4 : Medium dense, light brown, fine to coarse SAND and GRAVEL, little Silt (wet)	1 2			GLACIAL TILL	
10		SS-5	10-10.4	4	4	50/4"		SS-5 : Light brown, grey, fine to coarse SAND and GRAVEL, some Silt					
15		SS-6	15-15.2	2	2	50/2"		SS-6 : Very dense, light brown, grey, GRAVEL and fine to coarse SAND, trace Silt	3		15.2		216.8
								End of exploration at 15.2 feet below grade.					
20													
25													
30													

REMARKS

1 - Wet spoon at SS-4.
2 - Auger chatter between 7 and 15 feet below ground surface.
3 - Split spoon refusat at 15.2 feet below ground surface. Borehole backfilled with spoils.

Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual.

Exploration No.: GZ-2

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

500 Main Street
Groton, Massachusetts

EXPLORATION NO.: GZ-3
SHEET: 1 of 1
PROJECT NO: 05.0047465.00
REVIEWED BY: P. Waters

Logged By: K. Peters
Drilling Co.: GeoSearch
Foreman: P. McClenchen

Type of Rig: ATV
Rig Model: CME-55LC
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 228
Final Boring Depth (ft.): 6.3
Date Start - Finish: 4/15/2025 - 4/15/2025

H. Datum: Project
V. Datum: NAVD 88

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 3-1/4, 7-1/8

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Core Barrel Size: NA

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab. Time
4/15/25		Not Encountered	

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Depth (ft.)	STRATUM Description	Elev. (ft.)
		SS-1	0-2	24	13	6 5 4 4	9	SS-1 : Loose, light brown, fine to coarse SAND and GRAVEL, some Silt, trace Roots					
		SS-2	2-4	24	7	10 12 13 12	25	SS-2 : Medium dense, light brown, grey, fine to coarse SAND and GRAVEL, little Silt				FILL	
5		SS-3	5-6.3	15	13	6 11 50/3"		SS-3 : Light brown, grey, fine to coarse SAND, some Gravel, some Silt			5		223.0
								End of exploration at 6.3 feet below grade.	1 2		6.3	GLACIAL TILL	221.7
10													
15													
20													
25													
30													

REMARKS

1 - Split spoon refusal at 6.5 feet below ground surface. Boring offset to GZ-3A.
2 - Borehole backfilled with spoils.

Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual.

Exploration No.: GZ-3

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TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

500 Main Street
Groton, Massachusetts

EXPLORATION NO.: GZ-3A
SHEET: 1 of 1
PROJECT NO: 05.0047465.00
REVIEWED BY: P. Waters

Logged By: K. Peters
Drilling Co.: GeoSearch
Foreman: P. McClenchen

Type of Rig: ATV
Rig Model: CME-55LC
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 228
Final Boring Depth (ft.): 13.8
Date Start - Finish: 4/15/2025 - 4/15/2025

H. Datum: Project
V. Datum: NAVD 88

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 3-1/4, 7-1/8

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Core Barrel Size: NA

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab. Time
4/15/25		10'	5 min

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	STRATUM Depth (ft.)	STRATUM Description	STRATUM Elev. (ft.)
			0-10					: Augered to 10 feet.	1 2			FILL	
5											5		223.0
10		SS-1	10-10.4	5	4	50/5"		SS-1 : Light brown, GRAVEL and fine to coarse SAND, little Silt	3			GLACIAL TILL	
		SS-2	13.5-13.8	3	3	50/3"		SS-2 : Dark brown, GRAVEL and fine to coarse SAND, little Silt	4 5		13.8		214.2
15								End of exploration at 13.8 feet below grade.					
20													
25													
30													

REMARKS

1 - Boring offset from GZ-3. Augered to 10 feet below ground surface.
2 - Wet spoon at SS-1.
3 - Rig chatter and slow advancement from 10 to 13.5 feet below ground surface.
4 - Split spoon refusal at 13.8 feet below ground surface.
5 - Borehole backfilled with spoils.

Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual.

Exploration No.: GZ-3A

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

500 Main Street
Groton, Massachusetts

EXPLORATION NO.: GZ-4
SHEET: 1 of 1
PROJECT NO: 05.0047465.00
REVIEWED BY: P. Waters

Logged By: K. Peters
Drilling Co.: GeoSearch
Foreman: P. McClenchen

Type of Rig: ATV
Rig Model: CME-55LC
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 224
Final Boring Depth (ft.): 20.2
Date Start - Finish: 4/15/2025 - 4/15/2025

H. Datum: Project
V. Datum: NAVD 88

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 3-1/4, 7-1/8

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Core Barrel Size: NA

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab. Time
4/15/25		10'	5 min

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Depth (ft.)	STRATUM Description	Elev. (ft.)
		SS-1	0-2	24	12	5 6 4 10	10	SS-1 : Loose, light brown, fine to coarse SAND and GRAVEL, little Silt, trace Roots			0.2	TOPSOIL	223.8
		SS-2	2-4	24	15	9 8 9 8	17	SS-2 : Medium dense, grey, light brown, fine to coarse SAND and SILT, little Gravel				FILL	
5		SS-3	5-7	24	15	4 5 11 12	16	SS-3 : Top 10": Grey, light brown, fine to medium SAND Clayey SILT, little Gravel Bottom 5": Brown, fine to coarse SAND and GRAVEL, some Silt			4.5		219.5
10		SS-4	10-12	24	14	34 21 16 20	37	SS-4 : Dense, light brown, grey, GRAVEL and fine to coarse SAND, some Silt (wet)	1 2			GLACIAL TILL	
15		SS-5	15-16.8	22	13	19 32 51 50/4"	83	SS-5 : Very dense, grey, light brown, fine to coarse SAND and GRAVEL, little Silt					
20		SS-6	20-20.2	2	1.5	50/2"		SS-6 : Grey, light brown, GRAVEL and fine to coarse SAND, little Silt End of exploration at 20.2 feet below grade.	3 4		20.2		203.8
25													
30													

REMARKS

1 - Wet spoon at SS-4.
2 - Rig chatter observed while advancing from 10 to 20 feet below ground surface.
3 - Split spoon refusat 20.2 feet below ground surface.
4 - Borehole backfilled with spoils.

Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual.

Exploration No.: GZ-4

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

500 Main Street
Groton, Massachusetts

EXPLORATION NO.: GZ-5
SHEET: 1 of 1
PROJECT NO: 05.0047465.00
REVIEWED BY: P. Waters

Logged By: L. Pattershall
Drilling Co.: GeoSearch
Foreman: P. McClenchen

Type of Rig: ATV
Rig Model: CME-55LC
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 218.5
Final Boring Depth (ft.): 18.6
Date Start - Finish: 4/17/2025 - 4/17/2025

H. Datum: Project
V. Datum: NAVD 88

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 3-1/4, 7-1/8

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Core Barrel Size: NA

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab. Time
4/17/25		4'	5 min

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Depth (ft.)	STRATUM Description	Elev. (ft.)
		SS-1	0-2	24	14	1 3 3 4	6	SS-1 : Top 4": Dark brown, fine to medium SAND, some Silt, trace Roots Bottom 10": Tan, orange, fine to medium SAND, some Silt			0.3	TOPSOIL	218.2
		SS-2	2-4	24	15	2 3 4 5	7	SS-2 : Loose, tan, fine to medium SAND, trace Silt (wet)	1				
5		SS-3	5-7	24	15	3 4 6 6	10	SS-3 : Loose, tan, fine to coarse SAND, trace Gravel, trace Silt				STRATIFIED GLACIAL DEPOSITS	
		SS-4	7-9	24	24	6 7 7 9	14	SS-4 : Medium dense, tan, fine to coarse SAND, little Silt, trace Gravel					
10		SS-5	9-11	24	21	2 2 4 8	6	SS-5 : Loose, tan, fine to coarse SAND, trace Silt					
		SS-6	11-13	24	14	3 9 6 5	15	SS-6 : Top 7": Tan, fine to coarse SAND, trace Silt Bottom 7": Grey, fine to coarse SAND, some Gravel, some Silt			13		205.5
		SS-7	13-15	24	9	15 39 27 22	66	SS-7 : Top 5":: Grey, fine SAND, some Silt, little Gravel (Wet) Bottom 4": Tan, fine to medium SAND and SILT, some Gravel					
15		SS-8	15-17	24	10	12 29 32 28	61	SS-8 : Very dense, tan, grey, fine to coarse SAND and SILT, some Gravel				GLACIAL TILL	
		SS-9	17-18.6	19	12	27 29 100/6"		SS-9 : Grey, fine to coarse SAND and SILT, some Gravel	2		18.6		199.9
						100/1"		End of exploration at 18.6 feet below grade.	3				
20													
25													
30													

REMARKS

1 - Wet spoon at SS-2.
2 - Split spoon refusal at 18.6 feet below ground surface.
3 - Borehole backfilled with spoils and sand.

Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual.

Exploration No.: GZ-5

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

500 Main Street
Groton, Massachusetts

EXPLORATION NO.: GZ-6
SHEET: 1 of 1
PROJECT NO: 05.0047465.00
REVIEWED BY: P. Waters

Logged By: L. Pattershall
Drilling Co.: GeoSearch
Foreman: P. McClenchen

Type of Rig: ATV
Rig Model: CME-55LC
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 221
Final Boring Depth (ft.): 14.3
Date Start - Finish: 4/16/2025 - 4/16/2025

H. Datum: Project
V. Datum: NAVD 88

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 3-1/4, 7-1/8

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Core Barrel Size: NA

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab. Time
4/16/25		6'	5 min

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	STRATUM Depth (ft.)	STRATUM Description	STRATUM Elev. (ft.)
		SS-1	0-2	24	8	4 4 6 9	10	SS-1 : Loose, brown, fine to coarse SAND, some Gravel, little Silt			0.5	TOPSOIL	220.5
		SS-2	2-4	24	0	1 2 1 2	3	SS-2 : No Recovery				FILL	
5		SS-3	4-6	24	14	3 5 8 10	13	SS-3 : Top 2": Brown, fine to medium SAND, little Silt Bottom 12": Grey, fine to coarse SAND, some Silt, trace Gravel			5		216.0
		SS-4	6-8	24	13	6 9 15 18	24	SS-4 : Top 7": Brown, fine to medium SAND and SILT, tracde Gravel (wet) Bottom 6": Orange, brown, fine to medium SAND and SILT, little Gravel	1				
10		SS-5	10-12	24	15	11 16 17 18	33	SS-5 : Dense, tan, grey, fine to coarse SAND and GRAVEL, some Silt				STRATIFIED GLACIAL DEPOSITS	
		SS-6	12-14	24	18	5 10 42 99	52	SS-6 : Very dense, brown, grey, fine to coarse SAND and GRAVEL, some Silt					
15		SS-7	14-14.3	3	3	100/3"		SS-7 : Grey, GRAVEL, some fine to coarse Sand, little Silt (wet)	2		14.3		206.7
								End of exploration at 14.3 feet below grade.					
20													
25													
30													

REMARKS

1 - Wet spoon at SS-4.
2 - Borehole backfilled with spoils.

Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual.

Exploration No.: GZ-6

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

500 Main Street
Groton, Massachusetts

EXPLORATION NO.: GZ-7
SHEET: 1 of 1
PROJECT NO: 05.0047465.00
REVIEWED BY: P. Waters

Logged By: L. Pattershall
Drilling Co.: GeoSearch
Foreman: P. McClenchen

Type of Rig: ATV
Rig Model: CME-55LC
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 218
Final Boring Depth (ft.): 10
Date Start - Finish: 4/17/2025 - 4/17/2025

H. Datum: Project
V. Datum: NAVD 88

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 3-1/4, 7-1/8

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Core Barrel Size: NA

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab. Time
4/17/25		4'	5 min

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	Sample SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	STRATUM Depth (ft.)	STRATUM Description	STRATUM Elev. (ft.)
		SS-1	0-2	24	13	2 4 6 5	10	SS-1 : Top 5": Dark brown, fine to medium SAND, some Silt, trace Roots Bottom 8": Brown, fine to coarse SAND, some Silt, some Gravel			0.4	TOPSOIL	217.6
		SS-2	2-4	24	19	5 5 6 5	11	SS-2 : Top 6": Brown, fine to medium SAND, some Silt, little Gravel Bottom 6": Orange, brown, fine to medium SAND, some Silt, trace Gravel			2.5	FILL	215.5
5		SS-3	4-6	24	18	3 5 7 8	12	SS-3 : Medium dense, tan, orange, fine to coarse SAND, trace Silt (wet)	1		3	BURIED TOPSOIL	215.0
		SS-4	6-8	24	23	9 11 11 11	22	SS-4 : Medium dense, tan, orange, fine to coarse SAND, trace Silt				STRATIFIED GLACIAL DEPOSITS	
		SS-5	8-10	24	19	3 4 5 13	9	SS-5 : Loose, tan, fine to coarse SAND, trace Silt					
10											10		208.0
								End of exploration at 10 feet below grade.	2				
15													
20													
25													
30													

REMARKS

1 - Wet spoon at SS-3.
2 - Borehole backfilled with spoils.

Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual.

Exploration No.: GZ-7

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

500 Main Street
Groton, Massachusetts

EXPLORATION NO.: GZ-8
SHEET: 1 of 1
PROJECT NO: 05.0047465.00
REVIEWED BY: P. Waters

Logged By: L. Pattershall
Drilling Co.: GeoSearch
Foreman: P. McClenchen

Type of Rig: ATV
Rig Model: CME-55LC
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 216
Final Boring Depth (ft.): 10
Date Start - Finish: 4/16/2025 - 4/16/2025

H. Datum: Project
V. Datum: NAVD 88

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 3-1/4, 7-1/8

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Core Barrel Size: NA

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab. Time
4/16/25		2'	5 min

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	STRATUM Depth (ft.)	STRATUM Description	STRATUM Elev. (ft.)
		SS-1	0-2	24	13	1 2 5 5	7	SS-1 : Top 7": Dark brown, fine to medium SAND, some Silt, little Roots Bottom 6": Tan, orange, fine to coarse SAND, some Silt			0.6	TOPSOIL	215.4
		SS-2	2-4	24	16	2 4 5 6	9	SS-2 : Loose, tan, orange, fine to medium SAND, trace Silt (wet)	1				
5		SS-3	4-6	24	16	4 5 5 5	10	SS-3 : Medium dense, tan, fine to coarse SAND, trace Silt				STRATIFIED GLACIAL DEPOSITS	
		SS-4	6-8	24	23	5 5 6 10	11	SS-4 : Medium dense, tan, fine to coarse SAND, trace Silt, trace Gravel					
		SS-5	8-10	24	23	4 8 22 23	30	SS-5 : Medium dense, tan, fine to coarse SAND, trace Silt, trace Gravel					
10											10		206.0
								End of exploration at 10 feet below grade.	2				
15													
20													
25													
30													

REMARKS

1 - Wet spoon at SS-2.
2 - Borehole backfilled with spoils.

Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual.

Exploration No.: GZ-8

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

500 Main Street
Groton, Massachusetts

EXPLORATION NO.: GZ-9
SHEET: 1 of 1
PROJECT NO: 05.0047465.00
REVIEWED BY: P. Waters

Logged By: L. Pattershall
Drilling Co.: GeoSearch
Foreman: P. McClenchen

Type of Rig: ATV
Rig Model: CME-55LC
Drilling Method: HSA

Boring Location: See Plan
Ground Surface Elev. (ft.): 240
Final Boring Depth (ft.): 23
Date Start - Finish: 4/16/2025 - 4/16/2025

H. Datum: Project
V. Datum: NAVD 88

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 3-1/4, 7-1/8

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Core Barrel Size: NA

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab. Time
4/16/25		4.5'	5 min

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Sample Pen. (in)	Sample Rec. (in)	Sample Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Depth (ft.)	STRATUM Description	Elev. (ft.)
		SS-1	0-2	24	12	1 3 6 8	9	SS-1 : Loose, dark brown, fine to coarse SAND and SILT, trace Gravel			0.5	TOPSOIL	239.5
												FILL	
		SS-2	2-4	24	16	2 8 12 21	20	SS-2 : Medium dense, light brown, grey, fine to coarse SAND and GRAVEL, some Silt			2		238.0
5		SS-3	5-7	24	8	3 3 1 2	4	SS-3 : Loose, grey, brown, fine to medium SAND, some Silt, trace Gravel (wet)	1				
		SS-4	7-9	24	16	2 2 3 3	5	SS-4 : Loose, grey, fine to medium SAND and SILT, trace Roots				STRATIFIED GLACIAL DEPOSITS	
10		SS-5	10-12	24	13	4 6 7 9	13	SS-5 : Medium dense, grey, SILT and fine SAND (wet)					
											13.5		226.5
15		SS-6	15-17	24	8	9 11 11 14	22	SS-6 : Medium dense, dark grey, fine to coarse SAND and GRAVEL, some Silt				GLACIAL TILL	
20		SS-7	20-20.5	6	6	90 50/0		SS-7 : Dark grey, GRAVEL and fine to coarse SAND, some Silt	1		21		219.0
		C-1	21-23	24	19			C-1 : Hard, moderatley to extremely fractured, very slight weathering, light grey, white, fine to medium grained SCHIST REC=53%, RQD=0%				SCHIST	
									2		23		217.0
25								End of exploration at 23 feet below grade.					
30													

REMARKS

1 - Wet spoon at SS-3.
1 - Split spoon refusal at 20.5 feet. Rock core sample collected from 21 feet to 23 feet.
2 - Borehole backfilled with spoils.

Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual.

Exploration No.: GZ-9

Appendix C – Laboratory Test Data

Thielsch
DIVISION OF THE RISE GROUP

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
cts.thielsch.com
Let's Build a Solid Foundation

Client Information:		Project Information:	
GZA GeoEnvironmental, Inc.		**500 Main Street**	
Norwood, MA		**Groton, MA**	
781-278-4809		Project Number:	05.0047465.00 - Task 1
Project Contact:	Chris Eggers	Summary Page:	1 of 1
Collected By:	Client	Report Date:	5.1.2025

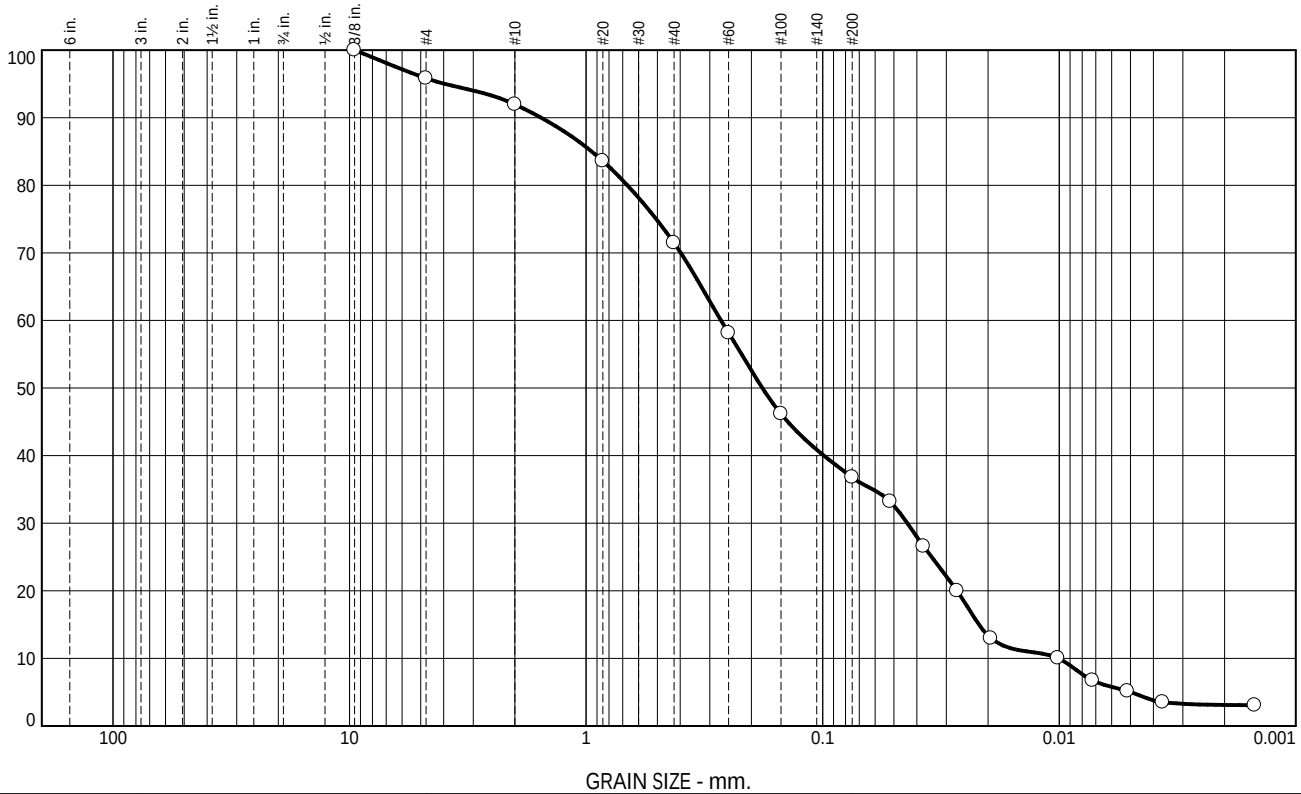
LABORATORY TESTING DATA SHEET, Report No.: 7425-D-B068

Material Source	Sample ID	Depth (ft)	Laboratory No.	Identification Tests									Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Rcvd Moisture Content %	LL %	PL %	OD LL	Gravel %	Sand %	Fines %	Org. %	pH	g_d MAX (pcf) W_{opt} (%)	g_d MAX (pcf) W_{opt} (%) (Corr.)	Dry unit wt. (pcf)	Test Moisture Content %	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318			D6913			D2974	D4792	D1557								
Test Pit	GZ-2 / S-2	2-4	25-S-B660					4.2	59.0	36.8											Brown f-m SAND and SILT, trace fine Gravel
Test Pit	GZ-5 / S-2	2-4	25-S-B661					0.0	98.1	1.9											Brown f-m SAND, trace Silt
Test Pit	GZ-5 / S-6/ Bottom 9"	11-13	25-S-B662					22.7	48.2	29.1											Grey f-c Sand, some Silt, some f-c Gravel
Test Pit	GZ-8 / S-2	2-4	25-S-B663					0.0	97.3	2.7											Brown f-m SAND, trace Silt

Date Received: **4.25.2025** Reviewed By: Michael C Collins Date Reviewed: **5.1.2025**

Particle Size Distribution Report

ASTM D6913 and D7928



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.2	3.8	20.5	34.7	33.7	3.1

Test Results (ASTM D6913 and D7928)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
3/8"	100.0			
#4	95.8			
#10	92.0			96.0
#20	83.6			87.2
#40	71.5			74.6
#60	58.2			60.7
#100	46.2			48.2
#200	36.8			38.4
0.0519 mm.	33.2			
0.0374 mm.	26.6			
0.0270 mm.	20.0			
0.0195 mm.	13.0			
0.0101 mm.	10.0			
0.0072 mm.	6.7			
0.0051 mm.	5.2			
0.0036 mm.	3.5			
0.0015 mm.	3.1			

* (no specification provided)

Material Description

Brown f-m SAND and SILT, trace fine Gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 1.5490 D_{85}= 0.9481 D_{60}= 0.2692
D_{50}= 0.1797 D_{30}= 0.0439 D_{15}= 0.0218
D_{10}= 0.0101 C_u= 26.74 C_c= 0.71

Classification

USCS= SM AASHTO= A-4(0)

Test Remarks

Source of Sample: Test Pit Depth: 2-4
Sample Number: GZ-2 / S-2 Sample Date: 5.1.2025

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: 500 Main Street
Groton, MA
Project No: 05.0047465.00 - Task 1 Figure 25-S-B660

Tested By: MA Checked By: Michael Collins

Particle Size Distribution Report

ASTM D6913 and D7928

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	4.9	53.3	39.9	1.9	

Test Results (ASTM D6913 and D7928)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
#4	100.0			
#10	95.1			95.1
#20	71.5			71.5
#40	41.8			41.8
#60	16.0			16.0
#100	5.1			5.1
#200	1.9			1.9
0.0569 mm.	0.1			
0.0403 mm.	0.1			
0.0285 mm.	0.1			
0.0201 mm.	0.1			
0.0147 mm.	0.1			
0.0104 mm.	0.1			
0.0074 mm.	0.0			
0.0052 mm.	0.0			
0.0037 mm.	0.0			
0.0015 mm.				

* (no specification provided)

Material Description

Brown f-m SAND, trace Silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 1.5548 D_{85}= 1.2880 D_{60}= 0.6359
D_{50}= 0.5086 D_{30}= 0.3373 D_{15}= 0.2424
D_{10}= 0.2016 C_u= 3.16 C_c= 0.89

Classification

USCS= SP AASHTO= A-1-b

Test Remarks

Source of Sample: Test Pit Depth: 2-4
Sample Number: GZ-5 / S-2 Sample Date: 5.1.2025

Thielsch Engineering Inc.

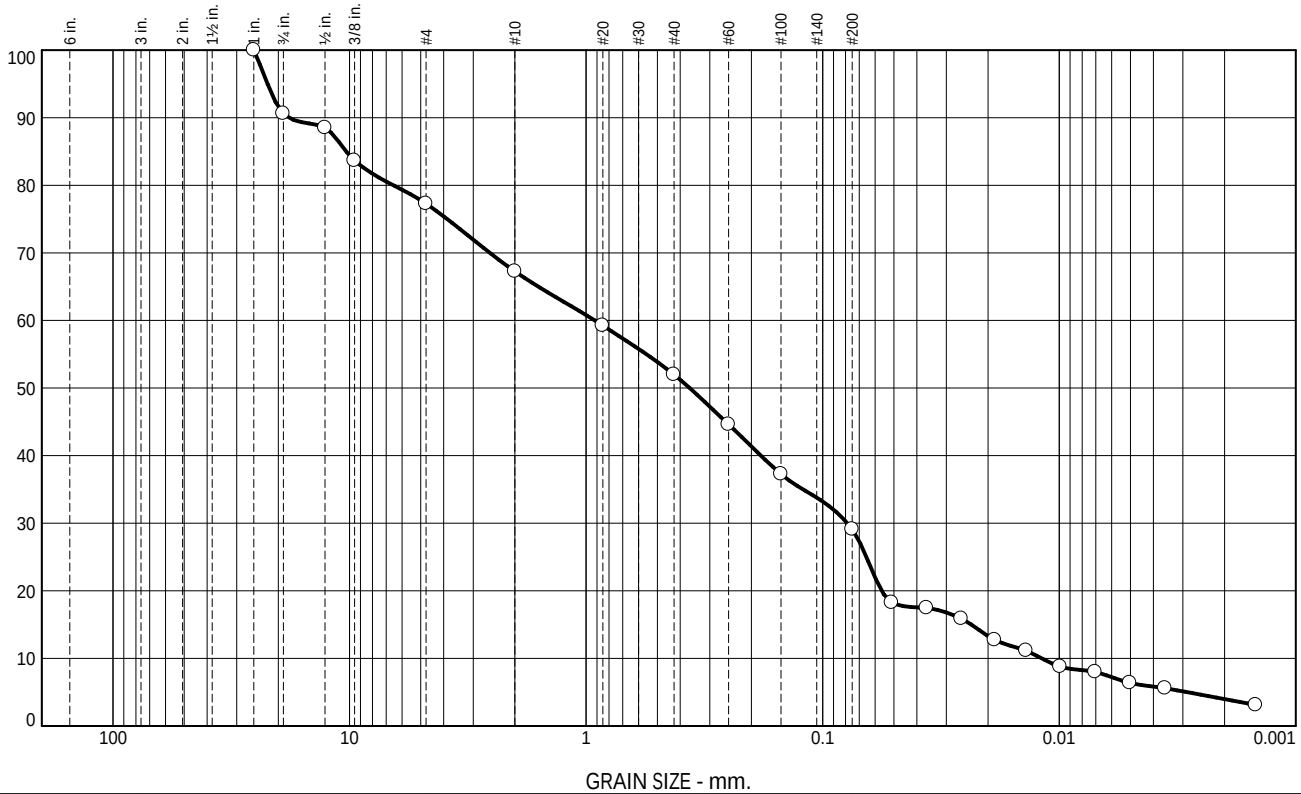
Cranston, RI

Client: GZA GeoEnvironmental
Project: 500 Main Street
Groton, MA
Project No: 05.0047465.00 - Task 1 Figure 25-S-B661

Tested By: MA Checked By: Michael Collins

Particle Size Distribution Report

ASTM D6913 and D7928



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.4	13.3	10.1	15.2	22.9	25.1	4.0

Test Results (ASTM D6913 and D7928)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
1"	100.0			
3/4"	90.6			
1/2"	88.5			
3/8"	83.6			
#4	77.3			
#10	67.2			87.0
#20	59.2			76.7
#40	52.0			67.3
#60	44.6			57.7
#100	37.3			48.2
#200	29.1			37.7
0.0510 mm.	18.2			
0.0363 mm.	17.4			
0.0259 mm.	15.9			
0.0187 mm.	12.7			
0.0138 mm.	11.1			
0.0099 mm.	8.8			
0.0070 mm.	8.0			
0.0050 mm.	6.4			
0.0036 mm.	5.6			
0.0015 mm.	3.1			

* (no specification provided)

Material Description

Grey f-c SAND, some Silt, some f-c Gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 18.0363 D_{85}= 10.3321 D_{60}= 0.9188
D_{50}= 0.3648 D_{30}= 0.0786 D_{15}= 0.0235
D_{10}= 0.0118 C_u= 77.57 C_c= 0.57

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Source of Sample: Test Pit Depth: 11-13
Sample Number: GZ-5 / S-6/Bottom 9" Sample Date: 5.1.2025

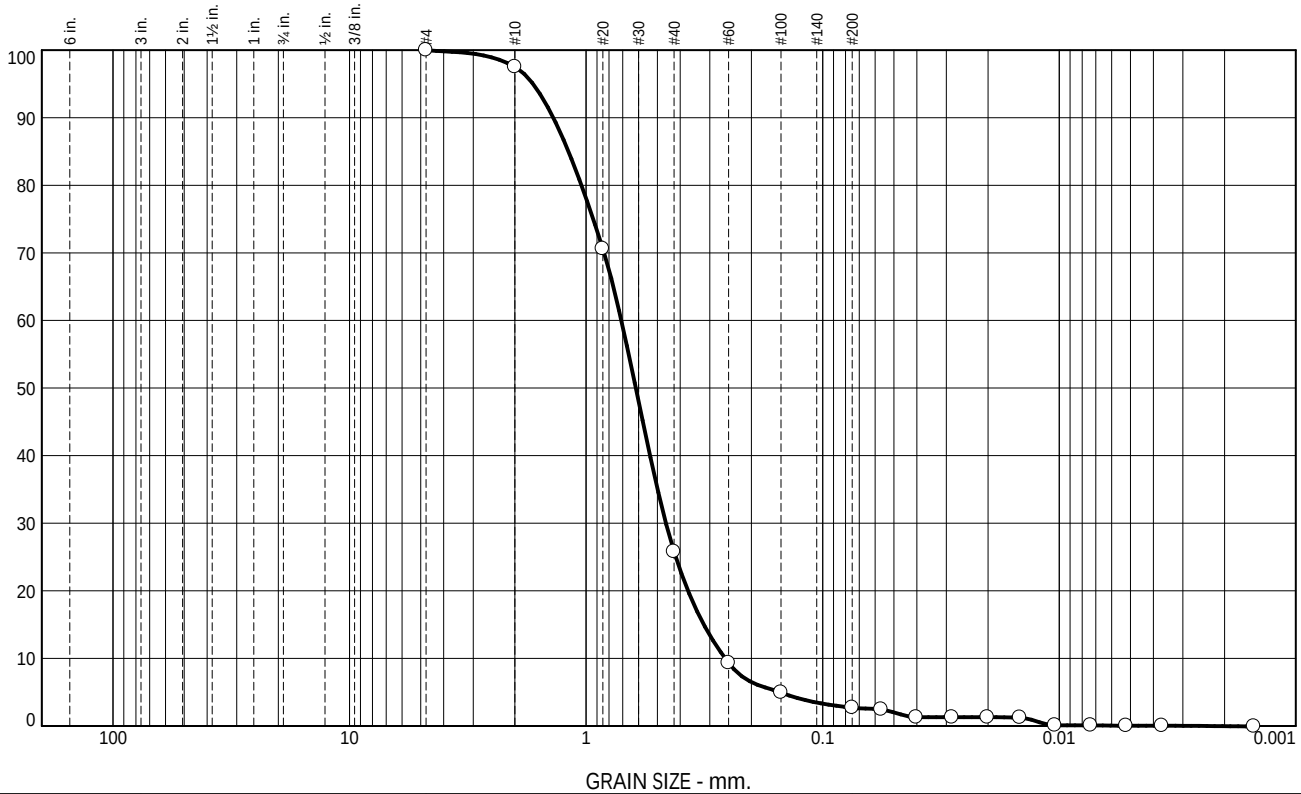
Thielsch Engineering Inc.
Cranston, RI

Client: GZA GeoEnvironmental
Project: 500 Main Street
Groton, MA
Project No: 05.0047465.00 - Task 1 Figure 25-S-B662

Tested By: MA Checked By: Michael Collins

Particle Size Distribution Report

ASTM D6913 and D7928



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	2.5	71.7	23.1	2.7	

Test Results (ASTM D6913 and D7928)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
#4	100.0			
#10	97.5			97.5
#20	70.6			70.6
#40	25.8			25.8
#60	9.3			9.3
#100	4.9			4.9
#200	2.7			2.7
0.0565 mm.	2.4			
0.0401 mm.	1.3			
0.0284 mm.	1.3			
0.0201 mm.	1.3			
0.0147 mm.	1.2			
0.0104 mm.	0.1			
0.0074 mm.	0.1			
0.0052 mm.	0.0			
0.0037 mm.	0.0			
0.0015 mm.				

* (no specification provided)

Material Description

Brown f-m SAND, trace Silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 1.3762 D_{85}= 1.1874 D_{60}= 0.7098
D_{50}= 0.6163 D_{30}= 0.4600 D_{15}= 0.3181
D_{10}= 0.2583 C_u= 2.75 C_c= 1.15

Classification

USCS= SP AASHTO= A-1-b

Test Remarks

Source of Sample: Test Pit Depth: 2-4
Sample Number: GZ-8 / S-2 Sample Date: 5.1.2025

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental
Project: 500 Main Street
Groton, MA
Project No: 05.0047465.00 - Task 1 Figure 25-S-B663

Tested By: MA Checked By: Michael Collins

Appendix D – Rock Core Photographs

500 Main Street, Groton, Massachusetts

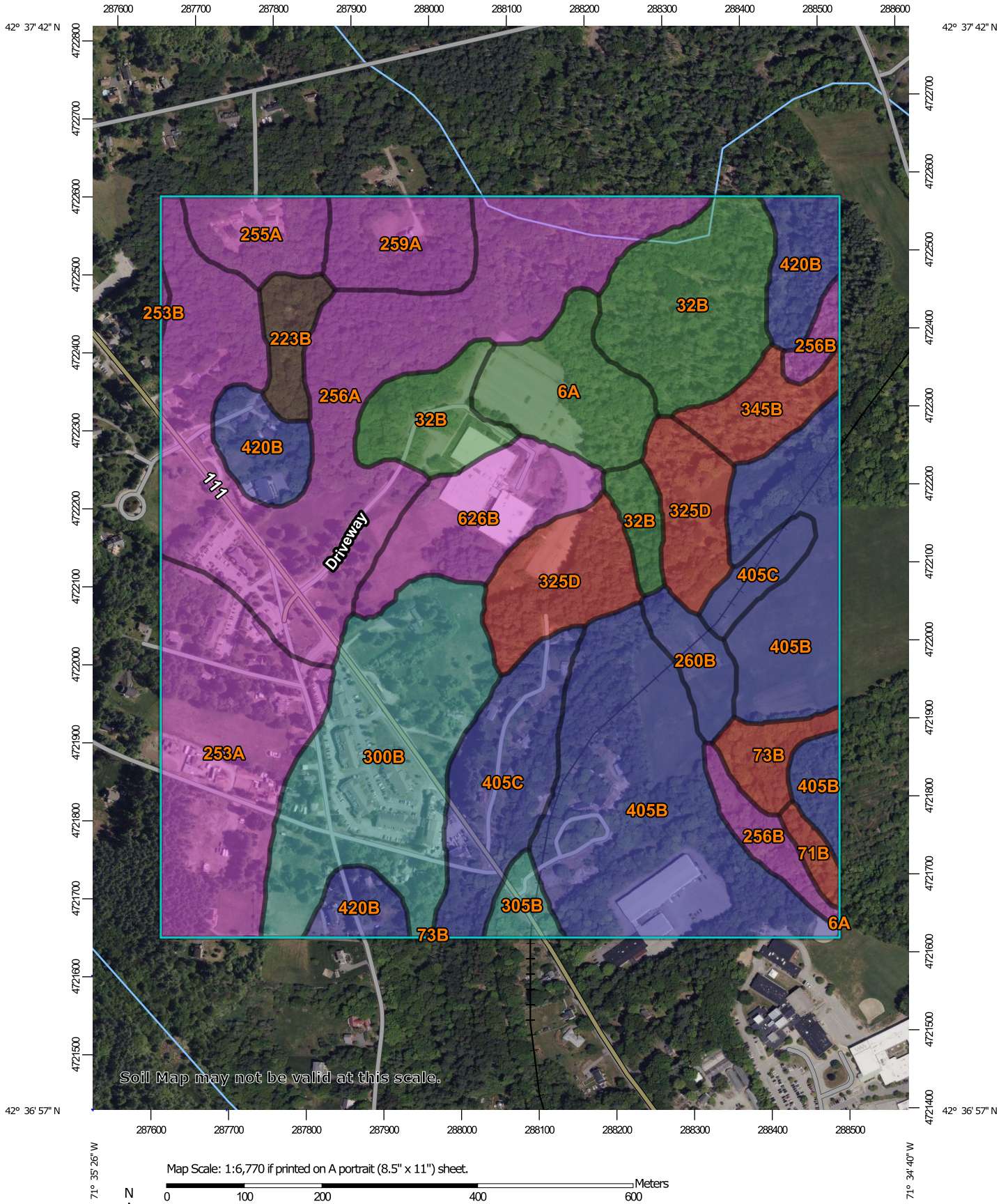
Rock Core Photographs

Boring No.	Run	Depth (ft)	Recovery (in)	Recovery (%)	RQD (in)	RQD (%)	Rock Type	Box Row
GZ-9	C-1	20 - 23	19	53	0	0	SCHIST	1

Notes:
1. Box row corresponds to the core box section in which the rock core sample is contained; Row 1 = Top, Row 4 = Bottom.
2. Top photo is dry; bottom photo is wetted.
3. Rock core sample starts on left side of photo.

GZA GeoEnvironmental, Inc.

Hydrologic Soil Group—Middlesex County, Massachusetts



Map Scale: 1:6,770 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 300 600 1200 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 24, Aug 27, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	A/D	7.7	3.7%
32B	Wareham loamy fine sand, 0 to 5 percent slopes	A/D	18.5	9.0%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	1.1	0.5%
73B	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	2.7	1.3%
223B	Scio very fine sandy loam, 3 to 8 percent slopes	B/D	2.8	1.4%
253A	Hinckley loamy sand, 0 to 3 percent slopes	A	18.1	8.8%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	0.1	0.1%
255A	Windsor loamy sand, 0 to 3 percent slopes	A	4.3	2.1%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	A	36.3	17.6%
256B	Deerfield loamy fine sand, 3 to 8 percent slopes	A	3.6	1.8%
259A	Carver loamy coarse sand, 0 to 3 percent slopes	A	5.6	2.7%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	B	2.9	1.4%
300B	Montauk fine sandy loam, 3 to 8 percent slopes	C	20.6	10.0%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	1.7	0.8%
325D	Newport channery fine sandy loam, 8 to 25 percent slopes	D	11.5	5.6%
345B	Pittstown silt loam, 3 to 8 percent slopes	D	3.8	1.9%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
405B	Charlton fine sandy loam, 3 to 8 percent slopes	B	34.8	16.9%
405C	Charlton fine sandy loam, 8 to 15 percent slopes	B	11.8	5.7%
420B	Canton fine sandy loam, 3 to 8 percent slopes	B	9.5	4.6%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	8.4	4.1%
Totals for Area of Interest			**206.0**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Recharge Calculations

Project	Nashoba Satellite Emergency Facility	**Project #**	16694.00
Calculated by	CSH	**Date**	5/30/2025
Checked by	KSS	**Date**	6/19/2025

REQUIRED RECHARGE VOLUME

Hydrologic Soil Group (HSG)	Impervious Area (ft^2)	Inches of Runoff (in)	Volume (ft^3)
A	1,230	0.60	62
B	31,892	0.35	930
C	134,616	0.25	2,805
D	2,885	0.10	24
TOTAL			**3,820**

CAPTURE AREA ADJUSTMENT

Required Recharge Volume (ft^3)	3,820
Total Site Net Impervious Area (ft^2)	170,623
Total Site Impervious Area Draining to Recharge Facilities (ft^2)	170,623
Capture Area Adjustment Factor	1.00
Adjusted Required Recharge Volume (ft^3)	**3,820**

PROVIDED RECHARGE VOLUME

Infiltration Basin #1P

Volumes provided below the lowest outlet at elevation: 220.6

Provided Volume:

Elevation	Area (ft^2)	Cumulative Volume (ft^3)
217.0	7,872	0
218.0	9,153	8,513
219.0	10,527	18,353
220.0	11,995	29,614
220.6	12,921	**37,088**

Drawdown: $(V_{Infiltration}/A_{Bottom})$/Rawl's Rate

Rawls Recharge Rate:	**8.27**	(in/hr)
Drawdown Time:	**7**	(hours)

Recharge Calculations

Project	Nashoba Satellite Emergency Facility	**Project #**	16694.00
Calculated by	CSH	**Date**	5/30/2025
Checked by	KSS	**Date**	6/19/2025

RECHARGE VOLUME SUMMARY

Required Recharge Volume:	**3,820**	(ft^3)
Total Recharge Volume Provided:	**37,088**	(ft^3)

120 Front Street Suite 500

Worcester, MA 01608

P 508.752.1001

Mounding Analysis

Project:	Nashoba SEF	**Project #:**	16694.00
Calculated by:	CSH	**Date:**	6/19/2025
Checked by:	KSS	**Date:**	6/19/2025

In accordance with MassDEP Stormwater Management Standards, mounding analysis is required for the proposed stormwater infiltration system as the bottom of the system, 217 is within 4 feet of estimated seasonal high groundwater (ESHGW), 214, and the system is used to attenuate the peak discharge rates for the 10-year and larger storms. The mounding analysis was performed using the Hantush method and calculation of the equation variables is included below.

Horizontal Hydraulic Conductivity (K)

Assumed to be 10x greater than the horizontal hydraulic conductivity (Rawl's Rate).

Rawl's	8.27	IN/HR
K	82.7	IN/HR
	165.4	**FT/DAY**

Specific Yield (ε)

From Table 4.2 Values of Specific Yield for Various Geologic Materials, Physical and Chemical Hydrogeology by Patrick A. Domerico and Franklin W. Schwartz. Sand.

Sy	**20**	**%**

Initial Saturated Thickness (h_i)

Estimated seasonal high groundwater (ESHGW) is 214.0 in the vicinity of the infiltration system . Bottom of borings/test pits is 206.0, which is assumed to be the bottom of the aquifer.

ESHGW	ESHGW	214	FT
Bottom of Aquifer		206	FT
hi	ESHGW - Elevation at Bottom of Aquifer		FT
hi		**8**	**FT**

Recharge Area Dimensions (A/B)

The stormwater recharge area consists of ... The system footprint is 177 feet long by 76 feet wide.

A	**177**	**FT**
B	**44.47**	**FT**
	44.5	

Recharge Rate (w)

The recharge rate is the runoff volume over the recharge bottom area. For this calculation, the runoff volume for the 10-year, 24-hour storm event was used.

Volume	74,052	CF/DAY
Area	7,871	SF
w	Volume/Area	FT/DAY
w	**9.41**	**FT/DAY**

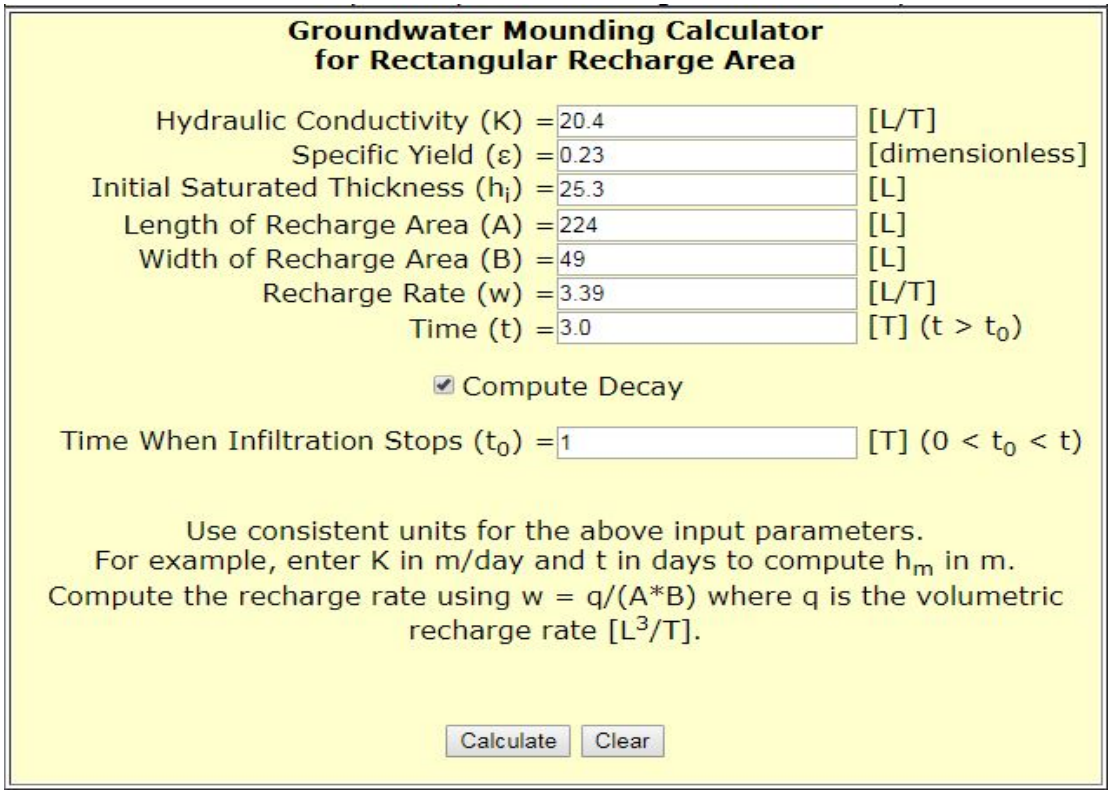
Time (t)

Per MassDEP Stormwater Management Standards, infiltration system must be fully dewatered (the maximum height of the mound below the bottom of system) within 72 hours (3 days).

t	3	**DAYS**

Below, the inputs for the mounding analysis are shown for the online calculator using the Hantush method, provided at http://www.aqtesolv.com/forum/rmound.asp. The results are included on the following page. As shown, the maximum height of the mound at 72 hours is X feet above ESHGW, or elevation X. This is below the bottom of the infiltration system at X.

Note to Engineer: Add screen capture of output from website below



Groundwater Mounding Calculator for Rectangular Recharge Area

Hydraulic Conductivity (K) =	20.4	[L/T]
Specific Yield (ε) =	0.23	[dimensionless]
Initial Saturated Thickness (h_i) =	25.3	[L]
Length of Recharge Area (A) =	224	[L]
Width of Recharge Area (B) =	49	[L]
Recharge Rate (w) =	3.39	[L/T]
Time (t) =	3.0	[T] ($t > t_0$)

☑ Compute Decay

Time When Infiltration Stops (t_0) = 1 [T] ($0 < t_0 < t$)

Use consistent units for the above input parameters.
For example, enter K in m/day and t in days to compute h_m in m.
Compute the recharge rate using w = q/(A*B) where q is the volumetric recharge rate [L^3/T].

Calculate Clear

Transient Water-Table Rise Beneath a Rectangular Recharge Area
Groundwater Mounding Solution by Hantush (1967)

Aquifer Properties:
Hydraulic conductivity, K = 165.4 ft/day
Specific yield, Sy = 0.2
Initial saturated thickness, h(0) = 8 ft

Recharge Area Properties:
Recharge rate, w = 9.41 ft/day
Simulation time, t = 3 day
Time when recharge stops, t(0) = 1 day
X coordinate at center of recharge area, X = 44.25 ft
Y coordinate at center of recharge area, Y = 19 ft
Length in x direction, l = 88.5 ft
Length in y direction, a = 38 ft

Water-Table Rise at Center of Recharge Area:

t (day)	h (ft)
0.3	3.83713
0.6	4.70171
0.9	5.19097
1.2	2.75042
1.5	1.81926
1.8	1.38807
2.1	1.12886
2.4	0.953556
2.7	0.826376
3	0.729627

Note: recovery begins after 1 day.

Report generated by AQTESOLV v4.50.002 (www.aqtesolv.com) on 06/19/25 at 15:01:11.

Appendix D: Standard 4 Computations and Supporting Information

- Operation and Maintenance Plan
- Water Quality Volume Calculations
- TSS Removal Worksheets

Nashoba Satellite Emergency Facility

490 Main Street, Groton MA 01450

PREPARED FOR

UMass Memorial Health Care
55 N Lake Avenue
Worcester, MA 01655
(508) 334-1000

PREPARED BY

120 Front Street
Suite 500
Worcester, MA 01608
508.752.1001

Summer 2025

Table of Contents

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Project Information

Site

Nashoba Satellite Emergency Facility
490 Main Street
Groton, Massachusetts

Developer

Chris Andersen
281 Lincoln Street
Worcester, MA 01605
(508)334-8168

Site Supervisor/Contact

Name:	James Sweeney
Telephone:	(203) 410-0632
Cell phone:	(203) 410-0632
Email:	jim.sweeney@whiting-turner.com

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Section A: Source Control

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A Source Control

A comprehensive source control program will be implemented at Nashoba Satellite Emergency Facility, which includes the following components:

- Regular pavement sweeping
- Catch basin cleaning
- Clearing litter from the parking area, islands, and perimeter landscape areas
- Enclosure and regular maintenance of all dumpsters
- Spill Prevention training

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Section B: Spill Prevention

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B Spill Prevention

Spill prevention equipment and training will be provided by the property management company

B.1 Initial Notification

In the event of a spill the facility and/or construction manager or supervisor will be notified immediately.

Facility Manager (name):	Chris Andersen
Facility Manager (phone):	(617) 699-2821
Construction Manager (name) :	James Sweeney
Construction Manager (phone):	(203) 410-0632

The supervisor will first contact the Fire Department and then notify the Police Department, the Public Health Commission and the Conservation Commission. The Fire Department is ultimately responsible for matters of public health and safety and should be notified immediately.

B.2 Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the main construction/facility office and readily accessible to all employees. A hazardous waste spill report shall be completed as necessary using the attached form.

Emergency Notification Phone Numbers

1. FACILITY MANAGER

Name: Chris Andersen
Phone: (617) 699-2821
Beeper/Cell:
Home Phone:

Alternate Contact:
Phone:
Beeper/Cell:
Home Phone:

2. FIRE & POLICE DEPARTMENT
Emergency: 911

3. CLEANUP CONTRACTOR
Address:
Phone:

4. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP)
Emergency: (888) 304-1133

5. NATIONAL RESPONSE CENTER
Phone: (800) 424-8802
Alternate: U.S. Environmental Protection Agency
Emergency:
Business:

6. GROTON BOARD OF HEALTH
Phone: (978) 448-1100
Groton Conservation Commission:
Phone: (978) 448-1100

Hazardous Waste & Oil Spill Report

Date: _____ **Time:** _____ **AM / PM**

Exact location (Transformer #): _____

Type of equipment: _____ **Make:** _____ **Size:** _____

S / N: _____ **Weather Conditions:** _____

On or near water? ☐ Yes ☐ No **If yes, name of body of water:** _____

Type of chemical / oil spilled: _____

Amount of chemical / oil spilled: _____

Cause of spill: _____

Measures taken to contain or clean up spill: _____

Amount of chemical / oil recovered: _____ **Method:** _____

Material collected as a result of cleanup:

_____ drums containing _____

_____ drums containing _____

_____ drums containing _____

Location and method of debris disposal: _____

Name and address of any person, firm, or corporation suffering charges: _____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring: _____

Spill reported by General Office by: _____ **Time:** _____ **AM / PM**

Spill reported to DEP / National Response Center by: _____

DEP Date: _____ **Time:** _____ **AM / PM** **Inspector:** _____

NRC Date: _____ **Time:** _____ **AM / PM** **Inspector:** _____

Additional comments: _____

B.3 Assessment – Initial Containment

The supervisor or manager will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. A list of recommended spill equipment to be kept on site is included on the following page.

Fire / Police Department: 911

Groton Health Department (978) 448-1100

Groton Conservation Commission: (978) 448-1100

Emergency Response Equipment

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

Supplies	Quantity	Recommended Suppliers
› Sorbent Pillows/"Pigs"	2	http://www.newpig.com Item # KIT276 — mobile container with two pigs
› Sorbent Boom/Sock	25 feet	http://www.forestry-suppliers.com
› Sorbent Pads	50	
› Lite-Dri® Absorbent	5 pounds	
› Shovel	1	Item # 33934 — Shovel (or equivalent)
› Pry Bar	1	Item # 43210 — Manhole cover pick (or equivalent)
› Goggles	1 pair	Item # 23334 — Goggles (or equivalent)
› Gloves – Heavy	1 pair	Item # 90926 — Gloves (or equivalent)

Section C: Snow Management

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C Snow Management

Snow storage areas are shown in the proposed Site Plans.

- Snow storage areas will be managed to prevent blockage of storm drain catch basins and stormwater drainage swales. Snow combined with sand and debris may block a storm drainage system, diminishing the infiltration capacity of the system and causing localized flooding.
- Sand and debris deposited on vegetated or paved areas shall be cleared from the site and properly disposed of at the end of the snow season, no later than May 15.
- Snow shall not be dumped into any waterbody, pond, or wetland resource area.

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Section D: Maintenance of Stormwater Management Systems

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D Maintenance of Stormwater Management Systems

D.1 Pavement Systems

D.1.1 Standard Asphalt Pavement

- Sweep or vacuum standard asphalt pavement areas at least two times per year with a rotary brush sweeper, vacuum or regenerative air sweeper and properly dispose of removed material.
- Recommended sweeping schedule:
- Oct/Nov
- Apr/May
- More frequent sweeping of paved surfaces will result in less accumulation in catch basins, less cleaning of subsurface structures, and less disposal costs.
- Check loading docks and dumpster areas frequently for spillage and/or pavement staining and clean as necessary.

D.2 Structural Stormwater Management Devices

D.2.1 Catch Basins / Area Drains

The proper removal of sediments and associated pollutants and trash occurs only when catch basin / area drain inlets and sumps are cleaned out regularly. The more frequent the cleaning, the less likely sediments will be re-suspended and subsequently discharged. In addition, frequent cleaning also results in more volume available for future deposition and enhances the overall performance. As noted in the pavement Operation and Maintenance (O&M) section, more frequent sweeping of paved surfaces will result in less accumulation in catch basins, less cleaning of subsurface structures, and less disposal costs.

These catch basins and area drains are constructed with sumps (minimum 4 feet for catch basin and 2 feet minimum for area drain) and hooded outlets in the catch basin to trap debris, sediments, and floating contaminants. Disposal of all sediments must be in

accordance with applicable local, state, and federal guidelines. A map of the catch basin and area drain locations is included in Section E.5 Maintenance Checklists and Device Location Maps.

Inspections and Cleaning

- All catch basins and area drains shall be inspected at least four times per year and cleaned a minimum of at least once per year.
- Sediment (if more than six inches deep) and/or floatable pollutants shall be pumped from the basin and disposed of at an approved offsite facility in accordance with all applicable regulations.
- Any structural damage or other indication of malfunction will be reported to the site manager and repaired as necessary
- During colder periods, the catch basin and area drain grates must be kept free of snow and ice.
- During warmer periods, the catch basin and area drain grates must be kept free of leaves, litter, sand, and debris.

D.2.2 Stormwater Outfalls

The stormwater drainage system has outfall locations where stormwater is discharged. A map of these locations is included in Section E.5 Maintenance Checklists and Device Location Maps.

- Inspect outfall locations monthly for the first three months after construction to ensure proper functioning and correct any areas that have settled or experienced washouts.
- Inspect outfalls annually after initial three-month period.
- Annual inspections should be supplemented after large storms, when washouts may occur.
- Maintain vegetation around outfalls to prevent blockages at the outfall.
- Maintain rip rap pad below each outfall and replace any washouts.
- Remove and dispose of any trash or debris at the outfall.

D.2.3 Roof Drain Leader

- Perform routine roof inspections quarterly.
- Keep roofs clean and free of debris.
- Keep roof drainage systems clear.
- Keep roof access limited to authorized personnel.
- Clean inlets twice per year or as necessary.

D.3 Vegetated Stormwater Management Devices

D.3.1 Surface Infiltration Basin

There is one surface infiltration bason at the proposed Nashoba Satellite Emergency Facility. The infiltration/detention ponds are partially vegetated basins that are designed to detain, clean and infiltrate roadway and rooftop runoff. The maintenance of the infiltration basins may affect the functioning of stormwater management practices. This includes the condition of the side slope vegetation and the sediment deposits in the bottom of the ponds.

Initial Post-construction Inspection

- Infiltration basins should be inspected after every major storm for the first few months to ensure proper stabilization and function.

Long-term Maintenance

- The grass on the sideslopes and in the buffer areas should be mowed, and grass clippings, organic matter, and accumulated trash and debris removed, at least twice during the growing season.
- Eroded or barren spots should be reseeded immediately after inspection to prevent additional erosion and accumulation of sediment.
- Deep tilling can be used to break up a clogged surface area.
- Sediment should be removed from the basin as necessary. Removal procedures should not take place until the floor of the basin is thoroughly dry.

Inspections and Cleaning

- Infiltration basins should be inspected at least twice a year to ensure proper stabilization and function.
- Light equipment, which will not compact the underlying soil, should be used to remove the top layer.

D.3.2 Vegetated Areas Maintenance

Although not a structural component of the drainage system, the maintenance of vegetated areas may affect the functioning of the stormwater management system. This includes the health/density of vegetative cover and activities such as the application and disposal of lawn and garden care products, disposal of leaves and yard trimmings and proper aeration of soils.

- Inspect planted areas on a semi-annual basis and remove any litter.
- Maintain planted areas adjacent to pavement to prevent soil washout.
- Immediately clean any soil deposited on pavement.
- Re-seed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming.

- Plant alternative mixture of grass species in the event of unsuccessful establishment.
- The grass vegetation should be cut to a height between three and four inches.
- Pesticide/Herbicide Usage – No pesticides are to be used unless a single spot treatment is required for a specific control application.
- Fertilizer usage should be avoided. If deemed necessary, slow release fertilizer should be used. Fertilizer may be used to begin the establishment of vegetation in bare or damaged areas, but should not be applied on a regular basis unless necessary.
- Annual application of compost amendments and aeration are recommended.

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Section E: Operations and Maintenance Plan Summary

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E Operations and Maintenance Plan Summary

This Operation and Maintenance Plan has been prepared in accordance with the Stormwater Management Policy developed by the DEP and local regulations. It specifies operational practices and drainage system maintenance requirements for the site. Requirements should be adjusted by the site manager as necessary to ensure successful functioning of system components.

E.1 Routine Maintenance Checklists

Routine required maintenance is described in Sections A – D. The following checklists are to be used by the property manager to implement and document the required maintenance and inspection tasks.

E.2 Reporting and Documentation

The site supervisor shall be responsible for ensuring that the scheduled tasks as described in this plan are appropriately completed and recorded in the Maintenance Log. Accurate records of all inspections, routine maintenance and repairs shall be documented and these records shall be available for inspection by members of the Groton Earth Removal-Stormwater Advisory Committee, or their designated agent, upon request.

The Maintenance Log shall:

- Document the completion of required maintenance tasks.
- Identify the person responsible for the completion of tasks.
- Identify any outstanding problems, malfunctions or inconsistencies identified during the course of routine maintenance.
- Document specific repairs or replacements.

E.3 Construction Practices Maintenance/ Evaluation Checklist

Nashoba Satellite Emergency Facility – Groton, MA

Best Management Practice	Inspection Frequency	Date Inspected	Inspector Initials	Minimum Maintenance and Key Items to Check	Cleaning or Repair Needed ☐Yes/No (List Items)	Date of Cleaning or Repair	Performed by:
Siltsock/ Silt Fencing	Weekly and after any rainfall			Sediment build up, broken bales or stakes			
Gravel Construction Entrance	Weekly and after any rainfall			Filled voids, runoff/sediments into street			
Catch Basin Protection	Weekly and after any rainfall			Clogged or sediment build-up at surface or in basin			
Diversion Channels	Weekly and after any rainfall			Maintained, moved as necessary to correct locations, Check for erosion or breakout			
Temporary Sedimentation Basins	Weekly and after any rainfall			Cracking, erosion, breakout, sediment buildup, contaminants			

Stormwater Control Manager: _____

E.4 Long-term Maintenance/Evaluation Checklist

Nashoba Satellite Emergency Facility – Groton, MA

Best Management Practice	Minimum Maintenance and Key Items to Check	Inspection Frequency	Date Inspected	Inspector Initials	Cleaning Frequency	Cleaning or Repair Needed ☐Yes/No	Date of Cleaning or Repair	Performed by:
Street Sweeping	Vacuum sweeper	4X per year			4X per year* minimum			
Outfall Structures	Remove debris and excess vegetation, replace any dislodged riprap	1X per year			1X per year			
Deep Sump and Hooded Catch basins / Area Drains	Remove sediment 1X per year or if >6 inches	4X per year			1X per year or as necessary			
Bioretention Basins	Inspect inlets, vegetation, overflow discharge pipes, drain time less than 4 days	2X per year first year, annually thereafter			2X per year first year, annually thereafter			
Roof Drains	Remove debris, clean inlets draining to subsurface bed	4x per year roof inspection			2x per year inlet cleaning, roof debris as necessary			

* Recommend sweeping Oct/Nov, Feb/Mar, Apr/May Jul/Aug with late winter most important

Stormwater Control Manager: _____

E.5 Maintenance Checklists and Device Location Maps

These checklists are provided for the maintenance crew to photocopy and use when conducting inspections and cleaning activities to the stormwater management systems.

Maintenance Checklists

Catch Basins / Area Drains – Inspect 4 times per year, clean when sediment depth >6 inches or at least once per year.

Catch Basin / Area Drains	Inspected (Y/N)	Sediment Depth (inches)	Cleaning needed (Y/N)	Date Cleaned	Comments (Trash, Oil, Pet waste, Lawn Debris, Damage)
				/ /	
				/ /	
				/ /	
				/ /	
				/ /	
				/ /	
				/ /	
				/ /	
				/ /	
				/ /	
				/ /	

Outfalls – Inspect 4 times per year, replace any dislodged rip-rap, remove excess vegetation, remove any debris.

Outfall	Inspected (Y/N)	Sediment Depth (inches)	Cleaning needed (Y/N)	Date Cleaned	Comments (Trash, Oil, Pet waste, Lawn Debris, Damage)
				/ /	
				/ /	
				/ /	
				/ /	

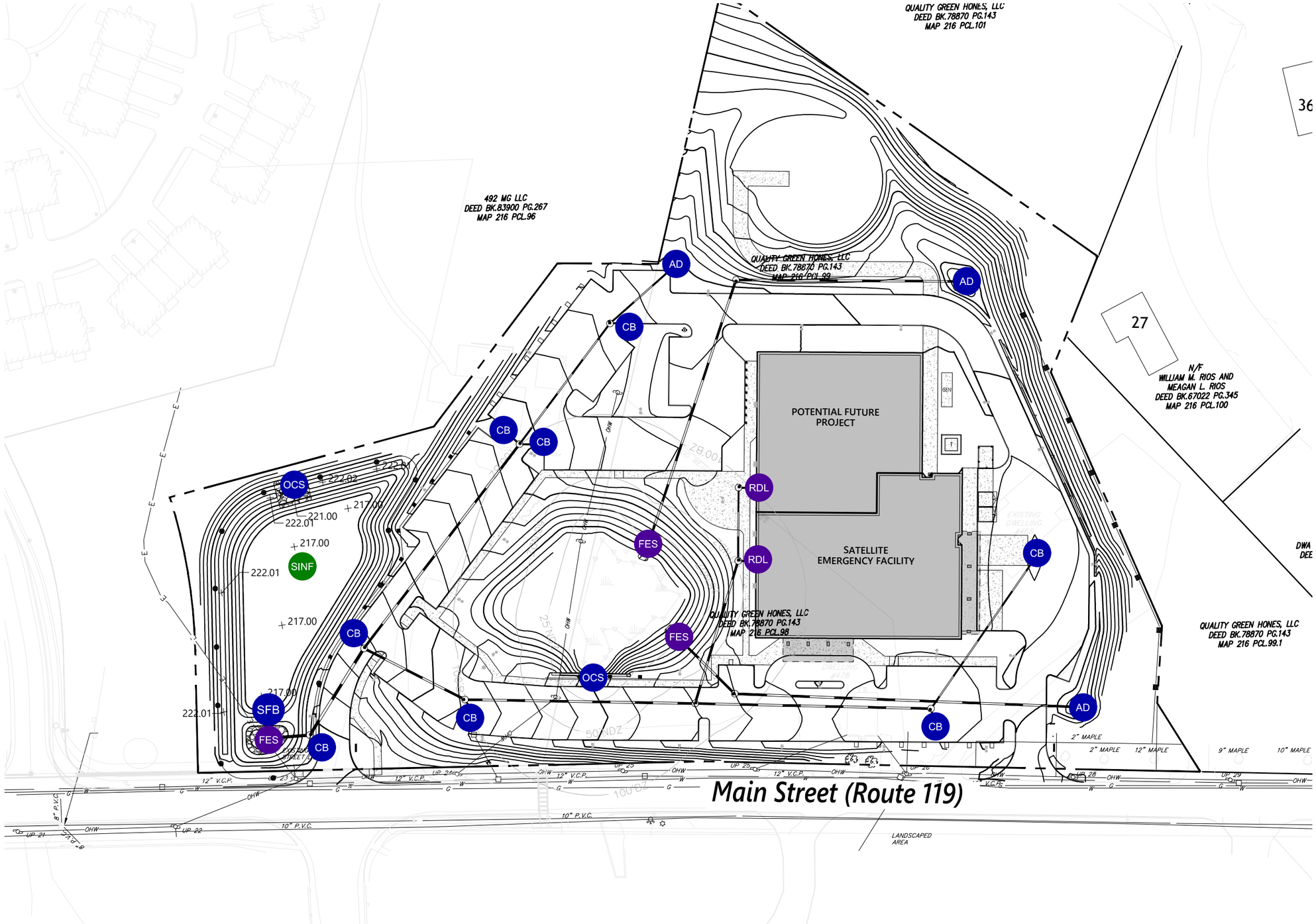
Infiltration/Detention Basins – Inspect once per year, remove sediment if more than 6 inches has accumulated in sediment forebay or sediment collection row.

Infiltration basin	Inspected (Y/N)	Sediment Depth (inches)	Cleaning needed (Y/N)	Date Cleaned	Comments (Trash, Oil, Pet waste, Lawn Debris, Damage)
Infiltration Basin #1P				/ /	

Roof Runoff Downspouts – Inspect roof drains monthly, clean inlets draining to the subsurface bed twice per year.

Bldg #	Inspected (Y/N)	Sediment Depth (inches)	Cleaning needed (Y/N)	Date Cleaned	Comments (Trash, Oil, Pet waste, Lawn Debris, Damage)
Medical Office Building				/ /	
Satellite Emergency Facility				/ /	

Device Location Maps



Legend

CB	CATCH BASIN
SFB	SEDIMENT FOREBAY
OCS	OUTLET CONTROL STRUCTURE
SINF	SURFACE INFILTRATION BASIN #1P
FES	FLARED END SECTION
RDL	ROOF DRAIN LEADER

0 40 80 160 Feet

Stormwater Device Location Plan
Nashoba Satellite Emergency Facility
490 Main Street
Groton, MA

June 2025

O&M Annual Maintenance Cost Estimate

O&M Annual Maintenance Cost Estimate

Project	Nashoba Satellite Emergency Facility	**Project #**	16694.00
Calculated by	MGH	**Date**	6/16/2025
Checked by	BMG	**Date**	6/19/2025

OPINION OF PROBABLE COST FOR MAINTENANCE OF STORMWATER BEST MANAGEMENT PRACTICES

Values below include maintenance operations for the Emergency Department Expansion (EDE) and the Parking Expansion (PE) components of the Project.

BMP	#/year	$/#	Annual Cost
Catch Basin Cleaning (7)	1	$10,000	$10,000
Outfall Cleaning	1	$0 [1]	$0
Bioretention Basin Maintenance (2)	2	$0 [2]	$0
Vegetated Area Maintenance	2	$0 [2]	$0

$10,000 Annual O&M Estimate

[1] Assumes outfall inspections and removal of vegetated growth by Owner's staff.

[2] Assumes maintenance of vegetated areas covered under landscape contract, allocated separately.

Water Quality Volume Calculations

Project	Nashoba Satellite Emergency Facility	**Project #**	16694.00
Calculated by	CSH	**Date**	6/12/2025
Checked by	KSS	**Date**	6/19/2025

Infiltration Basin #1P

Runoff from subcatchment area PR-2B & PR-2C

Water Quality Storm Runoff Depth	(in)	1.0
Total Impervious Area	(ft^2)	170,623

SEDIMENT FOREBAY WQV:

Required Volume*:	Runoff Depth to be Treated (in)	Required Volume (ft^3)
	0.1	**1,422**

Provided Volume:	Elevation	Area (ft^2)	Cumulative Volume (ft^3)
	217.0	383	0
	218.0	696	540
	219.0	1,080	**1,428**

BASIN WQV:

Required Volume:	Runoff Depth to be Treated (in)	Required Volume (ft^3)
	1.0	**14,219**

Provided Volume:	Elevation	Area (ft^2)	Cumulative Volume (ft^3)
	217.0	7,872	0
	218.0	9,153	8,513
	219.0	10,527	18,353
	220.0	11,995	29,614
	221.0	13,557	42,390
	222.0	15,213	**56,775**

FREEBOARD CHECK:

100-YR Peak Elevation:	220.9
Maximum Basin Elevation:	222.0
Basin Freeboard:	**1.1**

** Per MassDEP Treatment Requirement*

TSS Removal Calculation Worksheet

101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**Nashoba Emergency Fac.**	Sheet:	**1 of 1**
Project Number:	**16694.00**	Date:	**23-Jun-2025**
Location:	**Groton, MA**	Computed by:	**CSH**
Discharge Point:	**Infiltration Basin 1P>DP-2**	Checked by:	
Drainage Area(s):	**PR-2B & PR-2C**		

1. Pre-Treatment prior to Infiltration

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**25%**	**100%**	**25%**	**75%**
Sediment Forebay	**25%**	**75%**	**19%**	**56%**
	0%	**56%**	**0%**	**56%**

Pre-Treatment TSS Removal = **44%**

2. Total TSS Removal including Pretreatment 1.

BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Infiltration Basin	**80%**	**100%**	**80%**	**20%**
	0%	**20%**	**0%**	**20%**
	0%	**20%**	**0%**	**20%**
	0%	**20%**	**0%**	**20%**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
** Equals remaining load from previous BMP (E)

Treatment Train TSS Removal = **80%**

Appendix E: Standard 8 Supporting Information

› Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan

Section A: Erosion and Sedimentation Control Measures

As part of the Construction General Permit Notice of Intent process, an erosion and sedimentation control plan will be developed, and will include measures such as those described below.

Erosion and Sedimentation Control Measures

The following erosion and sedimentation controls are for use during the earthwork and construction phases of the project. The following controls are provided as recommendations for the site contractor and do not constitute or replace the final Stormwater Pollution Prevention Plan that must be fully implemented by the Contractor and owner in Compliance with EPA NPDES regulations.

Siltsock Barriers

Siltsock barriers will be placed to trap sediment transported by runoff before it reaches the drainage system or leaves the construction site.

Silt Fencing

In areas where high runoff velocities or high sediment loads are expected, siltsock barriers will be backed up with silt fencing. This semi-permeable barrier made of a synthetic porous fabric will provide additional protection. The silt fences and siltsock barrier will be replaced as determined by periodic field inspections or once sediment buildup reaches ¼ the height of the silt fence or siltsock.

Catch Basin Protection

Newly constructed and existing catch basins will be protected with siltsock barriers (where appropriate) or silt sacks throughout construction.

Gravel and Construction Entrance/Exit

A temporary crushed-stone construction entrance/exit will be constructed. A cross slope will be placed in the entrance to direct runoff to a protected catch basin inlet or settling area. If deemed necessary after construction begins, a wash pad may be included to wash off vehicle wheels before leaving the project site.

Diversion Channels

Diversion channels will be used to collect runoff from construction areas and discharge to either sedimentation basins or protected catch basin inlets.

Temporary Sediment Basins

Temporary sediment basins will be designed either as excavations or bermed stormwater detention structures (depending on grading) that will retain runoff for a

sufficient period of time to allow suspended soil particles to settle out prior to discharge. These temporary basins will be located based on construction needs as determined by the contractor and outlet devices will be designed to control velocity and sediment. Points of discharge from sediment basins will be stabilized to minimize erosion. Temporary sediment trapping devices shall not be removed until permanent stabilization is established in all contributory drainage areas. Similarly, stabilization shall be established prior to converting sediment traps/basins into permanent (post-construction) stormwater management facilities. All facilities used as temporary measures shall be cleaned prior to being put into final operation.

Vegetative Slope Stabilization

Stabilization of open soil surfaces will be implemented within 14 days after grading or construction activities have temporarily or permanently ceased, unless there is sufficient snow cover to prohibit implementation. Vegetative slope stabilization will be used to minimize erosion on slopes of 3:1 or flatter. Annual grasses, such as annual rye, will be used to ensure rapid germination and production of root mass. Permanent stabilization will be completed with the planting of perennial grasses or legumes. Establishment of temporary and permanent vegetative cover may be established by hydro-seeding or sodding. Four inches of a suitable topsoil, good seedbed preparation, and adequate lime, fertilizer and water will be provided for effective establishment of these vegetative stabilization methods. Mulch will also be used after permanent seeding to protect soil from the impact of falling rain and to increase the capacity of the soil to absorb water. During the months of October through March, when seeding may be impractical, an anchored mulch or sod shall be applied as approved by the Committee or by the Committee's designee; diversions and/or prepared outlets may be required in critical areas during construction. Permanent seeding will be undertaken in the spring from March through May and in late summer and early fall from August to October 15. During the peak summer months and in the fall after October 15, when seeding is found to be impractical, an appropriate temporary mulch shall be applied.

Stockpile Management

- Soil and other materials shall not be stockpiled or redistributed, either temporarily or permanently, in locations or in such a manner as would cause suffocation of tree root systems.

- Topsoil shall be stripped from disturbed areas, stockpiled in approved areas and stabilized with temporary vegetative cover if it is to be left for more than 30 calendar days; perimeter sediment controls shall be installed around each area of stockpiled topsoil.

- Soil stockpiles shall be stabilized or covered at the end of each workday.

Dust Control

Periodically moisten exposed surfaces on unpaved travelways to keep the travelway damp and reduce dust.

Inspections

Prior to any land disturbance activities commencing on the site, the developer shall physically mark limits of no land disturbance on the site with tape, signs, or orange construction fence, so that workers can see the areas to be protected. An inspection with a representative of the Committee will be scheduled and completed before clearing commences.

Appropriate erosion and sediment control measures shall be installed prior to soil disturbance. Measures shall be taken to control erosion within the project area. Sediment in runoff water shall be trapped and retained within the project area. Wetland areas and surface waters shall be protected from sediment. An inspection with a representative of the Committee will be scheduled and completed before clearing commences.

Maintenance

- The contractor or subcontractor will be responsible for implementing each control shown on the Sedimentation and Erosion Control Plan. In accordance with EPA and the Town of Groton regulations, the contractor must sign a copy of a certification to verify that a plan has been prepared and that permit regulations are understood.

- The on-site contractor will inspect all sediment and erosion control structures periodically and after each rainfall event. Records of the inspections will be prepared and maintained on-site by the contractor.

- Silt shall be removed from behind barriers if greater than 6-inches deep or once sediment buildup reaches ¼ the height of the silt fence or siltsock.

- Damaged or deteriorated items will be repaired immediately after identification.

- The underside of siltocks should be kept in close contact with the earth and reset as necessary.

- Sediment that is collected in structures shall be disposed of properly and covered if stored on-site.

- Erosion control structures shall remain in place until all disturbed earth has been securely stabilized. After removal of structures, disturbed areas shall be regraded and stabilized as necessary.

- All temporary erosion and sediment control measures shall be removed after final site stabilization. Disturbed soil areas resulting from the removal of temporary measures shall be permanently stabilized within 30 days. Written certification that this condition has been met, shall be submitted.

The sedimentation and erosion control plan is included in project plan set; a reduced version and Erosion Control Maintenance checklist is included here for quick reference.

Construction Best Management Practices - Maintenance/Evaluation Checklist

Construction Practices Maintenance/ Evaluation Checklist

Nashoba Satellite Emergency Facility – Groton, Massachusetts

Best Management Practice	Inspection Frequency	Date Inspected	Inspector Initials	Minimum Maintenance and Key Items to Check	Cleaning or Repair Needed ☐Yes/No (List Items)	Date of Cleaning or Repair	Performed by:
Siltsock/ Silt Fencing	Weekly and after any rainfall			Sediment build up, broken bales or stakes			
Gravel Construction Entrance	Weekly and after any rainfall			Filled voids, runoff/sediments into street			
Catch Basin Protection	Weekly and after any rainfall			Clogged or sediment build-up at surface or in basin			
Diversion Channels	Weekly and after any rainfall			Maintained, moved as necessary to correct locations, Check for erosion or breakout			
Temporary Sedimentation Basins	Weekly and after any rainfall			Cracking, erosion, breakout, sediment buildup, contaminants			

Stormwater Control Manager: _____

Section B: Construction Spill Prevention & Response

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Construction Phase Spill Prevention

Spill prevention equipment and training will be provided by the general contractor.

Initial Notification

In the event of a spill the facility and/or construction manager or supervisor will be notified immediately.

Facility Manager (name):	Chris Andersen
Facility Manager (phone):	(617) 699-2821
Construction Manager (name) :	James Sweeney
Construction Manager (phone):	(203) 410-0632

The supervisor will first contact the Fire Department and then notify the Police Department, the Public Health Commission and the Conservation Commission. The Fire Department is ultimately responsible for matters of public health and safety and should be notified immediately.

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The MassDEP and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the main construction/facility office and readily accessible to all employees. A hazardous waste spill report shall be completed as necessary using the attached form.

Emergency Notification Phone Numbers

1. FACILITY MANAGER

Name: Chris Anderson
Phone: (617) 699-2821
Beeper/Cell:
Home Phone:

Alternate Contact:
Phone:
Beeper/Cell:
Home Phone:

2. FIRE & POLICE DEPARTMENT
Emergency: 911

3. CLEANUP CONTRACTOR

Address:
Phone:

4. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP)
Emergency: (888) 304-1133

5. NATIONAL RESPONSE CENTER
Phone: (800) 424-8802

Alternate: U.S. Environmental Protection Agency
Emergency: Alternate:
Business:

6. GROTON BOARD OF HEALTH
Phone: (978) 448-1100

Groton Conservation Commission:
Phone: (978) 448-1100

Hazardous Waste & Oil Spill Report

Date: _____ **Time:** _____ **AM / PM**

Exact location (Transformer #): _____

Type of equipment: _____ **Make:** _____ **Size:** _____

S / N: _____ **Weather Conditions:** _____

On or near water? ☐ Yes ☐ No **If yes, name of body of water:** _____

Type of chemical / oil spilled: _____

Amount of chemical / oil spilled: _____

Cause of spill: _____

Measures taken to contain or clean up spill: _____

Amount of chemical / oil recovered: _____ **Method:** _____

Material collected as a result of cleanup:

_____ drums containing _____

_____ drums containing _____

_____ drums containing _____

Location and method of debris disposal: _____

Name and address of any person, firm, or corporation suffering charges: _____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring: _____

Spill reported by General Office by: _____ **Time:** _____ **AM / PM**

Spill reported to DEP / National Response Center by: _____

DEP Date: _____ **Time:** _____ **AM / PM** **Inspector:** _____

NRC Date: _____ **Time:** _____ **AM / PM** **Inspector:** _____

Additional comments: _____

Assessment – Initial Containment

The supervisor or manager will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. A list of recommended spill equipment to be kept on site is included on the following page.

Fire / Police Department: 911

Groton Health Department (978) 448-1100

Groton Conservation Commission: (978) 448-1100

Emergency Response Equipment

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

Supplies	Quantity	Recommended Suppliers
Sorbent Pillows/"Pigs"	2	http://www.newpig.com Item # KIT276 — mobile container with two pigs
Sorbent Boom/Sock	25 feet	http://www.forestry-suppliers.com
Sorbent Pads	50	
Lite-Dri® Absorbent	5 pounds	
Shovel	1	Item # 33934 — Shovel (or equivalent)
Pry Bar	1	Item # 43210 — Manhole cover pick (or equivalent)
Goggles	1 pair	Item # 23334 — Goggles (or equivalent)
Gloves – Heavy	1 pair	Item # 90926 — Gloves (or equivalent)

Appendix F: Standard 10 Illicit Discharge Statement

Illicit Discharge Compliance Statement

I, as Applicant and Applicant's Representative, certify the following as they pertain to the proposed development at 490 Main Street, Groton, Massachusetts:

1. Sanitary sewer and storm drainage structures which were part of the previous development on this site are to be completely removed during the site redevelopment. The design plans submitted with this report have been designed in full compliance with current standards. The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges.

Applicant

Name: Brittany Gesner, PE

Company: VHB

Signature: