

75 West St. Water Treatment Plant Upgrades
Georgetown, MA

STORMWATER MANAGEMENT REPORT

Georgetown Water Department

July 2025

Tighe&Bond

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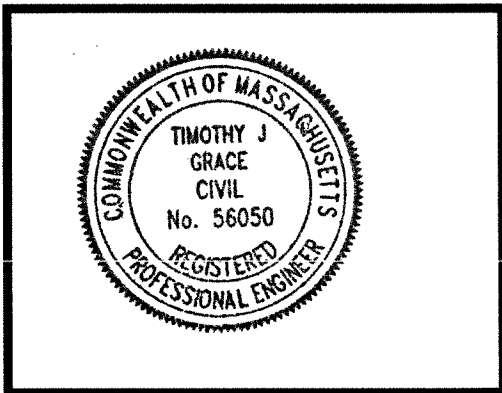
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SECTION 1

Section 1 Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the computations, published and site-specific soil information, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan, the Long-term Post-Construction Operation and Maintenance Plan and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist, provided in Appendix A, 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

 7/22/25
Signature, Date

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SECTION 2

Section 2

Project Description

2.1 Project Introduction

On behalf of Georgetown Water Department, Tighe & Bond has prepared the following Stormwater Management Report to support local permitting efforts for the 75 West Street Water Treatment Plant Improvements Project located at 75 West Street in Georgetown, Massachusetts.

The proposed project is a mix of new and re-development, as the existing water treatment plant building and site will remain, and a new building will be constructed to the east of the existing facility, and the two buildings will be connected by a covered walkway. The existing asphalt driveway runs along the south side of the current WTP building, and it will be extended east along the frontage of the new building where it will intersect with the new entrance off West Street. The new entrance drive extends along the east side of the proposed water treatment plant building between the facility and the athletic fields. The site does not currently have any stormwater management features, and runoff generally travels across the site, from east to west where it discharges to the adjacent wooded areas. The proposed stormwater management system includes a sediment forebay, an infiltration basin, and subsurface infiltration chambers.

The new WTP building will be a single-story building with a proposed footprint of approximately 60 feet by 90 feet (5,400 sf) located on the east side of the existing WTP adjacent to the existing parking lot associated with the existing soccer field. The site elevation is approximately 110 feet and is relatively flat.

A United States Geological Survey (USGS) Site Locus figure, Priority Resource figure and Orthophotograph of the Project site are provided in Appendix B as Figures 1-3 (respectively). Project plans are provided separately.

2.2 Existing Conditions

The Site is located within the Outside Residential C zoning district with Water Resource, Ground Water Protection and Floodplain Overlay districts. The proposed limit of work is on a portion of the site that is located out of the floodplain overlay district. Currently, the Site consists of mostly forested and wooded areas. A paved road running north/south divides the site. The eastern side of the site is developed and used as an existing water treatment facility, containing a building, driveways, and backwash lagoons. The western side of the road is a forested undeveloped area. The property consists of flat areas on the eastern side and steeper slopes on the west side that lead to a wetland area. Land surrounding the Site is occupied by soccer fields to the East, Parker River to the north and wooded areas to the West and North sides. All abutting properties are owned by the Town of Georgetown. A wetland area, named the Blueberry Swamp Conservation, abuts the property to the West.

The Natural Resources Conservation Service (NRCS) soil data was obtained through the Web Soil Survey portal on the United States Department of Agriculture (USDA) NRCS

website. The areas surrounding the property were queried for soil types according to the record soil survey maps maintained by NRCS. Soils within the project area, published in the USDA Soil Survey for Essex County, Version 20, dated Aug 27, 2024, include the Hinkley, Pits and Udorthents associations. Landforms on the property consist of plains. The NRCS Soils Mapping is provided in Appendix C. The hydrologic soil group (HSG) and further description for each soil association are presented in Table 2.1 below.

Table 2.1
Soil Descriptions

Soil Map Designation	Soil Name	Hydrologic Soil Group (HSG)
253A	Hinckley loamy sand, 0-3 percent slopes	A
253C	Hinckley loamy sand, 8-15 percent slopes	A
600	Pits, Gravel	N/A
651	Udorthents, smoothed	A

The hydrologic soil group designation (HSG) for this soil type is listed as A. The HSG rating for soil types is 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. Soils designated as HSG A are generally well draining and have a high capacity for water infiltration. Based on this, soils within the project area vary in their ability to infiltrate water and in the development of runoff.

A subsurface exploration was performed on July 7, 2025. The explorations included test pits to determine soil textures and seasonal high groundwater within the project site. The results of the exploration supported an infiltration rate of 8.27 in/hr. Web Soil Survey indicated HSG A, Surficial Geology indicated coarse deposits, and the percolation test results from the on-site septic system accepted rates less than 2 minutes per inch. This data will be confirmed in the field and the design updated as appropriate. The soils information is provided in Appendix C.

The individual runoff curve numbers (RCN) used in the calculation of the composite RCN for each drainage area are based on the values provided in TR-55, Urban Hydrology for Small Watersheds. RCN values vary depending on the type of ground cover and soil HSG. Existing Conditions Drainage Areas were delineated based on topography and stormwater discharge location. A summary of each existing drainage area, including area, RCN, and time of concentration calculations are provided in the HydroCAD reports in Appendix D. An Existing Conditions Drainage Area Map is provided as Figure 4 in Appendix B.

2.3 Floodplain Management

The Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map (FIRM) Community Panel Number 25009C0232F, effective July 8th, 2025 shows Zone A floodplain mapped on the site and all proposed work falls outside of the floodplain. All proposed work 75 West Street Water Treatment Plan Improvements Project Stormwater Management Report

is located outside of this Bordering Land Subject to Flooding. The boundaries of the Zone A area are depicted on the site plans.

2.4 Proposed Improvements

The proposed project is a mix of new and re-development, as the existing water treatment plant building and site will remain, and a new building will be constructed to the east of the existing facility, and the two buildings will be connected by a covered walkway. The existing asphalt driveway runs along the south side of the current WTP building, and it will be extended east along the frontage of the new building where it will intersect with the new entrance off West Street. The new entrance drive extends along the east side of the proposed water treatment plant building between the facility and the athletic fields.

The proposed stormwater management system includes a sediment forebay and an infiltration basin to mitigate the majority of the surface-level runoff, and subsurface infiltration system will be used to mitigate roof runoff.

Under proposed conditions, stormwater run-off flows directly into the sediment forebay from the driveway. Once the runoff enters a series of two forebays for pretreatment, it overflows into the adjacent infiltration basin for groundwater recharge. The runoff from the proposed roof will be collected with roof drains and piped into a subsurface infiltration system located under the proposed driveway adjacent to the plant. The system is designed to mitigate peak rates of runoff from major storm events, although an outlet is included in the design in case the capacity of the system is ever reached. Portions of the stormwater management features such as the infiltration basin and sediment forebay will be within the groundwater protection overlay district.

Proposed conditions drainage areas were delineated based on topography and stormwater discharge location. A summary of each proposed conditions drainage area, including area, RCN, and time of concentration calculations are provided in the HydroCAD reports in Appendix D. A Proposed Conditions Drainage Area Map is provided as Figure 5 in Appendix B.

The proposed stormwater management system treats both the quality and the quantity of stormwater discharge from the site. The system includes Best Management Practices (BMPs) such as an infiltration basin and subsurface infiltration chambers.

A brief description of the proposed BMPs incorporated into the stormwater management system are as follows:

Infiltration Basin: The proposed surface infiltration basin is the collection point for the majority of runoff from the project and is located in the southern area of the site. The infiltration basin has been designed in accordance with the Massachusetts Stormwater Handbook to provide the required groundwater recharge and water quality volume for the project. The infiltration basin was also modeled as a water surface to account for the additional water accumulation as the basin fills. The basin is equipped with an emergency overflow spillway to minimize the potential for flooding during extreme storm events.

Subsurface Infiltration System: The subsurface infiltration systems consist of prefabricated chambers set in a bed of gravel. Once full, the subsurface infiltration systems will discharge through an outlet.

2.5 Method of Hydrology and Hydraulic Analysis

The following storm drainage design criteria were used for all hydrologic and hydraulic analyses:

1. Design storm rainfall data was used per NOAA Atlas 14.
2. Piped storm drainage system and the outlets are designed for a 25-year storm event.
3. Minimum time of concentration = 6 minutes.
4. For SCS peak flow calculations, Curve Number were as follows:
 - a. >75% Grass Cover, Good (HSG A) = 39
 - b. Gravel Surface (HSG A) = 96
 - c. Paved Parking (HSG A) = 98
 - d. Roofs (HSG A) = 98
 - e. Woods, Good (HSG A) = 30
5. Minimum diameter pipes, excluding roof leaders, underdrains and foundation drains = 6 inches
6. Minimum pipe slope = 0.5 percent
7. The Storm Water Management Plan for the site is designed to treat the Water Quality Volume, remove Total Suspended Solids and promote groundwater recharge while reducing peak flow.
8. Watershed areas delineated using polylines in AutoCAD Civil 3D 2025.
9. Comparative hydrology analyzed using Hydro CAD Stormwater Modeling Software Version 10.00-20.

Runoff computations, storm drainage calculations, and suspended solids removal rates are included in Appendix D.

Table 2.2 below presents the design rainfall depths for the 2, 10, 25, and 100-year storms, as provided by the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service.

Table 2.2

Design Rainfall Depths

Storm Event	Rainfall Depth (inches)
2-Year	3.21
10-Year	5.08
25-Year	6.24
100-Year	8.04

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SECTION 3

Section 3

Regulatory Compliance

The project is required to comply with the ten MassDEP Massachusetts Stormwater Standards (Standards) under the Massachusetts Wetlands Protection Act and the Town of Georgetown Stormwater Bylaw. The Massachusetts Stormwater Checklist is provided in Appendix A.

3.1 LID Measures

MassDEP allows for reductions in structural stormwater Best Management Practice (BMP) requirements for water quantity and quality when certain criteria are met. The proposed project includes environmentally sensitive site design and low impact development techniques; however, the applicant is not requesting credit for LID measures.

Numerous alternatives were explored for the development of the project. The building location was chosen to minimize impacts on site and stay out of resource areas. The use of subsurface chambers reduces the clearing and grade changes required for a larger basin.

3.2 Standard 1: No New Untreated Discharges

The project will not result in any new stormwater conveyance discharging untreated stormwater directly to the Waters of the Commonwealth. Further documentation pertaining to stormwater treatment is provided in Section 3.5.

It is not anticipated that erosive stormwater velocities will be encountered post-construction subsequently causing erosion and siltation to Waters of the Commonwealth. All discharges have been designed to meet the thresholds identified in Volume 3 of the Massachusetts Stormwater Handbook. A summary of stormwater discharge velocities for the 2-year, 24-hour storm event are provided in Table 3.1, below, accompanied by permissible velocities as provided by MassDEP. These systems are designed to mitigate the 100-year storm. No flows from the systems are expected in the 2-year storm event.

Table 3.1
Stormwater Discharge Velocity Summary

Discharge Location	2-year Storm Event (cfs)	2-Year Storm Event Velocity (fps)	Maximum Permissible Velocity (fps)
Subsurface 1 Overflow – 12" Outlet (North)	0.00	0.00	4.0 ¹

¹ Maximum Permissible Velocity is based on Table 2.3.1 of Volume 3 of the MassDEP Stormwater Handbook for slopes between 5-10%.

All outfalls will be equipped with stone outlet protection as shown on the Site Plans. These devices are designed based on the anticipated flow from each outfall to dissipate energy and reduce the opportunity for erosion to develop.

3.3 Standard 2: Peak Discharge Rate Attenuation

Since the proposed project alters existing drainage patterns, stormwater management features are required to attenuate peak discharge rates through the use of infiltration and detention. Runoff either sheet flows directly into the forebay or is collected by deep-sump, hooded catch basin located within the driving areas and conveyed to the infiltration basin where runoff is infiltrated. Roof runoff and a small pavement area to the west is captured in the subsurface infiltration systems. Table 3.2 presents the results of the pre-development stormwater runoff analysis versus the post-development stormwater runoff analysis.

A hydrologic analysis of the pre-development and post-development site was performed to determine the impacts of the proposed project to peak discharge rates and stormwater runoff volumes. HydroCAD Release 10.00-20 is a hydrology and hydraulics software using Technical Release (TR) 20 and TR-55 methodologies for the determination of stormwater runoff quantities. The HydroCAD Report for both pre- and post-development conditions for the 2-, 10-, 25-, and 100-year storm events is provided in Appendix D.

Table 3.2
Peak Discharge Rate Comparison

Discharge Location	Condition	2-Year Storm Event	10-Year Storm Event	25-Year Storm Event	100-year Storm Event
Design Point 1	Existing	0.00	0.06	0.25	0.99
	Proposed	0.00	0.06	0.25	0.99
Design Point 2	Existing	0.36	0.57	0.93	2.54
	Proposed	0.36	0.57	0.92	2.30
Total	Existing	0.36	0.63	1.18	3.53
	Proposed	0.36	0.63	1.17	3.29

Table 3.2 indicates that existing peak discharge rates for the project and at each individual Design Point, are reduced under proposed conditions for all storm events.

The proposed storm drain collection system was analyzed to ensure that the pipe capacities proposed can accommodate the 25-year storm event, as well as meeting minimum and maximum flow velocity. Results of that analysis are provided in Appendix D. Supporting flow calculations for the 25-year storm event are provided separately in Appendix D, reflecting a rainfall depth of 6.24 inches.

3.4 Standard 3: Groundwater Recharge

The proposed project will allow treated stormwater runoff from the proposed project to infiltrate to groundwater. The infiltration systems have been designed in accordance with the MassDEP Stormwater Handbook and provide the required recharge volume.

Subsurface Infiltration System:

For Class A Soils: F = Target Depth Factor = 0.6 inch
 Total Impervious Area = 0.68 acres
 Contributing Impervious Area (See node 4S) = 0.12 acres
 $Rv0 = F * \text{Impervious Area} =$

$$0.12 \text{ acres} * 0.6 \text{ in} * \frac{1 \text{ ft}}{12''} * \frac{43560 \text{ ft}^2}{\text{acre}} = 261 \text{ ft}^3 = \text{Required Recharge Volume}$$

$$\text{Required Recharge Volume} = 261 \text{ ft}^3$$

Infiltration Basin:

For Class A Soils: F = Target Depth Factor = 0.6 inch

Total Impervious Area = 0.68 acres

Contributing Impervious Area (See node 5S) = 0.21 acres

Rv0 = F * Impervious Area =

$$0.21 \text{ acres} * 0.6 \text{ in} * \frac{1 \text{ ft}}{12''} * \frac{43560 \text{ ft}^2}{\text{acre}} = 457 \text{ ft}^3 = \text{Required Recharge Volume}$$

$$\text{Required Recharge Volume} = 457 \text{ ft}^3$$

$$\text{Total Required Recharge Volume} = 718 \text{ ft}^3$$

Groundwater Recharge Time and Drawdown:**Subsurface Infiltration System:**

$$TIME_{\text{Drawdown}} = \frac{V_s}{(K)(\text{Bottom Area})}$$

V_s = Storage Volume = 1,485 ft^3

K = 0.2 ft/hr (8.27 in/hr Rawls Rate)

Bottom Area = 953 ft^2 at elev. 104.24'

$$TIME_{\text{Drawdown}} = \frac{1,485 \text{ ft}^3}{(0.2 \text{ ft/hr})(953 \text{ ft}^2)} = 7.8 \text{ hr}$$

Infiltration Basin:

$$TIME_{\text{Drawdown}} = \frac{V_s}{(K)(\text{Bottom Area})}$$

V_s = Storage Volume = 2,408 ft^3

K = 0.2 ft/hr (8.27 in/hr Rawls Rate)

Bottom Area = 379 ft^2 at elev. 105.00'

$$TIME_{\text{Drawdown}} = \frac{2,408 \text{ ft}^3}{(0.2 \text{ ft/hr})(379 \text{ ft}^2)} = 31.8 \text{ hr}$$

3.5 Standard 4: Water Quality

Standard 4 of the Massachusetts Stormwater Standards addresses stormwater quality requirements. This standard requires that new stormwater management systems be designed to achieve an 80% Total Suspended Solids (TSS) removal rate prior to discharge. MassDEP has published presumed removal rates for each of the BMP's featured in their design guidelines. Additionally, this standard addresses the required volume of stormwater runoff that is to be treated by the BMPs, as well as components of a long-term source control and pollution prevention plan.

The following treatment trains have been incorporated into the design of the stormwater management system:

Treatment Train 1: This treatment train consists of two sediment forebays in a series, and an infiltration basin. The pretreatment requirement of 44% TSS removal prior to infiltration is met through the pretreatment features of this train. The overall TSS removal for this train is 80%.

Treatment Train 2: This treatment train consists of a subsurface infiltration system. There is no pretreatment requirement because this treatment train only consists of roof runoff. The overall TSS removal for this train is 80%.

Required Water Quality Volume (Standard 4):

The project requires a Water Quality Depth = 1"

Infiltration Basin:

Total Impervious area post construction: 0.68 acres

Total Impervious area before construction: 0.34 acres

Total Impervious Required to be treated (See node 5S) = 0.21 acres

$$V_{WQ} = D_{WQ} * Impervious Area = 1" * \frac{1ft}{12"} * 0.21 acres * \frac{43560 ft^2}{acre} = 762 ft^3$$

Target Volume:

Target Volume is defined as the larger of Required Recharge Volume and Required Water Quality Volume. Therefore, Target Volume = 762 ft³ (Required Water Quality Volume). Sediment forebays, Subsurface infiltration systems, and infiltration basins provide water quality volumes and are summarized in the following table.

Recharge and Water Quality Volume Summary Table

Area, Structure Reference	Provided Recharge	Provided Water
	Volume (cf)	Quality Volume (cf)
Sediment Forebay	N/A	294
Subsurface Infiltration System 1	1,485	1,485
Infiltration Basin	2,408	2,408
Total Volume Provided	3,893	4,187
Volume Required	718	762

All volumes calculated are below the elevation of the outlet. See HydroCAD Report for stage-storage tables.

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

The project area is not considered a Land Use with Higher Potential Pollutant Load (LUHPPL) but it is located within a Zone II. As such, the project has been designed to meet the 1" Required Water Quality Volume Depth.

The proposed BMPs of the stormwater management system have been designed in compliance with the requirements of Standard 5 and the Massachusetts Stormwater Handbook. Calculations supporting the more stringent Required Water Quality volume and 44% TSS removal prior to infiltration are provided in Appendix D. A long-term pollution prevention plan has also been developed for the project and is provided as part of the Long-Term Stormwater Operation & Maintenance Plan in Appendix F.

3.7 Standard 6: Critical Areas

The project has been designed to improve water quality and quantity under proposed conditions. The stormwater BMPs selected for the project remove 80% of annual average TSS loading when constructed and maintained property.

Other Critical Areas, as defined in the Massachusetts Stormwater Handbook, are shown on Figure 2 in Appendix B.

3.8 Standard 7: Redevelopment Projects

A portion of the project is considered redevelopment. However, the project fully complies with all Standards and no re-development credits are being sought.

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

A construction period Soil Erosion and Sediment Control Plan (SESCP) is provided in Appendix E. The SESCO presents the minimum soil erosion and sediment control practices to be used during construction. General soil erosion and sedimentation control BMPs are indicated on the Site Plans.

Additionally, there will be more than one acre of land disturbed as a result of this project, therefore the construction will be required to comply with the Environmental Policy Act (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP). Coverage under the CGP will be obtained before construction commences by the Contractor. The Contractor will be required file a Notice of Intent with the EPA and to implement a Stormwater Pollution Prevention Plan (SWPPP) prior to construction. A SWPPP was not prepared as part of this report.

3.10 Standard 9: Long-Term Operation and Maintenance Plan

A Long-Term Stormwater Operations and Maintenance Plan is included in Appendix F of this report. The O&M plan indicates the responsible parties for the project, routine and non-routine maintenance tasks and inspection criteria. The O&M Plan also provides guidance on long-term pollution prevention practices for the project.

3.11 Standard 10: Prohibition of Illicit Discharges

Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing, and water used to clean residential buildings without detergents. A signed Illicit Discharge Statement is provided in Appendix G.

3.12 Local Stormwater Management Regulations

The Town of Georgetown Planning Board governs the Stormwater Permit. The Town Stormwater Ordinance specifies that applicants shall follow the performance standards outlined in the Massachusetts Stormwater Standards. Compliance with those Standards have been demonstrated in the previous sections of this report.

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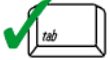
APPENDIX A



Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.¹ This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8²
- 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.



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.

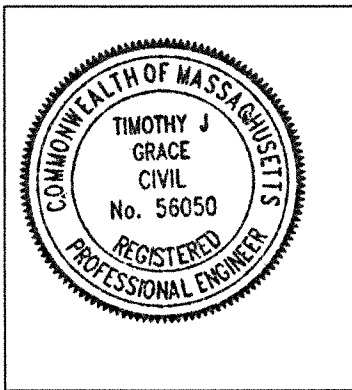
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



 7/22/25

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 Field¹
- 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.

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APPENDIX B

FIGURE 1
SITE LOCATION
May 2025

WTP Upgrades
West Street
Georgetown, Massachusetts

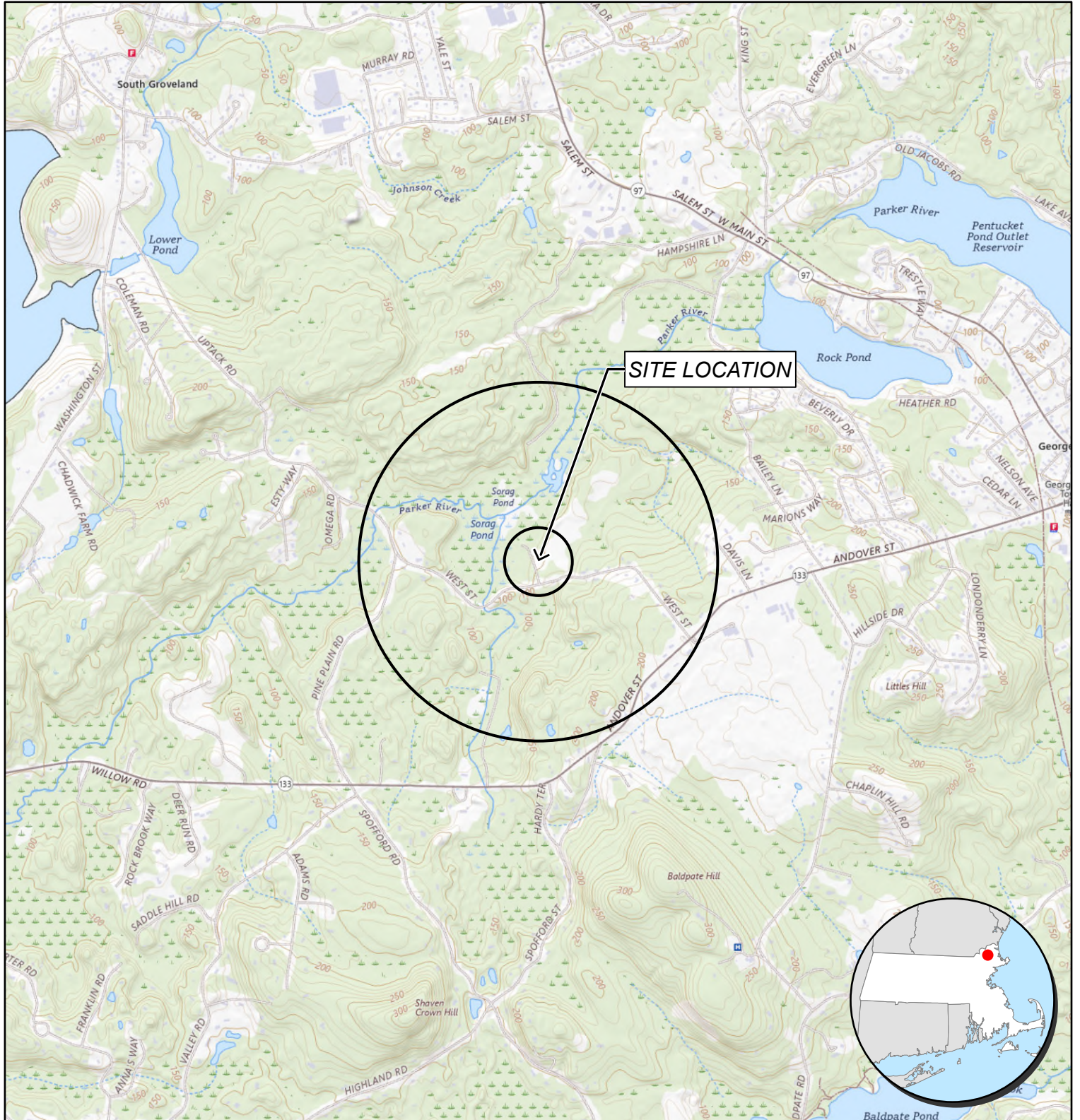
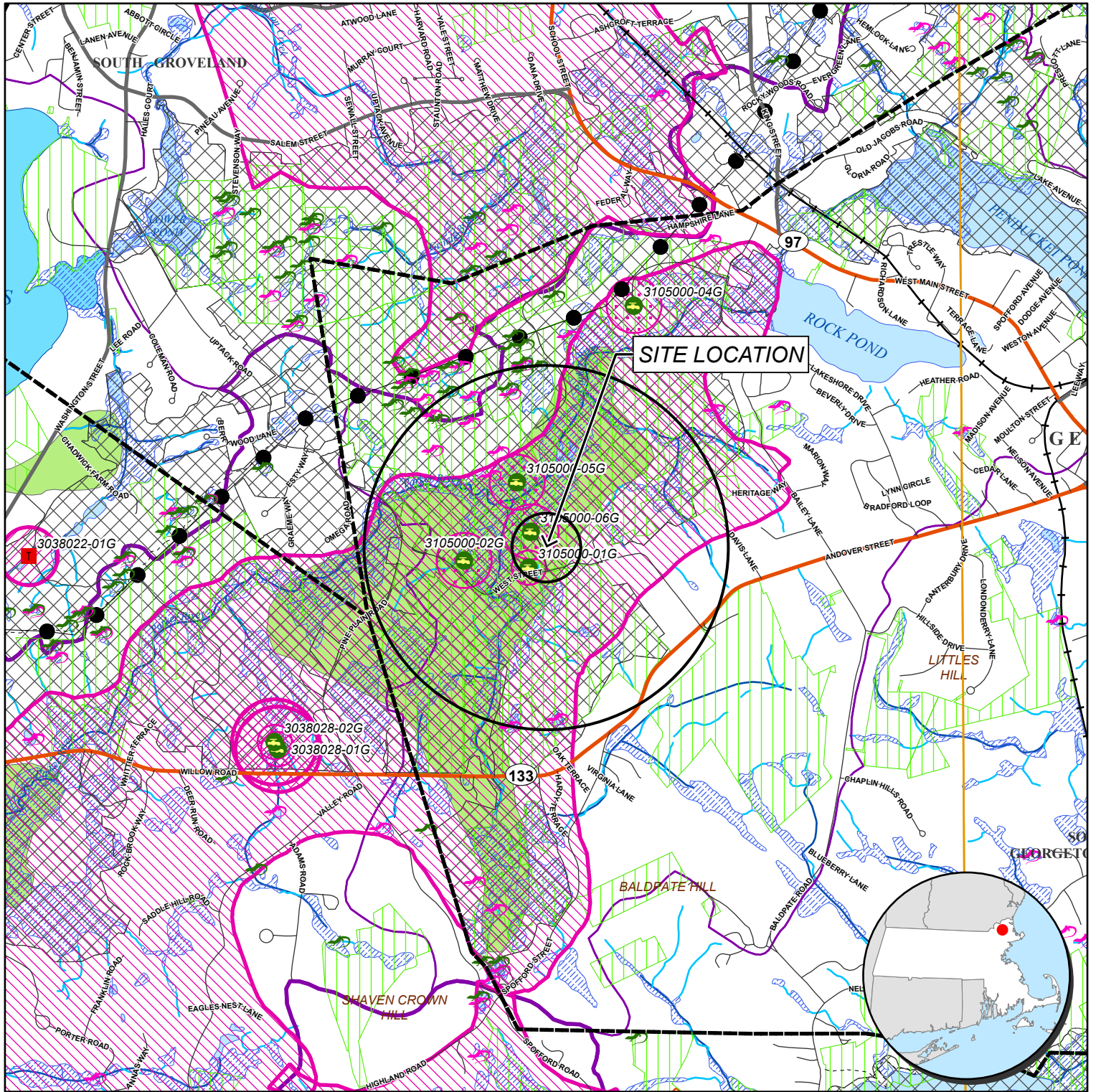


FIGURE 2
PRIORITY RESOURCE
 May 2025

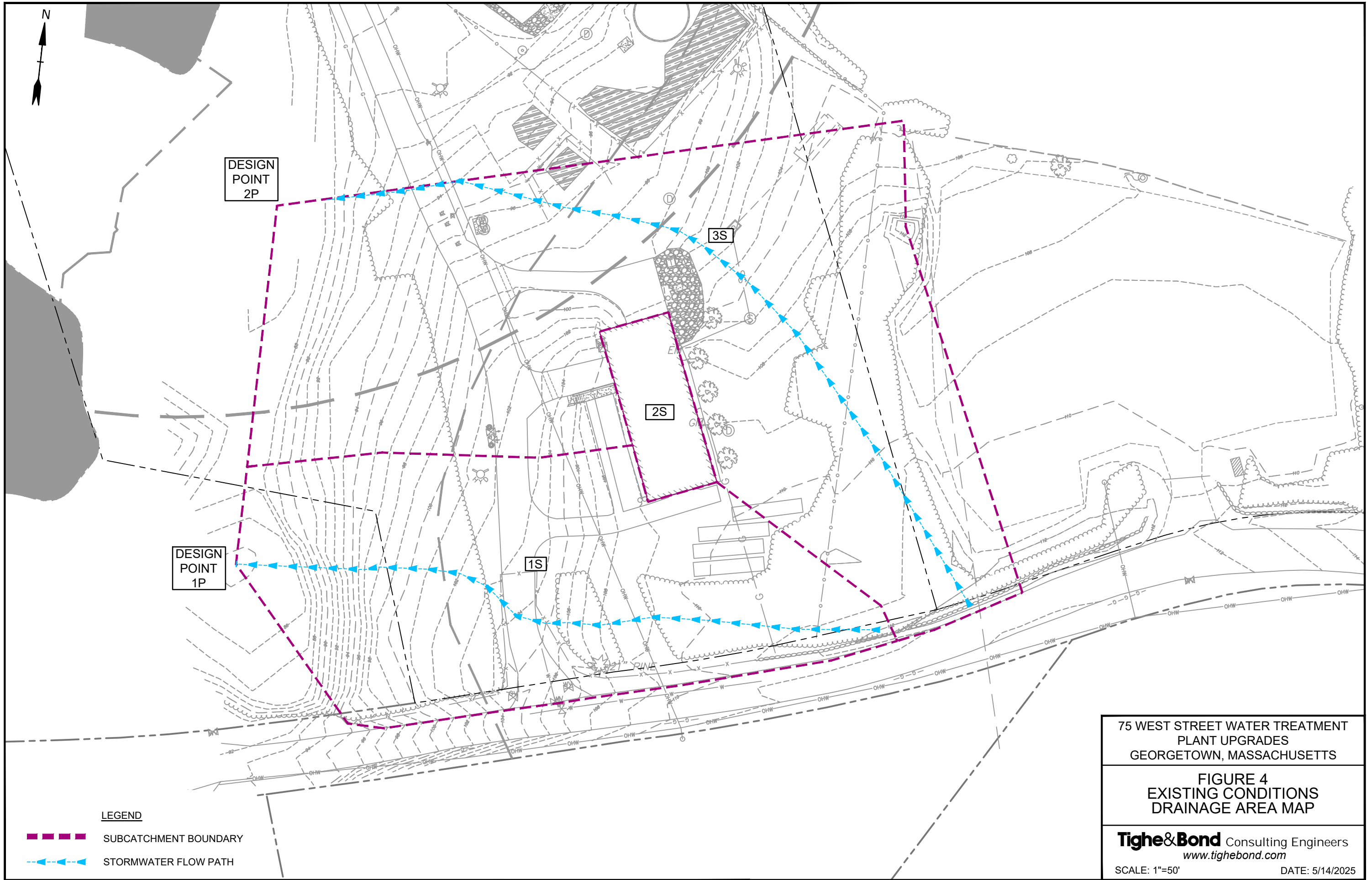


- | | | | | |
|--|---|--|---|--|
| <ul style="list-style-type: none"> NHESP Certified Vernal Pool NHESP Potential Vernal Pool Non-Landfill Solid Waste Site Proposed Well Emergency Surface Water Community Public Water Supply - Surface Water Community Public Water Supply - Groundwater | <ul style="list-style-type: none"> Non-Community Non-Transient Public Water Supply Non-Community Transient Public Water Supply Limited Access Highway Multi-Lane Highway, NOT Limited Access Other Numbered Route Major Road - Arterials and Collectors Minor Street or Road Aqueduct Hydrologic Connection | <ul style="list-style-type: none"> Stream/Intermittent Stream Pipeline Track or Trail Railroad Public Surface Water Supply Protection Area (Zone A) DEP Approved Wellhead Protection Area (Zone I) DEP Approved Wellhead Protection Area (Zone II) DEP Interim Wellhead Protection Area (IWPA) Protected and Recreational Open Space | <ul style="list-style-type: none"> Powerline Solid Waste Landfill Area of Critical Environmental Concern (ACEC) NHESP Priority Habitat for Rare Species NHESP Estimated Habitat for Rare Wildlife EPA Designated Sole Source Aquifer Major Drainage Basin Sub Drainage Basin MassDEP Inland Wetland MassDEP Coastal Wetland MassDEP Not Interpreted Wetland | <ul style="list-style-type: none"> Public Surface Water Supply (PSWS) Water Body Non-Potential Drinking Water Source Area - High Yield Non-Potential Drinking Water Source Area - Medium Yield Potentially Productive Medium Yield Aquifer Potentially Productive High Yield Aquifer County Boundary Municipal Boundary USGS Quadrangle Sheet Boundary |
|--|---|--|---|--|

Data source: Bureau of Geographic Information (MassGIS),
 Commonwealth of Massachusetts, Executive Office of Technology
 Circles indicate 500-foot and half-mile radii.
 Data valid as of May 2025.

FIGURE 3
AERIAL
May 2025





DESIGN POINT 1P

DESIGN POINT 2P

1S

2S

3S

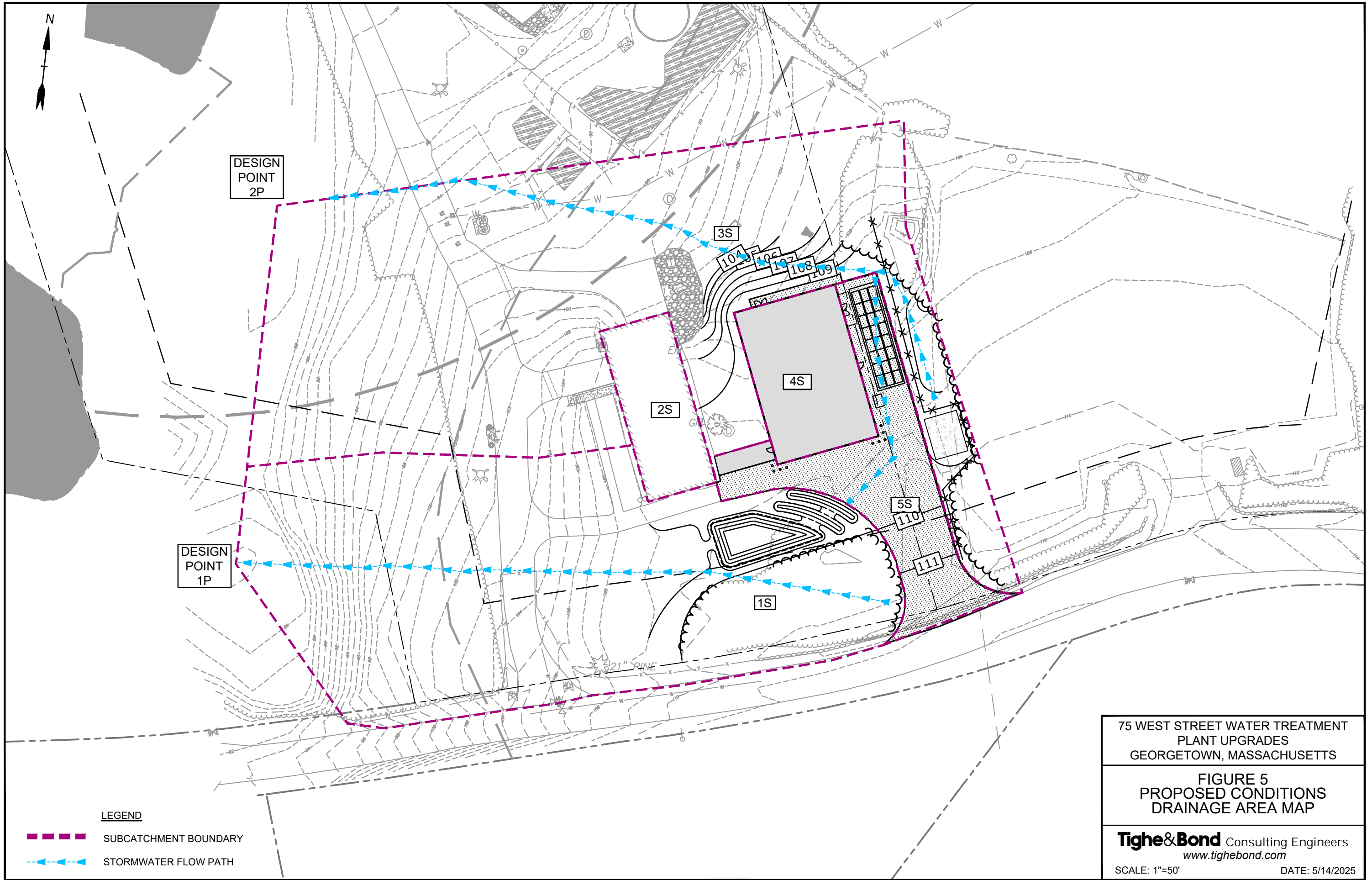
LEGEND

- - - - - SUBCATCHMENT BOUNDARY
- - - - - STORMWATER FLOW PATH

75 WEST STREET WATER TREATMENT PLANT UPGRADES
GEORGETOWN, MASSACHUSETTS

FIGURE 4
EXISTING CONDITIONS
DRAINAGE AREA MAP

Tighe&Bond Consulting Engineers
www.tighebond.com
SCALE: 1"=50' DATE: 5/14/2025



DESIGN POINT 2P

DESIGN POINT 1P

2S

3S

4S

5S

1S

104

106

107

108

109

110

111

21" PIPE

LEGEND

- ▬▬▬▬ SUBCATCHMENT BOUNDARY
- - - - - STORMWATER FLOW PATH

75 WEST STREET WATER TREATMENT PLANT UPGRADES
GEORGETOWN, MASSACHUSETTS

FIGURE 5
PROPOSED CONDITIONS
DRAINAGE AREA MAP

Tighe & Bond Consulting Engineers
www.tighebond.com

SCALE: 1"=50'

DATE: 5/14/2025

National Flood Hazard Layer FIRMMette



71°1'40"W 42°43'32"N



71°1'3"W 42°43'5"N

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

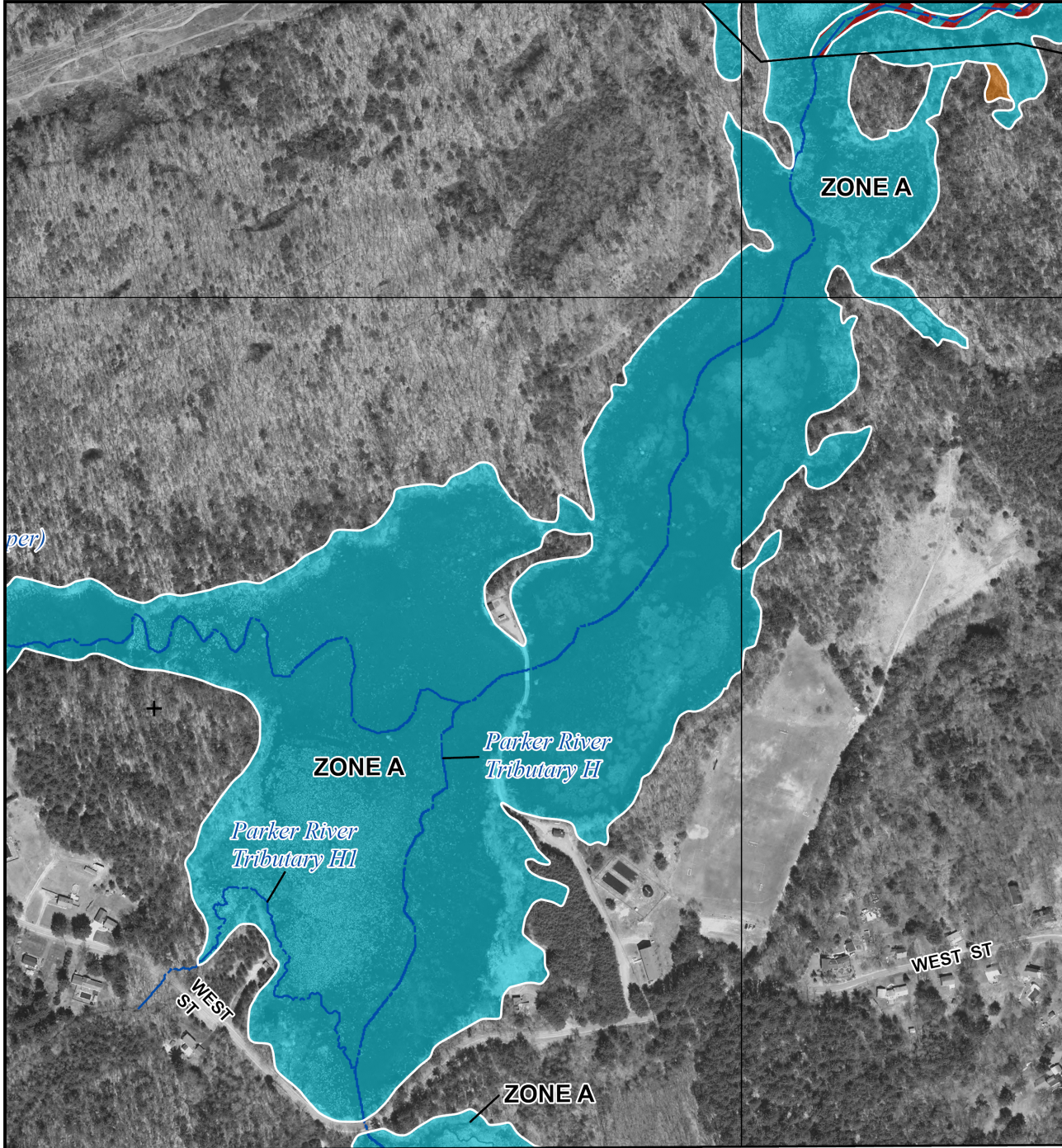
- | | | |
|------------------------------------|--|--|
| SPECIAL FLOOD HAZARD AREAS | | Without Base Flood Elevation (BFE)
<i>Zone A, V, A99</i> |
| | | With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i> |
| | | Regulatory Floodway |
| OTHER AREAS OF FLOOD HAZARD | | 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile <i>Zone X</i> |
| | | Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i> |
| | | Area with Reduced Flood Risk due to Levee. See Notes. <i>Zone X</i> |
| | | Area with Flood Risk due to Levee <i>Zone D</i> |
| OTHER AREAS | | NO SCREEN Area of Minimal Flood Hazard <i>Zone X</i> |
| | | Effective LOMRs |
| GENERAL STRUCTURES | | Area of Undetermined Flood Hazard <i>Zone D</i> |
| | | Channel, Culvert, or Storm Sewer |
| | | Levee, Dike, or Floodwall |
| OTHER FEATURES | | 20.2 Cross Sections with 1% Annual Chance Water Surface Elevation |
| | | 17.5 Coastal Transect |
| | | Base Flood Elevation Line (BFE) |
| | | Limit of Study |
| | | Jurisdiction Boundary |
| MAP PANELS | | Coastal Transect Baseline |
| | | Profile Baseline |
| | | Hydrographic Feature |
| | | Digital Data Available |
| | | No Digital Data Available |
| | | Unmapped |
| | | The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location. |



This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

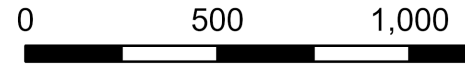
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **5/15/2023 at 7:26 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



Map Projection:
 NAD 1983 State Plane, Massachusetts Mainland,
 Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 500 feet



National Flood Insurance Program
 FEDERAL EMERGENCY MANAGEMENT AGENCY
 U.S. DEPARTMENT OF HOMELAND SECURITY

ESSEX COUNTY, MASSACHUSETTS
 (All Jurisdictions)

PANEL 0232 OF 0600



Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
GEORGETOWN, TOWN OF	250081	0232	G
GROVELAND, TOWN OF	250083	0232	G

VERSION NUMBER
 2.6.3.6

MAP NUMBER
 25009C0232G

MAP REVISED
 July 8, 2025

This is an official FIRMette showing a portion of the above-referenced flood map created from the MSC FIRMette Web tool. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For additional information about how to make sure the map is current, please see the Flood Hazard Mapping Updates Overview Fact Sheet available on the FEMA Flood Map Service Center home page at <https://msc.fema.gov>.

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APPENDIX C



United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for **Essex County, Massachusetts, Northern Part**



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

Custom Soil Resource Report

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

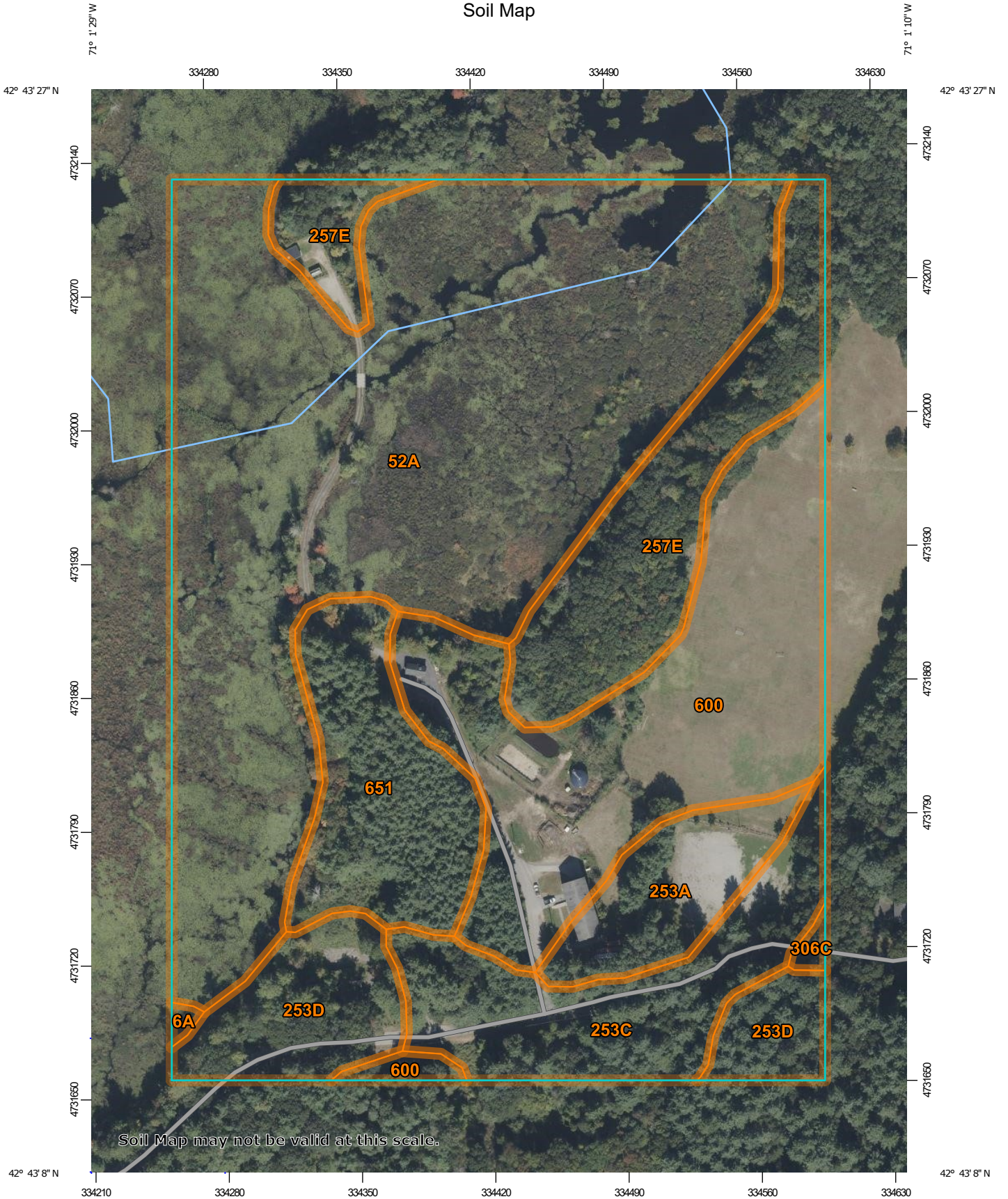
Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

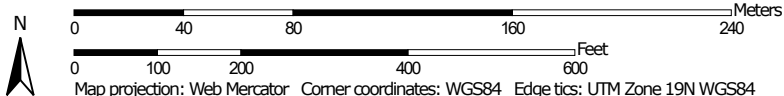
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map




Map Scale: 1:2,760 if printed on A portrait (8.5" x 11") sheet.



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 Map Unit Polygons


 Soil Map Unit Lines


 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot


 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water


 Perennial Water

 Rock Outcrop


 Saline Spot

 Sandy Spot

 Severely Eroded Spot


 Sinkhole


 Slide or Slip


 Sodic Spot


 Spoil Area

 Stony Spot


 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

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 1:15,800.

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: Essex County, Massachusetts, Northern Part
 Survey Area Data: Version 20, 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: Mar 1, 2023—Sep 1, 2023

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	0.1	0.1%
52A	Freetown muck, 0 to 1 percent slopes	17.8	44.3%
253A	Hinckley loamy sand, 0 to 3 percent slopes	1.7	4.2%
253C	Hinckley loamy sand, 8 to 15 percent slopes	3.3	8.3%
253D	Hinckley loamy sand, 15 to 25 percent slopes	2.6	6.5%
257E	Hinckley and Windsor soils, 25 to 35 percent slopes	4.4	10.9%
306C	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	0.1	0.2%
600	Pits, gravel	7.2	18.0%
651	Udortheents, smoothed	3.0	7.5%
Totals for Area of Interest		40.1	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas

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are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Essex County, Massachusetts, Northern Part

6A—Scarboro mucky fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svky
Elevation: 0 to 1,320 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Scarboro and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scarboro

Setting

Landform: Drainageways, outwash deltas, outwash terraces, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy glaciofluvial deposits derived from schist and/or sandy glaciofluvial deposits derived from gneiss and/or sandy glaciofluvial deposits derived from granite

Typical profile

Oe - 0 to 3 inches: mucky peat
A - 3 to 11 inches: mucky fine sandy loam
Cg1 - 11 to 21 inches: sand
Cg2 - 21 to 65 inches: gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: About 0 to 2 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 10 percent
Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Wareham

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Walpole

Percent of map unit: 5 percent
Landform: Deltas, depressions, outwash terraces, depressions, outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2q9
Elevation: 0 to 1,110 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Freetown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown

Setting

Landform: Depressions, depressions, swamps, kettles, marshes, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

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Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high
(0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Whitman

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 5 percent
Landform: Bogs, swamps, marshes, depressions, depressions, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

253A—Hinckley loamy sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svm7

Elevation: 0 to 1,420 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 250 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Hinckley and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash terraces, outwash plains, kame terraces, outwash deltas

Landform position (three-dimensional): Tread

Down-slope shape: Concave, convex, linear

Across-slope shape: Convex, linear, concave

Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material

A - 1 to 8 inches: loamy sand

Bw1 - 8 to 11 inches: gravelly loamy sand

Bw2 - 11 to 16 inches: gravelly loamy sand

BC - 16 to 19 inches: very gravelly loamy sand

C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3s

Hydrologic Soil Group: A

Custom Soil Resource Report

Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 5 percent
Landform: Outwash deltas, outwash terraces, kame terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Landform: Outwash deltas, kame terraces, outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 4 percent
Landform: Outwash deltas, outwash terraces, kame terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Walpole

Percent of map unit: 1 percent
Landform: Deltas, depressions, outwash terraces, depressions, outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

253C—Hinckley loamy sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2svm9
Elevation: 0 to 1,480 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent

Custom Soil Resource Report

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces

Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser

Down-slope shape: Concave, convex, linear

Across-slope shape: Convex, linear, concave

Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material

A - 1 to 8 inches: loamy sand

Bw1 - 8 to 11 inches: gravelly loamy sand

Bw2 - 11 to 16 inches: gravelly loamy sand

BC - 16 to 19 inches: very gravelly loamy sand

C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 8 to 15 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: A

Ecological site: F144AY022MA - Dry Outwash

Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent

Landform: Outwash deltas, moraines, outwash plains, kame terraces, outwash terraces

Landform position (two-dimensional): Backslope, footslope

Landform position (three-dimensional): Base slope, tread

Down-slope shape: Concave, linear

Across-slope shape: Concave, linear

Hydric soil rating: No

Windsor

Percent of map unit: 5 percent

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Landform: Moraines, eskers, kames, outwash deltas, outwash terraces, outwash plains, kame terraces

Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser

Down-slope shape: Concave, convex, linear

Across-slope shape: Convex, linear, concave

Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent

Landform: Kames, outwash plains, outwash terraces, moraines, eskers

Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser

Down-slope shape: Convex

Across-slope shape: Convex

Hydric soil rating: No

253D—Hinckley loamy sand, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 2svmc

Elevation: 0 to 1,460 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Hinckley and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Kames, kame terraces, outwash deltas, outwash terraces, moraines, eskers, outwash plains

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser

Down-slope shape: Concave, convex, linear

Across-slope shape: Convex, linear, concave

Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material

A - 1 to 8 inches: loamy sand

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Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 8 percent
Landform: Eskers, outwash terraces, kames, outwash plains, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Landform: Kames, kame terraces, moraines, eskers, outwash deltas, outwash terraces, outwash plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 2 percent
Landform: Eskers, kame terraces, outwash deltas, moraines, outwash plains, outwash terraces
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Convex, concave, linear
Across-slope shape: Convex, concave, linear
Hydric soil rating: No

257E—Hinckley and Windsor soils, 25 to 35 percent slopes

Map Unit Setting

National map unit symbol: 2svm2
Elevation: 0 to 1,470 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hinckley and similar soils: 50 percent
Windsor and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 25 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

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Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Windsor

Setting

Landform: Moraines, eskers, kames, outwash deltas, outwash terraces, outwash plains, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 25 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 10 percent
Landform: Kame terraces, outwash plains, kames, outwash terraces, moraines, eskers
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser

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Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

306C—Paxton fine sandy loam, 8 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w677
Elevation: 0 to 1,330 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Paxton, very stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton, Very Stony

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

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Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: C

Ecological site: F144AY007CT - Well Drained Dense Till Uplands

Hydric soil rating: No

Minor Components

Woodbridge, very stony

Percent of map unit: 8 percent

Landform: Hills, drumlins, ground moraines

Landform position (two-dimensional): Backslope, footslope

Landform position (three-dimensional): Side slope

Down-slope shape: Concave

Across-slope shape: Linear

Hydric soil rating: No

Charlton, very stony

Percent of map unit: 5 percent

Landform: Hills

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Convex

Hydric soil rating: No

Ridgebury, very stony

Percent of map unit: 2 percent

Landform: Drumlins, depressions, ground moraines, hills, drainageways

Landform position (two-dimensional): Footslope, toeslope

Landform position (three-dimensional): Head slope, base slope

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

600—Pits, gravel

Map Unit Setting

National map unit symbol: vjq2

Frost-free period: 125 to 165 days

Farmland classification: Not prime farmland

Map Unit Composition

Pits: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits

Setting

Parent material: Loose sandy and gravelly glaciofluvial deposits

651—Udorthents, smoothed

Map Unit Setting

National map unit symbol: vjwk

Elevation: 0 to 3,000 feet

Mean annual precipitation: 45 to 54 inches

Mean annual air temperature: 43 to 54 degrees F

Frost-free period: 145 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 80 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Parent material: Excavated and filled land loamy and/or excavated and filled land sandy and gravelly

Typical profile

H1 - 0 to 6 inches: variable

H2 - 6 to 60 inches: variable

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 20.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Hydric soil rating: Unranked

Minor Components

Urban land

Percent of map unit: 10 percent

Hydric soil rating: Unranked

Beaches

Percent of map unit: 8 percent

Custom Soil Resource Report

Hydric soil rating: Unranked

Dumps

Percent of map unit: 2 percent

Hydric soil rating: Unranked

References

- American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.
- American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.
- Federal Register. July 13, 1994. Changes in hydric soils of the United States.
- Federal Register. September 18, 2002. Hydric soils of the United States.
- Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.
- National Research Council. 1995. Wetlands: Characteristics and boundaries.
- Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262
- Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577
- Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580
- Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.
- United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.
- United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374
- United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084>

Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Georgetown Water Treatment Plant

Owner Name

75 West Street

Street Address

Georgetown

City

MA

State

2 / 53

Map/Lot #

01833

Zip Code

B. Site Information

1. (Check one) New Construction Upgrade

2. Soil Survey NRCS Web Soil Survey 253A/253C/600 Hinkley Loamy Sand/Pits, Gravel
Source Soil Map Unit Soil Series

Deltas, terraces, moraines, eskers, kames, plains None
Landform Soil Limitations

Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist / Loose sandy and gravelly glaciofluvial deposits
Soil Parent material

3. Surficial Geological Report Georgetown Quadrangle/ Stone and DiGiacomo-Cohen 2018 Coarse deposits
Year Published/Source Map Unit

Gravel deposits poorly sorted. Mixture of gravels and sands well sorted to poorly sorted. Very coarse to fine sand well sorted.
Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? Yes No

5. Within a velocity zone? Yes No

6. Within a Mapped Wetland Area? Yes No If yes, MassGIS Wetland Data Layer:

7. Current Water Resource Conditions (USGS): 7/3/2025 Range: Above Normal Normal Below Normal
Month/Day/ Year Wetland Type

8. Other references reviewed: Within a Zone II
(Zone II, IWPA, Zone A, EEA Data Portal, etc.)



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 1 7/7/2025 8:15am sunny, 80's 42.720038 -71.021748
Hole # Date Time Weather Latitude Longitude

1. Land Use wooded pine and oak trees none
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.)
 Description of Location: ~30' in from road, ~40' east of driveway 0-3%
Slope (%)

2. Soil Parent Material: Glaciofluvial Deposits Plain Plain
Landform Position on Landscape (SU, SH, BS, FS, TS, Plain)

3. Distances from: Open Water Body >50 feet Drainage Way >100 feet Wetlands >50 feet
 Property Line >10 feet Drinking Water Well >100 feet Other - feet

4. Unsuitable Materials Present: Yes No If Yes: Disturbed Soil/Fill Material Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: NA Depth to Weeping in Hole NA Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-2	O	loamy sand	10YR3/3	-	Cnc : -	-	-	-	massive	very friable	
					Dpl: -						
2-16	C	sand	10YR5/8	-	Cnc : -	-	15	40	single grain	loose	
					Dpl: -						
16-26	C ₂	sand	10YR6/4	-	Cnc : -	-	-	-	single grain	loose	
					Dpl: -						
26-40	C ₃	sand	10YR6/4	-	Cnc : -	-	30	20	single grain	loose	
					Dpl: -						
40-96	C ₄	sand	10YR6/4	-	Cnc : -	-	-	5	single grain	loose	
					Dpl: -						
96-120+	C ₅	sand	10YR6/4	-	Cnc : -	-	20	5	single grain	loose	
					Dpl: -						

Additional Notes:

C₂-C₅ are all same base sand, but have significantly different amounts of gravel and/or cobbles in defined layers.

No water or redox features - test pit terminated at 120 inches due to reach



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 2 7/7/2025 9:15 sunny, 80's 42.720072 -71.021462
Hole # Date Time Weather Latitude Longitude

1. Land Use: woodland pine and oak trees none
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.)

Description of Location: ~30' in from street and ~100' from driveway entrance 0-3
Slope (%)

2. Soil Parent Material: Glaciofluvial deposits plain plain
Landform Position on Landscape (SU, SH, BS, FS, TS, Plain)

3. Distances from: Open Water Body >50 feet Drainage Way >100 feet Wetlands >50 feet
 Property Line >10 feet Drinking Water Well >100 feet Other NA feet

4. Unsuitable Materials Present: Yes No If Yes: Disturbed Soil/Fill Material Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: - Depth to Weeping in Hole - Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-8	O	loamy sand	10YR2/2	-	Cnc : - Dpl: -	-	-	-	massive	very friable	
8-21	C	sand	10YR6/4	-	Cnc : - Dpl: -	-	-	10	single grain	loose	
21-48	C ₂	sand	10YR6/3	-	Cnc : - Dpl: -	-	20	30	single grain	loose	
48-138+	C ₃	sand	10YR6/3	-	Cnc : - Dpl: -	-	-	5	single grain	loose	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:
No water or redox features - test pit terminated at 138 inches due to reach



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

Depth to soil redoximorphic features

Obs. Hole # 1

Obs. Hole # 2

120+ inches

138+ inches

Depth to observed standing water in observation hole

_____ inches

_____ inches

Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)

_____ inches

_____ inches

_____ Index Well Number

_____ Reading Date

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

Yes No

b. If yes, at what depth was it observed (exclude O, A, and E Horizons)?

Upper boundary: _____
inches

Lower boundary: _____
inches

c. If no, at what depth was impervious material observed?

Upper boundary: _____
inches

Lower boundary: _____
inches



Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

Date

Typed or Printed Name of Soil Evaluator / License #

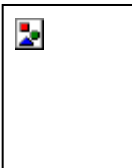
Expiration Date of License

Name of Approving Authority Witness

Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).

Field Diagrams: Use this area for field diagrams:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Georgetown Water Treatment Plant

Owner Name

75 West Street

Street Address

Georgetown

City

MA

State

2 / 53

Map/Lot #

01833

Zip Code

B. Site Information

1. (Check one) New Construction Upgrade

2. Soil Survey NRCS Web Soil Survey 253A/253C/600 Hinkley Loamy Sand/Pits, Gravel
Source Soil Map Unit Soil Series

Deltas, terraces, moraines, eskers, kames, plains None
Landform Soil Limitations

Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist / Loose sandy and gravelly glaciofluvial deposits
Soil Parent material

3. Surficial Geological Report Georgetown Quadrangle/ Stone and DiGiacomo-Cohen 2018 Coarse deposits
Year Published/Source Map Unit

Gravel deposits poorly sorted. Mixture of gravels and sands well sorted to poorly sorted. Very coarse to fine sand well sorted.
Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? Yes No

5. Within a velocity zone? Yes No

6. Within a Mapped Wetland Area? Yes No If yes, MassGIS Wetland Data Layer:

7. Current Water Resource Conditions (USGS): 7/3/2025 Range: Above Normal Normal Below Normal
Month/Day/ Year Wetland Type

8. Other references reviewed: Within a Zone II
(Zone II, IWPA, Zone A, EEA Data Portal, etc.)



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 3 7/7/2025 9:45am sunny, 80's 42.720711 -71.021291
Hole # Date Time Weather Latitude Longitude

1. Land Use wooded pine and oak trees none
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.)
 Slope (%) 5-10%

Description of Location: ~10' from fence to soccer field, 150' from building

2. Soil Parent Material: Glaciofluvial Deposits hill shoulder
Landform Position on Landscape (SU, SH, BS, FS, TS, Plain)

3. Distances from: Open Water Body >50 feet Drainage Way >100 feet Wetlands >50 feet
 Property Line >10 feet Drinking Water Well >100 feet Other - feet

4. Unsuitable Materials Present: Yes No If Yes: Disturbed Soil/Fill Material Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: NA Depth to Weeping in Hole NA Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-11	O	loamy sand	10YR3/3	-	Cnc : - Dpl: -	-	-	-	massive	very friable	
11-24	C	sand	10YR5/6	-	Cnc : - Dpl: -	-	30	10	single grain	loose	
24-65	C ₂	sand	10YR6/3	-	Cnc : - Dpl: -	-	10	30	single grain	loose	
65-144+	C ₃	sand	10YR6/3	120"	Cnc :2.5YR6/8 Dpl: -	100	-	5	single grain	loose	redox feature was a couple full ring layers around pit
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: _____

Hole # _____ Date _____ Time _____ Weather _____ Latitude _____ Longitude _____

1. Land Use: _____

(e.g., woodland, agricultural field, vacant lot, etc.) _____ Vegetation _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%) _____

Description of Location: _____

2. Soil Parent Material: _____

Landform _____ Position on Landscape (SU, SH, BS, FS, TS, Plain) _____

3. Distances from:

Open Water Body _____ feet Drainage Way _____ feet Wetlands _____ feet

Property Line _____ feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable Materials Present: Yes No If Yes: Disturbed Soil/Fill Material Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No

If yes: _____ Depth to Weeping in Hole _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
					Cnc :						
					Dpl:						
					Cnc :						
					Dpl:						
					Cnc :						
					Dpl:						
					Cnc :						
					Dpl:						
					Cnc :						
					Dpl:						

Additional Notes: _____



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

Depth to soil redoximorphic features

Obs. Hole # 3

Obs. Hole # _____

120 inches

_____ inches

Depth to observed standing water in observation hole

_____ inches

_____ inches

Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)

_____ inches

_____ inches

Index Well Number _____

Reading Date _____

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole/Well# _____

S_c _____

S_r _____

OW_c _____

OW_{max} _____

OW_r _____

S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

Yes No

b. If yes, at what depth was it observed (exclude O, A, and E Horizons)?

Upper boundary: _____
inches

Lower boundary: _____
inches

c. If no, at what depth was impervious material observed?

Upper boundary: _____
inches

Lower boundary: _____
inches



Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

Date

Typed or Printed Name of Soil Evaluator / License #

Expiration Date of License

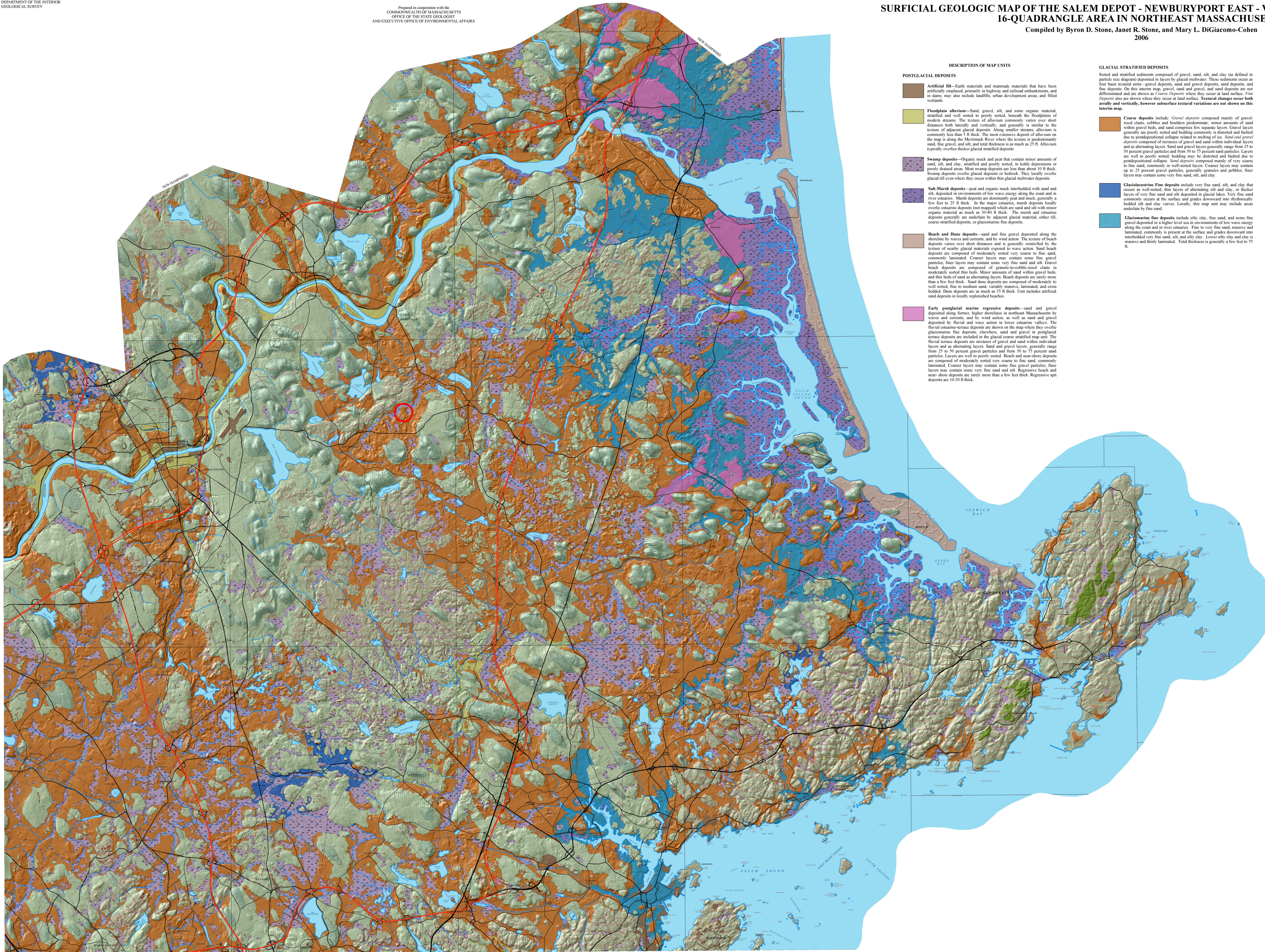
Name of Approving Authority Witness

Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).

Field Diagrams: Use this area for field diagrams:

Compiled by Byron D. Stone, Janet R. Stone, and Mary L. DiGiacomo-Cohen
2006



DESCRIPTION OF MAP UNITS

- POSTGLACIAL DEPOSITS**
- Artificial fill**—Earth materials and manmade materials that have been artificially emplaced, primarily in highway and railroad embankments and in dams; may also include landfills, urban development areas, and filled wetlands.
 - Floodplain alluvium**—Sand, gravel, silt, and some organic material, stratified and well sorted to poorly sorted, beneath the floodplains of modern streams. The texture of alluvium commonly varies over short distances both laterally and vertically, and generally is similar to the texture of adjacent glacial deposits. Along smaller streams, alluvium is commonly less than 5 ft thick. The most extensive deposit of alluvium on the map is along the Merrimack River where the texture is predominantly sand, fine gravel, and silt, and total thickness is as much as 25 ft. Alluvium typically overlies thicker glacial stratified deposits.
 - Swamp deposits**—Organic muck and peat that contain minor amounts of sand, silt, and clay, stratified and poorly sorted, in kettle depressions or poorly drained areas. Most swamp deposits are less than about 10 ft thick. Swamp deposits overlie glacial deposits or bedrock. They locally overlie glacial till even where they occur within thin glacial meltwater deposits.
 - Salt Marsh deposits**—peat and organic muck interbedded with sand and silt, deposited in environments of low wave energy along the coast and in river estuaries. Marsh deposits are dominantly peat and muck, generally a few feet to 25 ft thick. In the major estuaries, marsh deposits locally overlie estuarine deposits (not mapped) which are sand and silt with minor organic material as much as 30-80 ft thick. The marsh and estuarine deposits generally are underlain by adjacent glacial material, either till, coarse stratified deposits, or glaciolacustrine fine deposits.
 - Beach and Dune deposits**—sand and fine gravel deposited along the shoreline by waves and currents, and by wind action. The texture of beach deposits varies over short distances and is generally controlled by the texture of nearby glacial materials exposed to wave action. Sand beach deposits are composed of moderately sorted very coarse to fine sand, commonly laminated. Coarser layers may contain some fine gravel particles; finer layers may contain some very fine sand and silt. Gravel beach deposits are composed of granule-to-cobble-sized clasts in moderately sorted thin beds. Minor amounts of sand within gravel beds, and thin beds of sand as alternating layers. Beach deposits are rarely more than a few feet thick. Sand dune deposits are composed of moderately to well sorted, fine to medium sand, variably massive, laminated, and cross bedded. Dune deposits are as much as 35 ft thick. Unit includes artificial sand deposits in locally replenished beaches.
 - Early postglacial marine regressive deposits**—sand and gravel deposited along former, higher shorelines in northeast Massachusetts by waves and currents, and by wind action, as well as sand and gravel deposited by fluvial and wave action in lower estuarine valleys. The fluvial estuarine terrace deposits are shown on the map where they overlie glaciolacustrine fine deposits; elsewhere, sand and gravel in postglacial terrace deposits are included in the glacial coarse stratified map unit. The fluvial terrace deposits are mixtures of gravel and sand within individual layers and as alternating layers. Sand and gravel layers, generally range from 25 to 50 percent gravel particles and from 50 to 75 percent sand particles. Layers are well to poorly sorted. Beach and near-shore deposits are composed of moderately sorted very coarse to fine sand, commonly laminated. Coarser layers may contain some fine gravel particles; finer layers may contain some very fine sand and silt. Regressive beach and near-shore deposits are rarely more than a few feet thick. Regressive spit deposits are 10-30 ft thick.

GLACIAL STRATIFIED DEPOSITS

- Sorted and stratified sediments composed of gravel, sand, silt, and clay (as defined in particle size diagram) deposited in layers by glacial meltwater. These sediments occur as four basic textural units—gravel deposits, sand and gravel deposits, sand deposits, and fine deposits. On this interim map, gravel, sand and gravel, and sand deposits are not differentiated and are shown as *Coarse Deposits* where they occur at land surface. *Fine Deposits* also are shown where they occur at land surface. Textural changes occur both laterally and vertically, however subsurface textural variations are not shown on this interim map.
- Coarse deposits** include: Gravel deposits composed mainly of gravel-sized clasts; cobbles and boulders predominant; minor amounts of sand within gravel beds, and sand comprises few separate layers. Gravel layers generally are poorly sorted and bedding commonly is distorted and faulted due to postdepositional collapse. Sand deposits composed mainly of very coarse to fine sand, commonly in well-sorted layers. Coarser layers may contain up to 25 percent gravel particles, generally granules and pebbles; finer layers may contain some very fine sand, silt, and clay.
 - Glaciolacustrine Fine deposits** include very fine sand, silt, and clay that occurs as well-sorted, thin layers of alternating silt and clay, or thicker layers of very fine sand and silt deposited in glacial lakes. Very fine sand commonly occurs at the surface and grades downward into rhythmically bedded silt and clay varves. Locally, this map unit may include areas underlain by fine sand.
 - Glaciolacustrine fine deposits** include silt, clay, fine sand, and some fine gravel deposited in a higher level sea in environments of low wave energy along the coast and in river estuaries. Fine to very fine sand, massive and laminated, commonly is present at the surface and grades downward into interbedded very fine sand, silt, and silt, clay. Lower silt, clay and clay is massive and thinly laminated. Total thickness is generally a few feet to 75 ft.

GLACIAL TILL DEPOSITS

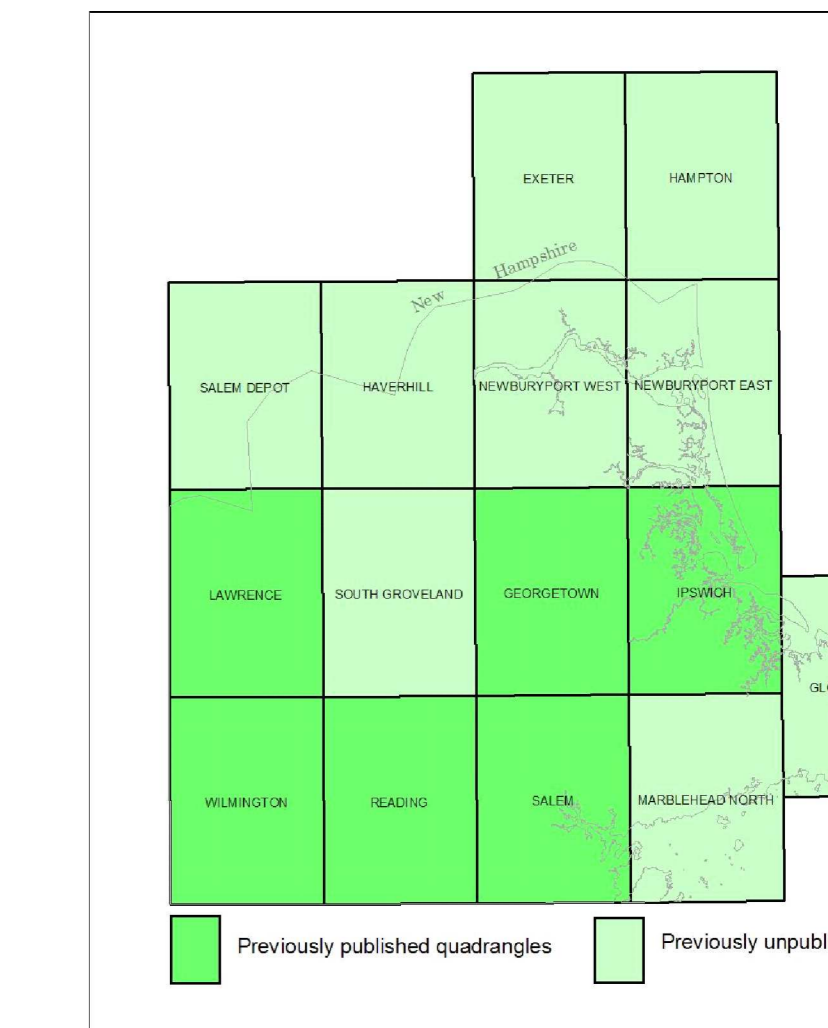
- Thin till**—Non-sorted, nonstratified matrix of sand, some silt, and little clay containing scattered gravel clasts and few large boulders; in areas where till is generally less than 10-15 ft thick and including areas of bedrock outcrop where till is absent. Predominantly upper till of the last glaciation; loose to moderately compact, generally sandy, commonly stony. Two facies are present in some places; a looser, coarser-grained ablation facies, melted out from supraglacial positions, and an underlying more compact, finer-grained lodgement facies deposited subglacially. In general, both ablation and lodgement facies of upper till derived from fine-grained bedrock are finer grained, more compact, less stony and have fewer surface boulders than upper till derived from coarser grained crystalline rocks. Fine-grained bedrock sources include the red Mesozoic sedimentary rocks of the Connecticut River lowland, marble in the western river valleys, and fine-grained schists in upland areas.
- Thick till**—Non-sorted, nonstratified matrix of sand, some silt, and little clay containing scattered gravel clasts and few large boulders at the surface; in the shallow subsurface, compact, non-sorted matrix of silt, very fine sand, and some clay containing scattered small gravel clasts in areas where till is greater than 10-15 ft thick, chiefly in drumlin landforms in which till thickness commonly exceeds 100 ft (maximum recorded thickness is 230 ft). Although upper till at the surface, the lower till constitutes the bulk of the material in these areas. Lower till is moderately to very compact, and is commonly finer grained and less stony than upper till. An oxidized zone, the lower part of a soil profile formed during a period of interglacial weathering, is generally present in the upper part of the lower till. This zone commonly shows closely spaced joints that are stained with iron and manganese oxides.
- End moraine deposits**—Composed predominantly of boulders and ablation facies sandy upper till, lenses of stratified sand and gravel occur locally within the till. Surface boulders on end moraine deposits are generally more numerous than on adjacent till surfaces; dense concentrations of boulders are present in some places. Deposits occur as free-standing hummocky landforms, commonly in ridges that trend NE-SW, and range in thickness from 10 to 60 ft.

BEDROCK AREAS

- Bedrock outcrops and areas of abundant outcrop or shallow bedrock**—Solid color shows extent of individual bedrock outcrops; line pattern indicates areas of shallow bedrock or clays where small outcrops are too numerous to map individually, in areas of shallow bedrock, surficial materials are less than 5-10 ft thick.

Boundaries	PARTICLE DIAMETER									
	10	5.0	2.0	0.85	0.425	0.25	0.15	0.075	0.0375	0.019
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
Boulders	>10	5-10	2-5	0.85-2	0.425-0.85	0.25-0.425	0.15-0.25	0.075-0.15	0.0375-0.075	<0.0375
Cobbles	>25	64	4	2	0.5	0.25	0.125	0.063	0.032	0.016
Gravels	>2	>0.85	>0.425	>0.25	>0.15	>0.075	>0.0375	>0.019	>0.0095	>0.00475
SANDS	GRAVEL PARTICLES					FINE PARTICLES				
	COARSE					FINE				
	VERY COARSE					VERY FINE				
	MEDIUM					FINE				
	SAND					CLAY				

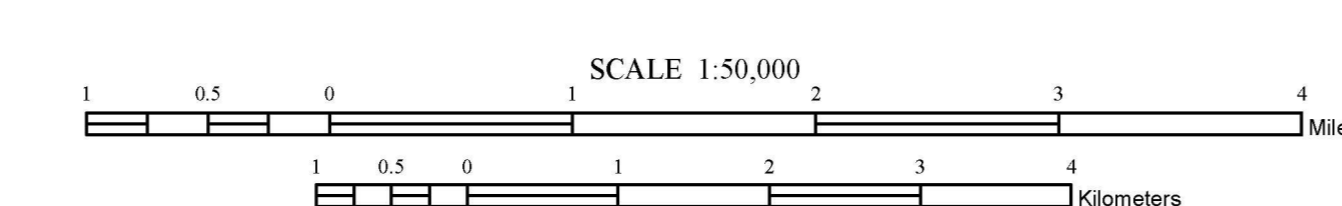
Grain-size classification used in this report, modified from Wentworth (1922)



SOURCES OF DATA

- See explanatory pamphlets for references
- Exeter Quadrangle**
Map units were reproduced from Goldsmith (2001)
 - Hampton Quadrangle**
Map units were reproduced from Koffel, Carl, Gephart, G. D., and Schaefer, J.P. (1989)
 - Salem Depot Quadrangle**
Stone, B.D., 1982, Unpublished field map
 - Haverhill Quadrangle**
Stone, B.D., 1982, Unpublished field map
 - Newburyport West Quadrangle**
Stone, B.D., 1982, Unpublished field map
 - Newburyport East Quadrangle**
Stone, B.D., 1982, Unpublished field map
 - Lawrence Quadrangle**
Map units were reproduced from Castle (1958). Glacial Stratified Deposits in this quadrangle include deposits of glacial Lake Melton, and other glaciolacustrine and glaciolacustrine deposits. Fine-grained glacial stratified deposits at land surface include lake-bottom deposits of glacial Lake Melton (unit Qm of Castle, 1958); the fine-grained unit has been extended beneath adjacent water bodies and postglacial deposits on this map. Deposits mapped as moraine ice-contact deposits (unit Qm of Castle, 1958) have been included here as coarse stratified deposits. Thick till areas were reproduced from the drumlin till unit (Qgd of Castle, 1958); other areas of thick till were inferred from photographic image and topographic analysis.
 - South Groveland Quadrangle**
Stone, B.D., 1982, Unpublished field maps
 - Georgetown Quadrangle**
Map units were reproduced from Cuppels (1969). Glacial Stratified Deposits in this quadrangle include glaciolacustrine, glaciolacustrine, and glaciolacustrine deposits. Fine-grained glacial stratified deposits at land surface include parts of marine and estuarine deposits (unit Qm of Cuppels, 1969); the fine-grained unit has been extended beneath adjacent water bodies and postglacial deposits on this map. Thick till areas shown on this map were inferred from photographic image and topographic analysis and drumlin symbols shown by Cuppels (1969).
 - Ipswich Quadrangle**
Map units were reproduced from Summel (1963). Glacial Stratified Deposits in this quadrangle include glaciolacustrine, glaciolacustrine, and glaciolacustrine deposits. Fine-grained glacial stratified deposits at land surface include marine and estuarine clay deposits (unit Qm of Summel, 1963); this unit has been extended beneath adjacent water bodies and postglacial deposits on this map. Thick till areas were reproduced from the drumlin till unit (Qd of Summel, 1963); other areas of thick till were inferred from photographic image and topographic analysis.
 - Wilmington Quadrangle**
Map units were reproduced from Castle (1959). Glacial Stratified Deposits in this quadrangle include glaciolacustrine and glaciolacustrine deposits. Thick till areas were reproduced from the drumlin till unit (Qgd of Castle, 1959); other areas of thick till were inferred from photographic image and topographic analysis.
 - Reading Quadrangle**
Map units were reproduced from Oldale (1962). Glacial Stratified Deposits in this quadrangle include glaciolacustrine and glaciolacustrine deposits. Fine-grained glacial stratified deposits at land surface include glacial lake deposits (unit Ql of Oldale, 1962); the fine-grained unit has been extended beneath adjacent water bodies and postglacial deposits on this map. Thick till areas were reproduced from the drumlin till unit (Qgd of Oldale, 1962) and other areas of thick till were inferred from photographic image and topographic analysis.
 - Salem Quadrangle**
Map units were reproduced from Oldale (1964). Glacial Stratified Deposits in this quadrangle include glaciolacustrine, glaciolacustrine, and glaciolacustrine deposits. Fine-grained glacial stratified deposits at land surface include marine clay deposits (unit Qm of Oldale, 1964); the fine-grained unit has been extended beneath adjacent water bodies and postglacial deposits on this map.
 - Marblehead North Quadrangle**
Map units were reproduced from Carnevale (1979)
 - Glocester Quadrangle**
Stone, B.D., 1982, Unpublished field maps
 - Rockport Quadrangle**
Stone, B.D., 1982, Unpublished field maps

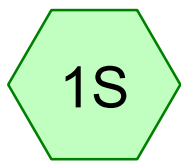
All base map data from MassGIS:
1:50,000-scale Shaded Relief
1:100,000-scale Hydrography
1:50,000-scale FOT Major Roads
1:25,000-scale Digital Quadrangle Template
1:25,000-scale Community Boundaries (Town)



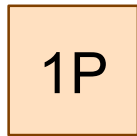
Geology mapped by authors of individual quadrangles - 1958-1982.
Geology compiled by Byron D. Stone, Janet R. Stone, and Mary L. DiGiacomo-Cohen, 2004-2006.
Vectorization of published quadrangles by the Office of the Massachusetts State Geologist, 2003.
Digital compilation and cartography by Mary L. DiGiacomo-Cohen, 2005-2006.

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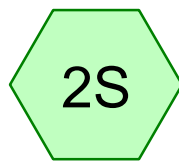
APPENDIX D



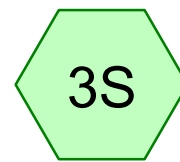
1S



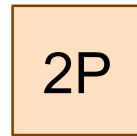
Design Point 1P



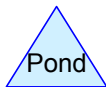
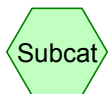
Roof



3S



Design Point 2P



Existing

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 YR	Type III 24-hr		Default	24.00	1	3.21	2
2	10 YR	Type III 24-hr		Default	24.00	1	5.08	2
3	25 YR	Type III 24-hr		Default	24.00	1	6.24	2
4	100 YR	Type III 24-hr		Default	24.00	1	8.04	2

Existing

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.180	39	>75% Grass cover, Good, HSG A (1S, 3S)
0.024	96	Gravel surface, HSG A (3S)
0.245	98	Paved parking, HSG A (1S, 3S)
0.095	98	Roofs, HSG A (2S)
1.171	30	Woods, Good, HSG A (1S, 3S)
2.715	43	TOTAL AREA

Existing

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
2.715	HSG A	1S, 2S, 3S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
2.715		TOTAL AREA

Existing

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
1.180	0.000	0.000	0.000	0.000	1.180	>75% Grass cover, Good	1S, 3S
0.024	0.000	0.000	0.000	0.000	0.024	Gravel surface	3S
0.245	0.000	0.000	0.000	0.000	0.245	Paved parking	1S, 3S
0.095	0.000	0.000	0.000	0.000	0.095	Roofs	2S
1.171	0.000	0.000	0.000	0.000	1.171	Woods, Good	1S, 3S
2.715	0.000	0.000	0.000	0.000	2.715	TOTAL AREA	

Existing

Type III 24-hr 2 YR Rainfall=3.21"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 1S: 1S Runoff Area=41,529 sf 10.31% Impervious Runoff Depth>0.00"
Tc=6.0 min CN=40 Runoff=0.00 cfs 0.000 af

Subcatchment 2S: Roof Runoff Area=4,125 sf 100.00% Impervious Runoff Depth>2.98"
Tc=0.0 min CN=98 Runoff=0.36 cfs 0.023 af

Subcatchment 3S: 3S Runoff Area=72,602 sf 8.82% Impervious Runoff Depth>0.01"
Tc=6.0 min CN=42 Runoff=0.00 cfs 0.002 af

Reach 1P: Design Point 1P Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach 2P: Design Point 2P Inflow=0.36 cfs 0.025 af
Outflow=0.36 cfs 0.025 af

Total Runoff Area = 2.715 ac Runoff Volume = 0.026 af Average Runoff Depth = 0.11"
87.47% Pervious = 2.375 ac 12.53% Impervious = 0.340 ac

Existing

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Type III 24-hr 2 YR Rainfall=3.21"

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Summary for Subcatchment 1S: 1S

Runoff = 0.00 cfs @ 23.98 hrs, Volume= 0.000 af, Depth> 0.00"

Routed to Reach 1P : Design Point 1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.21"

Area (sf)	CN	Description
13,612	39	>75% Grass cover, Good, HSG A
4,283	98	Paved parking, HSG A
23,634	30	Woods, Good, HSG A
41,529	40	Weighted Average
37,246		89.69% Pervious Area
4,283		10.31% Impervious Area

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

Summary for Subcatchment 2S: Roof

Runoff = 0.36 cfs @ 12.00 hrs, Volume= 0.023 af, Depth> 2.98"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.21"

Area (sf)	CN	Description
4,125	98	Roofs, HSG A
4,125		100.00% Impervious Area

Summary for Subcatchment 3S: 3S

Runoff = 0.00 cfs @ 21.42 hrs, Volume= 0.002 af, Depth> 0.01"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.21"

Area (sf)	CN	Description
37,779	39	>75% Grass cover, Good, HSG A
6,407	98	Paved parking, HSG A
1,029	96	Gravel surface, HSG A
27,387	30	Woods, Good, HSG A
72,602	42	Weighted Average
66,195		91.18% Pervious Area
6,407		8.82% Impervious Area

Existing

Type III 24-hr 2 YR Rainfall=3.21"

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

Summary for Reach 1P: Design Point 1P

Inflow Area = 0.953 ac, 10.31% Impervious, Inflow Depth > 0.00" for 2 YR event
 Inflow = 0.00 cfs @ 23.98 hrs, Volume= 0.000 af
 Outflow = 0.00 cfs @ 23.98 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach 2P: Design Point 2P

Inflow Area = 1.761 ac, 13.73% Impervious, Inflow Depth > 0.17" for 2 YR event
 Inflow = 0.36 cfs @ 12.00 hrs, Volume= 0.025 af
 Outflow = 0.36 cfs @ 12.00 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Existing

Type III 24-hr 10 YR Rainfall=5.08"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 1S: 1S Runoff Area=41,529 sf 10.31% Impervious Runoff Depth>0.25"
Tc=6.0 min CN=40 Runoff=0.06 cfs 0.020 af

Subcatchment 2S: Roof Runoff Area=4,125 sf 100.00% Impervious Runoff Depth>4.84"
Tc=0.0 min CN=98 Runoff=0.57 cfs 0.038 af

Subcatchment 3S: 3S Runoff Area=72,602 sf 8.82% Impervious Runoff Depth>0.33"
Tc=6.0 min CN=42 Runoff=0.20 cfs 0.046 af

Reach 1P: Design Point 1P Inflow=0.06 cfs 0.020 af
Outflow=0.06 cfs 0.020 af

Reach 2P: Design Point 2P Inflow=0.57 cfs 0.084 af
Outflow=0.57 cfs 0.084 af

Total Runoff Area = 2.715 ac Runoff Volume = 0.104 af Average Runoff Depth = 0.46"
87.47% Pervious = 2.375 ac 12.53% Impervious = 0.340 ac

Existing

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Type III 24-hr 10 YR Rainfall=5.08"

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Summary for Subcatchment 1S: 1S

Runoff = 0.06 cfs @ 12.43 hrs, Volume= 0.020 af, Depth> 0.25"

Routed to Reach 1P : Design Point 1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=5.08"

Area (sf)	CN	Description
13,612	39	>75% Grass cover, Good, HSG A
4,283	98	Paved parking, HSG A
23,634	30	Woods, Good, HSG A
41,529	40	Weighted Average
37,246		89.69% Pervious Area
4,283		10.31% Impervious Area

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

Summary for Subcatchment 2S: Roof

Runoff = 0.57 cfs @ 12.00 hrs, Volume= 0.038 af, Depth> 4.84"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=5.08"

Area (sf)	CN	Description
4,125	98	Roofs, HSG A
4,125		100.00% Impervious Area

Summary for Subcatchment 3S: 3S

Runoff = 0.20 cfs @ 12.37 hrs, Volume= 0.046 af, Depth> 0.33"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=5.08"

Area (sf)	CN	Description
37,779	39	>75% Grass cover, Good, HSG A
6,407	98	Paved parking, HSG A
1,029	96	Gravel surface, HSG A
27,387	30	Woods, Good, HSG A
72,602	42	Weighted Average
66,195		91.18% Pervious Area
6,407		8.82% Impervious Area

Existing

Type III 24-hr 10 YR Rainfall=5.08"

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

Summary for Reach 1P: Design Point 1P

Inflow Area = 0.953 ac, 10.31% Impervious, Inflow Depth > 0.25" for 10 YR event
 Inflow = 0.06 cfs @ 12.43 hrs, Volume= 0.020 af
 Outflow = 0.06 cfs @ 12.43 hrs, Volume= 0.020 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach 2P: Design Point 2P

Inflow Area = 1.761 ac, 13.73% Impervious, Inflow Depth > 0.57" for 10 YR event
 Inflow = 0.57 cfs @ 12.00 hrs, Volume= 0.084 af
 Outflow = 0.57 cfs @ 12.00 hrs, Volume= 0.084 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Existing

Type III 24-hr 25 YR Rainfall=6.24"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 1S: 1S Runoff Area=41,529 sf 10.31% Impervious Runoff Depth>0.57"
Tc=6.0 min CN=40 Runoff=0.25 cfs 0.046 af

Subcatchment 2S: Roof Runoff Area=4,125 sf 100.00% Impervious Runoff Depth>6.00"
Tc=0.0 min CN=98 Runoff=0.71 cfs 0.047 af

Subcatchment 3S: 3S Runoff Area=72,602 sf 8.82% Impervious Runoff Depth>0.70"
Tc=6.0 min CN=42 Runoff=0.67 cfs 0.097 af

Reach 1P: Design Point 1P Inflow=0.25 cfs 0.046 af
Outflow=0.25 cfs 0.046 af

Reach 2P: Design Point 2P Inflow=0.93 cfs 0.144 af
Outflow=0.93 cfs 0.144 af

Total Runoff Area = 2.715 ac Runoff Volume = 0.190 af Average Runoff Depth = 0.84"
87.47% Pervious = 2.375 ac 12.53% Impervious = 0.340 ac

Existing

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Type III 24-hr 25 YR Rainfall=6.24"

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Summary for Subcatchment 1S: 1S

Runoff = 0.25 cfs @ 12.30 hrs, Volume= 0.046 af, Depth> 0.57"

Routed to Reach 1P : Design Point 1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=6.24"

Area (sf)	CN	Description
13,612	39	>75% Grass cover, Good, HSG A
4,283	98	Paved parking, HSG A
23,634	30	Woods, Good, HSG A
41,529	40	Weighted Average
37,246		89.69% Pervious Area
4,283		10.31% Impervious Area

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

Summary for Subcatchment 2S: Roof

Runoff = 0.71 cfs @ 12.00 hrs, Volume= 0.047 af, Depth> 6.00"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=6.24"

Area (sf)	CN	Description
4,125	98	Roofs, HSG A
4,125		100.00% Impervious Area

Summary for Subcatchment 3S: 3S

Runoff = 0.67 cfs @ 12.14 hrs, Volume= 0.097 af, Depth> 0.70"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=6.24"

Area (sf)	CN	Description
37,779	39	>75% Grass cover, Good, HSG A
6,407	98	Paved parking, HSG A
1,029	96	Gravel surface, HSG A
27,387	30	Woods, Good, HSG A
72,602	42	Weighted Average
66,195		91.18% Pervious Area
6,407		8.82% Impervious Area

Existing

Type III 24-hr 25 YR Rainfall=6.24"

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

Summary for Reach 1P: Design Point 1P

Inflow Area = 0.953 ac, 10.31% Impervious, Inflow Depth > 0.57" for 25 YR event
 Inflow = 0.25 cfs @ 12.30 hrs, Volume= 0.046 af
 Outflow = 0.25 cfs @ 12.30 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach 2P: Design Point 2P

Inflow Area = 1.761 ac, 13.73% Impervious, Inflow Depth > 0.98" for 25 YR event
 Inflow = 0.93 cfs @ 12.13 hrs, Volume= 0.144 af
 Outflow = 0.93 cfs @ 12.13 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Existing

Type III 24-hr 100 YR Rainfall=8.04"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 1S: 1S Runoff Area=41,529 sf 10.31% Impervious Runoff Depth>1.26"
Tc=6.0 min CN=40 Runoff=0.99 cfs 0.100 af

Subcatchment 2S: Roof Runoff Area=4,125 sf 100.00% Impervious Runoff Depth>7.80"
Tc=0.0 min CN=98 Runoff=0.91 cfs 0.062 af

Subcatchment 3S: 3S Runoff Area=72,602 sf 8.82% Impervious Runoff Depth>1.46"
Tc=6.0 min CN=42 Runoff=2.19 cfs 0.202 af

Reach 1P: Design Point 1P Inflow=0.99 cfs 0.100 af
Outflow=0.99 cfs 0.100 af

Reach 2P: Design Point 2P Inflow=2.54 cfs 0.264 af
Outflow=2.54 cfs 0.264 af

Total Runoff Area = 2.715 ac Runoff Volume = 0.364 af Average Runoff Depth = 1.61"
87.47% Pervious = 2.375 ac 12.53% Impervious = 0.340 ac

Existing

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Type III 24-hr 100 YR Rainfall=8.04"

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Summary for Subcatchment 1S: 1S

Runoff = 0.99 cfs @ 12.11 hrs, Volume= 0.100 af, Depth> 1.26"

Routed to Reach 1P : Design Point 1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=8.04"

Area (sf)	CN	Description
13,612	39	>75% Grass cover, Good, HSG A
4,283	98	Paved parking, HSG A
23,634	30	Woods, Good, HSG A
41,529	40	Weighted Average
37,246		89.69% Pervious Area
4,283		10.31% Impervious Area

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

Summary for Subcatchment 2S: Roof

Runoff = 0.91 cfs @ 12.00 hrs, Volume= 0.062 af, Depth> 7.80"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=8.04"

Area (sf)	CN	Description
4,125	98	Roofs, HSG A
4,125		100.00% Impervious Area

Summary for Subcatchment 3S: 3S

Runoff = 2.19 cfs @ 12.11 hrs, Volume= 0.202 af, Depth> 1.46"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=8.04"

Area (sf)	CN	Description
37,779	39	>75% Grass cover, Good, HSG A
6,407	98	Paved parking, HSG A
1,029	96	Gravel surface, HSG A
27,387	30	Woods, Good, HSG A
72,602	42	Weighted Average
66,195		91.18% Pervious Area
6,407		8.82% Impervious Area

Existing

Type III 24-hr 100 YR Rainfall=8.04"

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

Summary for Reach 1P: Design Point 1P

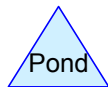
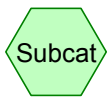
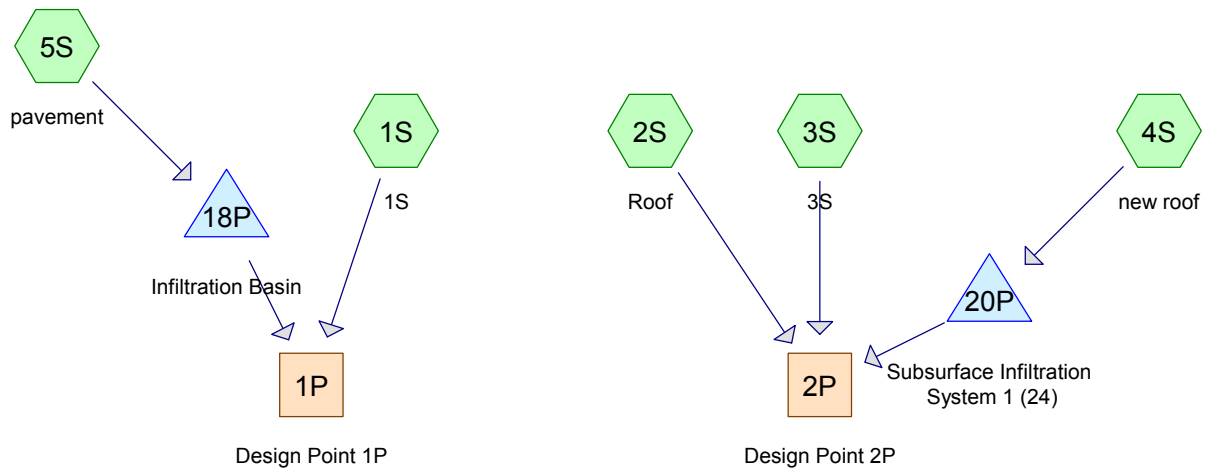
Inflow Area = 0.953 ac, 10.31% Impervious, Inflow Depth > 1.26" for 100 YR event
 Inflow = 0.99 cfs @ 12.11 hrs, Volume= 0.100 af
 Outflow = 0.99 cfs @ 12.11 hrs, Volume= 0.100 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach 2P: Design Point 2P

Inflow Area = 1.761 ac, 13.73% Impervious, Inflow Depth > 1.80" for 100 YR event
 Inflow = 2.54 cfs @ 12.11 hrs, Volume= 0.264 af
 Outflow = 2.54 cfs @ 12.11 hrs, Volume= 0.264 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs



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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 YR	Type III 24-hr		Default	24.00	1	3.21	2
2	10 YR	Type III 24-hr		Default	24.00	1	5.08	2
3	25 YR	Type III 24-hr		Default	24.00	1	6.24	2
4	100 YR	Type III 24-hr		Default	24.00	1	8.04	2

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.970	39	>75% Grass cover, Good, HSG A (1S, 3S)
0.024	96	Gravel surface, HSG A (3S)
0.460	98	Paved parking, HSG A (1S, 3S, 5S)
0.219	98	Roofs, HSG A (2S, 4S)
1.042	30	Woods, Good, HSG A (1S, 3S)
2.715	51	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
2.715	HSG A	1S, 2S, 3S, 4S, 5S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
2.715		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.970	0.000	0.000	0.000	0.000	0.970	>75% Grass cover, Good	1S, 3S
0.024	0.000	0.000	0.000	0.000	0.024	Gravel surface	3S
0.460	0.000	0.000	0.000	0.000	0.460	Paved parking	1S, 3S, 5S
0.219	0.000	0.000	0.000	0.000	0.219	Roofs	2S, 4S
1.042	0.000	0.000	0.000	0.000	1.042	Woods, Good	1S, 3S
2.715	0.000	0.000	0.000	0.000	2.715	TOTAL AREA	

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	20P	106.53	106.00	40.0	0.0133	0.010	0.0	12.0	0.0	

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Type III 24-hr 2 YR Rainfall=3.21"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 1S: 1S Runoff Area=41,529 sf 10.31% Impervious Runoff Depth>0.00"
Tc=6.0 min CN=40 Runoff=0.00 cfs 0.000 af

Subcatchment 2S: Roof Runoff Area=4,125 sf 100.00% Impervious Runoff Depth>2.98"
Tc=0.0 min CN=98 Runoff=0.36 cfs 0.023 af

Subcatchment 3S: 3S Runoff Area=57,838 sf 11.08% Impervious Runoff Depth>0.02"
Tc=6.0 min CN=43 Runoff=0.00 cfs 0.002 af

Subcatchment 4S: new roof Runoff Area=5,400 sf 100.00% Impervious Runoff Depth>2.98"
Tc=0.0 min CN=98 Runoff=0.47 cfs 0.031 af

Subcatchment 5S: pavement Runoff Area=9,364 sf 100.00% Impervious Runoff Depth>2.98"
Tc=6.0 min CN=98 Runoff=0.67 cfs 0.053 af

Reach 1P: Design Point 1P Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach 2P: Design Point 2P Inflow=0.36 cfs 0.026 af
Outflow=0.36 cfs 0.026 af

Pond 18P: Infiltration Basin Peak Elev=106.27' Storage=647 cf Inflow=0.67 cfs 0.053 af
Discarded=0.13 cfs 0.053 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.053 af

Pond 20P: Subsurface Infiltration System 1 Peak Elev=104.57' Storage=122 cf Inflow=0.47 cfs 0.031 af
Discarded=0.18 cfs 0.031 af Primary=0.00 cfs 0.000 af Outflow=0.18 cfs 0.031 af

Total Runoff Area = 2.715 ac Runoff Volume = 0.110 af Average Runoff Depth = 0.49"
74.99% Pervious = 2.036 ac 25.01% Impervious = 0.679 ac

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Type III 24-hr 2 YR Rainfall=3.21"

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Summary for Subcatchment 1S: 1S

Runoff = 0.00 cfs @ 23.98 hrs, Volume= 0.000 af, Depth> 0.00"

Routed to Reach 1P : Design Point 1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.21"

Area (sf)	CN	Description
13,612	39	>75% Grass cover, Good, HSG A
4,283	98	Paved parking, HSG A
23,634	30	Woods, Good, HSG A
41,529	40	Weighted Average
37,246		89.69% Pervious Area
4,283		10.31% Impervious Area

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

Summary for Subcatchment 2S: Roof

Runoff = 0.36 cfs @ 12.00 hrs, Volume= 0.023 af, Depth> 2.98"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.21"

Area (sf)	CN	Description
4,125	98	Roofs, HSG A
4,125		100.00% Impervious Area

Summary for Subcatchment 3S: 3S

Runoff = 0.00 cfs @ 17.14 hrs, Volume= 0.002 af, Depth> 0.02"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.21"

Area (sf)	CN	Description
28,633	39	>75% Grass cover, Good, HSG A
6,407	98	Paved parking, HSG A
1,029	96	Gravel surface, HSG A
21,769	30	Woods, Good, HSG A
57,838	43	Weighted Average
51,431		88.92% Pervious Area
6,407		11.08% Impervious Area

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Type III 24-hr 2 YR Rainfall=3.21"

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

Summary for Subcatchment 4S: new roof

Runoff = 0.47 cfs @ 12.00 hrs, Volume= 0.031 af, Depth> 2.98"
Routed to Pond 20P : Subsurface Infiltration System 1 (24)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.21"

Area (sf)	CN	Description
5,400	98	Roofs, HSG A
5,400		100.00% Impervious Area

Summary for Subcatchment 5S: pavement

Runoff = 0.67 cfs @ 12.08 hrs, Volume= 0.053 af, Depth> 2.98"
Routed to Pond 18P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 YR Rainfall=3.21"

Area (sf)	CN	Description
9,364	98	Paved parking, HSG A
9,364		100.00% Impervious Area

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

Summary for Reach 1P: Design Point 1P

Inflow Area = 1.168 ac, 26.82% Impervious, Inflow Depth > 0.00" for 2 YR event
Inflow = 0.00 cfs @ 23.98 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 23.98 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach 2P: Design Point 2P

Inflow Area = 1.546 ac, 23.65% Impervious, Inflow Depth > 0.20" for 2 YR event
Inflow = 0.36 cfs @ 12.00 hrs, Volume= 0.026 af
Outflow = 0.36 cfs @ 12.00 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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Type III 24-hr 2 YR Rainfall=3.21"

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Summary for Pond 18P: Infiltration Basin

Inflow Area = 0.215 ac, 100.00% Impervious, Inflow Depth > 2.98" for 2 YR event
 Inflow = 0.67 cfs @ 12.08 hrs, Volume= 0.053 af
 Outflow = 0.13 cfs @ 12.52 hrs, Volume= 0.053 af, Atten= 81%, Lag= 26.3 min
 Discarded = 0.13 cfs @ 12.52 hrs, Volume= 0.053 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Reach 1P : Design Point 1P

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 106.27' @ 12.52 hrs Surf.Area= 654 sf Storage= 647 cf

Plug-Flow detention time= 34.3 min calculated for 0.053 af (100% of inflow)
 Center-of-Mass det. time= 33.9 min (789.7 - 755.8)

Volume	Invert	Avail.Storage	Storage Description			
#1	105.00'	2,468 cf	Custom Stage Data Storage (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
105.00	379	96.0	0	0	379	
106.00	592	117.0	482	482	751	
107.00	843	134.0	714	1,195	1,113	
108.00	1,127	149.0	982	2,177	1,479	
108.25	1,202	152.0	291	2,468	1,560	

Device	Routing	Invert	Outlet Devices																		
#1	Discarded	105.00'	8.270 in/hr Exfiltration over Surface area																		
#2	Primary	108.25'	10.0' long x 5.0' breadth Broad-Crested Rectangular Weir																		
			Head (feet)	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60	1.80	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	
			Coef. (English)	2.34	2.50	2.70	2.68	2.68	2.66	2.66	2.65	2.65	2.65	2.65	2.65	2.66	2.68	2.70	2.74	2.79	2.88

Discarded OutFlow Max=0.13 cfs @ 12.52 hrs HW=106.27' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=105.00' (Free Discharge)
 ↑2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 20P: Subsurface Infiltration System 1 (24)

Inflow Area = 0.124 ac, 100.00% Impervious, Inflow Depth > 2.98" for 2 YR event
 Inflow = 0.47 cfs @ 12.00 hrs, Volume= 0.031 af
 Outflow = 0.18 cfs @ 11.91 hrs, Volume= 0.031 af, Atten= 61%, Lag= 0.0 min
 Discarded = 0.18 cfs @ 11.91 hrs, Volume= 0.031 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Reach 2P : Design Point 2P

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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Type III 24-hr 2 YR Rainfall=3.21"

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Peak Elev= 104.57' @ 12.11 hrs Surf.Area= 953 sf Storage= 122 cf

Plug-Flow detention time= 3.2 min calculated for 0.031 af (100% of inflow)

Center-of-Mass det. time= 3.1 min (753.8 - 750.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	104.25'	932 cf	20.50'W x 46.47'L x 3.75'H Field A 3,572 cf Overall - 1,242 cf Embedded = 2,331 cf x 40.0% Voids
#2A	104.75'	1,242 cf	ADS_StormTech SC-800 +Cap x 24 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 24 Chambers in 4 Rows Cap Storage= 3.4 cf x 2 x 4 rows = 27.4 cf
		2,174 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	106.53'	12.0" Round Culvert L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 106.53' / 106.00' S= 0.0133 '/ Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Discarded	104.25'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.18 cfs @ 11.91 hrs HW=104.29' (Free Discharge)

↑**2=Exfiltration** (Exfiltration Controls 0.18 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=104.25' (Free Discharge)

↑**1=Culvert** (Controls 0.00 cfs)

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Type III 24-hr 10 YR Rainfall=5.08"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 1S: 1S Runoff Area=41,529 sf 10.31% Impervious Runoff Depth>0.25"
Tc=6.0 min CN=40 Runoff=0.06 cfs 0.020 af

Subcatchment 2S: Roof Runoff Area=4,125 sf 100.00% Impervious Runoff Depth>4.84"
Tc=0.0 min CN=98 Runoff=0.57 cfs 0.038 af

Subcatchment 3S: 3S Runoff Area=57,838 sf 11.08% Impervious Runoff Depth>0.38"
Tc=6.0 min CN=43 Runoff=0.20 cfs 0.041 af

Subcatchment 4S: new roof Runoff Area=5,400 sf 100.00% Impervious Runoff Depth>4.84"
Tc=0.0 min CN=98 Runoff=0.75 cfs 0.050 af

Subcatchment 5S: pavement Runoff Area=9,364 sf 100.00% Impervious Runoff Depth>4.84"
Tc=6.0 min CN=98 Runoff=1.07 cfs 0.087 af

Reach 1P: Design Point 1P Inflow=0.06 cfs 0.020 af
Outflow=0.06 cfs 0.020 af

Reach 2P: Design Point 2P Inflow=0.57 cfs 0.080 af
Outflow=0.57 cfs 0.080 af

Pond 18P: Infiltration Basin Peak Elev=107.01' Storage=1,206 cf Inflow=1.07 cfs 0.087 af
Discarded=0.16 cfs 0.087 af Primary=0.00 cfs 0.000 af Outflow=0.16 cfs 0.087 af

Pond 20P: Subsurface Infiltration System 1 Peak Elev=104.96' Storage=350 cf Inflow=0.75 cfs 0.050 af
Discarded=0.18 cfs 0.050 af Primary=0.00 cfs 0.000 af Outflow=0.18 cfs 0.050 af

Total Runoff Area = 2.715 ac Runoff Volume = 0.236 af Average Runoff Depth = 1.05"
74.99% Pervious = 2.036 ac 25.01% Impervious = 0.679 ac

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Type III 24-hr 10 YR Rainfall=5.08"

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Summary for Subcatchment 1S: 1S

Runoff = 0.06 cfs @ 12.43 hrs, Volume= 0.020 af, Depth> 0.25"

Routed to Reach 1P : Design Point 1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=5.08"

Area (sf)	CN	Description
13,612	39	>75% Grass cover, Good, HSG A
4,283	98	Paved parking, HSG A
23,634	30	Woods, Good, HSG A
41,529	40	Weighted Average
37,246		89.69% Pervious Area
4,283		10.31% Impervious Area

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

Summary for Subcatchment 2S: Roof

Runoff = 0.57 cfs @ 12.00 hrs, Volume= 0.038 af, Depth> 4.84"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=5.08"

Area (sf)	CN	Description
4,125	98	Roofs, HSG A
4,125		100.00% Impervious Area

Summary for Subcatchment 3S: 3S

Runoff = 0.20 cfs @ 12.34 hrs, Volume= 0.041 af, Depth> 0.38"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=5.08"

Area (sf)	CN	Description
28,633	39	>75% Grass cover, Good, HSG A
6,407	98	Paved parking, HSG A
1,029	96	Gravel surface, HSG A
21,769	30	Woods, Good, HSG A
57,838	43	Weighted Average
51,431		88.92% Pervious Area
6,407		11.08% Impervious Area

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Type III 24-hr 10 YR Rainfall=5.08"

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

Summary for Subcatchment 4S: new roof

Runoff = 0.75 cfs @ 12.00 hrs, Volume= 0.050 af, Depth> 4.84"
Routed to Pond 20P : Subsurface Infiltration System 1 (24)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=5.08"

Area (sf)	CN	Description
5,400	98	Roofs, HSG A
5,400		100.00% Impervious Area

Summary for Subcatchment 5S: pavement

Runoff = 1.07 cfs @ 12.08 hrs, Volume= 0.087 af, Depth> 4.84"
Routed to Pond 18P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=5.08"

Area (sf)	CN	Description
9,364	98	Paved parking, HSG A
9,364		100.00% Impervious Area

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

Summary for Reach 1P: Design Point 1P

Inflow Area = 1.168 ac, 26.82% Impervious, Inflow Depth > 0.21" for 10 YR event
Inflow = 0.06 cfs @ 12.43 hrs, Volume= 0.020 af
Outflow = 0.06 cfs @ 12.43 hrs, Volume= 0.020 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach 2P: Design Point 2P

Inflow Area = 1.546 ac, 23.65% Impervious, Inflow Depth > 0.62" for 10 YR event
Inflow = 0.57 cfs @ 12.00 hrs, Volume= 0.080 af
Outflow = 0.57 cfs @ 12.00 hrs, Volume= 0.080 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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Type III 24-hr 10 YR Rainfall=5.08"

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Summary for Pond 18P: Infiltration Basin

Inflow Area = 0.215 ac, 100.00% Impervious, Inflow Depth > 4.84" for 10 YR event
 Inflow = 1.07 cfs @ 12.08 hrs, Volume= 0.087 af
 Outflow = 0.16 cfs @ 12.56 hrs, Volume= 0.087 af, Atten= 85%, Lag= 28.9 min
 Discarded = 0.16 cfs @ 12.56 hrs, Volume= 0.087 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Reach 1P : Design Point 1P

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 107.01' @ 12.56 hrs Surf.Area= 846 sf Storage= 1,206 cf

Plug-Flow detention time= 56.2 min calculated for 0.087 af (100% of inflow)
 Center-of-Mass det. time= 55.9 min (803.1 - 747.2)

Volume	Invert	Avail.Storage	Storage Description			
#1	105.00'	2,468 cf	Custom Stage Data Storage (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
105.00	379	96.0	0	0	379	
106.00	592	117.0	482	482	751	
107.00	843	134.0	714	1,195	1,113	
108.00	1,127	149.0	982	2,177	1,479	
108.25	1,202	152.0	291	2,468	1,560	

Device	Routing	Invert	Outlet Devices																		
#1	Discarded	105.00'	8.270 in/hr Exfiltration over Surface area																		
#2	Primary	108.25'	10.0' long x 5.0' breadth Broad-Crested Rectangular Weir																		
			Head (feet)	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60	1.80	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	
			Coef. (English)	2.34	2.50	2.70	2.68	2.68	2.66	2.66	2.65	2.65	2.65	2.65	2.65	2.66	2.68	2.70	2.74	2.79	2.88

Discarded OutFlow Max=0.16 cfs @ 12.56 hrs HW=107.01' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=105.00' (Free Discharge)
 ↑2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 20P: Subsurface Infiltration System 1 (24)

Inflow Area = 0.124 ac, 100.00% Impervious, Inflow Depth > 4.84" for 10 YR event
 Inflow = 0.75 cfs @ 12.00 hrs, Volume= 0.050 af
 Outflow = 0.18 cfs @ 11.72 hrs, Volume= 0.050 af, Atten= 76%, Lag= 0.0 min
 Discarded = 0.18 cfs @ 11.72 hrs, Volume= 0.050 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Reach 2P : Design Point 2P

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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Type III 24-hr 10 YR Rainfall=5.08"

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Peak Elev= 104.96' @ 12.31 hrs Surf.Area= 953 sf Storage= 350 cf

Plug-Flow detention time= 8.7 min calculated for 0.050 af (100% of inflow)

Center-of-Mass det. time= 8.6 min (750.8 - 742.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	104.25'	932 cf	20.50'W x 46.47'L x 3.75'H Field A 3,572 cf Overall - 1,242 cf Embedded = 2,331 cf x 40.0% Voids
#2A	104.75'	1,242 cf	ADS_StormTech SC-800 +Cap x 24 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 24 Chambers in 4 Rows Cap Storage= 3.4 cf x 2 x 4 rows = 27.4 cf
		2,174 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	106.53'	12.0" Round Culvert L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 106.53' / 106.00' S= 0.0133 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Discarded	104.25'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.18 cfs @ 11.72 hrs HW=104.29' (Free Discharge)

↑**2=Exfiltration** (Exfiltration Controls 0.18 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=104.25' (Free Discharge)

↑**1=Culvert** (Controls 0.00 cfs)

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Type III 24-hr 25 YR Rainfall=6.24"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 1S: 1S Runoff Area=41,529 sf 10.31% Impervious Runoff Depth>0.57"
Tc=6.0 min CN=40 Runoff=0.25 cfs 0.046 af

Subcatchment 2S: Roof Runoff Area=4,125 sf 100.00% Impervious Runoff Depth>6.00"
Tc=0.0 min CN=98 Runoff=0.71 cfs 0.047 af

Subcatchment 3S: 3S Runoff Area=57,838 sf 11.08% Impervious Runoff Depth>0.76"
Tc=6.0 min CN=43 Runoff=0.65 cfs 0.084 af

Subcatchment 4S: new roof Runoff Area=5,400 sf 100.00% Impervious Runoff Depth>6.00"
Tc=0.0 min CN=98 Runoff=0.93 cfs 0.062 af

Subcatchment 5S: pavement Runoff Area=9,364 sf 100.00% Impervious Runoff Depth>6.00"
Tc=6.0 min CN=98 Runoff=1.32 cfs 0.107 af

Reach 1P: Design Point 1P Inflow=0.25 cfs 0.046 af
Outflow=0.25 cfs 0.046 af

Reach 2P: Design Point 2P Inflow=0.92 cfs 0.132 af
Outflow=0.92 cfs 0.132 af

Pond 18P: Infiltration Basin Peak Elev=107.43' Storage=1,582 cf Inflow=1.32 cfs 0.107 af
Discarded=0.18 cfs 0.107 af Primary=0.00 cfs 0.000 af Outflow=0.18 cfs 0.107 af

Pond 20P: Subsurface Infiltration System 1 Peak Elev=105.19' Storage=529 cf Inflow=0.93 cfs 0.062 af
Discarded=0.18 cfs 0.062 af Primary=0.00 cfs 0.000 af Outflow=0.18 cfs 0.062 af

Total Runoff Area = 2.715 ac Runoff Volume = 0.347 af Average Runoff Depth = 1.53"
74.99% Pervious = 2.036 ac 25.01% Impervious = 0.679 ac

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Type III 24-hr 25 YR Rainfall=6.24"

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Summary for Subcatchment 1S: 1S

Runoff = 0.25 cfs @ 12.30 hrs, Volume= 0.046 af, Depth> 0.57"

Routed to Reach 1P : Design Point 1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=6.24"

Area (sf)	CN	Description
13,612	39	>75% Grass cover, Good, HSG A
4,283	98	Paved parking, HSG A
23,634	30	Woods, Good, HSG A
41,529	40	Weighted Average
37,246		89.69% Pervious Area
4,283		10.31% Impervious Area

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

Summary for Subcatchment 2S: Roof

Runoff = 0.71 cfs @ 12.00 hrs, Volume= 0.047 af, Depth> 6.00"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=6.24"

Area (sf)	CN	Description
4,125	98	Roofs, HSG A
4,125		100.00% Impervious Area

Summary for Subcatchment 3S: 3S

Runoff = 0.65 cfs @ 12.13 hrs, Volume= 0.084 af, Depth> 0.76"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=6.24"

Area (sf)	CN	Description
28,633	39	>75% Grass cover, Good, HSG A
6,407	98	Paved parking, HSG A
1,029	96	Gravel surface, HSG A
21,769	30	Woods, Good, HSG A
57,838	43	Weighted Average
51,431		88.92% Pervious Area
6,407		11.08% Impervious Area

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Type III 24-hr 25 YR Rainfall=6.24"

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

Summary for Subcatchment 4S: new roof

Runoff = 0.93 cfs @ 12.00 hrs, Volume= 0.062 af, Depth> 6.00"
Routed to Pond 20P : Subsurface Infiltration System 1 (24)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=6.24"

Area (sf)	CN	Description
5,400	98	Roofs, HSG A
5,400		100.00% Impervious Area

Summary for Subcatchment 5S: pavement

Runoff = 1.32 cfs @ 12.08 hrs, Volume= 0.107 af, Depth> 6.00"
Routed to Pond 18P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 YR Rainfall=6.24"

Area (sf)	CN	Description
9,364	98	Paved parking, HSG A
9,364		100.00% Impervious Area

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

Summary for Reach 1P: Design Point 1P

Inflow Area = 1.168 ac, 26.82% Impervious, Inflow Depth > 0.47" for 25 YR event
Inflow = 0.25 cfs @ 12.30 hrs, Volume= 0.046 af
Outflow = 0.25 cfs @ 12.30 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach 2P: Design Point 2P

Inflow Area = 1.546 ac, 23.65% Impervious, Inflow Depth > 1.02" for 25 YR event
Inflow = 0.92 cfs @ 12.13 hrs, Volume= 0.132 af
Outflow = 0.92 cfs @ 12.13 hrs, Volume= 0.132 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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Type III 24-hr 25 YR Rainfall=6.24"

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Summary for Pond 18P: Infiltration Basin

Inflow Area = 0.215 ac, 100.00% Impervious, Inflow Depth > 6.00" for 25 YR event
 Inflow = 1.32 cfs @ 12.08 hrs, Volume= 0.107 af
 Outflow = 0.18 cfs @ 12.58 hrs, Volume= 0.107 af, Atten= 86%, Lag= 30.1 min
 Discarded = 0.18 cfs @ 12.58 hrs, Volume= 0.107 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Reach 1P : Design Point 1P

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 107.43' @ 12.58 hrs Surf.Area= 960 sf Storage= 1,582 cf

Plug-Flow detention time= 69.0 min calculated for 0.107 af (100% of inflow)
 Center-of-Mass det. time= 68.7 min (812.7 - 744.0)

Volume	Invert	Avail.Storage	Storage Description		
#1	105.00'	2,468 cf	Custom Stage Data Storage (Irregular) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
105.00	379	96.0	0	0	379
106.00	592	117.0	482	482	751
107.00	843	134.0	714	1,195	1,113
108.00	1,127	149.0	982	2,177	1,479
108.25	1,202	152.0	291	2,468	1,560

Device	Routing	Invert	Outlet Devices											
#1	Discarded	105.00'	8.270 in/hr Exfiltration over Surface area											
#2	Primary	108.25'	10.0' long x 5.0' breadth Broad-Crested Rectangular Weir											
			Head (feet)	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60	1.80	2.00	
				2.50	3.00	3.50	4.00	4.50	5.00	5.50				
			Coef. (English)	2.34	2.50	2.70	2.68	2.68	2.66	2.65	2.65	2.65	2.65	
				2.65	2.67	2.66	2.68	2.70	2.74	2.79	2.88			

Discarded OutFlow Max=0.18 cfs @ 12.58 hrs HW=107.43' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.18 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=105.00' (Free Discharge)

↑2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 20P: Subsurface Infiltration System 1 (24)

Inflow Area = 0.124 ac, 100.00% Impervious, Inflow Depth > 6.00" for 25 YR event
 Inflow = 0.93 cfs @ 12.00 hrs, Volume= 0.062 af
 Outflow = 0.18 cfs @ 11.66 hrs, Volume= 0.062 af, Atten= 80%, Lag= 0.0 min
 Discarded = 0.18 cfs @ 11.66 hrs, Volume= 0.062 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Reach 2P : Design Point 2P

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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Type III 24-hr 25 YR Rainfall=6.24"

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Peak Elev= 105.19' @ 12.37 hrs Surf.Area= 953 sf Storage= 529 cf

Plug-Flow detention time= 13.6 min calculated for 0.062 af (100% of inflow)

Center-of-Mass det. time= 13.5 min (752.5 - 739.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	104.25'	932 cf	20.50'W x 46.47'L x 3.75'H Field A 3,572 cf Overall - 1,242 cf Embedded = 2,331 cf x 40.0% Voids
#2A	104.75'	1,242 cf	ADS_StormTech SC-800 +Cap x 24 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 24 Chambers in 4 Rows Cap Storage= 3.4 cf x 2 x 4 rows = 27.4 cf
		2,174 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	106.53'	12.0" Round Culvert L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 106.53' / 106.00' S= 0.0133 '/ Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Discarded	104.25'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.18 cfs @ 11.66 hrs HW=104.29' (Free Discharge)

↑**2=Exfiltration** (Exfiltration Controls 0.18 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=104.25' (Free Discharge)

↑**1=Culvert** (Controls 0.00 cfs)

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Type III 24-hr 100 YR Rainfall=8.04"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 1S: 1S Runoff Area=41,529 sf 10.31% Impervious Runoff Depth>1.26"
Tc=6.0 min CN=40 Runoff=0.99 cfs 0.100 af

Subcatchment 2S: Roof Runoff Area=4,125 sf 100.00% Impervious Runoff Depth>7.80"
Tc=0.0 min CN=98 Runoff=0.91 cfs 0.062 af

Subcatchment 3S: 3S Runoff Area=57,838 sf 11.08% Impervious Runoff Depth>1.55"
Tc=6.0 min CN=43 Runoff=1.93 cfs 0.172 af

Subcatchment 4S: new roof Runoff Area=5,400 sf 100.00% Impervious Runoff Depth>7.80"
Tc=0.0 min CN=98 Runoff=1.19 cfs 0.081 af

Subcatchment 5S: pavement Runoff Area=9,364 sf 100.00% Impervious Runoff Depth>7.79"
Tc=6.0 min CN=98 Runoff=1.70 cfs 0.140 af

Reach 1P: Design Point 1P Inflow=0.99 cfs 0.100 af
Outflow=0.99 cfs 0.100 af

Reach 2P: Design Point 2P Inflow=2.30 cfs 0.234 af
Outflow=2.30 cfs 0.234 af

Pond 18P: Infiltration Basin Peak Elev=108.02' Storage=2,198 cf Inflow=1.70 cfs 0.140 af
Discarded=0.22 cfs 0.140 af Primary=0.00 cfs 0.000 af Outflow=0.22 cfs 0.140 af

Pond 20P: Subsurface Infiltration System 1 Peak Elev=105.60' Storage=831 cf Inflow=1.19 cfs 0.081 af
Discarded=0.18 cfs 0.081 af Primary=0.00 cfs 0.000 af Outflow=0.18 cfs 0.081 af

Total Runoff Area = 2.715 ac Runoff Volume = 0.554 af Average Runoff Depth = 2.45"
74.99% Pervious = 2.036 ac 25.01% Impervious = 0.679 ac

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Type III 24-hr 100 YR Rainfall=8.04"

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Summary for Subcatchment 1S: 1S

Runoff = 0.99 cfs @ 12.11 hrs, Volume= 0.100 af, Depth> 1.26"

Routed to Reach 1P : Design Point 1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=8.04"

Area (sf)	CN	Description
13,612	39	>75% Grass cover, Good, HSG A
4,283	98	Paved parking, HSG A
23,634	30	Woods, Good, HSG A
41,529	40	Weighted Average
37,246		89.69% Pervious Area
4,283		10.31% Impervious Area

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

Summary for Subcatchment 2S: Roof

Runoff = 0.91 cfs @ 12.00 hrs, Volume= 0.062 af, Depth> 7.80"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=8.04"

Area (sf)	CN	Description
4,125	98	Roofs, HSG A
4,125		100.00% Impervious Area

Summary for Subcatchment 3S: 3S

Runoff = 1.93 cfs @ 12.11 hrs, Volume= 0.172 af, Depth> 1.55"

Routed to Reach 2P : Design Point 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=8.04"

Area (sf)	CN	Description
28,633	39	>75% Grass cover, Good, HSG A
6,407	98	Paved parking, HSG A
1,029	96	Gravel surface, HSG A
21,769	30	Woods, Good, HSG A
57,838	43	Weighted Average
51,431		88.92% Pervious Area
6,407		11.08% Impervious Area

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Type III 24-hr 100 YR Rainfall=8.04"

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

Summary for Subcatchment 4S: new roof

Runoff = 1.19 cfs @ 12.00 hrs, Volume= 0.081 af, Depth> 7.80"
Routed to Pond 20P : Subsurface Infiltration System 1 (24)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=8.04"

Area (sf)	CN	Description
5,400	98	Roofs, HSG A
5,400		100.00% Impervious Area

Summary for Subcatchment 5S: pavement

Runoff = 1.70 cfs @ 12.08 hrs, Volume= 0.140 af, Depth> 7.79"
Routed to Pond 18P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=8.04"

Area (sf)	CN	Description
9,364	98	Paved parking, HSG A
9,364		100.00% Impervious Area

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

Summary for Reach 1P: Design Point 1P

Inflow Area = 1.168 ac, 26.82% Impervious, Inflow Depth > 1.03" for 100 YR event
Inflow = 0.99 cfs @ 12.11 hrs, Volume= 0.100 af
Outflow = 0.99 cfs @ 12.11 hrs, Volume= 0.100 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach 2P: Design Point 2P

Inflow Area = 1.546 ac, 23.65% Impervious, Inflow Depth > 1.81" for 100 YR event
Inflow = 2.30 cfs @ 12.09 hrs, Volume= 0.234 af
Outflow = 2.30 cfs @ 12.09 hrs, Volume= 0.234 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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Type III 24-hr 100 YR Rainfall=8.04"

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Summary for Pond 18P: Infiltration Basin

Inflow Area = 0.215 ac, 100.00% Impervious, Inflow Depth > 7.79" for 100 YR event
 Inflow = 1.70 cfs @ 12.08 hrs, Volume= 0.140 af
 Outflow = 0.22 cfs @ 12.62 hrs, Volume= 0.140 af, Atten= 87%, Lag= 31.9 min
 Discarded = 0.22 cfs @ 12.62 hrs, Volume= 0.140 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Reach 1P : Design Point 1P

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 108.02' @ 12.62 hrs Surf.Area= 1,132 sf Storage= 2,198 cf

Plug-Flow detention time= 87.4 min calculated for 0.140 af (100% of inflow)
 Center-of-Mass det. time= 87.1 min (827.7 - 740.6)

Volume	Invert	Avail.Storage	Storage Description		
#1	105.00'	2,468 cf	Custom Stage Data Storage (Irregular) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
105.00	379	96.0	0	0	379
106.00	592	117.0	482	482	751
107.00	843	134.0	714	1,195	1,113
108.00	1,127	149.0	982	2,177	1,479
108.25	1,202	152.0	291	2,468	1,560

Device	Routing	Invert	Outlet Devices											
#1	Discarded	105.00'	8.270 in/hr Exfiltration over Surface area											
#2	Primary	108.25'	10.0' long x 5.0' breadth Broad-Crested Rectangular Weir											
			Head (feet)	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60	1.80	2.00	
				2.50	3.00	3.50	4.00	4.50	5.00	5.50				
			Coef. (English)	2.34	2.50	2.70	2.68	2.68	2.66	2.65	2.65	2.65	2.65	
				2.65	2.67	2.66	2.68	2.70	2.74	2.79	2.88			

Discarded OutFlow Max=0.22 cfs @ 12.62 hrs HW=108.02' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=105.00' (Free Discharge)

↑2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 20P: Subsurface Infiltration System 1 (24)

Inflow Area = 0.124 ac, 100.00% Impervious, Inflow Depth > 7.80" for 100 YR event
 Inflow = 1.19 cfs @ 12.00 hrs, Volume= 0.081 af
 Outflow = 0.18 cfs @ 11.60 hrs, Volume= 0.081 af, Atten= 85%, Lag= 0.0 min
 Discarded = 0.18 cfs @ 11.60 hrs, Volume= 0.081 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Reach 2P : Design Point 2P

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Proposed-printable

Type III 24-hr 100 YR Rainfall=8.04"

Prepared by Tighe & Bond

Printed 7/17/2025

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Peak Elev= 105.60' @ 12.43 hrs Surf.Area= 953 sf Storage= 831 cf

Plug-Flow detention time= 23.0 min calculated for 0.081 af (100% of inflow)

Center-of-Mass det. time= 22.9 min (758.5 - 735.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	104.25'	932 cf	20.50'W x 46.47'L x 3.75'H Field A 3,572 cf Overall - 1,242 cf Embedded = 2,331 cf x 40.0% Voids
#2A	104.75'	1,242 cf	ADS_StormTech SC-800 +Cap x 24 Inside #1 Effective Size= 45.0"W x 33.0"H => 7.11 sf x 7.12'L = 50.6 cf Overall Size= 51.0"W x 33.0"H x 7.55'L with 0.43' Overlap 24 Chambers in 4 Rows Cap Storage= 3.4 cf x 2 x 4 rows = 27.4 cf
		2,174 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	106.53'	12.0" Round Culvert L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 106.53' / 106.00' S= 0.0133 '/ Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Discarded	104.25'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.18 cfs @ 11.60 hrs HW=104.29' (Free Discharge)

↑**2=Exfiltration** (Exfiltration Controls 0.18 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=104.25' (Free Discharge)

↑**1=Culvert** (Controls 0.00 cfs)

INSTRUCTIONS:

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location:
(Pretreatment)

TSS Removal Calculation Worksheet

B BMP ¹	C TSS Removal Rate ¹	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Sediment Forebay	0.25	1.00	0.25	0.75
Sediment Forebay	0.25	0.75	0.19	0.56
	0.00	0.56	0.00	0.56
	0.00	0.56	0.00	0.56
	0.00	0.56	0.00	0.56

Total TSS Removal =

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

Project:
 Prepared By:
 Date:

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

INSTRUCTIONS:

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: 75 West St., Georgetown, MA Treatment Train 1

	B	C	D	E	F
	BMP ¹	TSS Removal Rate ¹	Starting TSS Load*	Amount Removed (C*D)	Remaining Load (D-E)
TSS Removal Calculation Worksheet	Infiltration Basin	0.80	1.00	0.80	0.20
		0.00	0.20	0.00	0.20
		0.00	0.20	0.00	0.20
		0.00	0.20	0.00	0.20
		0.00	0.20	0.00	0.20

Total TSS Removal =

80%

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

Project: G5020-006
 Prepared By: AEP
 Date: 7/17/2025

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



Project: Georgetown WTP
 Date: 7/17/2025
 Calculated by: AEP
 Checked by: TCW/TJG

Pipe Material
 Roughness Coefficient 0.012 RCP
 0.013 HDPE

Upstream Structure	Downstream Structure	Subcatchment Area (sf)*	Time of Concentration (minutes)*	Runoff Curve Number*	Anticipated Flow (cfs)*	Pipe Dia. (in)	Pipe Material	Pipe Area (sf)	Pipe Length (ft)	Upstream Invert	Downstream Invert	Pipe Slope (ft/ft)	Hydr. Radius (ft)	Full-Pipe Velocity (fps)	Full-Pipe Flow (cfs)
RD south	Subsurface 1	2,500	6.0	98	0.315	6	HDPE	0.196	203	108.00	106.53	0.007	0.13	2.44	0.48
RD north	Subsurface 1	2,500	6.0	98	0.315	6	HDPE	0.196	15	108.00	106.53	0.098	0.13	8.97	1.76
Subsurface 1	Outlet	5,000	6.0	98	0.63	12	HDPE	0.785	14	98.82	98.75	0.005	0.25	3.22	2.53

NOAA Atlas 14, Volume 10, Version 3
 Location name: **Georgetown, Massachusetts, USA***



Latitude: **42.7208°**, Longitude: **-71.022°**

Elevation: **94 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	0.309 (0.244-0.383)	0.369 (0.291-0.458)	0.467 (0.367-0.581)	0.549 (0.428-0.687)	0.661 (0.498-0.863)	0.746 (0.550-0.994)	0.834 (0.596-1.15)	0.932 (0.630-1.32)	1.07 (0.695-1.57)	1.18 (0.748-1.77)
10-min	0.438 (0.345-0.542)	0.523 (0.412-0.648)	0.662 (0.520-0.824)	0.778 (0.607-0.973)	0.937 (0.706-1.22)	1.06 (0.780-1.41)	1.18 (0.844-1.63)	1.32 (0.892-1.87)	1.52 (0.984-2.22)	1.68 (1.06-2.51)
15-min	0.515 (0.406-0.638)	0.615 (0.485-0.763)	0.779 (0.612-0.969)	0.915 (0.714-1.14)	1.10 (0.830-1.44)	1.24 (0.917-1.66)	1.39 (0.993-1.92)	1.55 (1.05-2.20)	1.78 (1.16-2.62)	1.97 (1.25-2.95)
30-min	0.710 (0.560-0.879)	0.847 (0.667-1.05)	1.07 (0.842-1.33)	1.26 (0.981-1.57)	1.52 (1.14-1.98)	1.71 (1.26-2.28)	1.91 (1.36-2.64)	2.14 (1.44-3.02)	2.45 (1.59-3.60)	2.71 (1.72-4.06)
60-min	0.904 (0.713-1.12)	1.08 (0.850-1.34)	1.36 (1.07-1.70)	1.60 (1.25-2.00)	1.93 (1.45-2.52)	2.18 (1.60-2.90)	2.43 (1.74-3.36)	2.72 (1.84-3.85)	3.12 (2.03-4.58)	3.45 (2.18-5.16)
2-hr	1.16 (0.928-1.43)	1.40 (1.12-1.73)	1.79 (1.42-2.21)	2.11 (1.66-2.62)	2.55 (1.95-3.33)	2.88 (2.15-3.84)	3.24 (2.35-4.50)	3.66 (2.48-5.16)	4.30 (2.80-6.26)	4.84 (3.07-7.20)
3-hr	1.35 (1.08-1.65)	1.63 (1.30-2.00)	2.09 (1.66-2.57)	2.47 (1.96-3.06)	3.00 (2.30-3.90)	3.39 (2.54-4.51)	3.81 (2.78-5.29)	4.33 (2.94-6.07)	5.12 (3.34-7.44)	5.81 (3.70-8.60)
6-hr	1.73 (1.40-2.10)	2.10 (1.69-2.56)	2.71 (2.18-3.31)	3.21 (2.57-3.95)	3.90 (3.02-5.05)	4.42 (3.34-5.85)	4.98 (3.66-6.89)	5.67 (3.88-7.91)	6.75 (4.42-9.74)	7.69 (4.91-11.3)
12-hr	2.18 (1.78-2.63)	2.66 (2.17-3.22)	3.45 (2.80-4.19)	4.10 (3.31-5.01)	5.01 (3.90-6.43)	5.67 (4.32-7.46)	6.40 (4.73-8.78)	7.29 (5.00-10.1)	8.67 (5.70-12.4)	9.87 (6.31-14.4)
24-hr	2.59 (2.13-3.11)	3.21 (2.64-3.86)	4.23 (3.47-5.10)	5.08 (4.13-6.16)	6.24 (4.90-7.98)	7.10 (5.46-9.30)	8.04 (6.00-11.0)	9.22 (6.35-12.7)	11.1 (7.29-15.8)	12.7 (8.13-18.4)
2-day	2.92 (2.43-3.48)	3.70 (3.07-4.42)	4.97 (4.12-5.96)	6.03 (4.95-7.27)	7.49 (5.94-9.54)	8.55 (6.64-11.2)	9.73 (7.36-13.4)	11.3 (7.80-15.4)	13.8 (9.09-19.5)	16.0 (10.3-23.0)
3-day	3.20 (2.68-3.81)	4.04 (3.38-4.81)	5.41 (4.50-6.46)	6.55 (5.41-7.86)	8.12 (6.48-10.3)	9.26 (7.23-12.1)	10.5 (8.00-14.4)	12.2 (8.47-16.6)	14.9 (9.88-21.0)	17.3 (11.2-24.9)
4-day	3.48 (2.92-4.12)	4.34 (3.65-5.15)	5.76 (4.81-6.85)	6.93 (5.75-8.29)	8.54 (6.84-10.8)	9.72 (7.62-12.6)	11.0 (8.40-15.0)	12.8 (8.87-17.3)	15.6 (10.3-21.9)	18.1 (11.7-25.8)
7-day	4.24 (3.60-5.00)	5.14 (4.35-6.06)	6.60 (5.56-7.81)	7.81 (6.53-9.30)	9.48 (7.64-11.9)	10.7 (8.43-13.8)	12.1 (9.21-16.3)	13.8 (9.66-18.7)	16.7 (11.1-23.3)	19.2 (12.5-27.4)
10-day	4.93 (4.20-5.79)	5.85 (4.98-6.88)	7.35 (6.22-8.67)	8.60 (7.22-10.2)	10.3 (8.34-12.9)	11.6 (9.13-14.8)	13.0 (9.90-17.3)	14.7 (10.3-19.8)	17.5 (11.7-24.4)	20.0 (13.0-28.4)
20-day	6.87 (5.91-8.01)	7.88 (6.77-9.20)	9.54 (8.16-11.2)	10.9 (9.26-12.9)	12.8 (10.4-15.7)	14.2 (11.2-17.9)	15.7 (11.9-20.5)	17.5 (12.3-23.3)	20.0 (13.4-27.6)	22.1 (14.4-31.1)
30-day	8.47 (7.33-9.84)	9.56 (8.26-11.1)	11.3 (9.76-13.2)	12.8 (10.9-15.0)	14.9 (12.1-18.1)	16.4 (13.0-20.4)	18.0 (13.6-23.2)	19.7 (14.0-26.1)	22.0 (14.9-30.3)	23.9 (15.6-33.5)
45-day	10.5 (9.14-12.1)	11.7 (10.2-13.5)	13.6 (11.8-15.8)	15.2 (13.0-17.8)	17.4 (14.2-21.0)	19.1 (15.1-23.6)	20.8 (15.7-26.4)	22.5 (16.0-29.6)	24.6 (16.7-33.6)	26.2 (17.1-36.6)
60-day	12.2 (10.7-14.1)	13.5 (11.8-15.6)	15.5 (13.5-18.0)	17.2 (14.8-20.0)	19.5 (16.0-23.5)	21.3 (16.9-26.1)	23.1 (17.4-29.1)	24.7 (17.7-32.5)	26.8 (18.2-36.5)	28.3 (18.5-39.4)

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

Tighe&Bond

APPENDIX E

CONSTRUCTION PERIOD SOIL EROSION AND SEDIMENT CONTROL PLAN

75 West Street Water Treatment Improvements Project
Georgetown, Massachusetts

July 2025

Prepared for:

Georgetown Water Department

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Section 1

Introduction

Stormwater runoff from construction activities can have a significant impact on water quality. As stormwater flows over a construction site, it can pick up pollutants like sediment, debris, and chemicals and transport these to a nearby storm sewer system or directly to a river, lake, or coastal water. Polluted stormwater runoff can harm or kill fish and other wildlife. Sedimentation can destroy aquatic habitat, and high volumes of runoff can cause stream bank erosion. Debris can clog waterways and potentially reach the ocean where it can kill marine wildlife and impact habitat.

Standard 8 of the Massachusetts Stormwater Standards requires:

“a plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented”.

The following Construction Period Soil Erosion and Sediment Control Plan (SESCP) identifies the requirements to comply with Standard 8.

Section 2 Project Information

2.1 Plan Contents

This PPP was developed for the West St Water Treatment Plant Improvements Project in Georgetown, Massachusetts. This PPP provides permit-related information to satisfy the requirements of Standard 8 of the Massachusetts Stormwater Handbook.

2.2 Project/ Site Information

Project Name and Address

Project/Site Name:	West Street Water Treatment Plant Improvements Project
Project Street/Location:	75 West St.
City:	Georgetown
State:	Massachusetts
ZIP Code:	01833
County or Similar Subdivision:	Essex County

2.3 Nature of the Construction Activity

General Description of Project

The proposed site development is a mix of redevelopment and new development. The existing water treatment building will remain, and a new building will be built to the west and the two buildings will be connected with a covered walkway. The existing driveway runs along the south side of the existing building. This driveway will be extended and widened to allow for truck access past the proposed building location. A second entrance from West Street will be added between the existing water treatment plant entrance and the athletic field entrance and connect to the proposed roadway. For stormwater management, a forebay and basin will be constructed in the area between the existing and proposed entrances. Additional subsurface infiltration areas will be used to mitigate flows from the proposed roof and the western point of the existing driveway.

Size of Construction Project

Total size of the property: 5.398 AC

Total area expected to be disturbed by the construction activities: 1.56 AC

The maximum area expected to be disturbed at any one time (in acres): 1.56 AC

TABLE 2-4

Pollutant-Generating Activities

Pollutant-Generating Activity	Pollutants or Pollutant Constituents (that could be discharged if exposed to stormwater)
-------------------------------	---

Pollutant-Generating Activity	Pollutants or Pollutant Constituents (that could be discharged if exposed to stormwater)
Site work	Soil particals and fines
Paving and construction areas	Petroleum, concrete, vehicle fluids, paints, solvents
Disinfection of water mains	Chlorine, dechlorination chemicals
Concrete construction	Concrete
Pavement marking	Paint
Solid waste storage	Construction debris, trash
Fertilizing	Fertilizers
Equipment use	Hydraulic Oils/fluids
Equipment use	Antifreeze/coolant
Portable toilets	Sewage
Staging areas	Sediment, gasoline, fuel oil, concrete, vehicle fluids, paints, solvents, fertilizers, adhesives, antifreeze/coolant, hydraulic oil/fluid, etc.

Construction Support Activities

If applicable, describe any construction support activities for the project (e.g., concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas)

Activity: _____

Location: _____

Description: _____

Contact information for construction support activity:

Name: _____

Telephone No: _____

Email: _____

2.4 Sequence and Estimated Dates of Construction Activities

The following is an anticipated construction sequence identifying the major components of construction for the project.

2.4.1 Estimated Dates of Construction Activity

Estimated Start Date of Construction Activities SPRING 2026

Estimated End Date of Construction Activities	SPRING 2028
Estimated Date(s) of Application of Stabilization Measures for Areas of the Site Required to be Stabilized	SPRING 2026
Estimated Date(s) when Stormwater Controls will be Removed	SPRING 2028

2.5 Allowable Non-Stormwater Discharges

Water from non-stormwater sources are allowed when properly managed. The following identifies discharge sources anticipated with the project.

TABLE 2-5

List of Allowable Non-Stormwater Discharges Present at the Site

Type of Allowable Non-Stormwater Discharge	Likely to be Present at Your Site?	Location on Site
Discharges from emergency fire-fighting activities	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
Fire hydrant flushings	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
Landscape irrigation	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
Waters used to wash vehicles and equipment ¹	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
Water used to control dust	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
Potable water including uncontaminated water line flushings	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
External building wash down, provided soaps, solvents, and detergents are not used, and external surfaces do not contain hazardous substances (e.g. see Appendix A) (e.g. paint or caulk containing PCBs)	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
Pavement wash waters ²	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
Uncontaminated air conditioning or compressor condensate	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
Uncontaminated, non-turbid discharges of ground water or spring water	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
Foundation or footing drains ³	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
Construction dewatering water ⁴	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	

¹provided that there is no discharge of soaps, solvents, or detergents used for such purposes

²provided spills or leaks of toxic or hazardous substances have not occurred (unless all spill material has been removed) and where soaps, solvents, and detergents are not used. You are prohibited from directing pavement wash waters directly into any water of the U.S., storm drain inlet, or stormwater conveyance, unless the conveyance is connected to a sediment basin, sediment trap, or similarly effective control;

³where flows are not contaminated with process materials such as solvents or contaminated ground water

⁴discharged in accordance with applicable regulations

* All treated (chlorinated) water flushed from water lines shall be disposed of by discharging to the nearest sanitary sewer or by other approved means provided in AWWA. It shall **not** be discharged to wetlands or waterways.

** **No** untreated or contaminated groundwater will be discharged to wetlands or waterways. Excess water will be discharged overland in upland areas and allowed to

naturally infiltrate in well-drained soils, or discharged to wetlands or streams only after passing through filtration sacks or similar devices.

2.6 Site Maps

An Erosion and Sediment Control Plan (ESCP) has been prepared to provide the Contractor with the minimum requirements for the prevention of erosion and sedimentation due to construction impacts.

Section 3

Erosion and Sediment Controls

The Contractor must implement erosion and sediment controls in accordance with the following requirements to minimize the discharge of pollutants in stormwater from construction activities. This project also includes site specific controls and permit conditions which may take precedent and are not included in the following descriptions. The Contractor shall also comply with the requirements in the project's permits.

3.1 Perimeter Controls

Provide perimeter controls to prevent sediment from entering and compromising the adjacent storm drain system.

General

Roadways and storm drainage components adjacent to the proposed project area will be protected by a row of erosion control barriers. The erosion control barriers will consist of straw wattles or mulch-filled tubes (e.g. compost filter tubes/socks) and siltation fencing placed in a fashion that restricts the contractor(s) to the areas necessary to conduct the work and will generally define the limits of work. The locations of these barriers are shown on the project drawings.

Specific Perimeter Controls

Perimeter Control Description

- Perimeter controls include the installation of a straw wattle or mulch log barrier and siltation fence system around the perimeter of the site. Perform work in accordance with the ESCP.

Installation

- Temporary erosion control measures shall be installed prior to the start of any earth disturbing activities.
- Erosion control barriers shall not be removed until their removal is approved by the Engineer.

Maintenance Requirements

- The contractor(s) will be required to maintain a reserve supply of erosion control barriers on-site to make repairs, as necessary.
- Perimeter control shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. They shall be repaired if there are any signs of erosion or sedimentation below them, any repairs shall be made immediately. If there are signs of undercutting at the center or the edges, or impounding of large volumes of water behind them, sediment barriers shall be replaced with a temporary check dam.
- Should the fabric on a barrier decompose or become ineffective prior to the end of the expected usable life and the barrier still is necessary, the fabric shall be replaced promptly.
- Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximated 1/3 the height of the barrier.

At the conclusion of the project, the erosion control barriers will be removed and properly disposed off-site following the stabilization of disturbed areas.

3.2 Sediment Track-Out

General

It is the Contractor's responsibility to take measures to prevent tracking of sediment from the project site. It is also the Contractor's responsibility to take measures to prevent tracking of sediment from any staging and material storage area. A stone tracking pad and street sweeping apparatus shall be used as necessary to minimize the track-out of sediment onto adjacent streets, other paved areas, and sidewalks from vehicles exiting the construction site.

Specific Track-Out Controls

Track-Out Controls Description

- Stone aggregate tracking pad
- Street sweeping

Installation

- Sediment track out controls to be installed by the Contractor include a stone aggregate tracking pad with an underlying geotextile fabric. The pad shall be constructed in accordance with the ESCP.

Maintenance Requirements

- The site exit shall be maintained in a condition which will prevent tracking of sediment onto public right-of-way. When washing is required, it shall be done in an area stabilized with aggregate which drains into a sediment trapping controls.
- If sediment is tracked out from the site to the surface of off-site streets, other paved areas, and sidewalks, the Contractor shall remove the deposited sediment by the end of the same work day in which the track-out occurs.

3.3 Stockpiled Sediment or Soil

General

Temporary soil stockpiles shall be surrounded by hay bales or silt fence and shall be stabilized by covering or temporary erosion control seeding. Stockpiles are to be located as far as possible from any surface water.

Specific Stockpile Controls

Description

- Temporary stockpiles of excavated soil may be present at the site as construction progresses.

Installation

- Install a sediment barrier consisting of silt fencing or straw bales along downgradient perimeter areas of stockpiles.

- For piles that will be unused for 14 or more days, temporary stabilization with erosion control seeding shall be used if perimeter controls and/or temporary covering are not sufficient to prevent sediment migration.

Maintenance Requirements

- Do not hose down or sweep soil or sediment accumulated on pavement or other impervious surfaces into any stormwater conveyance (unless connected to a sediment basin, sediment trap, or similarly effective control), storm drain inlet, or surface water.

3.4 Minimize Dust

General

The Contactor shall be responsible for the control of dust throughout the construction period. Dust control methods shall include, but be not limited to, sprinkling water or calcium chloride on exposed areas, covering loaded dump trucks leaving the site, and temporary mulching exposed soil areas. Dust control measures shall be utilized to prevent the migration of dust from the site to abutting areas.

Specific Dust Controls

Description

- Prevent dust from becoming a nuisance or hazard. During construction, excavated material and open or stripped areas are to be policed and controlled to prevent spreading of the material.
- Dust control measures shall be utilized to prevent the migration of dust from the site to abutting areas.
- Ensure that the existing equipment, facilities, and occupied space adjacent to or nearby areas of the work do not come in contact with dust or debris as a result of concrete demolition, excavation or surface preparation.

Installation

- Dust control methods shall include, but be not limited to, sprinkling water on exposed areas, using calcium chloride, covering loaded dump trucks leaving the site, and temporary mulching.
- Use a mechanical street sweeper daily.

Maintenance Requirements

- During the work on-site, daily all paved road and driveway surfaces shall be scraped and broomed free of excavated materials on a daily basis. Prior to sweeping, or as needed during the work day, the surfaces shall be hosed down or otherwise treated to eliminate active or potential dust conditions and the natural road or wearing surface shall be exposed.

3.5 Minimize the Disturbance of Steep Slopes

General

All slopes greater than 15% during the regular construction season are to have slope stabilization measures. This applies to all slopes greater than 8% after October 1st.

Specific Steep Slope Controls

- Where slopes greater than 3:1 will be created, synthetic erosion control fabric is to be utilized in these areas to prevent erosion until permanent vegetation is established.

3.6 Topsoil/Loam Areas**General**

All areas not to be paved or otherwise treated shall receive 4-inch loam and seed. The salvaging of existing loam and topsoil is not anticipated due to the urban nature of the site.

Specific Topsoil/Loam Area Controls

Description

- Erosion of topsoil/ loam areas will be controlled by providing temporary and permanent grass cover.
- Where slopes greater than 3:1 will be created, synthetic erosion control fabric will be utilized to prevent erosion until permanent vegetation is established.

Installation

- Temporary vegetative cover shall be provided to stabilize the site in areas where additional construction activity will not occur for more than 14 calendar days.

Maintenance Requirements

- Seeding shall be inspected periodically and at a minimum 95% of the soil surface should be covered by vegetation. If any evidence of erosion is apparent, repairs shall be made and additional measures shall be used to prevent further erosion.
- Straw mulch, wood fiber mulch, or erosion control blankets shall be applied immediately after seeding.

3.7 Soil Compaction**General**

In areas where final vegetative stabilization is proposed, the Contractor shall prevent excessive compaction by:

- Restricting vehicle and equipment use in these locations to avoid excessive soil compaction; or
- Prior to seeding or planting areas of exposed soil that have been compacted, use techniques that aerates the soils resulting in conditions that will support vegetative growth.

3.8 Storm Drain Inlets**General**

Provide catch basin inlet protection as per construction drawings and specifications in all catch basins within the vicinity of the earth disturbing activities to protect the

stormwater management system from high sediment loads and high velocities, while disturbance due to construction is occurring in the drainage area.

Specific Storm Drain Inlet Controls

Description

- Storm Drain Inlet Controls include the installation of Silt Sacks
- Refer to the ESCP for inlet control locations.

Installation

- Refer to manufacturer recommended specifications and installation instructions.

Maintenance Requirements

- Silt sacks shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. They shall be repaired or replaced as needed immediately.
- Sediment deposits should be removed after each storm event. They must be cleaned when deposits reach approximated 1/3 the height of the barrier.
- The Contractor shall remove the deposited sediment and make any repairs by the end of the same work day in which the sediment is observed or by the end of the next work day if observation occurs on a non-work day.

3.9 Sediment Traps

General

Permanent sediment basins are not proposed as part of the final stormwater management system, however, temporary sediment basins or sediment traps may be used during construction to retain runoff and settle out particles prior to discharge from the site.

Specific Sediment Basin/Sediment Trap Controls

Description

- Temporary sediment basins or sediment traps may be excavations or bermed detention areas on site with stabilized discharges.

Installation

- As required due to site conditions and activities.

Maintenance Requirements

- Contractor shall periodically remove sediments and dispose of them in an appropriate location. Discharge locations shall be inspected regularly and stabilized as necessary.

3.10 Dewatering Practices

General

Dewatering is not anticipated for this project. However, if dewatering is required, standard dewatering measures will be employed. No untreated groundwater will be discharged to wetlands or waterways. Excess water will be discharged overland in upgradient areas and allowed to naturally infiltrate, or discharged to the drainage system only after passing through filtration sacks or similar devices.

Specific Dewatering Practices

Dewatering Practice Description

- Provide, operate and maintain adequate pumping, diversion and drainage facilities in accordance with the approved dewatering plan to maintain the excavated area sufficiently dry from groundwater and/or surface runoff so as not to adversely affect construction procedures nor cause excessive disturbance of underlying natural ground. Locate dewatering system components so that they do not interfere with construction under this or other contracts.
- Install erosion/sedimentation controls for velocity dissipation at point discharges onto non-paved surfaces.

Installation

- Install sand and gravel, or crushed stone, filters in conjunction with sumps, well points, and/or deep wells to prevent the migration of fines from the existing soil during the dewatering operation.
- Transport pumped or drained water without interference to other work, damage to pavement, other surfaces, or property. Pump water through a silt filter bag prior to discharge to grade or drainage system.
- Do not discharge water into any separated sanitary sewer system.

Maintenance Requirements

- Repair any damage resulting from the failure of the dewatering operations and any damage resulting from the failure to maintain all the areas of work in a suitable dry condition.
- Take actions necessary to ensure that dewatering discharges comply with permits applicable to the Project. Dispose of water from the trenches and excavations in such a manner as to avoid public nuisance, injury to public health or the environment, damage to public or private property, or damage to the work completed or in progress.

3.11 Site Stabilization

General

Initiate site stabilization measures immediately whenever earth-disturbing activities have permanently ceased or will be temporarily suspended on any portion of the site for more than 14 days.

Complete the stabilization activities within 14 days after the permanent or temporary cessation of earth-disturbing activities. Temporary paving of disturbed areas of existing roads should be completed at a minimum at the end of each week.

Use the following stabilization practices to protect exposed soil from erosion and prevent sediment movement.

3.11.1 Seeding

Installation

- When construction has temporarily or permanently ceased, seeding shall occur immediately in accordance with the project specifications.

Maintenance Requirements

- Periodic inspections shall occur once a week and after every rainstorm of 0.25 inches or greater until a minimum of 70% of the soil surface is covered by vegetation.

3.11.2 Mulching

Installation

- When construction has temporarily or permanently ceased, mulching shall occur immediately, as required, for erosion control while vegetation is being established.

Maintenance Requirements

- Periodic inspections shall occur once a week and after every rainstorm 0.25 inches or greater.

3.11.3 Erosion Control Mats or Blankets

Installation

- When construction has temporarily or permanently ceased, erosion control blanket installation shall occur immediately on slopes greater than 3:1, or as required, for erosion control while vegetation is being established.

Maintenance Requirements

- Periodic inspections shall occur once a week and after every rainstorm 0.25 inches or greater.

Section 4 Pollution Prevention Standards

A clean and orderly construction site will reduce the opportunity for pollutants to enter the stormwater runoff stream. The following identifies sources of pollution anticipated on a typical construction site and preventative measures to avoid pollution.

4.1 Potential Sources of Pollution

TABLE 4-1

Construction Site Pollutants

Pollutant-Generating Activity	Pollutants or Pollutant Constituents	Location on Site
Site work	Soil particals and fines	Where disturbance is proposed
Paving and construction areas	Petroleum, concrete, vehicle fluids, paints, solvents	Where paving and construction is proposed
Disinfection of water mains	Chlorine, dechlorination chemicals	Where water mains are proposed
Concrete construction	Concrete	Where concrete is proposed
Pavement marking	Paint	Where pavement markings are proposed
Solid waste storage	Construction debris, trash	In dumpster locations
Fertilizing	Fertilizers	In areas of proposed seeding
Equipment use	Hydraulic Oils/fluids	Leaks/broken hoses from equipment
Equipment use	Antifreeze/coolant	Leaks/broken hoses from equipment
Portable toilets	Sewage	Where portable toilets are located
Staging areas	Sediment, gasoline, fuel oil, concrete, vehicle fluids, paints, solvents, fertilizers, adhesives, antifreeze/coolant, hydraulic oil/fluid, etc.	

4.2 Spill Prevention and Response

- Manufacturer’s recommended methods for cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and clean up supplies.
- Materials and equipment necessary for spill cleanup will be kept in the material storage areas on site. Equipment and materials will include but not be limited to brooms, dustpans, mops, rags, gloves, goggles, kitty litter, sand, sawdust and plastic or metal trash containers specifically for this purpose.

- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with hazardous substances.
- Spills of toxic or hazardous material will be reported to the appropriate state or local government agency regardless of size.
- The Spill Prevention Plan will be adjusted to include measures to prevent this type of spill from recurring and how to cleanup the spill if it recurs. A description of the spill, its cause and the cleanup measures will be included.
- The site superintendent responsible for day to day operations will be the Spill Response Coordinator (SRC). The SRC is responsible for decisive actions in the event of a spill at the facility. The SRC will supervise efforts to provide immediate containment of the spill to prevent a more difficult cleanup situation. Cleanup crews will utilize proper spill cleanup materials and employ safe work practices.

4.2.1 Federal and State Spill Notification

In accordance with 310 CMR 40.0333, the SRC shall notify the Massachusetts Department of Environmental Protection, Northeast Region - (978)-694-3200, the Local Emergency Planning Committee (LEPC) and any other authorities or agencies within two hours if an accident or other type of incident results in a release to:

- Land
 - 10 Gallons for more Oils (PCB<500 ppm)
 - 1 Gallon or more Oils (PCB ≥500 ppm)
- Waterways
 - Any quantity of Oils
- Or, triggers the exposure to toxic chemical levels as listed in 301 CMR 40.1600, Revised Massachusetts Contingency Plan

The SRC shall notify the National Response Center (NRC) at **(800) 424-8802** where a leak, spill, or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity consistent with Part 2.3.3.4c and established under either 40 CFR Part 110, 40 CFR Part 117, or 40 CFR Part 302, occurs during a 24-hour period.

In either event, the SRC will work with state and federal agencies to ensure that all appropriate forms and reports are submitted in a timely manner.

- Note: Trigger volumes for other chemical spills vary. Contact the DEP or a Licensed Site Professional (LSP) for specific guidance on reporting thresholds and requirements for other chemicals.

4.2.2 Local Notification

The following local agencies will be called to provide emergency assistance at the facility on the judgment of the SRC:

TABLE 4-2

Emergency Assistance Notification

Georgetown Fire Department 911 or (978) 352-5757	Georgetown Police Department 911 or (978) 352-5700
Hospital: Merrimack Valley Hospital (978) 374-2000	Department of Parks & Recreation: (978) 352-6851

4.3 Fueling and Maintenance of Equipment or Vehicles

General

Efforts shall be made to perform equipment/vehicle fueling and maintenance off-site. If fueling and/or maintenance of equipment or vehicles is performed on site, the following pollution prevention practices must be provided.

Specific Pollution Prevention Practices

- Site contractor/project manager shall provide an onsite vehicle fueling and maintenance area that is clean and dry.
- If possible keep area covered.
- Keep a spill kit at the fueling and maintenance area.
- Vehicles shall be inspected regularly for leaks and damage.
- Use drip pans, drip cloths or absorbent pads when replacing spent fluid.

4.4 Washing of Equipment and Vehicles

General

Efforts shall be made to perform equipment/vehicle washing and maintenance off-site. If washing of equipment and vehicles is performed on site, the following pollution prevention practices must be provided to minimize the discharge of pollutants.

Specific Pollution Prevention Practices

- Site contractor/project manager shall provide a proper washing area.
 - Discharges from washing areas shall be infiltrated or diverted into sanitary sewer system unless no soaps or detergents are used.
 - If soaps, detergents or solvents are stored onsite over must be provided to prevent these detergents from coming into contact with rainwater.
-

4.5 Storage, Handling, and Disposal of Construction Products, Materials, and Wastes

4.5.1 Building Products

- Site contractor/project manager shall designate a waste collection area on the site that does not receive a substantial amount of runoff from upland areas and does not drain directly to a water body.
- Ensure that containers have lids so they can be covered before periods of rain, and keep containers in a covered area whenever possible.
- Schedule waste collection to prevent the containers from overflowing.
- Clean up spills immediately. For hazardous materials, follow cleanup instructions on the package. Use an absorbent material such as sawdust or kitty litter to contain the spill.
- During the demolition phase of construction, provide extra containers and schedule more frequent pickups.
- Collect, remove, and dispose of all construction site wastes at authorized disposal areas.

4.5.2 Pesticides, Herbicides, Insecticides, Fertilizers, and Landscaping Materials

- Store new and used materials in a neat, orderly manner in their appropriate containers in a covered area. If storage in a covered area is not possible, the materials shall be covered with polyethylene or polypropylene sheeting to protect them from the elements.
- Storage area should include precautions to contain any potential spills.
- Immediately contain and clean up any spills with absorbent materials.

4.5.3 Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals

- Store new and used petroleum products for vehicles in a neat, orderly manner in their appropriate containers in a covered area. If storage in a covered area is not possible, the materials shall be covered with polyethylene or polypropylene sheeting to protect them from the elements.
- Storage area should include precautions to contain any potential spills.
- Immediately contain and clean up any spills with absorbent material.
- Have equipment available in fuel storage areas and in vehicles to contain and clean up any spills that occur.

4.5.4 Hazardous or Toxic Waste

- Store new and used materials in a neat, orderly manner in their appropriate containers in a covered area. If storage in a covered area is not possible, the materials shall be covered with polyethylene or polypropylene sheeting to protect them from the elements.
 - Storage areas should include precautions to contain any potential spills.
-

- Immediately contain and clean up any spills with absorbent materials.
- Have equipment available in fuel storage areas and in vehicles to contain and clean up any spills that occur.
- To prevent leaks, empty and clean hazardous waste containers before disposing of them.
- Never remove the original product label from the container because it contains important safety information. Follow the manufacturer's recommended method of disposal, which should be printed on the label.
- Never mix excess products when disposing of them, unless specifically recommended by the manufacturer.

4.5.5 Construction and Domestic Waste

- All materials shall be collected and stored in securely lidded receptacles, no construction waste materials will be buried. Clean up immediately if containers overflow.

4.5.6 Sanitary Waste

- Portable sanitary units will be provided throughout the course of the project for use by the site contractor/project manager's employees. A licensed sanitary waste management contractor will regularly collect all sanitary waste from the portable units. Position portable toilets so that they are secure and will not be tipped or knocked over.

4.6 Washing of Applicators and Containers used for Paint, Concrete or Other Materials

- The contractors should be encouraged where possible, to use washout facilities at their own plant or dispatch facility from stucco, paint, concrete, form release oils, curing compounds, and other construction materials.
 - If washout of these materials is done on site:
 - Direct all washwater into a leak-proof container or leak-proof pit. The container or pit must be designed so that no overflows can occur due to inadequate sizing or precipitation.
 - Handle washout or cleanout wastes as follows:
 - Do not dump liquid wastes in the storm sewers
 - Dispose of liquid wastes in accordance with applicable regulations
 - Remove and dispose of hardened concrete waste consistent with your handling of other construction wastes in Section 5.5.
 - Attempts should be made to locate washout area as far away as possible from surface waters and stormwater inlets or conveyances, and to the extent practicable, designate areas to be used for these activities and conduct such activities only in these areas.
 - Inspect washout facilities daily to detect leaks or tears and to identify when materials need to be removed.
-

4.7 Fertilizers

If fertilizers are to be used on site, the following requirements shall be followed:

- Store new and used materials in a neat, orderly manner in their appropriate containers in a covered area. If storage in a covered area is not possible, the materials shall be covered with polyethylene or polypropylene sheeting to protect them from the elements.
 - Storage area should include precautions to contain any potential spills.
 - Immediately contain and clean up any spills with absorbent materials.
 - Apply at a rate and in amounts consistent with manufacturer's specifications, or document departures from the manufacturer's specifications.
 - Apply at the appropriate time of year for the site, and preferably timed to coincide as closely as possible to the period of maximum vegetation uptake and growth
 - Avoid applying before heavy rains that could cause excessive nutrients to be discharged
 - Never apply to frozen ground
 - Never apply to stormwater conveyance channels with flowing water
 - Follow all federal, state, tribal, and local requirements regarding fertilizer application.
-

Tighe&Bond

APPENDIX F

**LONG-TERM POLLUTION PREVENTION AND
STORMWATER MANAGEMENT SYSTEM
OPERATION AND MAINTENANCE PLAN**

75 West Street Water Treatment Plant Improvements Project
Georgetown, Massachusetts

July 2025

Prepared for:

Georgetown Water Department

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Section 1

Introduction and Purpose

The following Long-Term Pollution Prevention and Stormwater Operations and Maintenance (O&M) Plan has been prepared for the stormwater management system at the proposed 75 West Street Water Treatment Plant Improvements project in Georgetown, Massachusetts. The purpose of the plan is to provide guidance and procedures for proper pollution prevention and stormwater management system maintenance following construction completion.

The proposed project has been designed in compliance with the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Handbook and the Georgetown Water Department to maintain or improve stormwater runoff quality and quantity. The stormwater management system components shall be maintained as recommended in the Massachusetts Stormwater Handbook.

Section 2 Responsible Parties

Georgetown Water Department is responsible for maintaining and servicing the proposed driveway, buildings, paved and unpaved parking and storage areas, landscaping, utility infrastructure and the stormwater management facilities post construction. The property is owned by the Town of Georgetown. During construction, the contractor will be responsible for stormwater management system maintenance.

Property Owner:

Georgetown Water Department
1 Moulton Street
Georgetown, MA 01833

Owner Signature, date:

Maintenance Contact:

Georgetown Water Department
1 Moulton Street
Georgetown, MA 01833
978-352-5720

Maintenance Contact
Signature, date:

Section 3

Long Term Pollution Prevention Plan

3.1 Good Housekeeping

The goal of the good housekeeping policy is to keep the site in a clean and orderly condition. A disorderly site can lead to improper materials management and can reduce the efficiency of any response to potential pollution problems.

The following good housekeeping measures will be followed at the site to aid in pollution prevention:

- Promptly clean and remove any spills or contamination from vehicles or other services.
- Perform preventative maintenance on the structural components of the stormwater system.
- Properly dispose of refuse.

3.2 Potential Sources of Pollution

The following sources of pollution are anticipated as part of the long-term use of the project.

Pollutant-Generating Activity	Pollutants or Pollutant Constituents (that could be discharged if exposed to stormwater)
Vehicular Access	Petroleum, concrete, vehicle fluids, paints, solvents
Solid waste storage	Construction debris, trash
Landscaping Activities	Fertilizers, pesticides, herbicides
Equipment use	Hydraulic oils, fluids, antifreeze, coolant

3.3 General Spill Prevention and Response

In the event of a spill, the following procedures shall be followed by the Maintenance Contact or their authorized representative:

- Manufacturer's recommended methods for cleanup will be clearly posted and facility personnel will be made aware of the procedures and the location of the information and clean up supplies.
- Materials and equipment necessary for spill cleanup will be kept in the material storage areas at the facility. Equipment and materials will include but not be limited to brooms, dustpans, mops, rags, gloves, goggles, kitty litter, sand, sawdust and plastic or metal trash containers specifically for this purpose.
- All spills will be cleaned up immediately after discovery.

- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with hazardous substances.
- Spills of toxic or hazardous material will be reported to the appropriate state or local government agency regardless of size.
- The Spill Prevention Plan will be adjusted to include measures to prevent this type of spill from recurring and how to cleanup the spill if it recurs. A description of the spill, its cause and the cleanup measures will be included.
- The Maintenance Contact is responsible for day to day operations will be the spill prevention and cleanup coordinator.

3.3.1 Federal and State Spill Notification

In accordance with 310 CMR 40.0333, the Maintenance Contact shall notify the Massachusetts Department of Environmental Protection (Northeast Region) – (978) 694-3200 the Local Emergency Planning Committee (LEPC) (if applicable) and any other authorities or agencies within two hours if an accident or other type of incident results in a release to:

- land
 - 10 Gallons for more Oils (PCB<500 ppm)
 - 1 Gallon or more Oils (PCB ≥500 ppm)
- waterways
 - Any quantity of Oils
- Or, triggers the exposure to toxic chemical levels as listed in 301 CMR 40.1600, Revised Massachusetts Contingency Plan (MPC)

The Maintenance Contact shall notify the National Response Center (NRC) at **(800) 424-8802** where a leak, spill, or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity consistent with Part 2.3.3.4c and established under either 40 CFR Part 110, 40 CFR Part 117, or 40 CFR Part 302, occurs during a 24-hour period.

In either event, the Maintenance Contact will work with state and federal agencies to ensure that all appropriate forms and reports are submitted in a timely manner.

- Note: Trigger volumes for other chemical spills vary. Contact the MassDEP or a Licensed Site Professional (LSP) for specific guidance on reporting thresholds and requirements for other chemicals.

3.3.2 Local Notification

The following local agencies will be called to provide emergency assistance at the facility on the judgment of the Maintenance Contact:

Georgetown Fire Department 911 or (978) 352-5757	Georgetown Police Department 911 or (978) 352-5700
Hospital: Merrimack Valley Hospital (978) 374-2000	Department of Parks & Recreation: (978) 352-6851

3.4 Storage, Handling, and Disposal of Materials and Wastes

The following procedures shall be followed throughout the facility when storing, handling and disposing of various materials.

3.4.1 Pesticides, Herbicides, Insecticides, Fertilizers, and Landscaping Materials

- Store new and used materials in a neat, orderly manner in their appropriate containers in a covered area. If storage in a covered area is not possible, the materials shall be covered with polyethylene or polypropylene sheeting to protect them from the elements.
- Storage area should include precautions to contain any potential spills.
- Immediately contain and clean up any spills with absorbent materials.
- Apply at a rate and in amounts consistent with manufacturer's specifications, or document departures from the manufacturer's specifications.
- Apply at the appropriate time of year for the site, and preferably timed to coincide as closely as possible to the period of maximum vegetation uptake and growth
- Avoid applying before heavy rains that could cause excessive nutrients to be discharged
- Never apply to frozen ground
- Never apply to stormwater conveyance channels with flowing water
- Follow all federal, state, tribal, and local requirements regarding fertilizer application.

3.4.2 Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals

- Store new and used petroleum products for vehicles in a neat, orderly manner in their appropriate containers in a covered area. If storage in a covered area is not possible, the materials shall be covered with polyethylene or polypropylene sheeting to protect them from the elements.
- Storage area should include precautions to contain any potential spills.
- Immediately contain and clean up any spills with absorbent material.
- Have equipment available in fuel storage areas and in vehicles to contain and clean up any spills that occur.

3.4.3 Hazardous or Toxic Waste

- Store new and used materials in a neat, orderly manner in their appropriate containers in a covered area. If storage in a covered area is not possible, the materials shall be covered with polyethylene or polypropylene sheeting to protect them from the elements.
- Storage areas should include precautions to contain any potential spills.
- Immediately contain and clean up any spills with absorbent materials.

- Have equipment available in fuel storage areas and in vehicles to contain and clean up any spills that occur.
- To prevent leaks, empty and clean hazardous waste containers before disposing of them.
- Never remove the original product label from the container because it contains important safety information. Follow the manufacturer's recommended method of disposal, which should be printed on the label.
- Never mix excess products when disposing of them, unless specifically recommended by the manufacturer.

3.4.4 Domestic Waste

- Site property manager shall designate a waste collection area on the site that does not receive a substantial amount of runoff from upland areas and does not drain directly to a water body.
- Ensure that containers have lids so they can be covered before periods of rain and keep containers in a covered area whenever possible.
- Schedule waste collection to prevent the containers from overflowing.
- Clean up spills immediately. For hazardous materials, follow cleanup instructions on the package. Use an absorbent material such as sawdust or kitty litter to contain the spill.

Section 4

Stormwater Management System

The on-site stormwater management system is comprised of a series of a deep sump catch basin, subsurface infiltration chambers, an infiltration basin and a stormwater outfall. In general, runoff from the proposed project area, excluding building rooftops, is collected in the sediment forebay. The east portion of the site is collected in a deep sump catch basin and pipes into the forebay while the west portion of the site sheet flows directly into the forebay. The forebay is a pretreatment system before the runoff flows into the infiltration basin. The basin infiltrates and includes an outlet control structure which discharges to a stormwater outfall at the wetland. The proposed building runoff is collected in roof drains and is piped into a series of subsurface infiltration chambers which discharges to a stormwater outfall to the north of the site.

See the attached Figures 1-3 in Appendix A for the location of the various described components of the Stormwater Management System.

4.1 Inspections

Inspections will be performed in accordance with the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Handbook. Figure 1, provided in Appendix A, identifies the location of each BMP to be inspected and maintained as described in this Section. All inspections should be logged using the Inspection Forms provided in Section 5.

The following stormwater management system features will be evaluated during each inspection:

4.1.1 Vegetated Surfaces

Inspection Frequency: Bi-annually in Summer and Winter

Special Inspection Event(s): Spring Snow Melt

All vegetative surfaces will be observed to identify locations of settlement, erosion and other impacts from the proposed roadway development. Areas of settlement and erosion that may result in a discharge of sediment into Waters of the Commonwealth shall be repaired and restored to a vegetated condition.

4.1.2 Driveway and Walkway Sweeping

Inspection Frequency: Quarterly

Special Inspection Event(s): Spring Snow Melt

All pavement surfaces should be inspected annually for deterioration or spalling. Additionally, the pavement surface should be regularly monitored to make sure it drains properly after storms. Cleanings should be conducted on a quarterly basis to prevent clogging. For best management practices, high-efficiency vacuum sweeping machines should be used to clean and maintain the surface.

4.1.3 Surface Infiltration Basin

Inspection Frequency: Bi-annually

Special Inspection Event(s): Rainfall greater than 0.5 inches

Surface infiltration basins should be inspected bi-annually for standing water. If standing water is observed for longer than 72 hours, a pump should be placed in the basin and discharged through the outlet pipe. After the system is dewatered, it should be observed by a Professional Engineer. A Professional Engineer should provide an opinion as to why the infiltration basin is not draining and provide recommendations to restore infiltration capacity to the system. Additionally, infiltration basins shall be observed to identify depths of sediment and occurrence of debris which would impact functionality. The outlet control structure, if applicable, shall be observed for signs of clogging during storm events and erosion. Any trash or debris encountered shall be removed.

If the basin is equipped with a Sediment Forebay, inspect the forebay monthly to observe sediment depth, and to identify signs of rilling and gulying an repair as needed. Forebays should be mowed as needed, with grass height no greater than 6 inches. Remove accumulated sediment quarterly, and when sediment depth is between 3 to 6 feet. After sediment removal, reseed by incorporating practices such as hydroseeding with a tackifier or erosion control blanket.

4.1.4 Subsurface Infiltration Chambers

Inspection Frequency: Quarterly and after major storm events

Special Inspection Event(s): Rainfall greater than 3 inches

Subsurface infiltration should be inspected, at a minimum, quarterly or after significant rain events. They should be observed for trash accumulation and signs of clogging.

Subsurface chambers rely on infiltration to fully dewater following a storm event. Should the chambers not dewater fully within 72 hours of a storm, further investigation is required. A test pit is required to determine if the subbase material is clogged and shall be replaced, or if other damage to the system has occurred. Consult with the design engineer in the event of subbase failure.

4.1.5 Culverts and Stone End Protection (Outfalls)

Inspection Frequency: Bi-annually

Special Inspection Event(s): Rainfall greater than 0.5 inches

System outfalls should be inspected twice a year as well as after every major storm, for slope integrity, soil moisture, vegetated health, soil stability, soil compaction, soil erosion, ponding and sediment accumulation. If the rip rap has been displaced, undermined or damaged, it should be replaced immediately. The channel immediately below the outlet should be checked to see that erosion is not occurring. The downstream channel will be kept clear of obstructions, such as fallen trees, debris, leaves and sediment that could change flow patterns and/or tail water depths in pipes. Repairs must be carried out immediately to avoid additional damage to the outlet protection apron.

Section 5 Operation and Maintenance Log Form

Date: _____

Person conducting Inspection: _____

Reason for Inspection (Routine / Significant Rainfall): _____

Stormwater Management System Components:

Vegetated Surface

Component inspected during this inspection _____

Any Repair Necessary _____

Other Comments _____

Driveway and Walkway Sweeping

Component inspected during this inspection _____

Any Repair Necessary _____

Other Comments _____

Infiltration Basins

Component inspected during this inspection _____

Any Repair Necessary _____

Other Comments _____

Subsurface Infiltration Chambers

Component inspected during this inspection _____

Any Repair Necessary _____

Other Comments _____

Culvert and Stone End Protection

Component inspected during this inspection _____

Any Repair Necessary _____

Other Comments _____

Section 6

Snow Management & De-Icing

Snow removal will occur along the proposed access road only. Snow storage should not be in or adjacent to wetland areas nor block drainage to surface inlets (e.g. catch basins).

Applications of chemical de-icing may be applied along with sand for the roads, main entrances, stop sign areas, and sidewalks. Apply only as needed using minimum quantities. Small quantities of deicers may be mixed with sand or sprayed on hard to maintain areas.

Sweep or clean up accumulated sand, sidewalks, steps, and roads as soon as possible after the road surface clears.

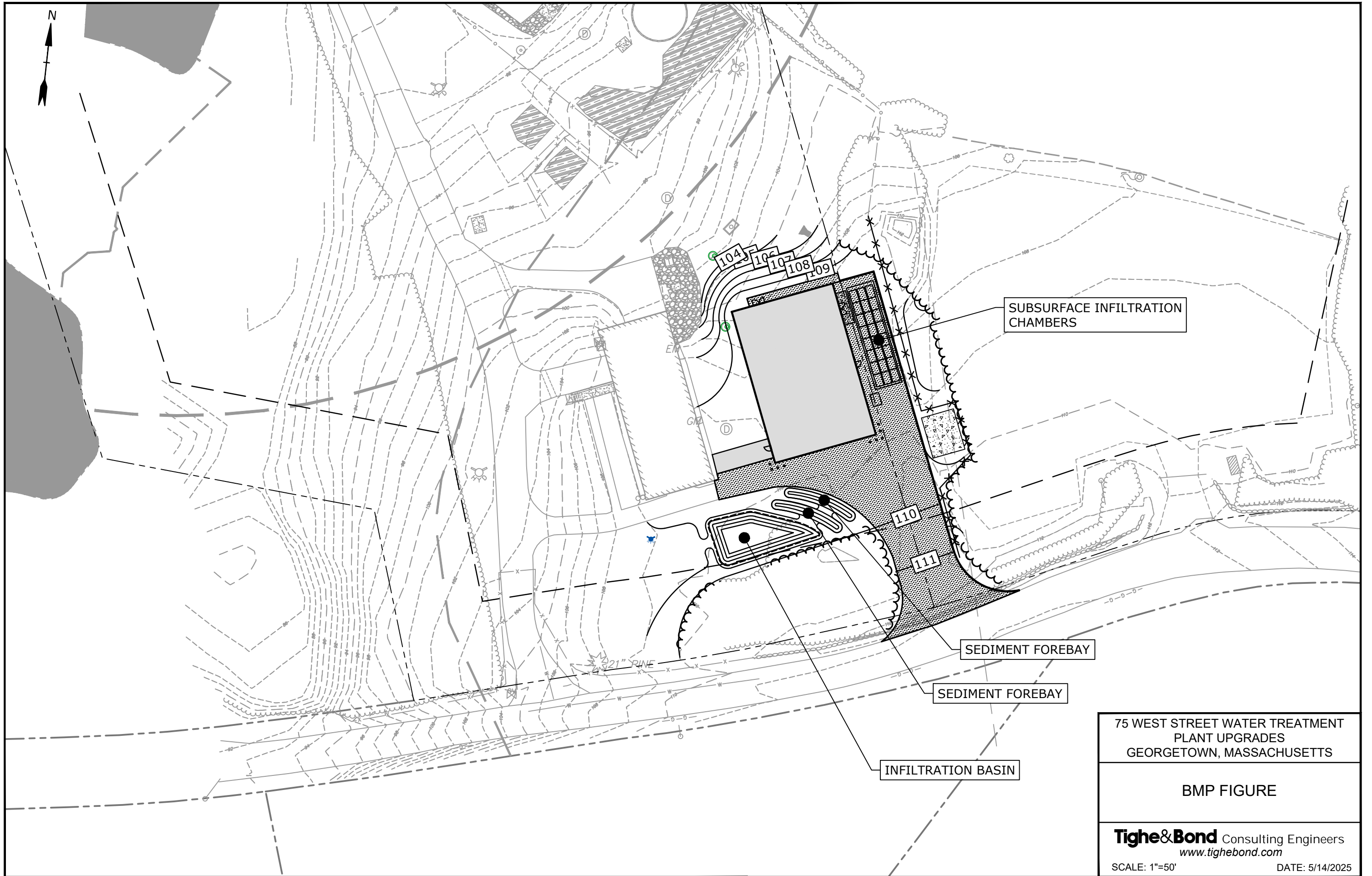
Section 7

Estimated O&M Budget

The following estimated O&M Budget includes the inspections and maintenance activities previously described on an annual basis.

Maintenance Component	Frequency	Unit Cost	Annual Cost
Vegetated Surfaces	4	\$100	\$400
Street Sweeping	4	\$250	\$1,000
Surface Infiltration Basins	2	\$500	\$1,000
System Outfalls	5	\$250	\$1,250
Total Annual Estimated Budget			3,650

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75 WEST STREET WATER TREATMENT
 PLANT UPGRADES
 GEORGETOWN, MASSACHUSETTS

BMP FIGURE

Tighe&Bond Consulting Engineers
www.tighebond.com
 SCALE: 1"=50' DATE: 5/14/2025

Tighe&Bond

APPENDIX G

Illicit Discharge Compliance Statement

Project Location: 75 West Street Water Treatment Plant Improvements Project

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

To the best of my knowledge, I am not aware of any existing illicit discharges located at the Project Location and will abandon or remove such illicit discharges/connections in the future, if found.

Signature:



Printed Name & Title:

Marlene Ladderbush
Utility Director

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