



STORMWATER MANAGEMENT REPORT

RESIDENCES AT BEAVER BROOK
SITE REDEVELOPMENT
MAP 32 BLOCK 245 LOTS 1 & 1.1 &
MAP 32 BLOCK 0 LOT 66
88, 91, & 101 MILL STREET
DRACUT, MASSACHUSETTS

GPI

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(GPI Project No.: NEX-2021147)

*Residences at Beaver Brook
Beaver Brook Holdings, LLC
Stormwater Management Report*

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EXECUTIVE SUMMARY

SECTION 1

This report contains a stormwater management analysis for the proposed site redevelopment of Beaver Brook Mill (aka Beaver Brook Village), located at 88, 91, and 101 Mill Street in Dracut, Massachusetts. The analysis includes both pre- and post-development calculations of stormwater runoff rates at specific locations on the project site.

This analysis has been prepared in accordance with the Town of Dracut Stormwater Management Rules and Regulations and the Stormwater Management Standards of the Massachusetts Department of Environmental Protection (MassDEP) Massachusetts Stormwater Policy.

The project site consists of three parcels identified as Map 32 Block 245 Lots 1 & 1.1, and Map 32 Block 0 Lot 66 with a combined area of approximately 7.88 acres. The project site is bordered by Mill Street and private residences to the west, Lakeview Avenue to the north, Beaver Brook to the east, and a condominium complex to the south.

The applicant, Beaver Brook Holdings, LLC, is proposing to redevelop the site by remodeling and reconstructing six existing buildings and constructing a new 6-story multifamily residential building including 2-stories of parking garage. The development will also include site grading, repaved parking lot and driveways, erosion control measures, new utility connections, and improvements to the existing stormwater management system.

In order to mitigate peak discharge rates and quality of stormwater runoff, a comprehensive stormwater management system has been designed that includes deep sump catch basins with hooded outlets, yard drains, three First Defense hydrodynamic particle separator units, and an underground infiltration system. The BMPs included in the proposed stormwater system are designed in accordance with MassDEP Stormwater Management Standards to improve stormwater quality and quantity at the design point.

Based on site topography and discharge points, two design points are identified for the purposes of this analysis. Design Point #1 represents Beaver Brook, which receives runoff from the eastern portion of the development including a majority of the proposed redevelopment area. Design Point #2 represents the canal to the west of the primary existing building which receives runoff from the western portion of the development, including Mill Street and the existing parking areas on Lot 66. The canal is a manmade diversion of Beaver Brook which historically served the former mill on the property and the approximate location of the raceway is shown on the revised site plans. The raceway eventually discharges back to Beaver Brook and therefore Design Point #1 is the ultimate discharge point for all site runoff and where the peak post-development rates of runoff are compared. Design Point #2 is included for reference as an intermediate analysis point.

The tables below summarize the comparative pre- and post-development peak rates and volumes of stormwater runoff at the design points.

TABLE 1: PEAK RATE ANALYSIS SUMMARY

Design Storm	Pre-Development (cfs)	Post-Development (cfs)	Change (cfs)
Design Point #1 – Beaver Brook (Total Site Runoff)			
2-year	19.6	16.7	-2.9
10-year	31.3	28.8	-2.5
25-year	40.5	37.9	-2.6
100-year	59.2	58.7	-0.5
Design Point #2 – Canal (Intermediate Analysis Point)			
2-year	7.4	7.6	+0.2
10-year	11.9	12.2	+0.3
25-year	15.5	15.8	+0.3
100-year	22.7	23.1	+0.4

(All values shown are peak rates in CFS, cubic feet per second)

TABLE 2: VOLUME ANALYSIS SUMMARY

Design Storm	Pre-Development (cf)	Post-Development (cf)	Change (cf)
Design Point #1 – Beaver Brook (Total Site Runoff)			
2-year	63,420	56,242	-7,178
10-year	104,097	95,221	-8,876
25-year	136,763	126,838	-9,925
100-year	203,961	192,364	-11,597
Design Point #2 – Canal (Intermediate Analysis Point)			
2-year	22,909	23,403	+494
10-year	37,959	38,777	+818
25-year	50,043	51,122	+1,079
100-year	74,886	76,500	+1,614

(All values shown are volumes in CF, cubic feet)

In conclusion, by reducing on-site impervious surfaces and incorporating a new on-site stormwater management system that includes provisions for stormwater treatment, there will be a reduction in the peak rates and volumes of stormwater runoff leaving the property at the ultimate design point during all storms analyzed.

Implementing the maintenance procedures outlined in the attached Operation and Maintenance Plan (O&M) will ensure the long-term performance of the system.

EXISTING CONDITIONS

SECTION 2

The project site consists of three parcels identified as Map 32 Block 245 Lots 1 & 1.1, and Map 32 Block 0 Lot 66 with a combined area of approximately 7.88 acres. The project site is bordered by Mill Street and private residences to the west, Lakeview Avenue to the north, Beaver Brook to the east, and a condominium complex to the south.

The site is currently developed with commercial and residential buildings with a combined footprint of 75,353 square-feet. Lot 1 is located toward the east and contains predominantly buildings and parking areas, with minimal pervious surfaces in the form of landscape islands. Lot 1.1 is located to the north of the site and contains the remainder of the building footprint and some pervious surfaces including maintained grassed areas and some trees. Lot 66 is across Mill Street to the west and contains a parking lot with some landscaped islands.

Site topography is variable, with slopes generally ranging between 1%-9% within the parking areas. To the south of the lot, steep slopes in excess of 33% can be found on a ridge separating the adjacent property up to a high elevation of 128 feet. The low elevation within the study area is the Beaver Brook adjacent property edge, at a low elevation of 95 feet.

Currently, there are existing catch basins and manholes conveying runoff to Beaver Brook and the canal. Runoff from most of the impervious surfaces on Lots 1 and 1.1 flows to a drainage network before discharging east into Beaver Brook. Most of the on-site pervious surface to the southeast sheet flows into Beaver Brook directly. The remaining portion of the site to the west flows through a drainage network into the canal.

The limits of the bank of Beaver Brook were delineated by Norse Environmental Services on April 3, 2024 and located by this office. The approximate resource boundary and its associated 100-foot buffer zone are shown on the site plans by this office for reference.

Test pits were performed by Greenman-Pedersen, Inc. on May 14, 2025 and locations are shown on the Grading & Drainage Plans prepared by this office. The test pits encountered fine sand, fill, and sand & gravel with depths to estimated seasonal high water table (ESHWT) of between 72 and 96 inches below ground. Refusal was not encountered in any of the pits. Test pit logs are included in Appendix D.

The NRCS Web Soil Survey identifies on-site soils as Rippowam fine sandy loam, Scituate fine sandy loam, and Canton fine sandy loam, with Hydrologic Soil Group (HSG) classifications of A/D, D, and B respectively. refer to Appendix C for additional information.

The site is located in a special flood hazard area (100-year flood) per current Flood Insurance Rate Map Number 25017C0136F, with an effective date of July 8, 2025.

PROPOSED CONDITIONS

SECTION 3

The applicant, Beaver Brook Holdings, LLC, is proposing to redevelop the site by remodeling and reconstructing six existing buildings and constructing a new 6-story multifamily residential building including 2-stories of parking garage. Currently, the property contains 74,500 square feet of commercial space with 47 residential units. The redevelopment of this property proposes converting and expanding some currently underutilized commercial space into new residential units and adding a new multi-family residential building within the large parking field on the south end of the property. The site will continue to be accessed through the existing full-access connections to Mill Street and Lakeview Avenue. The development will also include site grading, repaved parking lot and driveways, erosion control measures, new utility connections, and improvements to the existing stormwater management system.

The project results in a decrease in impervious coverage of approximately 1,157 square feet, therefore, this project is considered a redevelopment under the MassDEP Stormwater Policy Standards.

In order to mitigate peak discharge rates and quality of stormwater runoff, a comprehensive stormwater management system has been designed that includes deep sump catch basins with hooded outlets, yard drains, three First Defense hydrodynamic particle separator units, and an underground infiltration system. The BMPs included in the proposed stormwater system are designed in accordance with MassDEP Stormwater Management Standards to improve stormwater quality and quantity at the design point.

Stormwater runoff from the majority of paved parking areas will be captured in catch basins with deep sumps and hooded outlets and then directed through a hydrodynamic separator before discharging to Beaver Brook. Refer to Appendix G for more information. Several existing catch basins on-site to remain will be retrofitted with outlet hoods to improve sediment and floatables removal.

Stormwater runoff from the southern portion of the parking lot and a portion of the new residential building roof will be routed through an underground infiltration system. The system consists of (4) four rows of Cultec Recharger R-300HD chambers surrounded by crushed stone. Stormwater runoff will be treated through groundwater recharge into the underlying soil to remove TSS and Total Phosphorus to rates indicated in the Stormwater Handbook. A separator row with elevated bypass manifold is provided to enhance pretreatment and sediment removal.

The proposed hydrodynamic separator is an on-line unit with internal bypass weir and is sized to provide treatment of the water quality flow of its contributing area by removing sediment, debris, and floatable hydrocarbons. The proposed FD-4HC unit is NJCAT certified to provide water quality treatment for up to 1.50 cfs. Refer to Appendix G for more information.

In accordance with the performance standards for redevelopment sites contained in the Town of Dracut Stormwater Management Rules and Regulations, the proposed stormwater management system is designed to achieve 80% Total Suspended Solids (TSS) and 50% Total Phosphorus (TP) removal rates to the maximum extent practicable.

TSS removal rates of greater than 80% are expected to be achieved via street sweeping, deep-sump catch basins with hooded outlets, the First Defense hydrodynamic particle separators, and the underground infiltration system. Refer to Standard 4 within Section 4.

TP in stormwater runoff will be reduced from contributing areas which are routed to the underground infiltration system. There will also be an improvement to stormwater runoff quality due to the significant change in cover type from pavement, which is subject to pollutants from vehicles and run-on of grass clippings and mulch, to building roof, which is considered clean. Implementing additional recharge BMPs in other areas of the site was explored during design, however, this was deemed infeasible for the site given the significant site constraints including numerous existing and proposed underground utilities, limited space not occupied by buildings and steep grades, the retaining wall along Beaver Brook, and the encroachment of the 100-year flood zone AE associated with Beaver Brook.

Pipe sizing calculations have been provided for the proposed drain pipes however, the existing drainage system, which is largely remaining in place, is not sized for the 25-year storm. This project will reduce impervious surfaces, and will provide stormwater infiltration on site, resulting in improvements to the existing conditions and providing compliance with the MA stormwater standards to the maximum extent practicable. Calculations are included in Appendix G.

To prevent erosion and discharge of sediment during construction, Best Management Practices including catch basin inlet protection, silt fence, compost filter sock, stabilized construction exit, mulch and seeding have been incorporated into the construction sequence.

The total area of disturbance related to the proposed site, and stormwater management system construction is approximately 118,000 square-feet therefore the project will require an EPA Construction General Permit under the NPDES program.

COMPLIANCE WITH MASSDEP STORMWATER STANDARDS**SECTION 4****Standard #1: Untreated Stormwater**

No new untreated stormwater discharges directly to wetlands or waters of the Commonwealth are proposed.

Standard #2: Post Development Peak Discharge Rates

The proposed decrease in impervious surfaces will result in no increase in post-development peak flow rates of runoff compared with pre-development rates for the 2-year and 10-year design storms. Refer to Table 1 in Section 1.

Standard #3: Groundwater Recharge

The project proposes a net decrease of impervious coverage of 1,157 sf, therefore annual groundwater recharge is increased via the increased pervious areas on-site. Additionally, the underground infiltration system provides static storage volume for 1,834 cf of stormwater runoff which will recharge into the underlying soil.

Standard #4: TSS Removal

The proposed First Defense treatment unit is designed to treat the water quality flow from its contributing paved impervious surfaces. Portions of the paved parking lot will continue to be captured by existing catch basins, however, new outlet hoods will be installed to enhance pretreatment of these structures.

TABLE 3: TSS REMOVAL RATES SUMMARY

BMP	TSS Removal Rate
Street Sweeping	5%
Deep Sump Catch Basin	25%
Hydrodynamic Particle Separator	80%
Underground Infiltration System	80%

TABLE 4: TSS REMOVAL CALCULATIONS

Treatment Train 'A'				
BMP	Starting TSS Load	TSS Removal Rate	Amount Removed	Remaining Load
Street Sweeping	1.00	0.05	0.05	0.95
Deep Sump Catch Basin	0.95	0.25	0.24	0.71
Hydrodynamic Particle Separator	0.71	0.80	0.57	0.14
TSS Removal Rate=				86%
Treatment Train 'B'				
BMP	Starting TSS Load	TSS Removal Rate	Amount Removed	Remaining Load
Street Sweeping	1.00	0.05	0.05	0.95
Hydrodynamic Particle Separator	0.95	0.80	0.76	0.19
Underground Infiltration System	0.19	0.80	0.15	0.04
TSS Removal Rate=				96%

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

The project is classified as a land use with higher potential pollutant loads as a high use parking lot. BMPs capable of removing increased contaminant loads have been selected to mitigate any risk associated with the proposed traffic increase. The long-term pollution plan includes good housekeeping practices, preventative maintenance procedures and regular inspections.

Standard #6: Protection of Critical Areas

The site is not located within or near a Zone II of a public water supply or other critical area.

Standard #7: Redevelopment Projects

The site reduces impervious coverage and is considered a redevelopment. The project is subject to Standard 2, and the pretreatment and structural best management practice requirements of Standards 4 and 5 to the maximum extent practicable.

As shown in the standards above, the project complies with the Stormwater Management Standard as a redevelopment.

Standard #8: Erosion and Sediment Control

Erosion and sediment controls are incorporated into the project design to prevent erosion. An Erosion & Sediment Control Plan is included within the site plan set.

Standard #9: Operation and Maintenance Plan

An Operation and Maintenance Plan (O&M) meeting the requirements of this standard has been prepared and is included as a separate document.

Standard #10: Illicit Discharges

To the best of our knowledge, the site does not contain any illicit discharges. An illicit discharge statement is included in Appendix G.

STORMWATER MODELING METHODOLOGY**SECTION 5**

The drainage system for this project was modeled using HydroCAD, a stormwater modeling computer program that analyzes the hydrology, and hydraulics of stormwater runoff. HydroCAD is based largely on the hydrology techniques developed by the Soil Conservation Service (SCS/NRCS), combined with other hydrology and hydraulics calculations. For a given rainfall event, these techniques are used to generate hydrographs throughout a watershed. This provides verification that a given drainage system is adequate for the area under consideration, or to predict where flooding or erosion is likely to occur.

In HydroCAD, each watershed is modeled as a subcatchment, streams and culverts as a Reach (or Pond, depending on available storage capacity), and large wetlands and other natural or artificial storage areas as a Pond. SCS hydrograph generation and routing procedures were used to model both Pre-development and Post-development runoff conditions.

The Pre-development and Post-development watershed limits and the subcatchment characteristics were determined using both USGS and on-the-ground topographic survey information and through visual, on-site inspection. Conservative estimates were used at all times in estimating the hydrologic characteristics of each watershed or subcatchment.

The analysis utilizes rainfall amounts from the Northeast Regional Climate Center (NRCC) Extreme Precipitation Tables for the project site location. Rainfall depths for each 24-hour design storm are summarized below.

TABLE 5: RAINFALL SUMMARY

2-Year (in)	10-Year (in)	25-Year (in)	100-Year (in)
3.02	4.56	5.78	8.27

STORMWATER MANAGEMENT REPORT

88, 91, & 101 Mill Street – Dracut, MA

LIST OF APPENDICIES

- *MassDEP Checklist for Stormwater Report*..... **Appendix A**
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- *Soils Information*
- *Test Pit Logs*
- *Pre-Development HydroCAD Computations*
- *Post-Development HydroCAD Computations*
- *Supplemental Calculations and Backup Data*
- *Drainage Area Plans*..... **Appendix H**

STORMWATER MANAGEMENT REPORT

88, 91, & 101 Mill Street – Dracut, MA

APPENDIX A

MASSDEP CHECKLIST FOR STORMWATER REPORT

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.

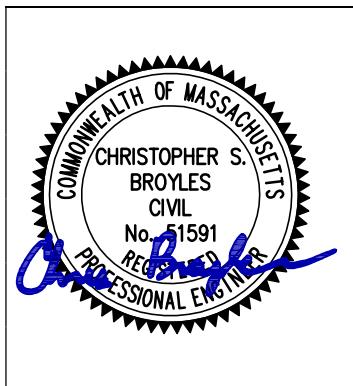
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



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 $\frac{1}{2}$ " 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 proprietary BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

- The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- The NPDES Multi-Sector General Permit does **not** cover the land use.
- LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- All exposure has been eliminated.
- All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

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

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

- Limited Project
- Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- Bike Path and/or Foot Path

Redevelopment Project

- Redevelopment portion of mix of new and redevelopment.

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

- The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- The project is **not** covered by a NPDES Construction General Permit.
- The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - Name of the stormwater management system owners;
 - Party responsible for operation and maintenance;
 - Schedule for implementation of routine and non-routine maintenance tasks;
 - Plan showing the location of all stormwater BMPs maintenance access areas;
 - Description and delineation of public safety features;
 - Estimated operation and maintenance budget; and
 - Operation and Maintenance Log Form.
- The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

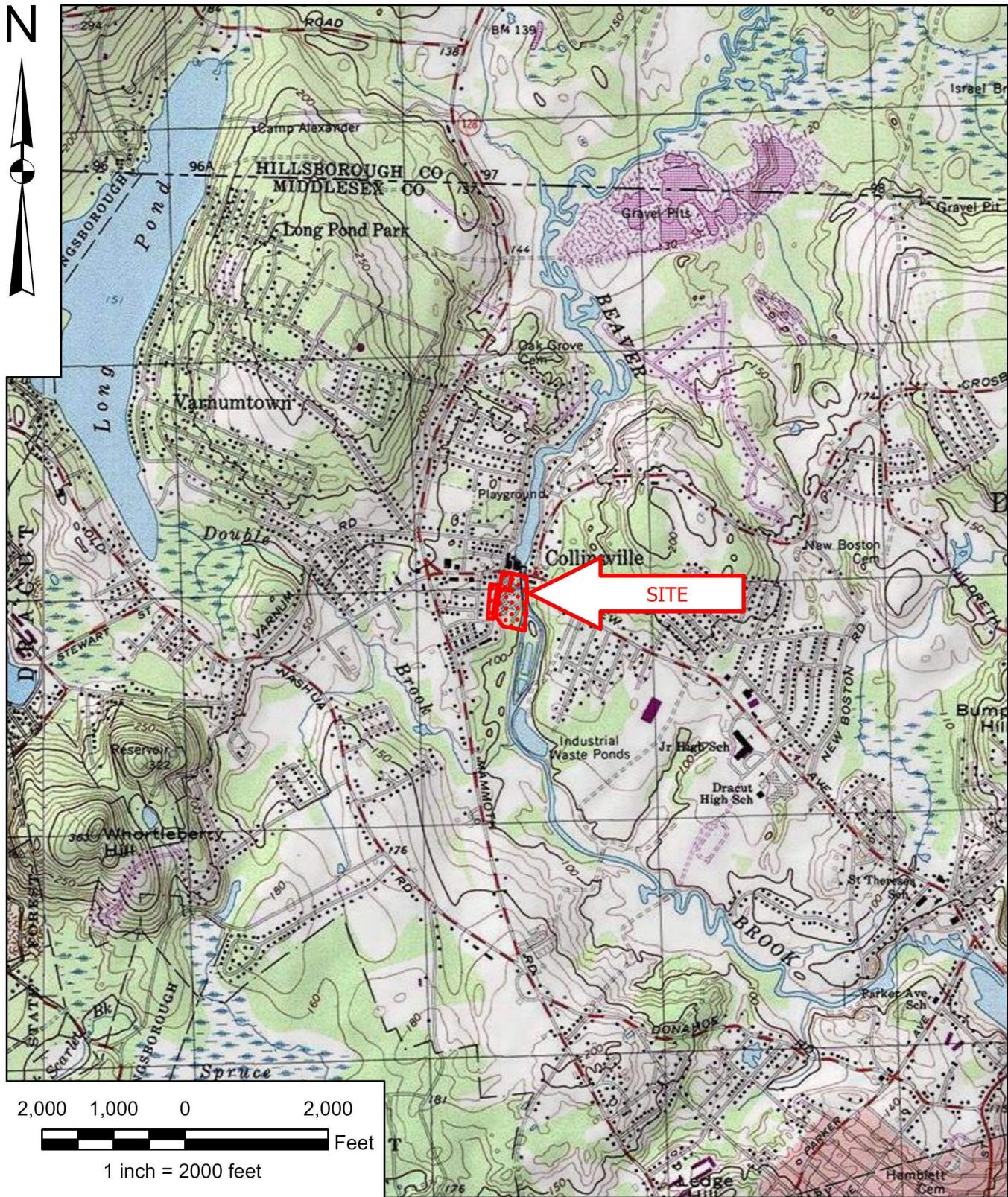
- The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- An Illicit Discharge Compliance Statement is attached;
- NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

STORMWATER MANAGEMENT REPORT

88, 91, & 101 Mill Street – Dracut, MA

APPENDIX B

FIGURES



USGS MAP

FOR BEAVER BROOK HOLDINGS, LLC
91 MILL STREET
DRACUT, MA

GPI

603.893.0720

GPINET.COM

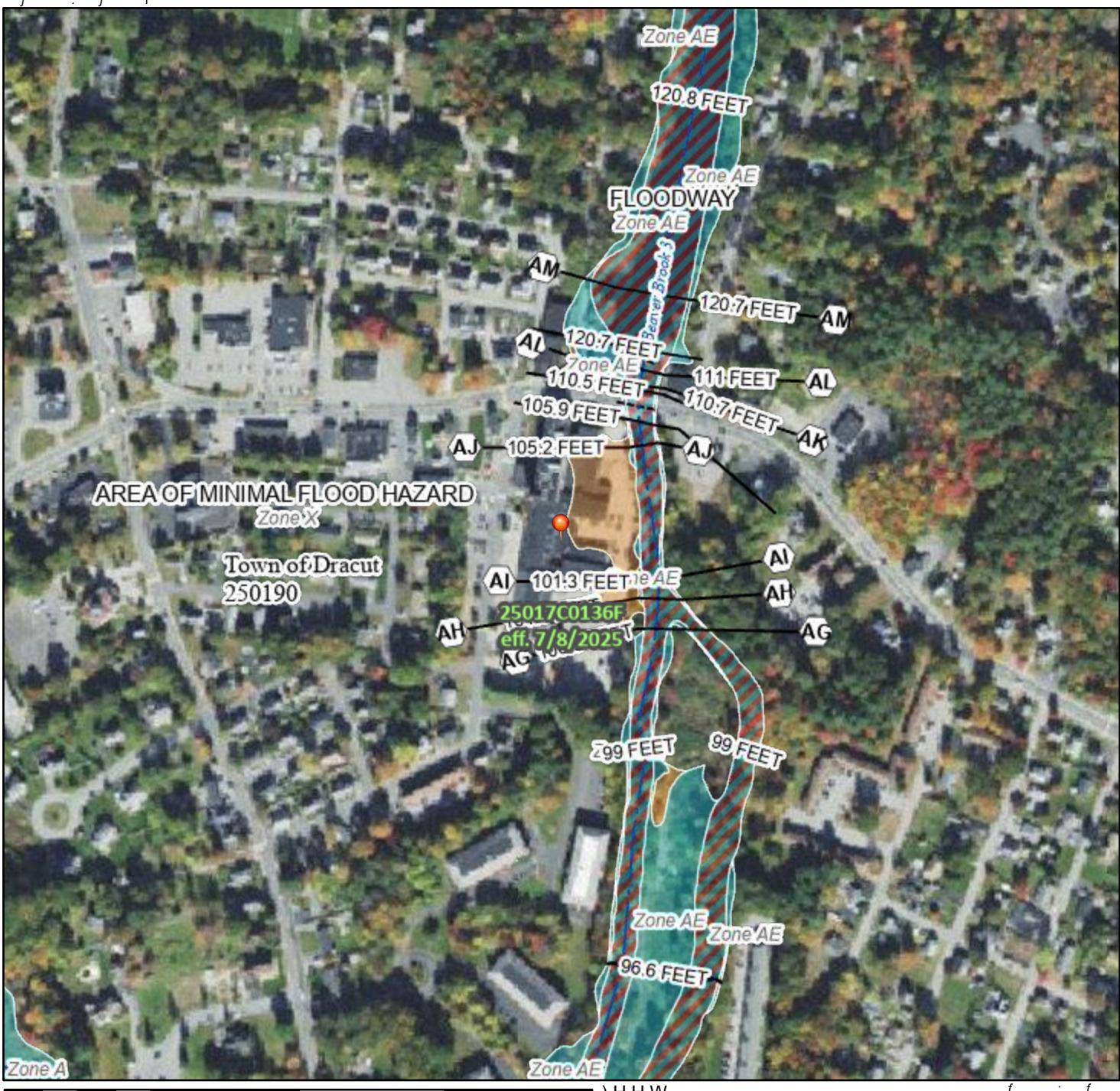
Engineering
Design
Planning
Construction Management

Greenman-Pedersen, Inc.
44 Stiles Road, Suite One
Salem, NH 03079

DRAWN BY: DJT
PROJECT #: NEX-2021147

DATE:
3/27/2025

FIGURE
1



63(&,\$/)/22 +\$=\$5' \$5	63(&,\$/)/22 +\$=\$5' \$5	:LWKRXW %DVH)ORRG (C =RQH \$ 9 \$:LWK %)(RURQH\$WK2 \$+ 9 5HJXODWRU\)ORRGZD\
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		-XULVGLFWLRQ %RXQGDU &RDVWDO 7UDQVHFW %D 27+(5 3URILOH %DVHOLQH)(785(6 +\GURJUDSKLF)HDWXUH
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7KLV PDS LPDJH LV YRLG LI WKH RQH R HOHPHQWV GR QRW DSSHDU EDVHPDS OHJHQG VFDQH EDU PDS FUHDWLRQ G ,50 SDQHO QXPEHU DQG ,50 HIIHFWLY XQPDSSHG DQG XQPRGHUQLJHG DUHDV UHJXODWRU\ SXUSRVHV		

%DVHPDS ,PDJHU\ 6RXUFH 86*6 1DWLRQDO 0DS

STORMWATER MANAGEMENT REPORT

88, 91, & 101 Mill Street – Dracut, MA

APPENDIX C

SOILS INFORMATION



United States
Department of
Agriculture



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 Middlesex County, Massachusetts



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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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315B—Scituate fine sandy loam, 3 to 8 percent slopes.....	13
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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: 1:1,690 if printed on A portrait (8.5" x 11") sheet.

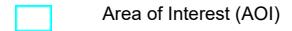
0 25 50 100 150
Meters

0 50 100 200 300
Feet

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 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts

Survey Area Data: Version 24, Aug 27, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
4A	Rippowam fine sandy loam, 0 to 3 percent slopes, frequently flooded	4.0	29.4%
300B	Montauk fine sandy loam, 3 to 8 percent slopes	0.7	5.0%
315B	Scituate fine sandy loam, 3 to 8 percent slopes	3.0	22.4%
420B	Canton fine sandy loam, 3 to 8 percent slopes	5.7	42.2%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	0.2	1.1%
Totals for Area of Interest		13.6	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 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.

Middlesex County, Massachusetts

4A—Rippowam fine sandy loam, 0 to 3 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 2zvd6

Elevation: 50 to 1,180 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

Rippowam and similar soils: 80 percent

Minor components: 20 percent

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

Description of Rippowam

Setting

Landform: Alluvial flats

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Dip

Down-slope shape: Linear

Across-slope shape: Concave

Parent material: Loamy alluvium over sandy and gravelly alluvium derived from granite and gneiss

Typical profile

H1 - 0 to 7 inches: fine sandy loam

H2 - 7 to 18 inches: fine sandy loam

H3 - 18 to 40 inches: sandy loam

H4 - 40 to 65 inches: stratified sand to fine sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: Frequent

Frequency of ponding: None

Available water supply, 0 to 60 inches: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4w

Hydrologic Soil Group: A/D

Ecological site: F144AY014CT - Wet Sandy Low Floodplain

Hydric soil rating: Yes

Minor Components

Saco

Percent of map unit: 10 percent
Landform: Terraces, alluvial flats
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Limerick

Percent of map unit: 5 percent
Landform: Terraces, alluvial flats
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Pootatuck

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

300B—Montauk fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyrh
Elevation: 0 to 1,030 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: All areas are prime farmland

Map Unit Composition

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

Description of Montauk

Setting

Landform: Recessional moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Parent material: Coarse-loamy over sandy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 4 inches: fine sandy loam

Bw1 - 4 to 26 inches: fine sandy loam

Bw2 - 26 to 34 inches: sandy loam

2Cd - 34 to 72 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: 20 to 39 inches to densic material

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 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)

Available water supply, 0 to 60 inches: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: C

Ecological site: F144AY007CT - Well Drained Dense Till Uplands

Hydric soil rating: No

Minor Components

Scituate

Percent of map unit: 6 percent

Landform: Ground moraines, hills, drumlins

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

Canton

Percent of map unit: 5 percent

Landform: Hills

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

Ridgebury

Percent of map unit: 4 percent

Landform: 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

315B—Scituate fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: vqqw
Elevation: 70 to 1,120 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: All areas are prime farmland

Map Unit Composition

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

Description of Scituate

Setting

Landform: Hillslopes, depressions
Landform position (two-dimensional): Summit, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable loamy eolian deposits over dense sandy lodgment till derived from granite and gneiss

Typical profile

H1 - 0 to 8 inches: fine sandy loam
H2 - 8 to 20 inches: sandy loam
H3 - 20 to 27 inches: loamy fine sand
H4 - 27 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 33 inches to densic material
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D
Ecological site: F144AY037MA - Moist Dense Till Uplands

Hydric soil rating: No

Minor Components

Woodbridge

Percent of map unit: 5 percent

Landform: Hillslopes

Landform position (two-dimensional): Shoulder, toeslope

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

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: No

Montauk

Percent of map unit: 5 percent

Landform: Hillslopes

Landform position (two-dimensional): Summit, shoulder

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

Down-slope shape: Convex

Across-slope shape: Convex

Hydric soil rating: No

Ridgebury

Percent of map unit: 5 percent

Landform: Drainageways, depressions

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Base slope

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

420B—Canton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w81b

Elevation: 0 to 1,180 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: All areas are prime farmland

Map Unit Composition

Canton and similar soils: 80 percent

Minor components: 20 percent

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

Description of Canton

Setting

Landform: Hills, moraines, ridges

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Nose slope, side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam

Bw1 - 7 to 15 inches: fine sandy loam

Bw2 - 15 to 26 inches: gravelly fine sandy loam

2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification

Drainage class: Well drained

Runoff class: Low

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: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: B

Ecological site: F144AY034CT - Well Drained Till Uplands

Hydric soil rating: No

Minor Components

Scituate

Percent of map unit: 10 percent

Landform: Hills, drumlins, ground moraines

Landform position (two-dimensional): Summit, backslope, footslope

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

Montauk

Percent of map unit: 5 percent

Landform: Moraines, ground moraines, hills, drumlins

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

Charlton

Percent of map unit: 4 percent

Landform: Ridges, ground moraines, hills

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

Swansea

Percent of map unit: 1 percent

Landform: Marshes, depressions, bogs, swamps, kettles

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

422B—Canton fine sandy loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w818

Elevation: 0 to 1,180 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

Canton, extremely stony, and similar soils: 80 percent

Minor components: 20 percent

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

Description of Canton, Extremely Stony

Setting

Landform: Moraines, hills, ridges

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Nose slope, side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material

A - 2 to 5 inches: fine sandy loam

Bw1 - 5 to 16 inches: fine sandy loam

Bw2 - 16 to 22 inches: gravelly fine sandy loam

2C - 22 to 67 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 8 percent

Surface area covered with cobbles, stones or boulders: 9.0 percent

Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification

Drainage class: Well drained

Runoff class: Low

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: 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 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: B

Ecological site: F144AY034CT - Well Drained Till Uplands

Hydric soil rating: No

Minor Components

Charlton, extremely stony

Percent of map unit: 6 percent

Landform: Ridges, ground moraines, hills

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

Scituate, extremely stony

Percent of map unit: 6 percent

Landform: Hills, ground moraines, drumlins

Landform position (two-dimensional): Summit, backslope, footslope

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

Montauk, extremely stony

Percent of map unit: 4 percent

Landform: Recessional moraines, ground moraines, hills, drumlins

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

Swansea

Percent of map unit: 4 percent

Landform: Marshes, depressions, bogs, swamps, kettles

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

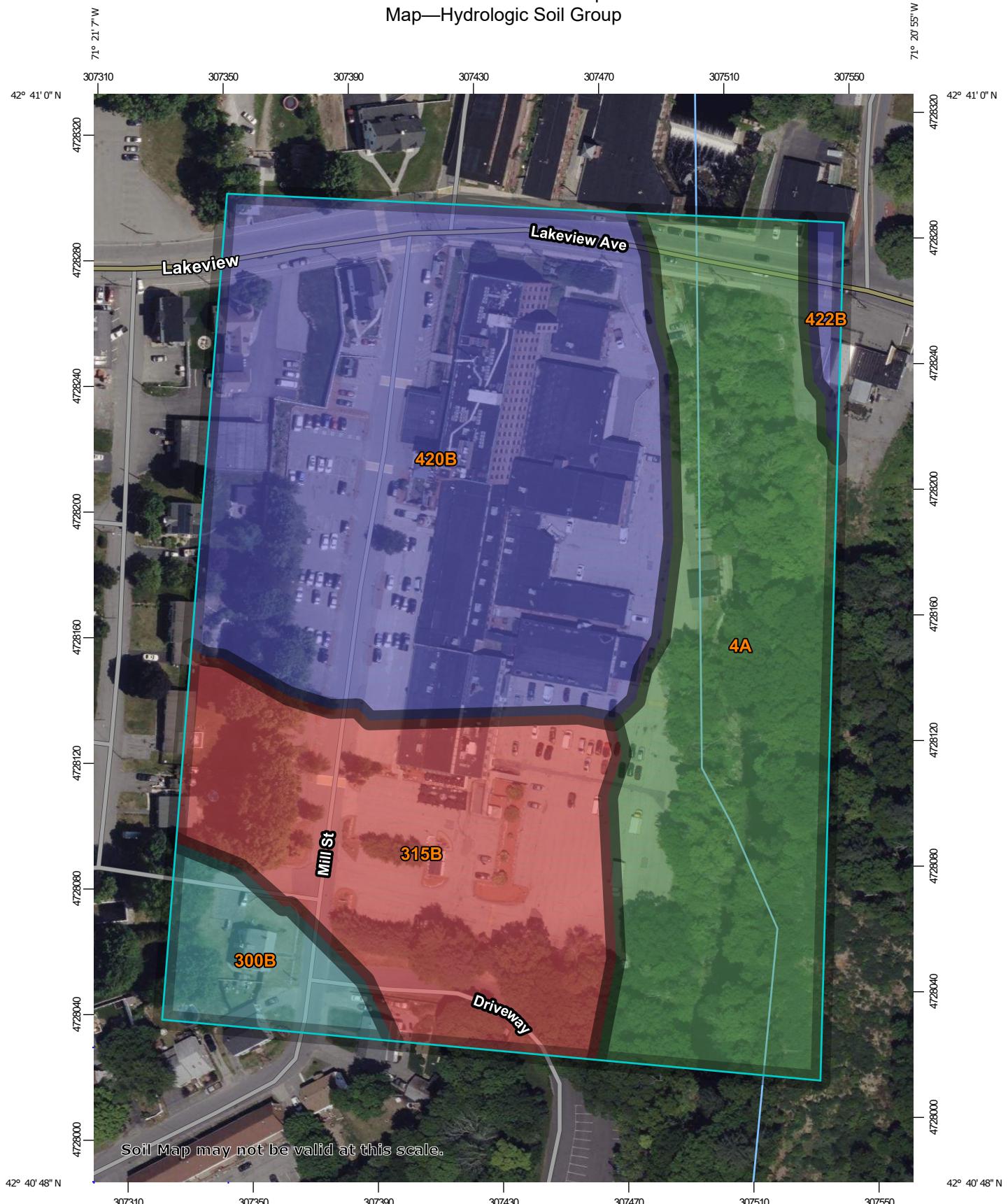
Custom Soil Resource Report

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:1,690 if printed on A portrait (8.5" x 11") sheet.

0 25 50 100 150
Meters

0 50 100 200 300
Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Lines

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Points

-  A
-  A/D
-  B
-  B/D

C

C/D

D

Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts

Survey Area Data: Version 24, Aug 27, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
4A	Rippowam fine sandy loam, 0 to 3 percent slopes, frequently flooded	A/D	4.0	29.4%
300B	Montauk fine sandy loam, 3 to 8 percent slopes	C	0.7	5.0%
315B	Scituate fine sandy loam, 3 to 8 percent slopes	D	3.0	22.4%
420B	Canton fine sandy loam, 3 to 8 percent slopes	B	5.7	42.2%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	B	0.2	1.1%
Totals for Area of Interest			13.6	100.0%

Rating Options—Hydrologic Soil Group*Aggregation Method: Dominant Condition**Component Percent Cutoff: None Specified**Tie-break Rule: Higher*

STORMWATER MANAGEMENT REPORT

88, 91, & 101 Mill Street – Dracut, MA

APPENDIX D

TEST PIT LOGS

TEST PIT DATA

Client: Beaver Brook Holdings, LLC
Project Address: 88, 91 and 101 Mill Street
Town, State: Dracut, MA
Job Number: 2021147
Date: May 14, 2025
Performed by: Diane Pantermoller (MASE #1835)

Test Pit No.		1	SCS Soil:		Rippowam Fine Sandy Loam
ESHWT:		72"	Standing Water:		92"
Refusal:		>109"	Roots:		72"
Depth	Horizon	Soil Texture	Color	Consistence	Layer Description (Gravel, Stones, Fill, etc)
0-18"	Fill/A	Loamy Sand	10yr 3/2	Friable	Trash
18-48"	B	Loamy Sand	10yr 6/8	Friable	
48-109"	C	Sand & Gravel	2.5y 7/4	Loose/Granular	
Test Pit No.		2	SCS Soil:		Rippowam Fine Sandy Loam
ESHWT:		96"	Standing Water:		96"
Refusal:		>106"	Roots:		None
Depth	Horizon	Soil Texture	Color	Consistence	Layer Description (Gravel, Stones, Fill, etc)
0-72"	Fill/A	Fill	10yr 3/2		Trash, Old Pipe, Clay Pipe, Large Boulders
Test Pit No.		3	SCS Soil:		Rippowam Fine Sandy Loam
ESHWT:		84"	Standing Water:		84"
Refusal:		>108"	Roots:		72"
Depth	Horizon	Soil Texture	Color	Consistence	Layer Description (Gravel, Stones, Fill, etc)
0-72"	Fill/A	Fill	10yr 3/2		Trash, Old Pipes, Plastic, Large Boulders
72-84"	B	Loamy Sand	10yr 6/5	Friable	
84-108"	C	Fine Sand	2.5y 7/4	Loose/Granular	

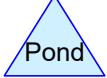
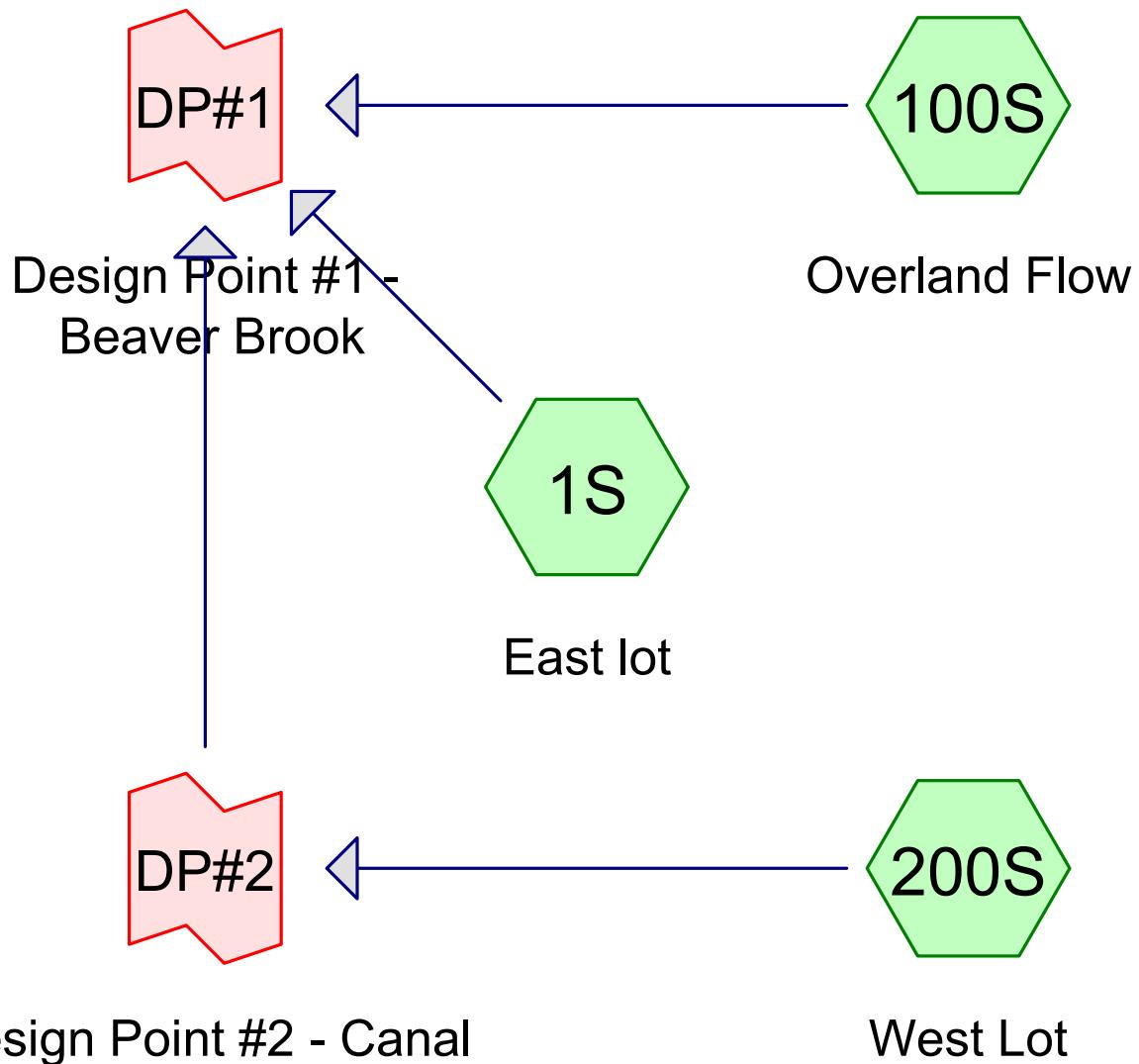
NOTES

STORMWATER MANAGEMENT REPORT

88, 91, & 101 Mill Street – Dracut, MA

APPENDIX E

PRE-DEVELOPMENT HYDROCAD COMPUTATIONS



Routing Diagram for Pre REV1
Prepared by Greenman-Pedersen, Inc, Printed 9/19/2025
HydroCAD® 10.20-7a s/n 04560 © 2025 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
15,575	61	>75% Grass cover, Good, HSG B (1S, 200S)
8	74	>75% Grass cover, Good, HSG C (200S)
17,839	80	>75% Grass cover, Good, HSG D (1S, 100S, 200S)
241	96	Gravel surface, HSG B (1S)
1,507	96	Gravel surface, HSG D (1S, 100S)
86,080	98	Paved parking, HSG B (1S, 200S)
574	98	Paved parking, HSG C (200S)
104,084	98	Paved parking, HSG D (1S, 100S, 200S)
69,328	98	Roofs, HSG B (1S, 200S)
6,900	98	Roofs, HSG D (1S, 200S)
2,019	98	Water Surface, HSG B (200S)
3,119	55	Woods, Good, HSG B (200S)
20,486	77	Woods, Good, HSG D (1S, 100S, 200S)
327,760	94	TOTAL AREA

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
176,363	HSG B	1S, 200S
583	HSG C	200S
150,815	HSG D	1S, 100S, 200S
0	Other	
327,760		TOTAL AREA

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sum Numb
0	15,575	8	17,839	0	33,422	>75% Grass cover, Good	
0	241	0	1,507	0	1,748	Gravel surface	
0	86,080	574	104,084	0	190,739	Paved parking	
0	69,328	0	6,900	0	76,228	Roofs	
0	2,019	0	0	0	2,019	Water Surface	
0	3,119	0	20,486	0	23,605	Woods, Good	
0	176,363	583	150,815	0	327,760	TOTAL AREA	

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	1S	0.00	0.00	12.0	0.0487	0.012	0.0	12.0	0.0	
2	1S	0.00	0.00	61.0	0.0948	0.012	0.0	12.0	0.0	
3	1S	0.00	0.00	123.0	0.0416	0.012	0.0	12.0	0.0	
4	1S	0.00	0.00	123.0	0.0184	0.012	0.0	12.0	0.0	
5	1S	0.00	0.00	157.0	0.0005	0.012	0.0	12.0	0.0	

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: East lot Runoff Area=188,340 sf 88.98% Impervious Runoff Depth=2.47"
Flow Length=631' Tc=6.5 min CN=95 Runoff=11.67 cfs 38,750 cf

Subcatchment 100S: Overland Flow Runoff Area=18,484 sf 0.12% Impervious Runoff Depth=1.14"
Flow Length=168' Tc=3.3 min CN=78 Runoff=0.61 cfs 1,761 cf

Subcatchment 200S: West Lot Runoff Area=120,937 sf 83.83% Impervious Runoff Depth=2.27"
Flow Length=107' Tc=5.2 min CN=93 Runoff=7.40 cfs 22,909 cf

Link DP#1: Design Point #1 - Beaver Brook Inflow=19.55 cfs 63,420 cf
Primary=19.55 cfs 63,420 cf

Link DP#2: Design Point #2 - Canal Inflow=7.40 cfs 22,909 cf
Primary=7.40 cfs 22,909 cf

Total Runoff Area = 327,760 sf Runoff Volume = 63,420 cf Average Runoff Depth = 2.32"
17.93% Pervious = 58,775 sf 82.07% Impervious = 268,986 sf

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: East lot Runoff Area=188,340 sf 88.98% Impervious Runoff Depth=3.98"
Flow Length=631' Tc=6.5 min CN=95 Runoff=18.33 cfs 62,529 cf

Subcatchment 100S: Overland Flow Runoff Area=18,484 sf 0.12% Impervious Runoff Depth=2.34"
Flow Length=168' Tc=3.3 min CN=78 Runoff=1.29 cfs 3,608 cf

Subcatchment 200S: West Lot Runoff Area=120,937 sf 83.83% Impervious Runoff Depth=3.77"
Flow Length=107' Tc=5.2 min CN=93 Runoff=11.93 cfs 37,959 cf

Link DP#1: Design Point #1 - Beaver Brook Inflow=31.28 cfs 104,097 cf
Primary=31.28 cfs 104,097 cf

Link DP#2: Design Point #2 - Canal Inflow=11.93 cfs 37,959 cf
Primary=11.93 cfs 37,959 cf

Total Runoff Area = 327,760 sf Runoff Volume = 104,097 cf Average Runoff Depth = 3.81"
17.93% Pervious = 58,775 sf 82.07% Impervious = 268,986 sf

Summary for Subcatchment 1S: East lot

[47] Hint: Peak is 215% of capacity of segment #4
 [47] Hint: Peak is 154% of capacity of segment #5
 [47] Hint: Peak is 233% of capacity of segment #6
 [47] Hint: Peak is 350% of capacity of segment #7
 [47] Hint: Peak is 2124% of capacity of segment #8

Runoff = 18.33 cfs @ 12.09 hrs, Volume= 62,529 cf, Depth= 3.98"
 Routed to Link DP#1 : Design Point #1 - Beaver Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=4.56"

Area (sf)	CN	Description
7,617	61	>75% Grass cover, Good, HSG B
9,822	80	>75% Grass cover, Good, HSG D
241	96	Gravel surface, HSG B
899	96	Gravel surface, HSG D
32,158	98	Paved parking, HSG B
84,928	98	Paved parking, HSG D
44,903	98	Roofs, HSG B
5,598	98	Roofs, HSG D
2,172	77	Woods, Good, HSG D
188,340	95	Weighted Average
20,752		11.02% Pervious Area
167,588		88.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	25	0.0330	0.15		Sheet Flow, Grass: Short n= 0.150 P2= 3.02"
0.5	35	0.0330	1.27		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.3	95	0.0638	5.13		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.0	12	0.0487	10.84	8.52	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.1	61	0.0948	15.13	11.88	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
0.2	123	0.0416	10.02	7.87	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
0.3	123	0.0184	6.67	5.24	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
2.4	157	0.0005	1.10	0.86	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'

n= 0.012 Corrugated PP, smooth interior

6.5 631 Total

Summary for Subcatchment 100S: Overland Flow

Runoff = 1.29 cfs @ 12.05 hrs, Volume= 3,608 cf, Depth= 2.34"
 Routed to Link DP#1 : Design Point #1 - Beaver Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=4.56"

Area (sf)	CN	Description			
2,626	80	>75% Grass cover, Good, HSG D			
608	96	Gravel surface, HSG D			
21	98	Paved parking, HSG D			
15,229	77	Woods, Good, HSG D			
18,484	78	Weighted Average			
18,463		99.88% Pervious Area			
21		0.12% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	19	0.3400	0.17		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.02"
1.4	149	0.1190	1.72		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.3	168	Total			

Summary for Subcatchment 200S: West Lot

Runoff = 11.93 cfs @ 12.07 hrs, Volume= 37,959 cf, Depth= 3.77"
 Routed to Link DP#2 : Design Point #2 - Canal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=4.56"

Area (sf)	CN	Description			
7,958	61	>75% Grass cover, Good, HSG B			
8	74	>75% Grass cover, Good, HSG C			
5,390	80	>75% Grass cover, Good, HSG D			
53,922	98	Paved parking, HSG B			
574	98	Paved parking, HSG C			
19,135	98	Paved parking, HSG D			
24,425	98	Roofs, HSG B			
1,301	98	Roofs, HSG D			
2,019	98	Water Surface, HSG B			
3,119	55	Woods, Good, HSG B			
3,084	77	Woods, Good, HSG D			
120,937	93	Weighted Average			
19,560		16.17% Pervious Area			
101,376		83.83% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	23	0.0180	0.12		Sheet Flow, Grass: Short n= 0.150 P2= 3.02"
2.0	84	0.0100	0.70		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
5.2	107				Total

Summary for Link DP#1: Design Point #1 - Beaver Brook

Inflow Area = 327,760 sf, 82.07% Impervious, Inflow Depth = 3.81" for 10-Year event
 Inflow = 31.28 cfs @ 12.08 hrs, Volume= 104,097 cf
 Primary = 31.28 cfs @ 12.08 hrs, Volume= 104,097 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link DP#2: Design Point #2 - Canal

Inflow Area = 120,937 sf, 83.83% Impervious, Inflow Depth = 3.77" for 10-Year event
 Inflow = 11.93 cfs @ 12.07 hrs, Volume= 37,959 cf
 Primary = 11.93 cfs @ 12.07 hrs, Volume= 37,959 cf, Atten= 0%, Lag= 0.0 min
 Routed to Link DP#1 : Design Point #1 - Beaver Brook

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: East lot Runoff Area=188,340 sf 88.98% Impervious Runoff Depth=5.19"
Flow Length=631' Tc=6.5 min CN=95 Runoff=23.55 cfs 81,505 cf

Subcatchment 100S: Overland Flow Runoff Area=18,484 sf 0.12% Impervious Runoff Depth=3.39"
Flow Length=168' Tc=3.3 min CN=78 Runoff=1.86 cfs 5,215 cf

Subcatchment 200S: West Lot Runoff Area=120,937 sf 83.83% Impervious Runoff Depth=4.97"
Flow Length=107' Tc=5.2 min CN=93 Runoff=15.48 cfs 50,043 cf

Link DP#1: Design Point #1 - Beaver Brook Inflow=40.52 cfs 136,763 cf
Primary=40.52 cfs 136,763 cf

Link DP#2: Design Point #2 - Canal Inflow=15.48 cfs 50,043 cf
Primary=15.48 cfs 50,043 cf

Total Runoff Area = 327,760 sf Runoff Volume = 136,763 cf Average Runoff Depth = 5.01"
17.93% Pervious = 58,775 sf 82.07% Impervious = 268,986 sf

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: East lot Runoff Area=188,340 sf 88.98% Impervious Runoff Depth=7.67"
Flow Length=631' Tc=6.5 min CN=95 Runoff=34.12 cfs 120,385 cf

Subcatchment 100S: Overland Flow Runoff Area=18,484 sf 0.12% Impervious Runoff Depth=5.64"
Flow Length=168' Tc=3.3 min CN=78 Runoff=3.06 cfs 8,689 cf

Subcatchment 200S: West Lot Runoff Area=120,937 sf 83.83% Impervious Runoff Depth=7.43"
Flow Length=107' Tc=5.2 min CN=93 Runoff=22.65 cfs 74,886 cf

Link DP#1: Design Point #1 - Beaver Brook Inflow=59.23 cfs 203,961 cf
Primary=59.23 cfs 203,961 cf

Link DP#2: Design Point #2 - Canal Inflow=22.65 cfs 74,886 cf
Primary=22.65 cfs 74,886 cf

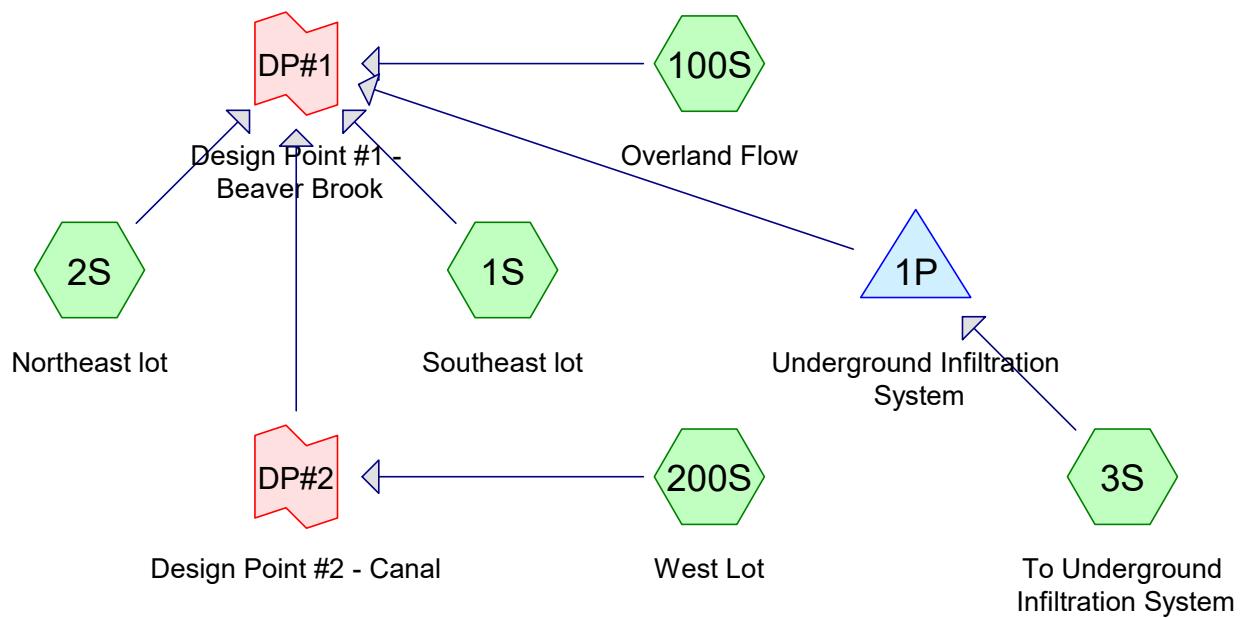
Total Runoff Area = 327,760 sf Runoff Volume = 203,961 cf Average Runoff Depth = 7.47"
17.93% Pervious = 58,775 sf 82.07% Impervious = 268,986 sf

STORMWATER MANAGEMENT REPORT

88, 91, & 101 Mill Street – Dracut, MA

APPENDIX F

POST-DEVELOPMENT HYDROCAD COMPUTATIONS



Routing Diagram for Post REV1
 Prepared by Greenman-Pedersen, Inc, Printed 9/19/2025
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Post REV1

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
18,085	61	>75% Grass cover, Good, HSG B (1S, 2S, 200S)
8	74	>75% Grass cover, Good, HSG C (200S)
16,243	80	>75% Grass cover, Good, HSG D (1S, 2S, 3S, 100S, 200S)
1,507	96	Gravel surface, HSG D (3S, 100S)
85,452	98	Paved parking, HSG B (1S, 2S, 200S)
574	98	Paved parking, HSG C (200S)
76,167	98	Paved parking, HSG D (1S, 2S, 3S, 100S, 200S)
67,687	98	Roofs, HSG B (1S, 2S, 200S)
36,488	98	Roofs, HSG D (1S, 2S, 3S, 200S)
2,019	98	Water Surface, HSG B (200S)
3,119	55	Woods, Good, HSG B (200S)
20,411	77	Woods, Good, HSG D (3S, 100S, 200S)
327,760	93	TOTAL AREA

Post REV1

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Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
176,363	HSG B	1S, 2S, 200S
583	HSG C	200S
150,815	HSG D	1S, 2S, 3S, 100S, 200S
0	Other	
327,760		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sum Numb
0	18,085	8	16,243	0	34,336	>75% Grass cover, Good	
0	0	0	1,507	0	1,507	Gravel surface	
0	85,452	574	76,167	0	162,194	Paved parking	
0	67,687	0	36,488	0	104,175	Roofs	
0	2,019	0	0	0	2,019	Water Surface	
0	3,119	0	20,411	0	23,530	Woods, Good	
0	176,363	583	150,815	0	327,760	TOTAL AREA	

Post REV1

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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	1S	0.00	0.00	13.0	0.0170	0.012	0.0	12.0	0.0	
2	1S	0.00	0.00	61.0	0.0948	0.012	0.0	12.0	0.0	
3	1S	0.00	0.00	123.0	0.0416	0.012	0.0	12.0	0.0	
4	1S	0.00	0.00	123.0	0.0184	0.012	0.0	12.0	0.0	
5	1S	0.00	0.00	157.0	0.0005	0.012	0.0	12.0	0.0	
6	2S	0.00	0.00	12.0	0.0086	0.012	0.0	12.0	0.0	
7	2S	0.00	0.00	46.0	0.0050	0.012	0.0	12.0	0.0	
8	2S	0.00	0.00	124.0	0.0050	0.012	0.0	12.0	0.0	
9	2S	0.00	0.00	98.0	0.0051	0.012	0.0	12.0	0.0	
10	1P	97.54	97.52	32.0	0.0006	0.012	0.0	12.0	0.0	
11	1P	97.75	97.65	10.0	0.0100	0.012	0.0	12.0	0.0	

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Southeast lot

Runoff Area=74,803 sf 93.74% Impervious Runoff Depth=2.57"
Flow Length=624' Tc=6.8 min CN=96 Runoff=4.71 cfs 16,031 cf

Subcatchment 2S: Northeast lot

Runoff Area=67,439 sf 86.18% Impervious Runoff Depth=2.27"
Flow Length=641' Tc=6.4 min CN=93 Runoff=3.95 cfs 12,775 cf

Subcatchment 3S: To Underground

Runoff Area=44,635 sf 81.96% Impervious Runoff Depth=2.47"
Tc=6.0 min CN=95 Runoff=2.82 cfs 9,183 cf

Subcatchment 100S: Overland Flow

Runoff Area=17,340 sf 0.14% Impervious Runoff Depth=1.14"
Flow Length=168' Tc=3.3 min CN=78 Runoff=0.57 cfs 1,652 cf

Subcatchment 200S: West Lot

Runoff Area=123,543 sf 83.81% Impervious Runoff Depth=2.27"
Flow Length=107' Tc=5.2 min CN=93 Runoff=7.56 cfs 23,403 cf

Pond 1P: Underground Infiltration System Peak Elev=98.32' Storage=2,817 cf Inflow=2.82 cfs 9,183 cf
Discarded=0.15 cfs 6,803 cf Primary=0.94 cfs 2,381 cf Outflow=1.10 cfs 9,183 cf

Link DP#1: Design Point #1 - Beaver Brook

Inflow=16.68 cfs 56,242 cf
Primary=16.68 cfs 56,242 cf

Link DP#2: Design Point #2 - Canal

Inflow=7.56 cfs 23,403 cf
Primary=7.56 cfs 23,403 cf

Total Runoff Area = 327,760 sf Runoff Volume = 63,045 cf Average Runoff Depth = 2.31"
18.11% Pervious = 59,373 sf 81.89% Impervious = 268,388 sf

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Southeast lot

Runoff Area=74,803 sf 93.74% Impervious Runoff Depth=4.10"
Flow Length=624' Tc=6.8 min CN=96 Runoff=7.30 cfs 25,530 cf

Subcatchment 2S: Northeast lot

Runoff Area=67,439 sf 86.18% Impervious Runoff Depth=3.77"
Flow Length=641' Tc=6.4 min CN=93 Runoff=6.38 cfs 21,167 cf

Subcatchment 3S: To Underground

Runoff Area=44,635 sf 81.96% Impervious Runoff Depth=3.98"
Tc=6.0 min CN=95 Runoff=4.42 cfs 14,819 cf

Subcatchment 100S: Overland Flow

Runoff Area=17,340 sf 0.14% Impervious Runoff Depth=2.34"
Flow Length=168' Tc=3.3 min CN=78 Runoff=1.21 cfs 3,385 cf

Subcatchment 200S: West Lot

Runoff Area=123,543 sf 83.81% Impervious Runoff Depth=3.77"
Flow Length=107' Tc=5.2 min CN=93 Runoff=12.19 cfs 38,777 cf

Pond 1P: Underground Infiltration System Peak Elev=98.93' Storage=3,758 cf Inflow=4.42 cfs 14,819 cf
Discarded=0.16 cfs 8,457 cf Primary=2.64 cfs 6,362 cf Outflow=2.80 cfs 14,819 cf

Link DP#1: Design Point #1 - Beaver Brook

Inflow=28.83 cfs 95,221 cf
Primary=28.83 cfs 95,221 cf

Link DP#2: Design Point #2 - Canal

Inflow=12.19 cfs 38,777 cf
Primary=12.19 cfs 38,777 cf

Total Runoff Area = 327,760 sf Runoff Volume = 103,678 cf Average Runoff Depth = 3.80"
18.11% Pervious = 59,373 sf 81.89% Impervious = 268,388 sf

Summary for Subcatchment 1S: Southeast lot

[47] Hint: Peak is 145% of capacity of segment #4

[47] Hint: Peak is 140% of capacity of segment #7

[47] Hint: Peak is 846% of capacity of segment #8

Runoff = 7.30 cfs @ 12.09 hrs, Volume= 25,530 cf, Depth= 4.10"
 Routed to Link DP#1 : Design Point #1 - Beaver Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=4.56"

Area (sf)	CN	Description
1,536	61	>75% Grass cover, Good, HSG B
3,148	80	>75% Grass cover, Good, HSG D
8,936	98	Paved parking, HSG B
16,178	98	Paved parking, HSG D
19,270	98	Roofs, HSG B
25,736	98	Roofs, HSG D
74,803	96	Weighted Average
4,684		6.26% Pervious Area
70,119		93.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	25	0.0240	0.13		Sheet Flow, Grass: Short n= 0.150 P2= 3.02"
0.4	23	0.0240	1.08		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.3	99	0.0638	5.13		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.0	13	0.0170	6.41	5.03	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.1	61	0.0948	15.13	11.88	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
0.2	123	0.0416	10.02	7.87	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
0.3	123	0.0184	6.67	5.24	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
2.4	157	0.0005	1.10	0.86	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
6.8	624	Total			

Summary for Subcatchment 2S: Northeast lot

[47] Hint: Peak is 178% of capacity of segment #4

[47] Hint: Peak is 234% of capacity of segment #5

[47] Hint: Peak is 234% of capacity of segment #6

[47] Hint: Peak is 231% of capacity of segment #7

Runoff = 6.38 cfs @ 12.09 hrs, Volume= 21,167 cf, Depth= 3.77"
 Routed to Link DP#1 : Design Point #1 - Beaver Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=4.56"

Area (sf)	CN	Description
8,590	61	>75% Grass cover, Good, HSG B
727	80	>75% Grass cover, Good, HSG D
22,595	98	Paved parking, HSG B
10,224	98	Paved parking, HSG D
23,993	98	Roofs, HSG B
1,310	98	Roofs, HSG D
67,439	93	Weighted Average
9,318		13.82% Pervious Area
58,121		86.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	25	0.0430	0.17		Sheet Flow, Grass: Short n= 0.150 P2= 3.02"
2.0	142	0.0300	1.21		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.7	194	0.0460	4.35		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.0	12	0.0086	4.56	3.58	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
0.2	46	0.0050	3.47	2.73	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
0.6	124	0.0050	3.47	2.73	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
0.5	98	0.0051	3.51	2.76	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
6.4	641	Total			

Summary for Subcatchment 3S: To Underground Infiltration System

Runoff = 4.42 cfs @ 12.08 hrs, Volume= 14,819 cf, Depth= 3.98"
 Routed to Pond 1P : Underground Infiltration System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=4.56"

Area (sf)	CN	Description		
4,978	80	>75% Grass cover, Good, HSG D		
899	96	Gravel surface, HSG D		
28,444	98	Paved parking, HSG D		
8,140	98	Roofs, HSG D		
2,175	77	Woods, Good, HSG D		
44,635	95	Weighted Average		
8,052		18.04% Pervious Area		
36,584		81.96% Impervious Area		
Tc (min)	Length (feet)	Slope (ft/ft) Velocity (ft/sec) Capacity (cfs) Description		
6.0				Direct Entry,

Summary for Subcatchment 100S: Overland Flow

Runoff = 1.21 cfs @ 12.05 hrs, Volume= 3,385 cf, Depth= 2.34"
 Routed to Link DP#1 : Design Point #1 - Beaver Brook

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=4.56"

Area (sf)	CN	Description		
1,556	80	>75% Grass cover, Good, HSG D		
608	96	Gravel surface, HSG D		
24	98	Paved parking, HSG D		
15,152	77	Woods, Good, HSG D		
17,340	78	Weighted Average		
17,316		99.86% Pervious Area		
24		0.14% Impervious Area		
Tc (min)	Length (feet)	Slope (ft/ft) Velocity (ft/sec) Capacity (cfs) Description		
1.9	19	0.3400	0.17	Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.02"
1.4	149	0.1190	1.72	Shallow Concentrated Flow, Woodland Kv= 5.0 fps
3.3	168	Total		

Summary for Subcatchment 200S: West Lot

Runoff = 12.19 cfs @ 12.07 hrs, Volume= 38,777 cf, Depth= 3.77"
 Routed to Link DP#2 : Design Point #2 - Canal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-Year Rainfall=4.56"

Area (sf)	CN	Description
7,958	61	>75% Grass cover, Good, HSG B
8	74	>75% Grass cover, Good, HSG C
5,834	80	>75% Grass cover, Good, HSG D
53,922	98	Paved parking, HSG B
574	98	Paved parking, HSG C
21,298	98	Paved parking, HSG D
24,425	98	Roofs, HSG B
1,301	98	Roofs, HSG D
2,019	98	Water Surface, HSG B
3,119	55	Woods, Good, HSG B
3,084	77	Woods, Good, HSG D
123,543	93	Weighted Average
20,004		16.19% Pervious Area
103,540		83.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	23	0.0180	0.12		Sheet Flow, Grass: Short n= 0.150 P2= 3.02"
2.0	84	0.0100	0.70		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
5.2	107			Total	

Summary for Pond 1P: Underground Infiltration System

Inflow Area = 44,635 sf, 81.96% Impervious, Inflow Depth = 3.98" for 10-Year event
 Inflow = 4.42 cfs @ 12.08 hrs, Volume= 14,819 cf
 Outflow = 2.80 cfs @ 12.18 hrs, Volume= 14,819 cf, Atten= 37%, Lag= 5.7 min
 Discarded = 0.16 cfs @ 12.18 hrs, Volume= 8,457 cf
 Primary = 2.64 cfs @ 12.18 hrs, Volume= 6,362 cf
 Routed to Link DP#1 : Design Point #1 - Beaver Brook

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
 Peak Elev= 98.93' @ 12.18 hrs Surf.Area= 2,252 sf Storage= 3,758 cf
 Flood Elev= 100.00' Surf.Area= 2,252 sf Storage= 4,868 cf

Plug-Flow detention time= 78.3 min calculated for 14,814 cf (100% of inflow)
 Center-of-Mass det. time= 78.3 min (849.0 - 770.7)

Post REV1

Prepared by Greenman-Pedersen, Inc

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Beaver Brook
 Type III 24-hr 10-Year Rainfall=4.56"
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 Page 11

Volume	Invert	Avail.Storage	Storage Description
#1A	96.50'	2,034 cf	20.50'W x 109.85'L x 3.50'H Field A 7,882 cf Overall - 2,796 cf Embedded = 5,086 cf x 40.0% Voids
#2A	97.00'	2,796 cf	Cultec R-300HD x 60 Inside #1 Effective Size= 45.6" W x 30.0" H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0" W x 30.0" H x 7.54'L with 0.46' Overlap 60 Chambers in 4 Rows Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf
#3	97.00'	68 cf	4.00'D x 5.40'H Vertical Cone/Cylinder -Impervious
		4,898 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	96.50'	2.410 in/hr Exfiltration over Wetted area Phase-In= 0.01'
#2	Primary	97.54'	12.0" Round Culvert L= 32.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.54' / 97.52' S= 0.0006 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#3	Device 2	97.75'	12.0" Round Culvert L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.75' / 97.65' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.16 cfs @ 12.18 hrs HW=98.93' (Free Discharge)
 ↑
 1=Exfiltration (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=2.64 cfs @ 12.18 hrs HW=98.93' TW=0.00' (Dynamic Tailwater)
 ↑
 2=Culvert (Barrel Controls 2.64 cfs @ 3.36 fps)
 ↑
 3=Culvert (Passes 2.64 cfs of 2.85 cfs potential flow)

Summary for Link DP#1: Design Point #1 - Beaver Brook

Inflow Area = 327,760 sf, 81.89% Impervious, Inflow Depth = 3.49" for 10-Year event
 Inflow = 28.83 cfs @ 12.09 hrs, Volume= 95,221 cf
 Primary = 28.83 cfs @ 12.09 hrs, Volume= 95,221 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link DP#2: Design Point #2 - Canal

Inflow Area = 123,543 sf, 83.81% Impervious, Inflow Depth = 3.77" for 10-Year event
 Inflow = 12.19 cfs @ 12.07 hrs, Volume= 38,777 cf
 Primary = 12.19 cfs @ 12.07 hrs, Volume= 38,777 cf, Atten= 0%, Lag= 0.0 min
 Routed to Link DP#1 : Design Point #1 - Beaver Brook

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Southeast lot

Runoff Area=74,803 sf 93.74% Impervious Runoff Depth=5.31"
Flow Length=624' Tc=6.8 min CN=96 Runoff=9.34 cfs 33,090 cf

Subcatchment 2S: Northeast lot

Runoff Area=67,439 sf 86.18% Impervious Runoff Depth=4.97"
Flow Length=641' Tc=6.4 min CN=93 Runoff=8.27 cfs 27,906 cf

Subcatchment 3S: To Underground

Runoff Area=44,635 sf 81.96% Impervious Runoff Depth=5.19"
Tc=6.0 min CN=95 Runoff=5.68 cfs 19,316 cf

Subcatchment 100S: Overland Flow

Runoff Area=17,340 sf 0.14% Impervious Runoff Depth=3.39"
Flow Length=168' Tc=3.3 min CN=78 Runoff=1.74 cfs 4,892 cf

Subcatchment 200S: West Lot

Runoff Area=123,543 sf 83.81% Impervious Runoff Depth=4.97"
Flow Length=107' Tc=5.2 min CN=93 Runoff=15.81 cfs 51,122 cf

Pond 1P: Underground Infiltration System Peak Elev=99.40' Storage=4,316 cf Inflow=5.68 cfs 19,316 cf
Discarded=0.17 cfs 9,488 cf Primary=3.85 cfs 9,828 cf Outflow=4.02 cfs 19,316 cf

Link DP#1: Design Point #1 - Beaver Brook

Inflow=37.87 cfs 126,838 cf
Primary=37.87 cfs 126,838 cf

Link DP#2: Design Point #2 - Canal

Inflow=15.81 cfs 51,122 cf
Primary=15.81 cfs 51,122 cf

Total Runoff Area = 327,760 sf Runoff Volume = 136,326 cf Average Runoff Depth = 4.99"
18.11% Pervious = 59,373 sf 81.89% Impervious = 268,388 sf

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Southeast lot

Runoff Area=74,803 sf 93.74% Impervious Runoff Depth=7.79"
Flow Length=624' Tc=6.8 min CN=96 Runoff=13.48 cfs 48,561 cf

Subcatchment 2S: Northeast lot

Runoff Area=67,439 sf 86.18% Impervious Runoff Depth=7.43"
Flow Length=641' Tc=6.4 min CN=93 Runoff=12.11 cfs 41,759 cf

Subcatchment 3S: To Underground

Runoff Area=44,635 sf 81.96% Impervious Runoff Depth=7.67"
Tc=6.0 min CN=95 Runoff=8.23 cfs 28,531 cf

Subcatchment 100S: Overland Flow

Runoff Area=17,340 sf 0.14% Impervious Runoff Depth=5.64"
Flow Length=168' Tc=3.3 min CN=78 Runoff=2.87 cfs 8,151 cf

Subcatchment 200S: West Lot

Runoff Area=123,543 sf 83.81% Impervious Runoff Depth=7.43"
Flow Length=107' Tc=5.2 min CN=93 Runoff=23.14 cfs 76,500 cf

Pond 1P: Underground Infiltration System Peak Elev=104.14' Storage=4,898 cf Inflow=8.23 cfs 28,531 cf
Discarded=0.18 cfs 11,138 cf Primary=9.22 cfs 17,392 cf Outflow=9.39 cfs 28,531 cf

Link DP#1: Design Point #1 - Beaver Brook

Inflow=58.69 cfs 192,364 cf
Primary=58.69 cfs 192,364 cf

Link DP#2: Design Point #2 - Canal

Inflow=23.14 cfs 76,500 cf
Primary=23.14 cfs 76,500 cf

Total Runoff Area = 327,760 sf Runoff Volume = 203,502 cf Average Runoff Depth = 7.45"
18.11% Pervious = 59,373 sf 81.89% Impervious = 268,388 sf

STORMWATER MANAGEMENT REPORT

88, 91, & 101 Mill Street – Dracut, MA

APPENDIX G

SUPPLEMENTAL CALCULATIONS AND BACKUP DATA

May 21, 2025

Town of Dracut Planning Board
62 Arlington Street
Dracut, MA 01826

Re: 88, 91, 101 Mill Street
Assessors Map 32 Block 245 Lots 1 & 1.1, Assessors Map 32 Block 0 Lot 66
Sub: Illicit Discharge Statement
Standard #10

Dear Board Members:

On behalf of our client, Beaver Brook Holdings, LLC, we hereby state that to the best of our knowledge, no illicit discharges exist on the above referenced site and none are proposed with the site development plans. Implementing the pollution prevention plan measures outlined in the site development plans will prevent illicit discharges to the stormwater management system, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease. Refer to the Grading & Drainage Plan from the site plan set for additional information.

Sincerely,
Greenman-Pedersen, Inc.



Christopher Broyles, P.E.
Project Manager

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Metadata for Point	
Smoothing	Yes
State	
Location	
Latitude	42.682 degrees North
Longitude	71.35 degrees West
Elevation	30 feet
Date/Time	Thu Apr 03 2025 09:02:57 GMT-0400 (Eastern Daylight Time)

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.42	0.52	0.69	0.86	1.08	1yr	0.74	1.02	1.25	1.58	1.99	2.52	2.75	1yr	2.23	2.65	3.09	3.78	4.41	1yr
2yr	0.34	0.52	0.64	0.85	1.06	1.34	2yr	0.92	1.23	1.55	1.93	2.42	3.02	3.34	2yr	2.67	3.21	3.72	4.45	5.06	2yr
5yr	0.40	0.62	0.77	1.04	1.33	1.69	5yr	1.15	1.54	1.96	2.46	3.06	3.82	4.25	5yr	3.38	4.08	4.71	5.60	6.34	5yr
10yr	0.45	0.70	0.89	1.21	1.57	2.01	10yr	1.35	1.82	2.34	2.94	3.67	4.56	5.10	10yr	4.04	4.90	5.63	6.67	7.51	10yr
25yr	0.53	0.84	1.07	1.48	1.96	2.53	25yr	1.69	2.28	2.96	3.73	4.67	5.78	6.49	25yr	5.11	6.24	7.13	8.40	9.42	25yr
50yr	0.59	0.96	1.23	1.72	2.32	3.04	50yr	2.00	2.70	3.56	4.50	5.60	6.91	7.80	50yr	6.12	7.50	8.53	10.00	11.17	50yr
100yr	0.68	1.11	1.43	2.02	2.75	3.62	100yr	2.38	3.20	4.25	5.38	6.70	8.27	9.37	100yr	7.32	9.01	10.21	11.92	13.26	100yr
200yr	0.78	1.27	1.65	2.36	3.27	4.33	200yr	2.82	3.80	5.10	6.45	8.04	9.90	11.27	200yr	8.76	10.83	12.22	14.21	15.75	200yr
500yr	0.94	1.54	2.01	2.92	4.10	5.47	500yr	3.54	4.76	6.47	8.20	10.22	12.57	14.38	500yr	11.12	13.83	15.50	17.93	19.78	500yr

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.36	0.44	0.59	0.72	0.81	1yr	0.62	0.80	1.09	1.34	1.69	2.34	2.57	1yr	2.07	2.47	2.78	3.08	4.11	1yr
2yr	0.32	0.49	0.60	0.82	1.01	1.21	2yr	0.87	1.18	1.39	1.82	2.33	2.94	3.24	2yr	2.60	3.12	3.63	4.34	4.92	2yr
5yr	0.37	0.56	0.70	0.96	1.22	1.44	5yr	1.05	1.41	1.65	2.14	2.73	3.58	3.96	5yr	3.17	3.81	4.39	5.23	5.96	5yr
10yr	0.40	0.62	0.77	1.07	1.38	1.63	10yr	1.19	1.59	1.85	2.41	3.08	4.15	4.59	10yr	3.68	4.42	5.06	6.03	6.85	10yr
25yr	0.46	0.70	0.87	1.24	1.63	1.91	25yr	1.41	1.87	2.17	2.84	3.58	5.05	5.58	25yr	4.47	5.37	6.13	7.28	8.24	25yr
50yr	0.50	0.76	0.95	1.37	1.84	2.17	50yr	1.59	2.12	2.45	3.22	4.03	5.84	6.49	50yr	5.17	6.24	7.09	8.40	9.45	50yr
100yr	0.55	0.83	1.04	1.51	2.07	2.45	100yr	1.78	2.40	2.77	3.54	4.54	6.42	7.54	100yr	5.68	7.25	8.19	9.70	10.86	100yr
200yr	0.61	0.92	1.16	1.68	2.35	2.78	200yr	2.02	2.72	3.11	4.00	5.13	7.37	8.75	200yr	6.52	8.42	9.49	11.19	12.46	200yr
500yr	0.70	1.04	1.33	1.94	2.76	3.30	500yr	2.38	3.22	3.66	4.71	6.06	8.81	10.71	500yr	7.79	10.30	11.53	13.53	14.94	500yr

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.31	0.48	0.58	0.78	0.96	1.12	1yr	0.83	1.10	1.28	1.68	2.13	2.70	2.93	1yr	2.39	2.82	3.32	4.06	4.74	1yr
2yr	0.35	0.55	0.67	0.91	1.12	1.32	2yr	0.97	1.29	1.51	1.96	2.51	3.12	3.45	2yr	2.76	3.31	3.84	4.59	5.22	2yr
5yr	0.44	0.68	0.84	1.15	1.46	1.69	5yr	1.26	1.66	1.93	2.48	3.12	4.05	4.56	5yr	3.59	4.38	5.04	5.99	6.74	5yr
10yr	0.53	0.81	1.01	1.41	1.82	2.07	10yr	1.57	2.02	2.35	2.98	3.72	5.00	5.65	10yr	4.43	5.43	6.20	7.34	8.21	10yr
25yr	0.68	1.04	1.29	1.85	2.43	2.69	25yr	2.10	2.63	3.06	3.79	4.66	6.58	7.50	25yr	5.82	7.21	8.18	9.62	10.72	25yr
50yr	0.83	1.26	1.57	2.25	3.04	3.29	50yr	2.62	3.22	3.74	4.56	5.54	8.10	9.32	50yr	7.17	8.96	10.06	11.80	13.10	50yr
100yr	1.01	1.53	1.91	2.76	3.79	4.03	100yr	3.27	3.94	4.57	5.63	6.59	10.31	11.56	100yr	9.12	11.12	12.39	14.50	16.01	100yr
200yr	1.23	1.85	2.35	3.40	4.74	4.92	200yr	4.09	4.81	5.57	6.79	7.84	12.78	14.35	200yr	11.31	13.80	15.27	17.81	19.63	200yr
500yr	1.61	2.39	3.08	4.47	6.35	6.41	500yr	5.48	6.27	7.28	8.72	9.86	16.99	19.06	500yr	15.04	18.33	20.12	23.38	25.62	500yr

First Defense® High Capacity

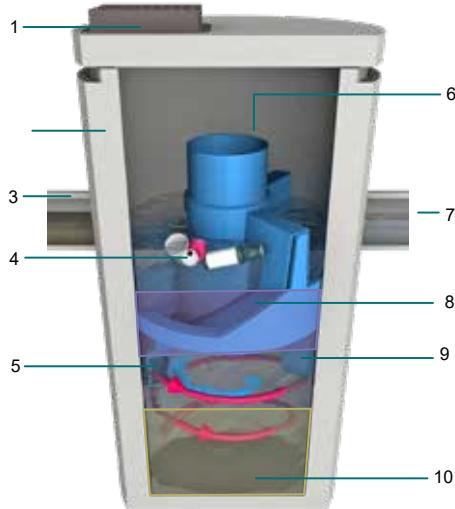
Advanced Hydrodynamic Separator

Product Summary

A Simple Solution for your Trickiest Sites

First Defense® High Capacity is a versatile stormwater separator with some of the highest approved flow rates in the United States, enabling engineers and contractors to save site space and projects costs by using the smallest possible footprint. It also works with single and multiple inlet pipes and inlet grates has an internal bypass to convey infrequent peak flows directly to the outlet.

Fig.1 The First Defense® High Capacity has internal components designed to efficiently capture pollutants and prevent washout at



Product Profile

1. Inlet Grate (optional)	6. Internal Bypass
2. Precast chamber	7. Outlet pipe
3. Inlet Pipe (optional)	8. Oil and Floatables Storage
4. Floatables Draw Off Slot (not pictured)	9. Outlet chute
5. Inlet Chute	10. Sediment Storage Sump

Applications

- » Areas requiring a minimum of 50% TSS removal
- » Stormwater treatment at the point of entry into the drainage line
- » Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- » Highways, car parks, industrial areas and urban developments
- » Pre-treatment to ponds, storage systems, green infrastructure

How it Works

Highest Flow through the Smallest Footprint



Contaminated stormwater runoff enters the inlet chute from a surface grate and/or inlet pipe. The inlet chute introduces flow into the chamber tangentially to create a low energy vortex flow regime (**magenta arrow**) that directs sediment into the sump while oils, floating trash and debris rise to the surface.

Treated stormwater exits through a submerged outlet chute located opposite to the direction of the rotating flow (**blue arrow**). Enhanced vortex separation is provided by forcing the rotating flow within the vessel to follow the longest path possible rather than directly from inlet to outlet.

Higher flows bypass the treatment chamber to prevent turbulence and washout of captured pollutants. An internal bypass conveys infrequent peak flows directly to the outlet eliminating the need for, and expense of, external bypass control structures. A floatables draw off slot functions to convey floatables into the treatment chamber prior to bypass.

Benefits

Small & Simple

- » Cut footprint size, cut costs: First Defense® provides space-saving, easy-to-install surface water treatment in standard sized chambers/manholes.
- » Adapt to site limitations: Variable configurations will help you effectively slip First Defense® into a tight spot. It also works well with large pipes, multiple inlet pipes and inlet grates.
- » Save installation time: Every First Defense® unit is delivered to site pre-assembled and ready for installation – so installation is as easy as fitting any chamber/manhole.



Stormwater Solutions

→ hydro-int.com/firstdefense

Sizing & Design

This adaptable online treatment system works easily with large pipes, multiple inlet pipes, inlet grates and now, contains a high capacity bypass for the conveyance of large peak flows. Designed with site flexibility in mind, the First Defense® High Capacity allows engineers to maximize available site space without compromising treatment level.



Free Sizing Tool



This simple online tool will recommend the best separator, model size and online/offline arrangement based on site-specific data entered by the user.

Go to hydro-int.com/sizing to access the tool.

First Defense® High Capacity Model Number	Diameter	Typical TSS Treatment Flow Rates		Peak Online Flow Rate	Maximum Pipe Diameter ¹	Oil Storage Capacity	Typical Sediment Storage Capacity ²	Minimum Distance from Outlet Invert to Top of Rim ³	Standard Distance from Outlet Invert to Sump Floor
		NJDEP Certified	110µm						
	(ft / m)	(cfs / L/s)	(cfs / L/s)	(cfs / L/s)	(in / mm)	(gal / L)	(yd ³ / m ³)	(ft / m)	(ft / m)
FD-3HC	3 / 0.9	0.84 / 23.7	1.06 / 30.0	15 / 424	18 / 450	125 / 473	0.4 / 0.3	2.0 - 3.5 / 0.6 - 1.0	3.71 / 1.13
FD-4HC	4 / 1.2	1.50 / 42.4	1.88 / 53.2	18 / 510	24 / 600	191 / 723	0.7 / 0.5	2.3 - 3.9 / 0.7 - 1.2	4.97 / 1.5
FD-5HC	5 / 1.5	2.35 / 66.2	2.94 / 83.2	20 / 566	24 / 600	300 / 1135	1.1 / .84	2.5 - 4.5 / 0.7 - 1.3	5.19 / 1.5
FD-6HC	6 / 1.8	3.38 / 95.7	4.23 / 119.8	32 / 906	30 / 750	496 / 1,878	1.6 / 1.2	3.0 - 5.1 / 0.9 - 1.6	5.97 / 1.8
FD-8HC	8 / 2.4	6.00 / 169.9	7.52 / 212.9	50 / 1415	48 / 1200	1120 / 4239	2.8 / 2.1	3.0 - 6.0 / 0.9 - 1.8	7.40 / 2.2
FD-10HC	10 / 3.0	9.38 / 265.6	11.75 / 332.7	50 / 1415	48 / 1200	1742 / 6594	4.4 / 3.3	6.5 - 8.0 / 2.0 - 2.4	10.25 / 3.12

¹Contact Hydro International when larger pipe sizes are required.

²Contact Hydro International when custom sediment storage capacity is required.

³Minimum distance for models depends on pipe diameter.



Maintenance

Easy vector hose access through the center shaft of the system makes for quick, simple sump cleanout while trash and floatables can be fished out from the surface with a net.

Nobody maintains our systems better than we do. To ensure optimal, ongoing device performance, be sure to recommend Hydro International as a preferred service and maintenance provider to your clients.



- 📍 Hydro International, 94 Hutchins Drive, Portland, ME 04102
- 📞 Tel: (207) 756-6200
- ✉ Email: stormwaterinquiry@hydro-int.com
- 🌐 Web: www.hydro-int.com/firstdefense

Download Drawings!

→ hydro-int.com/fddrawings

Access the Operation & Maintenance Manual

→ hydro-int.com/fd-om

Technical Abstract

First Defense® - High Capacity

NJCAT Verified 80% TSS Removal & Sizing - "Down to 50 microns"

Abstract

Hydro International has a state-of-the-art hydraulics and test facility that is used both to develop products and to evaluate performance. Through controlled testing using industry standard test protocols, Hydro's treatment products are evaluated under varying hydraulic and sediment load conditions. With a known drainage area or water quality flow rate, these test results are used to benchmark treatment objectives and to select the correct model size.

A common performance expectation for hydrodynamic stormwater separators is to remove 80% of Total Suspended Solids (TSS). To support this approach, Hydro International has completed efficiency tests for a range of flow rates and particle size ranges. All tests are conducted with an independent observer present and use industry accepted protocols. All analytics are completed by externally certified laboratories. The test procedures and results have been reviewed and verified by New Jersey Corporation for Advanced Technology (NJCAT).

First Defense

The FDHC (Figure 1) has patented flow-modifying internal components that create a gentle swirling flow path within the Vortex Chamber. The rotating flow creates low energy vortex forces that supplement gravitational settling forces to enhance separation of pollutants

The internal components are designed to fit into standard precast manholes and are installed to collect runoff as part of typical drainage network system. During a rain event, flow enters either from a surface inlet grate or inlet pipe. As flow enters the manhole, components divert flow and pollutants into a Vortex Chamber beneath a separation module, that includes both Inlet/Outlet Chutes and Bypass Weirs. The internal Bypass Weirs divert peak flows over the separation module and away from the Vortex Chamber where pollutants are collecting. This prevents high velocities from re-suspending captured pollutants during infrequent but large storm events.

Capable of providing high pollutant removals for a wide range of flow rates and pipe sizes, the FDHC can be installed either online or offline depending on pipes and peak flows. Its efficiency and simplicity make it economical to install and maintain.

Fine Sediment Removal Test Material

The feed sediment used for the removal efficiency testing was high purity silica (SiO_2 99.8%) supplied by two different commercial silica suppliers, blended in the proportions to produce a wide range of particle sizes distributed from less than 10 μm to over 1000 μm , with a $D_{50} = 63 \mu\text{m}$. This provides a loading bias towards finer particle sizes and produces more conservative results. In the presence of an independent observer, composited samples were sealed, signed, and packaged for independent transport to the outside laboratory for analysis.

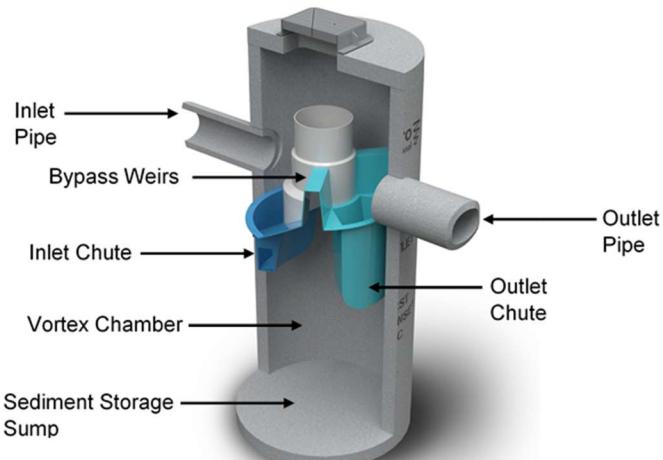


Figure 1 – First Defense High Capacity

The independent laboratory, GeoTesting Express, analyzed the three test sand samples for particle size distribution (PSD) using ASTM D 422-63. The particle size results were averaged to produce an overall measure of the test sediment. Because the goal was to verify the removal rate of the First Defense for various PSD ranges, the test sand was also graded into subset PSD ranges shown in Figure 2. Each subset is expressed as a separate PSD "Down To" the smallest particle size in that subset, as a fraction of subset's total mass.

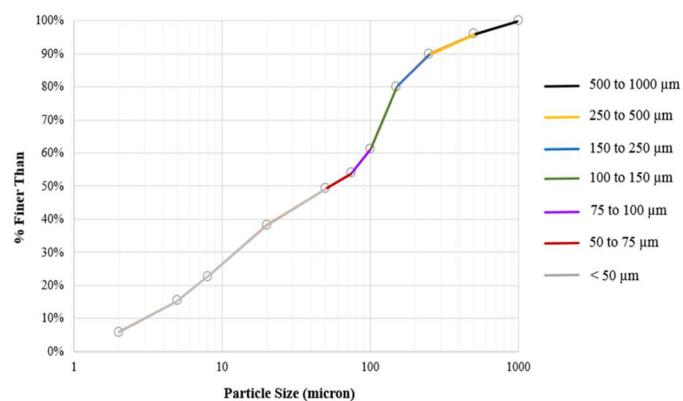


Figure 2 - Particle Size Distribution of Test Sediment

First Defense®

Laboratory Testing Arrangement

The laboratory setup consisted of a recirculating closed loop system with an 8-inch (200 mm) submersible Flygt pump that conveyed water from a 23,000 gal (87,064 L) reservoir through a PVC pipe network to the 4-ft (1.2m) First Defense (Fig.3). The flow rate of the pump was controlled by a GE Fuji Electric AF-300 P11 Adjustable Frequency Drive and measured by an EMCO Flow Systems 4411e Electromagnetic Flow Transmitter.

The sediment storage sump of the First Defense measures 18 inches (457 mm) in height. But it was fitted with a false bottom positioned 9 inches (229 mm) above the floor of the sump to simulate a 50% full condition during testing to ensure a conservative test result.

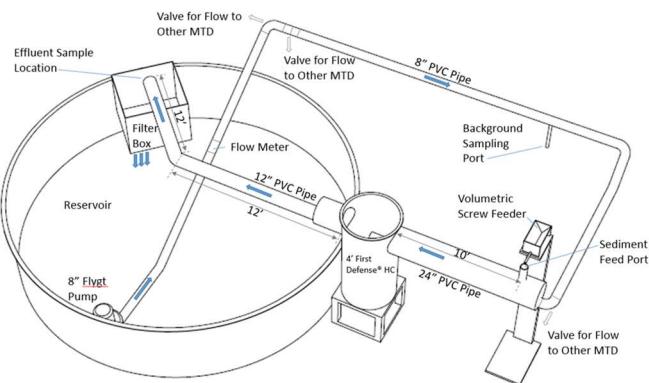


Figure 3 - Set-up of the Portland, Maine hydraulic testing facility

Performance Test Procedures

Removal efficiency testing was conducted in accordance with Section 5 of the NJDEP Laboratory Protocol for HDS MTDs. Particle sizes were determined for both the inlet feed and captured sediment removed from the sump between each test run.

A total of 15 evenly spaced effluent samples were taken at five flow rates: 0.38 cfs (10.8 L/s), 0.54 cfs (15.3 L/s), 0.82 cfs (23.2 L/s), 1.07 cfs (30.3 L/s), and 1.38 cfs (39.1 L/s).

Duplicate effluent samples were also taken at the first, middle and last sample at each flow. These were composited and analyzed for particle size distribution using laser diffraction. Background concentrations were also taken to ensure the recirculation and filter system kept background concentration below 20 mg/L.

To determine the effluent concentration within a specific particle size range, the percentage of particles in the particle size band was multiplied by the overall adjusted average effluent concentration. Removal efficiencies were calculated using the average influent concentration and average effluent concentration adjusted for background concentrations.

These results are summarized below and the full report can be viewed at: [FDHC PSD Removal Verification Report 9-16.pdf](#)

Performance Results

The First Defense performed well under the full range of tested flow rates showing high removal rates across a broad range of particle sizes. For all particles from 50 μm to 1,000 μm , the FDHC removed greater than 90% TSS for all tested flow rates up to 1.88 cfs, or 1.5 cfs with a safety factor of 1.25.

The results for all tests were plotted on a flow vs. removal efficiency graph and a best fit curve produced (Figure 4).

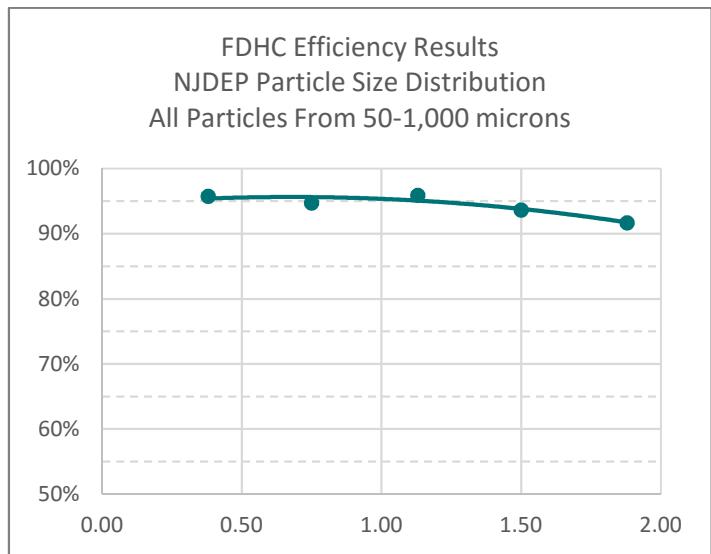


Figure 4 - Removal Efficiency Results of the 4-ft First Defense

First Defense Sizing for > 80% TSS Removal

Table 1 includes the treatment flow rates for different First Defense models based on surface loading rate scaling of the test unit, for greater than 80% TSS removal down to 50 microns. The treatment flow rates include a safety factor of 1.25 and actual removals from test results were greater than 90%.

For design purposes, the selected model's Treatment Flow Rate must be equal or greater to the site's required Water Quality Flow Rate.

The peak flow rate and maximum pipe size must be considered to determine whether an online or offline configuration is appropriate.

Refer to the First Defense product information brochure for visit [www.hydro-int.com/us](#) for more information.

Table 1. First Defense verified flow rates for greater than 80% TSS* removal with safety factor of 1.25.

Model:	FD-3HC	FD-4HC	FD-6HC	FD-8HC
Size:	3 ft (900 mm)	4 ft (1.2 m)	6 ft (1.8 m)	8 ft (2.4m)
cfs:	0.85	1.5	3.38	6.00
L/s:	24.0	42.5	95.7	170.0

*Actual removals for all particles down to 50 μm were > 90%.

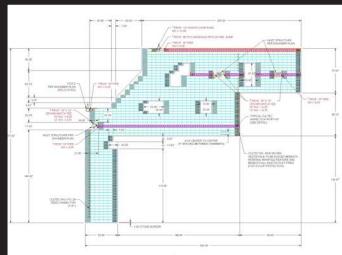
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Commercial Drainage



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Internal Manifold



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		Contactor® 100HD	Recharger® 150XLHD	Recharger® 280HD	Recharger® 300HD	Recharger® 360HD	Recharger® 902HD
Length	feet	8	11	8	7.54	4.17	4.10
Installed Length	feet	7.5	10.25	7	7.08	3.67	3.67
Width	inches	36	33	47	51	60	78
Height	inches	12.5	18.5	26.5	30	36	48
Bare Chamber Storage	ft³/ft gal/ft	1.866 13.96	2.650 19.82	6.079 45.48	6.53 48.85	10.00 74.80	17.31 129.50
Intermediate	ft³/unit gal./unit	14.00 105	27.16 203	42.55 318	46.27 346	36.66 274	63.47 475
Stand Alone	ft³/unit gal./unit	14.93 112	29.15 218	48.63 364	51.59 386	49.58 371	99.51 745
Min. Installed Storage	ft³/ft gal/ft	3.84 29	4.89 37	9.21 69	10.51 79	15.20 114	27.06 202
Intermediate	ft³/unit gal./unit	28.81 216	50.17 375	64.46 482	74.44 566	55.73 417	99.28 742
Stand Alone	ft³/unit gal./unit	30.73 230	53.84 403	73.67 551	101.99 763	86.72 649	187.60 1404
Min. Cover Required Paved Unpaved	inches	14 16	14 16	14 16	18 24	18 24	24 30

The Recharger 300HD, 360HD, and 902HD only come in only one model type and require a separate end plate.
 The Intermediate model for the Recharger models 360HD or 902HD in this case means a model which has an installed length of 3.67' located in the middle of a row.
 The Intermediate model for the Recharger model 300HD in this case means a model which has an installed length of 7.08' located in the middle of a row.
 A stand alone model for the Recharger 300HD, 360HD, or 902HD is a single chamber with two end plates.
 All other models as stand alone units shall be called Model R.

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 Plastic Chambers for Stormwater Management



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The first stormwater chambers manufactured with installations dating back over 35 years.

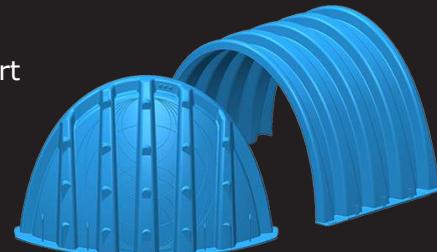
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Project: 88, 91, 101 Mill Street, Dracut, MA

GPI Project No.: NEX-2021147

Client: Beaver Brook Holdings, LLC

Date: 9/16/2025

MassDEP Water Quality Flow Calculation

Water Quality Flow Rate = WQF, Q (cfs)

Water Quality Volume (depth) = WQV (inches)

Unit peak discharge = qu (csm/in)

Impervious Area in watershed = A (acres)

Ia/P = 0.034 (For WQV=1-inch, use Figure 3)

Tc = 0.1 hrs

qu = 774 csm/in (from Figure 3)

1-acre = 0.00156 mi^2 (conversion factor)

$$\boxed{WQF, Q = (qu)(A)(WQV)}$$

	Inflow Area (Ac)	Percent Impervious	Inflow Area, Impervious, A (Ac)	Water Quality Flow, Q (cfs)
DMH-2(FD)	1.548	86.18%	1.334	1.61
DMH-10(FD)	1.717	93.74%	1.610	1.95
DMH-17(FD)	1.025	81.96%	0.840	1.02



NOAA Atlas 14, Volume 10, Version 3
 Location name: Dracut, Massachusetts, USA*
 Latitude: 42.6825°, Longitude: -71.3505°

Elevation: 117 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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	3.80 (3.04-4.74)	4.51 (3.60-5.64)	5.68 (4.51-7.12)	6.65 (5.26-8.36)	7.98 (6.07-10.4)	8.99 (6.68-12.0)	10.0 (7.21-13.8)	11.2 (7.60-15.8)	12.9 (8.36-18.7)	14.2 (9.00-21.0)
10-min	2.69 (2.15-3.36)	3.20 (2.56-3.99)	4.03 (3.20-5.05)	4.71 (3.73-5.93)	5.65 (4.30-7.40)	6.36 (4.73-8.49)	7.10 (5.11-9.80)	7.93 (5.38-11.2)	9.11 (5.92-13.2)	10.1 (6.37-14.9)
15-min	2.11 (1.69-2.63)	2.51 (2.00-3.13)	3.16 (2.51-3.95)	3.69 (2.92-4.65)	4.43 (3.38-5.80)	4.99 (3.71-6.66)	5.57 (4.01-7.68)	6.22 (4.22-8.76)	7.14 (4.64-10.4)	7.90 (5.00-11.7)
30-min	1.45 (1.16-1.81)	1.72 (1.38-2.15)	2.17 (1.73-2.72)	2.54 (2.01-3.19)	3.05 (2.32-3.99)	3.43 (2.55-4.58)	3.83 (2.75-5.28)	4.27 (2.90-6.02)	4.91 (3.19-7.13)	5.42 (3.43-8.03)
60-min	0.923 (0.738-1.15)	1.10 (0.875-1.37)	1.38 (1.10-1.73)	1.61 (1.28-2.03)	1.94 (1.48-2.54)	2.18 (1.62-2.91)	2.44 (1.75-3.36)	2.72 (1.85-3.83)	3.12 (2.03-4.54)	3.45 (2.18-5.10)
2-hr	0.581 (0.467-0.720)	0.701 (0.564-0.871)	0.899 (0.720-1.12)	1.06 (0.845-1.33)	1.29 (0.990-1.69)	1.45 (1.09-1.94)	1.64 (1.20-2.27)	1.86 (1.26-2.60)	2.19 (1.43-3.17)	2.48 (1.57-3.65)
3-hr	0.443 (0.358-0.547)	0.539 (0.435-0.666)	0.695 (0.559-0.863)	0.825 (0.659-1.03)	1.00 (0.776-1.31)	1.14 (0.859-1.52)	1.28 (0.942-1.78)	1.46 (0.995-2.04)	1.74 (1.14-2.51)	1.99 (1.26-2.91)
6-hr	0.282 (0.229-0.347)	0.345 (0.280-0.424)	0.447 (0.361-0.551)	0.532 (0.427-0.659)	0.648 (0.504-0.844)	0.734 (0.559-0.977)	0.828 (0.613-1.15)	0.948 (0.648-1.32)	1.14 (0.743-1.63)	1.30 (0.828-1.89)
12-hr	0.177 (0.145-0.216)	0.216 (0.176-0.264)	0.279 (0.227-0.343)	0.332 (0.269-0.409)	0.405 (0.316-0.522)	0.458 (0.350-0.605)	0.517 (0.383-0.710)	0.589 (0.404-0.813)	0.701 (0.460-0.998)	0.797 (0.510-1.16)
24-hr	0.106 (0.087-0.129)	0.130 (0.107-0.158)	0.169 (0.139-0.206)	0.201 (0.164-0.247)	0.246 (0.193-0.316)	0.279 (0.214-0.366)	0.315 (0.234-0.430)	0.359 (0.248-0.493)	0.427 (0.281-0.605)	0.486 (0.312-0.700)
2-day	0.060 (0.049-0.072)	0.074 (0.061-0.089)	0.097 (0.080-0.118)	0.117 (0.096-0.142)	0.143 (0.113-0.183)	0.163 (0.126-0.213)	0.185 (0.138-0.251)	0.211 (0.146-0.289)	0.253 (0.167-0.357)	0.290 (0.186-0.415)
3-day	0.043 (0.036-0.052)	0.054 (0.045-0.065)	0.070 (0.058-0.085)	0.084 (0.069-0.102)	0.103 (0.082-0.131)	0.117 (0.091-0.152)	0.132 (0.099-0.180)	0.151 (0.105-0.206)	0.181 (0.120-0.254)	0.207 (0.133-0.295)
4-day	0.035 (0.029-0.042)	0.043 (0.036-0.052)	0.056 (0.046-0.067)	0.067 (0.055-0.081)	0.081 (0.065-0.103)	0.092 (0.072-0.120)	0.104 (0.078-0.141)	0.119 (0.082-0.161)	0.141 (0.094-0.198)	0.161 (0.104-0.229)
7-day	0.024 (0.020-0.029)	0.029 (0.024-0.035)	0.037 (0.031-0.044)	0.043 (0.036-0.052)	0.052 (0.041-0.065)	0.058 (0.045-0.075)	0.066 (0.049-0.088)	0.074 (0.052-0.100)	0.087 (0.058-0.121)	0.098 (0.063-0.139)
10-day	0.020 (0.016-0.023)	0.023 (0.019-0.027)	0.029 (0.024-0.034)	0.033 (0.028-0.040)	0.040 (0.032-0.050)	0.044 (0.034-0.057)	0.049 (0.037-0.066)	0.055 (0.039-0.075)	0.064 (0.043-0.089)	0.072 (0.046-0.101)
20-day	0.014 (0.011-0.016)	0.015 (0.013-0.018)	0.019 (0.016-0.022)	0.021 (0.018-0.025)	0.025 (0.020-0.031)	0.027 (0.021-0.034)	0.030 (0.022-0.039)	0.033 (0.023-0.044)	0.037 (0.025-0.051)	0.040 (0.026-0.057)
30-day	0.011 (0.009-0.013)	0.012 (0.011-0.015)	0.015 (0.012-0.017)	0.016 (0.014-0.020)	0.019 (0.015-0.023)	0.021 (0.016-0.026)	0.023 (0.017-0.030)	0.025 (0.017-0.033)	0.027 (0.018-0.038)	0.029 (0.019-0.041)
45-day	0.009 (0.008-0.011)	0.010 (0.009-0.012)	0.012 (0.010-0.014)	0.013 (0.011-0.016)	0.015 (0.012-0.018)	0.016 (0.013-0.020)	0.018 (0.013-0.023)	0.019 (0.013-0.025)	0.021 (0.014-0.028)	0.022 (0.014-0.030)
60-day	0.008 (0.007-0.009)	0.009 (0.007-0.010)	0.010 (0.008-0.012)	0.011 (0.009-0.013)	0.012 (0.010-0.015)	0.014 (0.011-0.017)	0.015 (0.011-0.019)	0.016 (0.011-0.021)	0.017 (0.011-0.023)	0.018 (0.011-0.025)

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

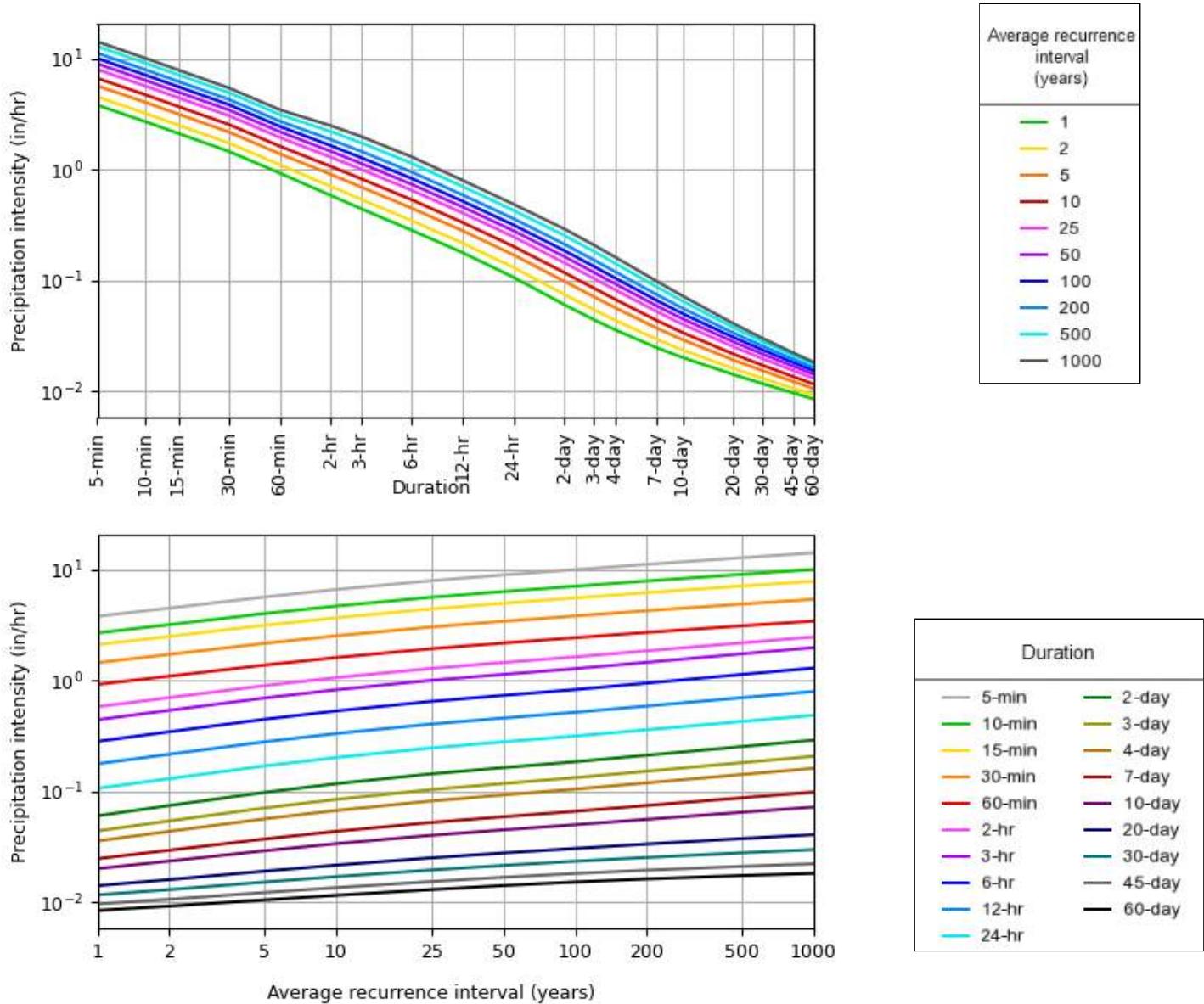
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

Please refer to NOAA Atlas 14 document for more information.

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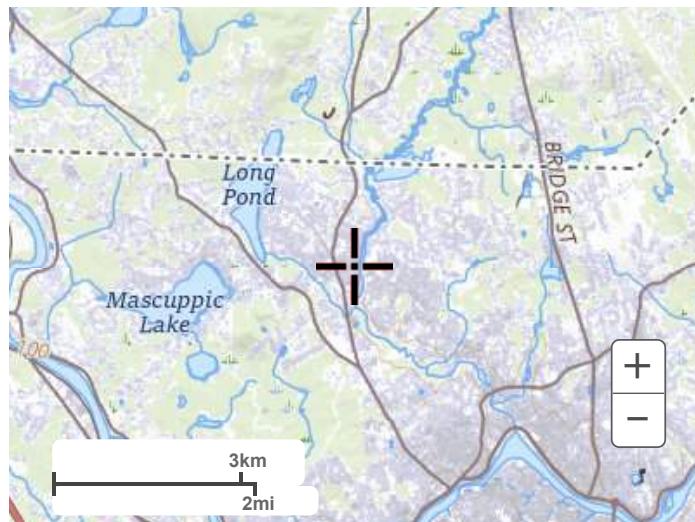
PF graphical

PDS-based intensity-duration-frequency (IDF) curves
 Latitude: 42.6825°, Longitude: -71.3505°



Maps & aerials

[Small scale terrain](#)



Large scale aerial



[Back to Top](#)

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

[Disclaimer](#)

Pipe Capacity Calculations

88, 91, 101 Mill Street
 Client Beaver Brook Holdings, LLC
 Subject Drainage pipe analysis

Proj. No. 2021147
 Date 9/17/2025
 Calc. by DJT
 Check by _____

paved C= 0.9
 unpaved C= 0.3

Designed for 25-Yr, 5 Min. Rainfall Intensity = 7.98 per NRCC IDF Curve

STRUCTURES		DISCHARGE								PIPE CALCULATIONS						
FROM	TO	TIME OF CONCENTRATION (MINUTES) MIN.= 6 MINUTES	RUNOFF COEFF.	DRAINAGE AREA IN ACRES			C x A		RAINFALL INTENSITY	DESIGN FLOW	PIPE DIA.	N VALUE	PIPE SLOPE	FULL CAPACITY	FULL VELOCITY	PEAK FLOW CONDITIONS
				paved area ACRES	unpaved area ACRES	TOTAL AREA ACRES	INC	TOTAL								
PIPE RUN #1																
YD-3	DMH-7	6.00	0.54	0.015	0.021	0.036	0.02	0.02	7.98	0.16	8	0.012	0.010	1.31	3.7	2.50
YD-4	DMH-7	6.00	0.55	0.005	0.006	0.011	0.01	0.01	7.98	0.05	8	0.012	0.010	1.31	3.7	1.77
DMH-7	DMH-6	6.00	0.90	0.058	0.000	0.058	0.05	0.08	7.98	0.62	12	0.012	0.006	2.99	3.8	2.95
CB-3	DMH-6	6.00	0.66	0.217	0.148	0.365	0.24	0.24	7.98	1.91	12	0.012	0.009	3.66	4.7	4.70
DMH-6	DMH-5	6.00		0.000	0.000	0.000	0.00	0.32	7.98	2.53	12	0.012	0.005	2.73	3.5	3.94
CB-2	DMH-5	6.00	0.87	0.189	0.011	0.200	0.17	0.17	7.98	1.38	12	0.012	0.009	3.66	4.7	4.31
CB-1	DMH-5	6.00	0.88	0.213	0.006	0.220	0.19	0.19	7.98	1.55	12	0.012	0.009	3.66	4.7	4.45
DMH-5	DMH-4	6.00		0.000	0.000	0.000	0.00	0.68	7.98	5.46	12	0.012	0.006	2.99	3.8	6.95
DMH-4	DMH-3	6.00	0.90	0.056	0.000	0.056	0.05	0.73	7.98	5.86	12	0.012	0.005	2.73	3.5	7.47
DMH-3	DMH-2	6.00		0.000	0.000	0.000	0.00	0.73	7.98	5.86	12	0.012	0.005	2.73	3.5	7.47
YD-2	DMH-9	6.00	0.30	0.000	0.010	0.010	0.00	0.00	7.98	0.02	8	0.012	0.012	1.43	4.1	1.54
CB-5	DMH-9	6.00	0.85	0.163	0.014	0.177	0.15	0.15	7.98	1.20	12	0.012	0.005	2.73	3.5	3.35
DMH-9	DMH-8	6.00		0.000	0.000	0.000	0.00	0.15	7.98	1.23	12	0.012	0.005	2.73	3.5	3.38
CB-4	DMH-8	6.00	0.90	0.194	0.000	0.194	0.17	0.17	7.98	1.40	12	0.012	0.005	2.73	3.5	3.47
DMH-8	DMH-2 (FD)	6.00	0.90	0.266	0.000	0.266	0.24	0.57	7.98	4.53	12	0.012	0.005	2.73	3.5	5.77
DMH-2 (FD)	DMH-1	6.00		0.000	0.000	0.000	0.00	1.30	7.98	10.40	12	0.012	0.005	2.73	3.5	13.24

Pipe Capacity Calculations

88, 91, 101 Mill Street
 Client Beaver Brook Holdings, LLC
 Subject Drainage pipe analysis
 Proj. No. 2021147
 Date 9/17/2025
 Calc. by DJT
 Check by _____

paved C= 0.9
 unpaved C= 0.3

Designed for 25-Yr, 5 Min. Rainfall Intensity = 7.98 per NRCC IDF Curve

STRUCTURES		DISCHARGE								PIPE CALCULATIONS					
FROM	TO	TIME OF CONCENTRATION (MINUTES) MIN.= 6 MINUTES	RUNOFF COEFF.	DRAINAGE AREA IN ACRES			C x A	RAINFALL INTENSITY	DESIGN FLOW	PIPE DIA.	n VALUE	PIPE SLOPE	FULL CAPACITY	FULL VELOCITY	PEAK FLOW CONDITIONS
				paved area ACRES	unpaved area ACRES	TOTAL AREA ACRES									
PIPE RUN #2															
CB-9	EDMH-1	6.00	0.77	0.116	0.031	0.147	0.11	0.11	7.98	0.91	12	0.012	0.008	3.45	4.4 3.65
CB-8	DMH-16	6.00	0.83	0.203	0.025	0.228	0.19	0.19	7.98	1.52	12	0.012	0.017	5.03	6.4 5.56
EDMH-2	DMH-17	6.00	0.78	0.521	0.129	0.650	0.51	0.81	7.98	6.47	12	0.012	0.005	2.73	3.5 8.24
PIPE RUN #3															
YD-6	YD-5	6.00	0.48	0.008	0.018	0.026	0.01	0.01	7.98	0.10	8	0.012	0.020	1.85	5.3 2.74
YD-5	DMH-15	6.00	0.76	0.047	0.015	0.062	0.05	0.06	7.98	0.47	8	0.012	0.233	6.32	18.1 10.44
DMH-15	DMH-14	6.00	0.90	0.201	0.000	0.201	0.18	0.24	7.98	1.92	12	0.012	0.005	2.73	3.5 3.74
CB-7	DMH-14	6.00	0.86	0.272	0.022	0.294	0.25	0.25	7.98	2.01	12	0.012	0.013	4.40	5.6 5.45
DMH-14	DMH-13	6.00	0.90	0.073	0.000	0.073	0.00	0.49	7.98	3.92	12	0.012	0.005	2.73	3.5 4.99
DMH-13	DMH-12	6.00	0.90	0.083	0.000	0.083	0.07	0.57	7.98	4.52	12	0.012	0.005	2.73	3.5 5.75
CB-6	DMH-12	6.00	0.90	0.086	0.000	0.086	0.08	0.08	7.98	0.62	12	0.012	0.012	4.23	5.4 3.77
DMH-12	DMH-11	6.00		0.000	0.000	0.000	0.00	0.64	7.98	5.14	12	0.012	0.005	2.73	3.5 6.54
DMH-11	DMH-10 (FD)	6.00		0.000	0.000	0.000	0.00	0.64	7.98	5.14	12	0.012	0.005	2.73	3.5 6.54

Stage-Area-Storage for Pond 1P: Underground Infiltration System

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
96.50	2,252	0	101.60	3,164	4,888
96.60	2,278	90	101.70	3,164	4,889
96.70	2,304	180	101.80	3,164	4,890
96.80	2,330	270	101.90	3,164	4,892
96.90	2,356	360	102.00	3,164	4,893
97.00	2,382	450	102.10	3,164	4,894
97.10	2,408	639	102.20	3,164	4,895
97.20	2,434	827	102.30	3,164	4,897
97.30	2,460	1,013	102.40	3,164	4,898
97.40	2,487	1,198			
97.50	2,513	1,382			
97.60	2,539	1,564			
97.70	2,565	1,744			
97.80	2,591	1,923			
97.90	2,617	2,099			
98.00	2,643	2,274			
98.10	2,669	2,446			
98.20	2,695	2,615			
98.30	2,721	2,782			
98.40	2,747	2,946			
98.50	2,773	3,107			
98.60	2,799	3,264			
98.70	2,825	3,418			
98.80	2,852	3,567			
98.90	2,878	3,711			
99.00	2,904	3,849			
99.10	2,930	3,982			
99.20	2,956	4,105			
99.30	2,982	4,216			
99.40	3,008	4,317			
99.50	3,034	4,411			
99.60	3,060	4,503			
99.70	3,086	4,594			
99.80	3,112	4,685			
99.90	3,138	4,777			
100.00	3,164	4,868			
100.10	3,164	4,869			
100.20	3,164	4,870			
100.30	3,164	4,872			
100.40	3,164	4,873			
100.50	3,164	4,874			
100.60	3,164	4,875			
100.70	3,164	4,877			
100.80	3,164	4,878			
100.90	3,164	4,879			
101.00	3,164	4,880			
101.10	3,164	4,882			
101.20	3,164	4,883			
101.30	3,164	4,884			
101.40	3,164	4,885			
101.50	3,164	4,887			



GPI Project No.	NEX-2021147	Sheet	1 of 1
Project Description	88, 91, & 101 Mill Street, Dracut, MA		
Task	Drawdown Calculations		
Calculated By	CNM	Date	09/19/25
Checked By		Date	

Drawdown within 72 hours Analysis for Static Method

Underground Infiltration System-1

Infiltration Rate: 2.41 inches/hour (From table 2.3.3: Rawls, Brakensiek, Saxton, 1982)

Design Infiltration Rate: 2.41 inches/hour

Volume Provided for Recharge: 1,834 cf

Basin bottom area: 2,252 sf

Time_{drawdown} = (Required Recharge Volume in cubic feet as determined by the Static Method)(1/Design Infiltration Rate in inches per hour)(conversion for inches to feet)(1/bottom area in feet)

$$\text{Time}_{\text{drawdown}} = (1,834 \text{ cf}) (1 / 2.41 \text{ in/hr}) (1\text{ft}/12 \text{ in.}) (1 / 2,252 \text{ sf})$$

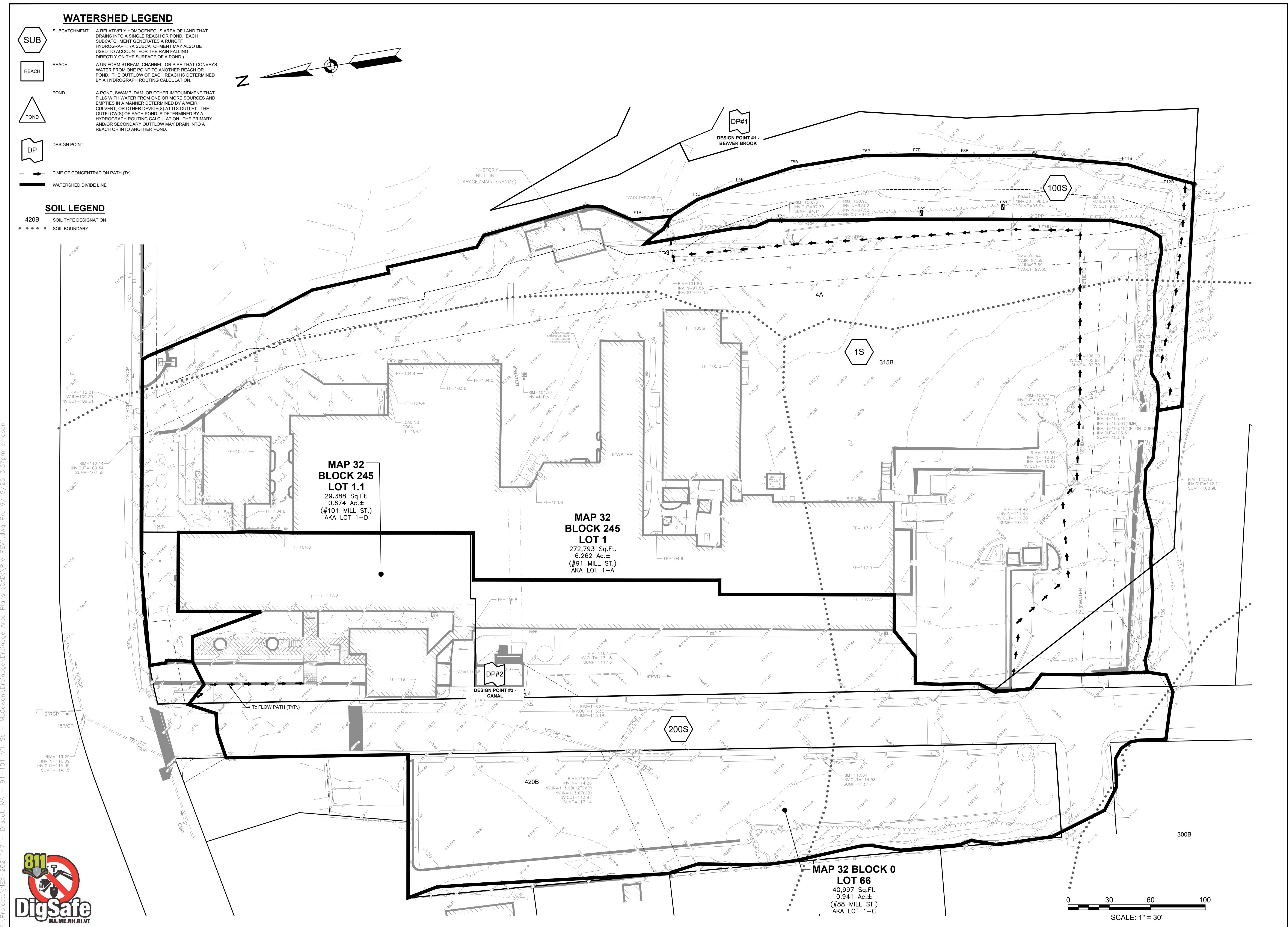
$$= 4.06 \text{ hours}$$

STORMWATER MANAGEMENT REPORT

88, 91, & 101 Mill Street – Dracut, MA

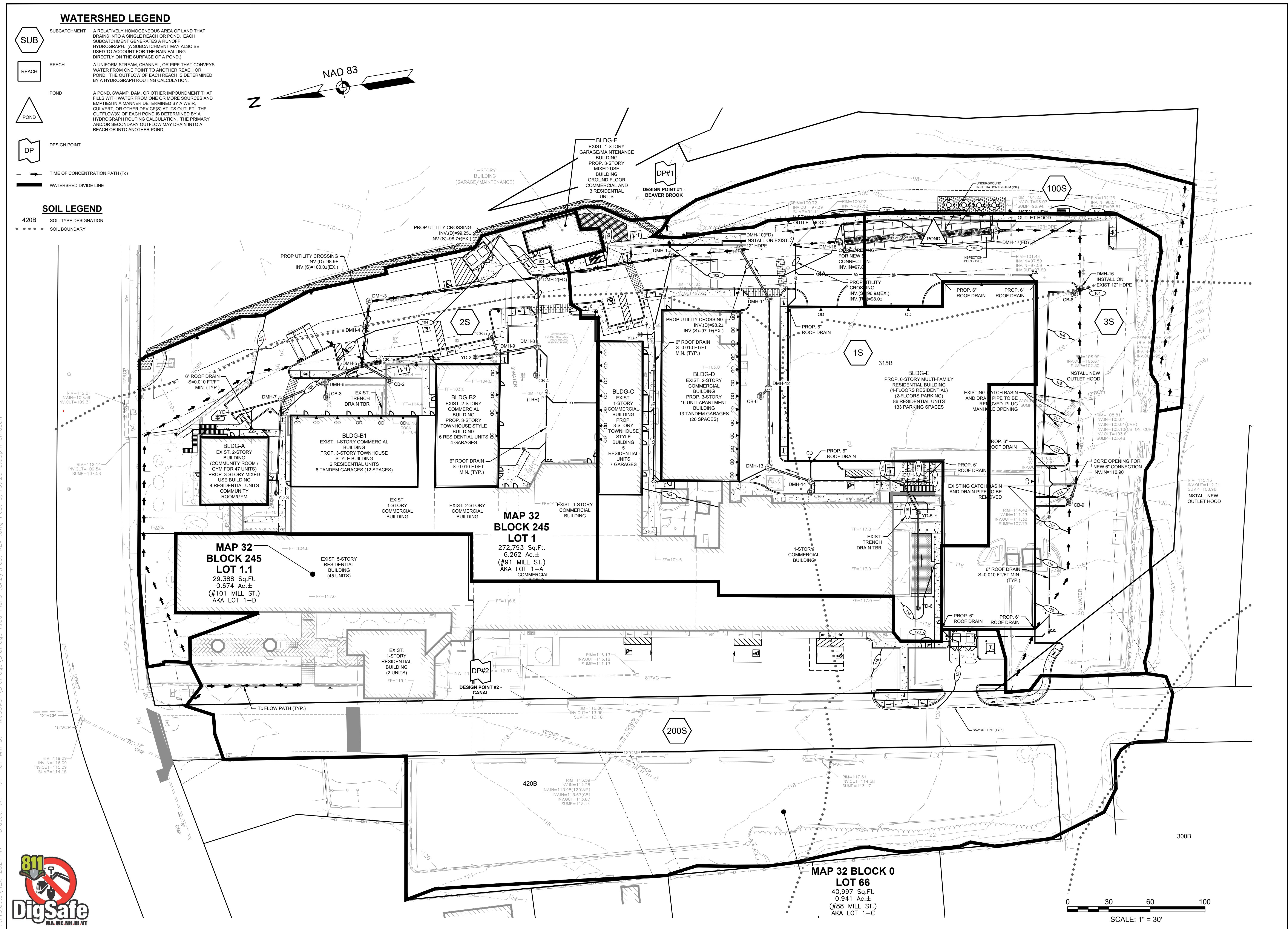
APPENDIX H

DRAINAGE AREA PLANS



REVISIONS		
1	MISC. REVISIONS	9/19/25
NO.	REVISION	DATE
MAY 21, 2025		

DRAWN/DESIGN BY **DJT** CHECKED BY **CSB/CNM**



REVISIONS		
1	REV. PER PEER REVIEW COMMENTS	9/19/25
NO.	REVISION	DATE
	MAY 21, 2025	
DRAWN/DESIGN BY	CSB/CNM	CHECKED BY
DJT		

STORMWATER MANAGEMENT REPORT

88, 91, & 101 Mill Street – Dracut, MA

(UNDER SEPARATE COVER)

**OPERATION AND MAINTENANCE PLAN FOR STORMWATER
MANAGEMENT SYSTEMS (O&M)**