

# **STORMWATER MANAGEMENT REPORT**

## **FOR**

### **ALDEN A. MILLS FIRE STATION**

Submitted to:

The City of Revere  
281 Broadway  
Revere, MA 02151

05 20, 2022

Revised:

Prepared for:

The City of Revere  
281 Broadway  
Revere, MA 02151

Prepared by:

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## *Report Summary*

## *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.<sup>1</sup> This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8<sup>2</sup>
- 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.

<sup>1</sup> 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.

<sup>2</sup> 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.

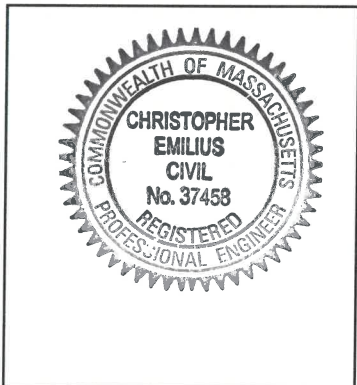
*Note:* Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that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



*Chris Emilius* 5/17/22  
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

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## 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

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## Checklist (continued)

### Standard 2: Peak Rate Attenuation

- ☒ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- ☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- ☐ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

### Standard 3: Recharge

- ☒ Soil Analysis provided.
- ☒ Required Recharge Volume calculation provided.
- ☐ Required Recharge volume reduced through use of the LID site Design Credits.
- ☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.
  - ☒ Static
  - ☐ Simple Dynamic
  - ☐ Dynamic Field<sup>1</sup>
- ☐ 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.

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<sup>1</sup> 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.



# Checklist for Stormwater Report

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## 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

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## Checklist (continued)

### Standard 4: Water Quality (continued)

- ☒ The BMP is sized (and calculations provided) based on:
  - ☒ The ½" or 1" Water Quality Volume or
  - ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- ☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

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

### Standard 6: Critical Areas

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



# Checklist for Stormwater Report

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## 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

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## 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.



This Stormwater Report has been prepared to demonstrate compliance with the Massachusetts Stormwater Management Standards in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00).

### **Project Overview:**

The City of Revere is proposing the construction of a new fire station at 140 Lynnway, Revere. The existing Alden Fire Station, located on the same lot, has been defunct since approximately 2000. The project is located within the Point of Pines neighborhood which is the community that the fire station will be servicing. The City is proposing this fire station due to the existing fire station's inability to properly service fire trucks, and high response times from neighboring fire stations for the Point of Pines neighborhood. The new 8,190 sf fire station will include 2 service bays for fire trucks as well and a service bay for fireboats. The project will be completed in 2 phases of construction: 1) The demolition of the existing fire station which took place in 2021 and 2) the construction of the proposed fire station and associated parking, utilities, and landscaping.

### **Site Description:**

The proposed project site is comprised of two parcels of land: a 15,079 sf city owned parcel (referred to as Lot 1) that contained the previous Alden Mills fire station until its demolition in 2021, and a 4,592 sf portion of an abutting lot owned by the Department of Conservation and Recreation (DCR) (referred to as Lot A) that will be acquired by the city as part of a larger proposed land transfer with DCR (see Figure 1: ANR Plan). The site is bounded by an MBTA bus stop to the north, residential buildings to the east, the Route 1A on and off ramps to the south, and Route 1A to the west (see Figure 2: USGS Map).

Based on MassGIS mapping the existing site is located with a Barrier Beach wetland resource area, categorized as Coastal Dune (see Figure 3: Environmental Constraints Map). According to Federal Emergency Management Agency (FEMA) flood insurance rate maps (FIRM) a majority of the project area is designated as a Zone X, although a small portion of the site (roughly 1,700 sf) falls within Zone AE and is designated as Land Subject to Coastal Storm Flowage (LSCSF). The project site can be found on the City of Revere, Massachusetts, Suffolk County, Community Panel No. 29 of 176, Map Number 25025C0029J, Effective Date March 16, 2016 (see Figure 4: FEMA Firmette).

Existing soil conditions within the limits of the project were taken from the Norfolk and Suffolk Counties, Massachusetts, soils maps published by the U.S. Department of Agriculture Natural Resources Conservation Service in cooperation with the Massachusetts Agriculture Experiment Station (See Figure 5). Additionally, a geotechnical investigation was performed by John Turner Consulting (JTC) in January 2021. Copies of these documents are included in the Appendix.

The following soil groups have been identified at the site:

626B: Merrimac-Urban land complex, 0 to 8 percent slopes, Hydrologic Group A.

651: Udorthents, smoothed.

### **Existing Drainage Conditions:**

Under existing conditions Lot 1 is partially developed with sidewalk, utility stubs, a concrete police monument and compacted gravel where the existing fire station was located. Lot A consists of several trees but is mostly open grass. The site generally slopes from northwest to southeast but is relatively flat, with the exception of steep slopes (>30%) on the western portion of the site leading up to the Route 1A bridge abutment. Figure 6 illustrates the existing drainage patterns on site. Currently, the site is divided into 2 drainage areas as the stormwater runoffs flows to 2 Design Points, which have been identified in the table below:

#### **Existing Conditions Hydrologic Data**

<b>Drainage Area</b>	<b>Discharge Location</b>	<b>Design Point</b>	<b>Area (Acres)</b>	<b>Curve Number</b>	<b>Time of Concentration (min)</b>
EX-1 Western Site	Route 1A CDS	DP-1	0.29	68	6
EX-2 Eastern Site	Lynnway CDS	DP-2	0.41	55	6

### **Proposed Drainage Conditions:**

Figure 7 illustrates the proposed post-construction drainage conditions for the project. As shown, the site will be divided into 4 drainage areas that discharge to the 2 Design Points. The table below provides a summary of the proposed conditions hydrologic data.

#### **Proposed Conditions Hydrologic Data**

<b>Drainage Area</b>	<b>Discharge Location</b>	<b>Design Point</b>	<b>Area (Acres)</b>	<b>Curve Number</b>	<b>Time of Concentration (min)</b>
PR-10 Western Site	Route 1A CDS	DP-1	0.04	92	6
PR-11 Route 1A Access	Lynnway CDS	DP-2	0.04	78	6
PR-20 Parking Lot	Lynnway CDS	DP-2	0.27	66	6
PR-21 Front Sidewalk	Lynnway CDS	DP-2	0.14	81	6
PR-22 Fire Station	Lynnway CDS	DP-2	0.20	98	6

### **Stormwater Management Objectives:**

The purpose of this analysis is to design a stormwater management system utilizing Best Management Practices (BMP's) that collects surface run-off through the use of proposed catch basins which will be piped to a subsurface infiltration basin. Runoff coming from pavement will be pretreated through the use of a particle separator before being discharged into the basin to meet with Massachusetts Department of Environmental Protection (MassDEP) stormwater

management regulations for pretreatment and TSS removal. The basin will then discharge to the existing drainage infrastructure located in the Lynnway east of the site.

**Selection of Storm Events:**

MEPA encouraged the use of the National Oceanic Atmospheric Administration's (NOAA) Atlas 14 Volume 10 precipitation data for Type III storm events as it is more conservative and relies on more years of data from a greater number of weather stations and more accurately reflects current conditions than data from NOAA's historic standard, Technical Paper 40 (TP40):

<b><u>Frequency (years)</u></b>	<b><u>Rainfall [24-hour event (inches)]</u></b>
2	3.20
10	5.05
25	6.21
100	7.05

**Summary of Peak Rate Runoff:**

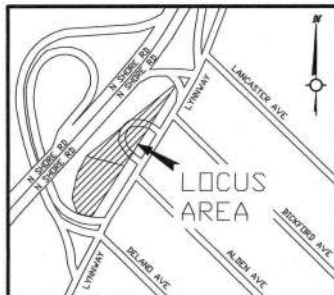
The tables below illustrate the existing and proposed peak stormwater flow in cubic feet per second for each storm event listed. **The proponent is requesting that Standard 2 be waived for this project as it is located in a land subject to coastal storm flowage.**

**TOTAL PEAK FLOW SUMMARY FOR PROJECT SITE**

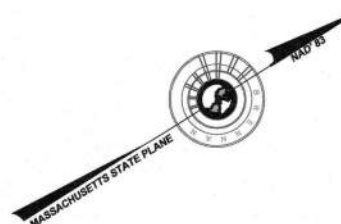
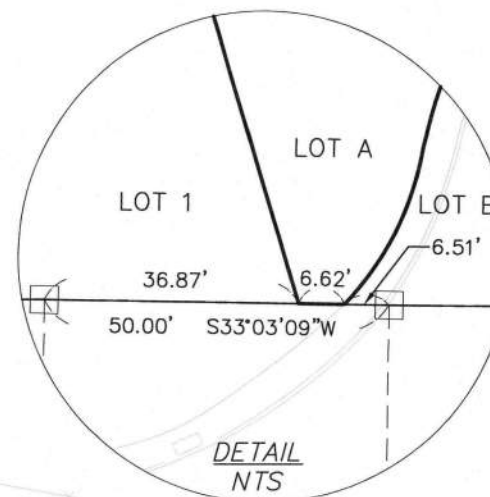
<b><u>DP-1</u></b>	<b><u>2 Year</u></b>	<b><u>10 Year</u></b>	<b><u>25 Year</u></b>	<b><u>100 Year</u></b>
Existing	0.21 cfs	0.62 cfs	0.92 cfs	1.15 cfs
Proposed	0.11 cfs	0.19 cfs	0.24 cfs	0.28 cfs
 <b><u>DP-2</u></b>				
Existing	0.04 cfs	0.39 cfs	0.70 cfs	0.96 cfs
Proposed	0.91 cfs	1.60 cfs	2.04 cfs	2.36 cfs

## *Figures*

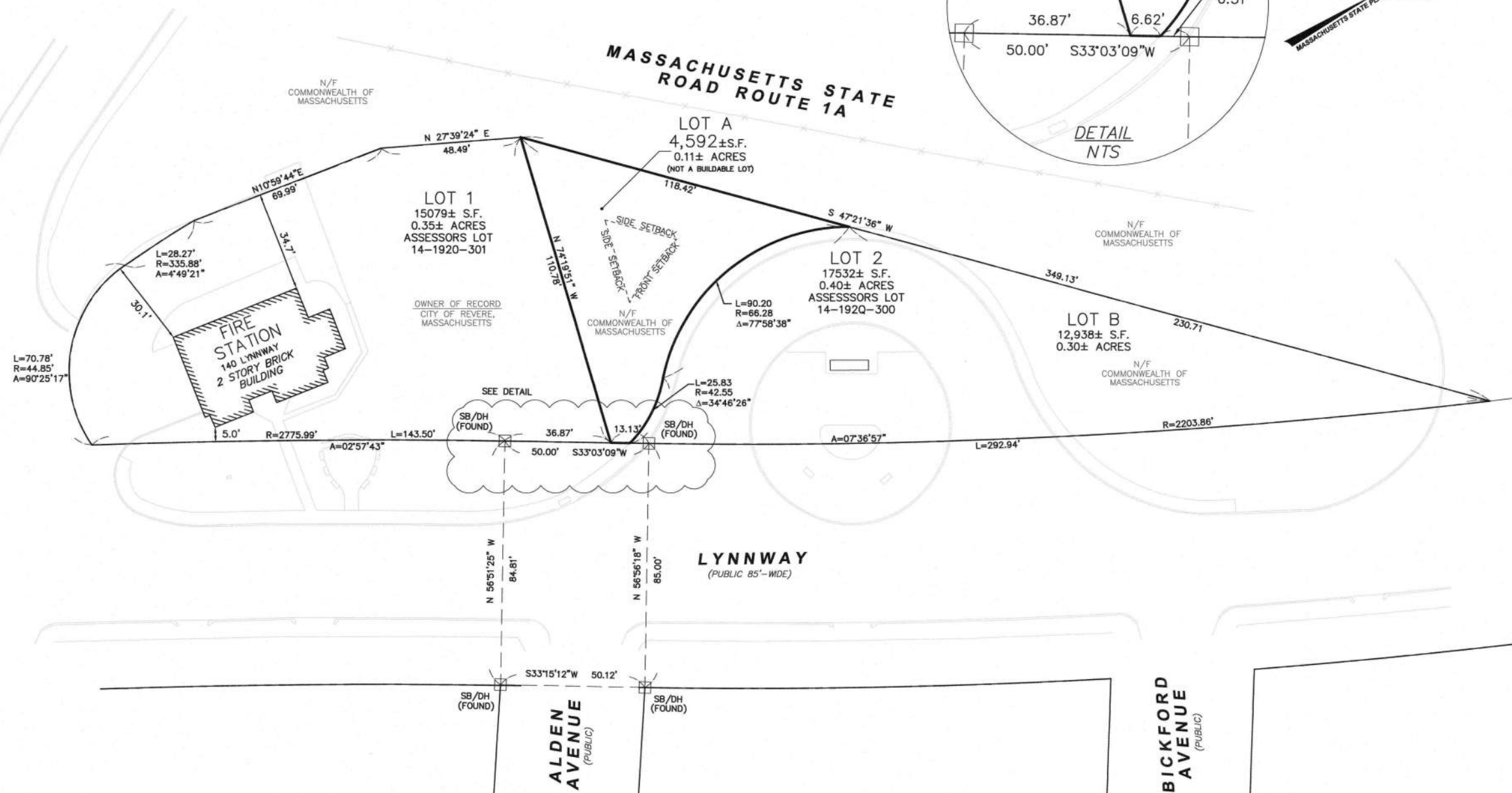
*Figure 1 - ANR Plan*



LOCUS MAP:  
NOT TO SCALE



RESERVED FOR REGISTRY ONLY



APPROVAL UNDER THE SUBDIVISION  
CONTROL LAW NOT REQUIRED  
CITY OF REVERE PLANNING BOARD

DATE: \_\_\_\_\_  
NO DETERMINATION OF COMPLIANCE  
WITH ZONING REQUIREMENTS HAS  
BEEN MADE OR INTENDED.

CURRENT ZONING INFORMATION:

ZONING DISTRICT: RA			
ZONING ORDINANCE OF THE CITY OF REVERE			
MINIMUM LOT AREA	6,000 SQ FT		
SETBACKS	SIDE YARD 20'	FRONT YARD 20'	REAR YARD 30'
FRONTAGE	60'		
USABLE OPEN SPACE (% OF TOTAL AREA)	35%		
MAXIMUM BUILDING COVERAGE	30%		
MAX HGT. (FT.)	30'		
MAX STORIES	2 1/2		

NOTES

- THIS SURVEY WAS PERFORMED ON THE GROUND BY BRENNAN CONSULTING INC. IN AUGUST OF 2019.
- THE HORIZONTAL DATUM REFERS TO NAD 83.
- THE PURPOSE OF THIS PLAN IS TO DIVIDE CITY OF REVERE ASSESSORS LOT 14-1920-300 INTO TWO LOTS A AND B, LOT A BEING A NON BUILDABLE LOT TO BE COMBINED WITH CITY OF REVERE ASSESSORS LOT 14-1920-301 AS SHOWN HEREON.
- THIS DOCUMENT IS AN INSTRUMENT OF SERVICE OF BRENNAN CONSULTING ISSUED TO OUR CLIENT FOR PURPOSES RELATED DIRECTLY AND SOLELY TO BRENNAN CONSULTING'S SCOPE OF SERVICES UNDER CONTRACT TO OUR CLIENT FOR THIS PROJECT. ANY USE OR REUSE OF THIS DOCUMENT FOR ANY REASON BY ANY PARTY FOR PURPOSES UNRELATED DIRECTLY AND SOLELY TO SAID CONTRACT SHALL BE AT THE USER'S SOLE AND EXCLUSIVE RISK AND LIABILITY, INCLUDING LIABILITY FOR VIOLATION OF COPYRIGHT LAWS, UNLESS WRITTEN CONSENT IS PROVIDED BY BRENNAN CONSULTING.

WE HEREBY CERTIFY THAT THIS PLAN WAS  
PREPARED IN ACCORDANCE WITH THE RULES  
AND REGULATIONS OF THE REGISTERS OF DEEDS.



PROFESSIONAL LAND SURVEYOR FOR BRENNAN CONSULTING

REVISIONS

NO.	DATE	DESCRIPTION	BY	CHK'D

PLANS OF RECORD

- 23.333 V.T.
- MDC PLAN 174
- 5227-1
- 5927-2
- 7604 PAGE 475

LOCUS DEED

BOOK 7604, PAGE 475



APPROVAL NOT REQUIRED (ANR) PLAN  
LOCATED IN  
REVERE, MASSACHUSETTS  
(SUFFOLK COUNTY)

PREPARED FOR  
WINTER STREET ARCHITECTS  
SCALE: 1"=20' DATE: JUNE 8, 2021

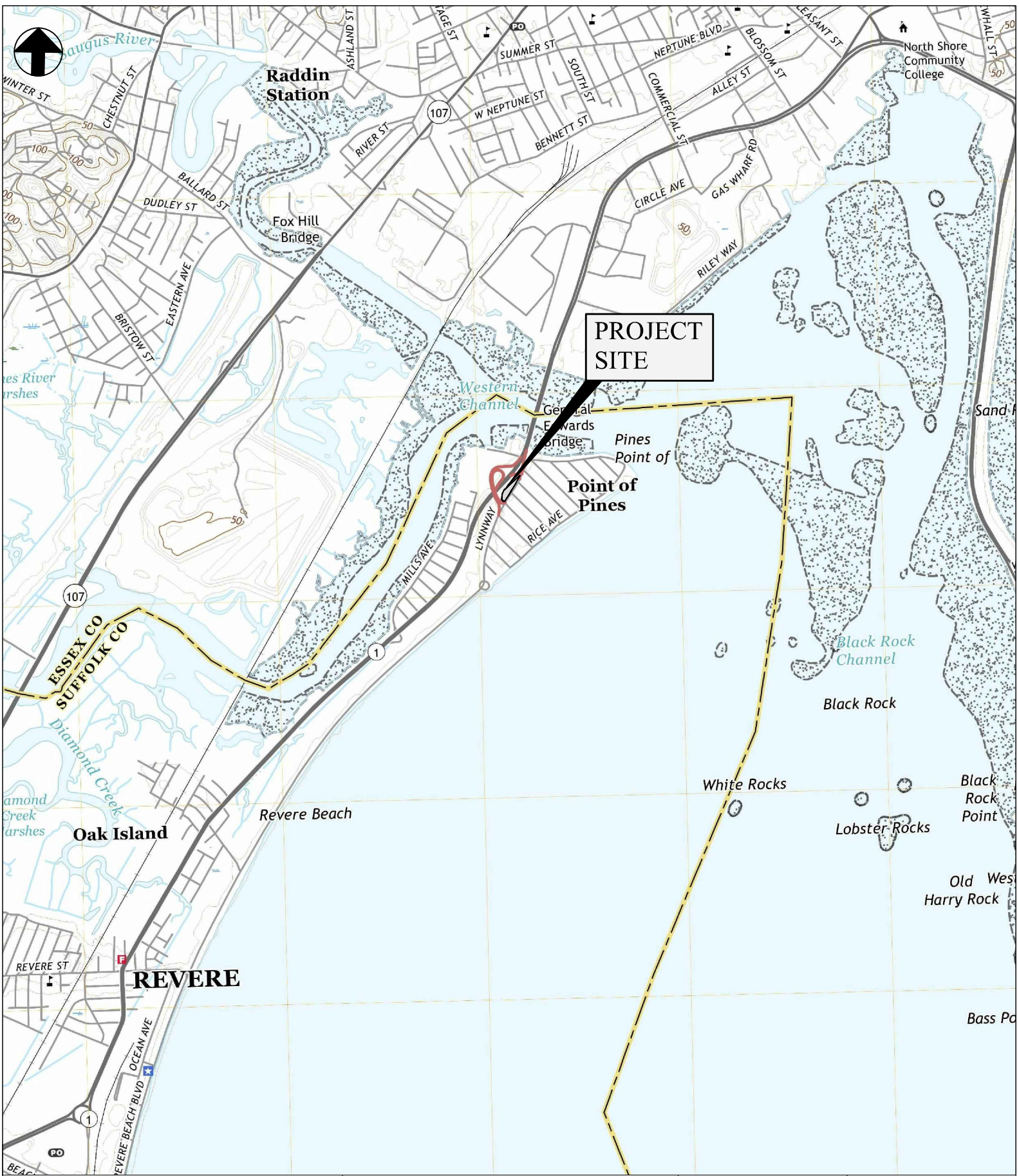
**Brennan Consulting**  
ENGINEERING • TRANSPORTATION • SURVEYING  
24 RAY AVENUE, BURLINGTON, MA  
PHONE: (781) 273-3434 FAX: (781) 273-3430

JUNE 8, 2021

PROJECT No. 19954B

*Figure 2 – USGS Map*





Project Civil Engineer  
**Brennan Consulting**  
ENGINEERING • TRANSPORTATION • SURVEYING  
BRENNAN CONSULTING, INC.  
24 Ray Avenue, Suite 203  
Burlington, MA 01803  
781.273.3434  
www.brennanconsults.com

Project Location  
**ALDEN FIRE STATION**  
140 Lynnway  
Revere, MA

SCALE: 1"=2000'  
DRAWN BY: WCG  
CHECKED BY: CE  
ISSUED: 03.31.21  
REVISED:

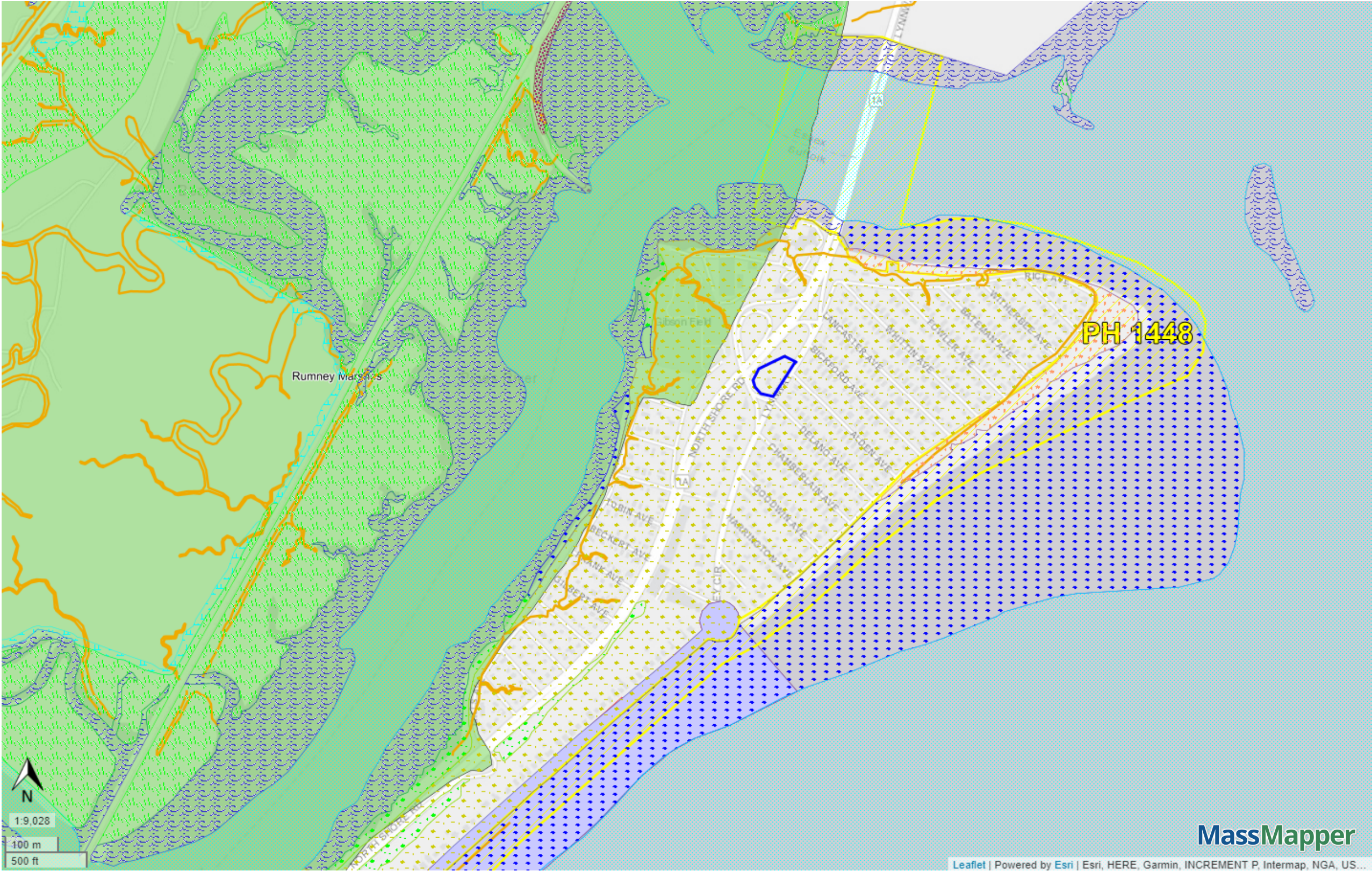
**LOCUS  
MAP**



**Figure 3 – Environmental Constraints Map**



# 140 Lynnway Revere - Environmental Constraints



## DEP Wetlands Detailed With Outlines

- Barrier Beach System
- Barrier Beach-Deep Marsh
- Barrier Beach-Wooded Swamp Mixed Trees
- Barrier Beach-Coastal Beach
- Barrier Beach-Coastal Dune
- Barrier Beach-Marsh
- Barrier Beach-Salt Marsh
- Barrier Beach-Shrub Swamp
- Barrier Beach-Wooded Swamp Coniferous
- Barrier Beach-Wooded Swamp Deciduous
- Bog
- Coastal Bank Bluff or Sea Cliff
- Coastal Beach
- Coastal Dune
- Cranberry Bog
- Deep Marsh
- Barrier Beach-Open Water
- Open Water
- Rocky Intertidal Shore
- Salt Marsh
- Shallow Marsh Meadow or Fen
- Shrub Swamp
- Tidal Flat
- Wooded Swamp Coniferous
- Wooded Swamp Deciduous
- Wooded Swamp Mixed Trees

## Tidelands Jurisdiction Chapter 91 Jurisdiction

- Areas of Critical Environmental Concern ACECs Transparent Green

## NHESP Priority Habitats of Rare Species

- MassHistoric Commission Inventory (Areas)

- National Register of Historic Places
- Preservation Restriction
- Massachusetts Historic Landmark
- Local Historic District
- NRHP and LHD
- Inventoried Property

## Zone IIs Dissolved

- Zone Is Dissolved

## IWPAs Dissolved

-



**Figure 4 – FEMA Flood Map**

# National Flood Hazard Layer FIRMette



42°26'36.89"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000

USGS The National Map: Orthoimagery. Data refreshed October, 2017.

42°26'10.34"N

## Legend

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
OTHER FEATURES		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/25/2019 at 2:38:25 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

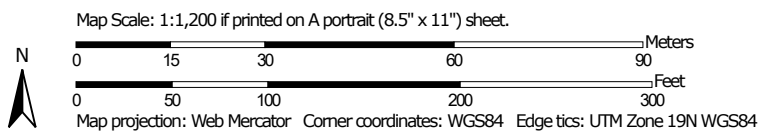
*Figure 5 – NRCS Hydrologic Soil Groups*



# Hydrologic Soil Group—Norfolk and Suffolk Counties, Massachusetts



Soil Map may not be valid at this scale.



**Natural Resources  
Conservation Service**

Web Soil Survey  
National Cooperative Soil Survey

7/22/2020  
Page 1 of 4

## 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 1:25,000.

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: Norfolk and Suffolk Counties, Massachusetts  
 Survey Area Data: Version 16, Jun 11, 2020

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

Date(s) aerial images were photographed: Sep 11, 2019—Oct 5, 2019

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

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	1.8	59.0%
655	Udorthents, wet substratum		1.3	41.0%
<b>Totals for Area of Interest</b>			<b>3.1</b>	<b>100.0%</b>

## Description

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

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

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

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

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

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

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



## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

*Figure 6 – Existing Conditions Drainage Plan*



**Figure 7 – Proposed Conditions Drainage Plan**



# *Stormwater Management Standards*

**Standard 1:** *No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

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

There are no direct discharges to wetlands or receiving waters. Overflow devices from the onsite infiltration basins are connected to the municipal drainage networks. There will be no erosion or scour to wetlands or receiving waters.

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

**Response:** The proponent is requesting that this standard be waived for this project as it is located in a land subject to coastal storm flowage.

**(See Existing and Proposed Conditions HydroCAD Analysis)**

**Standard 3:** Loss of annual recharge to groundwater shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater best management best management practices, and good operation and maintenance. At minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

Response: The loss of groundwater recharge has been computed as prescribed in Standard 3 of the Stormwater Management Policy. Required recharge volumes were calculated by utilizing the depth of runoff corresponding to the soil type times the impervious areas covering that soil type at the post-development site.

All impervious areas in the existing and proposed site area are in hydrologic soil group A, according to the soil data. In accordance with Stormwater Management Policy, a recharge depth factor of 0.60 inches will be used to calculate groundwater recharge.

Required Recharge Volume			
Hydrologic Group	Impervious Area	inches	Recharge Volume
A	21,542.0 sf	0.60	1,077.1 sf
B	0.0 sf	0.35	0.0 sf
C	0.0 sf	0.25	0.0 sf
D	0.0 sf	0.10	0.0 sf
Total	21,542.0 sf		1,077.1 sf
Provided Recharge Volume			
Infiltration Basin=	1,630.0 sf		

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom Area)}$$

Where:

*Rv* = Storage Volume

*K* = Saturated Hydraulic Conductivity For "Static" and "Simple Dynamic" Methods, use Rawls Rate (see Table 2.3.3). For "Dynamic Field" Method, use 50% of the in-situ saturated hydraulic conductivity.

*Bottom Area* = Bottom Area of Recharge Structure<sup>22</sup>

Infiltration Basin	
Rv=	1630 cf
K=	1.02 in/hr*
Bottom Area=	808.6 sf
Time =	23.72 hours

\*Infiltration rate is based on results from double ring infiltrometer test performed by John Turner Consulting in January 2021 (average of both rates measured with a 2.0 factor of safety).



**Standard 4:** Stormwater management systems shall be designed to remove 80% of the average annual post-condition load of Total Suspended Solids (TSS). This standard is met when:

- a.) Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;
- b.) Structural stormwater best management practices are sized to capture the required water quality volume as determined in accordance with the Massachusetts Stormwater Handbook; and
- c.) Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

The required water quality volume equals 1.0 inch of runoff times the total impervious area of the post-development project site and greater than 80% TSS removal prior to discharge to the infiltration BMP.

**(See Water Quality and TSS Removal Calculations Sheet.)**

**Standard 5:** For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If, through source control and/or pollution prevention, all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow melt and stormwater runoff, the proponent shall use the specific structural stormwater BMP's determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L.c. 21, ss 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

**The proposed Alden A. Mills Fire Station is not a land use with higher potential pollutant loads.**

**Standard 6:** *Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A “storm water discharge” as defined in 314 CMR 3.04(2)(a)1. or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 4.00. Stormwater discharge to a Zone I or Zone A are prohibited unless essential to the operation of the public water supply.*

*A stormwater discharge within a Zone II or Interim Wellhead Protection Area or near or to an Outstanding Resource Water, a Special Resource Water, a bathing beach, shellfish growing area, or cold-water fishery requires the use of a treatment train that provides 80% TSS removal prior to discharge. With the exception of runoff from a non-metal roof, and runoff from metal roofs located outside the Zone II or Interim Wellhead Protection Area of a public water supply or an industrial site, the treatment train shall provide for at least 44% TSS removal prior to discharge to the infiltration structure. For discharges within a Zone II or Interim Wellhead Protection Area or near or to an Outstanding Resource Water, a Special Resource Water, a shellfish growing area, a bathing beach, or a cold-water fishery, the treatment BMPs must be designed to treat the required water quality volume, a volume equal to one inch times the total impervious surfaces at the post-development site.*

**The proposed Alden A. Mills Fire Station will not discharge near or to a critical area.**

**Standard 7:** *A redevelopment project is required to meet the following Stormwater Management Standards only to the Maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.*

**The Alden A. Mills Fire Station is not a redevelopment project and therefore will comply with all required standards.**

**Standard 8:** *A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

**The Alden A. Mills Fire Station will not disturb more than an acre of land and therefore will not require a Federal NPDES permit with a standard Stormwater Pollution Prevention Plan (SWPPP).**

**Standard 9:** *A Long-Term Operation and Maintenance (O&M) Plan shall be developed and maintained to ensure that stormwater management systems function as designed.*

**A long term O&M Plan is attached as a separate document.**

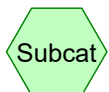
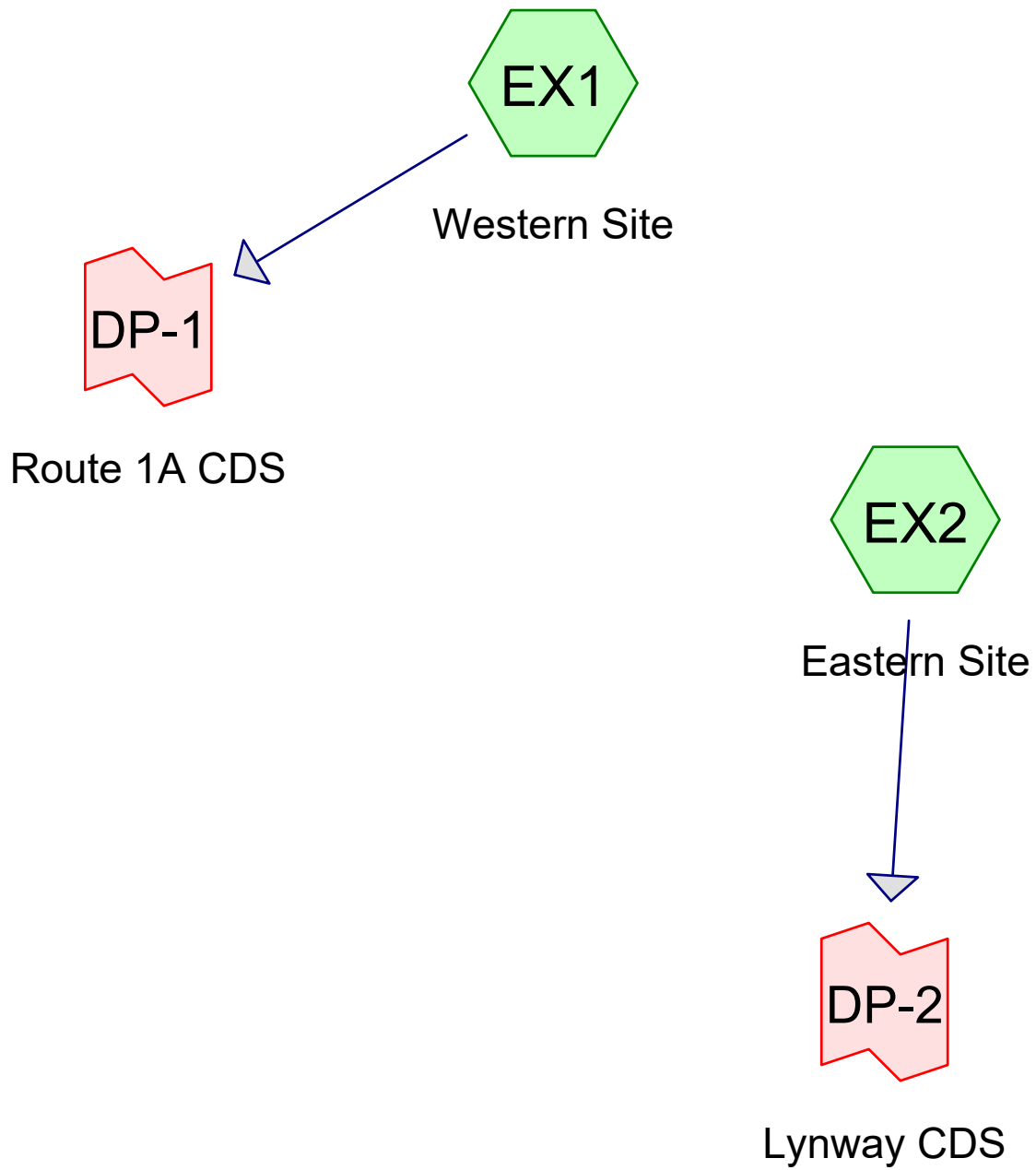
**Standard 10:** *All illicit discharges to the stormwater management system are prohibited.*

**An Illicit Discharge Compliance Statement is attached as a separate document.**

## *Appendix*

## *Standard 2*

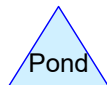
## *Existing Conditions HydroCAD Analysis*



Subcat



Reach



Pond



Link

**Routing Diagram for 19954B-EX - NOAA1**

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**19954B-EX - NOAA1**

Prepared by Microsoft

Printed 5/20/2022

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Page 2

**Rainfall Events Listing**

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-YR	Type III 24-hr		Default	24.00	1	3.20	2
2	10-YR	Type III 24-hr		Default	24.00	1	5.05	2
3	25-YR	Type III 24-hr		Default	24.00	1	6.21	2
4	100-YR	Type III 24-hr		Default	24.00	1	7.05	2



**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.444	39	>75% Grass cover, Good, HSG A (EX1, EX2)
0.186	96	Gravel surface, HSG A (EX1, EX2)
0.073	98	Paved parking, HSG A (EX1, EX2)
<b>0.702</b>	<b>60</b>	<b>TOTAL AREA</b>

**19954B-EX - NOAA1**

Prepared by Microsoft

Printed 5/20/2022

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Page 4

**Soil Listing (all nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
0.702	HSG A	EX1, EX2
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
<b>0.702</b>		<b>TOTAL AREA</b>

**19954B-EX - NOAA1**

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**Ground Covers (all nodes)**

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.444	0.000	0.000	0.000	0.000	0.444	>75% Grass cover, Good	EX1, EX2
0.186	0.000	0.000	0.000	0.000	0.186	Gravel surface	EX1, EX2
0.073	0.000	0.000	0.000	0.000	0.073	Paved parking	EX1, EX2
<b>0.702</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.702</b>	<b>TOTAL AREA</b>	

**19954B-EX - NOAA1***Type III 24-hr 2-YR Rainfall=3.20"*

Prepared by Microsoft

Printed 5/20/2022

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment EX1: Western Site**

Runoff Area=12,622 sf 6.48% Impervious Runoff Depth>0.66"  
Tc=6.0 min CN=68 Runoff=0.21 cfs 0.016 af

**Subcatchment EX2: Eastern Site**

Runoff Area=17,975 sf 13.13% Impervious Runoff Depth>0.21"  
Tc=6.0 min CN=55 Runoff=0.04 cfs 0.007 af

**Link DP-1: Route 1A CDS**

Inflow=0.21 cfs 0.016 af  
Primary=0.21 cfs 0.016 af

**Link DP-2: Lynway CDS**

Inflow=0.04 cfs 0.007 af  
Primary=0.04 cfs 0.007 af

**Total Runoff Area = 0.702 ac Runoff Volume = 0.023 af Average Runoff Depth = 0.40"**  
**89.61% Pervious = 0.629 ac 10.39% Impervious = 0.073 ac**

**Summary for Subcatchment EX1: Western Site**

Runoff = 0.21 cfs @ 12.11 hrs, Volume= 0.016 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
6,220	39	>75% Grass cover, Good, HSG A
818	98	Paved parking, HSG A
5,584	96	Gravel surface, HSG A
12,622	68	Weighted Average
11,804		93.52% Pervious Area
818		6.48% Impervious Area

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

**Summary for Subcatchment EX2: Eastern Site**

Runoff = 0.04 cfs @ 12.33 hrs, Volume= 0.007 af, Depth> 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
13,105	39	>75% Grass cover, Good, HSG A
2,361	98	Paved parking, HSG A
2,509	96	Gravel surface, HSG A
17,975	55	Weighted Average
15,614		86.87% Pervious Area
2,361		13.13% Impervious Area

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

**Summary for Link DP-1: Route 1A CDS**

Inflow Area = 0.290 ac, 6.48% Impervious, Inflow Depth > 0.66" for 2-YR event  
Inflow = 0.21 cfs @ 12.11 hrs, Volume= 0.016 af  
Primary = 0.21 cfs @ 12.11 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Link DP-2: Lynway CDS**

Inflow Area = 0.413 ac, 13.13% Impervious, Inflow Depth > 0.21" for 2-YR event  
Inflow = 0.04 cfs @ 12.33 hrs, Volume= 0.007 af  
Primary = 0.04 cfs @ 12.33 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**19954B-EX - NOAA1***Type III 24-hr 10-YR Rainfall=5.05"*

Prepared by Microsoft

Printed 5/20/2022

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment EX1: Western Site**

Runoff Area=12,622 sf 6.48% Impervious Runoff Depth>1.76"  
Tc=6.0 min CN=68 Runoff=0.62 cfs 0.042 af

**Subcatchment EX2: Eastern Site**

Runoff Area=17,975 sf 13.13% Impervious Runoff Depth>0.90"  
Tc=6.0 min CN=55 Runoff=0.39 cfs 0.031 af

**Link DP-1: Route 1A CDS**

Inflow=0.62 cfs 0.042 af  
Primary=0.62 cfs 0.042 af

**Link DP-2: Lynway CDS**

Inflow=0.39 cfs 0.031 af  
Primary=0.39 cfs 0.031 af

**Total Runoff Area = 0.702 ac Runoff Volume = 0.073 af Average Runoff Depth = 1.25"**  
**89.61% Pervious = 0.629 ac 10.39% Impervious = 0.073 ac**



**Summary for Subcatchment EX1: Western Site**

Runoff = 0.62 cfs @ 12.10 hrs, Volume= 0.042 af, Depth> 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=5.05"

Area (sf)	CN	Description
6,220	39	>75% Grass cover, Good, HSG A
818	98	Paved parking, HSG A
5,584	96	Gravel surface, HSG A
12,622	68	Weighted Average
11,804		93.52% Pervious Area
818		6.48% Impervious Area

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

**Summary for Subcatchment EX2: Eastern Site**

Runoff = 0.39 cfs @ 12.11 hrs, Volume= 0.031 af, Depth> 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=5.05"

Area (sf)	CN	Description
13,105	39	>75% Grass cover, Good, HSG A
2,361	98	Paved parking, HSG A
2,509	96	Gravel surface, HSG A
17,975	55	Weighted Average
15,614		86.87% Pervious Area
2,361		13.13% Impervious Area

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

**Summary for Link DP-1: Route 1A CDS**

Inflow Area = 0.290 ac, 6.48% Impervious, Inflow Depth > 1.76" for 10-YR event  
Inflow = 0.62 cfs @ 12.10 hrs, Volume= 0.042 af  
Primary = 0.62 cfs @ 12.10 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Link DP-2: Lynway CDS**

Inflow Area = 0.413 ac, 13.13% Impervious, Inflow Depth > 0.90" for 10-YR event

Inflow = 0.39 cfs @ 12.11 hrs, Volume= 0.031 af

Primary = 0.39 cfs @ 12.11 hrs, Volume= 0.031 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**19954B-EX - NOAA1***Type III 24-hr 25-YR Rainfall=6.21"*

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment EX1: Western Site**

Runoff Area=12,622 sf 6.48% Impervious Runoff Depth>2.57"  
Tc=6.0 min CN=68 Runoff=0.92 cfs 0.062 af

**Subcatchment EX2: Eastern Site**

Runoff Area=17,975 sf 13.13% Impervious Runoff Depth>1.48"  
Tc=6.0 min CN=55 Runoff=0.70 cfs 0.051 af

**Link DP-1: Route 1A CDS**

Inflow=0.92 cfs 0.062 af  
Primary=0.92 cfs 0.062 af

**Link DP-2: Lynway CDS**

Inflow=0.70 cfs 0.051 af  
Primary=0.70 cfs 0.051 af

**Total Runoff Area = 0.702 ac Runoff Volume = 0.113 af Average Runoff Depth = 1.93"**  
**89.61% Pervious = 0.629 ac 10.39% Impervious = 0.073 ac**

**Summary for Subcatchment EX1: Western Site**

Runoff = 0.92 cfs @ 12.10 hrs, Volume= 0.062 af, Depth> 2.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-YR Rainfall=6.21"

Area (sf)	CN	Description
6,220	39	>75% Grass cover, Good, HSG A
818	98	Paved parking, HSG A
5,584	96	Gravel surface, HSG A
12,622	68	Weighted Average
11,804		93.52% Pervious Area
818		6.48% Impervious Area

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

**Summary for Subcatchment EX2: Eastern Site**

Runoff = 0.70 cfs @ 12.10 hrs, Volume= 0.051 af, Depth> 1.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-YR Rainfall=6.21"

Area (sf)	CN	Description
13,105	39	>75% Grass cover, Good, HSG A
2,361	98	Paved parking, HSG A
2,509	96	Gravel surface, HSG A
17,975	55	Weighted Average
15,614		86.87% Pervious Area
2,361		13.13% Impervious Area

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

**Summary for Link DP-1: Route 1A CDS**

Inflow Area = 0.290 ac, 6.48% Impervious, Inflow Depth > 2.57" for 25-YR event  
Inflow = 0.92 cfs @ 12.10 hrs, Volume= 0.062 af  
Primary = 0.92 cfs @ 12.10 hrs, Volume= 0.062 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Summary for Link DP-2: Lynway CDS**

Inflow Area = 0.413 ac, 13.13% Impervious, Inflow Depth > 1.48" for 25-YR event  
Inflow = 0.70 cfs @ 12.10 hrs, Volume= 0.051 af  
Primary = 0.70 cfs @ 12.10 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment EX1: Western Site**

Runoff Area=12,622 sf 6.48% Impervious Runoff Depth>3.20"  
Tc=6.0 min CN=68 Runoff=1.15 cfs 0.077 af

**Subcatchment EX2: Eastern Site**

Runoff Area=17,975 sf 13.13% Impervious Runoff Depth>1.96"  
Tc=6.0 min CN=55 Runoff=0.96 cfs 0.067 af

**Link DP-1: Route 1A CDS**

Inflow=1.15 cfs 0.077 af  
Primary=1.15 cfs 0.077 af

**Link DP-2: Lynway CDS**

Inflow=0.96 cfs 0.067 af  
Primary=0.96 cfs 0.067 af

**Total Runoff Area = 0.702 ac Runoff Volume = 0.145 af Average Runoff Depth = 2.47"**  
**89.61% Pervious = 0.629 ac 10.39% Impervious = 0.073 ac**

**Summary for Subcatchment EX1: Western Site**

Runoff = 1.15 cfs @ 12.09 hrs, Volume= 0.077 af, Depth> 3.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=7.05"

Area (sf)	CN	Description
6,220	39	>75% Grass cover, Good, HSG A
818	98	Paved parking, HSG A
5,584	96	Gravel surface, HSG A
12,622	68	Weighted Average
11,804		93.52% Pervious Area
818		6.48% Impervious Area

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

**Summary for Subcatchment EX2: Eastern Site**

Runoff = 0.96 cfs @ 12.10 hrs, Volume= 0.067 af, Depth> 1.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=7.05"

Area (sf)	CN	Description
13,105	39	>75% Grass cover, Good, HSG A
2,361	98	Paved parking, HSG A
2,509	96	Gravel surface, HSG A
17,975	55	Weighted Average
15,614		86.87% Pervious Area
2,361		13.13% Impervious Area

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

**Summary for Link DP-1: Route 1A CDS**

Inflow Area = 0.290 ac, 6.48% Impervious, Inflow Depth > 3.20" for 100-YR event  
Inflow = 1.15 cfs @ 12.09 hrs, Volume= 0.077 af  
Primary = 1.15 cfs @ 12.09 hrs, Volume= 0.077 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

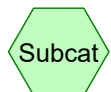
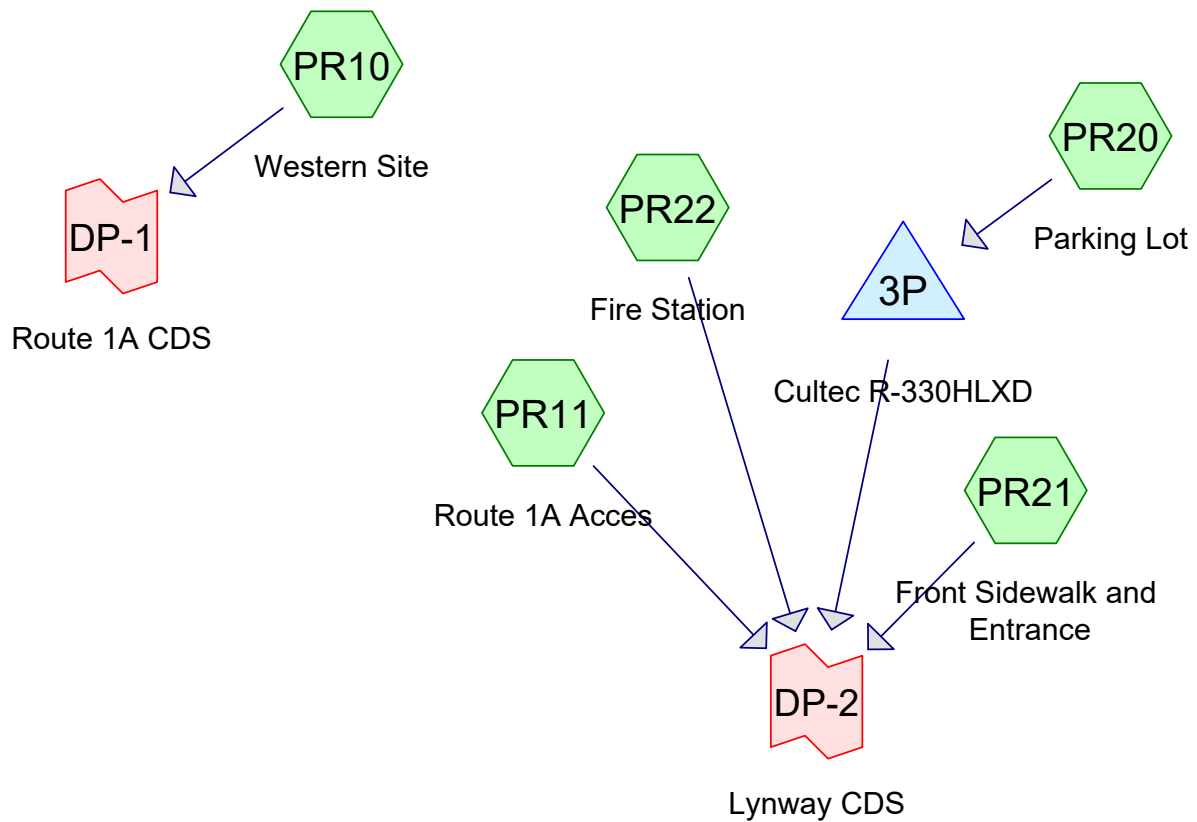


**Summary for Link DP-2: Lynway CDS**

Inflow Area = 0.413 ac, 13.13% Impervious, Inflow Depth > 1.96" for 100-YR event  
Inflow = 0.96 cfs @ 12.10 hrs, Volume= 0.067 af  
Primary = 0.96 cfs @ 12.10 hrs, Volume= 0.067 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

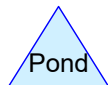
## *Proposed Conditions HydroCAD Analysis*



Subcat



Reach



Pond



Link

**Routing Diagram for 19954B-PR - NOAA**

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**Rainfall Events Listing**

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-YR	Type III 24-hr		Default	24.00	1	3.20	2
2	10-YR	Type III 24-hr		Default	24.00	1	5.05	2
3	25-YR	Type III 24-hr		Default	24.00	1	6.21	2
4	100-YR	Type III 24-hr		Default	24.00	1	7.06	2
5	Custom	Type III 24-hr		Default	24.00	1	6.50	2

**Area Listing (all nodes)**

Area (sq-ft)	CN	Description (subcatchment-numbers)
9,076	39	>75% Grass cover, Good, HSG A (PR10, PR11, PR20, PR21)
12,878	98	Paved parking, HSG A (PR10, PR11, PR20, PR21)
8,665	98	Roofs, HSG A (PR22)
<b>30,619</b>	<b>81</b>	<b>TOTAL AREA</b>

**Soil Listing (all nodes)**

Area (sq-ft)	Soil Group	Subcatchment Numbers
30,619	HSG A	PR10, PR11, PR20, PR21, PR22
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
<b>30,619</b>		<b>TOTAL AREA</b>

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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	Sub Num
9,076	0	0	0	0	9,076	>75% Grass cover, Good	
12,878	0	0	0	0	12,878	Paved parking	
8,665	0	0	0	0	8,665	Roofs	
<b>30,619</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>30,619</b>	<b>TOTAL AREA</b>	



**Pipe Listing (all nodes)**

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	3P	6.00	5.00	100.0	0.0100	0.012	6.0	0.0	0.0

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*Type III 24-hr 2-YR Rainfall=3.20"*

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment PR10: Western Site</b>	Runoff Area=1,859 sf 89.13% Impervious Runoff Depth>2.35" Tc=6.0 min CN=92 Runoff=0.11 cfs 364 cf
<b>Subcatchment PR11: Route 1A Acces</b>	Runoff Area=2,072 sf 65.73% Impervious Runoff Depth>1.27" Tc=6.0 min CN=78 Runoff=0.07 cfs 220 cf
<b>Subcatchment PR20: Parking Lot</b>	Runoff Area=11,907 sf 46.37% Impervious Runoff Depth>0.64" Tc=6.0 min CN=66 Runoff=0.16 cfs 637 cf
<b>Subcatchment PR21: Front Sidewalk and</b>	Runoff Area=6,116 sf 70.93% Impervious Runoff Depth>1.47" Tc=6.0 min CN=81 Runoff=0.24 cfs 748 cf
<b>Subcatchment PR22: Fire Station</b>	Runoff Area=8,665 sf 100.00% Impervious Runoff Depth>2.97" Tc=6.0 min CN=98 Runoff=0.60 cfs 2,141 cf
<b>Pond 3P: Cultec R-330HLXD</b>	Peak Elev=6.57' Storage=210 cf Inflow=0.16 cfs 637 cf Discarded=0.02 cfs 635 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 635 cf
<b>Link DP-1: Route 1A CDS</b>	Inflow=0.11 cfs 364 cf Primary=0.11 cfs 364 cf
<b>Link DP-2: Lynway CDS</b>	Inflow=0.91 cfs 3,109 cf Primary=0.91 cfs 3,109 cf

**Total Runoff Area = 30,619 sf Runoff Volume = 4,110 cf Average Runoff Depth = 1.61"**  
**29.64% Pervious = 9,076 sf 70.36% Impervious = 21,543 sf**

**Summary for Subcatchment PR10: Western Site**

Runoff = 0.11 cfs @ 12.09 hrs, Volume= 364 cf, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
202	39	>75% Grass cover, Good, HSG A
1,657	98	Paved parking, HSG A
1,859	92	Weighted Average
202		10.87% Pervious Area
1,657		89.13% Impervious Area

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

**Summary for Subcatchment PR11: Route 1A Acces**

Runoff = 0.07 cfs @ 12.10 hrs, Volume= 220 cf, Depth> 1.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
710	39	>75% Grass cover, Good, HSG A
1,362	98	Paved parking, HSG A
2,072	78	Weighted Average
710		34.27% Pervious Area
1,362		65.73% Impervious Area

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

**Summary for Subcatchment PR20: Parking Lot**

Runoff = 0.16 cfs @ 12.11 hrs, Volume= 637 cf, Depth> 0.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
6,386	39	>75% Grass cover, Good, HSG A
5,521	98	Paved parking, HSG A
11,907	66	Weighted Average
6,386		53.63% Pervious Area
5,521		46.37% Impervious Area

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

### Summary for Subcatchment PR21: Front Sidewalk and Entrance

Runoff = 0.24 cfs @ 12.10 hrs, Volume= 748 cf, Depth> 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
1,778	39	>75% Grass cover, Good, HSG A
4,338	98	Paved parking, HSG A
6,116	81	Weighted Average
1,778		29.07% Pervious Area
4,338		70.93% Impervious Area

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

### Summary for Subcatchment PR22: Fire Station

Runoff = 0.60 cfs @ 12.09 hrs, Volume= 2,141 cf, Depth> 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-YR Rainfall=3.20"

Area (sf)	CN	Description
8,665	98	Roofs, HSG A
8,665		100.00% Impervious Area

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

### Summary for Pond 3P: Cultec R-330HLXD

Inflow Area = 11,907 sf, 46.37% Impervious, Inflow Depth > 0.64" for 2-YR event  
Inflow = 0.16 cfs @ 12.11 hrs, Volume= 637 cf  
Outflow = 0.02 cfs @ 12.00 hrs, Volume= 635 cf, Atten= 88%, Lag= 0.0 min  
Discarded = 0.02 cfs @ 12.00 hrs, Volume= 635 cf  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Peak Elev= 6.57' @ 13.89 hrs Surf.Area= 809 sf Storage= 210 cf

Plug-Flow detention time= 109.2 min calculated for 635 cf (100% of inflow)  
Center-of-Mass det. time= 107.2 min ( 997.5 - 890.3 )

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Type III 24-hr 2-YR Rainfall=3.20"

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Volume	Invert	Avail.Storage	Storage Description
#1A	6.00'	706 cf	<b>25.67'W x 31.50'L x 3.54'H Field A</b> 2,863 cf Overall - 1,099 cf Embedded = 1,764 cf x 40.0% Voids
#2A	6.50'	1,099 cf	<b>Cultec R-330XLHD x 20 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		1,805 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	6.00'	<b>1.030 in/hr Exfiltration over Surface area</b>
#2	Primary	6.00'	<b>6.0" Round Culvert</b> L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 6.00' / 5.00' S= 0.0100 ' / ' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.20 sf
#3	Device 2	9.00'	<b>4.0' long x 0.5' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

**Discarded OutFlow** Max=0.02 cfs @ 12.00 hrs HW=6.04' (Free Discharge)↑ **1=Exfiltration** (Exfiltration Controls 0.02 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=6.00' (Free Discharge)↑ **2=Culvert** ( Controls 0.00 cfs)↑ **3=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)**Summary for Link DP-1: Route 1A CDS**

Inflow Area = 1,859 sf, 89.13% Impervious, Inflow Depth > 2.35" for 2-YR event  
 Inflow = 0.11 cfs @ 12.09 hrs, Volume= 364 cf  
 Primary = 0.11 cfs @ 12.09 hrs, Volume= 364 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

**Summary for Link DP-2: Lynway CDS**

Inflow Area = 28,760 sf, 69.14% Impervious, Inflow Depth > 1.30" for 2-YR event  
 Inflow = 0.91 cfs @ 12.09 hrs, Volume= 3,109 cf  
 Primary = 0.91 cfs @ 12.09 hrs, Volume= 3,109 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment PR10: Western Site</b>	Runoff Area=1,859 sf 89.13% Impervious Runoff Depth>4.14" Tc=6.0 min CN=92 Runoff=0.19 cfs 641 cf
<b>Subcatchment PR11: Route 1A Acces</b>	Runoff Area=2,072 sf 65.73% Impervious Runoff Depth>2.75" Tc=6.0 min CN=78 Runoff=0.15 cfs 475 cf
<b>Subcatchment PR20: Parking Lot</b>	Runoff Area=11,907 sf 46.37% Impervious Runoff Depth>1.76" Tc=6.0 min CN=66 Runoff=0.53 cfs 1,746 cf
<b>Subcatchment PR21: Front Sidewalk and</b>	Runoff Area=6,116 sf 70.93% Impervious Runoff Depth>3.03" Tc=6.0 min CN=81 Runoff=0.49 cfs 1,543 cf
<b>Subcatchment PR22: Fire Station</b>	Runoff Area=8,665 sf 100.00% Impervious Runoff Depth>4.81" Tc=6.0 min CN=98 Runoff=0.96 cfs 3,473 cf
<b>Pond 3P: Cultec R-330HLXD</b>	Peak Elev=7.84' Storage=1,036 cf Inflow=0.53 cfs 1,746 cf Discarded=0.02 cfs 891 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 891 cf
<b>Link DP-1: Route 1A CDS</b>	Inflow=0.19 cfs 641 cf Primary=0.19 cfs 641 cf
<b>Link DP-2: Lynway CDS</b>	Inflow=1.60 cfs 5,491 cf Primary=1.60 cfs 5,491 cf

**Total Runoff Area = 30,619 sf Runoff Volume = 7,878 cf Average Runoff Depth = 3.09"**  
**29.64% Pervious = 9,076 sf 70.36% Impervious = 21,543 sf**

**Summary for Subcatchment PR10: Western Site**

Runoff = 0.19 cfs @ 12.09 hrs, Volume= 641 cf, Depth> 4.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=5.05"

Area (sf)	CN	Description
202	39	>75% Grass cover, Good, HSG A
1,657	98	Paved parking, HSG A
1,859	92	Weighted Average
202		10.87% Pervious Area
1,657		89.13% Impervious Area

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

**Summary for Subcatchment PR11: Route 1A Acces**

Runoff = 0.15 cfs @ 12.09 hrs, Volume= 475 cf, Depth> 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=5.05"

Area (sf)	CN	Description
710	39	>75% Grass cover, Good, HSG A
1,362	98	Paved parking, HSG A
2,072	78	Weighted Average
710		34.27% Pervious Area
1,362		65.73% Impervious Area

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

**Summary for Subcatchment PR20: Parking Lot**

Runoff = 0.53 cfs @ 12.10 hrs, Volume= 1,746 cf, Depth> 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=5.05"

Area (sf)	CN	Description
6,386	39	>75% Grass cover, Good, HSG A
5,521	98	Paved parking, HSG A
11,907	66	Weighted Average
6,386		53.63% Pervious Area
5,521		46.37% Impervious Area



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

### Summary for Subcatchment PR21: Front Sidewalk and Entrance

Runoff = 0.49 cfs @ 12.09 hrs, Volume= 1,543 cf, Depth> 3.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=5.05"

Area (sf)	CN	Description
1,778	39	>75% Grass cover, Good, HSG A
4,338	98	Paved parking, HSG A
6,116	81	Weighted Average
1,778		29.07% Pervious Area
4,338		70.93% Impervious Area

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

### Summary for Subcatchment PR22: Fire Station

Runoff = 0.96 cfs @ 12.09 hrs, Volume= 3,473 cf, Depth> 4.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=5.05"

Area (sf)	CN	Description
8,665	98	Roofs, HSG A
8,665		100.00% Impervious Area

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

### Summary for Pond 3P: Cultec R-330HLXD

Inflow Area = 11,907 sf, 46.37% Impervious, Inflow Depth > 1.76" for 10-YR event  
Inflow = 0.53 cfs @ 12.10 hrs, Volume= 1,746 cf  
Outflow = 0.02 cfs @ 11.60 hrs, Volume= 891 cf, Atten= 96%, Lag= 0.0 min  
Discarded = 0.02 cfs @ 11.60 hrs, Volume= 891 cf  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Peak Elev= 7.84' @ 17.03 hrs Surf.Area= 809 sf Storage= 1,036 cf

Plug-Flow detention time= 326.0 min calculated for 889 cf (51% of inflow)  
Center-of-Mass det. time= 199.3 min ( 1,056.2 - 856.9 )

Volume	Invert	Avail.Storage	Storage Description
#1A	6.00'	706 cf	<b>25.67'W x 31.50'L x 3.54'H Field A</b> 2,863 cf Overall - 1,099 cf Embedded = 1,764 cf x 40.0% Voids
#2A	6.50'	1,099 cf	<b>Cultec R-330XLHD x 20 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		1,805 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	6.00'	<b>1.030 in/hr Exfiltration over Surface area</b>
#2	Primary	6.00'	<b>6.0" Round Culvert</b> L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 6.00' / 5.00' S= 0.0100 ' / ' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.20 sf
#3	Device 2	9.00'	<b>4.0' long x 0.5' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

**Discarded OutFlow** Max=0.02 cfs @ 11.60 hrs HW=6.04' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=6.00' (Free Discharge)

↑ **2=Culvert** ( Controls 0.00 cfs)

↑ **3=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

### Summary for Link DP-1: Route 1A CDS

Inflow Area = 1,859 sf, 89.13% Impervious, Inflow Depth > 4.14" for 10-YR event  
 Inflow = 0.19 cfs @ 12.09 hrs, Volume= 641 cf  
 Primary = 0.19 cfs @ 12.09 hrs, Volume= 641 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

### Summary for Link DP-2: Lynway CDS

Inflow Area = 28,760 sf, 69.14% Impervious, Inflow Depth > 2.29" for 10-YR event  
 Inflow = 1.60 cfs @ 12.09 hrs, Volume= 5,491 cf  
 Primary = 1.60 cfs @ 12.09 hrs, Volume= 5,491 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment PR10: Western Site</b>	Runoff Area=1,859 sf 89.13% Impervious Runoff Depth>5.27" Tc=6.0 min CN=92 Runoff=0.24 cfs 817 cf
<b>Subcatchment PR11: Route 1A Acces</b>	Runoff Area=2,072 sf 65.73% Impervious Runoff Depth>3.76" Tc=6.0 min CN=78 Runoff=0.21 cfs 650 cf
<b>Subcatchment PR20: Parking Lot</b>	Runoff Area=11,907 sf 46.37% Impervious Runoff Depth>2.59" Tc=6.0 min CN=66 Runoff=0.81 cfs 2,574 cf
<b>Subcatchment PR21: Front Sidewalk and</b>	Runoff Area=6,116 sf 70.93% Impervious Runoff Depth>4.07" Tc=6.0 min CN=81 Runoff=0.65 cfs 2,076 cf
<b>Subcatchment PR22: Fire Station</b>	Runoff Area=8,665 sf 100.00% Impervious Runoff Depth>5.97" Tc=6.0 min CN=98 Runoff=1.18 cfs 4,309 cf
<b>Pond 3P: Cultec R-330HLXD</b>	Peak Elev=9.01' Storage=1,634 cf Inflow=0.81 cfs 2,574 cf Discarded=0.02 cfs 934 cf Primary=0.02 cfs 97 cf Outflow=0.04 cfs 1,031 cf
<b>Link DP-1: Route 1A CDS</b>	Inflow=0.24 cfs 817 cf Primary=0.24 cfs 817 cf
<b>Link DP-2: Lynway CDS</b>	Inflow=2.04 cfs 7,131 cf Primary=2.04 cfs 7,131 cf

**Total Runoff Area = 30,619 sf Runoff Volume = 10,425 cf Average Runoff Depth = 4.09"**  
**29.64% Pervious = 9,076 sf 70.36% Impervious = 21,543 sf**

**Summary for Subcatchment PR10: Western Site**

Runoff = 0.24 cfs @ 12.09 hrs, Volume= 817 cf, Depth> 5.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-YR Rainfall=6.21"

Area (sf)	CN	Description
202	39	>75% Grass cover, Good, HSG A
1,657	98	Paved parking, HSG A
1,859	92	Weighted Average
202		10.87% Pervious Area
1,657		89.13% Impervious Area

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

**Summary for Subcatchment PR11: Route 1A Acces**

Runoff = 0.21 cfs @ 12.09 hrs, Volume= 650 cf, Depth> 3.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-YR Rainfall=6.21"

Area (sf)	CN	Description
710	39	>75% Grass cover, Good, HSG A
1,362	98	Paved parking, HSG A
2,072	78	Weighted Average
710		34.27% Pervious Area
1,362		65.73% Impervious Area

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

**Summary for Subcatchment PR20: Parking Lot**

Runoff = 0.81 cfs @ 12.10 hrs, Volume= 2,574 cf, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-YR Rainfall=6.21"

Area (sf)	CN	Description
6,386	39	>75% Grass cover, Good, HSG A
5,521	98	Paved parking, HSG A
11,907	66	Weighted Average
6,386		53.63% Pervious Area
5,521		46.37% Impervious Area

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Type III 24-hr 25-YR Rainfall=6.21"

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

**Summary for Subcatchment PR21: Front Sidewalk and Entrance**

Runoff = 0.65 cfs @ 12.09 hrs, Volume= 2,076 cf, Depth> 4.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-YR Rainfall=6.21"

Area (sf)	CN	Description
1,778	39	>75% Grass cover, Good, HSG A
4,338	98	Paved parking, HSG A
6,116	81	Weighted Average
1,778		29.07% Pervious Area
4,338		70.93% Impervious Area

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

**Summary for Subcatchment PR22: Fire Station**

Runoff = 1.18 cfs @ 12.09 hrs, Volume= 4,309 cf, Depth> 5.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-YR Rainfall=6.21"

Area (sf)	CN	Description
8,665	98	Roofs, HSG A
8,665		100.00% Impervious Area

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

**Summary for Pond 3P: Cultec R-330HLXD**

Inflow Area = 11,907 sf, 46.37% Impervious, Inflow Depth > 2.59" for 25-YR event  
 Inflow = 0.81 cfs @ 12.10 hrs, Volume= 2,574 cf  
 Outflow = 0.04 cfs @ 15.49 hrs, Volume= 1,031 cf, Atten= 95%, Lag= 203.7 min  
 Discarded = 0.02 cfs @ 11.15 hrs, Volume= 934 cf  
 Primary = 0.02 cfs @ 15.49 hrs, Volume= 97 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 9.01' @ 15.49 hrs Surf.Area= 809 sf Storage= 1,634 cf

Plug-Flow detention time= 314.1 min calculated for 1,029 cf (40% of inflow)  
 Center-of-Mass det. time= 186.5 min ( 1,031.8 - 845.3 )

Volume	Invert	Avail.Storage	Storage Description
#1A	6.00'	706 cf	<b>25.67'W x 31.50'L x 3.54'H Field A</b> 2,863 cf Overall - 1,099 cf Embedded = 1,764 cf x 40.0% Voids
#2A	6.50'	1,099 cf	<b>Cultec R-330XLHD x 20 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		1,805 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	6.00'	<b>1.030 in/hr Exfiltration over Surface area</b>
#2	Primary	6.00'	<b>6.0" Round Culvert</b> L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 6.00' / 5.00' S= 0.0100 ' / ' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.20 sf
#3	Device 2	9.00'	<b>4.0' long x 0.5' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

**Discarded OutFlow** Max=0.02 cfs @ 11.15 hrs HW=6.04' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.02 cfs @ 15.49 hrs HW=9.01' (Free Discharge)

↑ **2=Culvert** (Passes 0.02 cfs of 1.03 cfs potential flow)

↑ **3=Broad-Crested Rectangular Weir** (Weir Controls 0.02 cfs @ 0.33 fps)

### Summary for Link DP-1: Route 1A CDS

Inflow Area = 1,859 sf, 89.13% Impervious, Inflow Depth > 5.27" for 25-YR event  
 Inflow = 0.24 cfs @ 12.09 hrs, Volume= 817 cf  
 Primary = 0.24 cfs @ 12.09 hrs, Volume= 817 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

### Summary for Link DP-2: Lynway CDS

Inflow Area = 28,760 sf, 69.14% Impervious, Inflow Depth > 2.98" for 25-YR event  
 Inflow = 2.04 cfs @ 12.09 hrs, Volume= 7,131 cf  
 Primary = 2.04 cfs @ 12.09 hrs, Volume= 7,131 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

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Type III 24-hr 100-YR Rainfall=7.06"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment PR10: Western Site</b>	Runoff Area=1,859 sf 89.13% Impervious Runoff Depth>6.11" Tc=6.0 min CN=92 Runoff=0.28 cfs 947 cf
<b>Subcatchment PR11: Route 1A Acces</b>	Runoff Area=2,072 sf 65.73% Impervious Runoff Depth>4.53" Tc=6.0 min CN=78 Runoff=0.25 cfs 781 cf
<b>Subcatchment PR20: Parking Lot</b>	Runoff Area=11,907 sf 46.37% Impervious Runoff Depth>3.25" Tc=6.0 min CN=66 Runoff=1.02 cfs 3,223 cf
<b>Subcatchment PR21: Front Sidewalk and</b>	Runoff Area=6,116 sf 70.93% Impervious Runoff Depth>4.86" Tc=6.0 min CN=81 Runoff=0.77 cfs 2,475 cf
<b>Subcatchment PR22: Fire Station</b>	Runoff Area=8,665 sf 100.00% Impervious Runoff Depth>6.82" Tc=6.0 min CN=98 Runoff=1.35 cfs 4,922 cf
<b>Pond 3P: Cultec R-330HLXD</b>	Peak Elev=9.04' Storage=1,643 cf Inflow=1.02 cfs 3,223 cf Discarded=0.02 cfs 965 cf Primary=0.10 cfs 669 cf Outflow=0.12 cfs 1,634 cf
<b>Link DP-1: Route 1A CDS</b>	Inflow=0.28 cfs 947 cf Primary=0.28 cfs 947 cf
<b>Link DP-2: Lynway CDS</b>	Inflow=2.36 cfs 8,848 cf Primary=2.36 cfs 8,848 cf

**Total Runoff Area = 30,619 sf Runoff Volume = 12,349 cf Average Runoff Depth = 4.84"**  
**29.64% Pervious = 9,076 sf 70.36% Impervious = 21,543 sf**

**Summary for Subcatchment PR10: Western Site**

Runoff = 0.28 cfs @ 12.09 hrs, Volume= 947 cf, Depth> 6.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=7.06"

Area (sf)	CN	Description
202	39	>75% Grass cover, Good, HSG A
1,657	98	Paved parking, HSG A
1,859	92	Weighted Average
202		10.87% Pervious Area
1,657		89.13% Impervious Area

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

**Summary for Subcatchment PR11: Route 1A Acces**

Runoff = 0.25 cfs @ 12.09 hrs, Volume= 781 cf, Depth> 4.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=7.06"

Area (sf)	CN	Description
710	39	>75% Grass cover, Good, HSG A
1,362	98	Paved parking, HSG A
2,072	78	Weighted Average
710		34.27% Pervious Area
1,362		65.73% Impervious Area

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

**Summary for Subcatchment PR20: Parking Lot**

Runoff = 1.02 cfs @ 12.10 hrs, Volume= 3,223 cf, Depth> 3.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=7.06"

Area (sf)	CN	Description
6,386	39	>75% Grass cover, Good, HSG A
5,521	98	Paved parking, HSG A
11,907	66	Weighted Average
6,386		53.63% Pervious Area
5,521		46.37% Impervious Area



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Type III 24-hr 100-YR Rainfall=7.06"

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

**Summary for Subcatchment PR21: Front Sidewalk and Entrance**

Runoff = 0.77 cfs @ 12.09 hrs, Volume= 2,475 cf, Depth> 4.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=7.06"

Area (sf)	CN	Description
1,778	39	>75% Grass cover, Good, HSG A
4,338	98	Paved parking, HSG A
6,116	81	Weighted Average
1,778		29.07% Pervious Area
4,338		70.93% Impervious Area

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

**Summary for Subcatchment PR22: Fire Station**

Runoff = 1.35 cfs @ 12.09 hrs, Volume= 4,922 cf, Depth> 6.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=7.06"

Area (sf)	CN	Description
8,665	98	Roofs, HSG A
8,665		100.00% Impervious Area

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

**Summary for Pond 3P: Cultec R-330HLXD**

Inflow Area = 11,907 sf, 46.37% Impervious, Inflow Depth > 3.25" for 100-YR event  
 Inflow = 1.02 cfs @ 12.10 hrs, Volume= 3,223 cf  
 Outflow = 0.12 cfs @ 12.97 hrs, Volume= 1,634 cf, Atten= 88%, Lag= 52.6 min  
 Discarded = 0.02 cfs @ 10.75 hrs, Volume= 965 cf  
 Primary = 0.10 cfs @ 12.97 hrs, Volume= 669 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 9.04' @ 12.95 hrs Surf.Area= 809 sf Storage= 1,643 cf

Plug-Flow detention time= 243.6 min calculated for 1,631 cf (51% of inflow)  
 Center-of-Mass det. time= 125.0 min ( 963.7 - 838.7 )

Volume	Invert	Avail.Storage	Storage Description
#1A	6.00'	706 cf	<b>25.67'W x 31.50'L x 3.54'H Field A</b> 2,863 cf Overall - 1,099 cf Embedded = 1,764 cf x 40.0% Voids
#2A	6.50'	1,099 cf	<b>Cultec R-330XLHD x 20 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		1,805 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	6.00'	<b>1.030 in/hr Exfiltration over Surface area</b>
#2	Primary	6.00'	<b>6.0" Round Culvert</b> L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 6.00' / 5.00' S= 0.0100 ' / ' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.20 sf
#3	Device 2	9.00'	<b>4.0' long x 0.5' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

**Discarded OutFlow** Max=0.02 cfs @ 10.75 hrs HW=6.04' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.09 cfs @ 12.97 hrs HW=9.04' (Free Discharge)

↑ **2=Culvert** (Passes 0.09 cfs of 1.03 cfs potential flow)

↑ **3=Broad-Crested Rectangular Weir** (Weir Controls 0.09 cfs @ 0.56 fps)

### Summary for Link DP-1: Route 1A CDS

Inflow Area = 1,859 sf, 89.13% Impervious, Inflow Depth > 6.11" for 100-YR event  
 Inflow = 0.28 cfs @ 12.09 hrs, Volume= 947 cf  
 Primary = 0.28 cfs @ 12.09 hrs, Volume= 947 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

### Summary for Link DP-2: Lynway CDS

Inflow Area = 28,760 sf, 69.14% Impervious, Inflow Depth > 3.69" for 100-YR event  
 Inflow = 2.36 cfs @ 12.09 hrs, Volume= 8,848 cf  
 Primary = 2.36 cfs @ 12.09 hrs, Volume= 8,848 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

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*Type III 24-hr Custom Rainfall=6.50"*

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment PR10: Western Site</b>	Runoff Area=1,859 sf 89.13% Impervious Runoff Depth>5.56" Tc=6.0 min CN=92 Runoff=0.25 cfs 861 cf
<b>Subcatchment PR11: Route 1A Acces</b>	Runoff Area=2,072 sf 65.73% Impervious Runoff Depth>4.02" Tc=6.0 min CN=78 Runoff=0.22 cfs 694 cf
<b>Subcatchment PR20: Parking Lot</b>	Runoff Area=11,907 sf 46.37% Impervious Runoff Depth>2.81" Tc=6.0 min CN=66 Runoff=0.88 cfs 2,792 cf
<b>Subcatchment PR21: Front Sidewalk and</b>	Runoff Area=6,116 sf 70.93% Impervious Runoff Depth>4.34" Tc=6.0 min CN=81 Runoff=0.69 cfs 2,211 cf
<b>Subcatchment PR22: Fire Station</b>	Runoff Area=8,665 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=1.24 cfs 4,518 cf
<b>Pond 3P: Cultec R-330HLXD</b>	Peak Elev=9.02' Storage=1,636 cf Inflow=0.88 cfs 2,792 cf Discarded=0.02 cfs 945 cf Primary=0.04 cfs 286 cf Outflow=0.06 cfs 1,231 cf
<b>Link DP-1: Route 1A CDS</b>	Inflow=0.25 cfs 861 cf Primary=0.25 cfs 861 cf
<b>Link DP-2: Lynway CDS</b>	Inflow=2.15 cfs 7,710 cf Primary=2.15 cfs 7,710 cf

**Total Runoff Area = 30,619 sf Runoff Volume = 11,077 cf Average Runoff Depth = 4.34"**  
**29.64% Pervious = 9,076 sf 70.36% Impervious = 21,543 sf**

**Summary for Subcatchment PR10: Western Site**

Runoff = 0.25 cfs @ 12.09 hrs, Volume= 861 cf, Depth> 5.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr Custom Rainfall=6.50"

Area (sf)	CN	Description
202	39	>75% Grass cover, Good, HSG A
1,657	98	Paved parking, HSG A
1,859	92	Weighted Average
202		10.87% Pervious Area
1,657		89.13% Impervious Area

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

**Summary for Subcatchment PR11: Route 1A Acces**

Runoff = 0.22 cfs @ 12.09 hrs, Volume= 694 cf, Depth> 4.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr Custom Rainfall=6.50"

Area (sf)	CN	Description
710	39	>75% Grass cover, Good, HSG A
1,362	98	Paved parking, HSG A
2,072	78	Weighted Average
710		34.27% Pervious Area
1,362		65.73% Impervious Area

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

**Summary for Subcatchment PR20: Parking Lot**

Runoff = 0.88 cfs @ 12.10 hrs, Volume= 2,792 cf, Depth> 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr Custom Rainfall=6.50"

Area (sf)	CN	Description
6,386	39	>75% Grass cover, Good, HSG A
5,521	98	Paved parking, HSG A
11,907	66	Weighted Average
6,386		53.63% Pervious Area
5,521		46.37% Impervious Area

**19954B-PR - NOAA**

Prepared by Microsoft

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Type III 24-hr Custom Rainfall=6.50"

Printed 5/20/2022

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

**Summary for Subcatchment PR21: Front Sidewalk and Entrance**

Runoff = 0.69 cfs @ 12.09 hrs, Volume= 2,211 cf, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr Custom Rainfall=6.50"

Area (sf)	CN	Description
1,778	39	>75% Grass cover, Good, HSG A
4,338	98	Paved parking, HSG A
6,116	81	Weighted Average
1,778		29.07% Pervious Area
4,338		70.93% Impervious Area

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

**Summary for Subcatchment PR22: Fire Station**

Runoff = 1.24 cfs @ 12.09 hrs, Volume= 4,518 cf, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr Custom Rainfall=6.50"

Area (sf)	CN	Description
8,665	98	Roofs, HSG A
8,665		100.00% Impervious Area

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

**Summary for Pond 3P: Cultec R-330HLXD**

Inflow Area = 11,907 sf, 46.37% Impervious, Inflow Depth > 2.81" for Custom event  
 Inflow = 0.88 cfs @ 12.10 hrs, Volume= 2,792 cf  
 Outflow = 0.06 cfs @ 14.15 hrs, Volume= 1,231 cf, Atten= 93%, Lag= 123.5 min  
 Discarded = 0.02 cfs @ 11.00 hrs, Volume= 945 cf  
 Primary = 0.04 cfs @ 14.15 hrs, Volume= 286 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 9.02' @ 14.15 hrs Surf.Area= 809 sf Storage= 1,636 cf

Plug-Flow detention time= 289.5 min calculated for 1,231 cf (44% of inflow)  
 Center-of-Mass det. time= 164.4 min ( 1,007.3 - 842.9 )

Volume	Invert	Avail.Storage	Storage Description
#1A	6.00'	706 cf	<b>25.67'W x 31.50'L x 3.54'H Field A</b> 2,863 cf Overall - 1,099 cf Embedded = 1,764 cf x 40.0% Voids
#2A	6.50'	1,099 cf	<b>Cultec R-330XLHD x 20 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
		1,805 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	6.00'	<b>1.030 in/hr Exfiltration over Surface area</b>
#2	Primary	6.00'	<b>6.0" Round Culvert</b> L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 6.00' / 5.00' S= 0.0100 ' / ' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.20 sf
#3	Device 2	9.00'	<b>4.0' long x 0.5' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

**Discarded OutFlow** Max=0.02 cfs @ 11.00 hrs HW=6.04' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.03 cfs @ 14.15 hrs HW=9.02' (Free Discharge)

↑ **2=Culvert** (Passes 0.03 cfs of 1.03 cfs potential flow)

↑ **3=Broad-Crested Rectangular Weir** (Weir Controls 0.03 cfs @ 0.41 fps)

### Summary for Link DP-1: Route 1A CDS

Inflow Area = 1,859 sf, 89.13% Impervious, Inflow Depth > 5.56" for Custom event  
 Inflow = 0.25 cfs @ 12.09 hrs, Volume= 861 cf  
 Primary = 0.25 cfs @ 12.09 hrs, Volume= 861 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

### Summary for Link DP-2: Lynway CDS

Inflow Area = 28,760 sf, 69.14% Impervious, Inflow Depth > 3.22" for Custom event  
 Inflow = 2.15 cfs @ 12.09 hrs, Volume= 7,710 cf  
 Primary = 2.15 cfs @ 12.09 hrs, Volume= 7,710 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

## *Standard 4*

*Long Term Pollution Prevention Plan &  
Operation and Maintenance Plan*



## **ALDEN MILLS FIRE STATION**

### **LONG TERM POLLUTION PREVENTION AND OPERATION AND MAINTENANCE PLAN**

As required by Standards 4 and 9 of the Storm Water Management Handbook, this Long-Term Pollution Prevention and Operation and Maintenance Plan have been developed for source control and pollution prevention at the site after construction.

#### **MAINTENANCE RESPONSIBILITY**

The responsibility of the Long-Term Pollution Prevention and Operation and Maintenance Plan will be the responsibility of the Owner.

#### **GOOD HOUSEKEEPING PRACTICES**

The site to be kept clean of trash and debris at all times. Trash, junk, etc. is not to be left outside and will be subject to removal at the owner's expense.

#### **REQUIREMENTS FOR ROUTINE INSPECTIONS AND MAINTENANCE OF STORM WATER BMPs**

All storm water BMPs are to be inspected and maintained as follows:

##### ***Deep Sump Hooded Catch Basins***

Regular maintenance is essential. Deep sump catch basins remain effective at removing pollutants only if they are cleaned out regularly. Inspect at least four times per year and at the end of the foliage and snow removal seasons. Sediments shall be removed two times per year or whenever the depth of the deposits in the catch basin sump is greater than or equal to one foot from the bottom of the basin.

##### ***Contech Subsurface Infiltration Basin***

Infiltration basins dispose of water by holding it in an area where it can soak into the ground and when the water gets to specific elevations they will discharge via piping or overflow and similar to structural BMPs they regular maintenance. Outlets shall be inspected monthly for the first year and then spring and fall following the first year, each time after rainstorms.

##### ***STC 450i Stormceptor***

The Stormceptor STC targets hydrocarbons and total suspended solids (TSS) in stormwater runoff. It improves water quality by removing contaminants through the gravitational settling of fine sediments and floatation of hydrocarbons while preventing the re-suspension or scour of previously captured pollutants. Stormceptor shall be inspected monthly and maintained quarterly or as necessary.

## **PROVISIONS FOR MAINTENANCE OF LAWNS, GARDENS AND OTHER LANDSCAPE AREAS**

Proper maintenance of vegetated areas can prevent the pollution of stormwater runoff by controlling the source of pollutants such as suspended sediments, excess nutrients, and chemicals from landscape care products. Practices that should be followed under the regular maintenance of the vegetated landscape include:

- Inspect planted areas on a semi-annual basis and remove any litter.
- Maintain planted areas adjacent to pavement to prevent soil washout.
- Immediately clean any soil deposited on pavement.
- Re-seed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming.
- Plant alternative mixture of grass species in the event of unsuccessful establishment.
- The grass vegetation should be cut to a height between three and four inches.
- Pesticide/Herbicide Usage – No pesticides are to be used unless a single spot treatment is required for a specific control application.
- Fertilizer usage should be avoided. If deemed necessary, slow release fertilizer should be used. Fertilizer may be used to begin the establishment of vegetation in bare or damaged areas, but should not be applied on a regular basis unless necessary.
- Fertilizers shall be phosphorous free

## **SNOW DISPOSAL AND PLOWING**

The purpose of the snow and snowmelt management plan is to provide guidelines regarding snow disposal site selection, site preparation and maintenance that are acceptable to the Department of Environmental Protection. For the areas that require snow removal, snow storage onsite will largely be accomplished by using pervious upland areas along the shoulder of the roadway as windrowed by plows. No snow shall be pushed into the detention ponds. Any excess snow will be trucked off-site.

- Avoid dumping of snow into any water body, including coastal, rivers, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.
- Avoid disposing of snow on top of storm drain catch basins or in storm water basins. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.

## **SALT AND DEICING CHEMICALS**

The amount of salt and deicing chemicals to be used on the site shall be reduced to the minimum amount needed to provide safe pedestrian and vehicular travel. The following practices should be followed to control the amount of salt and deicing materials that come into contact with stormwater runoff:

- Devices used for spreading salt and deicing chemicals should be capable of varying the rate of application based on the site specific conditions.

- Sand and salt should be stockpiled under covered storage facilities that prevent precipitation and adjacent runoff from coming in contact with the deicing materials

### **STREET SWEEPING SCHEDULES**

There are three types of sweepers: Mechanical, Regenerative Air and Vacuum Filter.

1. Mechanical – Mechanical sweepers use brooms or rotary brushes to scour the pavement.
2. Regenerative Air – These sweepers blow air onto the road or parking lot surface, causing fines to rise where they are vacuumed.
3. Vacuum Filter – These sweepers remove fines along roads. Two general types of vacuum filter sweepers are available – wet and dry. The dry type uses a broom in combination with the vacuum. The wet type uses water for dust suppression.

Regardless of the type chosen, the efficiency of street sweeping is increased when sweepers are operated in tandem.

This project has not included street sweeping as part of the TSS removal calculations. However, it is recommended that street sweeping of the parking areas occur four times a year, including once after the spring snow melt.

### **REUSE AND DISPOSAL OF STREET SWEEPINGS**

Once removed from paved surfaces, the sweepings must be handled and disposed of properly. Mass DEP's Bureau of Waste Prevention has issued a written policy regarding the reuse and disposal of street sweepings. These sweepings are regulated as a solid waste, and can be used in three ways:

- In one of the ways already approved by Mass DEP (e.g., daily cover in a landfill, additive to compost, fill in a public way)
- If approved under a Beneficial Use Determination
- Disposed in a landfill

### **TRAINING OF STAFF OR PERSONNEL INVOLVED WITH IMPLEMENTING LONG-TERM POLLUTION PREVENTION PLAN**

The Long-Term Pollution Prevention Plan is to be implemented by property owner of the site. Trained and, if required, licensed Professionals are to be hired by the owner as applicable to implement the Long-Term Pollution Prevention Plan.

### **LIST OF EMERGENCY CONTACTS FOR IMPLEMENTING LONG-TERM POLLUTION PREVENTION PLAN**

The Owner will be required to maintain an updated list of Emergency Contacts for the site. This list will be provided during construction.

**POST CONSTRUCTION PHASE INSPECTION SCHEDULE AND EVALUATION CHECKLIST**

<b>Inspection Date</b>	<b>Inspector</b>	<b>BMP Inspected</b>	<b>Inspection Frequency Requirements</b>	<b>Comments</b>	<b>Recommendation</b>	<b>Follow-up Inspection Required (yes/no)</b>
		<b>Catch Basins</b>	<b>Monthly</b>			
		<b>Infiltration Basin</b>	<b>Monthly First Year Spring/Fall After</b>			
		<b>STC 450i Stormceptor</b>	<b>Four Times a Year</b>			

1. Refer to Massachusetts Stormwater Handbook Volume Two: Technical Handbook (February 2008) for recommendations regarding frequency for inspections and maintenance of specific BMP's.
2. Inspections to be conducted by a qualified professional such as an environmental scientists or civil engineer.
3. Limited or no use of sodium chloride salts, fertilizers or pesticides recommended.

Other Notes: (Include deviations from Conservation Commission Approvals, Planning Board Approvals and Approved Plans)

## *Water Quality Volume*

**Required Water Quality Volume**

Imp Area = 21,542 sf

Runoff Depth= 0.5 in

WQV = Impervious Area x Runoff Depth = 83,407 sf x 1/2 in x (1 ft/12 in)

WQV = 898 cf

**Provided Water Quality Volume**

WQV = 1,630 cf (Volume below lowest orifice for surface infiltration basin)

Imp Area = 24,081 sf

Runoff Depth= 0.1

WQV = Impervious Area x Runoff Depth = 83,407 sf x 1 in x (1 ft/12 in)

WQV = 201 cf

**Total Suspended Solid (TSS Removal) Worksheets**

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: PR11 - Route 1A Access

TSS Removal  
Calculation Worksheet

A BMP <sup>1</sup>	B TSS Removal Rate <sup>1</sup>	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Stormceptor 450i (WQU 107)	0.97	1.00	0.97	0.03

Total TSS Removal =

97%

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

Project: Alden Fire Station  
Prepared By: CG  
Date: 3/15/2022

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



## INSTRUCTIONS:

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

Version 1, Automated: Mar. 4, 2008

Location: P20 - Parking Lot

TSS Removal Calculation Worksheet	B	C	D	E	F
	BMP <sup>1</sup>	TSS Removal Rate <sup>1</sup>	Starting TSS Load*	Amount Removed (C*D)	Remaining Load (D-E)
	Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
	Infiltration Basin	0.80	0.75	0.60	0.15
		0.00	0.15	0.00	0.15
		0.00	0.15	0.00	0.15
		0.00	0.15	0.00	0.15

Total TSS Removal =

85%

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

Project: ALDEN A. MILLS FIRE STATION

Prepared By: CG

Date: 5/16/2022

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

## *Stormceptor Sizing Report*

## Brief Stormceptor Sizing Report - WQU 107

Project Information & Location			
Project Name	Alden FS	Project Number	49538
City	REVERE	State/ Province	Massachusetts
Country	United States of America	Date	5/20/2022
Designer Information		EOR Information (optional)	
Name	William Gosine	Name	
Company	Brennan Consultants	Company	
Phone #	603-494-6676	Phone #	
Email	wgosine@gmail.com	Email	

### Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	WQU 107
Target TSS Removal (%)	80
TSS Removal (%) Provided	97
Recommended Stormceptor Model	STC 450i

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary		
Stormceptor Model	% TSS Removal Provided	% Runoff Volume Captured Provided
STC 450i	97	100
STC 900	99	100
STC 1200	99	100
STC 1800	99	100
STC 2400	99	100
STC 3600	99	100
STC 4800	99	100
STC 6000	99	100
STC 7200	100	100
STC 11000	100	100
STC 13000	100	100
STC 16000	100	100

Sizing Details			
Drainage Area		Water Quality Objective	
Total Area (acres)	0.05	TSS Removal (%)	80.0
Imperviousness %	66.0	Runoff Volume Capture (%)	100.00
Rainfall		Oil Spill Capture Volume (Gal)	
Station Name	BOSTON WSFO AP	Peak Conveyed Flow Rate (CFS)	0.20
State/Province	Massachusetts	Water Quality Flow Rate (CFS)	0.04
Station ID #	0770	Up Stream Storage	
Years of Records	58	Storage (ac-ft)	Discharge (cfs)
Latitude	42°21'38"N	0.000	0.000
Longitude	71°0'38"W	Up Stream Flow Diversion	
		Max. Flow to Stormceptor (cfs)	

Particle Size Distribution (PSD) The selected PSD defines TSS removal		
Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Notes
<ul style="list-style-type: none"> <li>Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.</li> <li>Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.</li> <li>For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.</li> </ul>

For Stormceptor Specifications and Drawings Please Visit:  
<https://www.conteches.com/technical-guides/search?filter=1WBC005EYX>

## *Standard 9*

## *Operation and Maintenance Log*

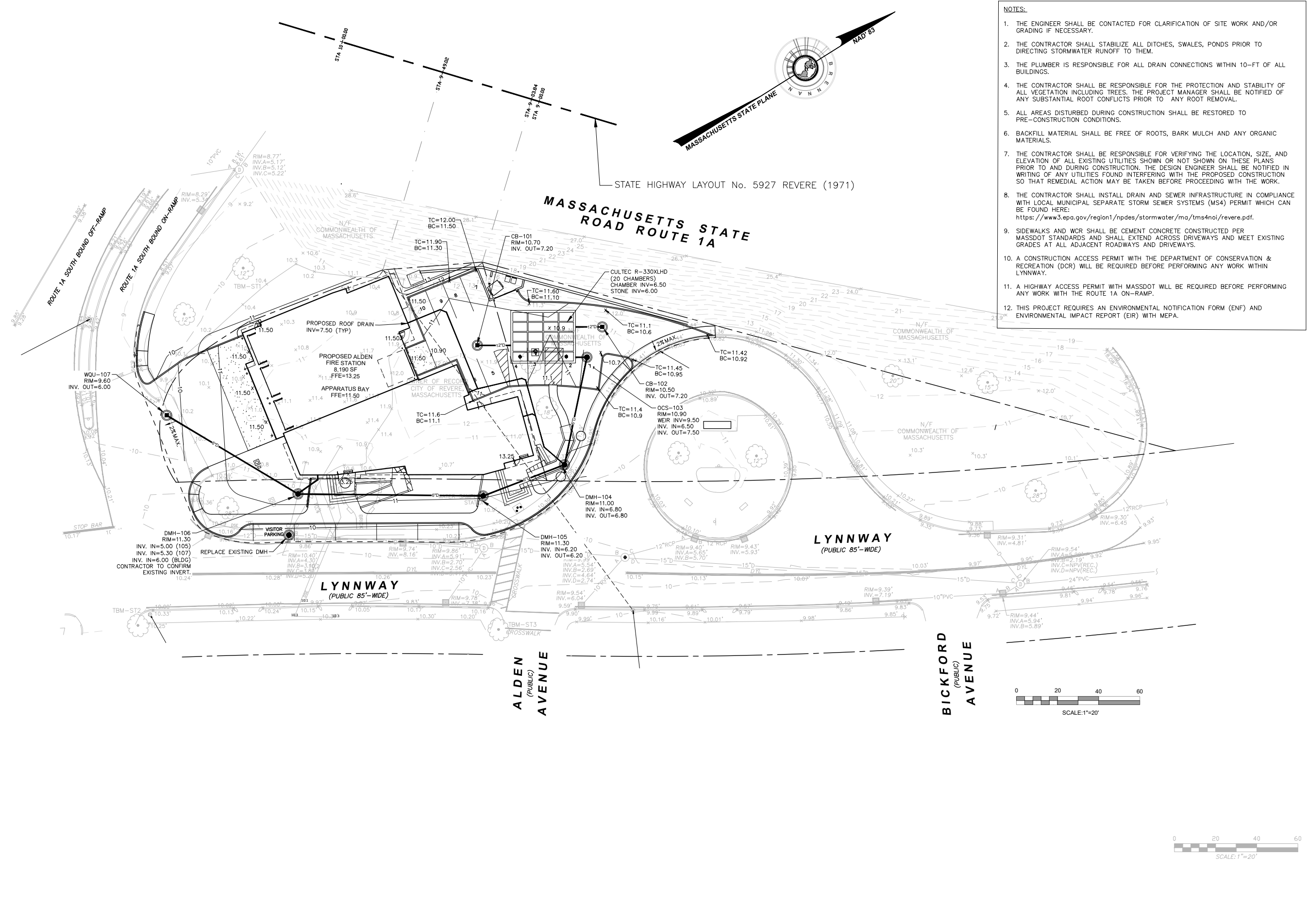
## Drainage Operation and Maintenance Log

Site Maintenance Supervisor: \_\_\_\_\_ Date: \_\_\_\_\_  
 Routine     $\Delta$  Response to Rainfall Event \_\_\_\_ in  $\Delta$  Other \_\_\_\_\_

BMP	Frequency	Date Performed	Comments
Catch Basins and Drain Manholes	Monthly Inspections		
	Maintenance Quarterly and as necessary		
Stormceptor STC450i	Monthly for first 3 months/Bi-annually after		
	Maintenance Quarterly and as necessary		
Pavement Areas (parking, driveways, service areas)	Monthly Sweeping		
	Trash & Litter Removal as necessary		
Landscaped & Vegetated Areas	Maintenance as necessary		
Cultec Infiltration System*	Monthly (First Year)		
	Bi-Annual Inspections		

Inspection Form

\*Inspect infiltration basin after each 1" rainfall for the first 3 months after construction.



- NOTES:
1. THE ENGINEER SHALL BE CONTACTED FOR CLARIFICATION OF SITE WORK AND/OR GRADING IF NECESSARY.
  2. THE CONTRACTOR SHALL STABILIZE ALL DITCHES, SWALES, PONDS PRIOR TO DIRECTING STORMWATER RUNOFF TO THEM.
  3. THE PLUMBER IS RESPONSIBLE FOR ALL DRAIN CONNECTIONS WITHIN 10-FT OF ALL BUILDINGS.
  4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION AND STABILITY OF ALL VEGETATION INCLUDING TREES. THE PROJECT MANAGER SHALL BE NOTIFIED OF ANY SUBSTANTIAL ROOT CONFLICTS PRIOR TO ANY ROOT REMOVAL.
  5. ALL AREAS DISTURBED DURING CONSTRUCTION SHALL BE RESTORED TO PRE-CONSTRUCTION CONDITIONS.
  6. BACKFILL MATERIAL SHALL BE FREE OF ROOTS, BARK MULCH AND ANY ORGANIC MATERIALS.
  7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION, SIZE, AND ELEVATION OF ALL EXISTING UTILITIES SHOWN OR NOT SHOWN ON THESE PLANS PRIOR TO AND DURING CONSTRUCTION. THE DESIGN ENGINEER SHALL BE NOTIFIED IN WRITING OF ANY UTILITIES FOUND INTERFERING WITH THE PROPOSED CONSTRUCTION SO THAT REMEDIAL ACTION MAY BE TAKEN BEFORE PROCEEDING WITH THE WORK.
  8. THE CONTRACTOR SHALL INSTALL DRAIN AND SEWER INFRASTRUCTURE IN COMPLIANCE WITH LOCAL MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4) PERMIT WHICH CAN BE FOUND HERE:  
<https://www3.epa.gov/region1/npdes/stormwater/ma/tms4noi/revere.pdf>.
  9. SIDEWALKS AND WCR SHALL BE CEMENT CONCRETE CONSTRUCTED PER MASSDOT STANDARDS AND SHALL EXTEND ACROSS DRIVEWAYS AND MEET EXISTING GRADES AT ALL ADJACENT ROADWAYS AND DRIVEWAYS.
  10. A CONSTRUCTION ACCESS PERMIT WITH THE DEPARTMENT OF CONSERVATION & RECREATION (DCR) WILL BE REQUIRED BEFORE PERFORMING ANY WORK WITHIN LYNNWAY.
  11. A HIGHWAY ACCESS PERMIT WITH MASSDOT WILL BE REQUIRED BEFORE PERFORMING ANY WORK WITH THE ROUTE 1A ON-RAMP.
  12. THIS PROJECT REQUIRES AN ENVIRONMENTAL NOTIFICATION FORM (ENF) AND ENVIRONMENTAL IMPACT REPORT (EIR) WITH MEPA.

GRADING AND DRAINAGE PLAN  
LOCATED IN  
140 LYNNWAY  
REVERE, MA  
PREPARED FOR  
WINTER STREET ARCHITECTS

SCALE: 1" = 20'  
DATE: 4-13-2021

**Brennan Consulting**  
ENGINEERING • TRANSPORTATION • SURVEYING  
24 RAY AVENUE, BURLINGTON, MA  
PHONE: (781) 273-3434 FAX: (781) 273-3430

REVISIONS			
NO.	DATE	DESCRIPTION	BY

CHECKED BY: CE  
DRAWN BY: CG  
PROJECT 19954B

C-04



## *Stormceptor Maintenance Guide*

## **Stormceptor® STC**

### **Inspection and Maintenance Information**

#### **Stormceptor® Inspection and Maintenance**

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and are required to insure proper functioning of the Stormceptor System. Both inspection and maintenance of the Stormceptor system is easily performed from the surface. Stormceptor's patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

#### ***When is inspection needed?***

- Post-construction inspection is required prior to putting the Stormceptor System into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Specifically for New Jersey installations, regulations require all BMPs to be inspected a minimum four times per year and after every storm with greater than one inch of rainfall.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after an oil, fuel or other chemical spill.

#### ***When is maintenance cleaning needed?***

- For optimum performance, the unit should be cleaned out once the sediment depth reaches 15% of the unit's total storage capacity (see Table 1). Generally, the minimum cleaning frequency is once annually, although the frequency can be based on historical inspection results.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

Table 1

<b>Sediment Maintenance Depth* and Oil Capacity</b>		
<b>STC Model</b>	<b>Sediment Depth* (inches)</b>	<b>Oil Capacity (gallons)</b>
450i	8	86
900	8	251
1200	10	251
1800	15	251
2400	12	840

3600	17	840
4800	15	909
6000	18	909
7200	15	1059
11000	17	2797
13000	20	2797
16000	17	3055
* based on 15% of the lower chamber volume		

***What conditions can compromise the Stormceptor System performance?***

- If the system is not maintained regularly and fills with sediment and debris beyond the capacity indicated in Table 1, sediment removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur in the system and removal efficiency of sediment and hydrocarbons may be reduced.

***What training is required?***

The Stormceptor System is inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins. For typical inspection and maintenance activities, no specific supplemental training is required for the Stormceptor System. Information provided in this document or the Stormceptor Operation and Maintenance Manual (provided to the system owner) contains sufficient guidance to maintain the system properly.

In unusual circumstances, such as if a damaged component needs replacement or some other condition requires manned entry into the vessel, confined space entry procedures must be followed. Only professional maintenance service providers trained in these procedures should enter the vessel. Service provider companies typically have personnel who are trained and certified in confined space entry procedures according to local, state, and federal standards.

***What equipment is typically required for inspection?***

- Manhole access cover lifting tool
- Oil dipstick
- Sediment probe
- Flashlight
- Camera
- Data log
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

***How is the Stormceptor System inspected?***

- The Stormceptor System can be inspected through a standard surface manhole

access cover.

- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick. Oil depth is measured through the oil inspection port. Sediment depth can be measured through the oil inspection port or exit riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

***What equipment is typically required for maintenance?***

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick
- Sediment probe
- Flashlight
- Camera
- Data log
- Safety cones and caution tape
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required

***How is the Stormceptor System maintained?***

- The Stormceptor System can be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
- For 6-ft diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch outlet riser pipe.
- For 4-ft diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch drop tee hole.
- Using the vacuum hose, decant the water from the lower chamber to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank.
- Remove the sludge from the bottom of the unit using the vacuum hose.
- Re-fill the lower chamber with water where required by the local jurisdiction.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using proper confined space entry procedures.

***What is required for proper disposal?***

- Disposal requirements for recovered pollutants may vary depending on local guidelines. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.

### ***What about oil spills?***

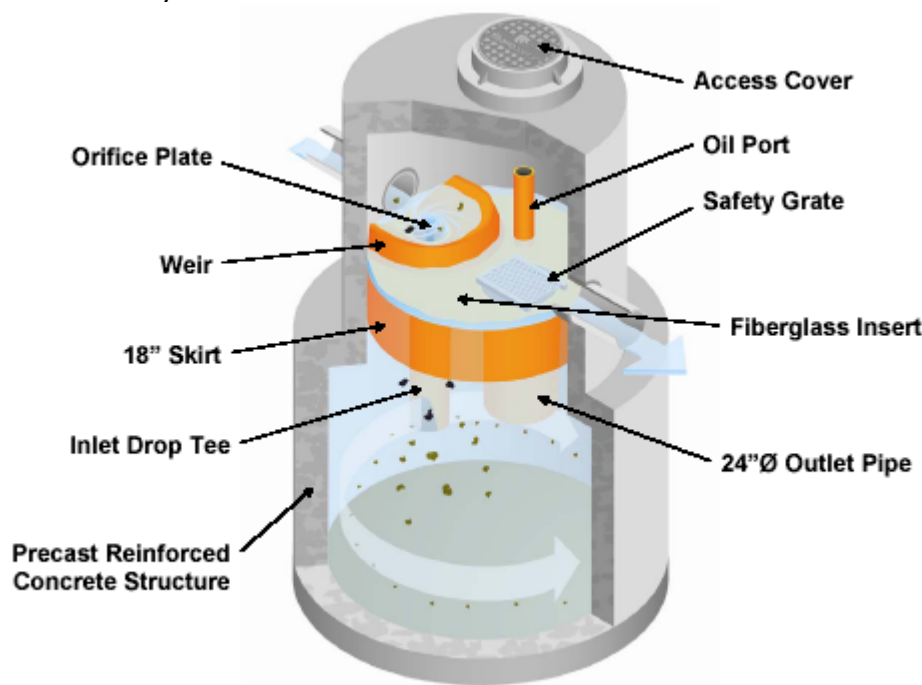
- Petroleum-based pollutants captured by the Stormceptor system (oil/chemical/fuel spills) should be removed and disposed of by a licensed waste management company.
- Although Stormceptor captures virtually all free oil, a sheen at the outlet **does not** mean the unit isn't working. A rainbow or sheen can be visible at oil concentrations of less than 10 mg/L (ppm).

### ***What factors affect the costs involved with inspection/maintenance?***

- Inspection and maintenance costs are based on unit size, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

### ***System schematic and component functions***

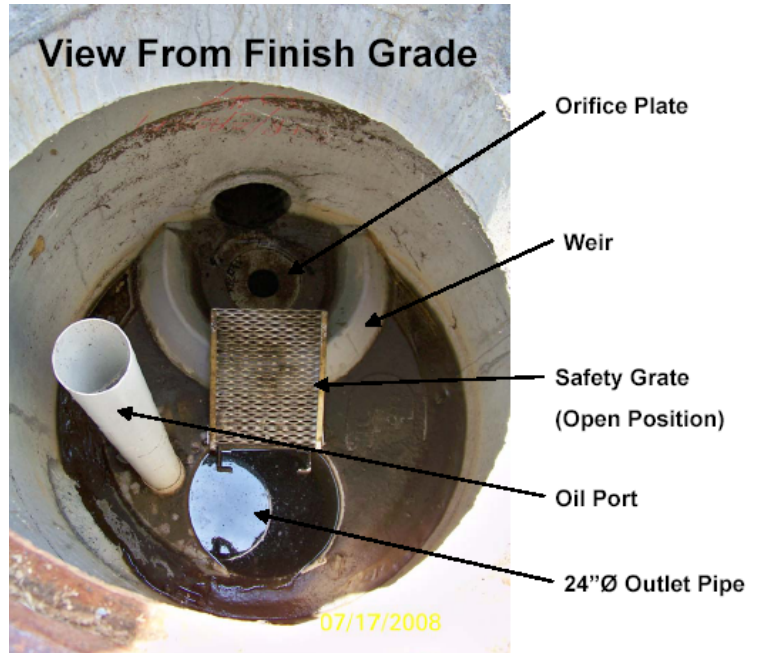
Below is a schematic of the Stormceptor System with key components identified and their functions briefly described.



- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel's watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower treatment chamber
- **Orifice plate** – controls water flow rate into the lower treatment chamber and prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower treatment chamber and splits flow into two opposite tangential streams
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vector access port for sediment removal

- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

The Stormceptor System has no moving parts to wear out and therefore maintenance activities are generally focused on pollutant removal.



The depth of sediment can be measured from the surface by using a sediment probe or dipstick tube equipped with a ball check valve and inserted through the 24-inch outlet riser pipe. Oil level can similarly be checked through the oil inspection port.



A maintenance worker stationed on the surface uses a vacuum hose to evacuate water, sediment, and debris from the system.

***Purchasing replacement parts***

Since there are no moving parts in the Stormceptor System, broken, damaged, or worn parts are not typically encountered. However, if replacement parts are necessary, they may be obtained by contacting the following supplier of authentic Stormceptor components.

In New Jersey, contact:

Camtek Construction Products Corp.  
3481 Treeline Drive  
Murrysville, PA 15668  
Phone: (724) 327-3400

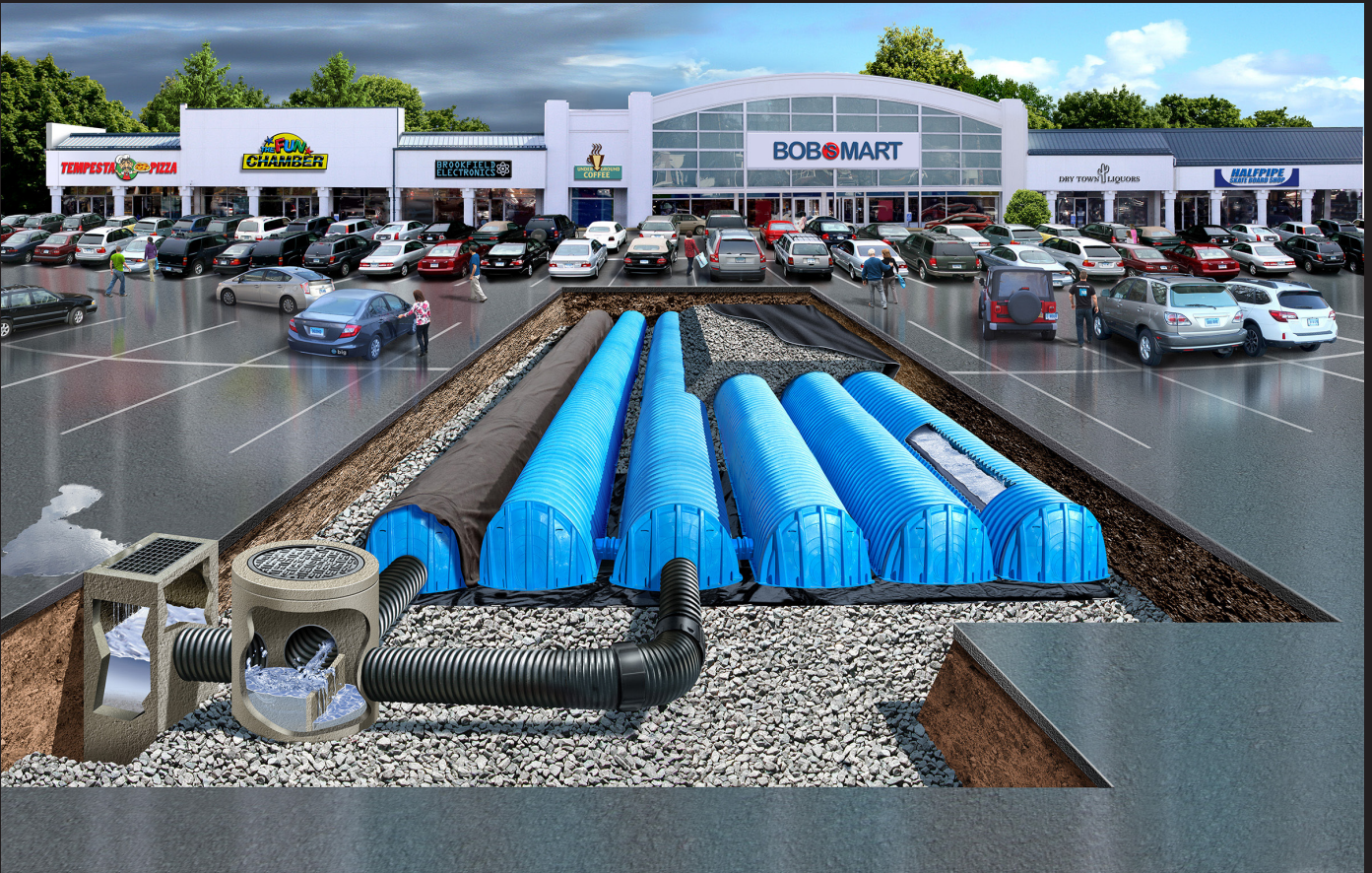
The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor's long and effective service life.

## *Cultec Maintenance Guide*



# CONTACTOR® & RECHARGER®

## STORMWATER MANAGEMENT SOLUTIONS



## OPERATION & MAINTENANCE GUIDELINES FOR CULTEC STORMWATER MANAGEMENT SYSTEMS



STORMWATER MANAGEMENT SOLUTIONS



# OPERATIONS AND MAINTENANCE GUIDELINES

## Published by

**CULTEC, Inc.**

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Brookfield, Connecticut 06804 USA

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U.S. Patents 6,129,482; 6,322,288; 6,854,925; 7,226,241; 7,806,627; 8,366,346; 8,425,148; U.S. Designs D613,819; D638,095; D668,318; Canadian Patent 2,450,565; 2,591,255; Canadian Designs 129144; 135983; 159073; 160977; and/or other U.S. or Foreign Patent(s) or Patent(s) Pending.

## Contact Information:

For general information on our other products and services, please contact our offices within the United States at (800)428-5832, (203)775-4416 ext. 202, or e-mail us at [custservice@cultec.com](mailto:custservice@cultec.com).

For technical support, please call (203)775-4416 ext. 203 or e-mail [tech@cultec.com](mailto:tech@cultec.com).

Visit [www.cultec.com/downloads.html](http://www.cultec.com/downloads.html) for Product Downloads and CAD details.

Doc ID: CLT057 01-20

January 2020

*These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC.  
All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings.  
Actual designs may vary.*

*This manual contains guidelines recommended by CULTEC, Inc. and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.*

## Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

## Operation and Maintenance Requirements

### I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

### II. Inspection and Maintenance Options

- A. The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pretreatment device). CCTV inspection of this row can be deployed through this access port to determine if any sediment has accumulated in the inlet row.
- B. If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.
  1. **Manhole Access**

This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.



## 2. StormFilter Access

Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

- C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

## III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

- A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.
- B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.
- C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.
- D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

## IV. Suggested Maintenance Schedules

### A. Minor Maintenance

The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

Frequency	Action
Monthly in first year	Check inlets and outlets for clogging and remove any debris, as required.
Spring and Fall	Check inlets and outlets for clogging and remove any debris, as required.
One year after commissioning and every third year following	Check inlets and outlets for clogging and remove any debris, as required.

### B. Major Maintenance

The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

	Frequency	Action
Inlets and Outlets	Every 3 years	<ul style="list-style-type: none"> <li>Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.</li> </ul>
	Spring and Fall	<ul style="list-style-type: none"> <li>Check inlet and outlets for clogging and remove any debris as required.</li> </ul>
CULTEC Stormwater Chambers	2 years after commissioning	<ul style="list-style-type: none"> <li>Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique.</li> <li>Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.</li> </ul>
	9 years after commissioning every 9 years following	<ul style="list-style-type: none"> <li>Clean stormwater management chambers and feed connectors of any debris.</li> <li>Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique.</li> <li>Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.</li> </ul>
	45 years after commissioning	<ul style="list-style-type: none"> <li>Clean stormwater management chambers and feed connectors of any debris.</li> <li>Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required.</li> <li>Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique.</li> <li>Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection.</li> <li>Attain the appropriate approvals as required.</li> <li>Establish a new operation and maintenance schedule.</li> </ul>
Surrounding Site	Monthly in 1 <sup>st</sup> year	<ul style="list-style-type: none"> <li>Check for depressions in areas over and surrounding the stormwater management system.</li> </ul>
	Spring and Fall	<ul style="list-style-type: none"> <li>Check for depressions in areas over and surrounding the stormwater management system.</li> </ul>
	Yearly	<ul style="list-style-type: none"> <li>Confirm that no unauthorized modifications have been performed to the site.</li> </ul>

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC, Inc. at 1-800-428-5832.

# WQMP

## Operation & Maintenance (O&M) Plan

Project Name: \_\_\_\_\_

### Prepared for:

Project Name: \_\_\_\_\_

Address: \_\_\_\_\_

City, State Zip: \_\_\_\_\_

### Prepared on:

Date: \_\_\_\_\_

This O&M Plan describes the designated responsible party for implementation of this WQMP, including: operation and maintenance of all the structural BMP(s), conducting the training/educational program and duties, and any other necessary activities. The O&M Plan includes detailed inspection and maintenance requirements for all structural BMPs, including copies of any maintenance contract agreements, manufacturer's maintenance requirements, permits, etc.

## 8.1.1 Project Information

Project name	
Address	
City, State Zip	
Site size	
List of structural BMPs, number of each	
Other notes	

## 8.1.2 Responsible Party

The responsible party for implementation of this WQMP is:

Name of Person or HOA Property Manager	
Address	
City, State Zip	
Phone number	
24-Hour Emergency Contact number	
Email	

## 8.1.3 Record Keeping

Parties responsible for the O&M plan shall retain records for at least 5 years.

All training and educational activities and BMP operation and maintenance shall be documented to verify compliance with this O&M Plan. A sample Training Log and Inspection and Maintenance Log are included in this document.

## 8.1.4 Electronic Data Submittal

This document along with the Site Plan and Attachments shall be provided in PDF format. AutoCAD files and/or GIS coordinates of BMPs shall also be submitted to the City.

## Appendix \_\_\_\_

### **BMP SITE PLAN**

Site plan is preferred on minimum 11" by 17" colored sheets, as long as legible.



## BMP OPERATION & MAINTENANCE LOG

Project Name: \_\_\_\_\_

Today's Date: \_\_\_\_\_

Name of Person Performing Activity (Printed): \_\_\_\_\_

Signature: \_\_\_\_\_

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

## Minor Maintenance

Frequency		Action
<b>Monthly in first year</b>		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
<input type="checkbox"/> Month 1	Date:	
<input type="checkbox"/> Month 2	Date:	
<input type="checkbox"/> Month 3	Date:	
<input type="checkbox"/> Month 4	Date:	
<input type="checkbox"/> Month 5	Date:	
<input type="checkbox"/> Month 6	Date:	
<input type="checkbox"/> Month 7	Date:	
<input type="checkbox"/> Month 8	Date:	
<input type="checkbox"/> Month 9	Date:	
<input type="checkbox"/> Month 10	Date:	
<input type="checkbox"/> Month 11	Date:	
<input type="checkbox"/> Month 12	Date:	
<b>Spring and Fall</b>		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<b>One year after commissioning and every third year following</b>		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
<input type="checkbox"/> Year 1	Date:	
<input type="checkbox"/> Year 4	Date:	
<input type="checkbox"/> Year 7	Date:	
<input type="checkbox"/> Year 10	Date:	
<input type="checkbox"/> Year 13	Date:	
<input type="checkbox"/> Year 16	Date:	
<input type="checkbox"/> Year 19	Date:	
<input type="checkbox"/> Year 22	Date:	

## Major Maintenance

	Frequency	Action
<b>Inlets and Outlets</b>	<b>Every 3 years</b>	Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
		Notes
	<input type="checkbox"/> Year 1	Date:
	<input type="checkbox"/> Year 4	Date:
	<input type="checkbox"/> Year 7	Date:
	<input type="checkbox"/> Year 10	Date:
	<input type="checkbox"/> Year 13	Date:
	<input type="checkbox"/> Year 16	Date:
	<input type="checkbox"/> Year 19	Date:
	<input type="checkbox"/> Year 22	Date:
	<b>Spring and Fall</b>	Check inlet and outlets for clogging and remove any debris, as required.
		Notes
	<input type="checkbox"/> Spring	Date:
	<input type="checkbox"/> Fall	Date:
	<input type="checkbox"/> Spring	Date:
	<input type="checkbox"/> Fall	Date:
	<input type="checkbox"/> Spring	Date:
	<input type="checkbox"/> Fall	Date:
	<input type="checkbox"/> Spring	Date:
	<input type="checkbox"/> Fall	Date:
	<input type="checkbox"/> Spring	Date:
	<input type="checkbox"/> Fall	Date:
<b>CULTEC Stormwater Chambers</b>	<b>2 years after commissioning</b>	<input type="checkbox"/> Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. <input type="checkbox"/> Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
		Notes
	<input type="checkbox"/> Year 2	Date:

## Major Maintenance

Frequency		Action
CULTEC Stormwater Chambers	<b>9 years after commissioning every 9 years following</b>	<input type="checkbox"/> Clean stormwater management chambers and feed connectors of any debris.  <input type="checkbox"/> Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique.  <input type="checkbox"/> Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
	Notes	
	<input type="checkbox"/> Year 9	Date:
	<input type="checkbox"/> Year 18	Date:
	<input type="checkbox"/> Year 27	Date:
	<input type="checkbox"/> Year 36	Date:
	<b>45 years after commissioning</b>	<input type="checkbox"/> Clean stormwater management chambers and feed connectors of any debris.  <input type="checkbox"/> Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required.  <input type="checkbox"/> Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique.  <input type="checkbox"/> Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection.  <input type="checkbox"/> Attain the appropriate approvals as required.  <input type="checkbox"/> Establish a new operation and maintenance schedule.
	Notes	
	<input type="checkbox"/> Year 45	Date:

## Major Maintenance

Frequency		Action	
Surrounding Site	<b>Monthly in 1<sup>st</sup> year</b>		
	<input type="checkbox"/> Check for depressions in areas over and surrounding the stormwater management system.		
	Notes		
	<input type="checkbox"/> Month 1	Date:	
	<input type="checkbox"/> Month 2	Date:	
	<input type="checkbox"/> Month 3	Date:	
	<input type="checkbox"/> Month 4	Date:	
	<input type="checkbox"/> Month 5	Date:	
	<input type="checkbox"/> Month 6	Date:	
	<input type="checkbox"/> Month 7	Date:	
	<input type="checkbox"/> Month 8	Date:	
	<input type="checkbox"/> Month 9	Date:	
	<input type="checkbox"/> Month 10	Date:	
	<input type="checkbox"/> Month 11	Date:	
	<input type="checkbox"/> Month 12	Date:	
	<b>Spring and Fall</b>		
	<input type="checkbox"/> Check for depressions in areas over and surrounding the stormwater management system.		
	Notes		
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<b>Yearly</b>		
	<input type="checkbox"/> Confirm that no unauthorized modifications have been performed to the site.		
	Notes		
<input type="checkbox"/> Year 1	Date:		
<input type="checkbox"/> Year 2	Date:		
<input type="checkbox"/> Year 3	Date:		
<input type="checkbox"/> Year 4	Date:		
<input type="checkbox"/> Year 5	Date:		
<input type="checkbox"/> Year 6	Date:		
<input type="checkbox"/> Year 7	Date:		



**CULTEC, Inc.**

878 Federal Road • P.O. Box 280 • Brookfield, CT 06804 USA

P: (203) 775-4416 • Toll Free: 1(800) 4-CULTEC • [www.cultec.com](http://www.cultec.com)



RETENTION • DETENTION • INFILTRATION • WATER QUALITY

## **Standard 10**

## *Illicit Discharge Statement*



# **Brennan Consulting**

**ENGINEERING • TRANSPORTATION • SURVEYING**

May 20, 2022  
MassDEP Northeast Regional Office  
205B Lowell Street  
Wilmington, MA 01887

Subject: **Alden Mills Fire Station – Illicit Discharge Statement**  
270 Barnum Road  
Devens, Massachusetts 01434

Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents. In accordance with Standard 10 of the Massachusetts Stormwater Regulations, this project will not involve any illicit discharge to the stormwater management system.

Please feel free to contact me if you have any questions.

Sincerely yours,  
**Brennan Consulting**



Chris Emilius, P.E.  
Principal

# *Geotech Report*

## GEOTECHNICAL INVESTIGATION REPORT

### PROPOSED ALDEN MILLS/POINT OF PINES FIRE STATION

140 Lynnway  
Revere, Massachusetts

Prepared for:

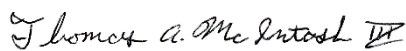
CBI Consultants, LLC  
250 Dorchester Avenue  
Boston, MA 02127

Prepared by:

John Turner Consulting, Inc.  
356 Manchaug Road  
Sutton, Massachusetts 01590

**JTC Project No. 20-04-114**

February 10, 2021



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February 10, 2021

Jennifer dos Santos, CDT, MCPPO, Associate A.I.A  
Project Manager  
CBI Consultants, LLC  
250 Dorchester Ave.  
Boston, Massachusetts 02127  
D: 617.464.6965  
C: 978.985.9317  
F: 617.464.2971

**RE: Geotechnical Investigation Report  
Proposed Alden Mills/Point of Pines Fire Station  
140 Lynnway  
Revere, Massachusetts**

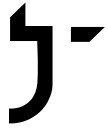
Dear Ms. Dos Santos:

In accordance with our proposal and authorization to proceed, John Turner Consulting, Inc. (JTC) has performed a geotechnical investigation for the above captioned project. Presented herein and attached are the results of the site subsurface investigation, and our recommendations regarding the design and construction of the foundation, and other geotechnical related concerns or issues.

We appreciate the opportunity to assist you on this venture and we look forward to working with you on this project through its completion. Please do not hesitate to contact us if you have any questions or require additional information.

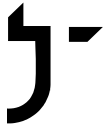
Sincerely,  
**JOHN TURNER CONSULTING, INC.**

Thomas A. McIntosh III, PE  
Senior Geotechnical Engineer  
356 Manchaug Road  
Sutton, MA 01590  
[Tmcintosh@consultjtc.com](mailto:Tmcintosh@consultjtc.com)  
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## 1.0 INTRODUCTION

John Turner Consulting, Inc. (JTC) is pleased to present this *Geotechnical Investigation Report* for the proposed Fire Station to be located at 140 Lynnway in Revere, Massachusetts. JTC conducted geotechnical explorations and laboratory testing in January of 2021. Engineering evaluations were completed in general accordance with our proposed scope of services submitted to CBI Consultants, LLC on December 08, 2021. Our work was authorized on January 28, 2021.

The purpose of the geotechnical investigation was to obtain information on the subsurface conditions at the site and to provide geotechnical engineering recommendations to support the planning, design, and construction of the proposed development. This investigation did not include an assessment relative to oil, gasoline, solid waste, and/or other hazardous materials. Similarly, this investigation/evaluation did not include review of site design or construction issues such as infiltration systems, dry wells, underground utilities, protection of existing structures, retaining walls, temporary excavation support, and/or other site/temporary design issues unless specifically addressed herein.

This report summarizes available project information, presents the geotechnical exploration and laboratory testing programs, describes the subsurface conditions encountered, and provides geotechnical engineering recommendations to support the planning, design, and construction of the proposed development. The contents of this report are subject to the attached *Limitations*.

## 2.0 PROJECT INFORMATION

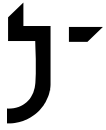
The following subsections provide general descriptions of the site, the regional geologic setting, and the proposed development.

### 2.1 Site Description

The site is presently occupied by the existing Fire Station and paved driveway, centrally located within a 15,283 s.f., irregularly shaped, property. The existing building will be demolished to make way for the new facility. The site is bounded by the Lynnway and MBTA access roadway to the south and east, the route 1A southbound on ramp to the west, and Massachusetts Route 1A to the north. The site is generally flat and level with grades ranging from EL.10.0± feet to EL. 12.0± feet. A highway berm rises approximately 18 feet from the northern edge of the property to the Route 1A roadway surface. The site is situated on a peninsula surrounded by the Atlantic Ocean.

### 2.2 Proposed Development

JTC understands the proposed development involves the construction of a new, 3-story facility, access road constructed at the north side of the building and connecting into the existing MBTA traffic circle, and associated parking areas. The existing fire station will be demolished. The intent is to support the building on conventional shallow spread footing foundations and a slab-on-



grade, i.e., no basement. The development will also include associated stormwater infiltration areas.

The site is generally flat and level and will require only minor cuts and/or fills of up to about 2 feet within the building site.

Preliminary structural loading has not been provided, however, based on JTC's experience with this type of construction we are anticipating the following approximate loading conditions:

- Exterior strip/wall footing loads will be on the order of 5 kips per linear foot or less;
- Column loads will range generally range from 100 to 150 kips;
- Live loads applied to the floor slab-on-grade will be on the order of 150 pounds per square foot (psf) or less.

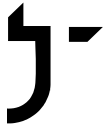
### 3.0 GEOTECHNICAL EXPLORATIONS

#### 3.1 Subsurface Investigations

JTC subcontracted Soil Exploration Corp. to drill eight (8) geotechnical test borings (designated as B-1 through B-8, inclusive) via a truck-mounted Mobile B-57 drill rig. Test borings were drilled within close proximity to borings B-6 and B-7 for infiltration testing. Test boring B-4 was reinstated as a monitoring well with the well screen placed at 15.0 feet below the ground surface. JTC directed the drilling, testing, and sampling activities and logged the subsurface conditions encountered at each exploration location. The test boring locations were selected in relation to the existing site features and proposed development. The attached *Exploration Location Plan* depicts the approximate test boring locations.

The test borings were advanced to depths ranging from 9 to 27.0 feet below the ground surface (bgs) utilizing 4¼-inch inside-diameter continuous-flight hollow-stem-augers. As the borings were advanced, standard penetration tests (SPTs) were conducted at regular intervals and soil samples were obtained via 2-inch outside-diameter split-spoon samplers driven by a 140-pound safety (SAFE-T) hammer. SPTs were performed in general accordance with ASTM D1586, Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.

Selected soil samples were sealed in moisture-tight containers and returned to JTC's office for further review, classification, and/or geotechnical laboratory testing. Detailed records of the drilling/excavation, testing, sampling performed, and the soil, bedrock, and groundwater conditions observed at each test boring location are provided on the attached *Test Boring Logs*.



## 4.0 GEOTECHNICAL LABORATORY TESTING

JTC selected representative soil samples for geotechnical laboratory testing at our in-house laboratory. The following tests were performed:

- 7 Moisture contents;
- 7 Particle-size analyses;
- 2 Atterberg Limits tests;
- 4 hydrometer tests.

Geotechnical laboratory testing was performed in general accordance with ASTM procedures. Test results are provided on the attached *Geotechnical Laboratory Testing Reports*.

## 5.0 GEOTECHNICAL FIELD TESTING - INFILTRATION TESTING

JTC performed infiltration tests at the bottom of borings B-6 [IT-1] and B-7 [TP-2.] Testing was performed in accordance with the Massachusetts Stormwater Handbook: Volume 3, Chapter 1.

### 5.1 Testing Setup

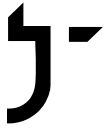
At the bottom of each test pit, a clean, flat surface was prepared in the native soils approximately 4.75 feet bgs. A 4-inch diameter Schedule 40 PVC pipe was placed on the testing surface and the surrounding soils were tamped and secured around the pipe. Subsequently, JTC added approximately 2 inches of fine gravel inside the PVC pipe to prevent scouring and hydraulic conductivity laterally during testing. A 2 feet head of water was added to the pipe on January 19, 2021 and the soils left to soak for the next 24 hours.

### 5.2 Infiltration Test Procedure

JTC returned to the site the following day to perform infiltration testing at the prepared locations. The testing procedure consisted of:

- Filling the pipes with water to a depth of 2 feet above the bottom of pipe;
- Taking regular water level measurements over the following hour;
- Refilling the water after each hour and repeating the process for a total of four cycles.





### 5.3 Infiltration Test Results

The test results are summarized in the following tables:

#### Summary of Infiltration Testing

Infiltration Test #	Proximal Boring Designation	Depth (feet bgs)	Soil Type	Measured Infiltration Rate (in/hr)				Average Measured Rate (in/hr)
				Trial 1	Trial 2	Trial 3	Trial 4	
IT-1	B-6	4.75	SC-SM	0.125	0.125	0.125	0.125	0.125
IT-2	B-7	4.75	SC-SM	4.8	4.32	4.0	2.88	4.0

As presented in the tables above, JTC concludes that the silty clayey Sand (SC-SM) with gravel encountered at boring locations B-6/IT-1 and B-7/IT-2 exhibited infiltration rates of approximately 0.125 in/hr and 4.0 inches/hr, respectively.

No factors of safety have been applied to the measured rates presented in the table. JTC recommends applying a minimum safety factor of 2 to the measured rates for design purposes.

### 6.0 SUBSURFACE CONDITIONS

The following subsections describe the site soil, bedrock, and groundwater conditions encountered, based on results of the geotechnical explorations and laboratory testing. Detailed descriptions of the conditions observed at each test boring are provided on the attached *Test Boring Logs*.

#### 6.1 Soils - Borings

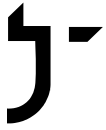
The overburden soils encountered at the test boring locations appear to be consistent with those described by the published geologic data. The primary soil strata are briefly described in the paragraphs below.

##### 6.1.1 Asphalt-Concrete Pavement

Asphalt-concrete pavement was encountered at the ground surface of test boring B-8. The pavement was approximately 3 inches thick and was underlain by approximately 6 inches of granular pavement base.

##### 6.1.2 Topsoil/Subsoil

Topsoil materials were encountered at the ground surface of borings B-1 through B-7. The Topsoil



consisted of brown sandy Silt (ML), with organics, rootlets and trace gravel. Where encountered, the thickness of the Topsoil was approximately 6 to 10 inches.

### **6.1.3 Fill**

Fill materials were encountered beneath the asphalt-concrete pavement and/or topsoil at each test boring location. The Fill typically consisted of dark tan, silty clayey Sand (SC-SM) with gravel and dark, tan silty clayey Sand (SC-SM). Isolated layers of silty Sand (SM) with gravel and tan clayey Sand (SC) were observed in boring B-4 and B-5. Borings B-6 and B-7 were terminated in the fill at a depth of 9.0 feet bgs. The Fill was typically loose to medium dense based on SPT N-values.

### **6.1.4 Salt Marsh Deposits/Peat**

Dark brown, fibrous Peat (PT) was observed within borings B-1 through B-4 from 7.5 feet to 10.0 feet bgs. Where encountered the peat was no more than 6 inches thick. The Peat was typically loose based on SPT N-values.

### **6.1.5 Marine Deposits**

Marine Deposits consisting of grey Gravel with sand (GP); grey, silty Sand (SM); and grey Sand (SP-SC) with silty clay were encountered underlying the Fill to the full depth of boring at boring locations B-1 through B-5 and B-8. silty sand (SM) with little gravel were encountered beneath the Urban Fill in all boring locations with the exception of borings B-4 and B-4a. This stratum is interpreted to be Glacial Till and was about 2 to 8.5 feet thick. The Glacial Till was described as medium dense to very dense based on observations of drilling.

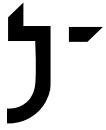
## **6.2 Bedrock**

Practical refusal to further penetration of the augers and/or split-spoon sampler was not encountered at any boring location. Bedrock is not anticipated to impact construction.

## **6.3 Groundwater**

Groundwater was encountered at all boring locations at a depth of 7.0 feet to 9.0 feet bgs at the time of drilling and upon completion of the drilling operations. Short-term (i.e., during drilling, upon completion of drilling, and/or a few hours after drilling) water levels observed in test borings performed in silty soils should be considered approximate.

JTC estimates that this investigation occurred during a period of seasonally normal to low ground water. Site groundwater levels should be expected to fluctuate seasonally and in response to precipitation events, construction activity, site use, and adjacent site use.



## 7.0 GEOTECHNICAL ANALYSIS & RECOMMENDATIONS

The evaluation of the site and the proposed development was based on the subsurface conditions encountered at the geotechnical test borings, results of geotechnical laboratory testing, preliminary site plans, and preliminary/assumed structural loading conditions, as described herein.

The Topsoil, Fill, and Peat materials are not suitable for direct support of shallow foundations. As such, JTC recommends that ground improvements [e.g., removal and replacement (R&R) of Existing Fill and/or installation of Aggregate Piers/Rigid Inclusions] be implemented to provide suitable bearing/support for shallow foundations and/or to minimize post-construction settlement of shallow foundations. Subsequent to the recommended ground improvements (i.e., R&R, Aggregate Piers/Rigid Inclusions, and/or equivalent), JTC believes that the proposed building can be supported on a system of continuous and/or isolated shallow spread footings bearing on Structural Fill and/or improved subgrade soils, provided that the design and construction recommendations presented herein are satisfied.

### 7.1 Removal and Replacement of Fill Option

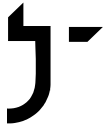
R&R of unsuitable soils within/beneath a proposed building pad is a common ground improvement method. R&R for the proposed development would involve the removal/excavation of all Existing Fill and Former Topsoil materials. These excavations/over-excavations would generally extend 7 to 10 feet bgs across the proposed building pad (i.e., footprint of the addition, plus about 5 to 10 feet laterally, as needed to accommodate the footing zone of influence, as described herein). These excavations/over-excavations may require temporary excavation to protect the existing site features and existing sidewalks.

The Fill material may be suitable to remain in place beneath the floor-slab-on-grade provided:

- The Existing Fill is subjected to proof-rolling densification with a minimum 10-ton vibratory roller utilizing a crisscross pattern of at least 8 passes. JTC should directly observe the proof-rolling/densification efforts to check for areas of instability, which are typically evidenced by pumping or weaving. Any unstable areas should be over-excavated and replaced with Structural Fill.
- JTC reviews the excavations/over-excavations for the footings/FZOI. Any organics, compressible matter, and other unsuitable materials observed will be subject to complete removal and replacement with Structural Fill.

### 7.2 Placement of Aggregate Piers and/or Rigid Inclusions Option

Alternatively, ground improvements consisting of Aggregate Piers and/or Rigid Inclusions may be considered. For this site, the boulders observed in the Fill may require selective excavation to facilitate the installation of Aggregate Piers and/or Rigid Inclusions. In general, Aggregate

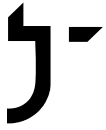


Pier/Rigid Inclusion foundation elements would be constructed by drilling (or displacing) 18-inch to 30-inch diameter cavities through the Fill and into the underlying native Glacial Till. The cavities are then backfilled with crushed stone that is densified with impact and/or vibratory compaction. The densification process pushes the crushed stone radially outward into the sidewalls of the cavities and thereby increasing the lateral stresses in the matrix soil surrounding the Aggregate Pier elements. The end product is the formation of very stiff aggregate elements that are extremely efficient in providing foundation support and reducing foundation settlement. Aggregate Piers are sometimes grouted (via Portland cement) where soft and/or organic soils are present. And, in some cases, the cavities are backfilled with concrete. The grouted and/or concrete elements are even stiffer than the traditional Aggregate Pier and are commonly referred to as Rigid Inclusions. Aggregate Piers and/or Rigid Inclusions are typically designed and constructed by a specialty design-build firm and/or Geo-Contractor. Some products included patented/licensed technology. The design of Aggregate Piers/Rigid Inclusions and/or equivalent should be completed by a Professional Engineer licensed in Massachusetts. The design should be provided as a *Technical Submittal*.

### 7.3 Site Preparation and Grading

Site preparation and grading should be performed in accordance with the following procedures:

- A geotechnical engineer should directly observe site preparation and grading activities;
- The site soils contain substantial proportions of fine sand, and silt, and may degrade and/or become unworkable when subjected to construction traffic or other disturbance during wet conditions. As such, site preparations, grading, and earthworks should be performed during a dry season if possible. The Contractor shall be aware of these conditions and must take precautions to minimize subgrade disturbance. Such precautions may include diverting storm run-off away from construction areas, reducing traffic in sensitive areas, minimizing the extent of exposed subgrade if inclement weather is forecast, backfilling excavations and footings as soon as practicable, grading (and compacting) exposed subgrades to promote surface water run-off, and maintaining an effective dewatering program, as necessary. Over-excavation to remove degraded or unworkable subgrade soils should be anticipated and budgeted (cost and schedule);
- Any existing buildings, structures, and/or associated foundations (including footings, foundation walls, slabs-on-grade, and/or basements) should be completely removed from proposed building and pavement areas and replaced/backfilled with properly placed and compacted *Structural Fill*;
- Any existing subsurface utilities and underground structures should be completely removed from the footprint of the proposed building and replaced/backfilled with properly placed and compacted *Structural Fill*. Any existing subsurface utilities in proposed pavement areas should be removed and/or appropriately abandoned in place (e.g., pressure grouting), as approved by the on-site geotechnical engineer;
- The site should be cleared and stripped of any existing asphalt-concrete pavement not



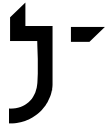
designated to remain; existing trees/vegetation not designated to remain; Topsoil, rootmat, forest mat; loamy/organic-laden Subsoil; and any otherwise unsuitable materials;

- In cut areas, the final foot of excavation should be performed using a smooth-edged cutting bucket (no teeth) to minimize subgrade disturbance;
- Following clearing, stripping, and/or cutting, the exposed subgrade soils should be proof-rolled with successive passes aligned perpendicularly. The proof-rolling/densification of the Existing Fill within the building pad (i.e., the building footprint plus about 5 feet laterally) should occur prior to the R&R operations for the proposed footings. Within the building pad, the exposed subgrade should be proof-rolled and subject to vibratory densification via at least 8 passes using a large (10-ton) smooth-drum roller and a crisscross pattern. Proof-rolling/densification should not be performed if/when the exposed subgrade soils are wet (i.e., due to presence of groundwater, stormwater, perched water, etc.) because this may result in soil pumping and instability. Therefore, the proof-rolling efforts, including the number of passes and whether to employ static or vibratory methods, should be directed by the on-site geotechnical engineer;
  - Any loose, soft, wet, and/or otherwise unsuitable soils (typically evidenced by rutting, pumping, and/or deflection of the subgrade) should be over-excavated to expose suitable soils, or other remedial measures should be taken, as approved by the on-site geotechnical engineer; and
  - The over-excavation should then be backfilled with properly placed and compacted *Structural Fill*.
- *Structural Fill* should be used for subgrade fill in the building pad. The placement of *Structural Fill* materials to achieve design subgrades in the building pad should not begin until the exposed subgrade soils have been directly observed and approved by the on-site geotechnical engineer;
- *Common Fill* is acceptable for subgrade fill in parking and driveway areas. The placement of *Common Fill* materials to achieve design subgrades in pavement areas should not begin until the exposed subgrade soils have been directly observed and approved by the on-site geotechnical engineer; and
- *Structural Fill* and *Common Fill* materials and placement and compaction requirements are provided in the attached Specifications.

#### 7.4 Shallow Foundations and Foundation Walls

Based on the subsurface conditions encountered at the exploration locations and our current understanding and assumptions relative to the proposed development, the following foundation design recommendations are provided [note that the recommendations for shallow foundations assume that the recommended ground improvements (i.e. Remove & Replace, Aggregate Piers/Rigid Inclusions, and/or equivalent) will be completed:

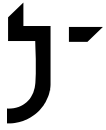
- The Urban Fill materials are not suitable for direct support of shallow foundations.



- The building can be supported on a system of continuous and/or isolated shallow spread footings bearing on improved Urban Fill and/or on *Structural Fill* or crushed stone built-up from properly prepared native soil subgrades;
- Following ground improvements (Rammed/Grouted Aggregate Piers and/or equivalent), shallow foundations may be designed using an allowable bearing pressure of approximately 5,000 psf. [An allowable bearing pressure of 3,000 psf may be used if the method of ground improvement is R&R only (i.e. Aggregate Piers/Rigid Inclusions are not used)]. Design bearing pressures may be increased by one-third ( $\frac{1}{3}$ ) when considering seismic and or transient wind loading conditions;
- Continuous wall footings should have a minimum width of 2 feet. Isolated column footings should have a minimum width of 3 feet;
- Exterior footings should be founded at least 4 feet below the lowest adjacent grade to provide adequate frost protection. Interior footings in heated portions of the building should be founded at least 2 feet below FFE;
- Total post-construction settlements due to applied foundation loads are estimated to be on the order of 1 inch or less, based on strip footing widths and column footing widths of up to 3 feet and 5 feet, respectively. Differential settlements along continuous wall footings and/or between isolated column footings are estimated to be on the order of 0.5 inches or less. The estimated settlements and resulting angular distortion are anticipated to be within the allowable limits for this type of structure; and
- Recommended lateral earth pressures and friction factors for unbalanced/basement walls are provided in the attached *Specifications*.

Recommendations for shallow foundation subgrade preparation and construction are provided as follows:

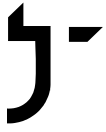
- A geotechnical engineer or his/her representative should directly observe foundation subgrade preparation activities;
- If shallow and/or perched groundwater is encountered, it must be continuously maintained at least 2 feet below the bottom of excavation and subsequent construction grade until the backfilling is complete;
- The native foundation subgrade soils will be sensitive to moisture and will readily disturb or soften if exposed to wet conditions during construction activities. Therefore, the final foot, at a minimum, of excavation for foundations should be performed using a smooth-edged cutting bucket (no teeth) to minimize subgrade disturbance. Furthermore, the exposed foundation subgrade should be protected with an 8-inch (minimum) thick layer of  $\frac{3}{4}$ -inch minus crushed stone encased in a geotextile fabric (e.g., Mirafi 140N or equal). The crushed stone shall be placed immediately upon exposure of the native foundation subgrade soils and densified with a plate compactor until exhibiting stable conditions. The purpose of the crushed stone is to protect the fine-grained subgrade soils from disturbance, facilitate construction dewatering (if necessary), and provide a dry/stable



subgrade upon which to progress construction

- Prior to setting forms and placing reinforcing steel, a geotechnical engineer should directly observe footing subgrades;
  - Footing subgrades should be level or suitably benched and free of standing water and/or debris;
  - Loose, soft, wet, frozen, or otherwise unsuitable soils should either be re-compacted or over-excavated to a suitable subgrade, as approved by the on-site geotechnical engineer; and
  - Over-excavations should be backfilled with properly placed and compacted *Structural Fill* as approved by the on-site geotechnical engineer.
- Foundation subgrade soils should be protected against physical disturbance, precipitation, and/or frost throughout construction. Surface water run-on/run-off should be diverted away from open foundation excavations. The Contractor shall ultimately be responsible for the means and methods to protect the foundation subgrade during construction;
- Interior footings, piers, and/or walls and the interior side of balanced perimeter foundation walls should be backfilled with *Clean Granular Fill* and/or 3-inch minus material meeting the requirements of *Structural Fill*, as described in the attached *Tables*;
- Exterior footings, piers, and the exterior side of balanced foundation walls should be backfilled with non-frost-susceptible fill in order to mitigate potential adverse effects of frost. Backfill for exterior footings, piers, and foundation walls should consist of well-graded, free-draining, granular soil conforming to the requirements of *Clean Granular Fill*, as described in the attached *Specifications*. Alternatively, a suitable bond break (such as rigid polystyrene insulation) may be provided as approved by the on-site geotechnical engineer. In this case, footings and walls (excluding unbalanced/basement walls) may be backfilled with *Common Fill* (see attached *Specifications*) having a maximum particle-size of 3 inches, as approved by the on-site geotechnical engineer;
- Should bedrock be encountered during excavation for interior or exterior footings, JTC recommends that the bedrock be overexcavated a minimum of 12" and backfilled with compacted *Structural Fill* (see attached *Specifications*) to provide a "cushion" and level bearing surface for the proposed footing.
- Backfill for footings and foundation walls should be placed in uniform horizontal lifts having a maximum loose lift thickness of 8 inches and compacted to 95 percent of its modified proctor maximum dry density (MPMDD; per ASTM D1557). Thinner lifts may be required in order to achieve the required compaction criteria; and
- To minimize the potential for foundation wall damage during the backfill and compaction activities, it is recommended that foundation wall backfill be placed in a manner that maintains a balanced fill height on both sides of the wall (up to the final exterior grade).





## 7.5 Floor Slab-On-Grade

Design recommendations for the floor slab-on-grade are provided as follows:

- A modulus of vertical subgrade reaction,  $k_{vi}$ , of 125 pounds per cubic inch (pci) should be available for structural design of the floor slabs-on-grade, provided that the subgrade, *Structural Fill*, and the *Crushed Stone Base* are prepared as recommended in Subsections 7.0, 7.1, 7.2, and 7.3;
- Basement floor slabs-on-grade should be underlain by a minimum 9-inch thick layer of 1-inch minus *Crushed Stone* to provide a capillary break and a stable working surface. Non-basement floor slabs-on-grade may be underlain by a minimum 9-inch thick layer of *Clean Granular Fill* to provide a capillary break and a stable working surface.
- The floor slab should be isolated structurally from foundation walls and columns/piers to allow for differential movement; and
- The need/desire to provide a moisture/vapor barrier beneath floor slab-on-grade should be evaluated by the architect and/or the structural engineer, based on the building's specific interior usage requirements.

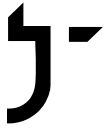
During construction, we expect that much of the building footprint will be excavated or disturbed during site preparation and grading (Subsection 7.3), excavations for shallow foundations (Subsection 7.4), and/or excavations for new underground utilities. It is imperative that the subgrade beneath the floor slab-on-grade be reinstated with properly placed and compacted *Structural Fill* and/or prepared as recommended herein. Additionally:

- A geotechnical engineer should directly observe the subgrade soils prior to the placement of the recommended *Crushed Stone* base course;
  - The subgrade should be level and free of standing water and/or debris;
  - Loose, soft, wet, frozen, or otherwise unsuitable soils should either be re-compacted or over-excavated to a suitable subgrade, as approved by the on-site geotechnical engineer; and
  - Over-excavations should be backfilled with properly placed and compacted *Structural Fill*.
- The *Crushed Stone* base course should not be placed until the subgrade has been reviewed by the on-site geotechnical engineer. Subsequently, the Clean Granular Fill should be compacted to the satisfaction of the geotechnical engineer to 95% of its MPMDD.

## 7.6 Seismic Considerations

Earthquake loadings must be considered under the requirements of the current edition of the Massachusetts Building Code (MA-Code) which refer to the 2015 edition of the International Building Code (IBC). IBC Table 1613.5.2 is used to establish the site class based on the average





soil properties and soil profile. Site class is then used to determine the site coefficient and mapped spectral response for a given structure. Based on the conditions encountered at the test boring locations, the site is classified as:

**Site Class D: Stiff Soil Profile.**

Liquefaction refers to the loss of strength in saturated cohesionless soils due to the buildup of pore water pressures during cyclic or seismic loading. Based on the conditions encountered at the test boring locations, the site is NOT considered to be susceptible to liquefaction.

## **7.7 Re-Use of Site Soils**

The Topsoil and Fill materials encountered at the exploration locations are not expected to be suitable for re-use as *Structural Fill*, *Clean Granular Fill*.

Some of the Fill encountered at the test boring locations may be suitable for re-use as *Common Fill*, provided that it is appropriately segregated from excessively silty fill, oversized boulders, debris/fragments, and/or otherwise unsuitable materials.

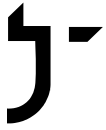
## **7.8 Construction Monitoring and Quality Control Testing**

A qualified engineer or representative should be retained to review the site and subgrade operations, as required by Section 1705 of the Massachusetts State Building Code (MA-Code). Similarly, quality control testing, including in-place field density and moisture tests, should be performed to confirm that the specified compaction is achieved. It is recommended that JTC be retained to provide earthwork construction monitoring and quality control testing services.

Quality control testing recommendations are provided as follows:

- During site grading and foundation subgrade preparation, 3 field density tests should be performed for every 4,000 square feet (per lift) of *Structural Fill* placement, at a minimum. At least 3 tests should be performed on each lift of material even if the lift is less than 4,000 square feet;
- During foundation wall backfilling, 3 field density tests should be performed for every 100 linear feet (per lift) of fill placement, at a minimum. At least 3 tests should be performed on each lift of material even if the lift is less than 100 linear feet;
- During placement and compaction of *Clean Granular Fill* as the base course below sidewalks, 3 field density tests should be performed for every 4,000 square feet of placement. At least 3 tests should be performed on each lift of material even if the lift is less than 4,000 square feet;
- During backfilling of utility trenches, at least 1 test should be conducted on *Structural Fill* per 50 linear feet (per lift) of trench; and

During site grading and pavement subgrade preparation, 3 field density tests should be



performed for every 4,000 square feet (per lift) of *Common Fill*, at a minimum. At least 3 tests should be performed on each lift even if the lift is less than 4,000 square feet.

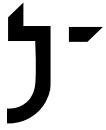
## 7.9 Additional Considerations

Additional design recommendations are provided as follows:

- Exterior concrete sidewalks shall be underlain by at least 12 inches of *Clean Granular Fill*. The thickness of the *Clean Granular Fill* shall be increased to no less than 18 inches for exterior concrete slabs located adjacent to exterior doorways and ramps to provide additional frost protection at building entry/exit points;
- Roof drains or similar features should be provided to collect roof run-off and prevent ponding near the building. Roof drains and other stormwater controls should not discharge to foundation drains;
- The exterior ground surface adjacent to the building should be sloped away from the building to provide for positive drainage. Similarly, the final surface materials adjacent to the building should be relatively impermeable to reduce the volume of precipitation infiltrating into the subsurface proximate to building foundations. Such impermeable materials include cement concrete, bituminous concrete, and/or vegetated silty/clayey topsoil; and
- Permanent fill or cut slopes should have a maximum slope of 2.5H:1V (horizontal to vertical) or flatter for dry conditions. Permanent fill or cut slopes should be no steeper than 3H:1V for wet/submerged conditions (e.g., stormwater basin) unless a properly designed surface slope stabilization system (e.g. rip rap, geosynthetics) is provided.

Additional construction considerations/recommendations are provided as follows:

- Safe temporary excavation and/or fill slopes are the responsibility of the Contractor. Excavations should be conducted in accordance with local, state, and federal (OSHA) requirements, at a minimum. If an excavation cannot be properly sloped or benched due to space limitations, adjacent structures, and/or seepage, the Contractor should install an engineered shoring system to support the temporary excavation;
- Subgrade conditions will be influenced by excavation methods, precipitation, stormwater management, groundwater control(s), and/or construction activities. Most of the site soils are poorly-drained, moisture-sensitive, and considered susceptible to disturbance when exposed to wet conditions and construction activities. As such, the Contractor shall be aware of these conditions and must take precautions to minimize subgrade disturbance. Such precautions may include diverting storm run-off away from construction areas, reducing traffic in sensitive areas, minimizing the extent of exposed subgrade if inclement weather is forecast, backfilling excavations and footings as soon as practicable, and maintaining an effective dewatering program, as necessary;
- Proper groundwater control and stormwater management are necessary to maintain site

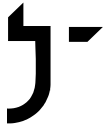


stability. Groundwater should be continuously maintained at least 2 feet below the working construction grade until earthworks and/or backfilling are complete;

- If groundwater seepage and/or wet soils due to shallow groundwater are observed, a  $\frac{3}{4}$ -inch minus crushed stone base should be placed atop the exposed subgrade soils. The stone should be immediately placed atop the undisturbed subgrade and then tamped with a plate compactor until exhibiting stable conditions. The stone shall be protected, as required, with a geotextile filter fabric such as Mirafi 140N or equal. The purpose of the stone base is to protect the wet subgrade, facilitate dewatering, and provide a dry/stable base upon which to progress construction; and
- All slopes should be protected from erosion during (and after) construction.

## 8.0 CLOSING

We trust the contents of this report are responsive to your needs at this time. Should you have any questions or require additional assistance, please do not hesitate to contact our office.



## APPENDIX A: LIMITATIONS

### Explorations

1. The analyses and recommendations presented in this report are based in part upon the data obtained from widely-spaced subsurface explorations. Subsurface conditions between exploration locations may vary from those encountered at the exploration locations. The nature and extent of variations between explorations may not become evident until construction. If variations appear, it will be necessary to re-evaluate the recommendations of this report.
2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretation of widely-spaced explorations and samples; actual strata transitions are probably more gradual. For specific information, refer to the individual test pit and/or boring logs.
3. Water level readings have been made in the test pits and/or test borings under conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time the measurements were made.

### Review

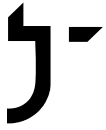
4. It is recommended that John Turner Consulting, Inc. be given the opportunity to review final design drawings and specifications to evaluate the appropriate implementation of the geotechnical engineering recommendations provided herein.
5. In the event that any changes in the nature, design, or location of the proposed areas are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and conclusions of the report modified or verified in writing by John Turner Consulting, Inc.

### Construction

6. It is recommended that John Turner Consulting, Inc. be retained to provide geotechnical engineering services during the installation phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

### Use of Report

7. This report has been prepared for the exclusive use of CBI Consultants, LLC for specific application to the project located at 140 Lynnway - Revere, Massachusetts. All considerations are based on the available information and is in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.
8. This report has been prepared for this project by John Turner Consulting, Inc. This report was completed for preliminary design purposes and may be limited in its scope to complete an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to preliminary geotechnical design considerations.



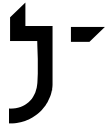
## APPENDIX B: RECOMMENDED SOIL GRADATION & COMPACTION SPECIFICATIONS

**TABLE 1: Structural Fill**

SIEVE SIZE	PERCENT PASSING BY WEIGHT
5-inch	100
¾-inch	60 - 100
No. 4	20 - 80
No. 200	0 - 10

### NOTES:

1. For use as structural load support below foundations and within the building pad. Structural Fill placed beneath building foundations should include the Footing Zone of Influence which is defined as that area extending laterally one foot from the edge of the footing then outward and downward at a 1:1.5 (H:V) splay.
2. ¾-inch crushed stone may be used in wet conditions.
3. Structural Fill should be free of construction and demolition debris, frozen soil, organic soil, peat, stumps, brush, trash, and refuse;
4. Structural Fill should not be placed on soft, saturated, or frozen subgrade soils;
5. Structural Fill should be placed in lifts not exceeding 12 inches for heavy vibratory rollers and 8 inches for vibratory plate compactors.
6. Place and compact within  $\pm 3\%$  of optimum moisture content.
7. Compact to at least 95% relative compaction per ASTM D1557.
8. The adequacy of the compaction efforts should be verified by field density testing.



**TABLE 2: Clean Granular Fill**

Clean SIEVE SIZE	PERCENT PASSING BY WEIGHT
3-inch	100
¾-inch	60 – 90
No. 4	20 – 70
No. 200	2 – 8

**NOTES:**

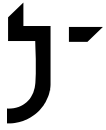
1. For minimum 9-inch base below floor slab-on-grade.
2. For minimum 18-inch base for exterior concrete slabs exposed to frost.
3. For minimum 24-inch base at exterior ramps, aprons, and loading bays adjacent to entrances/exit ways.
4. For use as footing and foundation wall backfill.
5. For use as backfill behind unbalanced foundation/retaining walls.
6. Place in lifts not exceeding 12 inches for heavy vibratory rollers and 8 inches for vibratory plate compactors.
7. Place and compact within  $\pm 3\%$  of optimum moisture content.
8. Compact to at least 95% relative compaction per ASTM D1557.
9. Compaction efforts should be verified by field density testing.
10. Compact to at least 95% relative compaction per ASTM D1557 when placed as foundation wall backfill in conjunction with a bond break.
11. Compaction efforts should be verified by field density testing.

**TABLE 3: Common Fill**

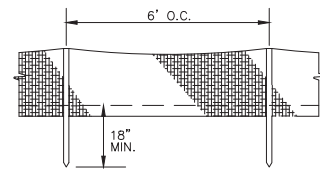
SIEVE SIZE	PERCENT PASSING BY WEIGHT
6-inch	100
¾-inch	60 – 100
No. 4	20 – 85
No. 200	0 – 25

**NOTES:**

1. For use as common/subgrade fill in parking areas and roadway embankments.
2. For use as foundation wall backfill if used in conjunction with a bond break and sized/screened to 3-inch minus.
3. Place in lifts not exceeding 12 inches.
4. Maximum stone size should not exceed  $\frac{1}{2}$  the actual lift thickness.
5. Compact to at least 92% relative compaction per ASTM D1557 when placed as subgrade fill in parking areas or roadway embankments.
6. Compact to at least 95% relative compaction per ASTM D1557 when placed as foundation wall backfill in conjunction with a bond break.
7. Compaction efforts should be verified by field density testing.



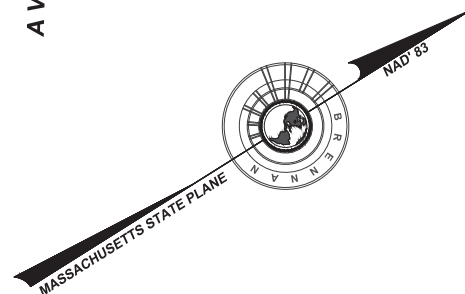
## APPENDIX C: SITE PLAN & TEST BORING LOCATION PLAN



2' CONTOUR	----- 298 -----
10' CONTOUR	----- 300 -----
PROPERTY LINE	-----
BUILDING SETBACK LINE	-----
EDGE OF PAVEMENT	-----
EDGE OF GRAVEL	-----
STONE WALL	-----
FENCE	-----○-----
TREELINE	-----
STORM DRAIN LINE	-----
WATER LINE	-----
UNDERGROUND TELEPHONE	----- UG <sup>T</sup> -----
GAS LINE	-----
OVERHEAD WIRES	-----
DRAIN MANHOLE	⊕
CATCH BASIN	□
FIRE HYDRANT	⋈
WATER VALVE	WV
WATER GATE	WV
GAS VALVE	GV
UTILITY POLE	⌚ UP-#
GUY WIRE	➤
DI	DUCTILE IRON
RD	ROOF DRAIN
LSA	LANDSCAPED AREA
BOC	BOTTOM OF CURB
TOC	TOP OF CURB
PS	PARTICLE SEPARATOR
WCR	WHEELCHAIR RAMP



1. CONTRACTOR SHALL CONTACT DIG SAFE AT 1-888-DIG-SAFE AT LEAST SEVEN DAYS PRIOR TO ANY CONSTRUCTION ACTIVITIES.
2. INSTALL EROSION AND SILTATION DEVICES AS INDICATED ON THE DRAWINGS.
3. LEGALLY DISPOSE OF ALL DEMOLISHED MATERIALS OFF SITE. STOCKPILED TOPSOIL SHALL BE SCREENED FOR RE-USE AND EXCESS MATERIAL REMOVED FROM SITE.
4. TOPSOIL REMOVAL AND SUBGRADE EXPOSURE SHALL BE PERFORMED IN STAGES TO CONTROL EROSION AND SEDIMENT TRANSFER FROM SITE.
5. CONTRACTOR SHALL INSPECT EROSION CONTROL MEASURES DAILY AND PRIOR TO ANY PREDICTED STORM EVENT AND REPAIR AS NECESSARY.
6. ALL WORK SHALL CONFORM TO THE APPLICABLE REGULATIONS AND STANDARDS OF THE CITY OF REVERE AND SHALL BE BUILT IN A WORKMANLIKE MANNER IN ACCORDANCE WITH THE PLANS AND THE CITY OF REVERE STANDARD DETAILS AND SPECIFICATIONS.
7. GRANITE CURB REMOVED AND STACKED SHALL BE OFFERED TO THE DEPARTMENT OF CONSERVATION AND RECREATION FOR SALVAGE.

[illegible]

CHECKED BY: CE
DRAWN BY: CG
<b>PROJECT 19954B</b>

C-02

**SITE PREPARATION & DEMOLITION PLAN**  
LOCATED IN  
**140 LYNNWAY**  
**REVERE, MA**

---

**PREPARED FOR**  
**WINTER STREET ARCHITECTS**

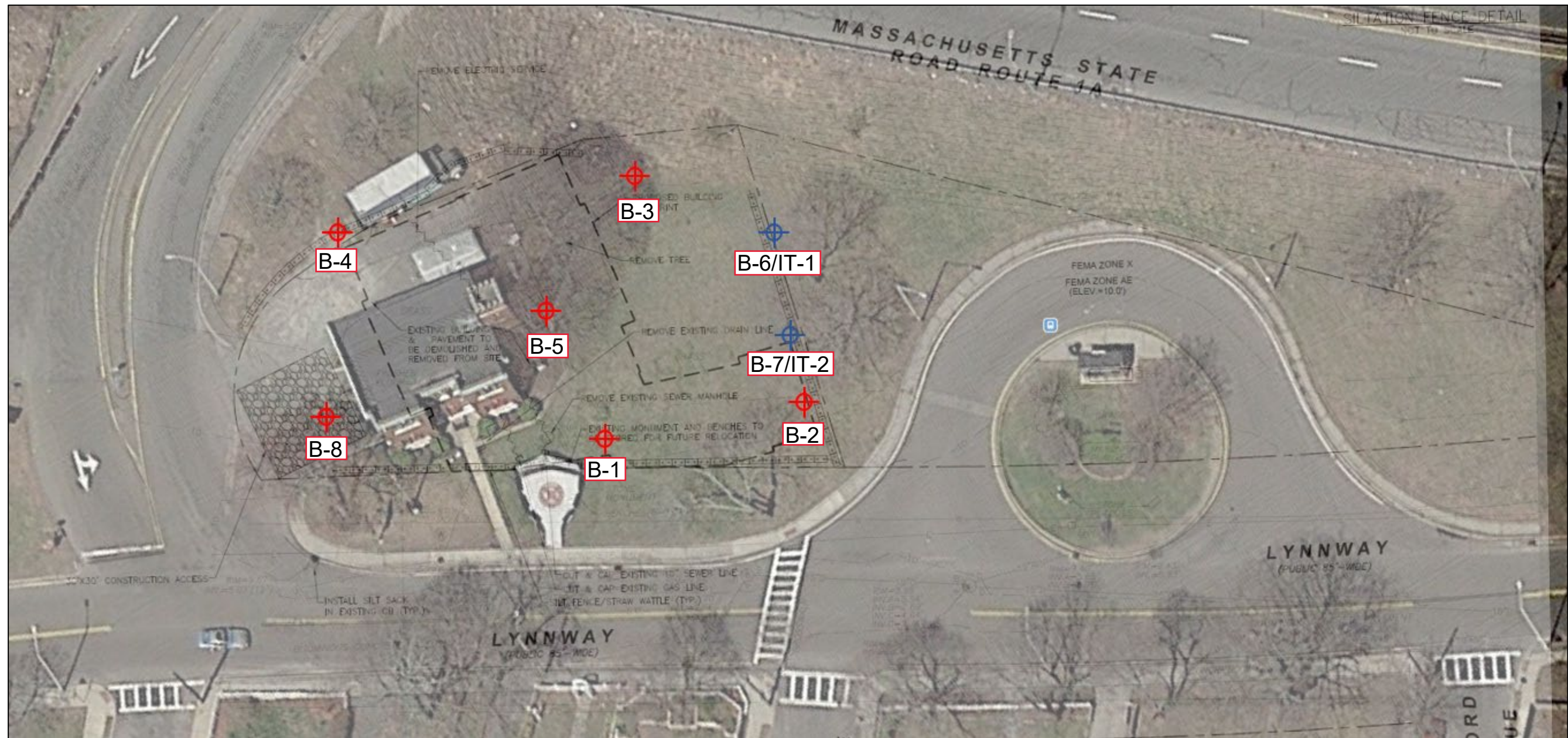
DATE: X-X-2020

**SCALE: 1" = 20'**

**Brennan Consulting**  
ENGINEERING • TRANSPORTATION • SURVEYING  
24 RAY AVENUE, BURLINGTON, MA  
PHONE: (781) 273-3434 FAX: (781) 273-3430

24 RAY AVENUE, BURLINGTON, MA  
PHONE: (781) 273-3434 FAX: (781) 273-3430





**Notes:**

1. Test borings were performed on January 19 & 20, 2021 under the direction of JTC. Test boring locations should be considered approximate.
2. Refer to the Test Boring Logs for the subsurface conditions encountered at each exploration location.
3. Basemap source(s): 2020 "Boring Site Preparation and Demolition Plan", prepared by Brennan Consulting – Burlington, MA.
4. Not to Scale.

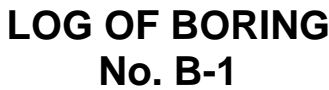
**CBI Consultants, LLC**  
**250 Dorchester Avenue**  
**Boston, Massachusetts 02127**

**Proposed Fire Station**  
**140 Lynnway**  
**Revere, Massachusetts**



**TEST BORING LOCATION PLAN**

## **APPENDIX D: TEST BORING LOGS & KEY TO SYMBOLS AND DESCRIPTIONS**



**PROJECT NO.:** 21-04-008

**PROJECT LOCATION:** 140 Lynnway - Revere, MA

**ELEVATION:** \_\_\_\_\_ G.S.

**LOGGED BY:** \_\_\_\_\_ TMc

**DATE:** 01-19-21

**AFTER 24 HOURS:** 

[illegible]

*Test boring backfilled with soil cuttings upon completion.*



# LOG OF BORING No. B-1

**PROJECT:** Alden Mills/Point of Pines - Proposed Fire Station      **PROJECT NO.:** 21-04-008  
**CLIENT:** Revere Fire Department  
**PROJECT LOCATION:** 140 Lynnway - Revere, MA  
**LOCATION:** Refer To Test Boring Location Plan      **ELEVATION:** G.S.  
**DRILLER:** Soil Exploration Corp.      **LOGGED BY:** TMc  
**DRILLING METHOD:** 4.25" ID HSA      **DATE:** 01-19-21  
**DEPTH TO - WATER> INITIAL:** 8.0      **AFTER 24 HOURS:**

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS
							Plastic Limit ——— Liquid Limit Water Content - • Penetration -
	-becomes loose -noxious odor observed			SS08	3 3 4 8		
	Grey, poorly graded, Sand (SP-SC) with silty clay; loose						
	Boring terminated at 27 ft.						
28							
31.5							
35							
38.5							
42							
45.5							
49							












Test boring backfilled with soil cuttings upon completion.



# LOG OF BORING No. B-2

**PROJECT:** Alden Mills/Point of Pines - Proposed Fire Station      **PROJECT NO.:** 21-04-008  
**CLIENT:** Revere Fire Department  
**PROJECT LOCATION:** 140 Lynnway - Revere, MA  
**LOCATION:** Refer To Test Boring Location Plan      **ELEVATION:** G.S.  
**DRILLER:** Soil Exploration Corp.      **LOGGED BY:** TMc  
**DRILLING METHOD:** 4.25" ID HSA      **DATE:** 01-19-21  
**DEPTH TO - WATER> INITIAL:** 8.5      **AFTER 24 HOURS:**

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS				
							Plastic Limit	—	Liquid Limit	Water Content - ●	Penetration - 
0	[TOPSOIL] Dark brown, sandy Silt (ML), trace gravel, rootlets, organics; medium dense -no sample recovery;			SS01	3 6 8 13						
3.5				SS02	13 13 12 13						
5	[FILL] Dark tan, silty clayey Sand (SC-SM) with gravel; loose			SS03	5 5 2 4						
7				SS04	3 4 5 9						
8.5	[ORGANICS] Dark brown, Peat (PT); loose; wet										
10.5	[MARINE DEPOSITS] Dark grey, Gravel (GP-GM) with sand; medium dense			SS05	3 4 8 10						
14											
17.5	-becomes dense			SS06	12 15 15 27						
21	Grey, silty Sand (SM); medium dense			SS07	4 5 6 9						
24.5											


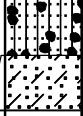
Test boring backfilled with soil cuttings upon completion.



# LOG OF BORING No. B-2

**PROJECT:** Alden Mills/Point of Pines - Proposed Fire Station      **PROJECT NO.:** 21-04-008  
**CLIENT:** Revere Fire Department  
**PROJECT LOCATION:** 140 Lynnway - Revere, MA  
**LOCATION:** Refer To Test Boring Location Plan      **ELEVATION:** G.S.  
**DRILLER:** Soil Exploration Corp.      **LOGGED BY:** TMc  
**DRILLING METHOD:** 4.25" ID HSA      **DATE:** 01-19-21  
**DEPTH TO - WATER> INITIAL:** 8.5      **AFTER 24 HOURS:**

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS
							Plastic Limit ——— Liquid Limit Water Content - • Penetration - 
	-becomes loose -noxious odor observed			SS08	2		
					3		
					4		
					5		
	Grey, poorly graded, Sand (SP-SC) with silty clay; loose						
	Boring terminated at 27 ft.						
28							
31.5							
35							
38.5							
42							
45.5							
49							


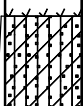



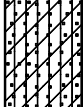

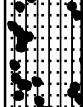
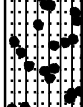

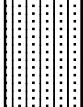
Test boring backfilled with soil cuttings upon completion.



# LOG OF BORING No. B-3

**PROJECT:** Alden Mills/Point of Pines - Proposed Fire Station      **PROJECT NO.:** 21-04-008  
**CLIENT:** Revere Fire Department  
**PROJECT LOCATION:** 140 Lynnway - Revere, MA  
**LOCATION:** Refer To Test Boring Location Plan      **ELEVATION:** G.S.  
**DRILLER:** Soil Exploration Corp.      **LOGGED BY:** TMc  
**DRILLING METHOD:** 4.25" ID HSA      **DATE:** 01-19-21  
**DEPTH TO - WATER> INITIAL:** 9.0      **AFTER 24 HOURS:**

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS				
							Plastic Limit	—	Liquid Limit	Water Content - •	Penetration - 
0	[TOPSOIL] Dark brown, sandy Silt (ML), trace gravel, rootlets, organics; loose		0.5	SS01	3 4 5 6						
	[FILL] Dark tan, silty clayey Sand (SC-SM) with gravel; medium dense -red mottling observed in sample		3.5	SS02	6 7 7 8						
	-becomes loose -shattered rock in spoon		7	SS03	4 4 4 4						
	-orange color mottling observed in sample		10	SS04	4 3 4 5						
10.5	[ORGANICS] Dark brown, Peat (PT); medium dense; wet		10.5	SS05	12 9 12 18						
	[MARINE DEPOSITS] Dark grey, Gravel (GP-GM) with sand; medium dense;		14								
	Grey, silty Sand (SM); medium dense		16	SS06	6 9 15 18						
17.5											
21				SS07	4 6 11 12						
24.5											

Test boring backfilled with soil cuttings upon completion.



# LOG OF BORING No. B-3

**PROJECT:** Alden Mills/Point of Pines - Proposed Fire Station      **PROJECT NO.:** 21-04-008  
**CLIENT:** Revere Fire Department  
**PROJECT LOCATION:** 140 Lynnway - Revere, MA  
**LOCATION:** Refer To Test Boring Location Plan      **ELEVATION:** G.S.  
**DRILLER:** Soil Exploration Corp.      **LOGGED BY:** TMc  
**DRILLING METHOD:** 4.25" ID HSA      **DATE:** 01-19-21  
**DEPTH TO - WATER> INITIAL:** 9.0      **AFTER 24 HOURS:**

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS
							Plastic Limit — Liquid Limit Water Content - • Penetration -
25	Grey, poorly graded, Sand (SP-SC) with silty clay; loose			SS08	6 11 12 14		
28	Boring terminated at 27 ft.						
31.5							
35							
38.5							
42							
45.5							
49							

Test boring backfilled with soil cuttings upon completion.





# LOG OF BORING No. B-4

**PROJECT:** Alden Mills/Point of Pines - Proposed Fire Station      **PROJECT NO.:** 21-04-008  
**CLIENT:** Revere Fire Department  
**PROJECT LOCATION:** 140 Lynnway - Revere, MA  
**LOCATION:** Refer To Test Boring Location Plan      **ELEVATION:** G.S.  
**DRILLER:** Soil Exploration Corp.      **LOGGED BY:** TMc  
**DRILLING METHOD:** 4.25" ID HSA      **DATE:** 01-20-21  
**DEPTH TO - WATER> INITIAL:** 7.0      **AFTER 24 HOURS:**

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	TEST RESULTS				
						Plastic Limit ——— Liquid Limit Water Content - ● Penetration -				
0	[TOPSOIL] Dark brown, sandy Silt (ML), trace gravel, rootlets, organics; medium dense			SS01	3 5 7 9					
	[FILL] Dark tan, silty clayey Sand (SC-SM) with gravel; medium dense		0.67	SS02	9 8 11 9					
3.5	-shattered rock in spoon			SS03	4 100/3					
7	Tan-grey, clayey Sand (SC); loose			SS04	1 2 3 6					
	[ORGANICS] Dark brown, Peat (PT); loose; wet		8.5							
10.5	[MARINE DEPOSITS] Dark grey, Gravel (GP-GM) with sand; medium dense; -peat observed in sample		10	SS05	5 11 11 11					
14				SS06	6 10 11 12					
17.5										
21	Grey, silty Sand (SM); medium dense			SS07	4 6 8 10					
24.5										

Test boring backfilled with soil cuttings upon completion.



# LOG OF BORING No. B-4

PROJECT: Alden Mills/Point of Pines - Proposed Fire Station PROJECT NO.: 21-04-008  
CLIENT: Revere Fire Department  
PROJECT LOCATION: 140 Lynnway - Revere, MA  
LOCATION: Refer To Test Boring Location Plan ELEVATION: G.S.  
DRILLER: Soil Exploration Corp. LOGGED BY: TMc  
DRILLING METHOD: 4.25" ID HSA DATE: 01-20-21  
DEPTH TO - WATER> INITIAL: 7.0 AFTER 24 HOURS:

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS				
							Plastic Limit	Liquid Limit		Water Content -	Penetration -
	-noxious odor observed				3						
				SS08	8						
	Grey, poorly graded, Sand (SP-SC) with silty clay; medium dense				19						
					18						
	Boring terminated at 27 ft.										
28											
31.5											
35											
38.5											
42											
45.5											
49											

Test boring backfilled with soil cuttings upon completion.



# LOG OF BORING No. B-5

**PROJECT:** Alden Mills/Point of Pines - Proposed Fire Station      **PROJECT NO.:** 21-04-008  
**CLIENT:** Revere Fire Department  
**PROJECT LOCATION:** 140 Lynnway - Revere, MA  
**LOCATION:** Refer To Test Boring Location Plan      **ELEVATION:** G.S.  
**DRILLER:** Soil Exploration Corp.      **LOGGED BY:** TMc  
**DRILLING METHOD:** 4.25" ID HSA      **DATE:** 01-20-21  
**DEPTH TO - WATER> INITIAL:** 8.0      **AFTER 24 HOURS:**

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS				
							Plastic Limit	—	Liquid Limit	Water Content - •	Penetration -
0	[TOPSOIL] Dark brown, sandy Silt (ML), trace gravel, rootlets, organics; medium dense			SS01	3 4 7 9						
	[FILL] Tan-brown, silty Sand (SM) with gravel; medium dense -shattered rock in spoon tip			SS02	14 10 10 9						
3.5											
				SS03	5 5 6 10						
7	Dark tan, silty clayey Sand (SC-SM) with gravel; medium dense; wet		7	SS04	5 5 6 8						
10.5	[MARINE DEPOSITS] Dark grey, Gravel (GP-GM) with sand; medium dense;		10	SS05	5 10 11 10						
14											
				SS06	5 7 21 29						
17.5											
21	Grey, silty Sand (SM); medium dense			SS07	5 10 15 12						
24.5											

Test boring backfilled with soil cuttings upon completion.



# LOG OF BORING No. B-5

**PROJECT:** Alden Mills/Point of Pines - Proposed Fire Station      **PROJECT NO.:** 21-04-008  
**CLIENT:** Revere Fire Department  
**PROJECT LOCATION:** 140 Lynnway - Revere, MA  
**LOCATION:** Refer To Test Boring Location Plan      **ELEVATION:** G.S.  
**DRILLER:** Soil Exploration Corp.      **LOGGED BY:** TMc  
**DRILLING METHOD:** 4.25" ID HSA      **DATE:** 01-20-21  
**DEPTH TO - WATER> INITIAL:** 8.0      **AFTER 24 HOURS:**

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS
							Plastic Limit ——— Liquid Limit Water Content - • Penetration -
25	Grey, poorly graded, Sand (SP-SC) with silty clay; medium dense -noxious odor observed			SS08	6 10 9 9		
28	Boring terminated at 27 ft.						
31.5							
35							
38.5							
42							
45.5							
49							

*Test boring backfilled with soil cuttings upon completion.*



# LOG OF BORING No. B-6/IT-1

**PROJECT:** Alden Mills/Point of Pines - Proposed Fire Station      **PROJECT NO.:** 21-04-008  
**CLIENT:** Revere Fire Department  
**PROJECT LOCATION:** 140 Lynnway - Revere, MA  
**LOCATION:** Refer To Test Boring Location Plan      **ELEVATION:** G.S.  
**DRILLER:** Soil Exploration Corp.      **LOGGED BY:** TMc  
**DRILLING METHOD:** 4.25" ID HSA      **DATE:** 01-20-21  
**DEPTH TO - WATER> INITIAL:** 8.0      **AFTER 24 HOURS:**

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS				
							Plastic Limit	—	Liquid Limit	Water Content - •	Penetration -
0	[TOPSOIL] Dark brown, sandy Silt (ML), trace gravel, rootlets, organics; medium loose			SS01	5 4 5 15						
3.5	[FILL] Dark tan, silty clayey Sand (SC-SM) with gravel; medium dense -becomes medium dense  -becomes loose		0.67	SS02	22 9 9 9						
7	Tan, silty clayey Sand (SC-SM); medium dense		7	SS03	4 4 4 4						
				SS04	3 4 3 4						
10.5	Boring terminated at 9 ft.										
14											
17.5											
21											
24.5											

Test boring backfilled with soil cuttings upon completion.



# LOG OF BORING No. B-7/IT-2

**PROJECT:** Alden Mills/Point of Pines - Proposed Fire Station      **PROJECT NO.:** 21-04-008  
**CLIENT:** Revere Fire Department  
**PROJECT LOCATION:** 140 Lynnway - Revere, MA  
**LOCATION:** Refer To Test Boring Location Plan      **ELEVATION:** G.S.  
**DRILLER:** Soil Exploration Corp.      **LOGGED BY:** TMc  
**DRILLING METHOD:** 4.25" ID HSA      **DATE:** 01-20-21  
**DEPTH TO - WATER> INITIAL:** 8.0      **AFTER 24 HOURS:**

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS				
							Plastic Limit ——— Liquid Limit Water Content - ● Penetration -				
0	[TOPSOIL]										
	Dark brown, sandy Silt (ML), trace gravel, rootlets, organics; loose			SS01	2 4 5 12						
	[FILL]		0.83								
	Dark tan, silty clayey Sand (SC-SM) with gravel; loose			SS02	14 14 12 9						
3.5	-becomes medium dense -shattered rock in spoon										
	Tan, silty clayey Sand (SC-SM); traces of topsoil and roots in sample; dense			SS03	5 22 9 9						
7	-shattered rock in spoon -becomes medium dense			SS04	6 10 6 6						
	Boring terminated at 9 ft.										
10.5											
14											
17.5											
21											
24.5											







Test boring backfilled with soil cuttings upon completion.



# LOG OF BORING No. B-8

**PROJECT:** Alden Mills/Point of Pines - Proposed Fire Station      **PROJECT NO.:** 21-04-008  
**CLIENT:** Revere Fire Department  
**PROJECT LOCATION:** 140 Lynnway - Revere, MA  
**LOCATION:** Refer To Test Boring Location Plan      **ELEVATION:** G.S.  
**DRILLER:** Soil Exploration Corp.      **LOGGED BY:** TMc  
**DRILLING METHOD:** 4.25" ID HSA      **DATE:** 01-20-21  
**DEPTH TO - WATER> INITIAL:** 7.0      **AFTER 24 HOURS:**

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS				
							Plastic Limit	—	Liquid Limit	Water Content - •	Penetration - 
0	[PAVEMENT] 3" bituminous concrete pavement			SS01	8 7 7 9						
	[PAVEMENT BASE] Brown, silty Sand (SM) with gravel; medium dense		0.25								
	[FILL] Dark tan, silty clayey Sand (SC-SM) with gravel; medium dense		0.75	SS02	3 4 10 8						
3.5	-becomes loose										
	Tan-brown, silty Sand (SM) with gravel; loose		6	SS03	2 2 5 9						
7	[MARINE DEPOSITS] Dark grey, Gravel (GP-GM) with sand; medium dense; -peat observed in sample		7	SS04	9 10 6 6						
10.5				SS05	5 5 8 10						
	Boring terminated at 12 ft.										
14											
17.5											
21											
24.5											

Test boring backfilled with soil cuttings upon completion.

MAJOR DIVISIONS			SYMBOLS		TYPICAL NAMES	
COARSE-GRAINED SOILS OVER 50% > No.200 SIEVE SIZE	GRAVELS	CLEAN GRAVELS WITH LESS THAN 5% FINES	GW		Well-graded gravels or gravel-sand mixtures, little or no fines	
			GP		Poorly graded gravels or gravel-sand mixtures, little or no fines	
		GRAVELS WITH OVER 15% FINES	GM		Silty gravels, gravel-sand mixtures	
			GC		Clayey gravels, gravel-sand-clay mixtures	
	SANDS	CLEAN SANDS WITH LESS THAN 5% FINES	SW		Well-graded sand or gravelly sands, little or no fines	
			SP		Poorly graded sands or gravelly sands, little or no fines	
		SANDS WITH OVER 15% FINES	SM		Silty sand, sand-silt mixtures	
			SC		Clayey sands, sand-clay mixtures	
FINE-GRAINED SOILS OVER 50% < No.200 SIEVE SIZE	SILTS & CLAYS  LIQUID LIMIT 50% OR LESS		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL		Organic silts and organic silty clays of low plasticity	
	SILTS & CLAYS  LIQUID LIMIT GREATER THAN 50%		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
			CH		Inorganic clays of high plasticity, fat clays	
			OH		Organic clays of medium to high plasticity, organic silty clays, organic silts	
	HIGHLY ORGANIC SOILS		PT		Peat and other highly organic soils	

KEY TO SYMBOLS AND DESCRIPTIONS

	Shelby Tube		Auger Cuttings
	Standard Split Spoon Sample		3" Split Spoon Sample
	Rock Core		Dynamic Cone Penetrometer
	Vane Shear		Bulk/Grab Sample
	Geoprobe Sample		Sonic or Vibro-Core Sample
	Water Table (at time of drilling)		Water Table (after 24 hours)

TYPICAL SYMBOLS

SOIL MOISTURE MODIFIERS





























Term	Description
Dry	Absence of moisture; dusty, dry to touch
Moist	Damp but no visible water
Wet	Visible free water

The descriptor "damp" should not be used (use "moist").  
The descriptor "saturated" should not be used (use "wet").

	Recessed Cover
	Set in Concrete
	Top of Well
	Recessed Pipe
	Covered Riser
	Capped Riser w/ Locking Cover
	Pipe Riser
	Concrete Seal
	Gravel Backfill
	Assorted Cuttings
	Bentonite Slurry
	Bentonite Pellets
	Silica Sand, blank PVC
	Slotted Pipe w/ Sand
	Endcap on Pipe
	Packed in Sand
	Silica Sand, No Pipe (End Plug)

WELL SYMBOLS

## KEY TO SYMBOLS AND DESCRIPTIONS

	Shelby Tube		Auger Cuttings		Recessed Cover
	Standard Split Spoon Sample		3" Split Spoon Sample		Set in Concrete
	Rock Core		Dynamic Cone Penetrometer		Top of Well
	Vane Shear		Bulk/Grab Sample		Recessed Pipe
	Geoprobe Sample		Sonic or Vibro-Core Sample		Covered Riser
	Water Table (at time of drilling)		Water Table (after 24 hours)		Capped Riser w/ Locking Cover
					Pipe Riser
					Concrete Seal
					Gravel Backfill
					Assorted Cuttings
					Bentonite Slurry
					Bentonite Pellets
					Silica Sand, blank PVC
					Slotted Pipe w/ Sand
					Endcap on Pipe Packed in Sand
					Silica Sand, No Pipe (End Plug)

## TYPICAL SYMBOLS

## SOIL MOISTURE MODIFIERS

Term	Description
Dry	Absence of moisture; dusty, dry to touch
Moist	Damp but no visible water
Wet	Visible free water

The descriptor "damp" should not be used (use "moist").  
The descriptor "saturated" should not be used (use "wet").

## WELL SYMBOLS

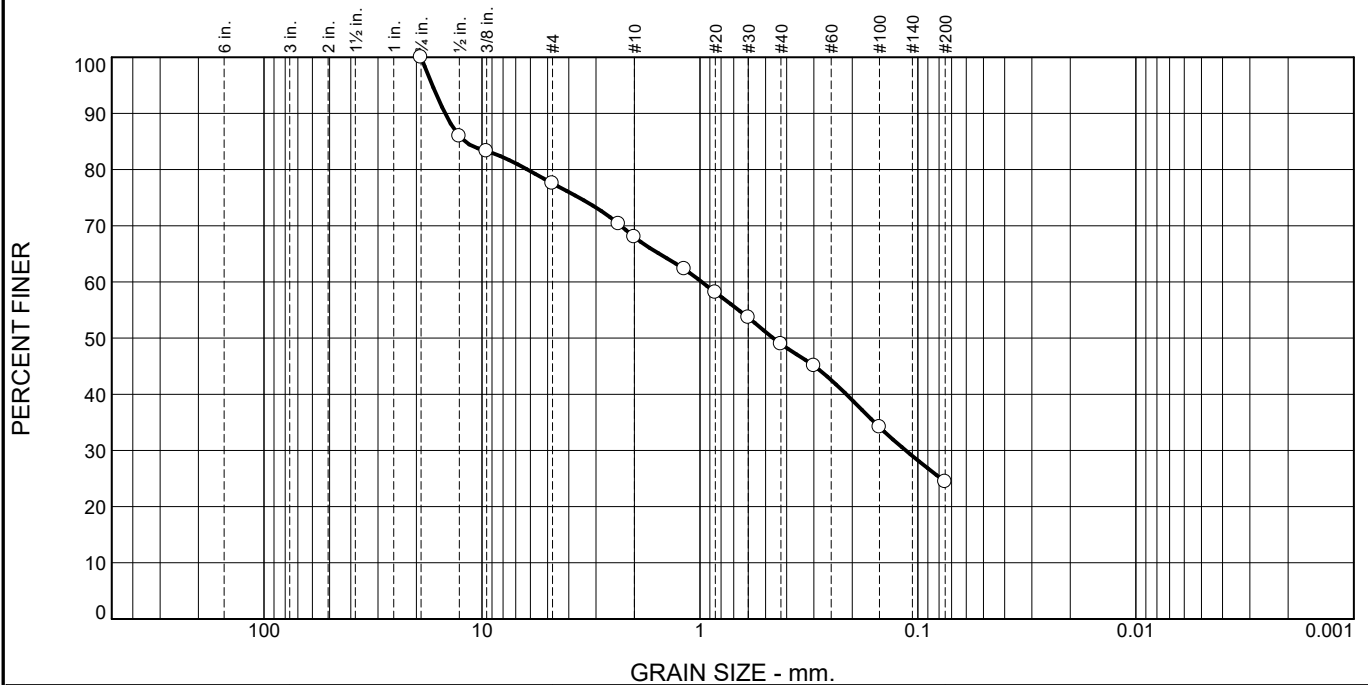
CLASSIFICATION	RANGE OF GRAIN SIZES		RELATIVE DENSITY/CONSISTENCY					PERCENT OR PORTIONS OF SOIL	
	U.S. Standard Sieve Size	Grain Size in Millimeters	Gravel, Sand, and Silt (nonplastic)		Silt (plastic) and Clay			Term	Description
BOULDERS	Above 12"	Above 305	N-Value	Relative Density	N-Value	Su	Consistency	Parting:	> 1/16 in.
COBBLES	12" to 3"	305 to 76.2	0 - 4	Very Loose	0 - 2	0 - 250	Very Soft	Seam:	0.5 in. to 1/16 in.
GRAVEL coarse fine	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.75 76.2 to 19.1 19.1 to 4.75	5 - 10	Loose	3 - 4	251 - 500	Soft	Layer:	12 in. to 0.5 in.
			11-30	Medium Dense	5 - 8	501 - 1000	Medium Stiff	Stratum:	> 12 in.
			31 - 50	Dense	9 - 15	1001 - 2000	Stiff	Pocket:	Small erratic deposit
SAND coarse medium fine	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.75 to 0.075 4.75 to 2.00 2.00 to 0.425 0.425 to 0.075	51 +	Very Dense	16 - 30	2001 - 4000	Very Stiff	Lens:	Lenticular deposit
					31 +	4001+	Hard	Occasional:	One or less per foot of thickness
			Standard Penetration Testing (SPT) N <sub>60</sub> based on blows per 12 inches. WR = Weight of Rods; WH = Weight of Hammer					Frequent	More than one per foot of thickness
SILT & CLAY	Below No. 200	Below 0.075						Varved	Alternating seams or layers of silt and/or clay and sometimes f. sand

**REFERENCE: UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D2488-93**



## **APPENDIX E: GEOTECHNICAL LABORATORY TESTING REPORTS**

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	22.5	9.5	19.1	24.5	24.4	

Test Results (ASTM D 422 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
1/2"	86.0		
3/8"	83.3		
#4	77.5		
#8	70.3		
#10	68.0		
#16	62.3		
#20	58.1		
#30	53.6		
#40	48.9		
#50	45.1		
#100	34.1		
#200	24.4		

\* (no specification provided)

## Material Description

Dark brown silty sand with gravel

## Atterberg Limits (ASTM D 4318)

PL= - LL= - PI= -

## Classification

USCS (D 2487)= SM AASHTO (M 145)= -

## Coefficients

D<sub>90</sub>= 14.7642 D<sub>85</sub>= 11.9693 D<sub>60</sub>= 0.9811  
D<sub>50</sub>= 0.4619 D<sub>30</sub>= 0.1137 D<sub>15</sub>=  
D<sub>10</sub>= C<sub>u</sub>= C<sub>c</sub>=

## Remarks

Moisture content 10.7%

Date Received: 1/22/2021 Date Tested: 1/26/2021

Tested By: Matt Watson

Checked By: Rob Faria

Title: Lab Manager

Location: B-5 SS02

Sample Number: 3521-047

Depth: 2'-4'

Date Sampled: 1/22/2021

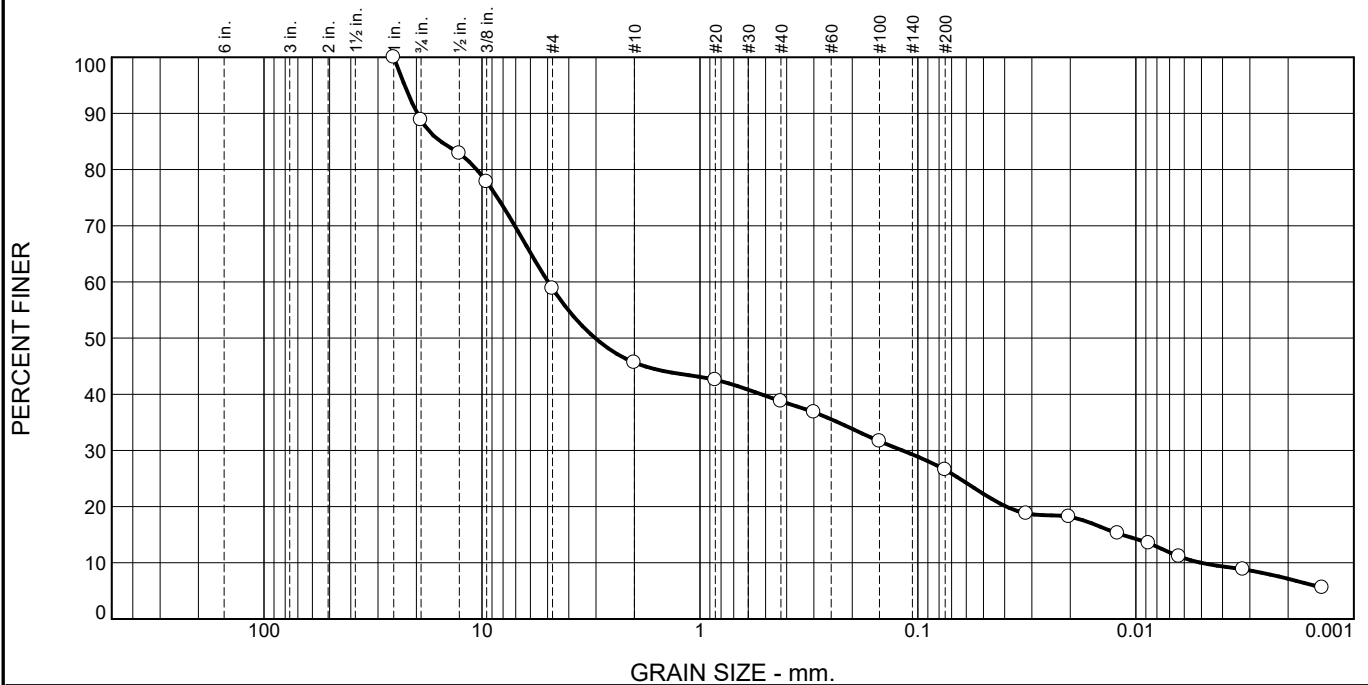


Client: City of Revere  
Project: Alden Mills/Point of Pines Fire Station  
Revere, MA

Project No: 20-04-114

Figure 047A

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.2	30.0	13.2	6.8	12.3	16.5	10.0

Test Results (ASTM D 422 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
3/4"	88.8		
1/2"	82.9		
3/8"	77.8		
#4	58.8		
#10	45.6		
#20	42.6		
#40	38.8		
#50	36.8		
#100	31.6		
#200	26.5		
0.0318 mm.	18.8		
0.0203 mm.	18.2		
0.0121 mm.	15.2		
0.0087 mm.	13.5		
0.0063 mm.	11.1		
0.0032 mm.	8.8		
0.0014 mm.	5.6		

\* (no specification provided)

**Material Description**  
Light brown silty, clayey sand with gravel

**Atterberg Limits (ASTM D 4318)**  
PL= - LL= - PI= -

**Classification**  
USCS (D 2487)= SC-SM AASHTO (M 145)= -

**Coefficients**  
D<sub>90</sub>= 19.8151 D<sub>85</sub>= 15.4674 D<sub>60</sub>= 4.9730  
D<sub>50</sub>= 3.0265 D<sub>30</sub>= 0.1180 D<sub>15</sub>= 0.0116  
D<sub>10</sub>= 0.0050 C<sub>u</sub>= 988.66 C<sub>c</sub>= 0.56

**Remarks**  
Moisture content 12.6%

Date Received: 1/21/2021 Date Tested: 1/29/2021

Tested By: Matt Watson

Checked By: Rob Faria

Title: Lab Manager

Location: B-6/ IT-1 SS03  
Sample Number: 3521-045 Depth: 5'-7'

Date Sampled: 1/22/2021

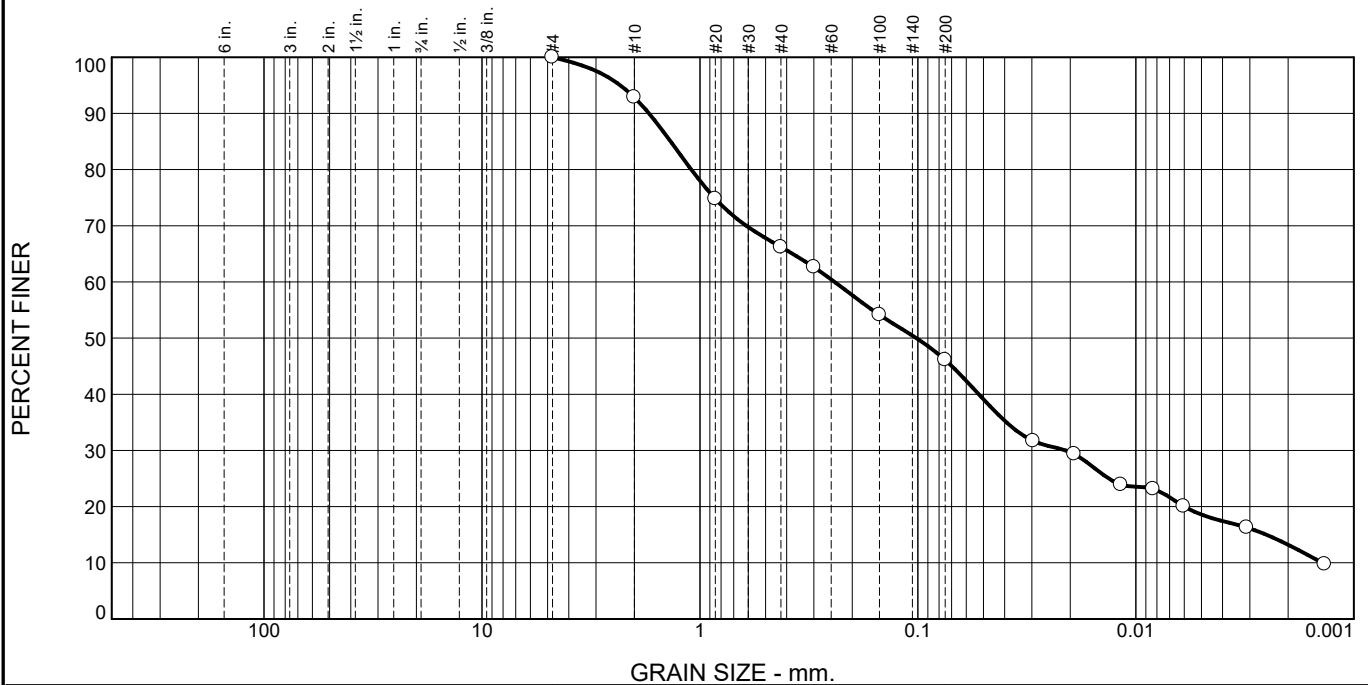


Client: City of Revere  
Project: Alden Mills/Point of Pines Fire Station  
Revere, MA

Project No: 20-04-114

Figure 045A

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	7.1	26.7	20.1	27.5	18.6

Test Results (ASTM D 422 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	92.9		
#20	74.8		
#40	66.2		
#50	62.6		
#100	54.1		
#200	46.1		
0.0295 mm.	31.7		
0.0192 mm.	29.3		
0.0117 mm.	23.9		
0.0083 mm.	23.1		
0.0060 mm.	20.1		
0.0031 mm.	16.3		
0.0014 mm.	9.8		

\* (no specification provided)

## Material Description

Light brown silty, clayey sand

## Atterberg Limits (ASTM D 4318)

PL= 15 LL= 21 PI= 6

## Classification

USCS (D 2487)= SC-SM AASHTO (M 145)= -

## Coefficients

D<sub>90</sub>= 1.7136 D<sub>85</sub>= 1.3628 D<sub>60</sub>= 0.2410  
D<sub>50</sub>= 0.1017 D<sub>30</sub>= 0.0210 D<sub>15</sub>= 0.0025  
D<sub>10</sub>= 0.0014 C<sub>u</sub>= 172.44 C<sub>c</sub>= 1.31

## Remarks

Moisture content 14.6%

Date Received: 1/22/2021 Date Tested: 1/29/2021

Tested By: Matt Watson

Checked By: Rob Faria

Title: Lab Manager

Location: B-7/ IT-2 SS03

Sample Number: 3521-046

Depth: 5'-7'

Date Sampled: 1/22/2021

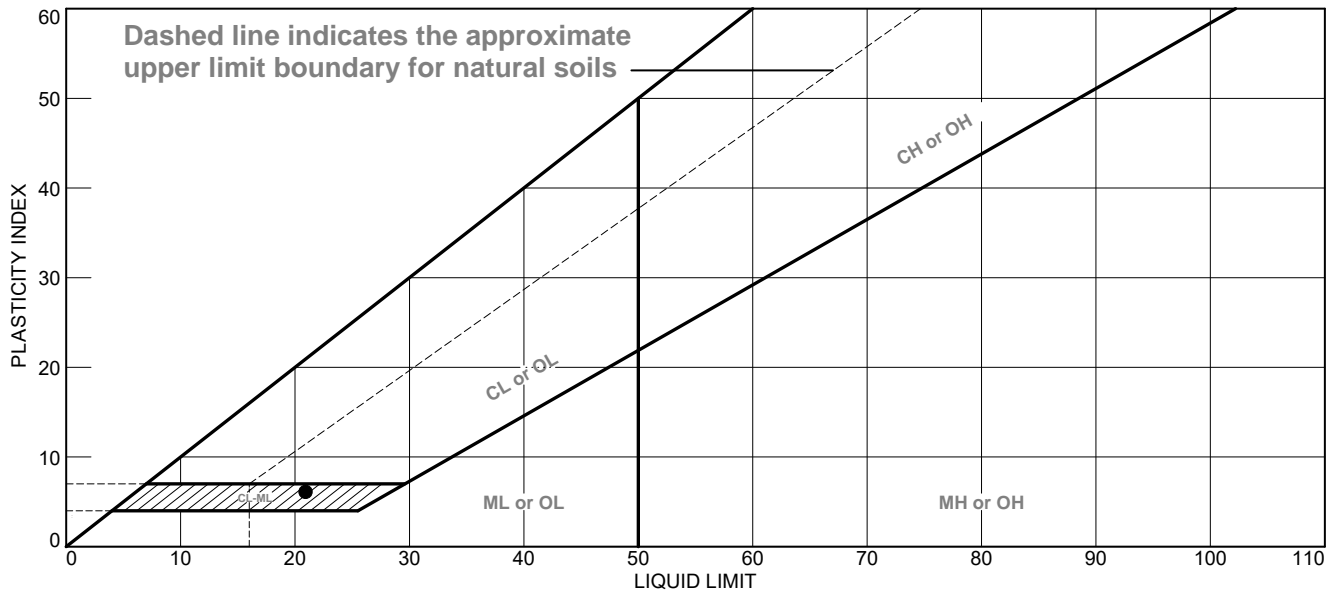


Client: City of Revere  
Project: Alden Mills/Point of Pines Fire Station  
Revere, MA

Project No: 20-04-114

Figure 046A

# LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light brown silty, clayey sand	21	15	6	66.2	46.1	SC-SM

**Project No.** 20-04-114    **Client:** City of Revere  
**Project:** Alden Mills/Point of Pines Fire Station  
 Revere, MA  
**Location:** B-7/ IT-2 SS03  
**Sample Number:** 3521-046    **Depth:** 5'-7'

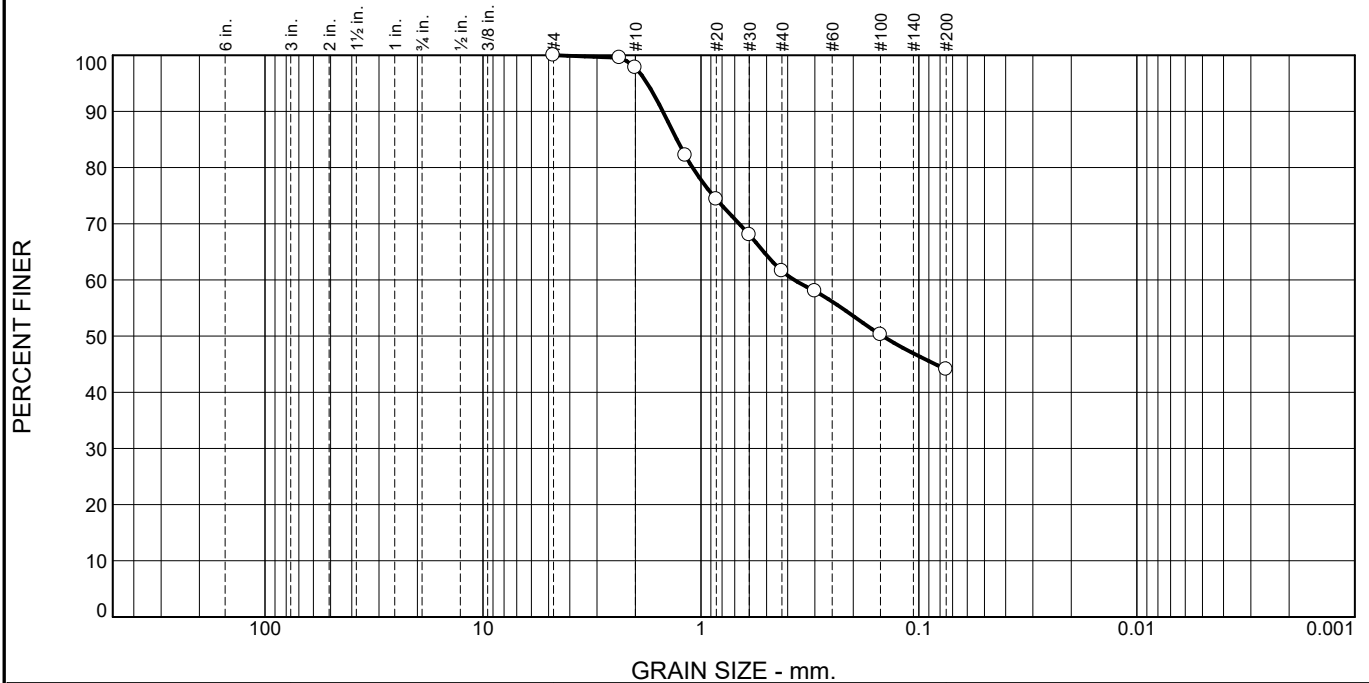


**Remarks:**

**Figure** 046B

**Tested By:** Matt Watson    **Checked By:** Rob Faria

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	2.2	36.2	17.5	44.1	

Test Results (ASTM D 422 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#8	99.5		
#10	97.8		
#16	82.2		
#20	74.4		
#30	68.0		
#40	61.6		
#50	58.0		
#100	50.3		
#200	44.1		

\* (no specification provided)

**Material Description**  
Light gray clayey sand

**Atterberg Limits (ASTM D 4318)**  
PL= 15 LL= 24 PI= 9

**Classification**  
USCS (D 2487)= SC AASHTO (M 145)= -

**Coefficients**  
D<sub>90</sub>= 1.4969 D<sub>85</sub>= 1.2903 D<sub>60</sub>= 0.3737  
D<sub>50</sub>= 0.1465 D<sub>30</sub>= C<sub>u</sub>= D<sub>15</sub>= C<sub>c</sub>=

**Remarks**  
Moisture content 15.2%

**Date Received:** 1/21/2021 **Date Tested:** 1/29/2021

**Tested By:** Matt Watson

**Checked By:** Rob Faria

**Title:** Lab Manager

Location: B-4 SS04

Sample Number: 3521-048

Depth: 7'-9'

Date Sampled: 1/21/2021

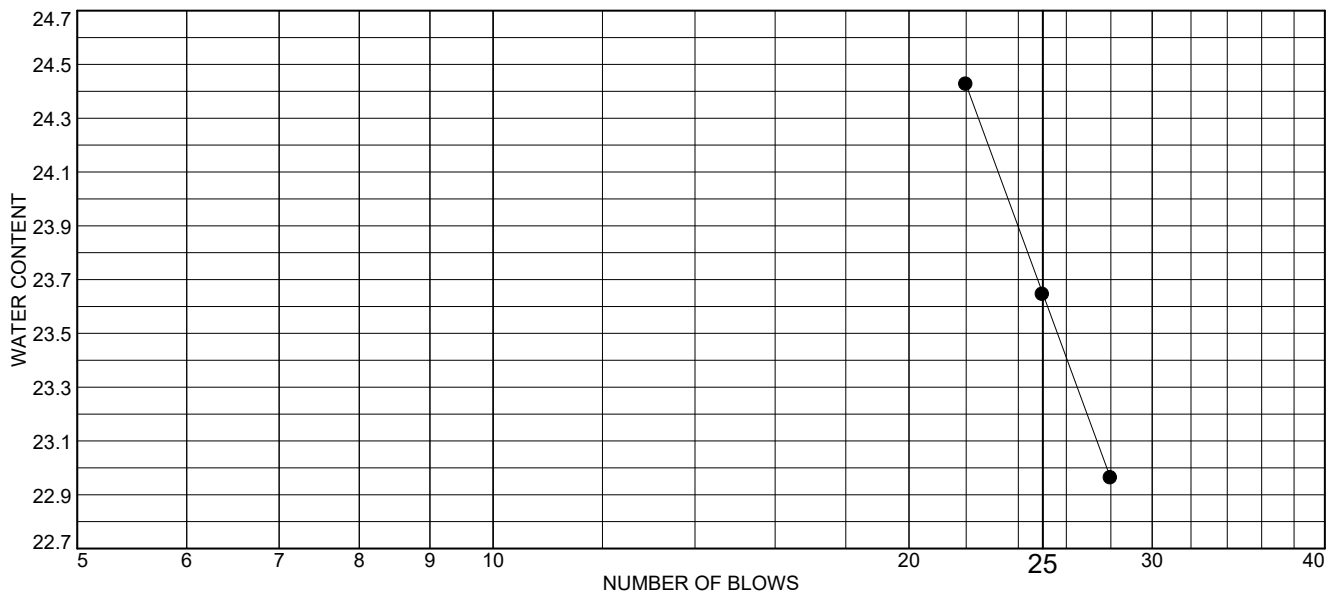
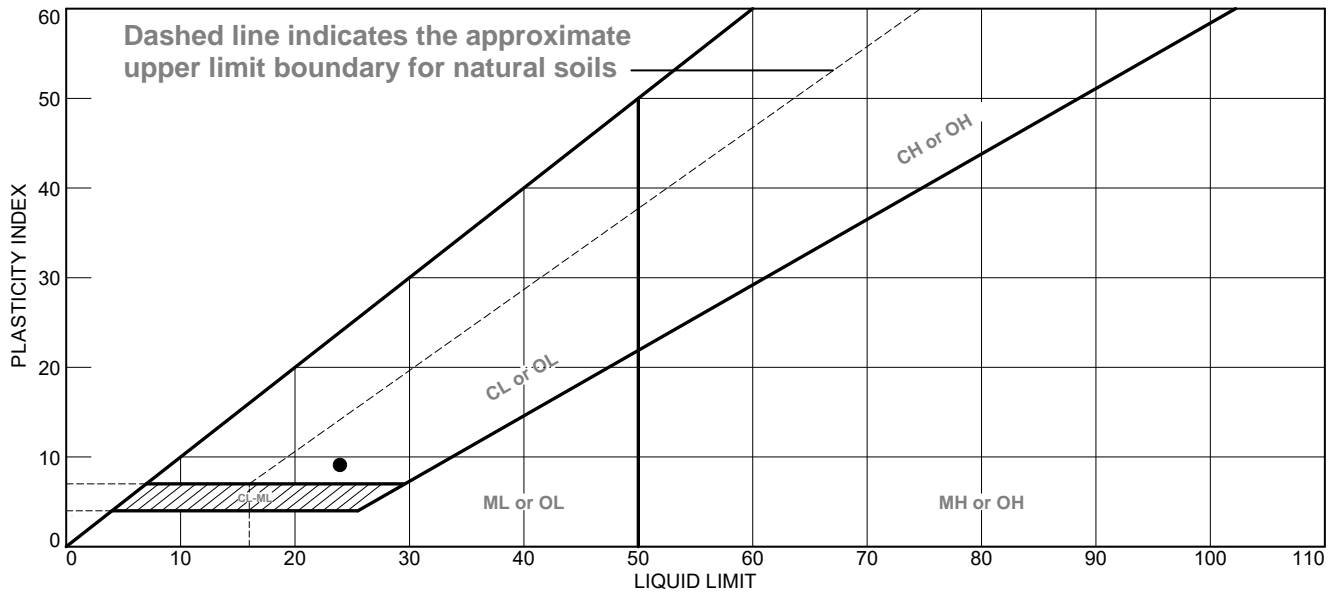


**Client:** City of Revere  
**Project:** Alden Mills/Point of Pines Fire Station  
Revere, MA

**Project No:** 20-04-114

**Figure** 048A

# LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light gray clayey sand	24	15	9	61.6	44.1	SC

**Project No.** 20-04-114    **Client:** City of Revere  
**Project:** Alden Mills/Point of Pines Fire Station  
 Revere, MA  
**Location:** B-4 SS04  
**Sample Number:** 3521-048    **Depth:** 7'-9"

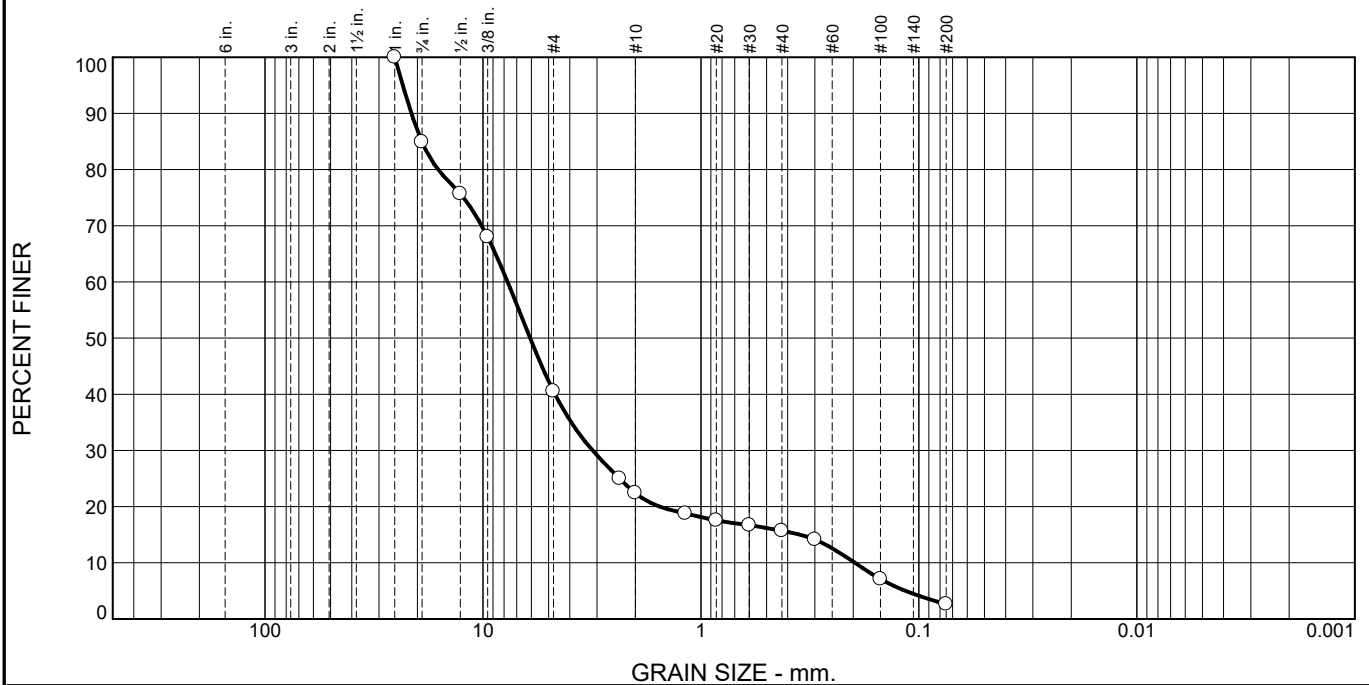


**Remarks:**

**Figure** 048B

**Tested By:** Matt Watson    **Checked By:** Rob Faria

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.1	44.4	18.1	6.7	13.1	2.6	

Test Results (ASTM D 422 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
3/4"	84.9		
1/2"	75.7		
3/8"	68.0		
#4	40.5		
#8	25.0		
#10	22.4		
#16	18.8		
#20	17.5		
#30	16.7		
#40	15.7		
#50	14.1		
#100	7.1		
#200	2.6		

\* (no specification provided)

<b>Material Description</b>	
Dark brown grayish gravel with sand	
<b>Atterberg Limits (ASTM D 4318)</b>	
PL= -	LL= - PI= -
<b>Classification</b>	
USCS (D 2487)= GP	AASHTO (M 145)= -
<b>Coefficients</b>	
D <sub>90</sub> = 21.2981	D <sub>85</sub> = 19.0981 D <sub>60</sub> = 7.7125
D <sub>50</sub> = 6.0784	D <sub>30</sub> = 3.1418 D <sub>15</sub> = 0.3512
D <sub>10</sub> = 0.1968	C <sub>u</sub> = 39.19 C <sub>c</sub> = 6.50
<b>Remarks</b>	
Moisture content 6.5%	
Date Received: 1/21/2021	Date Tested: 1/29/2021
Tested By: Matt Watson	
Checked By: Rob Faria	
Title: Lab Manager	

Location: B-1 SS05

Sample Number: 3521-049

Depth: 10'-12'

Date Sampled: 1/21/2021



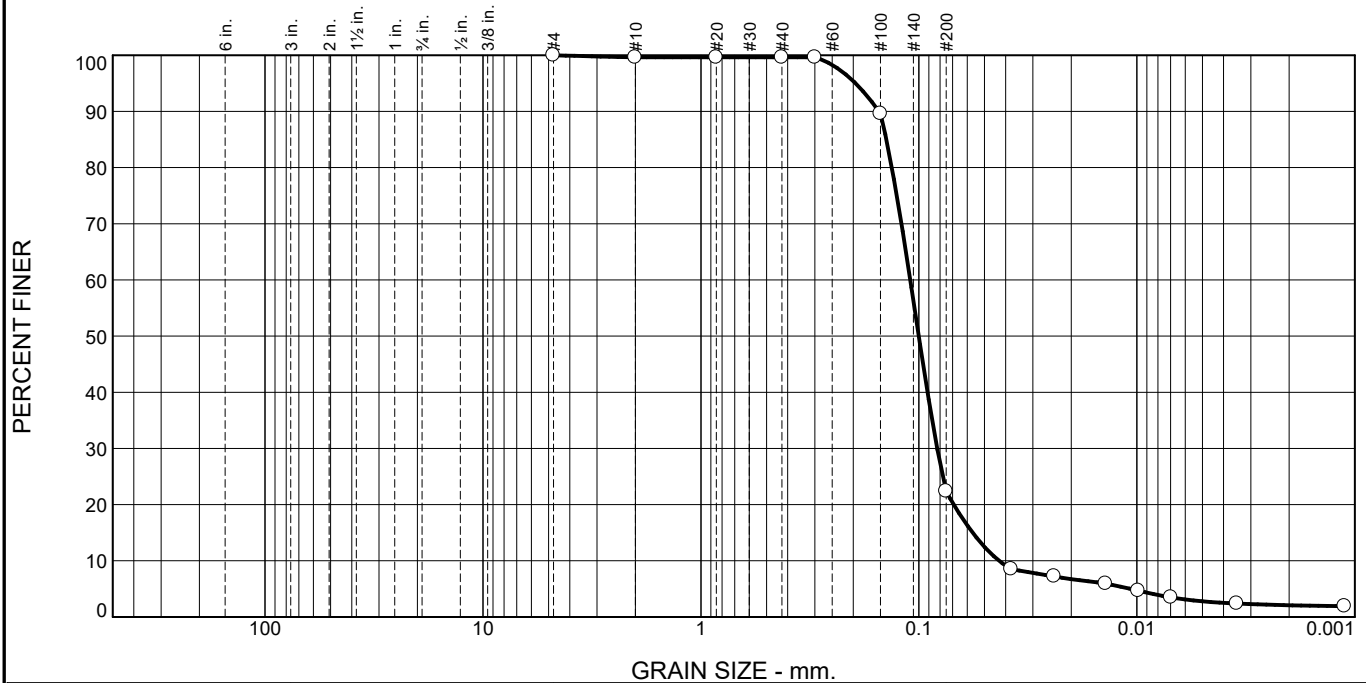
Client: City of Revere  
Project: Alden Mills/Point of Pines Fire Station  
Revere, MA

Project No: 20-04-114

Figure 049A



# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	0.0	77.2	19.6	2.8

Test Results (ASTM D 422 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.6		
#20	99.6		
#40	99.6		
#50	99.6		
#100	89.6		
#200	22.4		
0.0377 mm.	8.5		
0.0240 mm.	7.2		
0.0139 mm.	5.9		
0.0099 mm.	4.7		
0.0070 mm.	3.5		
0.0035 mm.	2.4		
0.0011 mm.	1.9		

\* (no specification provided)

<b>Material Description</b>		
Light gray silty sand		
<b>Atterberg Limits (ASTM D 4318)</b>		
PL= -	LL= -	PI= -
<b>Classification</b>		
USCS (D 2487)= SM	AASHTO (M 145)= -	
<b>Coefficients</b>		
D <sub>90</sub> = 0.1524	D <sub>85</sub> = 0.1410	D <sub>60</sub> = 0.1096
D <sub>50</sub> = 0.1002	D <sub>30</sub> = 0.0824	D <sub>15</sub> = 0.0567
D <sub>10</sub> = 0.0429	C <sub>u</sub> = 2.56	C <sub>c</sub> = 1.44
<b>Remarks</b>		
Moisture content 30.1%		
<b>Date Received:</b> 1/21/2021 <b>Date Tested:</b> 1/29/2021		
<b>Tested By:</b> Matt Watson		
<b>Checked By:</b> Rob Faria		
<b>Title:</b> Lab Manager		

Location: B-3 SS07

Sample Number: 3521-050

Depth: 20'-22'

Date Sampled: 1/21/2021

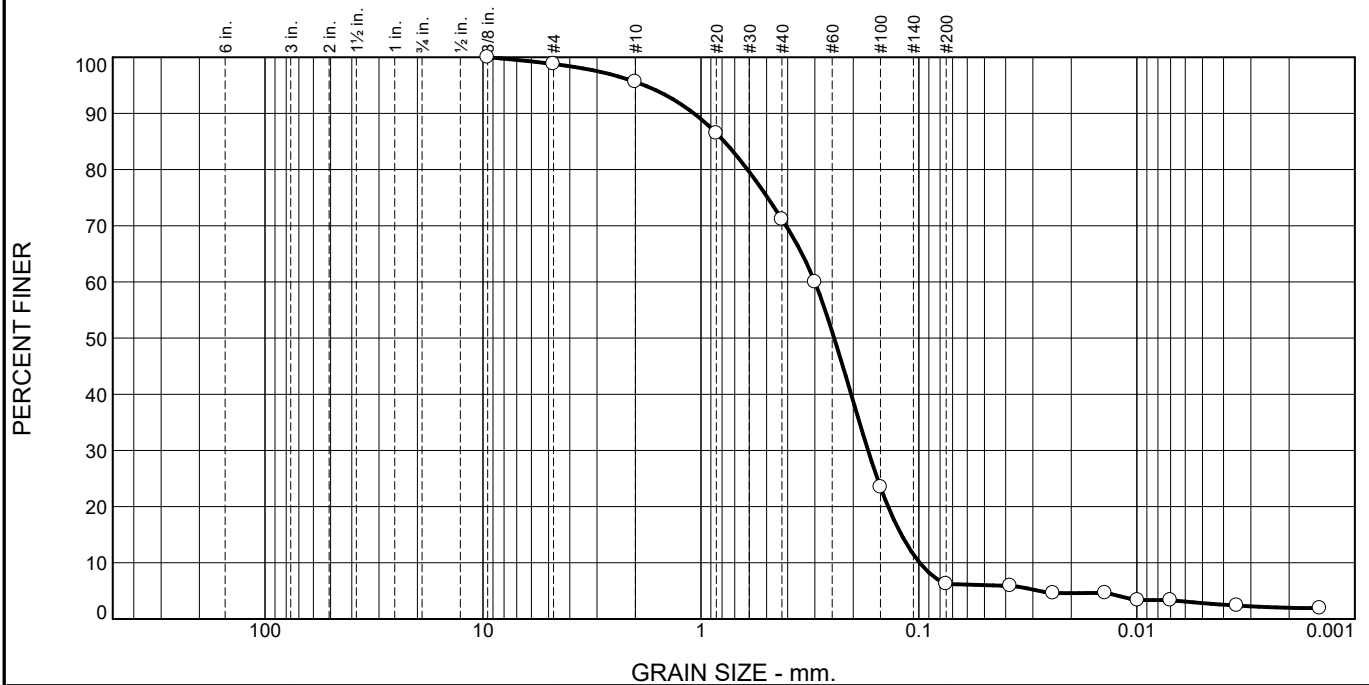


**Client:** City of Revere  
**Project:** Alden Mills/Point of Pines Fire Station  
 Revere, MA

**Project No:** 20-04-114

**Figure** 050A

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.2	3.2	24.5	64.9	3.4	2.8

Test Results (ASTM D 422 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8"	100.0		
#4	98.8		
#10	95.6		
#20	86.5		
#40	71.1		
#50	60.0		
#100	23.5		
#200	6.2		
0.0381 mm.	5.9		
0.0242 mm.	4.6		
0.0140 mm.	4.6		
0.0099 mm.	3.4		
0.0070 mm.	3.4		
0.0035 mm.	2.4		
0.0014 mm.	1.9		

\* (no specification provided)

## Material Description

Light gray sand with silty clay

## Atterberg Limits (ASTM D 4318)

PL= - LL= - PI= -

## Classification

USCS (D 2487)= SP-SC AASHTO (M 145)= -

## Coefficients

D<sub>90</sub>= 1.0766 D<sub>85</sub>= 0.7814 D<sub>60</sub>= 0.3001  
D<sub>50</sub>= 0.2445 D<sub>30</sub>= 0.1710 D<sub>15</sub>= 0.1204  
D<sub>10</sub>= 0.0992 C<sub>u</sub>= 3.03 C<sub>c</sub>= 0.98

## Remarks

Moisture content 23.9%

Date Received: 1/21/2021 Date Tested: 1/29/2021

Tested By: Matt Watson

Checked By: Rob Faria

Title: Lab Manager

Location: B-2 SS08

Sample Number: 3521-051

Depth: 25'-27'

Date Sampled: 1/21/2012



Client: City of Revere  
Project: Alden Mills/Point of Pines Fire Station  
Revere, MA

Project No: 20-04-114

Figure 051A

## **APPENDIX F: SITE PHOTOGRAPHS**

**Proposed Fire Station  
140 Lynnway  
Revere, Massachusetts**

**SITE PHOTOGRAPHS**



**Existing Fire Station**



**Site Facing West - Typical Drill Rig Setup**



**Sample of Fill – Silty Clayey Sand (SC-SM) with gravel**



**Sample of Peat (PT)**



**Sample of Native Gravel (GP-GM) with Sand**



**Sample of Native Silty Sand (SM)**



March 30, 2021

Jennifer dos Santos, CDT, MCPPO, Associate A.I.A.  
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**RE: Addendum: Demolition & Backfilling  
Geotechnical Investigation Report  
Proposed Alden Mills/Point of Pines Fire Station  
140 Lynnway  
Revere, Massachusetts**

Dear Ms. Dos Santos:

The following addendum provides further geotechnical recommendations for the demolition and backfilling procedures associated with the removal of the existing building and proper reinstatement of the building footprint for the above captioned project. The addendum is also authored with respect to the design team's decision to install aggregate piers in the footing foundation zone of the proposed building. The recommendations presented herein are based on the subsurface conditions encountered in test borings drilled on January 19<sup>th</sup> & 20<sup>th</sup>, 2021 as described in the *Geotechnical Investigation Report* dated February 10<sup>th</sup>, 2021.

This addendum addresses the post-demolition subgrade assessment, backfilling procedure, and specified backfill composition and placement procedure. The aforementioned site-specific *Geotechnical Investigation Report* contains the following excerpts along with **added verbiage** included with this addendum:

- Any existing buildings, structures, and/or associated foundations (including footings, foundation walls, slabs-on-grade, and/or basements) should be completely removed from proposed building and pavement areas and replaced/backfilled with properly placed and compacted *Structural Fill*;  
**[The specified backfill of *Structural Fill* is required for the final 3' of backfilling from the top of FFE. The backfill below this point, 3' below FFE and deeper, can be specified *Common Fill* down to the native subgrade level. (See backfill specifications at the end of this addendum for sieve reports)].**
- JTC reviews the excavations/over-excavations for the footings/FZOI. Any organics, compressible matter, and other unsuitable materials observed will be subject to complete



removal and replacement with *Structural Fill*.

**[Once the existing building and other associated structures have been removed, excavation (over-excavation) would continue until the suitable native subgrade is exposed. JTC would need to witness and verify this suitable subgrade before backfilling occurred. According to the boring logs in the Geotech Report the suitable native subgrade is approximately 7' to 10' bgs (below ground surface) in the proposed building footprint area.]**

Prior to placing the *Common Fill* directly on top of the suitable native subgrade, JTC recommends a proof-rolling process to densify the native subgrade:

- Following demolishing, clearing, and/or cutting, the exposed subgrade soils should be proof-rolled with successive passes aligned perpendicularly. Within the building pad, the exposed subgrade should be proof-rolled and subject to vibratory densification;
- Any loose, soft, wet, and/or otherwise unsuitable soils (typically evidenced by rutting, pumping, and/or deflection of the subgrade) should be over-excavated to expose suitable soils, or other remedial measures should be taken, as approved by the on-site geotechnical engineer; and
- The over-excavation should then be backfilled with properly placed and compacted *Common Fill*. **(Previous report version indicated *Structural Fill*, but *Common Fill* placement will be sufficient, per this addendum).**

**[During site grading, slab, and foundation subgrade preparation, field density tests should be performed on the *Structural Fill* and *Common Fill*, depending on the placement elevation. Backfill in building footprint should be placed in uniform horizontal lifts having a maximum loose lift thickness of 10 inches and compacted to 95% of its modified proctor maximum dry density (MPMDD; per ASTM D1557) in the slab area, and 90% in the footing area. This procedure will facilitate the aggregate pier mandrel to penetrate the compacted backfill.]**

We appreciate the opportunity to assist you on this venture and we look forward to working with you on this project through its completion. Please do not hesitate to contact us if you have any questions or require additional information.

Sincerely,

**JOHN TURNER CONSULTING, INC.**

Judson D. Zachar, P.E.

Director of Geotechnical Engineering

[judsonz@consultjtc.com](mailto:judsonz@consultjtc.com)



### Structural Fill

SIEVE SIZE	PERCENT PASSING BY WEIGHT
5-inch	100
¾-inch	60 - 100
No. 4	20 - 80
No. 200	0 - 10

- NOTES:
1. For use as structural load support below the foundations. Structural Fill placed beneath building foundations should include the Footing Zone of Influence which is defined as that area extending laterally one foot from the edge of the footing then outward and downward at a 1H:1.5V splay.
  2. ¾-inch crushed stone may be used in wet conditions.
  3. Structural Fill should be free of construction and demolition debris, frozen soil, organic soil, peat, stumps, brush, trash, and refuse;
  4. Structural Fill should not be placed on soft, saturated, or frozen subgrade soils;
  5. Structural Fill should be placed in lifts not exceeding 12 inches for heavy vibratory rollers and 8 inches for vibratory plate compactors.
  6. Compact to at least 95% relative compaction per ASTM D1557 in slab area. 90% relative compaction in footing area for aggregate piers.

### Clean Granular Fill

SIEVE SIZE	PERCENT PASSING BY WEIGHT
3-inch	100
¾-inch	60 – 90
No. 4	20 – 70
No. 200	2 – 8

- NOTES:
1. For minimum 9-inch base below floor slabs-on-grade.
  2. For minimum 15-inch base for exterior concrete slabs exposed to frost.
  3. For minimum 24-inch base at exterior ramps, aprons, and loading bays adjacent to entrances/exit ways.
  4. For use as footing and foundation wall backfill.
  5. For use as backfill behind unbalanced foundation/retaining walls.
  6. Place in lifts not exceeding 12 inches for heavy vibratory rollers and 8 inches for vibratory plate compactors.
  7. Place and compact within  $\pm 3\%$  of optimum moisture content.

### Common Fill

SIEVE SIZE	PERCENT PASSING BY WEIGHT
6-inch	100
¾-inch	60 – 100
No. 4	20 – 85
No. 200	0 – 25

- NOTES:
1. For use as common/subgrade fill in parking areas and roadway embankments.
  2. For use as foundation wall backfill if used in conjunction with a bond break and sized/screened to 3-inch minus.
  3. Place in lifts not exceeding 12 inches.
  4. Maximum stone size should not exceed ½ the actual lift thickness.
  5. Compact to at least 90% relative compaction per ASTM D1557 when placed as subgrade fill in footing areas for aggregate piers installation.

## *Pipe Sizing*



