FARLAND CORP.

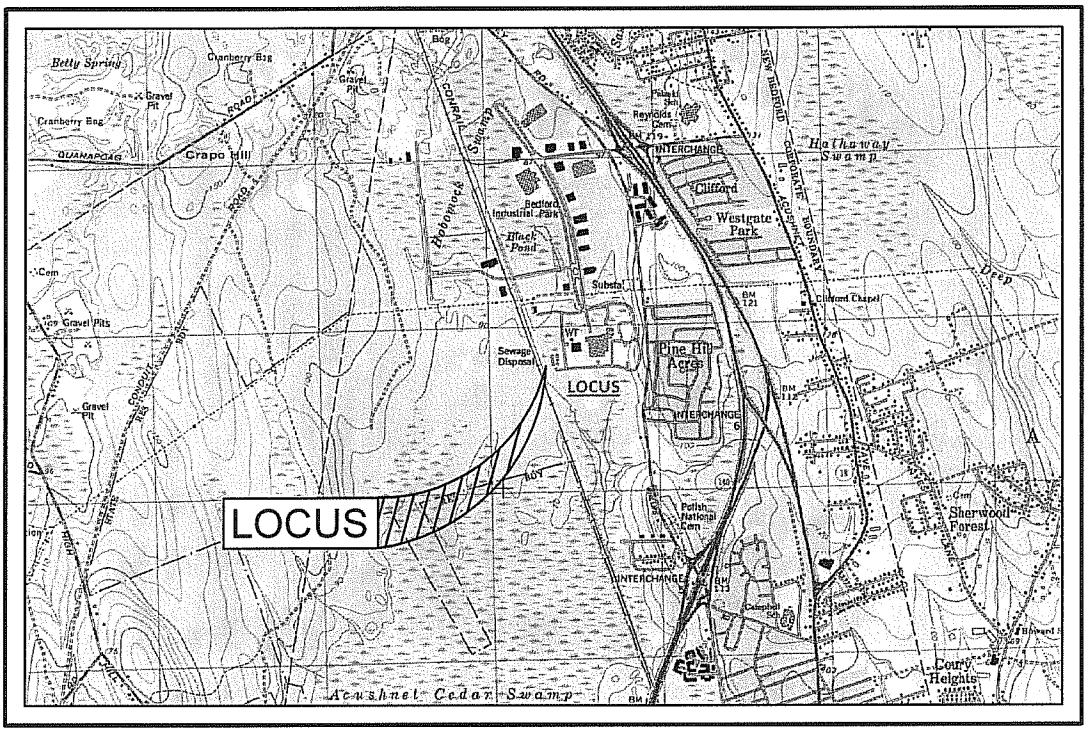
ENGINEERING A BETTER TOMORROW

ENGINEERING | SITE WORK | LAND SURVEYING

STORMWATER REPORT

SITE PLAN

ASSESSORS MAP 134 - LOT 5
100 DUCHAINE BLVD.
NEW BEDFORD, MASSACHUSETTS



PREPARED FOR:

MIH1, LLC
401 COUNTY STREET
NEW BEDFORD, MA 02740

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STORMWATER MANAGEMENT REPORT AND HYDROLOGIC ANALYSIS

Proposed Site Clearing
100 Duchaine Blvd., New Bedford, Massachusetts

Project Summary

The subject property encompasses approximately 8.09 acres of forested land located on the westerly side of Duchaine Boulevard in New Bedford, Massachusetts. The site is currently undeveloped. It is bounded on the west by railroad tracks and on the east by commercial property. The topography has very minimal sloping, with the highest elevation 81 to an elevation of 77 near the rear of the lot.

The applicant is seeking permission to clear cut the parcel for temporary stockpile of material. Stormwater associated with the development will be controlled by a detention basin.

Methodology

Drainage computations were performed using the Natural Resources Conservation Services (NRCS) TR-20 method and HydroCAD® Drainage Calculation Software. Sketches of the existing and proposed watershed areas, HydroCAD® Report, and copies of the calculation sheets are included as appendices to this report.

Existing Conditions

The soils underlying the site are identified in the Soil Survey of Bristol County ***(see Appendix G)***. The Soils underlying the site consist of Scarboro mucky fine sandy loam, 0 to 3 percent slopes and Sudbury fine sandy loam, 0 to 3 percent slopes. Soil information was taken from United States Department of Agriculture, Natural Resources Conservation Service, Web *Soil Survey of Bristol County, Massachusetts.*

The Scarboro soil has the following properties:

- Permeability: Very Poorly drained
- Available water capacity: Low
- Depth to groundwater: 0-2 inches
- Hydrologic Soil Group: HSG-D

The Scarboro soil has the following properties:

- Permeability: Moderately well drained
- Available water capacity: Low

- Depth to groundwater: 18-36 inches
- Hydrologic Soil Group: HSG-B

Stormwater Management Overview

Existing Conditions:
Currently, the project area consists of a wooded undeveloped area in which stormwater sheet flows in the bordering vegetated wetland area.

Proposed Conditions:
Under proposed conditions, the stormwater will sheet flow to a detention basin. This basin will handle all storms up to a 100 year storm event. During a 100 year storm event stormwater will overflow the two broad crested weirs.

Stormwater Management Standards

Standard #1: Untreated Discharges
Under proposed conditions, there will be no new untreated discharges or erosion in wetland areas.

To improve existing conditions, we have proposed a rip rap pad at the pipe outlet to help control velocity and future erosion at the outlet. All stormwater discharges have been held below erodible velocities.

Standard #2: Peak Rate Control
The design of the stormwater system was designed for the post-development conditions to handle all storms' peak discharges and runoff volume to include the 2, 10 and 100-year storm events. The site drainage system was designed in consideration of the structural standards and techniques of the Best Management Practices (BMP) and Low Impact Development (LID) outlined in the "Stormwater Management Handbook".

The results of site drainage calculations are presented in the following Tables. The results are based upon evaluation of Pre-development conditions and the design of proposed surface and subsurface drainage systems for the Post-development condition. These results show the Post-Development offsite volume and runoff rates are reduced to less than the Pre-development conditions, thus meeting the BMP guidelines for this site development.

Table 1 - Comparison of Pre- versus Post-Development Offsite Runoff Rate, cfs

Frequency Storm	2-Year	10-Year	100-Year
Pre-Development	0.46	2.11	5.92
Post-Development	0.28	0.91	5.79

Table 2 - Comparison of Pre- versus Post-Development Offsite Runoff Volume, af			
Frequency Storm	**2-Year**	**10-Year**	**100-Year**
Pre-Development	0.080	0.219	0.517
Post-Development	0.030	0.074	0.410

Groundwater recharge is a factor in the design of the subsurface drainage system. Table-3 below presents the minimum recharge required and the proposed recharge of stormwater based upon the BMP methods of the "Stormwater Management Handbook". The proposed recharge quantities meet or exceed the required minimum recharges.

Standard #3: Recharge to Groundwater
Recharge facilities are proposed and sized according to the Stormwater Management Standards.

Table 3 - Drainage Recharge Calculation (Required Recharge = 0.35" Total Site Runoff from Impervious Areas for Class-B Soils)	
Required Recharge	**Proposed Recharge**
0 sf x 0.35" = 0 CF	10,846 CF

Standard #4: Total Suspended Solids Removal/ Water Quality
In accordance with the guidelines of the Stormwater Management Policy, the Total Suspended Solids (TSS) Removal was calculated to be 80% thus meeting the minimum 80% requirement.

Standard #5: Higher Potential Pollutant Loads
The uses associated with this project are not classified to be land uses with higher potential pollutant loads; therefore, Standard #5 is not applicable to this project.

Standard #6: Critical Areas
This project is not located in a critical area.

Standard #7: Re-development Standards
This project is considered new construction.

Standard #8: Construction Period Pollution Prevention Plan

We will prepare a Construction Period Pollution Prevention Plan in accordance with the regulations prior to start of construction.

Standard #9: Operation and Maintenance
A long-term operation and maintenance plan will be prepared to ensure that stormwater management systems function as designed.

Standard #10: Illicit Discharge Statement
Under this proposal, we are not proposing any illicit discharges as defined in the Stormwater Management Regulations.

EXHIBIT "A"

HYDROLOGIC CALCULATIONS & WATERSHED PLANS

Tributary to BVW

Subcat Reach Pond Link

Drainage Diagram for 16357PRE
Prepared by Thompson Farland, Inc., Printed 4/21/2016

Summary for Subcatchment S-1: Tributary to BVW

Runoff = 0.46 cfs @ 12.34 hrs, Volume= 0.080 af, Depth= 0.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.40"

Area (sf)	CN	Description
4,500	85	Gravel roads, HSG B
117,300	55	Woods, Good, HSG B
121,800	56	Weighted Average
121,800		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	8	0.0100	0.65		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.40"
10.0	315	0.0110	0.52		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
10.2	323	Total			

Summary for Subcatchment S-1: Tributary to BVW

Runoff = 2.11 cfs @ 12.17 hrs, Volume= 0.219 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
4,500	85	Gravel roads, HSG B
117,300	55	Woods, Good, HSG B
121,800	56	Weighted Average
121,800		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	8	0.0100	0.65		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.40"
10.0	315	0.0110	0.52		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
10.2	323	Total			

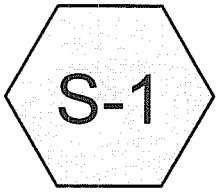
Summary for Subcatchment S-1: Tributary to BVW

Runoff = 5.92 cfs @ 12.15 hrs, Volume= 0.517 af, Depth= 2.22"

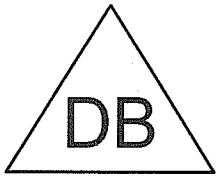
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
4,500	85	Gravel roads, HSG B
117,300	55	Woods, Good, HSG B
121,800	56	Weighted Average
121,800		Pervious Area

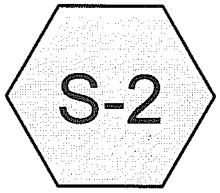
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	8	0.0100	0.65		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.40"
10.0	315	0.0110	0.52		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
10.2	323	Total			



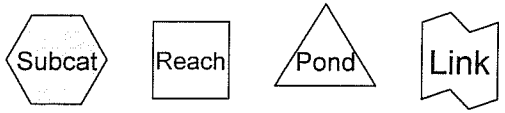
Tributary to Basin



Detention Basin



Tributary to BVW



Drainage Diagram for 16357POST
Prepared by Thompson Farland, Inc., Printed 4/21/2016

Summary for Subcatchment S-1: Tributary to Basin

Runoff = 4.18 cfs @ 12.10 hrs, Volume= 0.304 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.40"

	Area (sf)	CN	Description
	3,650	85	Gravel roads, HSG B
*	15,798	98	Detention Pond
	63,900	82	Dirt roads, HSG B
	6,052	55	Woods, Good, HSG B
	89,400	83	Weighted Average
	73,602		Pervious Area
	15,798		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	8	0.0100	0.65		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.40"
6.4	200	0.0110	0.52		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
6.6	208	Total			

Summary for Subcatchment S-2: Tributary to BVW

Runoff = 0.28 cfs @ 12.12 hrs, Volume= 0.030 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.40"

Area (sf)	CN	Description
850	85	Gravel roads, HSG B
5,100	82	Dirt roads, HSG B
26,450	55	Woods, Good, HSG B
32,400	60	Weighted Average
32,400		Pervious Area

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

Summary for Pond DB: Detention Basin

Inflow Area = 2.052 ac, 17.67% Impervious, Inflow Depth = 1.77" for 2-yr event
Inflow = 4.18 cfs @ 12.10 hrs, Volume= 0.304 af
Outflow = 0.29 cfs @ 13.94 hrs, Volume= 0.304 af, Atten= 93%, Lag= 110.3 min
Discarded = 0.29 cfs @ 13.94 hrs, Volume= 0.304 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 76.51' @ 13.94 hrs Surf.Area= 12,322 sf Storage= 5,831 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 198.0 min (1,028.7 - 830.7)

Volume	Invert	Avail.Storage	Storage Description
#1	76.00'	19,745 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
76.00	10,538	0	0
77.00	14,035	12,287	12,287
77.50	15,798	7,458	19,745

Device	Routing	Invert	Outlet Devices
#1	Discarded	76.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	77.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir X 2.00**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.29 cfs @ 13.94 hrs HW=76.51' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.29 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=76.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Subcatchment S-1: Tributary to Basin

Runoff = 7.03 cfs @ 12.09 hrs, Volume= 0.512 af, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

	Area (sf)	CN	Description
	3,650	85	Gravel roads, HSG B
*	15,798	98	Detention Pond
	63,900	82	Dirt roads, HSG B
	6,052	55	Woods, Good, HSG B
	89,400	83	Weighted Average
	73,602		Pervious Area
	15,798		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	8	0.0100	0.65		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.40"
6.4	200	0.0110	0.52		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
6.6	208	Total			

Summary for Subcatchment S-2: Tributary to BVW

Runoff = 0.91 cfs @ 12.10 hrs, Volume= 0.074 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
850	85	Gravel roads, HSG B
5,100	82	Dirt roads, HSG B
26,450	55	Woods, Good, HSG B
32,400	60	Weighted Average
32,400		Pervious Area

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

Summary for Pond DB: Detention Basin

Inflow Area = 2.052 ac, 17.67% Impervious, Inflow Depth = 2.99" for 10-yr event
Inflow = 7.03 cfs @ 12.09 hrs, Volume= 0.512 af
Outflow = 0.33 cfs @ 15.07 hrs, Volume= 0.503 af, Atten= 95%, Lag= 178.6 min
Discarded = 0.33 cfs @ 15.07 hrs, Volume= 0.503 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 76.96' @ 15.07 hrs Surf.Area= 13,895 sf Storage= 11,727 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 356.9 min (1,172.5 - 815.7)

Volume	Invert	Avail.Storage	Storage Description
#1	76.00'	19,745 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
76.00	10,538	0	0
77.00	14,035	12,287	12,287
77.50	15,798	7,458	19,745

Device	Routing	Invert	Outlet Devices
#1	Discarded	76.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	77.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir X 2.00**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.33 cfs @ 15.07 hrs HW=76.96' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.33 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=76.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Subcatchment S-1: Tributary to Basin

Runoff = 11.62 cfs @ 12.09 hrs, Volume= 0.860 af, Depth= 5.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
	3,650	85	Gravel roads, HSG B
*	15,798	98	Detention Pond
	63,900	82	Dirt roads, HSG B
	6,052	55	Woods, Good, HSG B
	89,400	83	Weighted Average
	73,602		Pervious Area
	15,798		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	8	0.0100	0.65		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.40"
6.4	200	0.0110	0.52		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
6.6	208	Total			

Summary for Subcatchment S-2: Tributary to BVW

Runoff = 2.20 cfs @ 12.09 hrs, Volume= 0.161 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
850	85	Gravel roads, HSG B
5,100	82	Dirt roads, HSG B
26,450	55	Woods, Good, HSG B
32,400	60	Weighted Average
32,400		Pervious Area

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

Summary for Pond DB: Detention Basin

Inflow Area = 2.052 ac, 17.67% Impervious, Inflow Depth = 5.03" for 100-yr event
Inflow = 11.62 cfs @ 12.09 hrs, Volume= 0.860 af
Outflow = 3.93 cfs @ 12.39 hrs, Volume= 0.803 af, Atten= 66%, Lag= 17.9 min
Discarded = 0.35 cfs @ 12.39 hrs, Volume= 0.553 af
Primary = 3.59 cfs @ 12.39 hrs, Volume= 0.249 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 77.17' @ 12.39 hrs Surf.Area= 14,646 sf Storage= 14,770 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 230.1 min (1,031.2 - 801.0)

Volume	Invert	Avail.Storage	Storage Description
#1	76.00'	19,745 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
76.00	10,538	0	0
77.00	14,035	12,287	12,287
77.50	15,798	7,458	19,745

Device	Routing	Invert	Outlet Devices
#1	Discarded	76.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	77.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir X 2.00**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.35 cfs @ 12.39 hrs HW=77.17' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.35 cfs)

Primary OutFlow Max=3.59 cfs @ 12.39 hrs HW=77.17' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 3.59 cfs @ 1.04 fps)

EXHIBIT "B"

NRCS SOIL MAP

Soil Map—Bristol County, Massachusetts, Southern Part

Map Scale: 1:1,700 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Bristol County, Massachusetts, Southern Part
Survey Area Data: Version 9, Sep 28, 2015

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

Date(s) aerial images were photographed: Mar 30, 2011—Oct 8, 2011

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

Map Unit Legend

Bristol County, Massachusetts, Southern Part (MA603)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
38A	Pipestone loamy sand, 0 to 3 percent slopes	0.0	0.0%
39A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	6.2	58.1%
260A	Sudbury fine sandy loam, 0 to 3 percent slopes	2.2	20.9%
602	Urban land	2.2	20.9%
Totals for Area of Interest		**10.6**	**100.0%**