Drywell Sizing Calculations

47 Smith Road

Hingham, MA

COMMONWEALTH OF MASSACHUSETTS
GREGORY J. TANSEY
CIVIL
No. 37219
REGISTERED PROFESSIONAL ENGINEER

6-11-20

Patriot Permitting & Engineering

9 Barstow Lane

Rockland, MA

Introduction

The purpose of this analysis is to ensure that the proposed addition at 47 Smith Road in Hingham will not cause any adverse impact from stormwater runoff to the abutting properties. The analysis ensures that the addition will not have any adverse impact to the abutting properties by providing drywells of a particular type shape and location so as to contain the runoff generated by the 100 year storm and infiltrate it into the ground.

On Site Soils

The soils shown by the soils map contained herein indicate that a very permeable soil type exists on site having a deep ground water table. These soil conditions are ideal for sub surface recharge systems such as the recharge chamber systems proposed for this project. Sub surface recharge systems are generically referred to as drywells as the principal is all the same, namely runoff is temporally stored in a hollow sub surface structure of some type and is then disposed of by infiltrating it into the soil matrix for which the system resides.

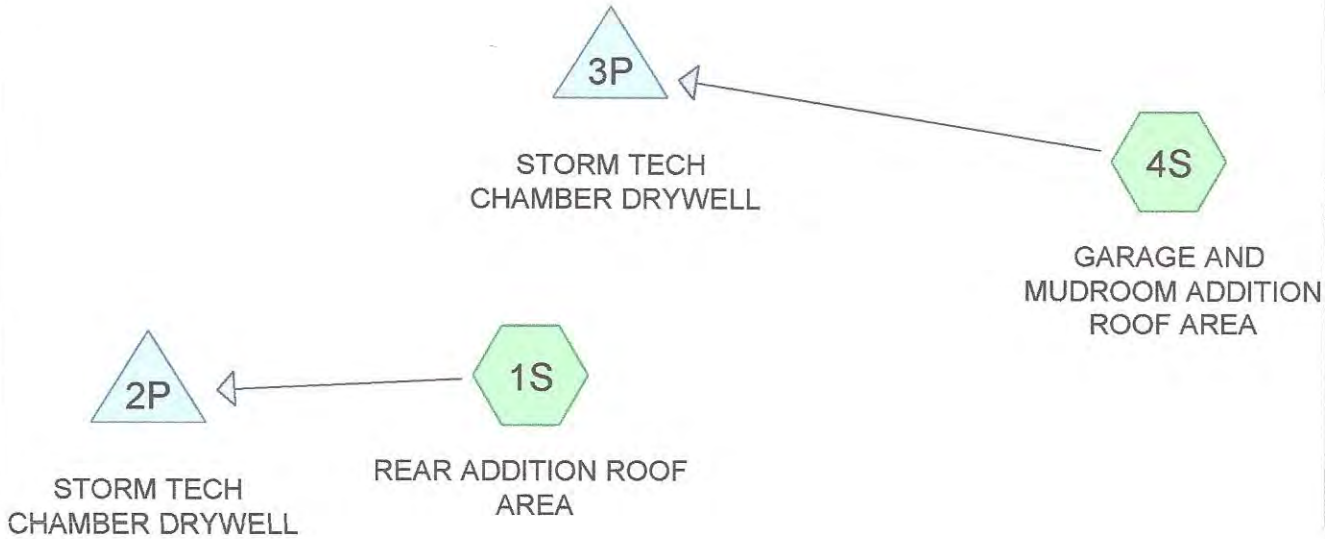
The soil type present on site is the Quonset Sandy Loam. This soil is described as an excessively draining sand. This material is ideal for the recharge system proposed. This soil is classified as an HSG A type. HSG stands for hydraulic soil group. Soil scientists have classified soils into four groupings: A, B, C, and D. An "A" group soil has the fastest infiltration rate where the "D" group has the slowest infiltration rate. Since the Quonset soil has an HSG of "A", it is the best soil type suited for this application.

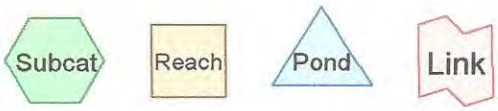
Proposed Recharge System

The proposed recharge system consists of two Infiltrator chamber in a tandem configuration having 12" of crushed stone all around them and 6" of crushed stone above and below them. The chamber unit chose for this design is the Stormtech SC-310 chamber. This chamber is slightly different from other chambers as it was designed specifically for recharging stormwater. Other chambers on the market are similar to the SC-310 but have less volume. This is because other chambers were designed for septic systems and the disposal of effluent and not stormwater.

Conclusion

The system will serve the owners very well provided no abuse of the system occurs and minimal maintenance is performed. We recommend installing inspections ports on one of the chambers for each system. For maintenance, the homeowner should have his gutters cleaned once per year or have gutter guards installed to prevent decomposed tree litter from entering the chambers and have the chambers inspected for such intrusions. Any debris observed in the chambers can be vacuumed out.





Drainage Diagram for 2020-02 DRYWELL SIZING CALCS
Prepared by {enter your company name here}, Printed 6/11/2020
HydroCAD® 9.10 s/n 06596 © 2010 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.025	98	Unconnected roofs, HSG A (1S, 4S)
0.025		**TOTAL AREA**

Summary for Subcatchment 1S: REAR ADDITION ROOF AREA

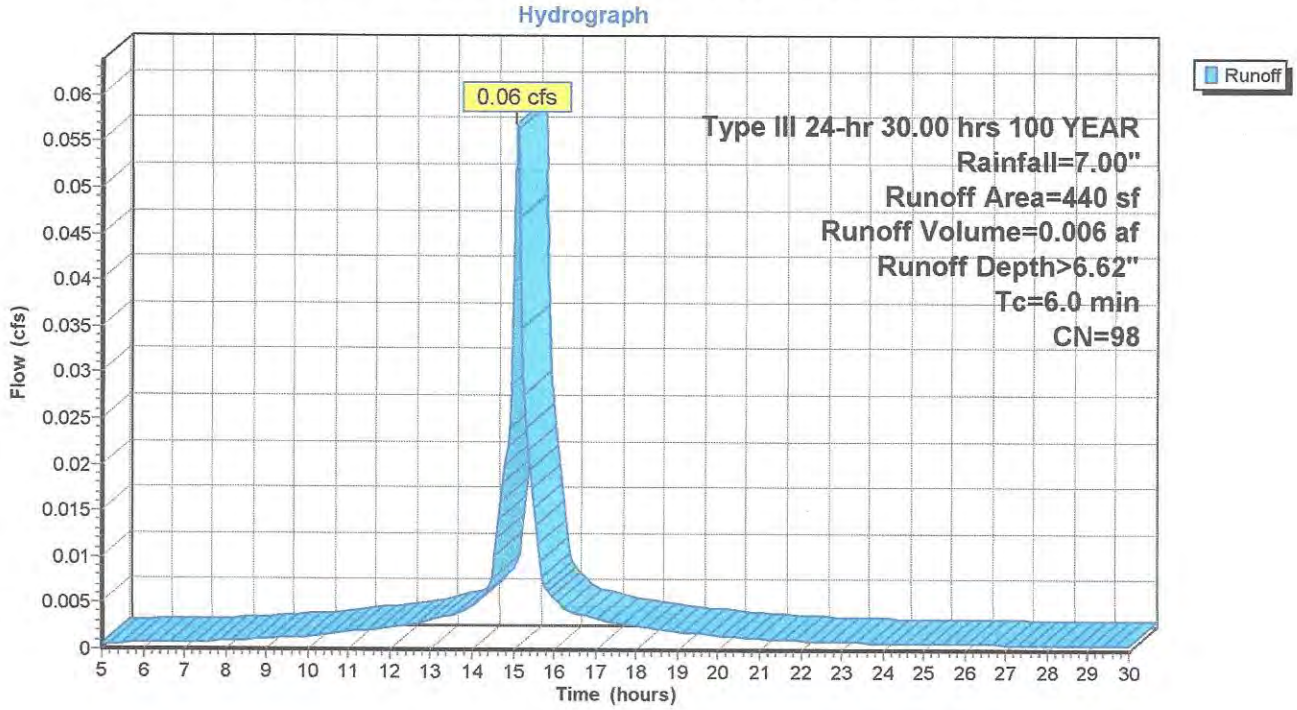
Runoff = 0.06 cfs @ 15.09 hrs, Volume= 0.006 af, Depth> 6.62"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 30.00 hrs 100 YEAR Rainfall=7.00"

Area (sf)	CN	Description
440	98	Unconnected roofs, HSG A
440		100.00% Impervious Area
440		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 MINUTE MINIMUM**

Subcatchment 1S: REAR ADDITION ROOF AREA



Summary for Subcatchment 4S: GARAGE AND MUDROOM ADDITION ROOF AREA

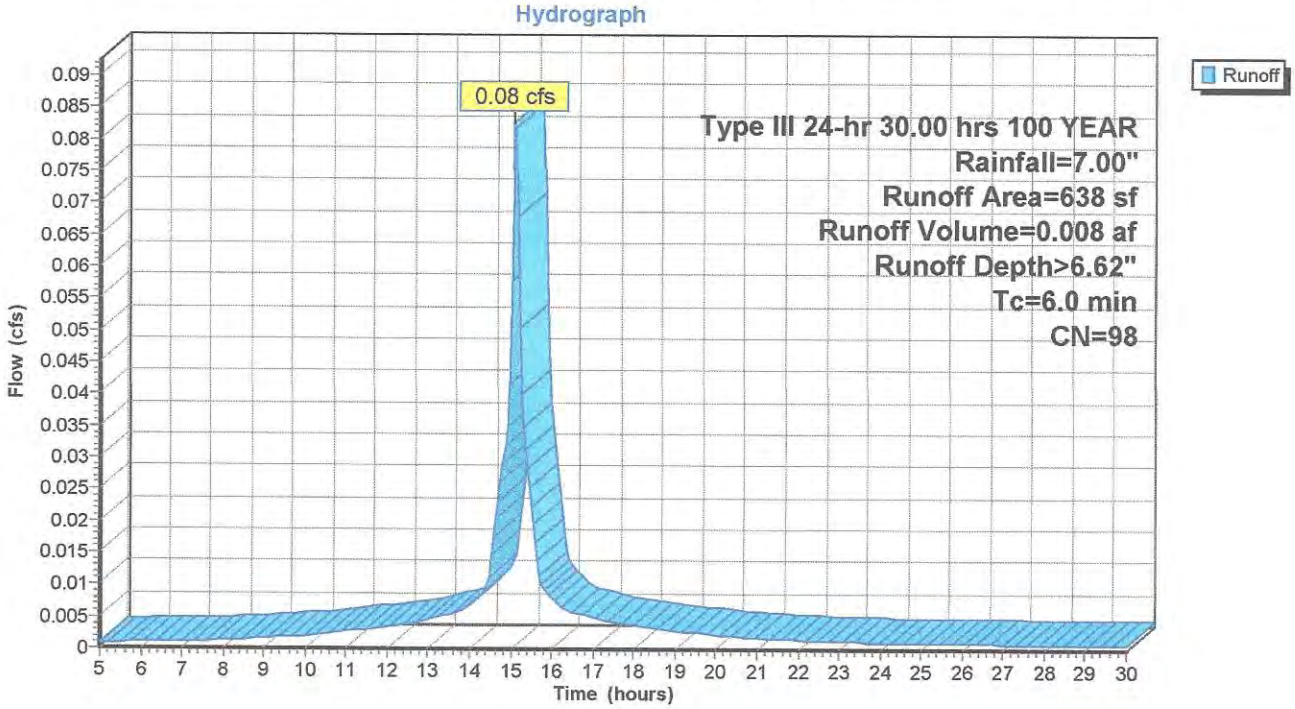
Runoff = 0.08 cfs @ 15.09 hrs, Volume= 0.008 af, Depth> 6.62"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 30.00 hrs 100 YEAR Rainfall=7.00"

Area (sf)	CN	Description
638	98	Unconnected roofs, HSG A
638		100.00% Impervious Area
638		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 MINUTE MINIMUM**

Subcatchment 4S: GARAGE AND MUDROOM ADDITION ROOF AREA



Summary for Pond 2P: STORM TECH CHAMBER DRYWELL

Inflow Area =	0.010 ac,100.00% Impervious, Inflow Depth > 6.62" for 100 YEAR event			
Inflow =	0.06 cfs @ 15.09 hrs, Volume=	0.006 af		
Outflow =	0.02 cfs @ 15.41 hrs, Volume=	0.006 af, Atten= 66%, Lag= 19.3 min		
Discarded =	0.02 cfs @ 15.41 hrs, Volume=	0.006 af		

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 56.89' @ 15.41 hrs Surf.Area= 78 sf Storage= 36 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 8.5 min (950.5 - 942.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	56.00'	61 cf	**4.83'W x 16.24'L x 2.33'H Field A** 183 cf Overall - 29 cf Embedded = 154 cf x 40.0% Voids
#2A	56.50'	29 cf	**StormTech SC-310** x 2 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
		91 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 52.80'

Discarded OutFlow Max=0.02 cfs @ 15.41 hrs HW=56.89' (Free Discharge)
└**1=Exfiltration** (Controls 0.02 cfs)

Pond 2P: STORM TECH CHAMBER DRYWELL - Chamber Wizard Field A

Chamber Model = StormTech SC-310
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C

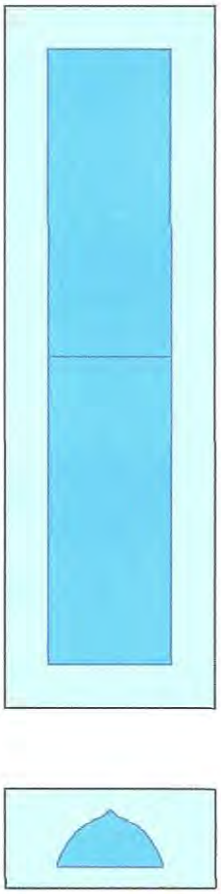
2 Chambers/Row x 7.12' Long = 14.24' + 12.0" End Stone x 2 = 16.24' Base Length
1 Rows x 34.0" Wide + 12.0" Side Stone x 2 = 4.83' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

2 Chambers x 14.7 cf = 29.5 cf Chamber Storage

183.2 cf Field - 29.5 cf Chambers = 153.7 cf Stone x 40.0% Voids = 61.5 cf Stone Storage

Stone + Chamber Storage = 91.0 cf = 0.002 af

2 Chambers
6.8 cy Field
5.7 cy Stone



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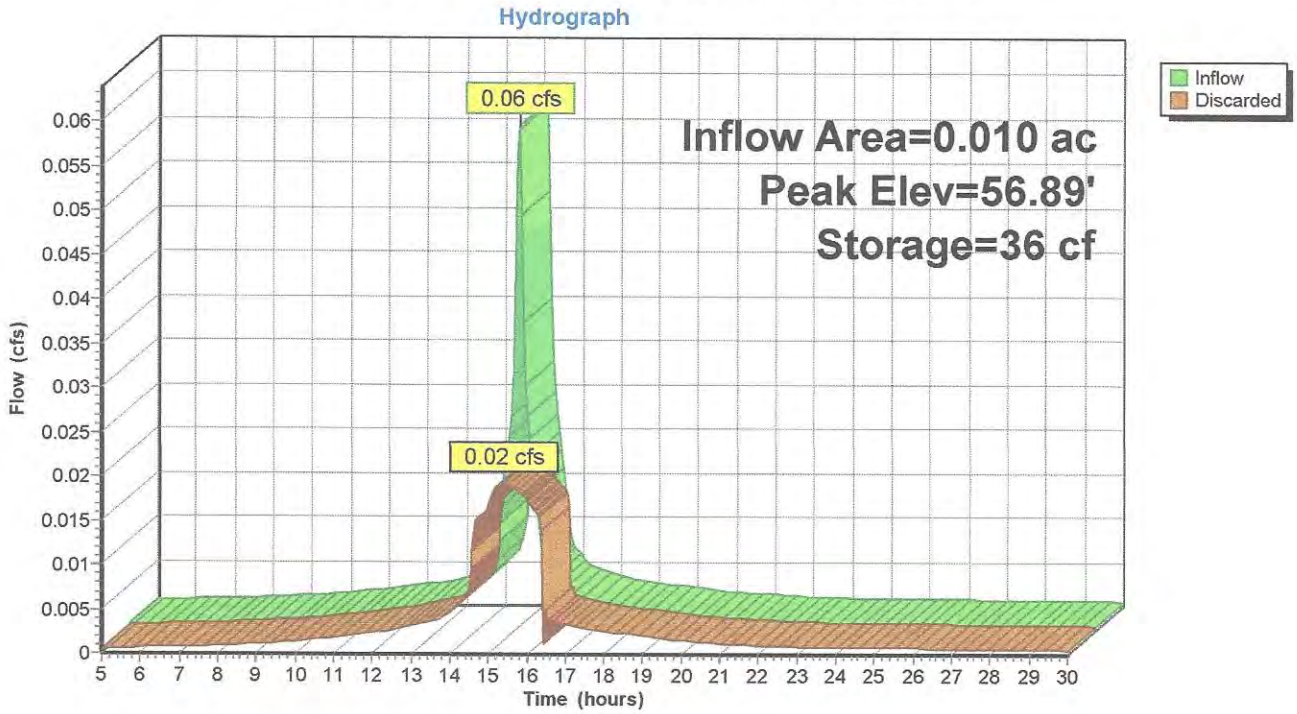

Summary for Pond 3P: STORM TECH CHAMBER DRYWELL

Inflow Area =	0.015 ac,100.00% Impervious, Inflow Depth > 6.62" for 100 YEAR event			
Inflow =	0.08 cfs @ 15.09 hrs, Volume=	0.008 af		
Outflow =	0.02 cfs @ 15.49 hrs, Volume=	0.008 af, Atten= 72%, Lag= 24.5 min		
Discarded =	0.02 cfs @ 15.49 hrs, Volume=	0.008 af		

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 57.66' @ 15.49 hrs Surf.Area= 78 sf Storage= 69 cf

Plug-Flow detention time= 16.2 min calculated for 0.008 af (100% of inflow)
Center-of-Mass det. time= 16.0 min (958.0 - 942.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	56.00'	61 cf	**4.83'W x 16.24'L x 2.33'H Field A** 183 cf Overall - 29 cf Embedded = 154 cf x 40.0% Voids
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		91 cf	Total Available Storage

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Discarded OutFlow Max=0.02 cfs @ 15.49 hrs HW=57.66' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Pond 3P: STORM TECH CHAMBER DRYWELL - Chamber Wizard Field A

Chamber Model = StormTech SC-310
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
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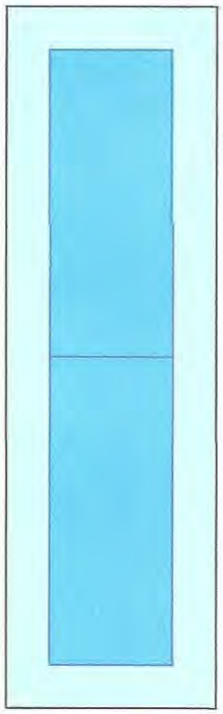
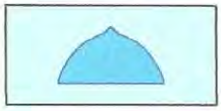
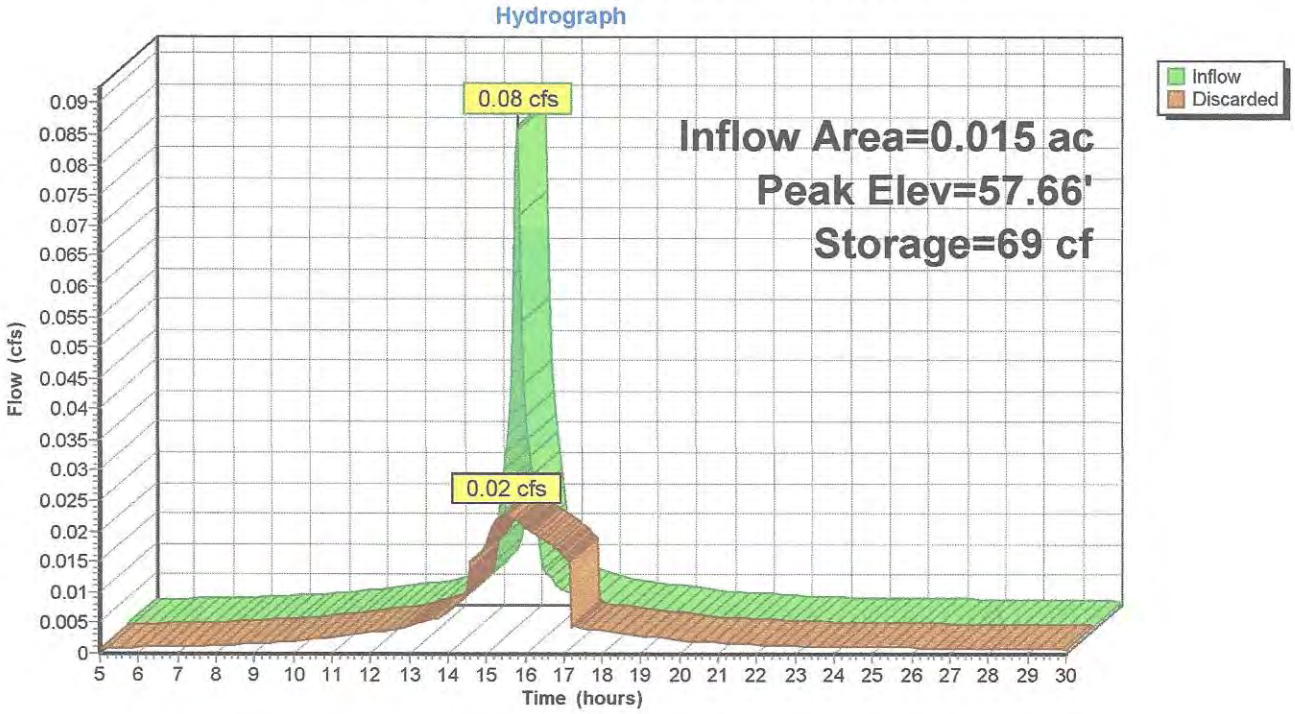




Pond 3P: STORM TECH CHAMBER DRYWELL



Soil Map—Plymouth County, Massachusetts
(47 Smith Road Hingham, MA)

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 1:12,000.

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: Plymouth County, Massachusetts
Survey Area Data: Version 12, Sep 12, 2019

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

Date(s) aerial images were photographed: Aug 10, 2014—Aug 25, 2014

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	0.1	12.3%
111C	Chatfield-Rock outcrop-Canton complex, 8 to 15 percent slopes, very stony	0.5	62.7%
262B	Quonset sandy loam, 3 to 8 percent slopes	0.2	25.0%
Totals for Area of Interest		**0.9**	**100.0%**

Plymouth County, Massachusetts

262B—Quonset sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: bqtk
Elevation: 0 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Quonset

Setting

Landform: Eskers, deltas, terraces, kames, outwash plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glaciofluvial deposits

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oa - 1 to 2 inches: highly decomposed plant material
A - 2 to 4 inches: sandy loam
Bw1 - 4 to 7 inches: channery sandy loam
Bw2 - 7 to 14 inches: channery loamy sand
BC - 14 to 22 inches: very channery loamy sand
C - 22 to 65 inches: extremely channery sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s

Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Warwick

Percent of map unit: 8 percent
Landform: Terraces, deltas, outwash plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Deerfield

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Footslope, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Hinckley

Percent of map unit: 4 percent
Landform: Outwash deltas, eskers, terraces, kames
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Canton

Percent of map unit: 3 percent
Landform: Ridges, till plains, hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 12, Sep 12, 2019