DGT Associates
Surveying & Engineering

1071 Worcester Rd.
Framingham, MA 01701
508.879.0030
www.dgtassociates.com

November 27, 2023

Job: 25889

Mr. Mark Oram
19 Washington Street
Sherborn, MA 01770

RE: 34 Brush Hill Road – Soil Testing

Dear Mr. Oram:

This report contains the results of the on-site soil testing conducted by DGT Associates on October 25th and 26th, 2023, at the subject property in Sherborn, Massachusetts. The testing consisted of fourteen (14) deep hole test pits, five (5) percolation test holes, and two (2) permeability test holes.

The purpose of the testing was to assess the suitability of the soils for the design of a new soil absorption system (SAS) and for stormwater purposes at the subject property. Testing was performed by Massachusetts Licensed Soil Evaluator (Frederick J. Schobel, E.I.T.) of DGT and on 10/26/23 was witnessed by Mark Oram for the Town of Sherborn Board of Health. The testing was also observed by Kevin Riopelle of DGT. Backhoe excavation services were provided by Cambell C. Jones Construction.

According to the Natural Resources Conservation Service (NRCS) Soils Mapping, the soil in the area of testing is Paxton fine sandy loam. The testing generally confirmed the NRCS data. The NRCS soils map and soil information is contained in Attachment #3.

DGT began testing on the first day (10/25/23) on the downhill portion of the lot (Northwest) with test pits TH 23-01 through 23-06. The purpose of those test pits was for stormwater management and therefore unwitnessed by the Board of Health Agent. Two additional unwitnessed test pits, TH 23-07 and 23-08, were completed in the area of the planned soil absorption system for exploratory purposes to confirm soil consistency and groundwater conditions in preparation for the scheduled witnessed testing on 10/26/23.

The second day of testing (10/26/23) testing was conducted on the uphill portion of the lot for the design of the soil absorption system. This comprised of test pits TH 23-09 through TH 23-14.

The Test Holes on both days of testing generally revealed a fine sandy loam topsoil over a firm sandy loam substratum. The soil test logs and Soil Test Hole Location Plan are contained in Attachment #1 and Attachment #2 respectively.

The Estimated Seasonal High Groundwater Table (ESHGWT) was determined by the observation of redoximorphic features within each of the test holes. The redoximorphic features were observed between 29 - 38” below grade. Weeping and standing groundwater were also observed in most of these test holes. The weeping elevation of groundwater varied across the site with it generally being shallower in the test holes on the downhill (Northwest) portion of the lot and deeper in the test holes uphill (Southeast). The weeping groundwater was observed between 32 – 111” below grade. In the test pits that had standing groundwater, it was observed between 108 – 111” below grade.

No refusal was observed in any of the test pits conducted on the site.

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Percolation tests were performed within the substratum layers adjacent to test pits TH 23-09, 23-10, 23-11, and 23-12. A percolation test was performed in each of the substratum soil types observed to determine the most restrictive percolation rate to be used for design purposes. The percolation rates observed for TH 23-09, 23-10b, and 23-11 were 20, 47 and 14 minutes per inch respectively. The percolation tests for TH 23-10a and 23-12 were canceled in the field by the soil evaluator due to groundwater intrusion. The percolation test logs are contained in Attachment #1.

Please contact me if you have any questions regarding this report.

Sincerely,
DGT Associates

Fred Schobel

Frederick J Schobel, EIT (SE 14561)
Staff Engineer

Attachments:

1. Deep Test Hole, Percolation, and Permeability Test Logs
2. Soil Test Hole Location Plan
3. NRCS and USGS Soil Maps and Information

Attachment 1

Deep Hole, Percolation, and Permeability Test Logs

Commonwealth of Massachusetts
City/Town of Sherborn

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

A. Facility Information

Fenix Partners Brush Hill LLC
Owner Name

34 Brush Hill Road
Street Address

1/18
Map/Lot #

Sherborn
City

MA
State

01770
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade

2. Soil Survey NRCS (Source) | 305B/305C (Soil Map Unit) | Paxton Fine Sandy Loam (Soil Series)

Ground Moraines, Drumlins, Hills
Landform

Shallow depth to groundwater
Soil Limitations

Coarse-loamy lodgement till derived from gneiss, granite, and/or schist
Soil Parent material

3. Surficial Geological Report 2018 Stone et. al. (Year Published/Source) | Thick Till (Map Unit)

Nonsorted, nonstratified matrix of sand, some silt, and little clay containing scattered gravel clasts and few large boulders
Description of Geologic Map Unit:

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

5. Within a velocity zone? ☐ Yes ☒ No

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

7. Current Water Resource Conditions (USGS): 10/23/2023 MA-DVW 10R (Month/Day/ Year) Range: ☒ Above Normal ☐ Normal ☐ Below Normal

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

Commonwealth of Massachusetts
City/Town of Sherborn

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

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

Deep Observation Hole Number: 23-01 (Hole #) | 10/25/2023 (Date) | A.M. (Time) | 60 Sunny (Weather) | 42.2570 (Latitude) | -71.4009 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: See Test Hole Location Plan

2. Soil Parent Material: Coarse-loamy lodgement till derived from gneiss, granite, and/or schist | Ground Moraines, Drumlins (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

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

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 48" Depth to Weeping in Hole | N/A Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 6"	A	FSL	10 YR 3/2		Cnc : Dpl:				Massive	Friable	
6 - 16"	B_w	FSL	10 YR 4/6		Cnc : Dpl:				Massive	Friable	
16 - 33"	C_1	SL	10 YR 5/4		Cnc : Dpl:				Massive	Friable	
33 - 128"	C_2	SL	2.5 Y 5/4	33"	Cnc : 7.5 YR 6/8 Dpl: 5 Y 6/1	>5			Massive	Firm	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: Unwitnessed test pit for Stormwater purposes

Commonwealth of Massachusetts
City/Town of Sherborn

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

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

Deep Observation Hole Number: 23-02 (Hole #) | 10/25/2023 (Date) | A.M. (Time) | 60 Sunny (Weather) | 42.2570 (Latitude) | -71.4009 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: See Test Hole Location Plan

2. Soil Parent Material: Coarse-loamy lodgement till derived from gneiss, granite, and/or schist | Ground Moraines, Drumlins (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

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

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 32" Depth to Weeping in Hole 108" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 12"	A	FSL	10 YR 3/2		Cnc : Dpl:				Massive	Friable	
12 - 30"	B_w	FSL	10 YR 4/6		Cnc : Dpl:				Massive	Friable	
30 - 110"	C	SL	2.5 Y 5/4	30"	Cnc : 7.5 YR 6/8 Dpl: 5 Y 6/1	>5			Massive	Firm	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: Unwitnessed test pit for Stormwater purposes

Commonwealth of Massachusetts
City/Town of Sherborn

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

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

Deep Observation Hole Number: 23-03 (Hole #) | 10/25/2023 (Date) | A.M. (Time) | 60 Sunny (Weather) | 42.2570 (Latitude) | -71.4009 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: See Test Hole Location Plan

2. Soil Parent Material: Coarse-loamy lodgement till derived from gneiss, granite, and/or schist | Ground Moraines, Drumlins (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

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

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 45" Depth to Weeping in Hole | N/A Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 6"	A	FSL	10 YR 3/2		Cnc : Dpl:				Massive	Friable	
6 - 20"	B_w	FSL	10 YR 4/6		Cnc : Dpl:				Massive	Friable	
20 - 30"	C_1	SL	10 YR 5/4		Cnc : Dpl:				Massive	Friable	
30 - 108"	C_2	SL	2.5 Y 5/4	30"	Cnc : 7.5 YR 6/8 Dpl: 5 Y 6/1	>5			Massive	Firm	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: Unwitnessed test pit for Stormwater purposes

Commonwealth of Massachusetts
City/Town of Sherborn

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

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

Deep Observation Hole Number: 23-04 (Hole #) | 10/25/2023 (Date) | A.M. (Time) | 60 Sunny (Weather) | 42.2570 (Latitude) | -71.4009 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: See Test Hole Location Plan

2. Soil Parent Material: Coarse-loamy lodgement till derived from gneiss, granite, and/or schist | Ground Moraines, Drumlins (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

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

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 47" Depth to Weeping in Hole | N/A Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 8"	A	FSL	10 YR 3/2		Cnc : Dpl:				Massive	Friable	
8 - 20"	B_w	FSL	10 YR 4/6		Cnc : Dpl:				Massive	Friable	
20 - 30"	C_1	SL	10 YR 5/4		Cnc : Dpl:				Massive	Friable	
30 - 120"	C_2	SL	2.5 Y 5/4	29"	Cnc : 7.5 YR 6/8 Dpl: 5 Y 6/1	>5			Massive	Firm	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: Unwitnessed test pit for Stormwater purposes

Commonwealth of Massachusetts
City/Town of Sherborn

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

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

Deep Observation Hole Number: 23-05 (Hole #) | 10/25/2023 (Date) | A.M. (Time) | 60 Sunny (Weather) | 42.2570 (Latitude) | -71.4009 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: See Test Hole Location Plan

2. Soil Parent Material: Coarse-loamy lodgement till derived from gneiss, granite, and/or schist | Ground Moraines, Drumlins (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

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

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 44" Depth to Weeping in Hole | N/A Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 6"	A	FSL	10 YR 3/2		Cnc : Dpl:				Massive	Friable	
6 - 20"	B_w	FSL	10 YR 4/6		Cnc : Dpl:				Massive	Friable	
20 - 33"	C_1	SL	10 YR 5/4		Cnc : Dpl:				Massive	Friable	
33 - 126"	C_2	SL	2.5 Y 5/4	30"	Cnc : 7.5 YR 6/8 Dpl: 5 Y 6/1	>5			Massive	Firm	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: Unwitnessed test pit for Stormwater purposes

Commonwealth of Massachusetts
City/Town of Sherborn

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

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

Deep Observation Hole Number: 23-06 (Hole #) | 10/25/2023 (Date) | A.M. (Time) | 60 Sunny (Weather) | 42.2570 (Latitude) | -71.4009 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: See Test Hole Location Plan

2. Soil Parent Material: Coarse-loamy lodgement till derived from gneiss, granite, and/or schist | Ground Moraines, Drumlins (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

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

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 72" Depth to Weeping in Hole | N/A Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 6"	A	FSL	10 YR 3/2		Cnc : Dpl:				Massive	Friable	
6 - 25"	B_w	FSL	10 YR 4/6		Cnc : Dpl:				Massive	Friable	
25 - 36"	C_1	SL	10 YR 5/4		Cnc : Dpl:				Massive	Friable	
36 - 114"	C_2	SL	2.5 Y 5/4	30"	Cnc : 7.5 YR 6/8 Dpl: 5 Y 6/1	>5			Massive	Firm	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: Unwitnessed test pit for Stormwater purposes

Commonwealth of Massachusetts
City/Town of Sherborn

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

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

Deep Observation Hole Number: 23-07 (Hole #) | 10/25/2023 (Date) | P.M. (Time) | 60 Sunny (Weather) | 42.2570 (Latitude) | -71.4009 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: See Test Hole Location Plan

2. Soil Parent Material: Coarse-loamy lodgement till derived from gneiss, granite, and/or schist | Ground Moraines, Drumlins (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

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

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: N/A Depth to Weeping in Hole N/A Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 9"	A	FSL	10 YR 3/2		Cnc : Dpl:				Massive	Friable	
9 - 32"	B_w	FSL	10 YR 4/6		Cnc : Dpl:				Massive	Friable	
32 - 40"	C_1	SL	10 YR 5/4		Cnc : Dpl:				Massive	Friable	
40 - 126"	C_2	SL	2.5 Y 5/4	32"	Cnc : 7.5 YR 6/8 Dpl: 5 Y 6/1	>5			Massive	Firm	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: Unwitnessed test pit for exploratory purposes

Commonwealth of Massachusetts
City/Town of Sherborn

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

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

Deep Observation Hole Number: 23-08 (Hole #) | 10/25/2023 (Date) | P.M. (Time) | 60 Sunny (Weather) | 42.2570 (Latitude) | -71.4009 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: See Test Hole Location Plan

2. Soil Parent Material: Coarse-loamy lodgement till derived from gneiss, granite, and/or schist | Ground Moraines, Drumlins (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

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

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 57" Depth to Weeping in Hole | N/A Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 10"	A	FSL	10 YR 3/2		Cnc : Dpl:				Massive	Friable	
10 - 28"	B_w	FSL	10 YR 4/6		Cnc : Dpl:				Massive	Friable	
28 - 34"	C_1	SL	10 YR 5/4		Cnc : Dpl:				Massive	Friable	
34 - 100"	C_2	SL	2.5 Y 5/4	31"	Cnc : 7.5 YR 6/8 Dpl: 5 Y 6/1	>5			Massive	Firm	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: Unwitnessed test pit for exploratory purposes

Commonwealth of Massachusetts
City/Town of Sherborn

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

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

Deep Observation Hole Number: 23-09 (Hole #) | 10/26/2023 (Date) | A.M. (Time) | 70 Sunny (Weather) | 42.2570 (Latitude) | -71.4009 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: See Test Hole Location Plan

2. Soil Parent Material: Coarse-loamy lodgement till derived from gneiss, granite, and/or schist | Ground Moraines, Drumlins (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

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

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 96" Depth to Weeping in Hole | N/A Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 15"	A	FSL	10 YR 3/2		Cnc : Dpl:				Massive	Friable	
15 - 31"	B_w	FSL	10 YR 4/6		Cnc : Dpl:				Massive	Friable	
31 - 37"	C_1	SL	10 YR 4/4		Cnc : Dpl:				Massive	Friable	
37 - 120"	C_2	SL	2.5 Y 4/3	38"	Cnc : 7.5 YR 6/8 Dpl: 5 Y 6/1	>5	Some	Some	Massive	Friable	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Sherborn

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

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

Deep Observation Hole Number: 23-10 (Hole #) | 10/26/2023 (Date) | A.M. (Time) | 70 Sunny (Weather) | 42.2570 (Latitude) | -71.4009 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: See Test Hole Location Plan

2. Soil Parent Material: Coarse-loamy lodgement till derived from gneiss, granite, and/or schist | Ground Moraines, Drumlins (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

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

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 54" Depth to Weeping in Hole 108" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 10"	A	FSL	10 YR 3/2		Cnc : Dpl:				Massive	Friable	
10 - 34"	B_w	FSL	10 YR 4/6		Cnc : Dpl:				Massive	Friable	
34 - 40"	C_1	SL	10 YR 4/4		Cnc : Dpl:				Massive	Friable	
40 - 120"	C_2	SL	2.5 Y 4/3	36"	Cnc : 7.5 YR 6/8 Dpl: 5 Y 6/1	>5			Massive	Firm	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Sherborn

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

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

Deep Observation Hole Number: 23-11 (Hole #) | 10/26/2023 (Date) | A.M. (Time) | 70 Sunny (Weather) | 42.2570 (Latitude) | -71.4009 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Grass Lawn (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: See Test Hole Location Plan

2. Soil Parent Material: Coarse-loamy lodgement till derived from gneiss, granite, and/or schist | Ground Moraines, Drumlins (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

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

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 111" Depth to Weeping in Hole 117" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 16"	A	FSL	10 YR 3/2		Cnc : Dpl:				Massive	Friable	
16 - 27"	B_W	FSL	10 YR 4/6		Cnc : Dpl:				Massive	Friable	
27 - 40"	C_1	SL	10 YR 4/4	37"	Cnc : 7.5 YR 6/8 Dpl: 5 Y 6/1	>5			Massive	Friable	
40 - 72"	C_2	SL	2.5 Y 5/4		Cnc : Dpl:				Massive	Friable	Firm in place Stratified layers of LS
72 - 132"	C_3	SL	2.5 Y 4/3		Cnc : Dpl:				Massive	Firm	
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Sherborn

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

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

Deep Observation Hole Number: 23-12 (Hole #) | 10/26/2023 (Date) | P.M. (Time) | 70 Sunny (Weather) | 42.2570 (Latitude) | -71.4009 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: See Test Hole Location Plan

2. Soil Parent Material: Coarse-loamy lodgement till derived from gneiss, granite, and/or schist | Ground Moraines, Drumlins (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

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

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 86" Depth to Weeping in Hole 130" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 12"	A	FSL	10 YR 3/2		Cnc : Dpl:				Massive	Friable	
12 - 20"	B_w	FSL	10 YR 4/6		Cnc : Dpl:				Massive	Friable	
20 - 42"	C_1	SL	10 YR 4/4	36"	Cnc : 7.5 YR 6/8 Dpl: 5 Y 6/1	>5			Massive	Friable	
42 - 60"	C_2	SL	2.5 Y 5/4		Cnc : Dpl:				Massive	Friable	Firm in place
60 - 136"	C_3	SL	2.5 Y 4/3		Cnc : Dpl:				Massive	Firm	
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Sherborn

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

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

Deep Observation Hole Number: 23-13 (Hole #) | 10/26/2023 (Date) | P.M. (Time) | 70 Sunny (Weather) | 42.2570 (Latitude) | -71.4009 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: See Test Hole Location Plan

2. Soil Parent Material: Coarse-loamy lodgement till derived from gneiss, granite, and/or schist | Ground Moraines, Drumlins (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

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

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 75" Depth to Weeping in Hole 130" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 11"	A	FSL	10 YR 3/2		Cnc : Dpl:				Massive	Friable	
11 - 24"	B_w	FSL	10 YR 4/6		Cnc : Dpl:				Massive	Friable	
24 - 31"	C_1	SL	10 YR 4/4		Cnc : Dpl:				Massive	Friable	
31 - 46"	C_2	SL	2.5 Y 5/4	31"	Cnc : 7.5 YR 6/8 Dpl: 5 Y 6/1	>5			Massive	Friable	Firm in place
46 - 146"	C_3	SL	2.5 Y 4/3		Cnc : Dpl:		Some		Massive	Firm	
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Sherborn

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

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

Deep Observation Hole Number: 23-14 (Hole #) | 10/26/2023 (Date) | P.M. (Time) | 70 Sunny (Weather) | 42.2570 (Latitude) | -71.4009 (Longitude)

1. Land Use: Vacant Lot (e.g., woodland, agricultural field, vacant lot, etc.) | Wooded (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-8 (Slope (%))

Description of Location: See Test Hole Location Plan

2. Soil Parent Material: Coarse-loamy lodgement till derived from gneiss, granite, and/or schist | Ground Moraines, Drumlins (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

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

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 51" Depth to Weeping in Hole 108" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 8"	A	FSL	10 YR 3/2		Cnc : Dpl:				Massive	Friable	
8 - 22"	B_w	FSL	10 YR 4/6		Cnc : Dpl:				Massive	Friable	
22 - 32"	C_1	SL	10 YR 4/4		Cnc : Dpl:				Massive	Friable	
32 - 120"	C_2	SL	2.5 Y 4/3	36"	Cnc : 7.5 YR 6/8 Dpl: 5 Y 6/1	>5			Massive	Firm	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

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

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

	Obs. Hole # 23-01	Obs. Hole # 23-02
☒ Depth to soil redoximorphic features	33 inches	30 inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

Index Well Number _____ Reading Date _____

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

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

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

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

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: 16 inches Lower boundary: 128 inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

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

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):	Obs. Hole # 23-03	Obs. Hole # 23-04
☒ Depth to soil redoximorphic features	30 inches	29 inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number _____ Reading Date

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

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

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

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

      ☒ Yes ☐ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: 20 inches Lower boundary: 120 inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

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

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

	Obs. Hole # 23-05	Obs. Hole # 23-06
☒ Depth to soil redoximorphic features	30 inches	30 inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number _____ Reading Date

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

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

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

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

      ☒ Yes ☐ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: 20 inches Lower boundary: 126 inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

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

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

	Obs. Hole # 23-07	Obs. Hole # 23-08
☒ Depth to soil redoximorphic features	32 inches	31 inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number _____ Reading Date

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

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

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

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

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: 28 inches Lower boundary: 126 inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

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

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

	Obs. Hole # 23-09	Obs. Hole # 23-10
☒ Depth to soil redoximorphic features	38 inches	36 inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

Index Well Number _____ Reading Date _____

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

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

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

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

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: 31 inches Lower boundary: 120 inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

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

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

	Obs. Hole # 23-11	Obs. Hole # 23-12
☒ Depth to soil redoximorphic features	37 inches	36 inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

Index Well Number _____ Reading Date _____

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

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

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

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

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: 20 inches Lower boundary: 136 inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of Sherborn

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

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

	Obs. Hole # 23-13	Obs. Hole # 23-14
☒ Depth to soil redoximorphic features	31 inches	36 inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

Index Well Number _____ Reading Date _____

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

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

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

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

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: 24 inches Lower boundary: 146 inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of Sherborn

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

F. Certification

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

Fred Schobel	11/27/23
Signature of Soil Evaluator	Date
Frederick Schobel, EIT, SE 14561	10/1/2024
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
Mark Oram, RS, CHO	Sherborn
Name of Approving Authority Witness	Approving Authority

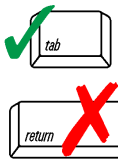
Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

Commonwealth of Massachusetts
City/Town of Sherborn
Percolation Test
Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

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



A. Site Information

Fenix Partners Brush Hill LLC
Owner Name

34 Brush Hill Road
Street Address or Lot #

Sherborn	MA	01770
City/Town	State	Zip Code

	617-308-1961
Contact Person (if different from Owner)	Telephone Number

B. Test Results

	10/26/23 Date	9:44 A.M. Time	10/26/23 Date	10:20 A.M. Time
Observation Hole #	23-09		23-11	
Depth of Perc	54 - 66"		52 - 64"	
Start Pre-Soak	9:44 A.M.		10:20 A.M.	
End Pre-Soak	9:59 A.M.		10:35 A.M.	
Time at 12”	10:06 A.M.		10:35 A.M.	
Time at 9”	10:47 A.M.		12:35 P.M.	
Time at 6”	11:47 A.M.		2:56 P.M.	
Time (9”-6”)	60 Minutes		141 Minutes	
Rate (Min./Inch)	20 Min./Inch		47 Min./Inch	
	Test Passed: ☒ Test Failed: ☐		Test Passed: ☒ Test Failed: ☐	

Frederick Schobel, EIT, SE 14561
Test Performed By:

Mark Oram, RS, CHO
Board of Health Witness

Comments:

Commonwealth of Massachusetts
City/Town of Sherborn
Percolation Test
Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

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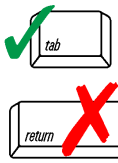

A. Site Information

Fenix Partners Brush Hill LLC
Owner Name

34 Brush Hill Road
Street Address or Lot #

Sherborn	MA	01770
City/Town	State	Zip Code
	617-308-1961	
Contact Person (if different from Owner)	Telephone Number	

B. Test Results

	10/26/23 Date	9:38 A.M. Time	10/26/23 Date	11:20 A.M. Time
Observation Hole #	23-10a		23-10b	
Depth of Perc	53 - 65"		30 - 42"	
Start Pre-Soak	9:38 A.M.		11:20 A.M.	
End Pre-Soak	9:53 A.M.		11:35 A.M.	
Time at 12”	9:53 A.M.		11:35 A.M.	
Time at 9”	Test canceled due to		11:58 A.M.	
Time at 6”	Groundwater Intrusion		12:40 P.M.	
Time (9”-6”)			42 Minutes	
Rate (Min./Inch)			14 Min./Inch	
	Test Passed: ☐ Test Failed: ☐		Test Passed: ☒ Test Failed: ☐	

Frederick Schobel, EIT, SE 14561
Test Performed By:

Mark Oram, RS, CHO
Board of Health Witness

Comments:

Commonwealth of Massachusetts
City/Town of Sherborn
Percolation Test
Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

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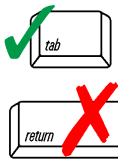


A. Site Information

Fenix Partners Brush Hill LLC
Owner Name

34 Brush Hill Road
Street Address or Lot #

Sherborn	MA	01770
City/Town	State	Zip Code
	617-308-1961	
Contact Person (if different from Owner)	Telephone Number	

B. Test Results

	10/26/23 Date	12:53 P.M. Time	Date	Time
Observation Hole #	23-12			
Depth of Perc	39 - 51"			
Start Pre-Soak	12:53 P.M.			
End Pre-Soak	1:08 P.M.			
Time at 12”	1:08 P.M.			
Time at 9”	3:40 P.M.			
Time at 6”				
Time (9”-6”)	Test canceled due to			
Rate (Min./Inch)	Groundwater Intrusion			
	Test Passed: ☐ Test Failed: ☐		Test Passed: ☐ Test Failed: ☐	

Frederick Schobel, EIT, SE 14561
Test Performed By:

Mark Oram, RS, CHO
Board of Health Witness

Comments:

Permeability Test Pit 23-03

Date Performed:	25-Oct-23
Soil Horizon of Perm Test:	C_2
Depth to water level =	19"
Depth to bottom of tube =	30"
Start Soak:	9:50 a.m.
Start Test:	10:05 a.m.

	Time Interval (Minutes)	Incremental Volume(L)
Test 1:	5	0.750
Test 2:	5	0.750
Test 3:	5	0.750
Test 4:	5	0.750
Test 5:	5	0.750
Test 6:	5	0.750
Test 7:	5	0.750
Test 8:	5	0.750
Test 9:	5	0.750
Test 10:	5	0.750
Cumulative Time/Volume	**50**	**7.500**

Q=Cumulative Volume cm^3 / Total time in seconds

Q= 2.500 cm^3/sec

Computation of Permeability(k)

k=Q / 5.5 r Hw=

k=coefficient of permeability (cm/sec)

r=inside radius of pipe in centimeters= 7.6 (6" DIA.)

Hw=applied head in centimeters= 28 cm (11 inches)

Q=Computed flow rate in CC/sec= 2.500 cm^3/sec

k=Q / 5.5 r Hw= **0.00214 cm/sec** 3.027 IN/HR

Permeability Test Pit 23-06

Date Performed:	25-Oct-23
Soil Horizon of Perm Test:	C_1
Depth to water level =	22"
Depth to bottom of tube =	33"
Start Soak:	11:34 a.m.
Start Test:	11:49 a.m.

	Time Interval (Minutes)	Incremental Volume(L)
Test 1:	5	0.500
Test 2:	5	0.500
Test 3:	5	0.500
Test 4:	5	0.500
Test 5:	5	0.500
Test 6:	5	0.500
Test 7:	5	0.500
Test 8:	5	0.500
Cumulative Time/Volume	**40**	**4.000**

Q=Cumulative Volume cm^3 / Total time in seconds

Q= 1.667 cm^3/sec

Computation of Permeability(k)

k=Q / 5.5 r Hw=

k=coefficient of permeability (cm/sec)

r=inside radius of pipe in centimeters= 7.6 (6" DIA.)

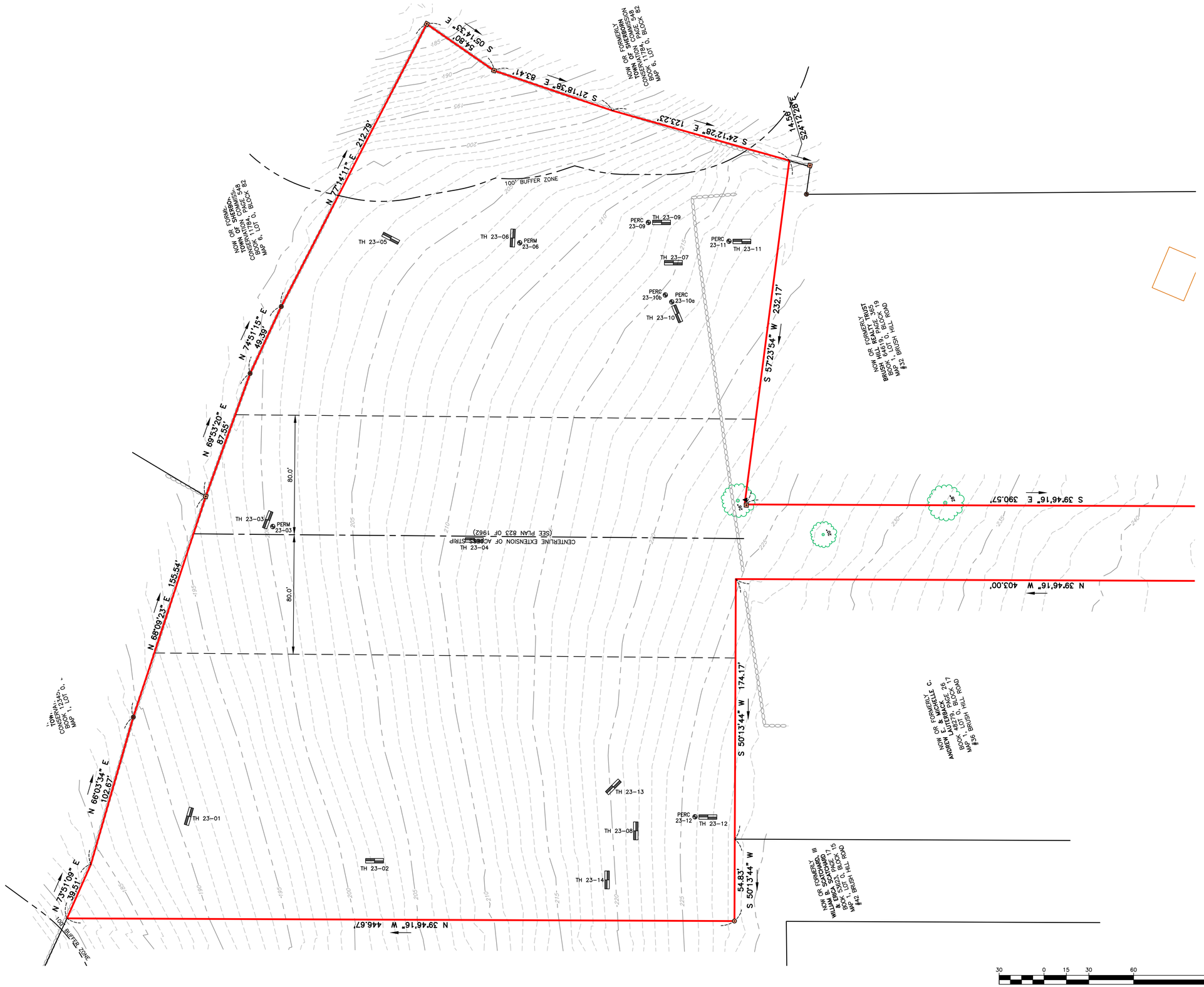
Hw=applied head in centimeters= 28 cm (11 inches)

Q=Computed flow rate in CC/sec= 1.667 cm^3/sec

k=Q / 5.5 r Hw= **0.00142 cm/sec** 2.018 IN/HR

Attachment 2

Soil Test Hole Location Plan



DGT Associates
Surveying & Engineering

Framingham
Boston ● Worcester ● Preston, CT

1071 Worcester Road
Framingham, MA 01701
508-879-0030

www.DGTassociates.com

NO.	APP	DATE	DESCRIPTION

DATE: **NOVEMBER 20, 2023**

SCALE: **1" = 30'**

DESIGN:	DRAFTED:	CHECKED:
	FJS	**KMR**

PROJECT TITLE:

SHERBORN COTTAGE COURT

34 BRUSH HILL ROAD
SHERBORN, MA 01770

SHEET TITLE:

SOIL TEST HOLE LOCATION PLAN

SHEET: **1 OF 1**

PROJECT NO.: **F25889**

ST-1

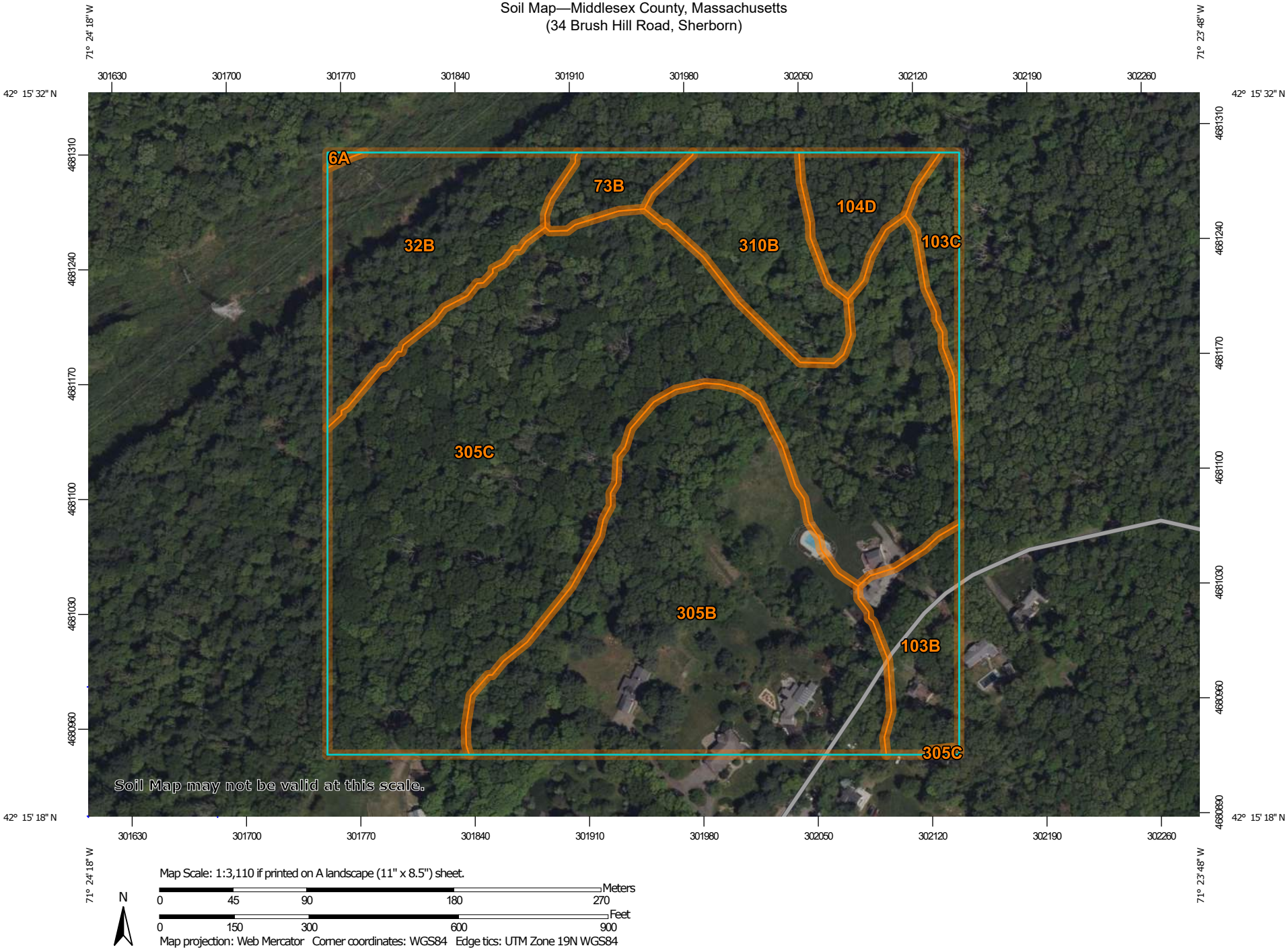
F:\F-25800\F-25889 Fenix 34 Brush Hill Rd Sherborn MA\F-25889_Master\Dwg\F-25889 Eng Wp.dwg

Attachment 3

National Resources Conservation Service (NRCS)
Soils Map and Information

United States Geological Survey (USGS)
Surficial Materials Map and Information

Soil Map—Middlesex County, Massachusetts
(34 Brush Hill Road, Sherborn)



Map Scale: 1:3,110 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 45 90 180 270

Feet
0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 23, Sep 12, 2023

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	0.0	0.1%
32B	Wareham loamy fine sand, 0 to 5 percent slopes	3.5	9.9%
73B	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	0.6	1.8%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	1.5	4.2%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	0.7	1.9%
104D	Hollis-Rock outcrop-Charlton complex, 15 to 25 percent slopes	1.1	3.1%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	9.3	26.3%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	16.4	46.5%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	2.2	6.3%
Totals for Area of Interest		**35.2**	**100.0%**

Middlesex County, Massachusetts

305B—Paxton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t2qp
Elevation: 0 to 1,570 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Paxton

Setting

Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge
Percent of map unit: 9 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury
Percent of map unit: 6 percent
Landform: Depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Toeslope, backslope, footslope
Landform position (three-dimensional): Base slope, head slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Charlton
Percent of map unit: 5 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 23, Sep 12, 2023

Middlesex County, Massachusetts

305C—Paxton fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w66y
Elevation: 0 to 1,320 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Paxton

Setting

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

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C

Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Charlton
Percent of map unit: 7 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Woodbridge
Percent of map unit: 6 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury
Percent of map unit: 2 percent
Landform: Drumlins, drainageways, depressions, ground moraines, hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

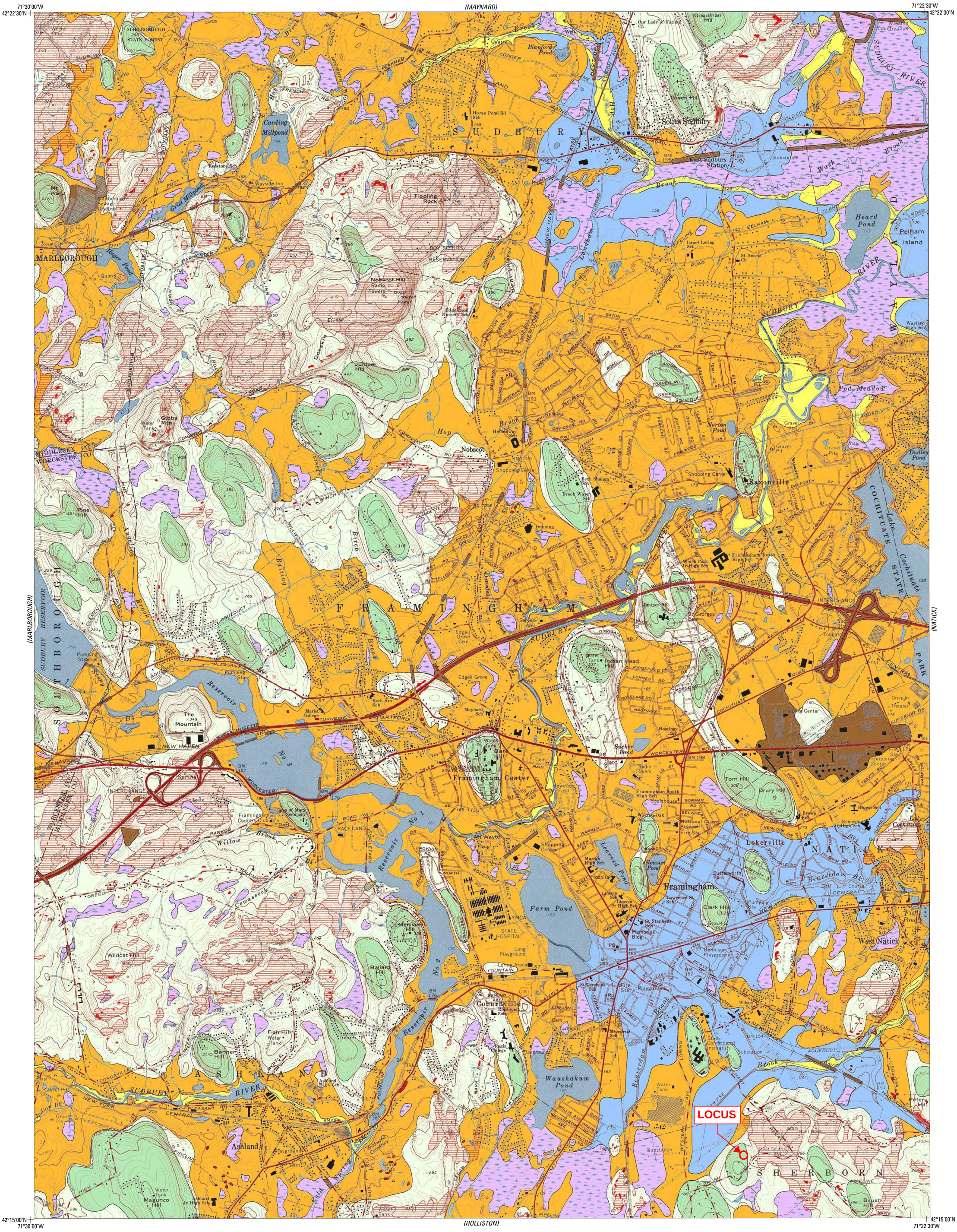
Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 23, Sep 12, 2023

U.S. Department of the Interior
U.S. Geological Survey

Prepared in cooperation with the
Commonwealth of Massachusetts
Massachusetts Geological Survey
and Executive Office for Administration and Finance

Scientific Investigations Map 3402
Quadrangle 98—Framingham
Discussion of surficial materials and description of map units available at https://doi.org/10.3133/sim3402

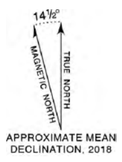


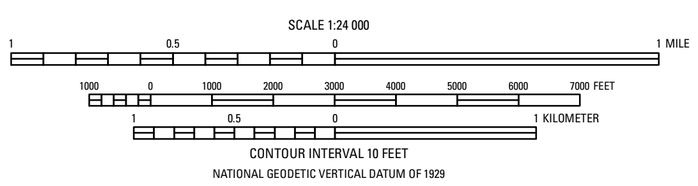
Base from U.S. Geological Survey, 1965

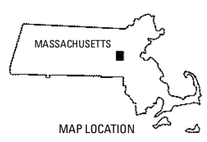
Map was scanned, processed, georeferenced, rectified, and cropped by the Massachusetts Geological Survey

Lambert Conformal Conic projection. North American Datum of 1983

Massachusetts state plane coordinate system, mainland zone







Map units were reproduced from Nelson (1974b). Some units were mapped or revised from analysis of topographic (lidar) data and 2005 orthophoto images.

Surficial Materials Map of the Framingham Quadrangle, Massachusetts

Compiled by
Janet R. Stone and Byron D. Stone
2018

For sale by U.S. Geological Survey, Box 25286, Denver Federal Center, Denver, CO 80225; https://store.usgs.gov; 1–888–ASK–USGS (1–888–275–8747)

Suggested citation: Stone, J.R., and Stone, B.D., comps., 2018, Surficial materials map of the Framingham quadrangle, Massachusetts, quadrangle 98 *in* Stone, J.R., Stone, B.D., DiGiacomo-Cohen, M.L., and Mabee, S.B., comps., Surficial materials of Massachusetts—A 1:24,000-scale geologic map database: U.S. Geological Survey Scientific Investigations Map 3402, 1 sheet, scale 1:24,000, https://doi.org/10.3133/sim3402.

ISSN 2329-132X (online)
https://doi.org/10.3133/sim3402

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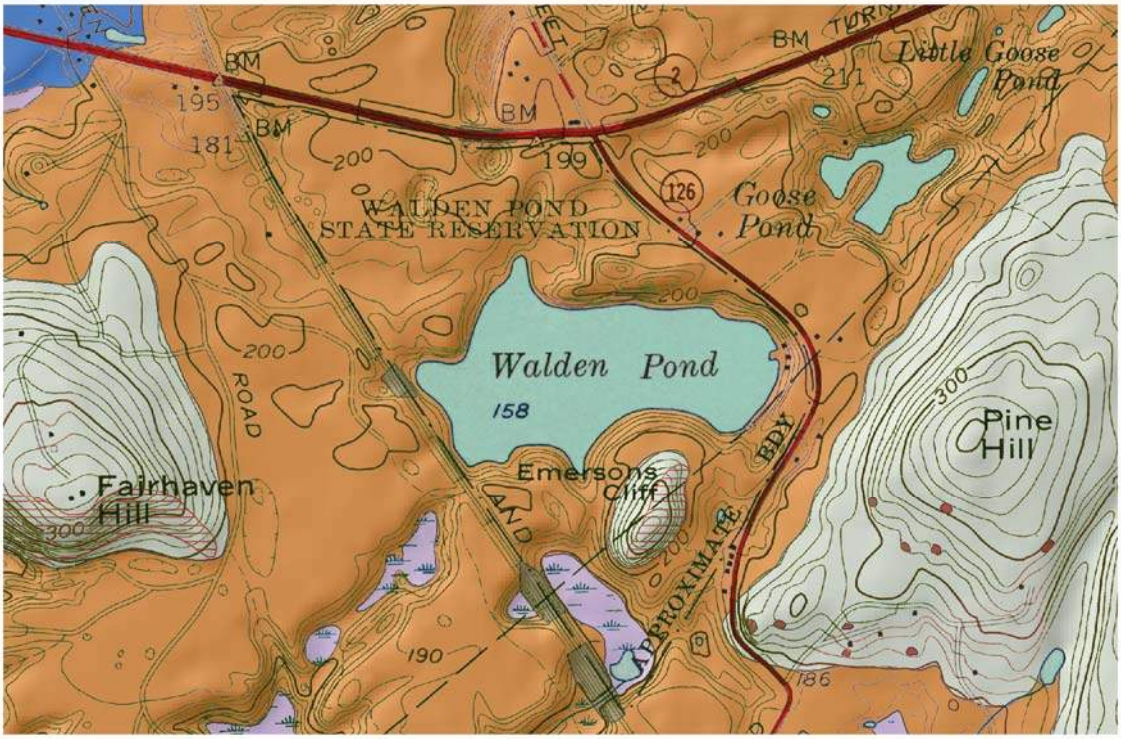
science for a changing world

Prepared in cooperation with the Commonwealth of Massachusetts
Office of the State Geologist and Executive Office of Environmental Affairs

Surficial Geologic Map of the Clinton-Concord-Grafton-Medfield 12-quadrangle area in East Central Massachusetts

Compiled by Janet R. Stone and Byron D. Stone



Open-File Report 2006-1260A

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
Dirk Kempthorne, Secretary

U.S. Geological Survey
Mark D. Myers, Director

U.S. Geological Survey, Reston, Virginia 2006

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Suggested citation:
Stone, J.R., and Stone, B.D., 2006, Surficial Geologic Map of the Clinton-Concord-Grafton-Medfield 12-quadrangle area in East Central Massachusetts: U.S. Geological Survey Open-File Report 2006-1260A.

Cover figure. A portion of the surficial geologic map of the Concord quadrangle, shown with semi-transparent shaded relief on a scanned topographic base map.

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Surficial Geologic Map of the Clinton-Concord-Grafton-Medfield 12-quadrangle area in East Central Massachusetts

Compiled by Janet R. Stone, and Byron D. Stone

Introduction

The surficial geologic map shows the distribution of nonlithified earth materials at land surface in an area of twelve 7.5-minute quadrangles (total 660 mi^2) in east-central Massachusetts (fig. 1). Across Massachusetts, these materials range from a few feet to more than 500 ft in thickness. They overlie bedrock, which crops out in upland hills and in resistant ledges in valley areas. The geologic map differentiates surficial materials of Quaternary age on the basis of their lithologic characteristics (grain size, sedimentary structures, mineral and rock-particle composition), constructional geomorphic features, stratigraphic relationships, and age. Surficial materials also are known in engineering classifications as unconsolidated soils, which include coarse-grained soils, fine-grained soils, or organic fine-grained soils. Surficial materials underlie and are the parent materials of modern pedogenic soils, which have developed in them at the land surface. Surficial earth materials significantly affect human use of the land, and an accurate description of their distribution is particularly important for water resources, construction aggregate resources, earth-surface hazards assessments, and land-use decisions.

The mapped distribution of surficial materials that lie between the land surface and the bedrock surface is based on detailed geologic mapping of 7.5-minute topographic quadrangles, as part of a cooperative state-wide mapping program between the U.S. Geological Survey and the Massachusetts Department of Public Works (now Massachusetts Highway Department) (Page, 1967; Stone, 1982), and the Office of the Massachusetts State Geologist. Each published geologic map presents a detailed description of local geologic map units, the genesis of the deposits, and age correlations among units. Regional summaries of these maps and unpublished maps discuss the ages of multiple glaciations, the nature of glaciofluvial, glaciolacustrine, and glaciomarine deposits, and the processes of ice advance and retreat across Massachusetts (Warren and Stone, 1986; Koteff and Pessl, 1981; papers in Larson and Stone, 1982; Oldale and Barlow, 1986; Stone and Borns, 1986).

This compilation of surficial geologic materials is an interim product that defines the areas of exposed bedrock, and the boundaries between glacial till, glacial stratified deposits, and overlying postglacial deposits. This work is part of a comprehensive study to produce a statewide digital map of the surficial geology at a 1:24,000-scale level of accuracy. This map of 12 quadrangles revises previous digital surficial geologic maps (Stone and Beinikis, 1993; MassGIS, 1999) that were compiled on base maps at regional scales of 1:250,000 and 1:125,000. The purpose of this study is to provide fundamental geologic data for the evaluation of natural resources, hazards, and land information within the Commonwealth of Massachusetts.

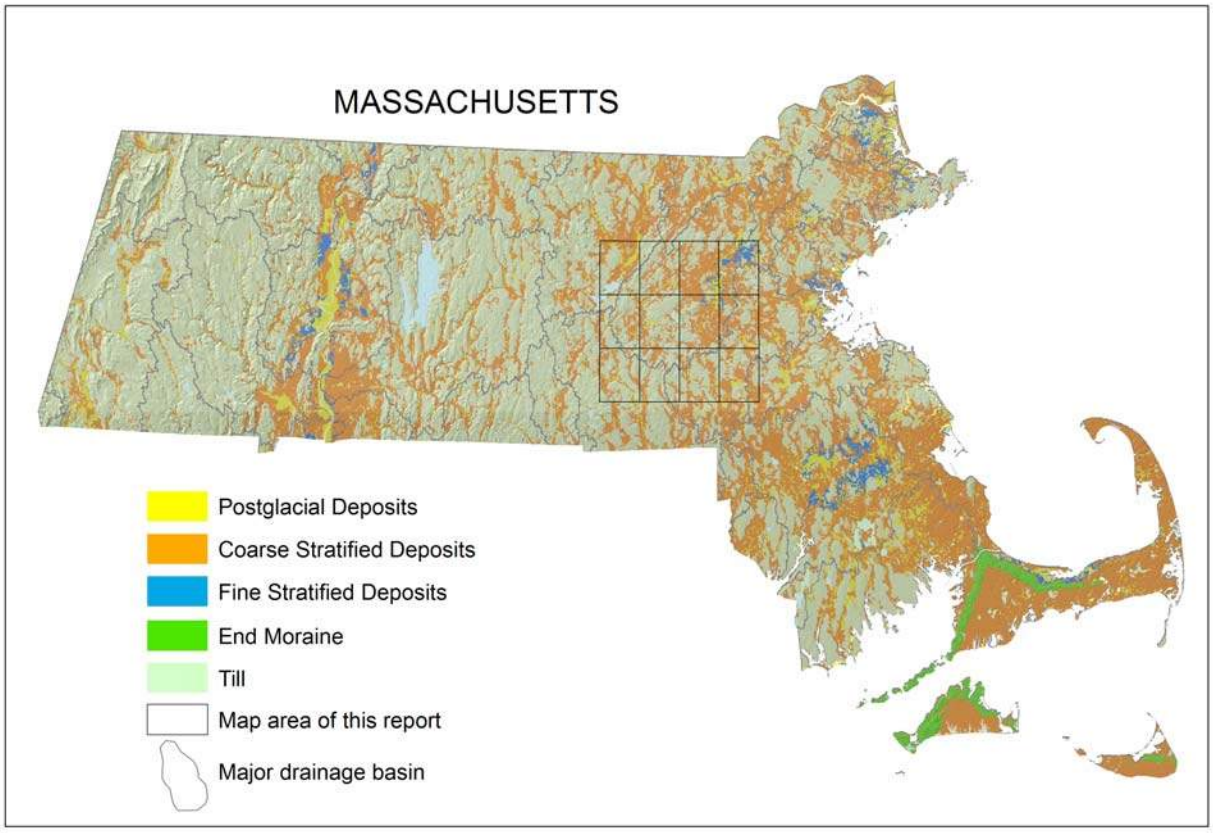

Figure 1. General distribution of glacial and postglacial deposits in Massachusetts (Stone and Beinikis, 1993, MassGIS, 1999) and map area covered by this report.

Surficial Materials in Massachusetts

Most of the surficial materials in Massachusetts are deposits of the last two continental ice sheets that covered all of New England in the latter part of the Pleistocene ice age (Schafer and Hartshorn, 1965; Stone and Borns, 1986; Oldale and others, 1982). The glacial deposits are divided into two broad categories, ***glacial till*** and ***glacial stratified deposits***. Till, the most widespread glacial deposit, was laid down directly by glacier ice. Glacial stratified deposits are concentrated in valleys and lowland areas and were laid down by glacial meltwater in streams, lakes, and the sea in front of the retreating ice margin during the last deglaciation. Postglacial sediments, primarily floodplain alluvium and swamp deposits, make up a lesser proportion of the unconsolidated materials.

Glacial till deposits consist of nonsorted, generally nonstratified mixtures of mineral and rock particles ranging in grain size from clay to large boulders. The matrix of most tills is composed dominantly of fine sand and silt. Boulders within and on the surface of tills range from sparse to abundant. Some tills contain lenses of sorted sand and gravel and less commonly, masses of laminated fine-grained sediments. The color and lithologic characteristics of till deposits vary across Massachusetts, but generally reflect the composition of the local underlying and northerly adjacent bedrock from which the till was derived. Till blankets the bedrock surface in variable thickness, ranging from a few inches to more than 200 ft, and commonly underlies stratified

meltwater deposits. Tills deposited during the last two glaciations occur in superposition within Massachusetts (Koteff, 1966; Newton, 1978; Weddle and others, 1989). The upper till was deposited during the last (late Wisconsinan) glaciation; it is the most extensive till and commonly is observed in surface exposures, especially in areas where till thickness is less than 15 ft (thin till unit on the map). The lower till ("old" till) was deposited during an earlier glaciation (probably Illinoian). The lower till has a more limited distribution; it is principally a subsurface deposit that constitutes the bulk of material in drumlins and other hills where till thickness is greater than 15 ft. The distribution of lower till is shown primarily by the thick till unit on the map. The lower till generally is overlain by thin upper till deposits in these areas. In all exposures showing the superposed two tills, the base of the upper till truncates the weathered surface of the old till. The lower part of the upper till commonly displays a zone of shearing, dislocation, and brecciation in which clasts of lower till were mixed and incorporated into the upper till during the last glaciation.

End moraine deposits are composed predominantly of bouldery ablation till, but may also locally include sorted sediments. These deposits were laid down by glacial-melting processes along active ice margins during retreat of the last (late-Wisconsinan) ice sheet. Extensive end moraines on Nantucket and Martha's Vineyard (fig. 1) are related to the terminal position of the late-Wisconsinan ice sheet, and the end moraines on Cape Cod are associated with recessional positions of the last ice sheet. Less extensive end moraines occur locally elsewhere in southeastern Massachusetts, in the Boston area and in the Gloucester-Rockport area of northeastern Massachusetts.

Glacial stratified deposits consist of layers of well-sorted to poorly sorted gravel, sand, silt, and clay laid down by flowing meltwater in glacial streams, lakes, and marine embayments that occupied the valleys and lowlands of Massachusetts during retreat of the last ice sheet. Textural variations within the meltwater deposits occur both areally and vertically because meltwater-flow regimes were different in glaciofluvial (stream), glaciodeltaic (where a stream entered a lake or the sea), glaciolacustrine (lake bottom), and glaciomarine (marine bottom) depositional environments. Grain-size variations also resulted from meltwater deposition in positions either proximal to or distal from the retreating glacier margin, which was the principal sediment source. A common depositional setting contained a proximal, ice-marginal meltwater stream in which horizontally bedded glaciofluvial gravel and/or sand and gravel were laid down; farther down valley, the stream entered a glacial lake where glaciodeltaic sediments were deposited, consisting of horizontally layered sand and gravel delta-topset beds overlying inclined layers of sand in delta-foreset beds. Farther out in the glacial lake, very fine sand, silt, and clay settled out on the lake bottom in flat-lying, thinly bedded glaciolacustrine layers. Thick sequences having these textural variations commonly are present in the vertical section of meltwater deposits across the State (Stone and others, 1992). Detailed geologic maps permit precise mapping of meltwater sedimentary units within each glacial lake or valley outwash system (Jahns, 1941; 1953; Koteff, 1966). These units, known as *morphosequences* (Koteff, 1974; Koteff and Pessl, 1981), are the smallest mappable stratigraphic units on detailed geologic maps. *Morphosequences* are bodies of stratified meltwater sediments that are contained in a continuum of landforms, grading from ice-contact forms (eskers, kames) to non-ice-contact forms (flat valley terrace, delta plains) that were deposited simultaneously at and beyond the margin of the ice sheet, graded to a specific base level. Each morphosequence consists of a proximal part (head) deposited within or near the ice margin, and a distal part deposited farther away from the ice margin. Both grain size and ice-melt collapse deformation of beds decrease from the proximal to the distal part of each morphosequence. The head of each morphosequence is either ice marginal (ice contact) or near ice marginal. The surface

altitude of fluvial sediments in each morphosequence was controlled by a specific base level, either a glacial-lake or marine water plane or a valley knickpoint. Few morphosequences extend distally more than 10 km, and most are less than 2 km in length. In any one basin, individual morphosequences were deposited sequentially as the ice margin retreated systematically northward. Consequently, in many places the distal, finer grained facies of a younger morphosequence stratigraphically overlies the proximal, coarse-grained facies of a preceding morphosequence. Figure 2 shows the variability of sediment types in the subsurface of glacial stratified deposits. The figure schematically shows the relationship between coarse-grained deltaic deposits and extensive fine-grained lake (or marine) deposits in the subsurface. Such coarse- and fine-grained units are common in most of the valleys and lowlands of Massachusetts (Langer, 1979, Stone and others, 1979; Stone and others, 1992; Stone and others, 2005). On this interim map, coarse-grained and fine-grained textural variations within glacial stratified deposits are shown only where they occur at land surface. Subsurface textural variations are not shown.

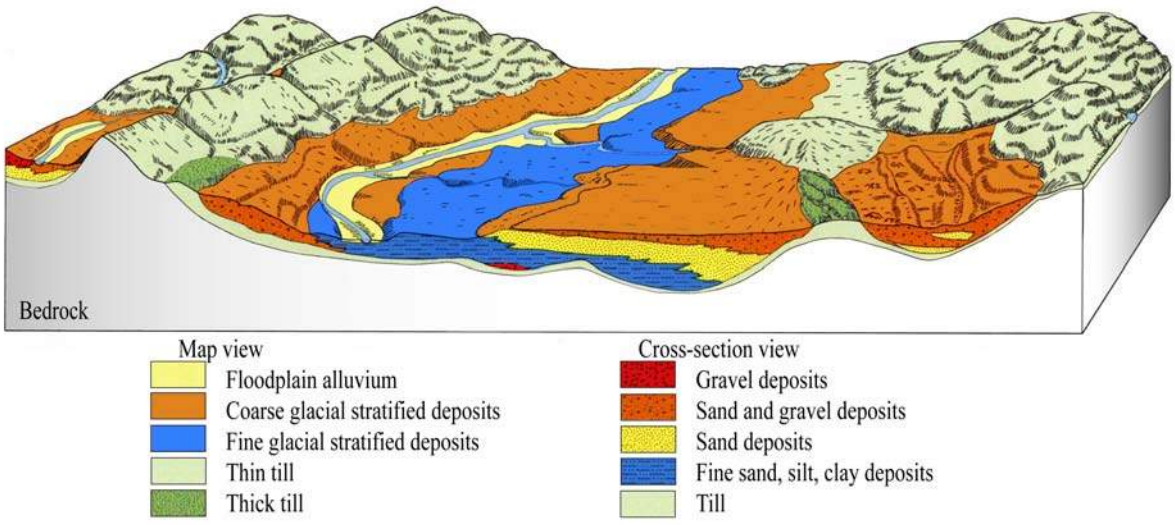

Figure 2. Block diagram illustrating the typical areal and vertical distribution of glacial and postglacial deposits overlying bedrock (modified from Stone and others, 1992).

The areal distribution of till and stratified deposits across Massachusetts is related regional physiography (fig. 1). The thickness of these materials varies considerably because of such factors as the high relief of the bedrock surface, changing environments of deposition during deglaciation, and various effects of postglacial erosion and removal of glacial sediments. In highland areas, notably in the western and central parts of the State, till is the major surficial material and is present as a discontinuous mantle of variable thickness over the bedrock surface. Till is thickest in drumlins (reportedly as much as 230 ft thick) and on the northwest slopes of most bedrock hills. Glacial meltwater deposits that average 50 feet in thickness (Stone and Beinikis, 1993) overlie the till in small upland valleys and north-sloping basins between bedrock hills. Glacial stratified deposits are the predominant surficial materials in the Connecticut River valley, the northeastern and southeastern lowlands, and on Cape Cod and the islands. These deposits generally overlie till; however, well logs indicate that in some places till is not present and the stratified deposits lie

directly on bedrock. On Cape Cod and the islands, in the southeastern lowland, and in parts of the Connecticut River valley these deposits completely cover the till-draped bedrock surface.

Postglacial deposits locally overlie the glacial deposits throughout the State. Alluvium underlies the floodplains of most streams and rivers. Swamps occur in low-lying, poorly drained areas in upland and lowland settings, but swamp deposits are shown only where they are estimated to be at least 3 ft thick. Salt-marsh and estuarine deposits are present mainly along the tidal portions of streams and rivers entering the offshore areas. Beach deposits occur along the shoreline.

Description of Map Units

Postglacial Deposits

Artificial fill—Earth materials and manmade materials that have been artificially emplaced, primarily in highway and railroad embankments, and in dams; may also include landfills, urban development areas, and filled coastal wetlands.

Floodplain alluvium—Sand, gravel, silt, and some organic material, stratified and well sorted to poorly sorted, beneath the floodplains of modern streams. The texture of alluvium commonly varies over short distances both laterally and vertically, and generally is similar to the texture of adjacent glacial deposits. Along smaller streams, alluvium is commonly less than 5 ft thick. The most extensive deposit of alluvium on the map is along the Charles, Assabet, and Concord Rivers where the texture is predominantly sand, fine gravel, and silt, and total thickness is as much as 25 ft. Alluvium typically overlies thicker glacial stratified deposits.

Swamp deposits—Organic muck and peat that contain minor amounts of sand, silt, and clay, stratified and poorly sorted, in kettle depressions or poorly drained areas. Most swamp deposits are less than about 10 ft thick. Swamp deposits overlie glacial deposits or bedrock. They locally overlie glacial till even where they occur within thin glacial meltwater deposits.

Glacial Stratified Deposits

Sorted and stratified sediments composed of gravel, sand, silt, and clay (as defined in particle size diagram, fig. 3) deposited in layers by glacial meltwater. These sediments occur as four basic textural units—gravel deposits, sand and gravel deposits, sand deposits, and fine deposits. On this interim map, gravel, sand and gravel, and sand deposits are not differentiated and are shown as *Coarse Deposits* where they occur at land surface. *Fine Deposits* also are shown where they occur at land surface. **Textural changes occur both areally and vertically (fig. 2), however subsurface textural variations are not shown on this interim map.**

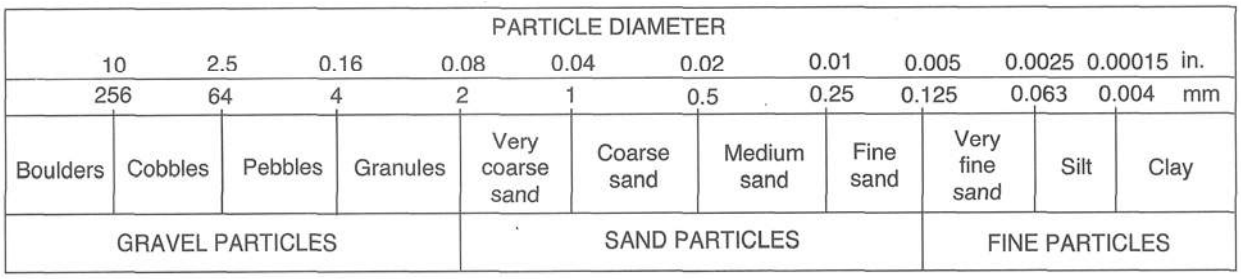

Figure 3. Grain-size classification used in this report, modified from Wentworth (1922).

Coarse deposits include: *Gravel deposits* composed mainly of gravel-sized clasts; cobbles and boulders predominate; minor amounts of sand within gravel beds, and sand comprises few separate layers. Gravel layers generally are poorly sorted and bedding commonly is distorted and faulted due to postdepositional collapse related to melting of ice. *Sand and gravel deposits* composed of mixtures of gravel and sand within individual layers and as alternating layers. Sand and gravel layers generally range from 25 to 50 percent gravel particles and from 50 to 75 percent sand particles. Layers are well to poorly sorted; bedding may be distorted and faulted due to postdepositional collapse. *Sand deposits* composed mainly of very coarse to fine sand, commonly in well-sorted layers. Coarser layers may contain up to 25 percent gravel particles, generally granules and pebbles; finer layers may contain some very fine sand, silt, and clay.

Fine deposits include very fine sand, silt, and clay that occurs as well-sorted, thin layers of alternating silt and clay, or thicker layers of very fine sand and silt. Very fine sand commonly occurs at the surface and grades downward into rhythmically bedded silt and clay varves. Locally, this map unit may include areas underlain by fine sand.

Glacial Till Deposits

Thin till—Nonsorted, nonstratified matrix of sand, some silt, and little clay containing scattered gravel clasts and few large boulders; in areas where till is generally less than 10-15 ft thick and including areas of bedrock outcrop where till is absent. Predominantly upper till of the last glaciation; loose to moderately compact, generally sandy, commonly stony. Two facies are present in some places; a looser, coarser-grained ablation facies, melted out from supraglacial position; and an underlying more compact, finer-grained lodgement facies deposited subglacially. In general, both ablation and lodgement facies of upper till derived from fine-grained bedrock are finer grained, more compact, less stony and have fewer surface boulders than upper till derived from coarser grained crystalline rocks. Fine-grained bedrock sources include the red Mesozoic sedimentary rocks of the Connecticut River lowland, marble in the western river valleys, and fine-grained schists in upland areas.

Thick till—Nonsorted, nonstratified matrix of sand, some silt, and little clay containing scattered gravel clasts and few large boulders at the surface; in the shallow subsurface, compact, nonsorted matrix of silt, very fine sand, and some clay containing scattered small gravel clasts in areas where till is greater than 10-15 ft thick, chiefly in drumlin landforms in which till thickness commonly exceeds 100 ft (maximum recorded thickness is 230 ft). Although upper till is the surface deposit, the lower till constitutes the bulk of the material in these areas. Lower till is moderately to very compact, and is commonly finer grained and less stony than upper till. An oxidized zone, the lower part of a soil profile formed during a period of interglacial weathering, is generally present in the upper part of the lower till. This zone commonly shows closely spaced joints that are stained with iron and manganese oxides.

Bedrock Areas

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

Map Compilation

This compilation is the first in a series of interim products showing surficial geology in twelve 7.5-minute quadrangles in east-central Massachusetts: Clinton, Hudson, Maynard, Concord, Shrewsbury, Marlborough, Framingham, Natick, Grafton, Milford, Holliston, and Medfield (fig. 4, fig 5 area A). Figure 5 shows all of the compilation areas for surficial geology in Massachusetts. These maps will be produced sequentially by letter designation.

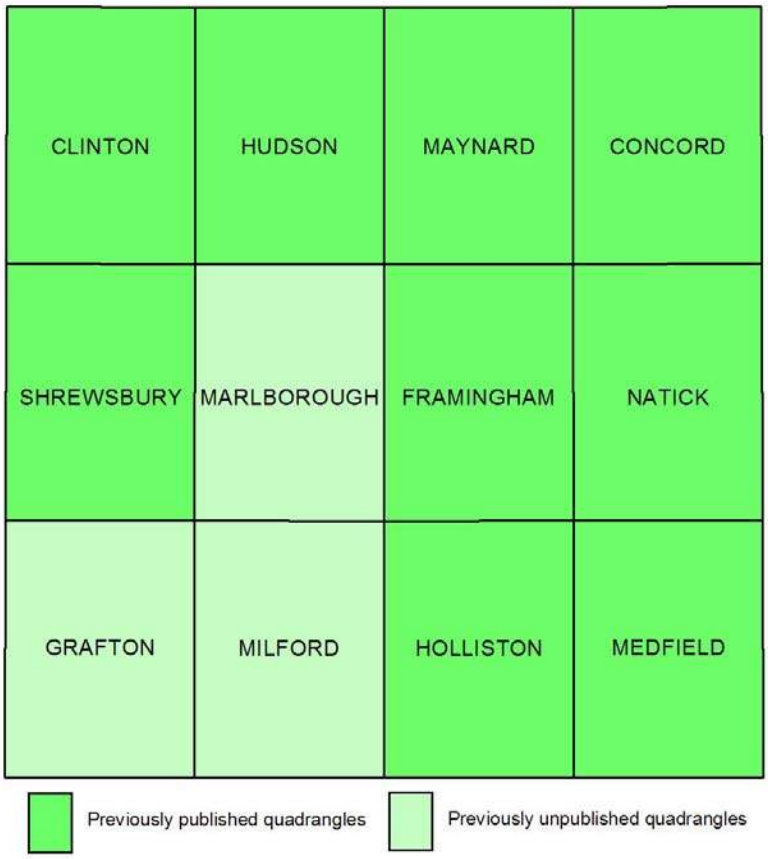

Figure 4. 7.5-minute quadrangles in this compilation.

This map was compiled in several steps: 1) Paper copies of the published surficial geologic maps for nine quadrangles were scanned and georeferenced by MASSGIS. 2) The Office of the Massachusetts State Geologist vectorized the georeferenced images in order to digitally retain the original line work of the published maps (Mabee and others, 2004). 3) Digital geologic map units were compiled and grouped into nine basic units in four broader categories: *Postglacial deposits*

including artificial fill, swamp deposits, and floodplain alluvium; *glacial stratified deposits* including coarse-grained and fine-grained deposits; *glacial till* including thin till and thick till (drumlins); and *bedrock areas* including outcrops and areas of shallow bedrock). The distribution of glacial stratified deposits beneath adjacent overlying postglacial deposits and water bodies was inferred by the compilers. 4) The same basic units for three unpublished quadrangles were compiled and digitized from scanned field maps by U.S. Geological Survey personnel. 5) The 12 individual quadrangles were joined and edge-matched in order to form a seamless geologic map. Discrepancies along quadrangle boundaries were resolved, and thick till areas were added by the compilers in quadrangles where this unit was not previously mapped.

All geologic mapping was completed at 1:24,000-scale; however the browse graphic is presented at 1:50,000 scale with shaded relief base. The 1:24,000-scale, 10-ft contour interval topographic base maps used for this mapping effort are included as part of the digital data package in the TOPOS folder. The GEOLOGY folder included with this report contains 3 ARCGIS shapefiles which are geologic units that cover the entire map area, and are intended for use at quadrangle scale; the shapefiles can be clipped by quadrangle or town boundaries. Unlike conventional geologic maps, the digital mapping is arranged in layers according to superposition. The till-bedrock shapefile should be placed on the bottom, and overlain by the stratified deposits shapefile; these materials are shown everywhere that they occur including beneath postglacial deposits, such as swamp deposits, floodplain alluvium, and water bodies. The postglacial shapefile should be placed on top because these materials overlie the other two layers. Instructions for using the digital files are included in the README file and metadata.

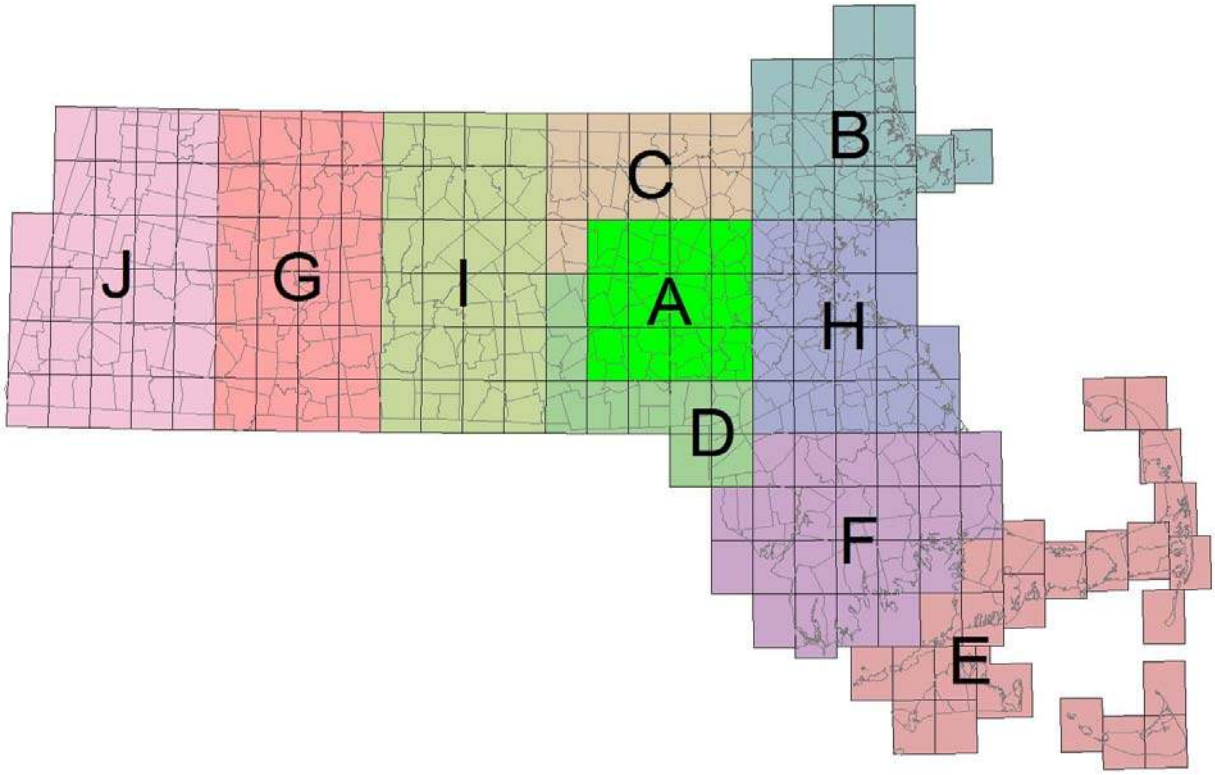

Figure 5. Compilation areas in Massachusetts.

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Appendix

Sources of Data by 7.5-Minute Quadrangle

Clinton Quadrangle

Map units were reproduced from Koteff (1966). Glacial Stratified Deposits in this quadrangle include deposits of glacial Lakes Nashua, Assabet, and Leominster, and other smaller valley deposits. Fine-grained glacial stratified deposits at land surface include glacial Lake Nashua lake-bottom deposits (unit Qnbb of Koteff, 1966). Areas of thick till shown on this map were inferred from photographic image and topographic analysis and drumlin symbols shown by Koteff (1966).

Hudson and Maynard Quadrangles

Map units were reproduced from Hansen (1956). Glacial Stratified Deposits in this quadrangle include various glacial lake and stream deposits. Fine-grained glacial stratified deposits at land surface include lake-bottom deposits of glacial Lake Sudbury (parts of unit Qsg of Hansen, 1956); this unit has been extended beneath adjacent water bodies and postglacial deposits on this map. Drumlin till unit was reproduced from the published map; other areas of thick till were inferred from photographic image and topographic analysis.

Concord Quadrangle

Map units were reproduced from Koteff (1964). Glacial Stratified Deposits in this quadrangle include deposits of glacial lakes Sudbury and Concord, and other smaller valley deposits. Fine-grained glacial stratified deposits at land surface include lake-bottom deposits of glacial Lakes Sudbury and Concord (unit Qlsb and Qlcb of Koteff, 1964); these units have been extended beneath adjacent water bodies and postglacial deposits on this map. Thick till areas shown on this map were inferred from photographic image and topographic analysis and drumlin symbols shown by Koteff (1964).

Shrewsbury Quadrangle

Map units were reproduced from Shaw (1969). Glacial Stratified Deposits in this quadrangle include deposits of glacial Lakes Assabet and Nashua, and other smaller valley deposits. Thick till areas shown on this map were inferred from photographic image and topographic analysis and drumlin symbols shown by Shaw (1969).

Marlborough Quadrangle

Stone, B.D., 1982, Unpublished field maps

Hildreth, C.T., and Stone, B.D., 2004, Surficial geologic map of the Marlborough Quadrangle, unpublished data.

Framingham Quadrangle

Map units were reproduced from Nelson (1974). Glacial Stratified Deposits in this quadrangle include deposits of glacial Lakes Charles and Sudbury, and other smaller valley deposits. Fine-grained glacial stratified deposits at land surface include lake-bottom deposits of glacial Lakes Sudbury and Charles (unit Qlsb and Qlcb of Nelson, 1974); these units have been extended beneath adjacent water bodies and postglacial deposits on this map. Some contacts between till and glacial stratified deposits have been modified from Nelson (1974). Thick till areas shown on this map were inferred from photographic image and topographic analysis and drumlin symbols shown by Nelson (1974).

Natick Quadrangle

Map units were reproduced from Nelson (1974). Glacial Stratified Deposits in this quadrangle include deposits of glacial Lakes Charles and Sudbury, and other smaller valley deposits. Fine-grained glacial stratified deposits at land surface include lake-bottom deposits of glacial lake Sudbury (unit Qlsb of Nelson, 1974); this unit has been extended beneath adjacent water bodies and postglacial deposits on this map. Thick till areas shown on this map were inferred from photographic image and topographic analysis and drumlin symbols shown by Nelson (1974).

Grafton Quadrangle

Haselton, G.M., and Fontaine, E., 1982, Unpublished field maps

Distribution of bedrock outcrops from Walsh, G.W., 2005, Bedrock Geologic Map of the Grafton quadrangle, unpublished data.

Milford Quadrangle

Haselton, G.M., and Fontaine, E., 1982, Unpublished field map.

Holliston Quadrangle

Map units were reproduced from Volckman (1975). Glacial Stratified Deposits in this quadrangle include deposits of glacial Lake Medfield, and other smaller valley deposits. Fine-grained glacial stratified deposits at land surface include lake-bottom deposits of glacial Lake Medfield (unit Qm2 of Volckman, 1975); this unit has been extended beneath adjacent water bodies and postglacial deposits on this map. Thick till areas shown on this map were inferred from photographic image and topographic analysis and drumlin symbols shown by Volckman (1975).

Medfield Quadrangle

Map units were reproduced from Volckman (1975). Glacial Stratified Deposits in this quadrangle include deposits of glacial Lake Medfield, and other smaller valley deposits. Thick till areas shown on this map were inferred from photographic image and topographic analysis and drumlin symbols shown by Volckman (1975).