Deep Hole Testing/Form 11 – A BOH Refresher

Bruce Bouck

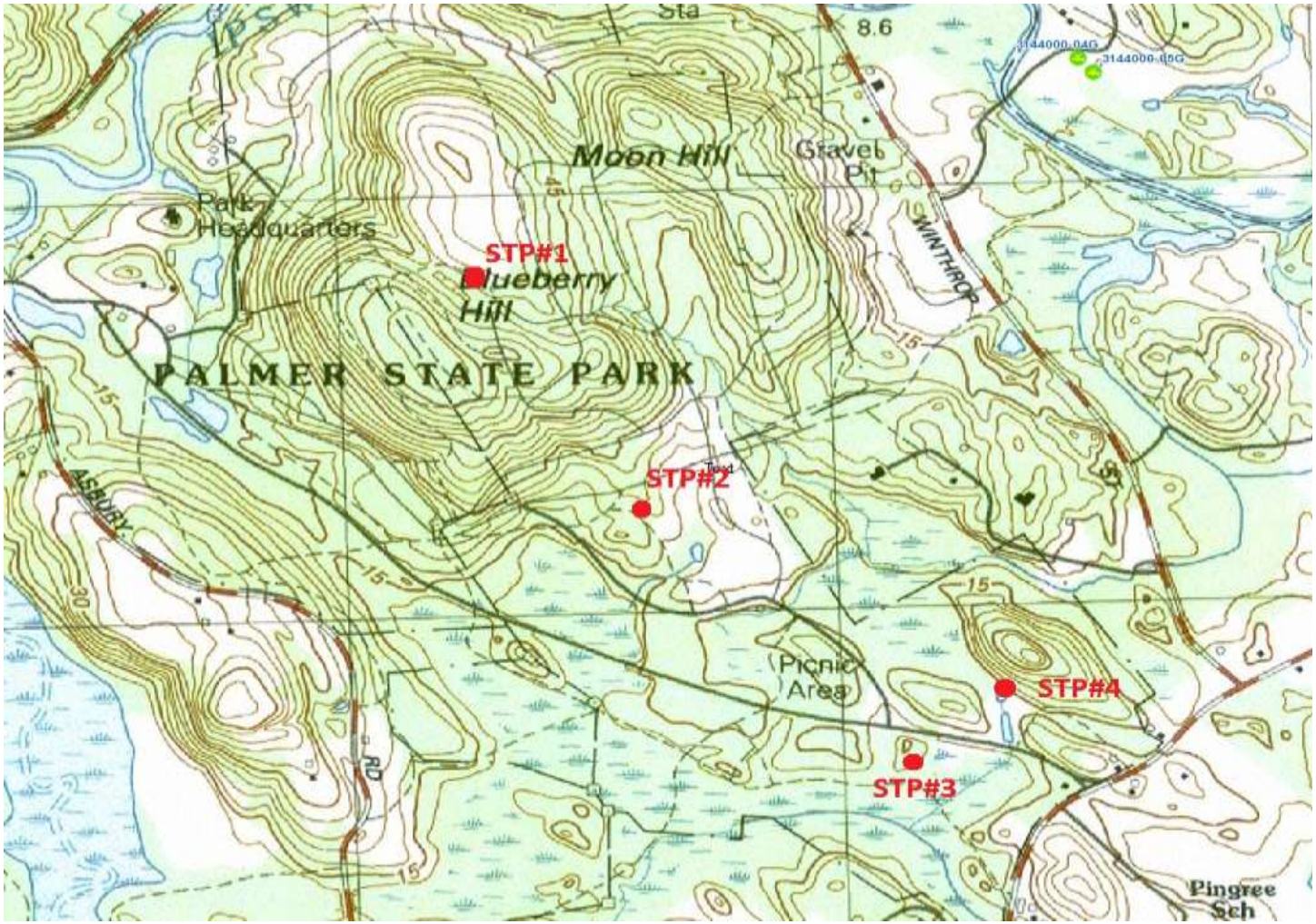
Sr. Hydrogeologist

MassDEP Drinking Water Program

Deep Hole Testing/Form 11 Topics To Be Covered

- Filling out Form 11 completely
- Deep Hole expectations
- Field tips for the reviewer/documentation
- Redox examples
- Perc testing hole location
- Form 11 soil log completeness
- Final site documentation

Filling out Form 11 Section B (Reference Information) – Topsfield Bradley Palmer Site



Form 11 – Section B. Site Information

Commonwealth of Massachusetts
City/Town of

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

A. Facility Information

Owner Name

Street Address | Map/Lot #

City | State | Zip Code

B. Site Information

1. (Check one) ☐ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☐ Yes ☐ No If yes: Source | Soil Map Unit

Soil Name | Soil Limitations

Soil Parent material | Landform

3. Surficial Geological Report Available? ☐ Yes ☐ No If yes: Year Published/Source | Map Unit

Description of Geologic Map Unit:

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

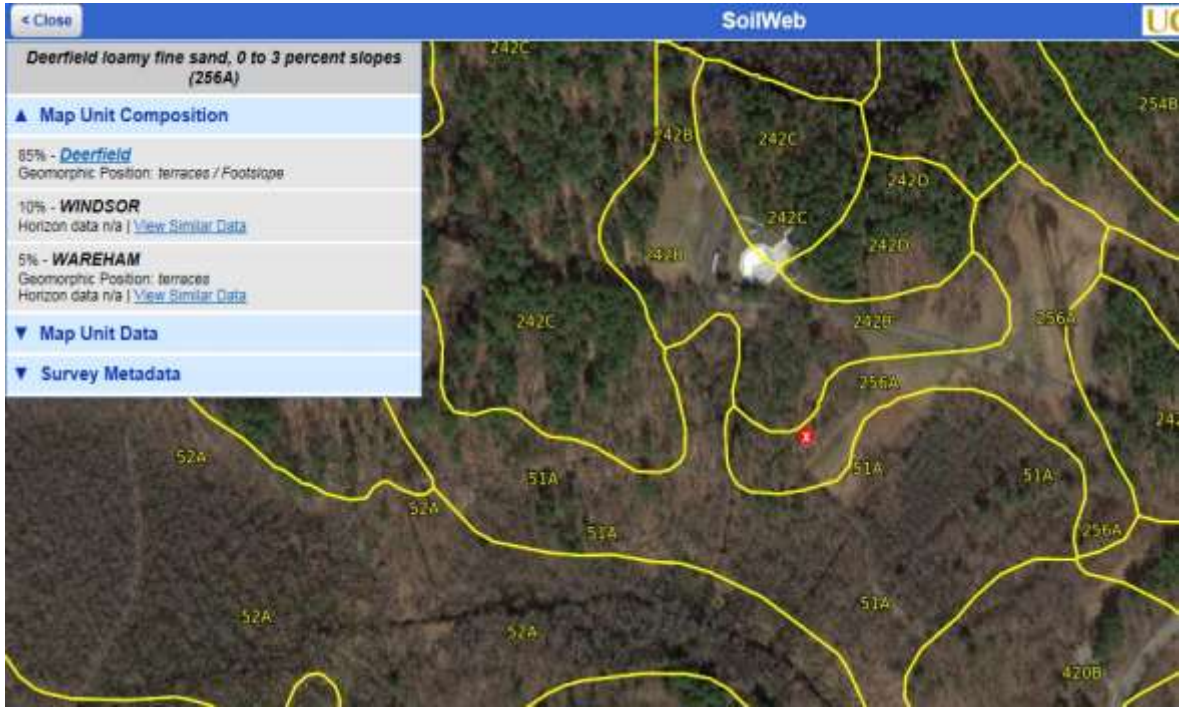
5. Within a velocity zone? ☐ Yes ☐ No

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

7. Current Water Resource Conditions (USGS): Month/Day/ Year Range: ☐ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed:

Question 2: Soil Survey (Cal-Davis SoilWeb)



Report — Map Unit Description

Essex County, Massachusetts, Southern Part

256A—Deerfield loamy fine sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vk4s
Elevation: 0 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Deerfield and similar soils: 85 percent
Minor components: 15 percent

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

Description of Deerfield

Setting

Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loose sandy glaciofluvial deposits derived from granite and gneiss

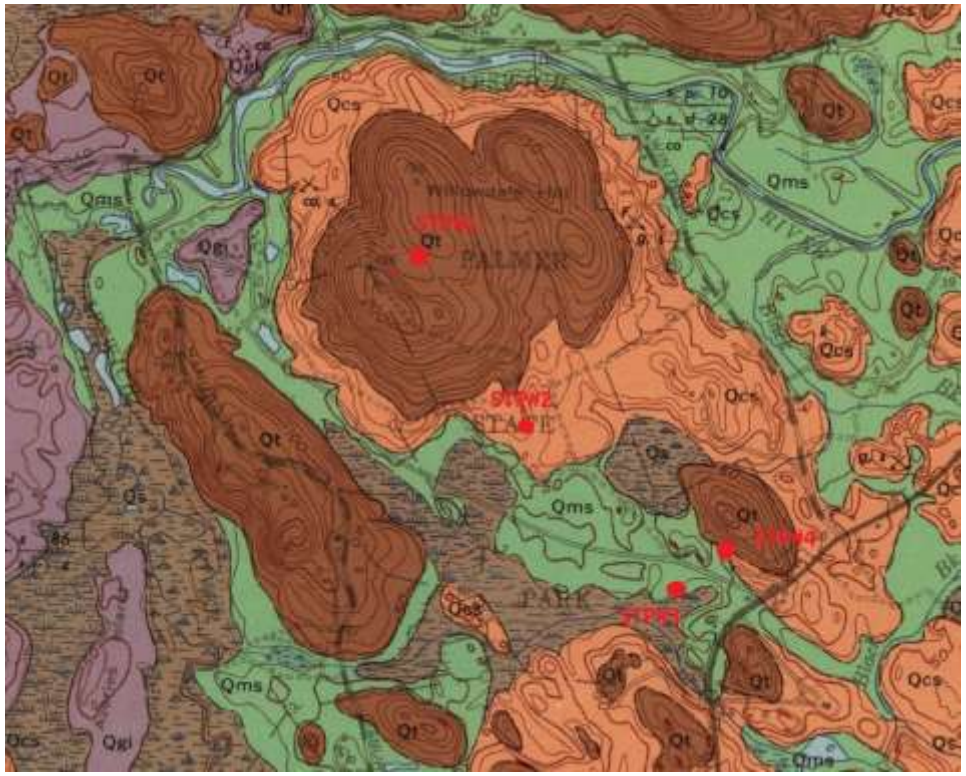
Typical profile

O - 0 to 2 inches: muck
H2 - 2 to 7 inches: loamy fine sand
H3 - 7 to 26 inches: loamy fine sand
H4 - 26 to 60 inches: fine sand

Properties and qualities

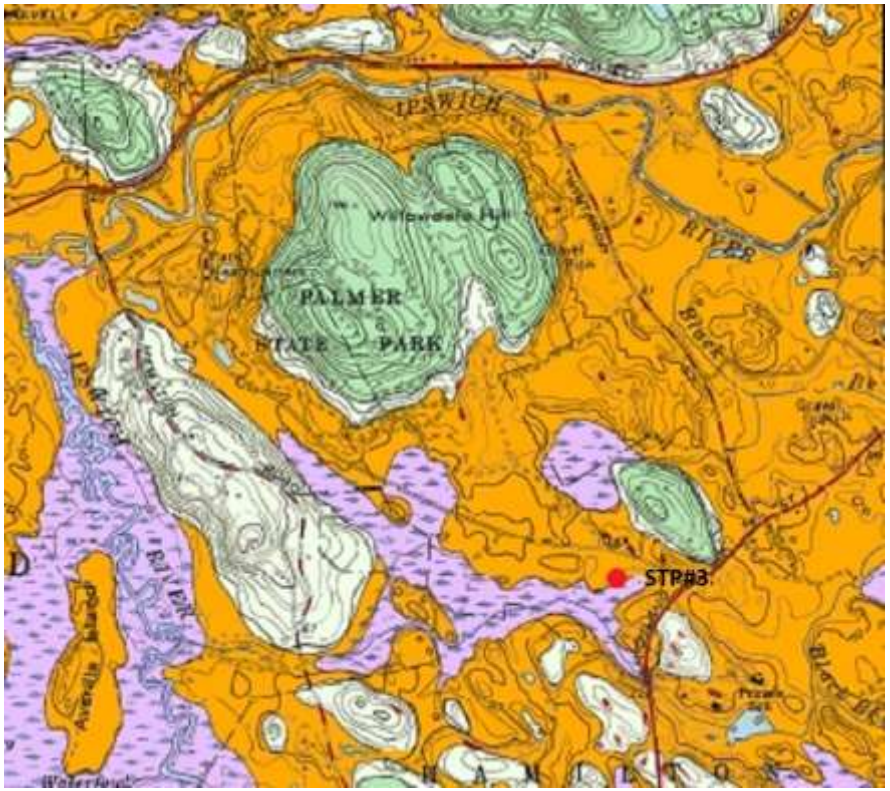
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.7 inches)

Question 3: Surficial Geologic Maps continued

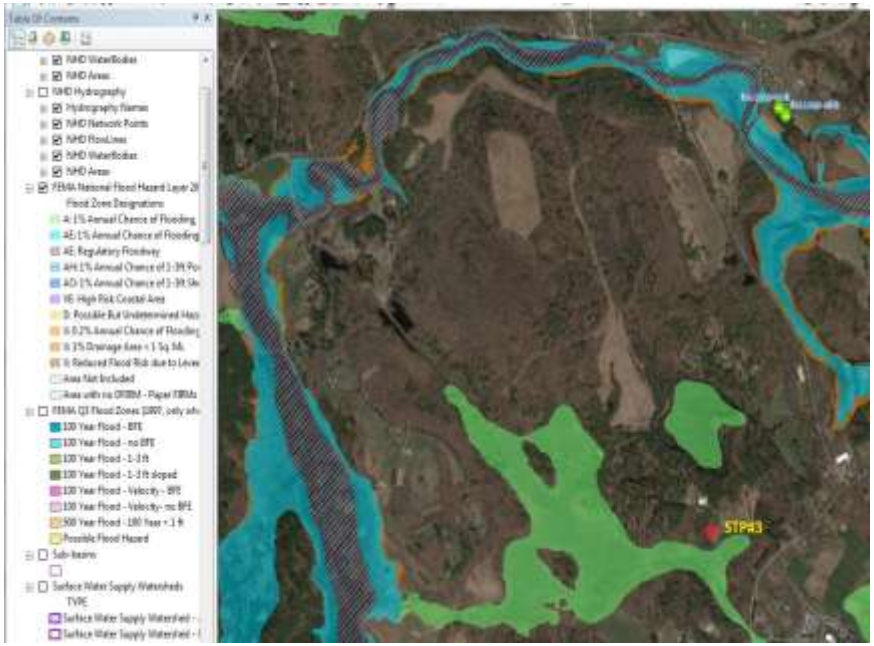


- Older maps with more detail

- newer generalized maps

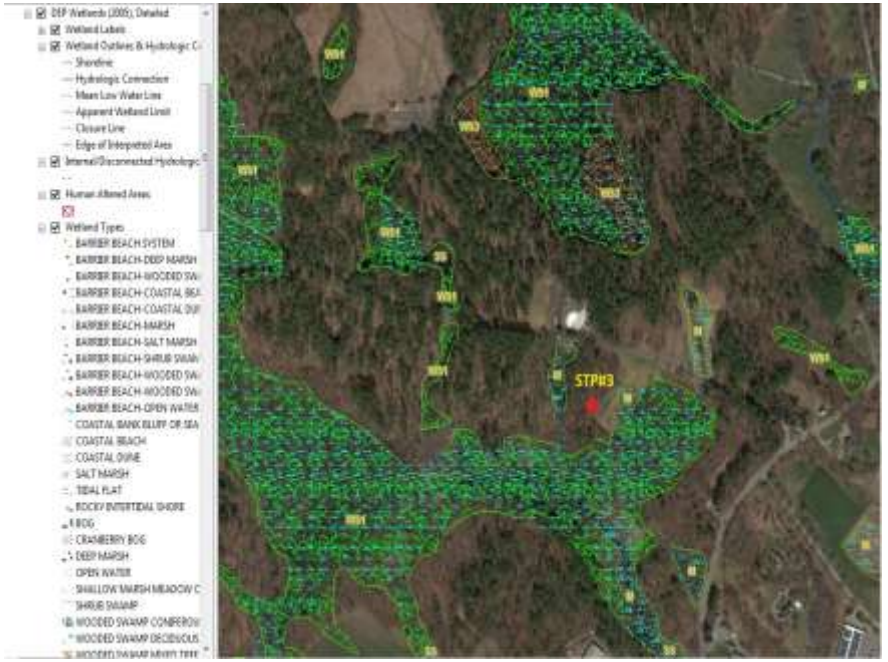


Question 4, 5 & 6 Flood rate Insurance Map/Velocity Zone/Wetland (MassGIS)

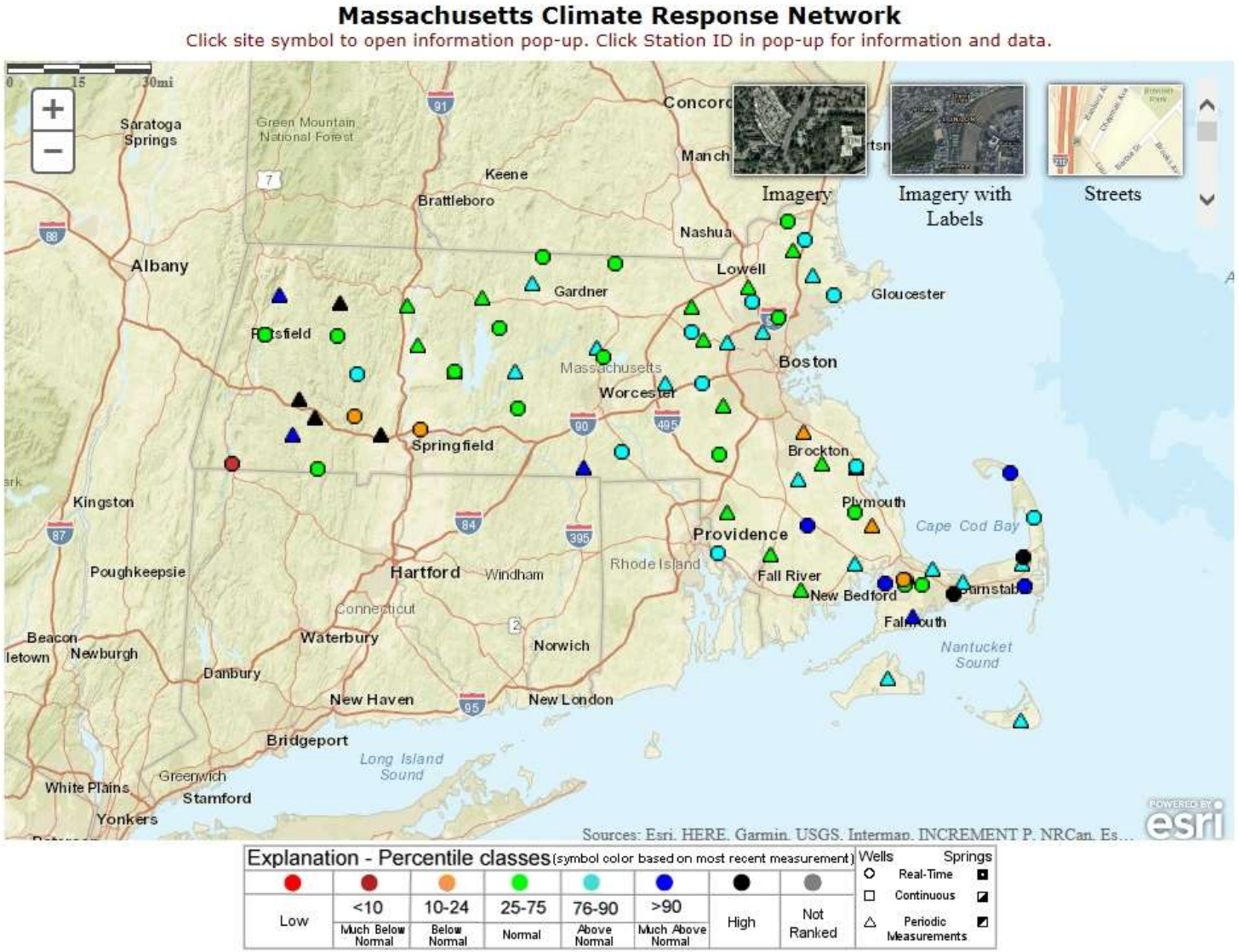


- Regulatory floodways and velocity zones

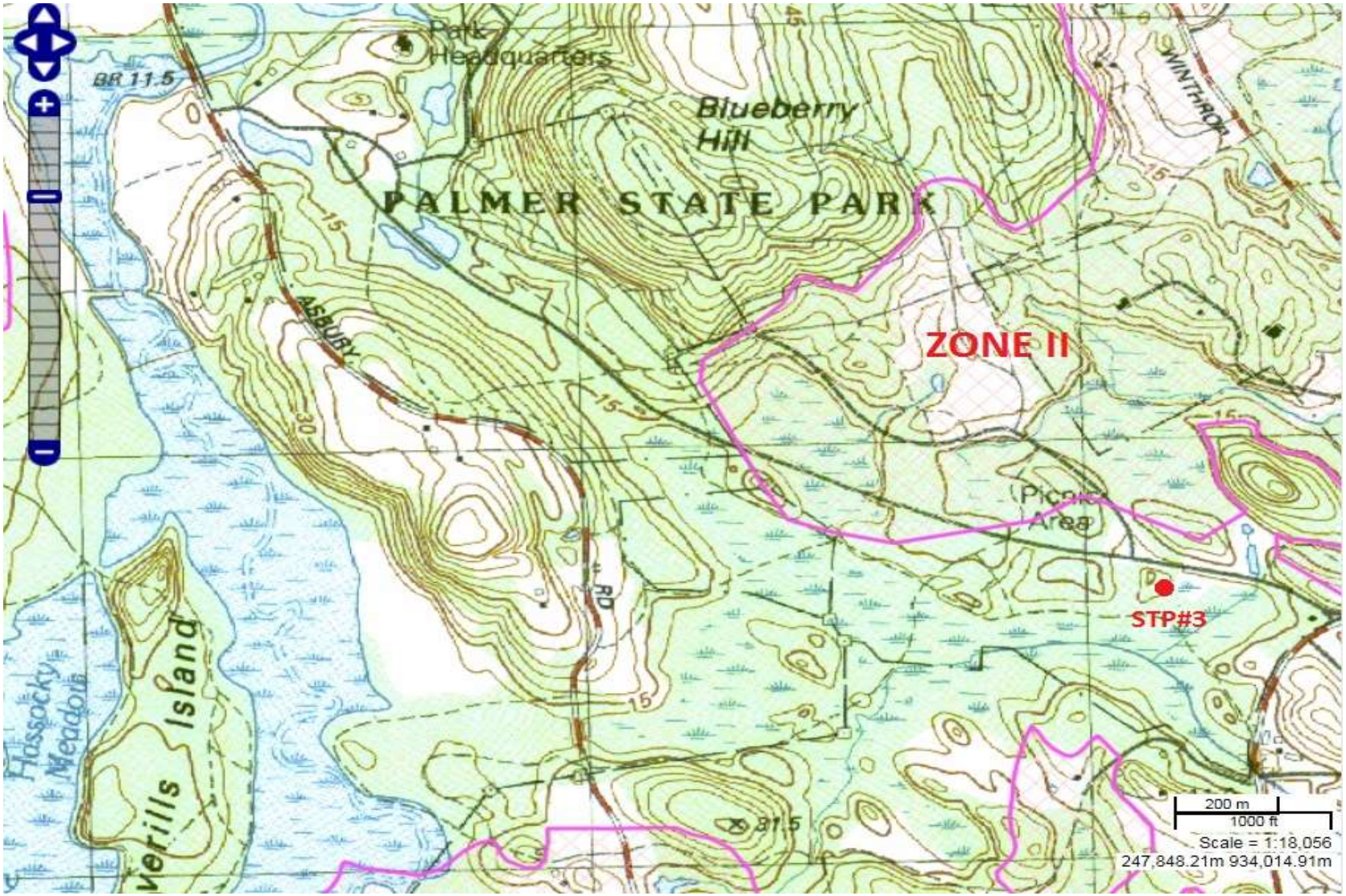
- Wetlands data



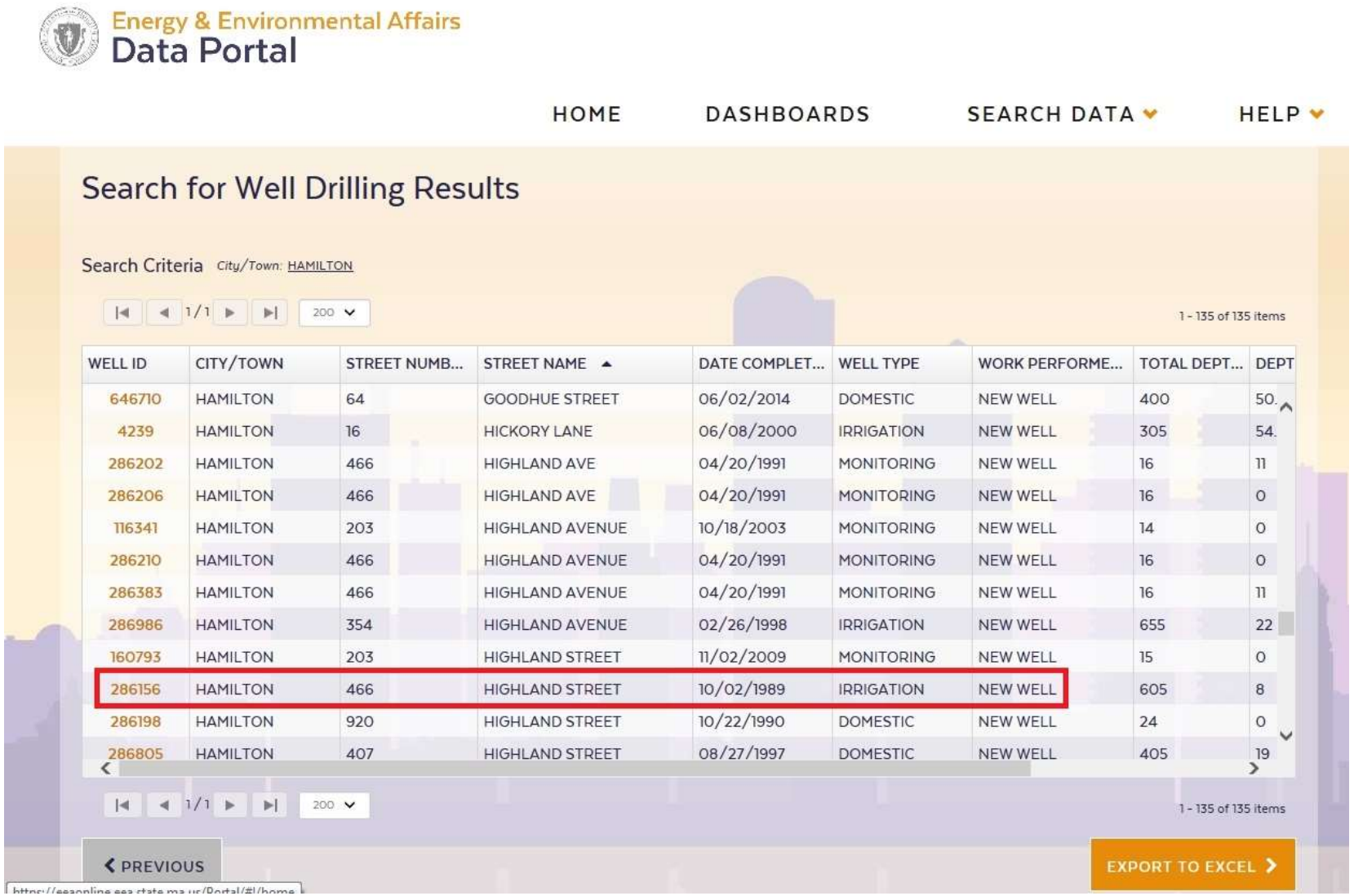
Question 7: Current Water resource Conditions Map (USGS site) 3/21/18



Question 8: Other references Reviewed (MassGIS Zone II)



Question 8: NEAREST WELL



Section B filled in completely

Commonwealth of Massachusetts
City/Town of

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

A. Facility Information

Owner Name

Street Address | Map/Lot #

City | State | Zip Code

B. Site Information

1. (Check one) ☑ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☑ Yes ☐ No If yes: - NRCS Soil Survey - Cal Davis Soilweb (Source) 256A / 242B (Soil Map Unit)

Deerfield loamy fine sand, 0-3% slopes / Hinckley gravelly fine sandy loam, 3-8% slopes (Soil Name)

possible high water table (Soil Limitations)

loose sandy glaciofluvial deposits derived from granite and gneiss / friable sandy and gravelly glaciofluvial deposits derived from granite and gneiss (Soil Parent Material)

terrace / floodplains (Landform)

3. Surficial Geological Report Available? ☑ Yes ☐ No If yes: 1969 Cuppels / 2006 Stone (Year Published/Source) Qms / Coarse deposits (Map Unit)

Marine and estuarine sand (Cuppels)
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: N/A (Wetland Type)

7. Current Water Resource Conditions (USGS): 3/21/18 (Month/Day/Year) Range: ☑ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed: GIS - not in Zone II / IWPA, but close
Searchwell - no wells nearby

Section C: On-Site Review

Commonwealth of Massachusetts
City/Town of

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: TH-1 (Hole #) | 5/22/18 (Date) | 8:30 am (Time) | overcast 72° (Weather) | 42.00595 (Latitude) | -71.20226 (Longitude:)

1. Land Use: agricultural field - Hay field (e.g., woodland, agricultural field, vacant lot, etc.) | grass (Vegetation) | none (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3% (Slope (%))

   Description of Location: farm field approximately 500 ft north of Union Street adjacent to airport shed

2. Soil Parent Material: glacial outwash | terrace (Landform) | SU (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body 1000 feet | Drainage Way N/A feet | Wetlands 700 feet
   Property Line 150 feet | Drinking Water Well 300 feet | Other N/A feet

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

5. Groundwater Observed: ☑ Yes ☐ No If yes: 42" Depth Weeping from Pit | 46" 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			

Proper Deep Hole Construction

- Title 5 regulation 310 CMR 15.000
- Subpart B – Siting of Systems
    - 15.100: General Provisions
    - 15.101: Site Evaluation Criteria
    - 15.102: Deep Observation Hole Test
    - 15.103: Soil Profile
    - 15.104: Percolation Testing
    - 15.105: Procedure for Performing a Percolation Test
    - 15.106: Landscape Position
    - 15.107: Hydrogeologic Properties

Specifics

- Deep hole down to at least 4 feet below the proposed SAS bottom elevation
- Minimum depth of 10 feet
- Adjoining shelf down to 5 feet to allow detailed soil evaluation
- Minimum 2 holes per SAS area (2 in primary and 2 in reserve)

Make sure pit is wide enough and shelf is close to deep portion of pit

No shelf/ramp entire whole – not acceptable

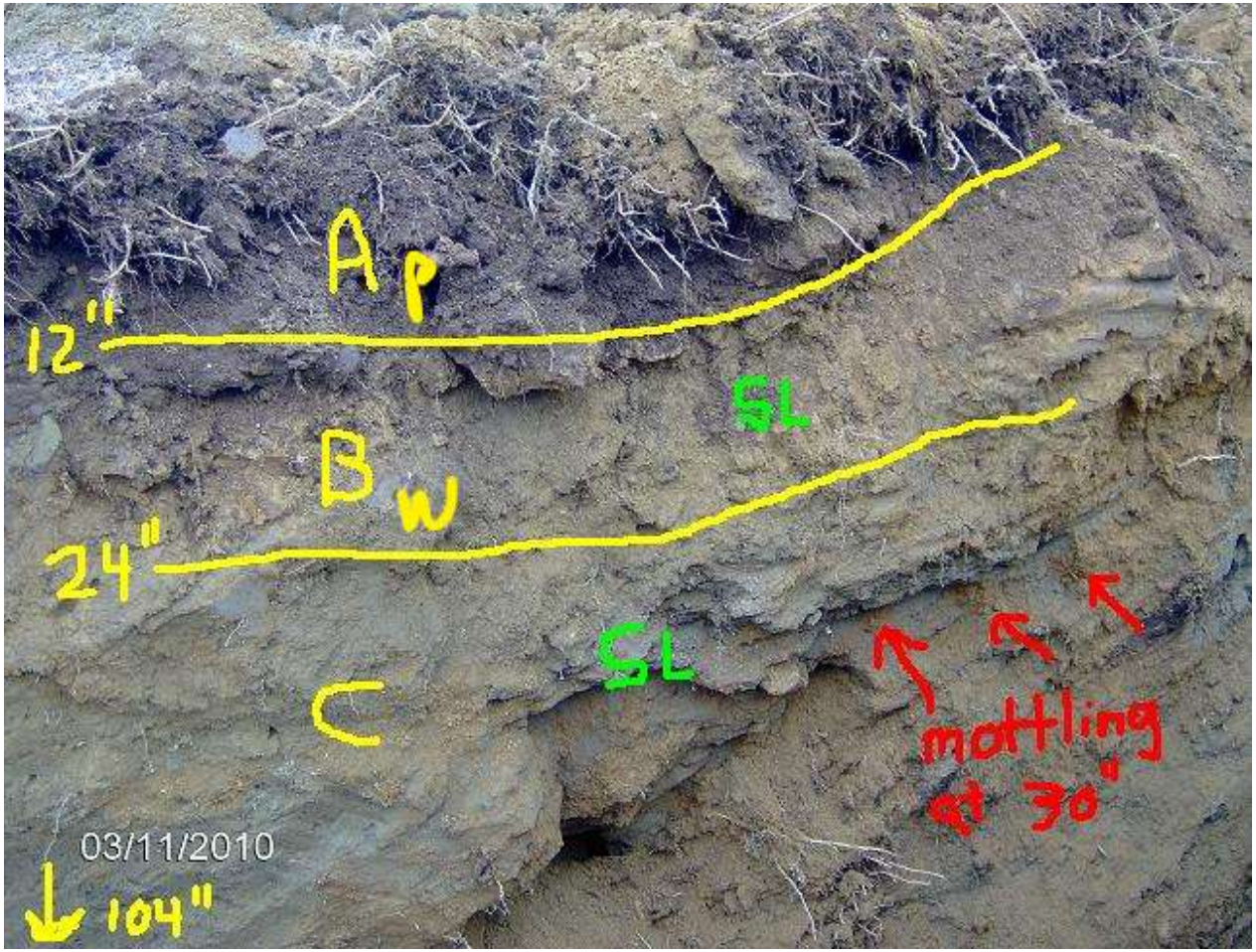
Using spoils pile to populate soil log – not acceptable

Get in the hole!!!!

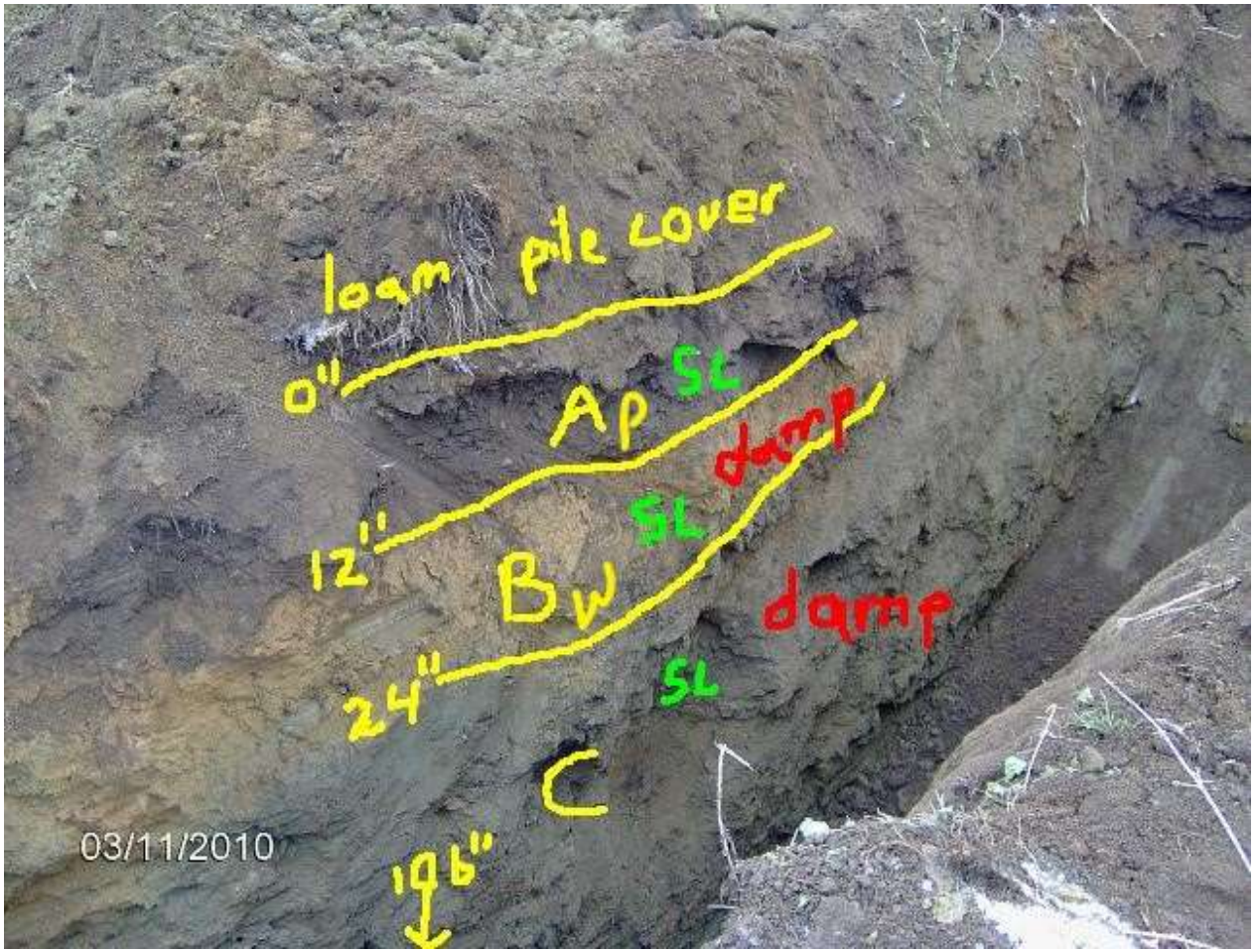
Get dirty!!!!

Be careful of potential cave-ins

Tip – take picture and draw general log on it



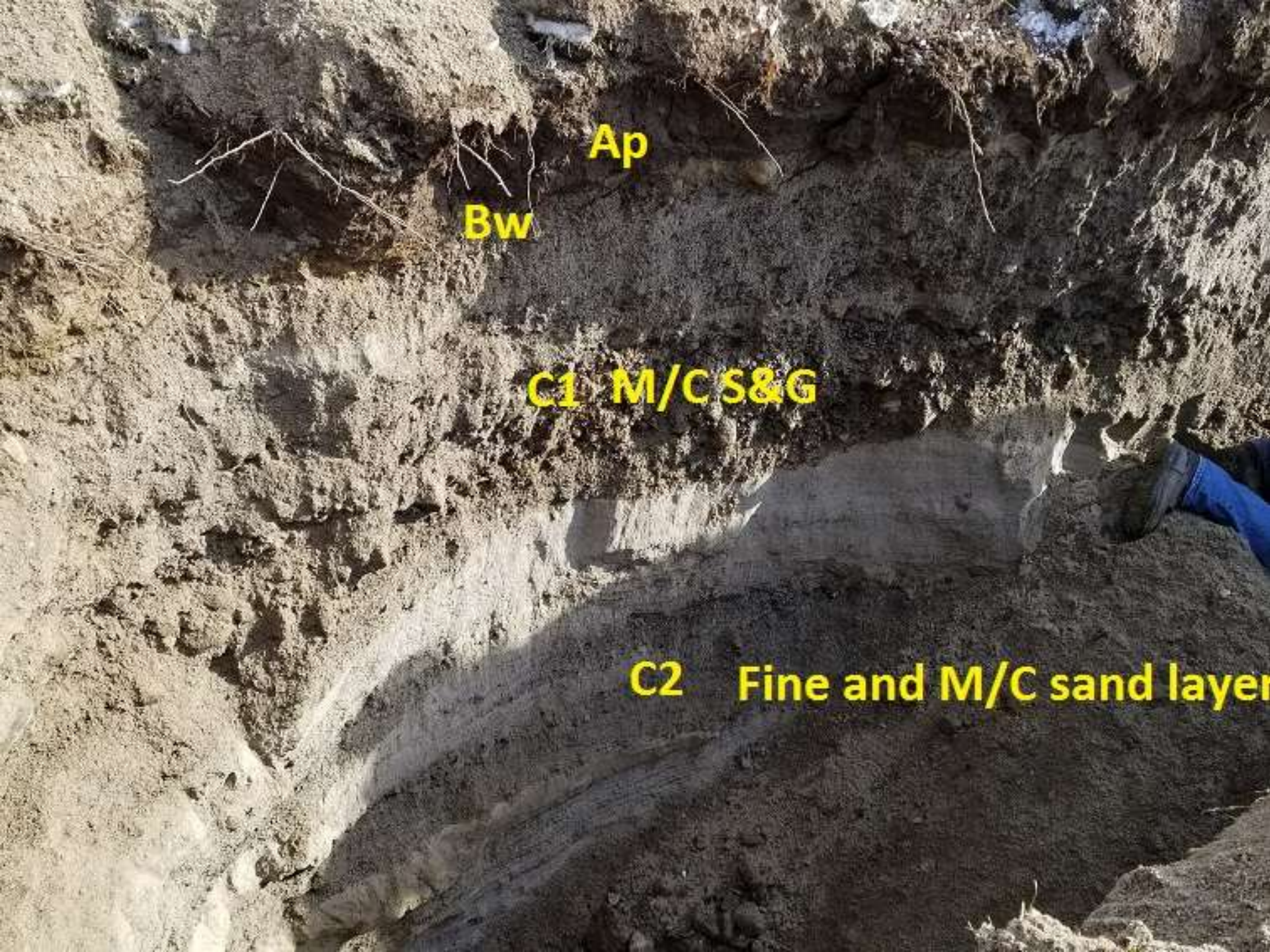
Do this while standing around waiting for the perc test to finish



Before

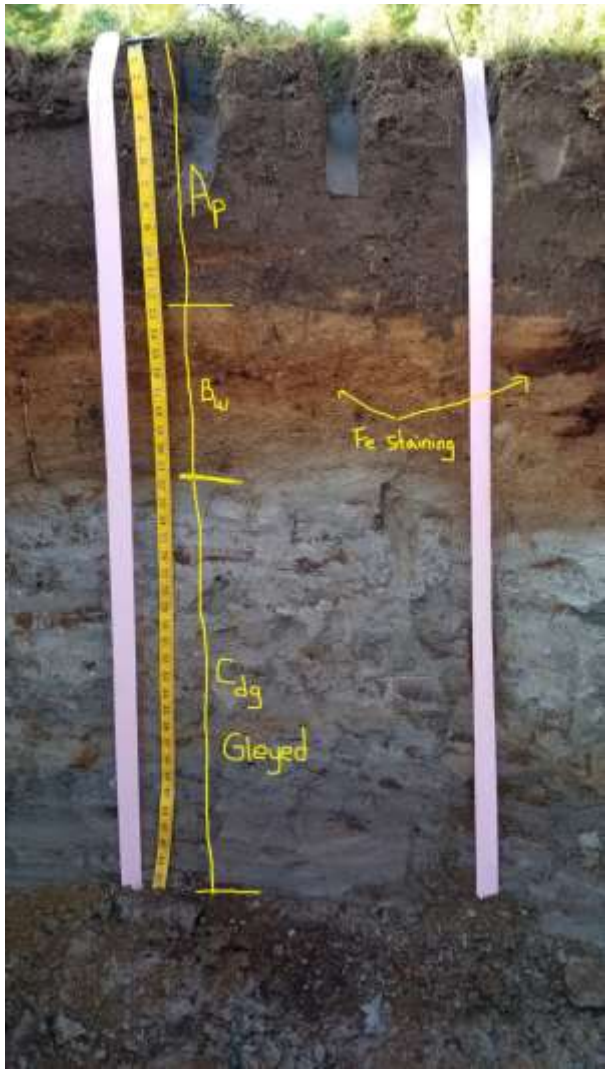
After

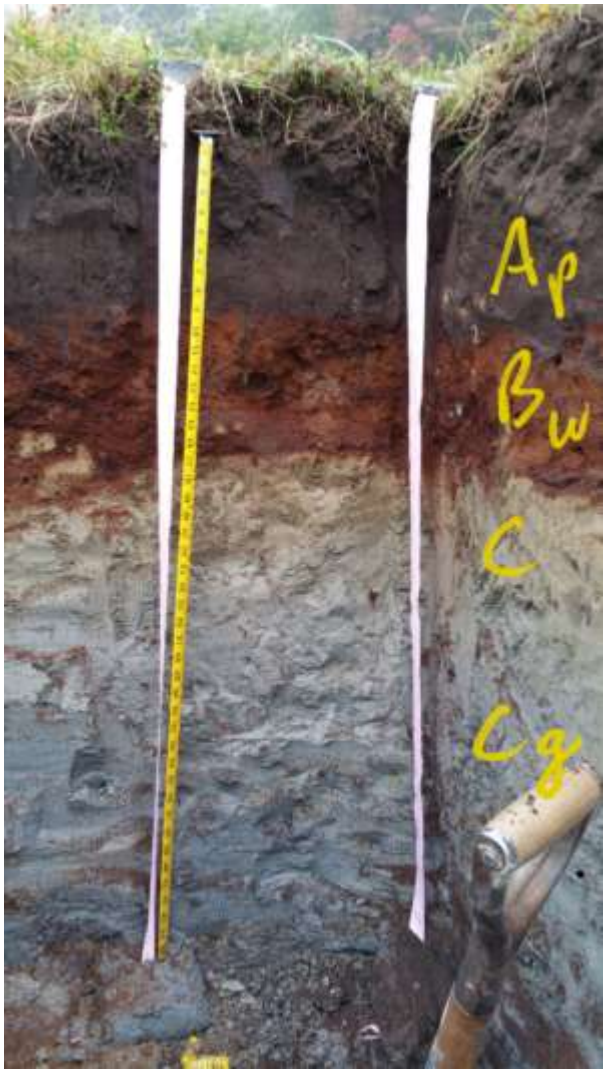
Take photo and complete once you are back in the office – include perc test results

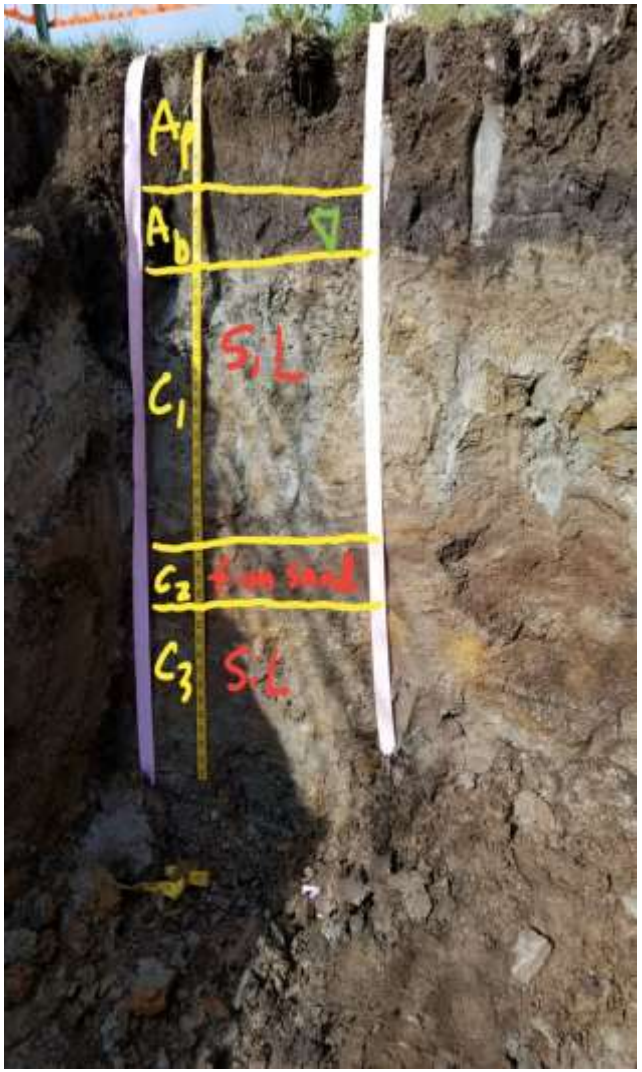

Ap
Bw
C1 M/C S&G
C2 Fine and M/C sand layer

….more examples

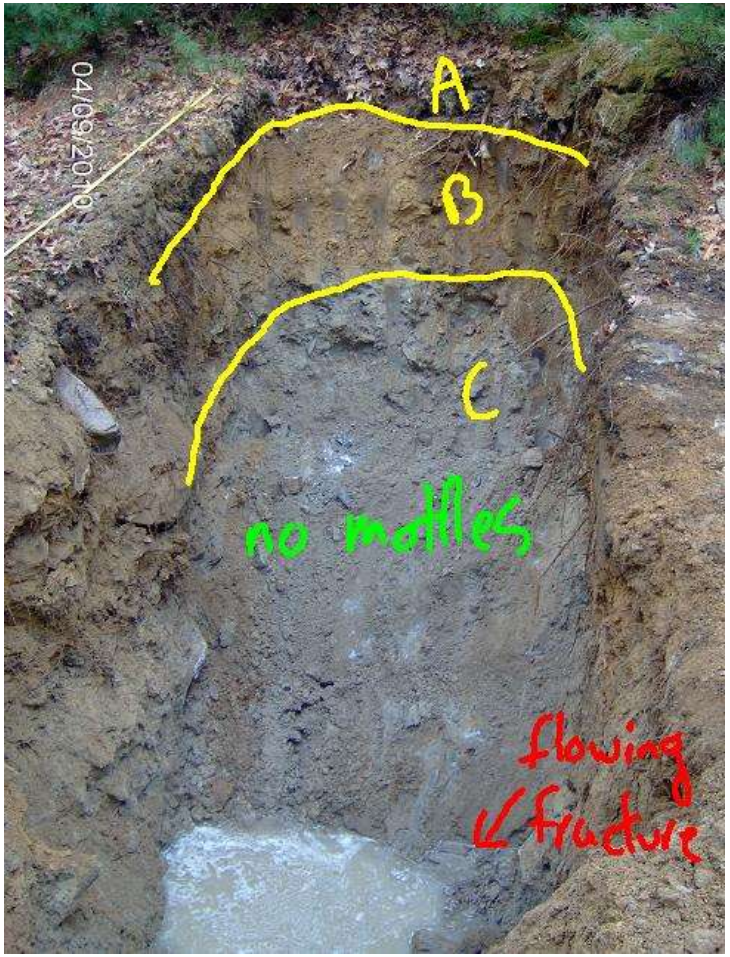
Sometimes it's only a matter of feet







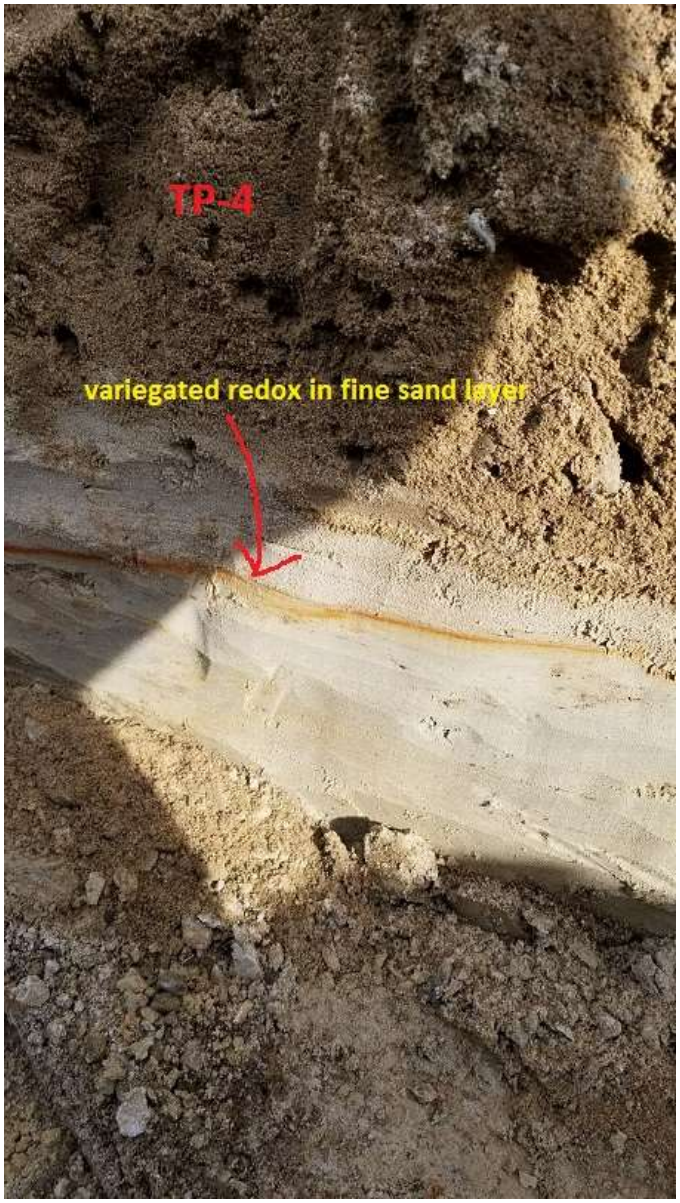
Bedrock just might be an issue here!!!!



Should you be a detailed logger or a “lumper”?

Redox

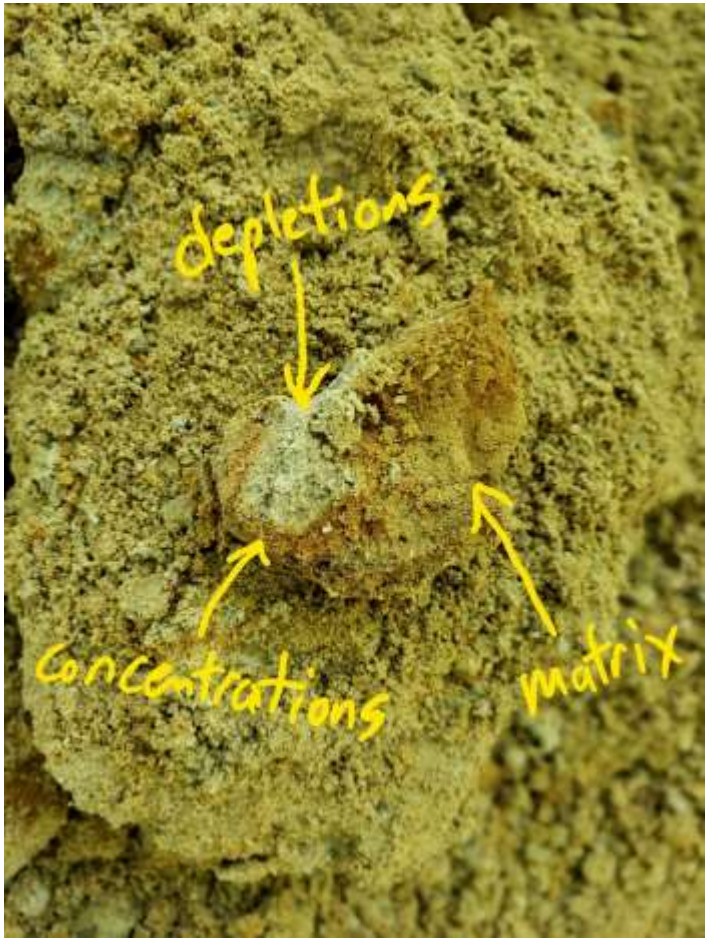
Variegated redox



Redox

Sometimes you only see 2 colors

Typical redox with matrix, concentrations, and depletions



Perc testing

Perc test in most limiting layer

Provide perc wall stability when needed

Do you think this will pass????

…..or how about this????

Picking the right material to perc

Make sure your perc hole is not too close to the deep part of the hole

Loading Test

Test pit soil log example

Field log

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

5. Groundwater Observed: ☐ Yes ☐ No If yes: _____ Depth Weeping from Pit _____ 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	SL	10YR 4/3						Granular	friable	
10-24	B	LS	10YR 5/8						Massive	friable	
24-112	C	Sand	2.5YR 5/2	42"					Massive	friable	

Additional Notes:

Corrected field log

3. Distances from: Open Water Body _____ feet; Drainage Way _____ feet; Wetlands _____ feet
Property Line _____ feet; Drinking Water Well _____ 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: _____ Depth Weeping from Pit _____ 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_p	SL	10YR 4/3	—	—	—	—	—	Granular	friable	
10-24	B_w	LS	10YR 5/8	—	—	—	—	—	Massive	friable	
24-44 ~~24-112~~	C_1	S and G ~~Sand~~	2.5YR 5/2	42"	5Y 7/2 (D) 7.5YR 5/6 (O)	10%	15%	—	single grain ~~Massive~~	loose ~~friable~~	
44-112	C_2	Sand	2.5YR 5/2	↓	↓	↓ **	—	—	Single grain	loose	

Additional Notes:
** redox becomes significantly more abundant around 80"

Example log

Commonwealth of Massachusetts
City/Town of Sturbridge
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: OSE-3

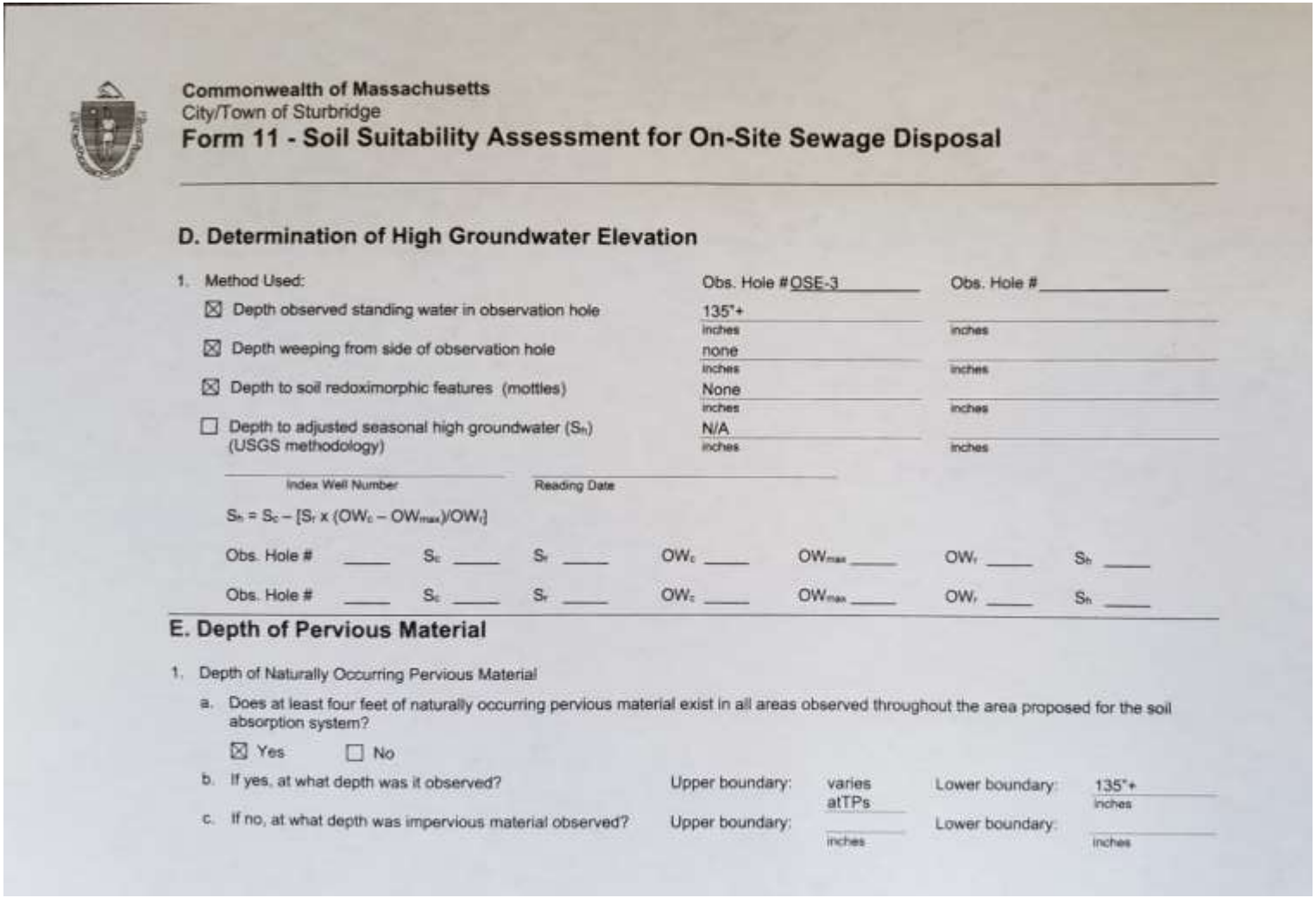
Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	Ap	10 YR 4/3	None	None	None	Sandy Loam			Granular	Friable	
8-14	Bw	10 YR 5/8	None	None	None	Loamy Sand			Massive	Friable	
14-56	C1	7.5 YR 6/8	None	None	None	Coarse Sand and Gravel			Single Grained	Loose	
56-78	C2*	10 YR 6/6	None	None	None	M-Sand			Massive	Friable	
78-135	C3	2.5 YR 5/6	None	None	None	Fine Sandy Loam			Massive	Friable	

Additional Notes:

No refusal encountered, no mottles, no water. Large boulder at 135" depth.

*2" layer of fine loamy sand, same as C4 layer from OSE #1

Parts D and E relative to the entire site for the SAS



Commonwealth of Massachusetts
City/Town of Sturbridge
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # OSE-3	Obs. Hole # _____
☒ Depth observed standing water in observation hole	135"+ inches	inches
☒ Depth weeping from side of observation hole	none inches	inches
☒ Depth to soil redoximorphic features (mottles)	None inches	inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	N/A inches	inches

Index Well Number _____ Reading Date _____

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

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

Obs. Hole # _____ 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? Upper boundary: varies atTPs Lower boundary: 135"+ inches

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

Signature and license # of Certified Soil Evaluator

Commonwealth of Massachusetts
City/Town of Sturbridge
Form 11 - Soil Suitability Assessment for On

F. Board of Health Witness

David Boyer, Bruce Bouck, Deanna Clark — Mar
Name of Board of Health Witness — Boar

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental evaluations and that the above analysis has been performed by me cons described in 310 CMR 15.017. I further certify that the results of my soil accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator — 5/1(Date

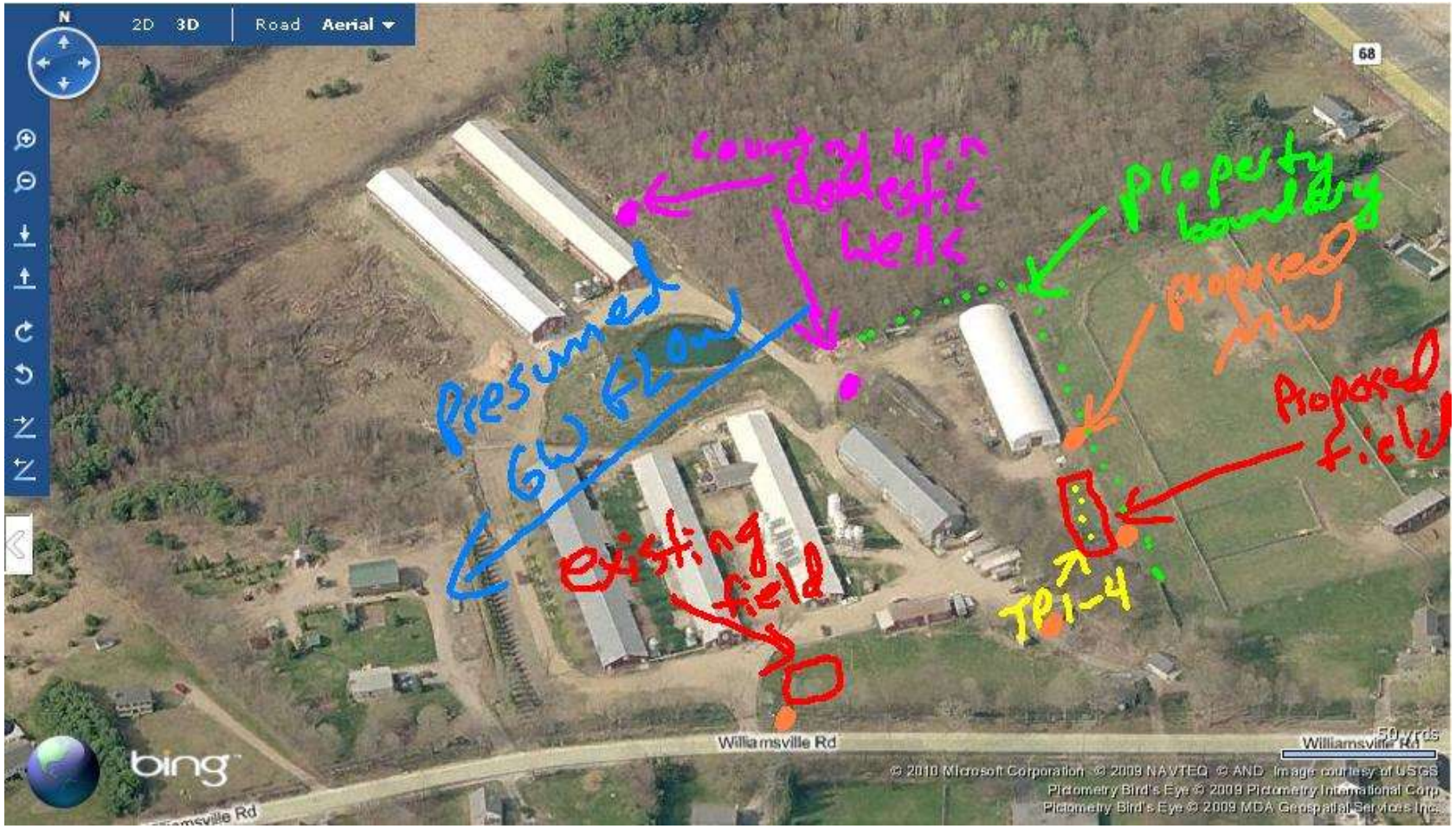
#14111 — 4/4/
Typed or Printed Name of Soil Evaluator / License # — Expi

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the designer and the property owner with Percolation Test Form 12.

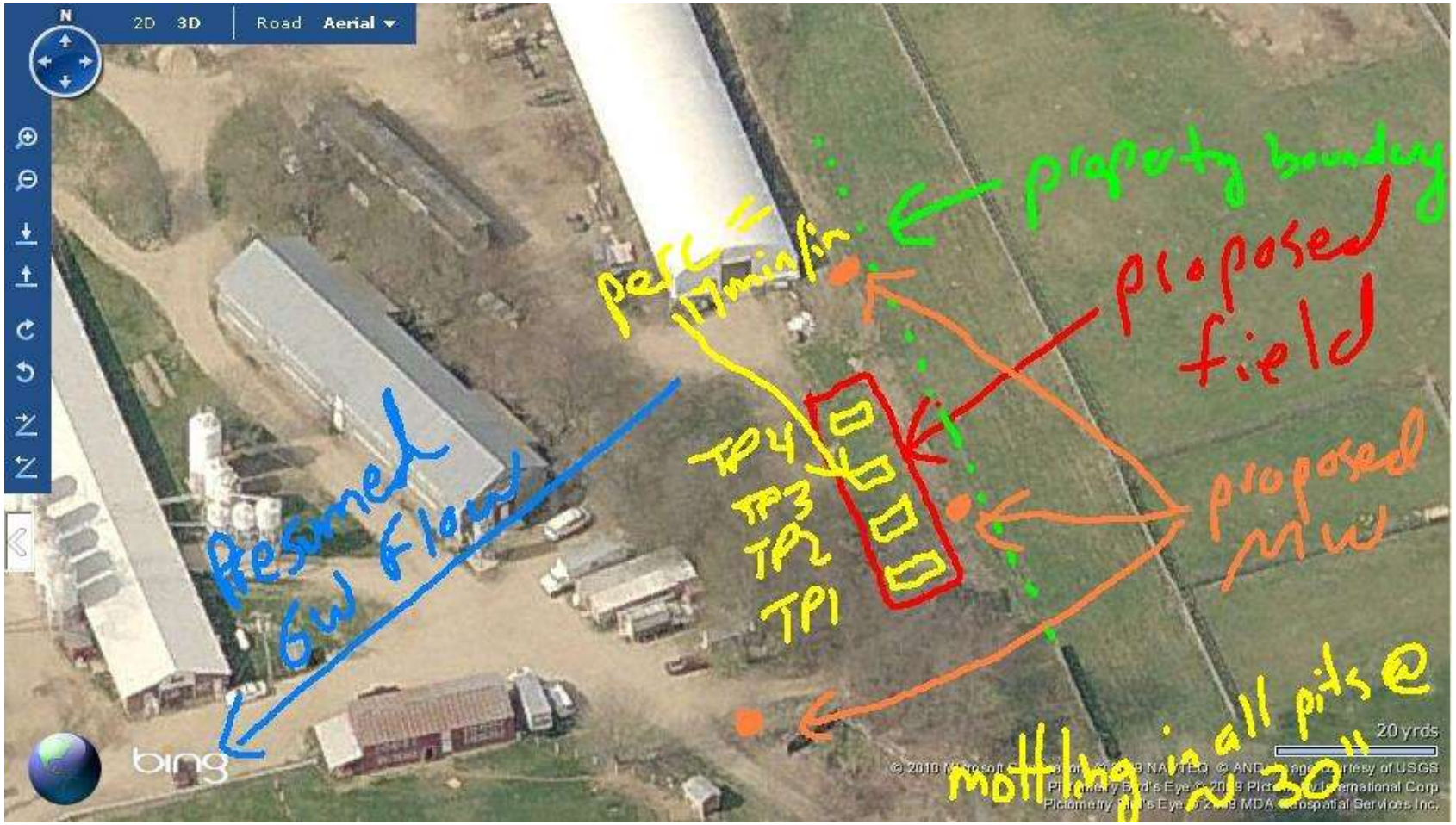
Know your surroundings and create a record – topo map is key potential impacts

Orthophotos help with specific detail of land use

Pictometry zooms in to the site for refined detail – provide as much additional detail for your records

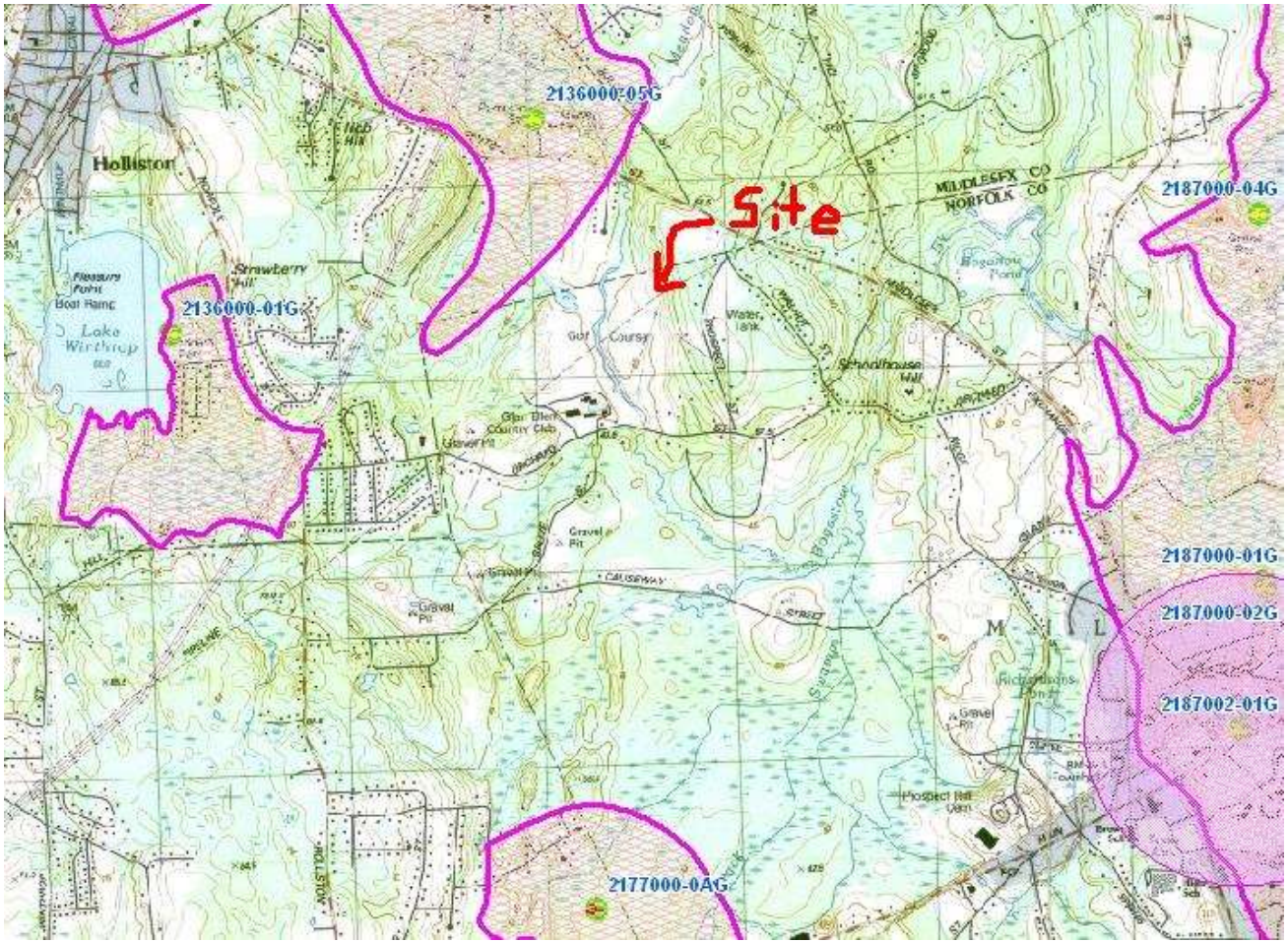


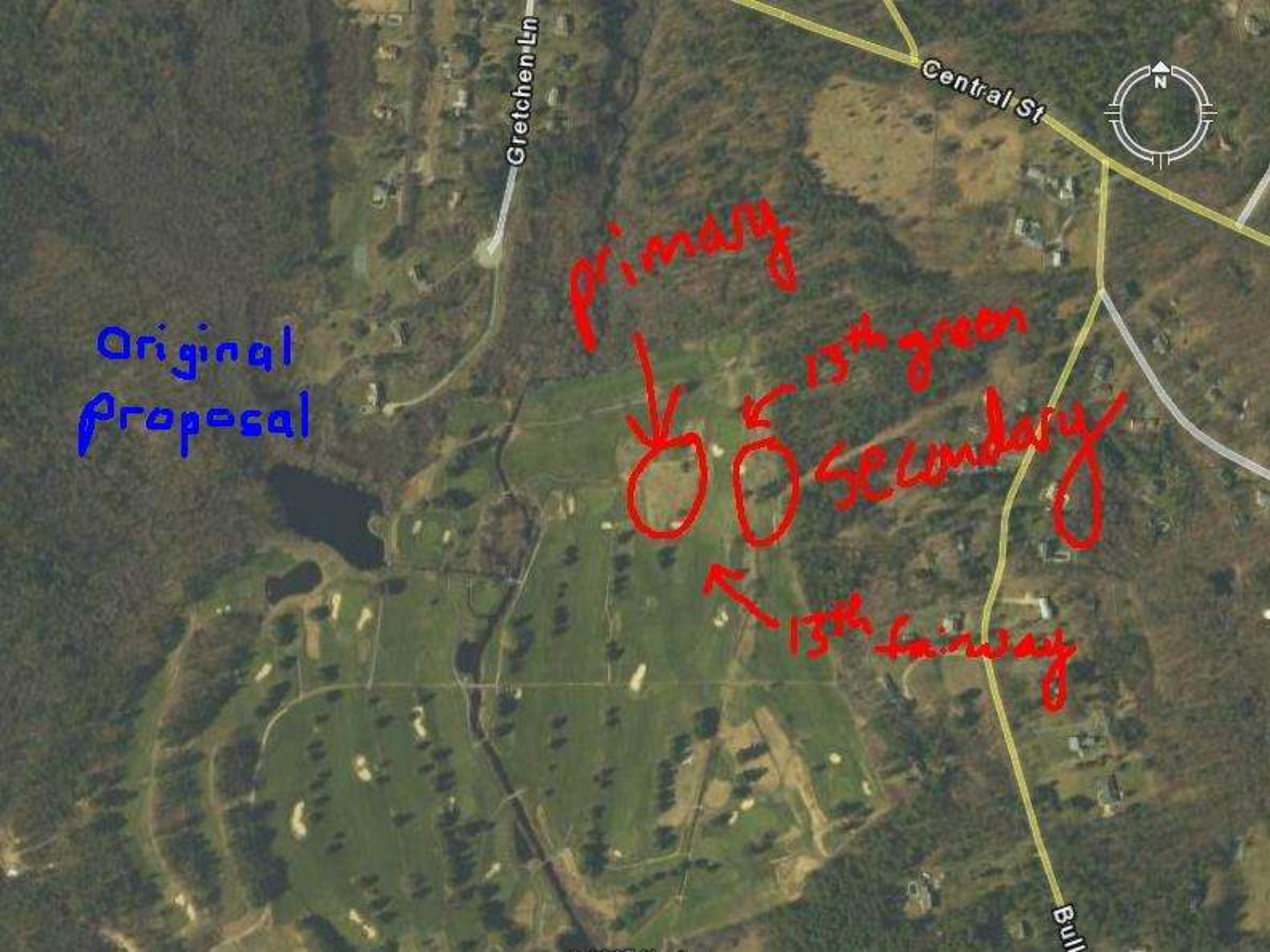
Refine further



Photograph test pit locations

Example picture documentation




Gretchen Ln
Central St
N
Original Proposal
Primary
13th green
Secondary
13th fairway


TP-106
#13
N
Proposed
field
TP-101
TP
201
TP-204
Standpipe
TP-102
TP-
105
TP-104
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202
TP-103
TP-203
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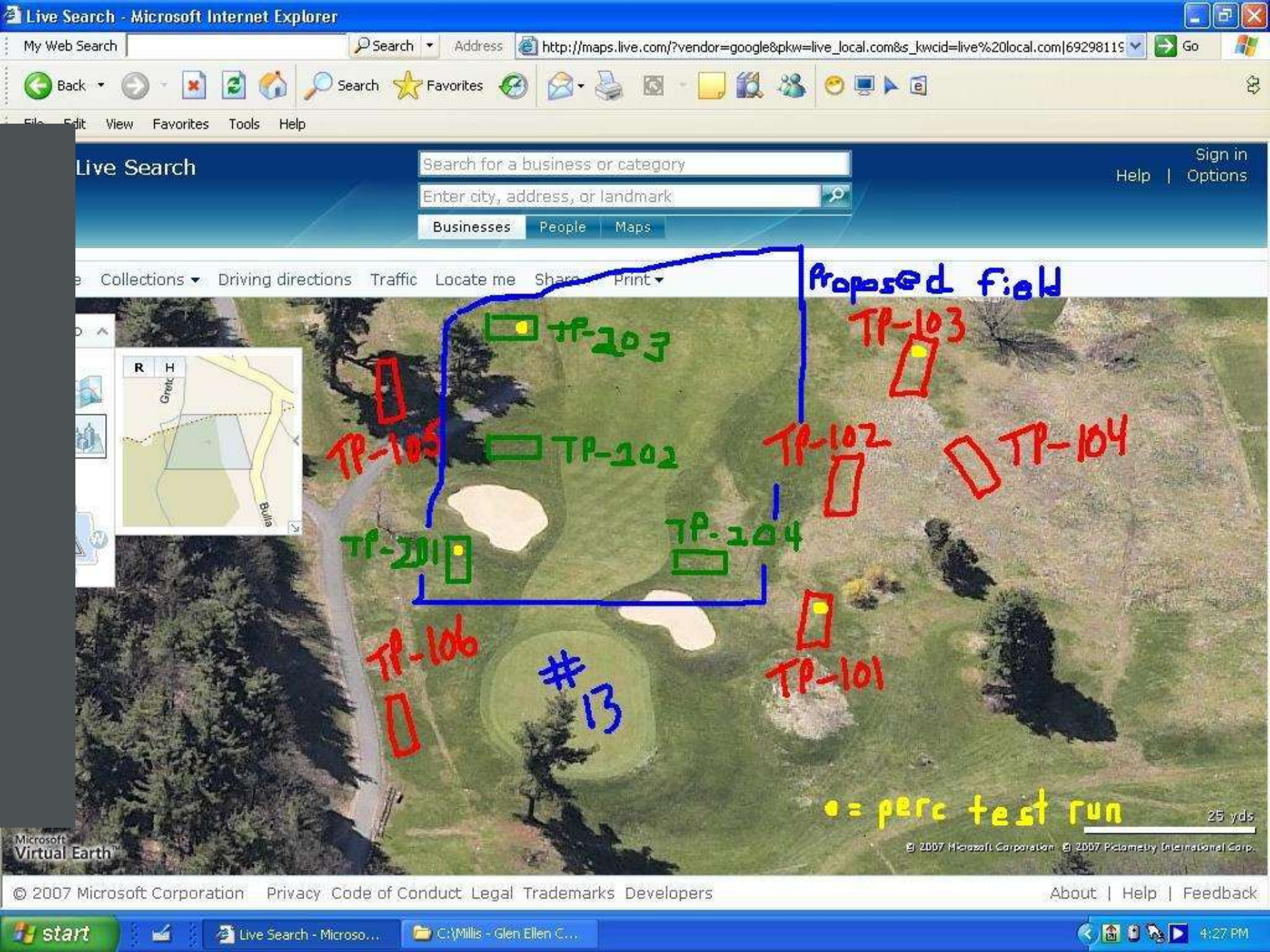
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Live Search
Search for a business or category
Enter city, address, or landmark
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People
Maps
Sign in
Help | Options
Collections
Driving directions
Traffic
Locate me
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Print
Proposed field
TP-103
TP-203
TP-105
TP-202
TP-102
TP-104
TP-201
TP-204
TP-106
#13
TP-101
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25 yds
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start
Live Search - Microso...
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CAT
311
103
202
201
08 29 20

Summary

- Make sure Form 11 is filled out completely
- Be there when digging commences
- Make sure holes are deep enough and shelved appropriately
- Get in the hole
- Safety first
- Know your redox
- Proper perc testing
- Take pictures and document what you witnessed
- Create a record of the site

Bruce Bouck

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617-335-6839

QUESTIONS????