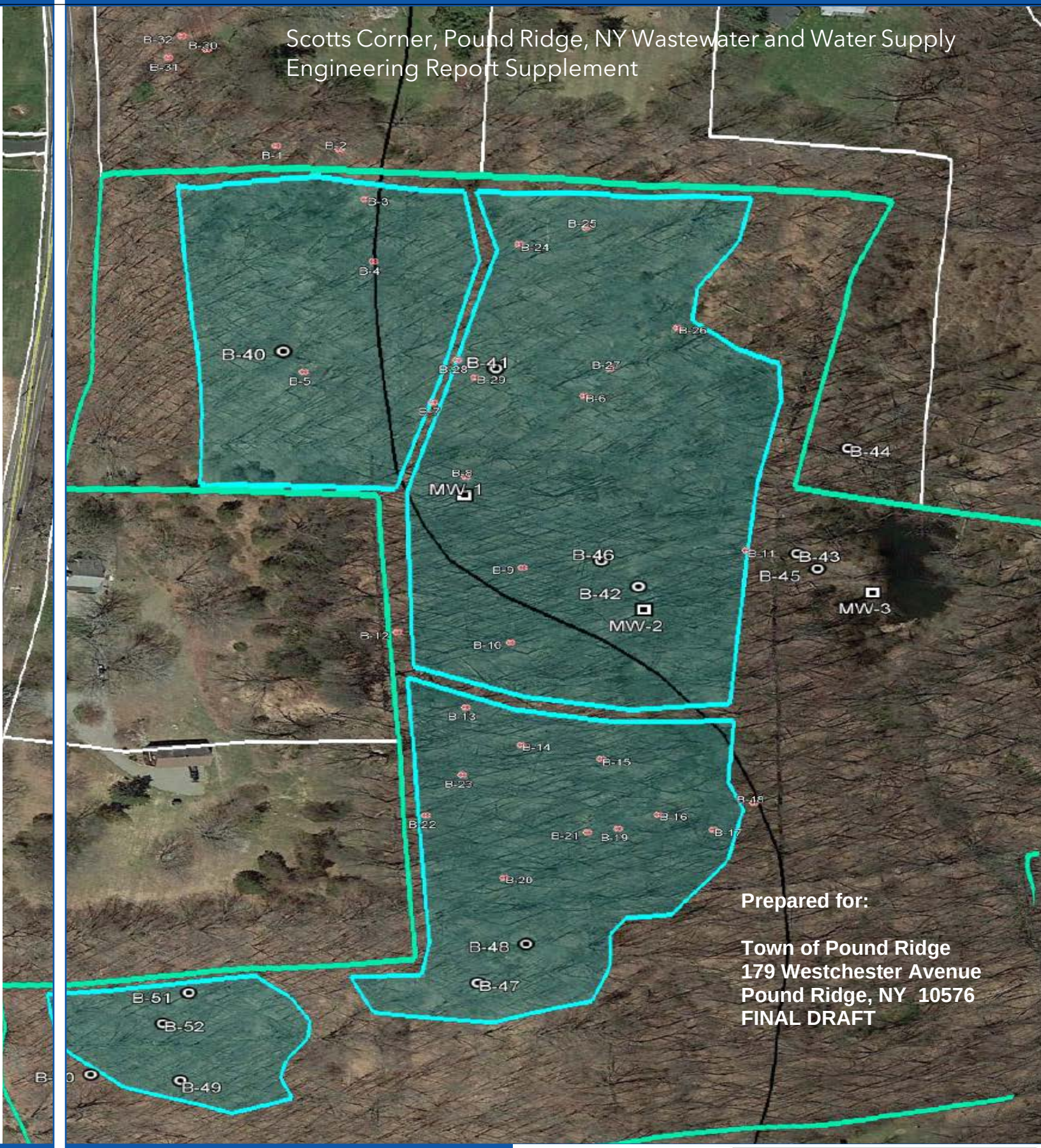
a. Old Pound Parcels – Evaluation for Effluent Disposal

Old Pound Road Parcels - Evaluation for Effluent Disposal



November 16, 2020

Environmental Engineers/Consultants

LOMBARDO ASSOCIATES, INC.

188 Church Street, Newton, Massachusetts 02458

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ENGINEERING REPORT CERTIFICATION

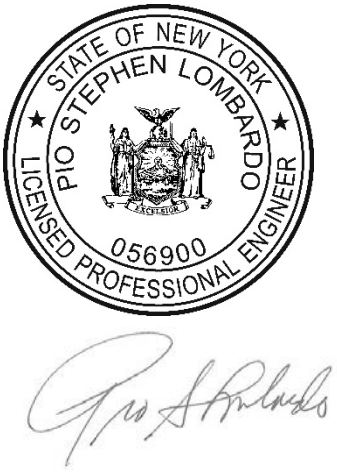
During the preparation of this Engineering Report Supplement, I have studied and evaluated the cost and effectiveness of the processes, materials, techniques, and technologies for carrying out the proposed project or activity for which assistance is being sought from the New York State Clean Water State Revolving Fund. In my professional opinion, I have recommended for selection, to the maximum extent practicable, a project or activity that maximizes the potential for efficient water use, reuse, recapture, and conservation, and energy conservation, taking into account the cost of constructing the project or activity, the cost of operating and maintaining the project or activity over the life of the project or activity, and the cost of replacing the project and activity.

This Engineering Report Supplement has been prepared in accordance with the NYSDEC New York State Design Standards for Intermediate Sized Wastewater Treatment Systems dated March 5, 2014 https://www.dec.ny.gov/docs/water_pdf/2014designstd.pdf

Title of Engineering Report:	**Scotts Corner, Pound Ridge, NY Wastewater and Water Supply Engineering Report Supplement**
Date of Report Supplement:	**November 16, 2020**
Professional Engineer's Name:	**Pio S. Lombardo, P.E., NYS PE # 056900**

Signature:

Date: November 16, 2020



1 INTRODUCTION

This Report provides draft interim findings associated with the following activities that were authorized by the October 6, 2020 Agreement between the Town of Pound Ridge and Lombardo Associates, Inc. (LAI).

1. 2 - 3 days of borings at Old Pound Road site using a direct push machine and manually approximate location.
2. Create 3-D representation of subsurface depth to rock, groundwater and soil types.
3. Collect a minimum of ten (10) soil samples and have sieve analysis performed to estimate hydraulic conductivity.
4. Estimate disposal capacity with consideration of setbacks from property lines and water bodies/wetlands.
5. Brief Report on findings

During summer 2020, the Town purchased parcels 9820-16, 9820-19 and 9820-26 with sizes of 18.86 acres, 2.23 acres and 0.25 acres, respectively. Figure 1-1 illustrates the parcels locations.

Figure 1-1 Parcel Locations

Figure 1-2 presents a location map for Scotts Corner and Old Pound Road site.

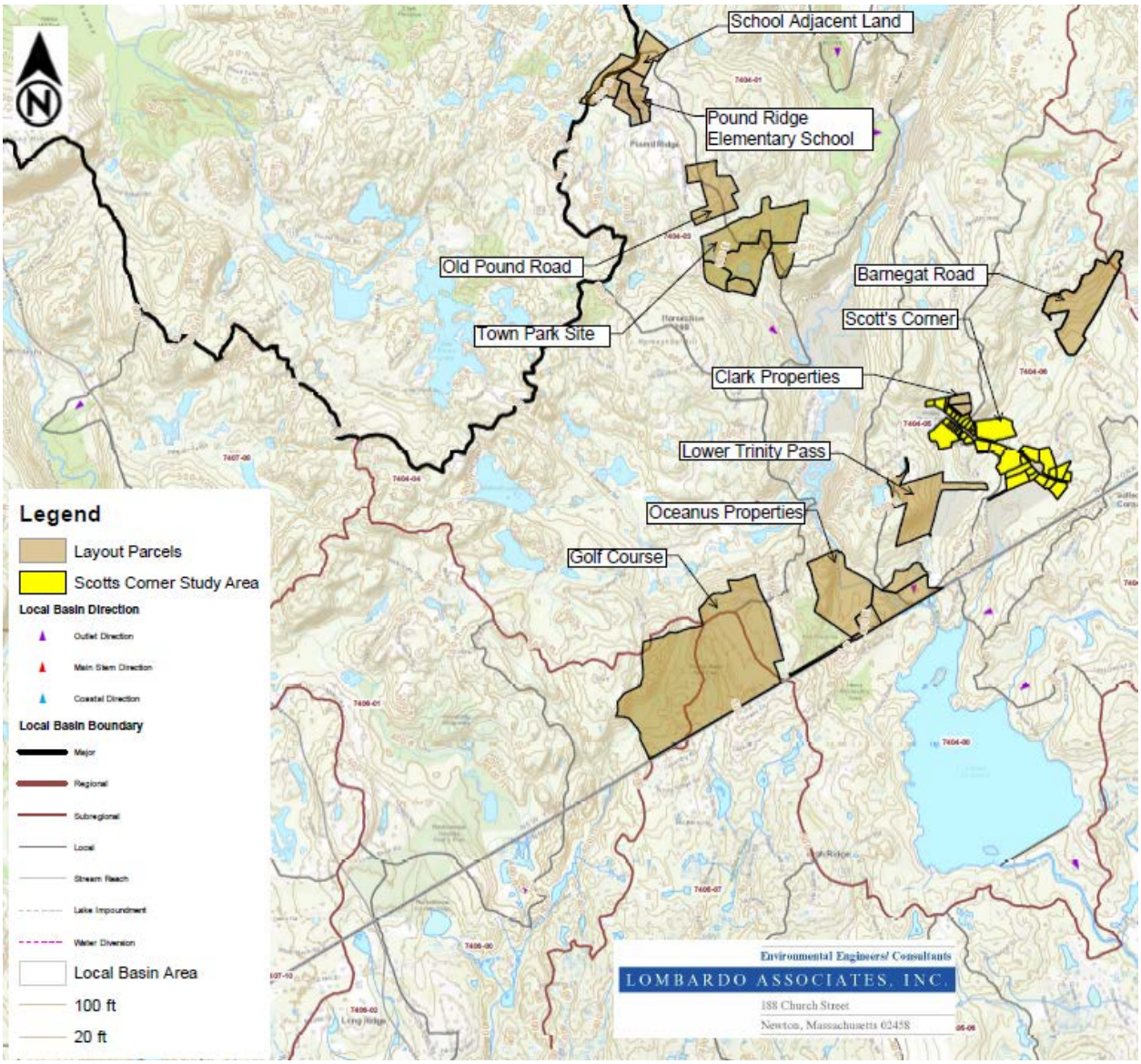


Figure 1-2 Scotts Corner – Old Pound Road – Location Map

With consideration of appropriate separations to property lines and wetlands and avoidance of steep sloped areas (hereinafter referred to as "available area"), Figure 1-3 presents preliminary available area for locating treatment and / or disposal at Old Pound Road site.

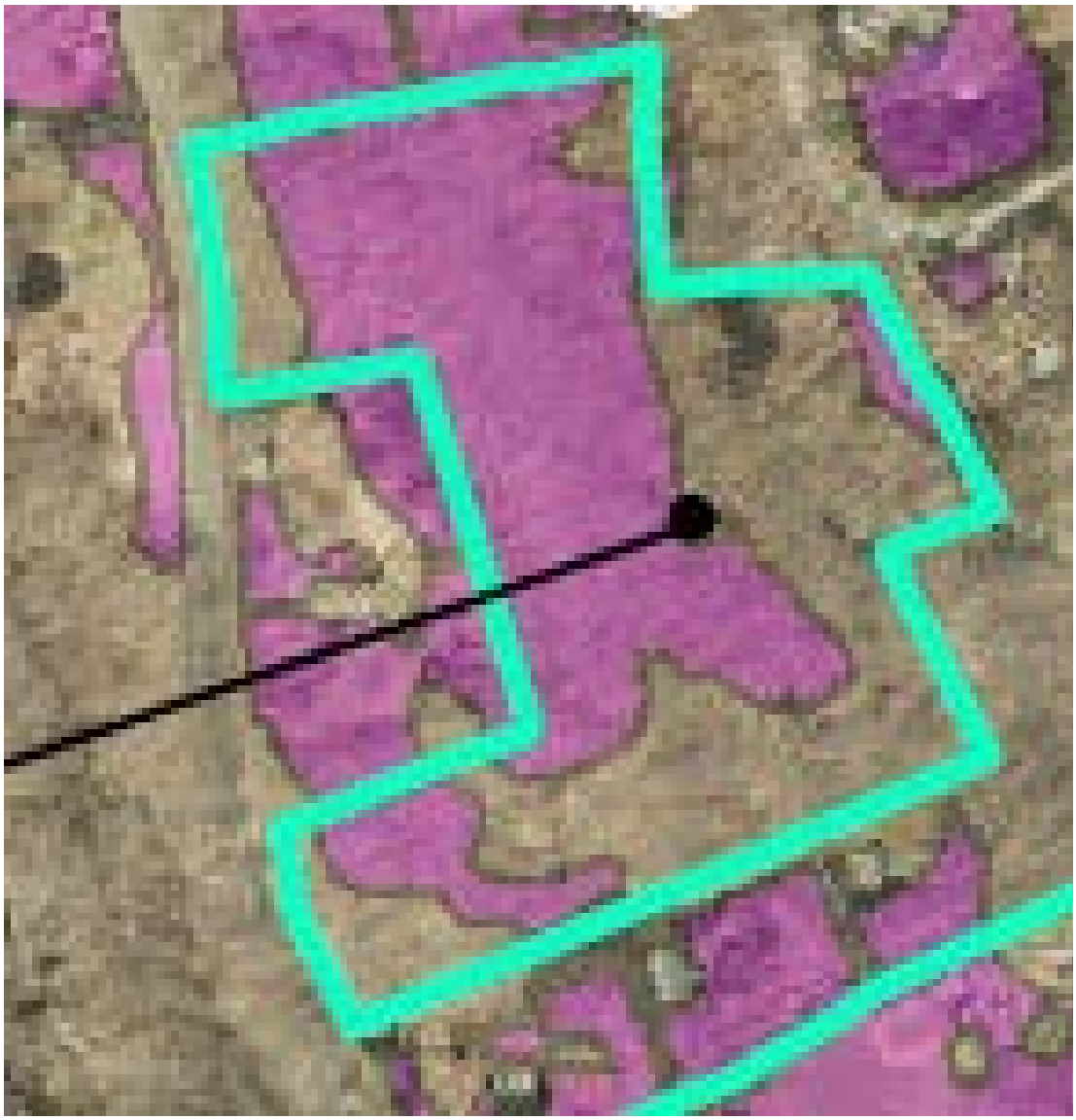


Figure 1-3 Old Pound Road – Available Area Map

Most of the site's available area was disaggregated into zones based upon topography considerations, as shown on Figure 1-4. Approximate zone areas:

1 – 73,000-sq. ft
2 – 151,000-sq. ft
3 – 92,000-sq. ft
4 – 31,000-sq. ft

for total of, say, 350,000 +/- sf.

For preliminary design purposes, wastewater treatment and disposal demands are 40,000 gpd for existing uses and up to 80,000 gpd for build out uses.

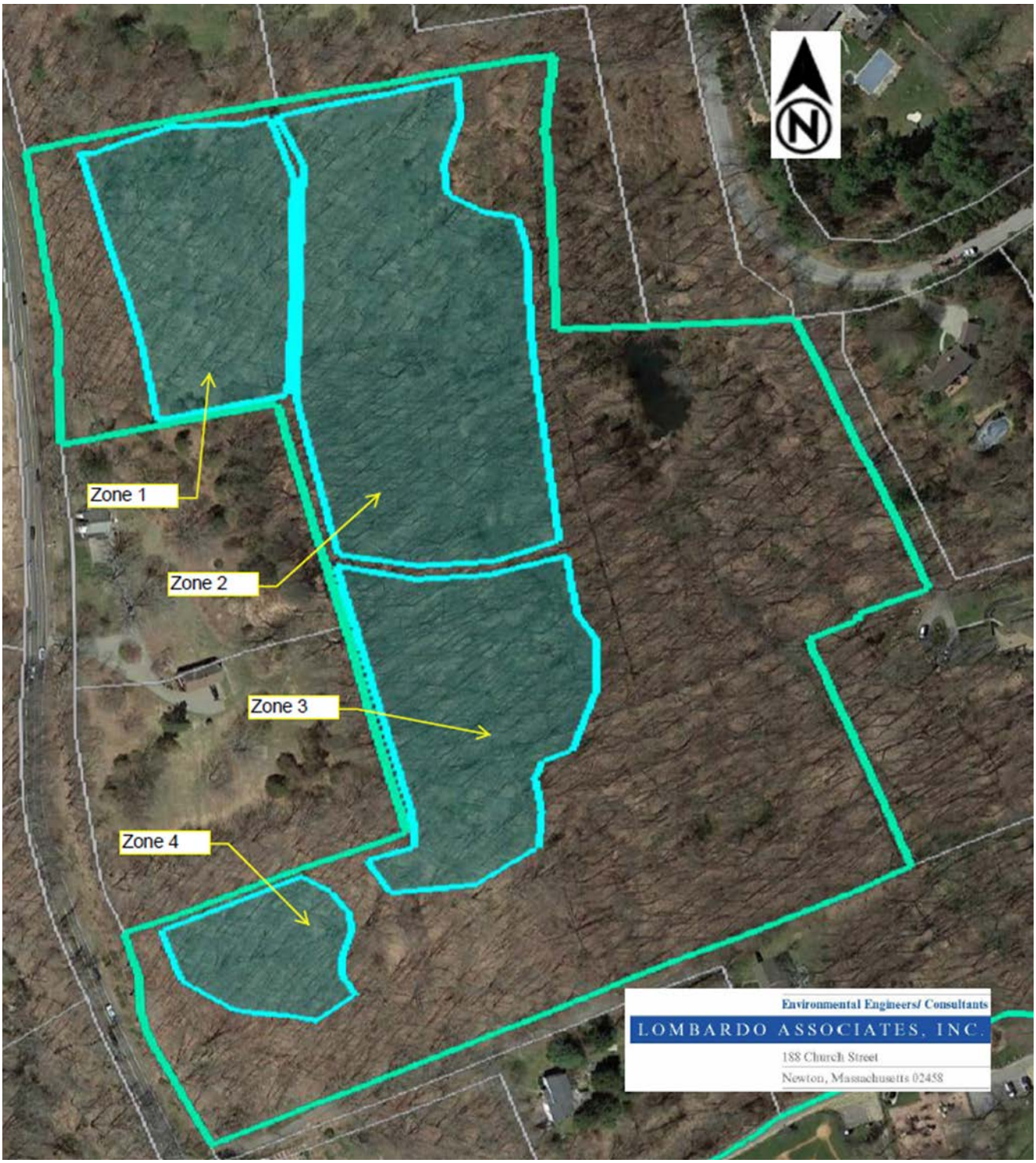


Figure 1-4 Preliminary Disposal Zones

2 BORINGS – LOCATIONS & SOIL PROFILES

Figure 2-1 illustrates the approximate location of the 44 soil borings to bedrock taken on the property. As location information was obtained by a cell phone app and cell reception was poor in some areas, the location data needs to be viewed with caution, especially borings 40 - 52.

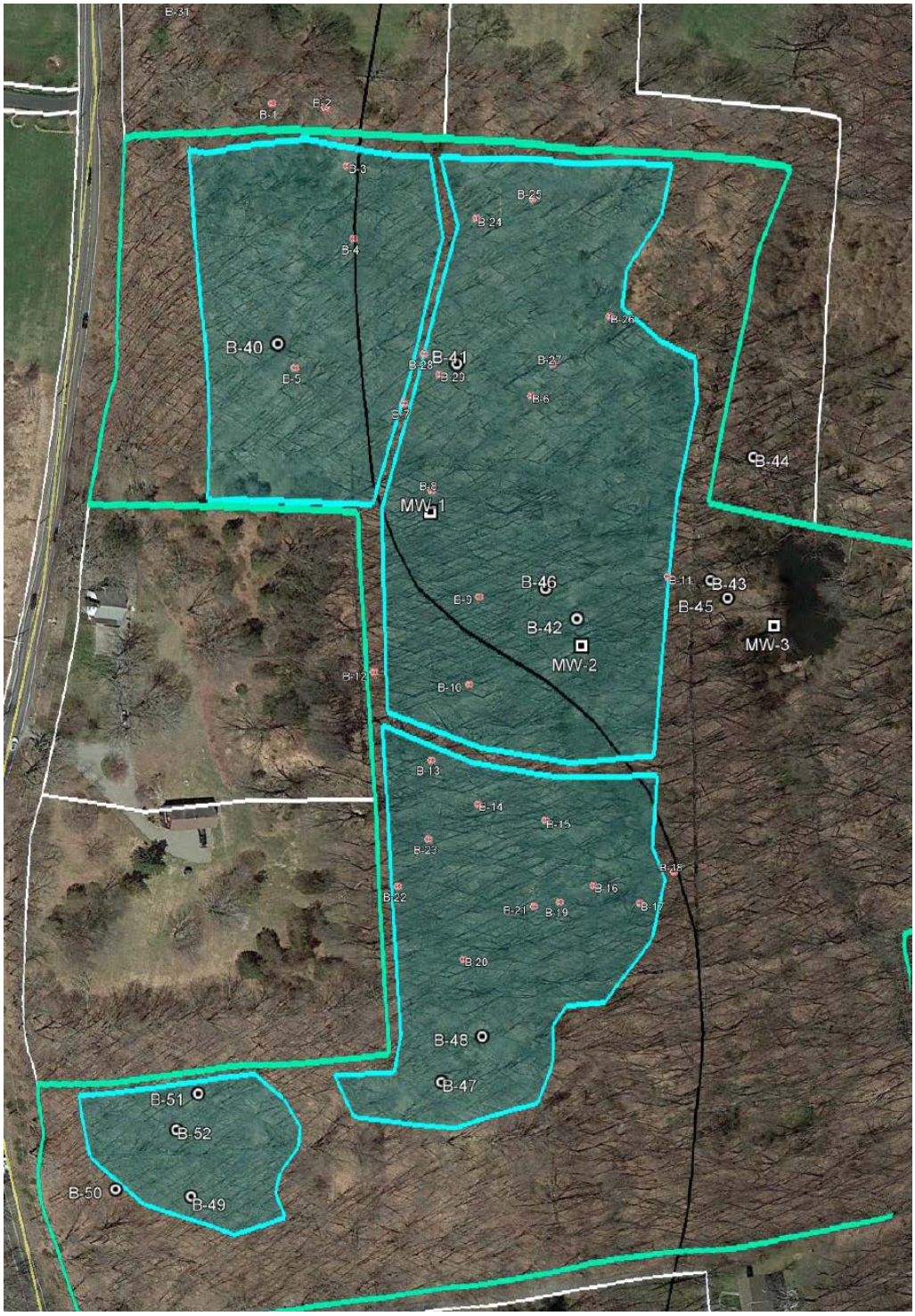


Table 2-1 presents depth to bedrock for the 44 locations with an average of 10 feet below grade (bg). The soil profiles / surficial geology of the 44 soil borings are presented on Table 2-2. The data indicates that the surficial geology is typically a fine sand.

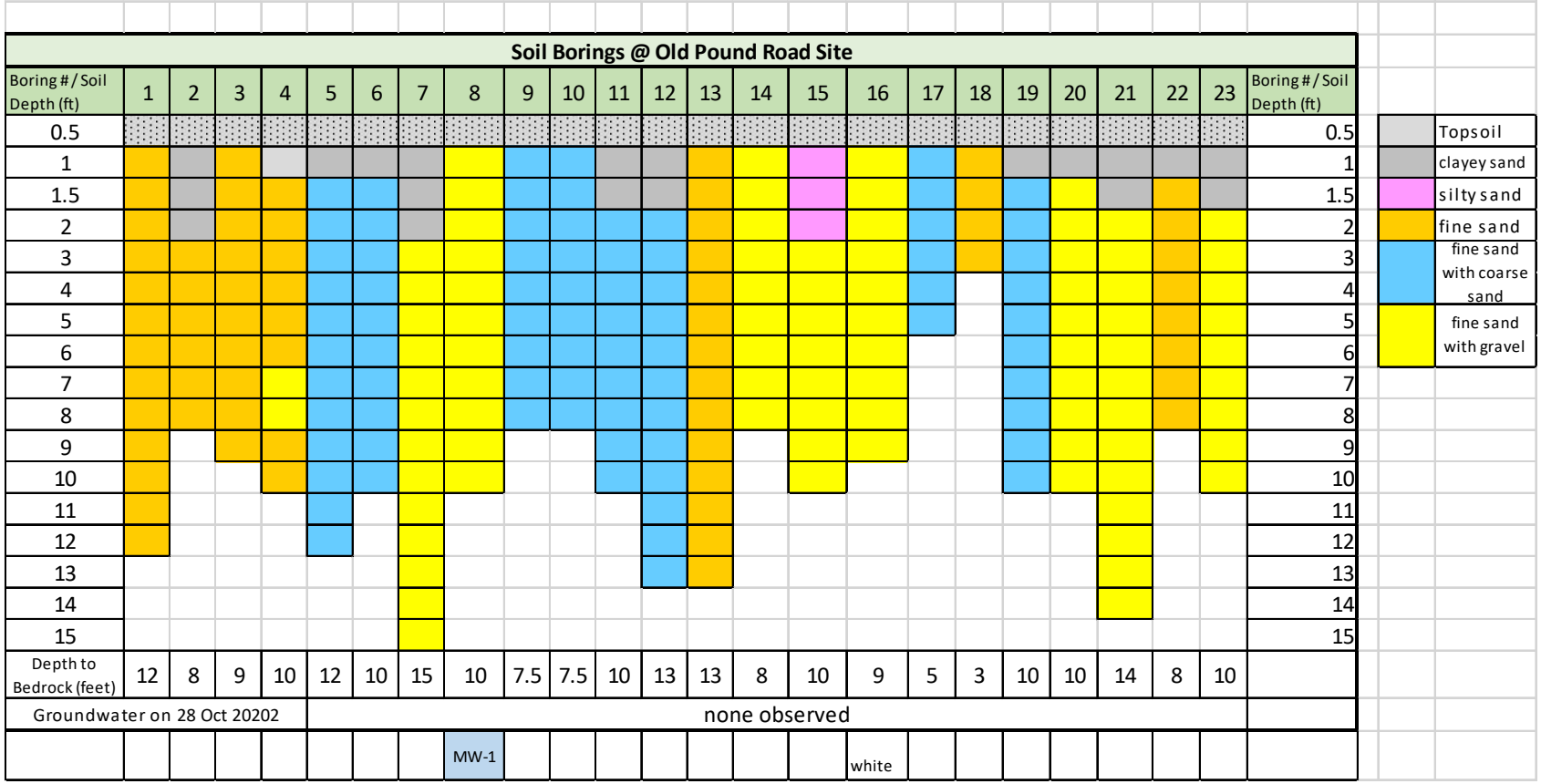
Table 2-3 presents sieve analysis results for 11 samples taken at borings 4, 7, 13 & 21.

Figure 2-1 Borings Location Map

Table 2-1 Depth to Bedrock at Boring Locations

Boring #	Depth to Bedrock (feet)	Boring #	Depth to Bedrock (feet)
1	12	53	10
2	8	54	9
3	9	55	8
4	10	56	8
5	12	57	10
6	10	58	5
7	15	59	10
8	10	60	10
9	7.5	61	15
10	7.5	40	15
11	10	41	10
12	13	42	10
13	13	43	10
14	8	44	10
15	10	45	14
16	9	46	11
17	5	47	7
18	3	48	10
19	10	49	10
20	10	50	12
21	14	51	9
22	8	52	12.5

Table 2-2 Soil Profiles



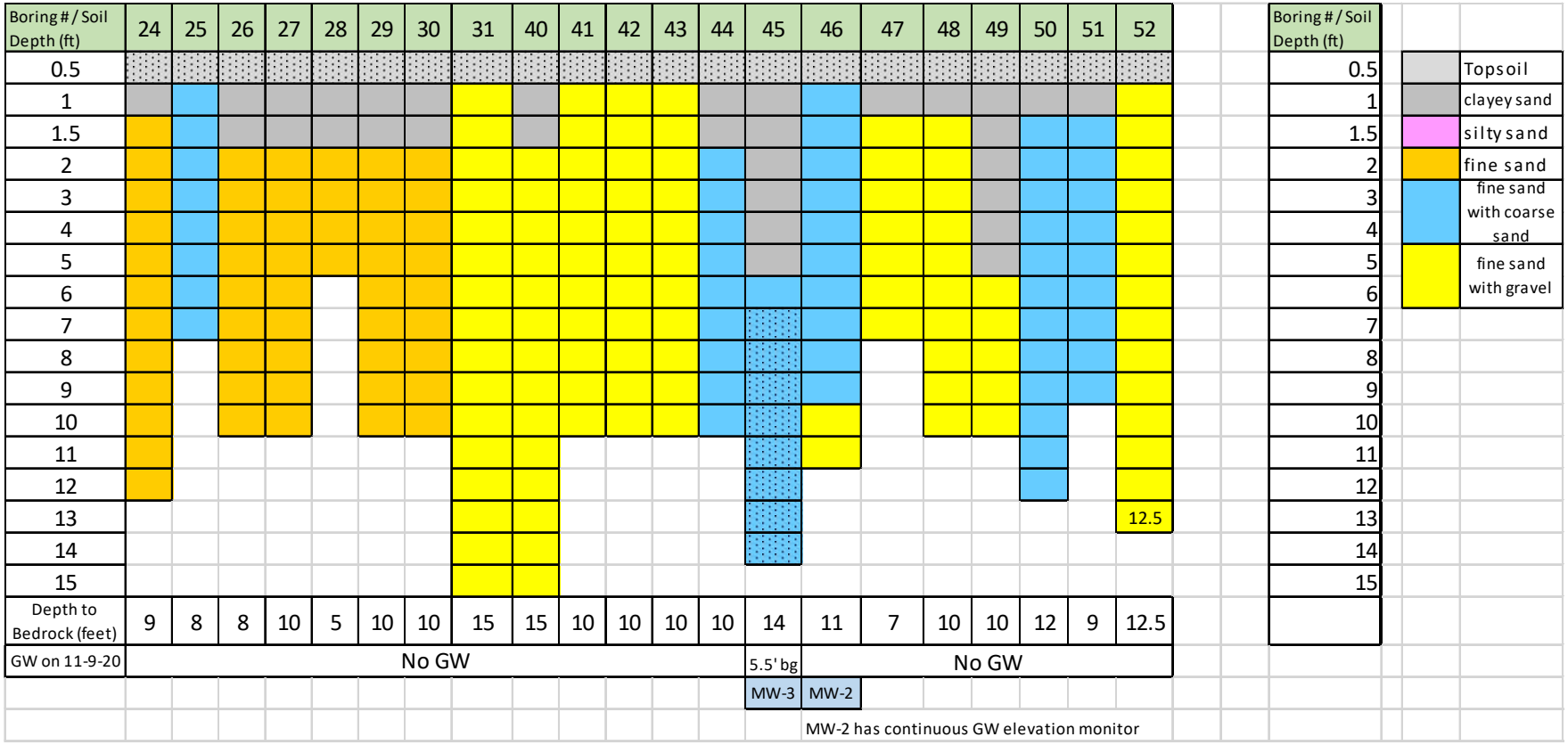

Boring # / Soil Depth (ft)
24 25 26 27 28 29 30 31 40 41 42 43 44 45 46 47 48 49 50 51 52
0.5 1 1.5 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Depth to Bedrock (feet)
9 8 8 10 5 10 10 15 15 10 10 10 10 14 11 7 10 10 12 9 12.5
GW on 11-9-20
No GW
5.5' bg
No GW
MW-3
MW-2
MW-2 has continuous GW elevation monitor
12.5
Topsoil
clayey sand
silty sand
fine sand
fine sand with coarse sand
fine sand with gravel

Table 2-3 Soil Sieve Analysis & Hydraulic Conductivity Calculations

Soils Sieve Analysis - 7 Old Pound Road Site									Hydraulic conductivity (ft/day)			
Count	Boring #	Feet below ground	% Gravel	% Sand	% Silt	% Clay	uniformity coefficient (C_u)**	D_{10} (mm)	At Boring	Shallow Elev.	Mid Elev	Deep Soils Elev
1	4	4	60.1	30.4	8.4	1.1	192	0.0795	17.9	17.9		
2	4	7	33.8	40.7	22.7	2.8	58	0.0412	4.8		4.8	
3	7	2	5.8	55.3	34.9	4	6	0.0394	4.4	4.4		
4	7	8	27.7	55.4	14.7	2.2	41	0.0524	7.8		7.8	
5	7	12	35.1	51.5	11.7	1.7	62	0.0598	10.1			10.1
6	13	3	43.3	43.9	11.2	1.6	104	0.0621	10.9	10.9		
7	13	9	38.2	48	12.6	1.2	71	0.0602	10.3		10.3	
8	13	12	17.4	61.1	19.7	1.8	13	0.0487	6.7			6.7
9	21	3	30	47.5	20.2	2.3	29	0.0455	5.9			
10	21	9	50.8	36.1	11.6	1.5	203	0.0604	10.3		10.3	
11	21	13	18.6	52.9	25.3	3.2	10	0.0408	4.7			4.7
* Hydraulic Conductivity calculated with Hazen-Williams formula									Average	11.1	8.3	7.2
**Soils with C_u <= 4 are considered to be "poorly graded" or uniform									Average of Mid & Deep			7.82
$C_u = (D_{60}/D_{10})$									Geomean of Mid & Deep			7.45

3 BEDROCK CONTOURS & GROUDWATER FLOW ISSUES

Figure 3-1 presents computer generated bedrock elevation contours based upon the Table 2-1 depth to rock data and 2-foot surface topographic information obtained from 2020 Westchester County GIS. LAI created a computer generated 1-foot topographic map.

Estimated groundwater flow path based upon surface topography is presented on Figure 3-2.

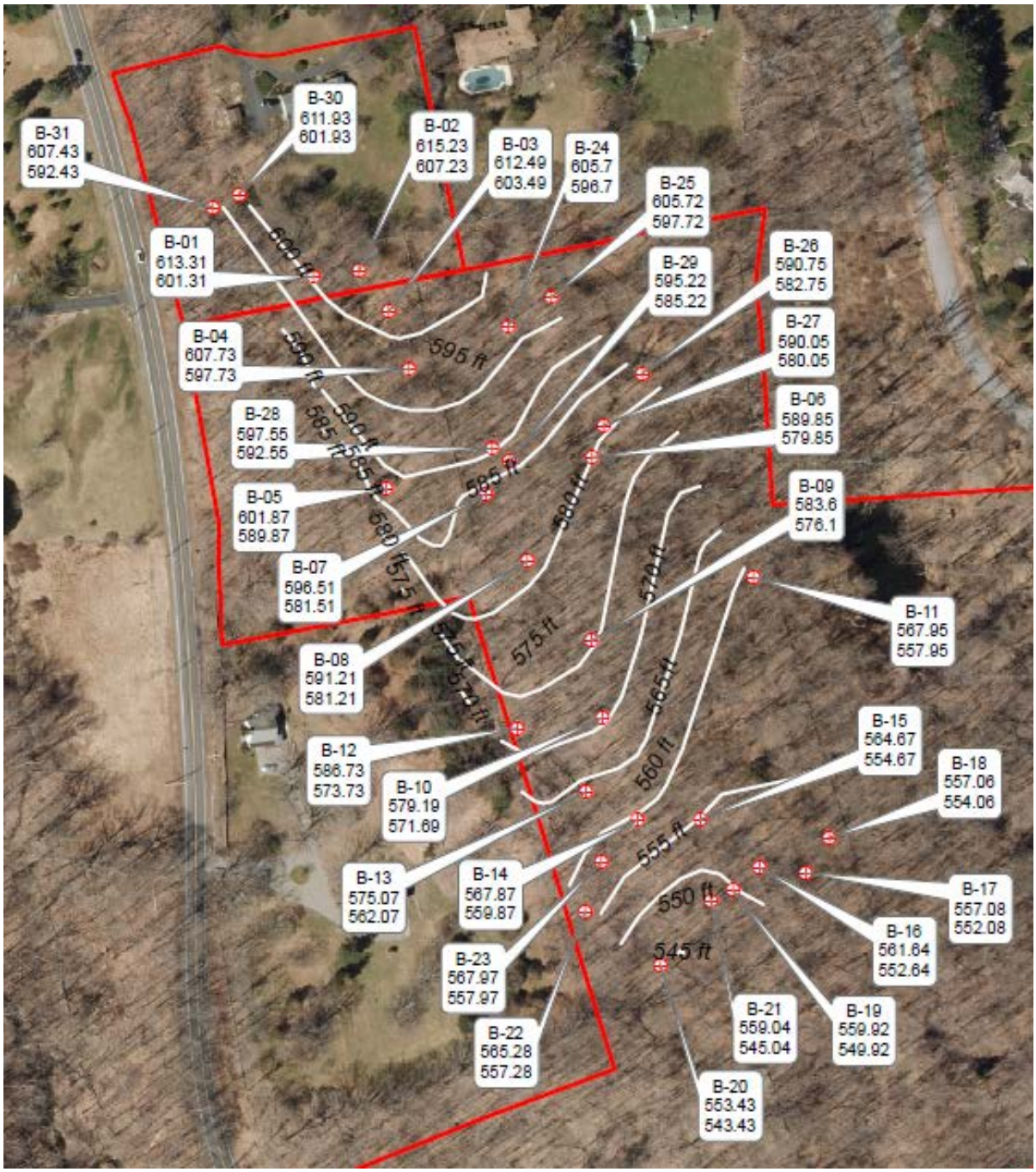


Figure 3-1 Preliminary Bedrock Contours

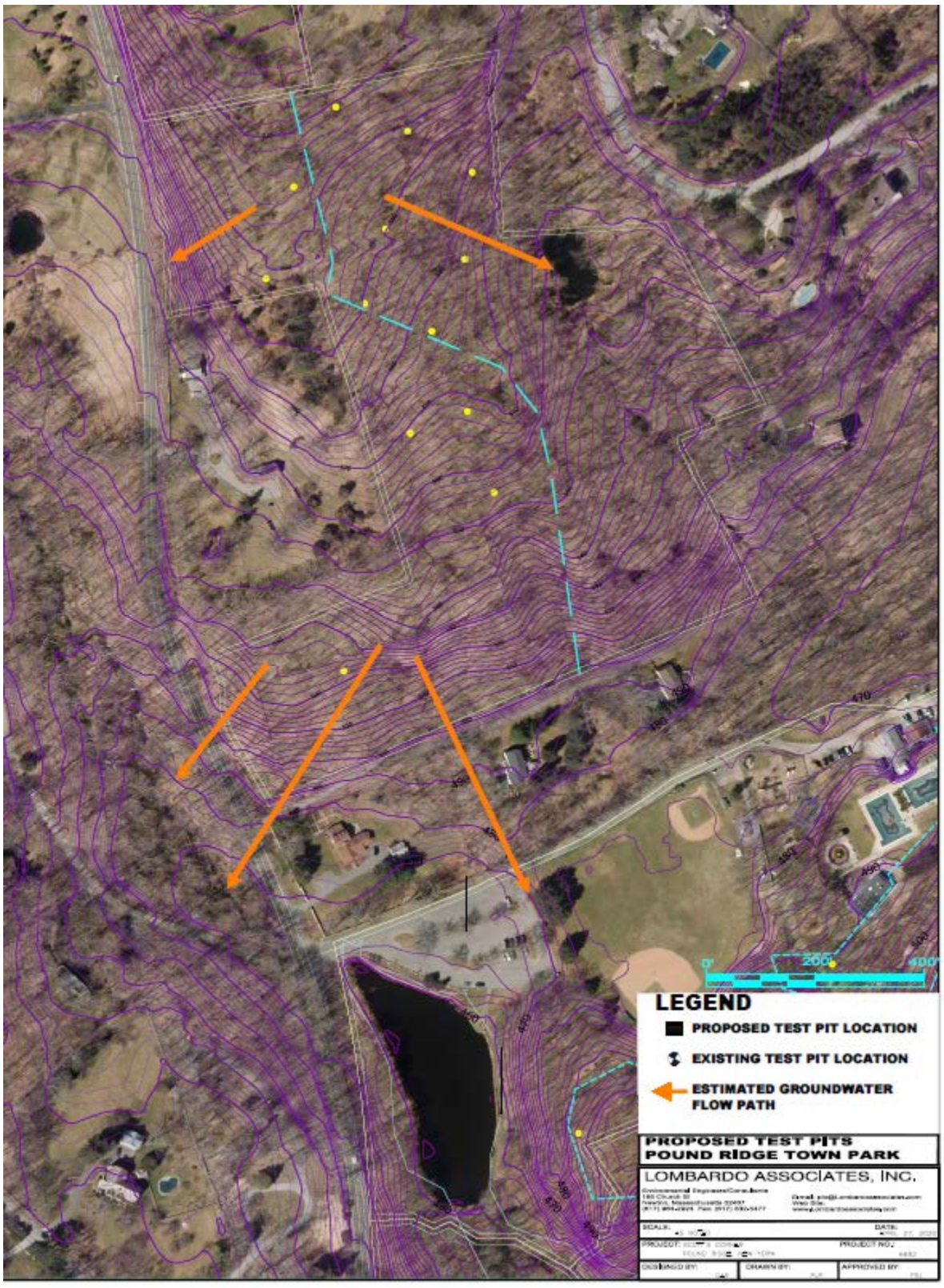


Figure 3-2 Preliminary GW Flow Direction

4 ESTIMATE DISPOSAL CAPACITY

Disposal capacity of final layouts will be determined by use of the USGS Groundwater Flow computer model MODFLOW. For analytical purposes only, Darcy's Law capacity estimates are prepared to provide preliminary insights to the disposal capacities of the candidate sites.

Darcy's Law Capacity Estimates Methodology

The treated wastewater disposal capacity is estimated in the following manner:

1. Available Area determined as discussed in Section 1
2. Viable zones within the available area were identified based upon surface and bedrock topography (work with contours) and preliminary disposal system layout considerations.
3. Darcy's Law disposal capacity of the drainfield zones was calculated at the downgradient face of the zone as follows, see Figures 4-1.

4. Q = K*A*i, where Q = volumetric flow (cf/day),
   K = Hydraulic conductivity (ft/day) of unsaturated zone,
   A = cross sectional area (sf) of discharge cross sectional area
   i = groundwater slope
5.
   i. Hydraulic conductivity (K) of soils estimated based upon sieve analysis and use of Hazen Williams formula K= C * (D10)2, where K = Hydraulic conductivity (cm/sec), D10 = 10th percentile grain size by weight in mm, C = dimensionless coefficient =1, for K in cm/sec and D10 in mm.;
   ii. Borings data basis depth to bedrock,
   iii. No mottling basis for no significant seasonal high groundwater elevation
   iv. Cross Sectional area computed by:
      - ✓ Length measured as the furthest downgradient face of zone See Figure 4-2 for initial layouts
      - ✓ Depth calculated by subtracting from depth to GW/BR (ii above)
        - separation between grade and bottom of drip disposal system;
        - separation between drip bottom and max mounded GW elev.

6. Darcy's Law flow estimates calculated

Table 4-1 presents estimated site disposal capacity using Darcy's Law.

The lack of soil mottling suggest that groundwater buildup does not occur at the site. Three groundwater monitoring wells were installed as shown on Figure 2-1 and Table 2-2. Groundwater was observed at MW-3, whose elevation appears to be governed by Pond elevation, which in turn is governed by an outlet weir elevation.

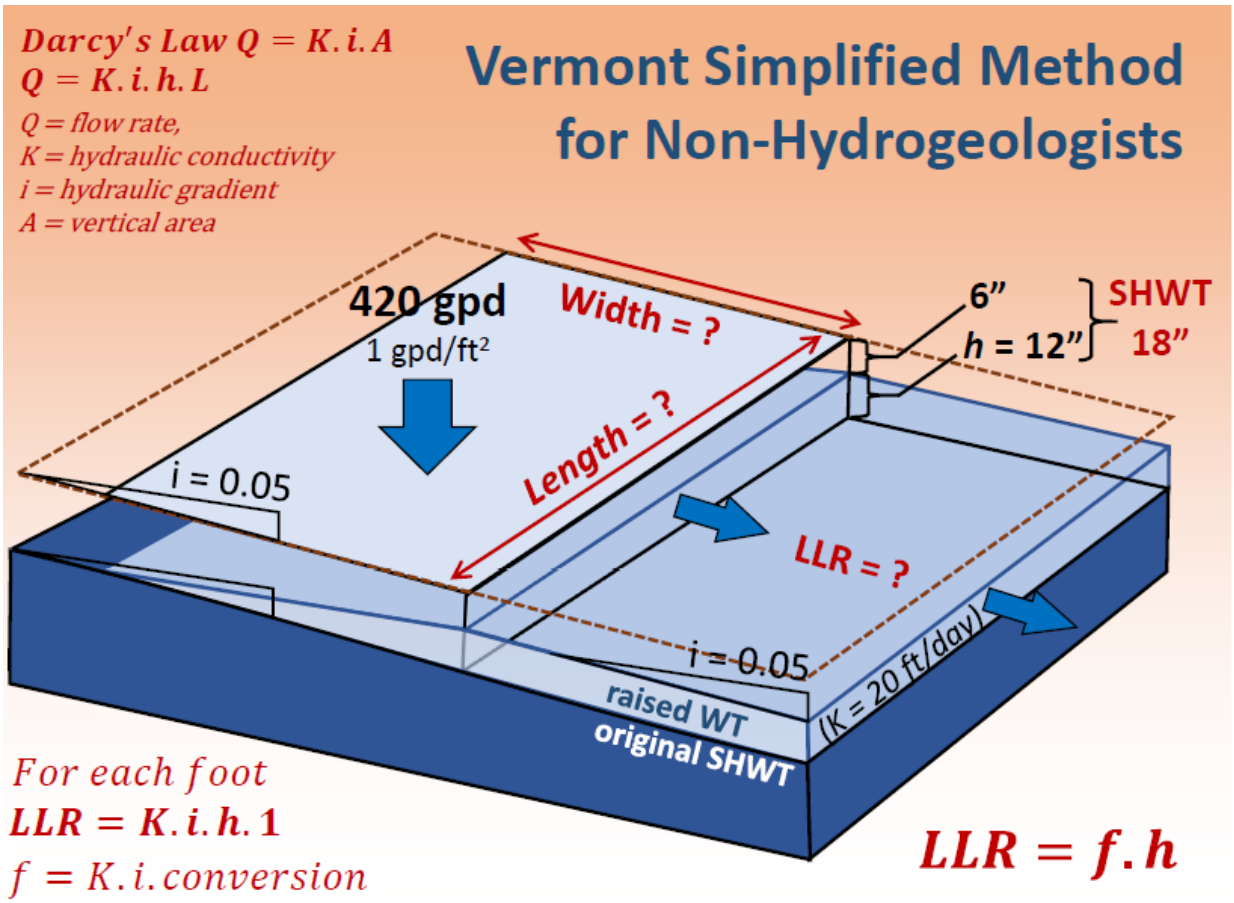


Figure 4-1 Simplified Darcy's Law Mounding Analysis-Example

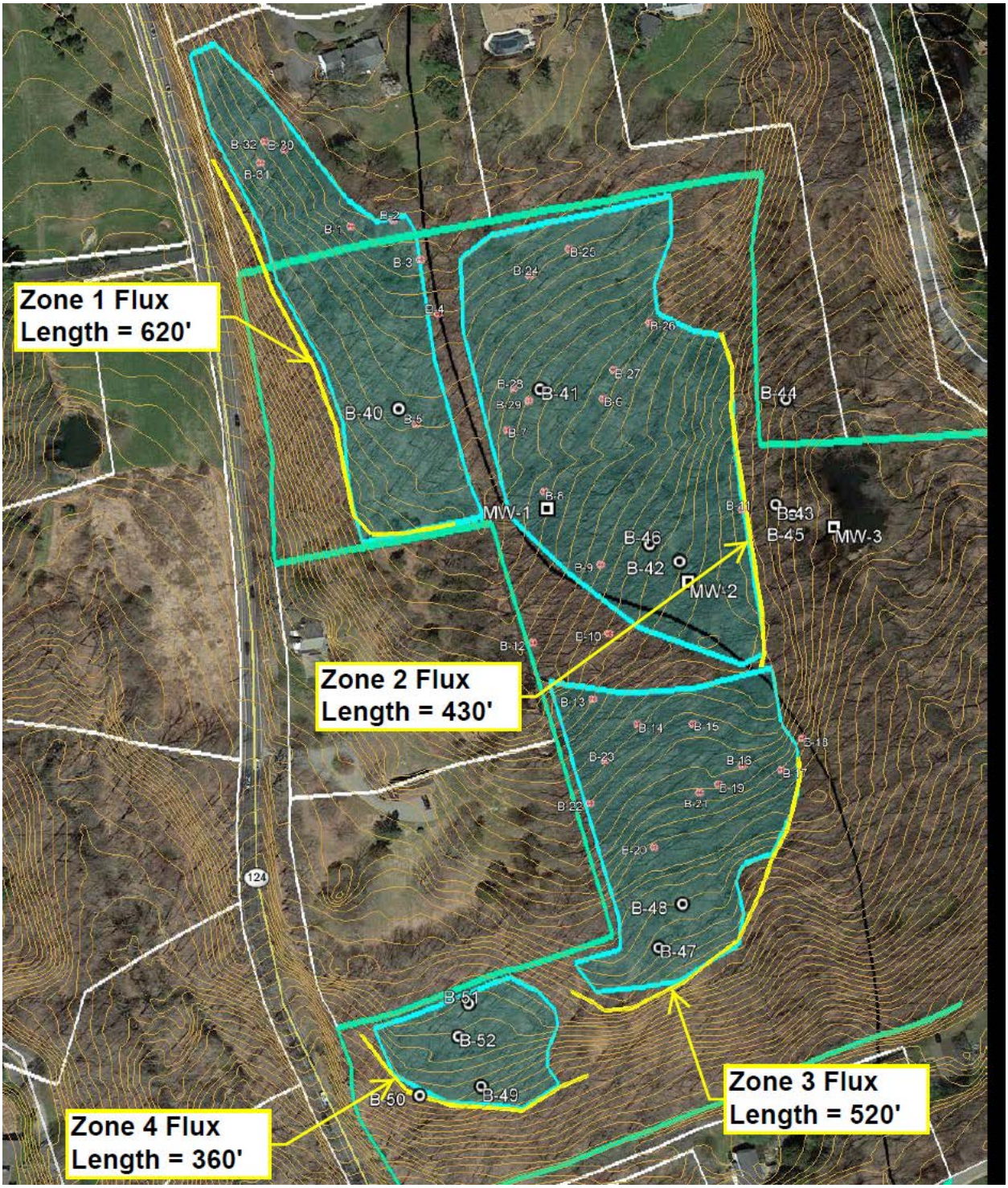


Figure 4-2 Preliminary Estimates of groundwater zone faces

Table 4-1 Disposal Capacity Estimates with Varying GW & Separation Elevations

Old Pound Road Potential Drainfield Zones Capacity Analysis - No Groundwater													
DF Zone #	GW Flux Length (ft)	Soil Type	GW Depth Above Bed rock	Depth to BR (ft)	Depth to GW (ft)	Disp. Sys. Depth Below Grade (ft)	Min. Separation Between Drip & GW Mound (ft)	Max. Mound Height (ft)	Hyd. Cond.[1] (ft/d)	Slope (%)	Flux Area (ft^2)	Flow - Darcy	
												(ft^3/ day)	(gpd)
1	620	ChB	0.00	10.0	10.0	1.0	2.0	7.0	7.8	7.0%	4,340	2,370	**17,725**
2	430	ChB	0.00	10.0	10.0	1.0	2.0	7.0	7.8	8.0%	3,010	1,878	**14,049**
3	520	ChC, ChD	0.00	10.0	10.0	1.0	2.0	7.0	7.8	8.0%	3,640	2,271	**16,990**
4	360	ChD, ChC	0.00	10.0	10.00	1.0	2.0	7.0	7.8	7.0%	2,520	1,376	**10,292**
												Total	**59,056**

[1] From Sieve Analysis Table 2-3. For reference, average aalue from Table 17, Westchester County Soils Survey= 6.6 feet/day

Old Pound Road Potential Drainfield Zones Capacity Analysis - Groundwater 1 foot above Bedrock													
DF Zone #	GW Flux Length (ft)	Soil Type	GW Depth Above Bed rock	Depth to BR (ft)	Depth to GW (ft)	Disp. Sys. Depth Below Grade (ft)	Min. Separation Between Drip & GW Mound (ft)	Max. Mound Height (ft)	Hyd. Cond.[1] (ft/d)	Slope (%)	Flux Area (ft^2)	Flow - Darcy	
												(ft^3/ day)	(gpd)
1	620	ChB	1.00	10.0	9.0	1.0	2.0	6.0	7.8	7.0%	3,720	2,031	**15,193**
2	430	ChB	1.00	10.0	9.0	1.0	2.0	6.0	7.8	8.0%	2,580	1,610	**12,042**
3	520	ChC, ChD	1.00	10.0	9.0	1.0	2.0	6.0	7.8	8.0%	3,120	1,947	**14,563**
4	360	ChD, ChC	1.00	10.0	9.00	1.0	2.0	6.0	7.8	7.0%	2,160	1,179	**8,822**
												Total	**50,619**

[1] From Sieve Analysis Table 2-3. For reference, average aalue from Table 17, Westchester County Soils Survey= 6.6 feet/day

Old Pound Road Potential Drainfield Zones Capacity Analysis - Groundwater 2 feet above Bedrock												Flow - Darcy	
DF Zone #	GW Flux Length (ft)	Soil Type	GW Depth Above Bed rock	Depth to BR (ft)	Depth to GW (ft)	Disp. Sys. Depth Below Grade (ft)	Min. Separation Between Drip & GW Mound (ft)	Max. Mound Height (ft)	Hyd. Cond.[1] (ft/d)	Slope (%)	Flux Area (ft^2)	(ft^3/ day)	(gpd)
1	620	ChB	2.00	10.0	8.0	1.0	2.0	5.0	7.8	7.0%	3,100	1,693	**12,661**
2	430	ChB	2.00	10.0	8.0	1.0	2.0	5.0	7.8	8.0%	2,150	1,342	**10,035**
3	520	ChC, ChD	2.00	10.0	8.0	1.0	2.0	5.0	7.8	8.0%	2,600	1,622	**12,136**
4	360	ChD, ChC	2.00	10.0	8.00	1.0	2.0	5.0	7.8	7.0%	1,800	983	**7,351**
												Total	**42,183**

[1] From Sieve Analysis Table 2-3. For reference, average aalue from Table 17, Westchester County Soils Survey= 6.6 feet/day

Old Pound Road Potential Drainfield Zones Capacity Analysis - Groundwater 2 feet above Bedrock													Flow - Darcy	
DF Zone #	Area (sf)	GW Flux Length (ft)	Soil Type	GW Depth Above Bed rock	Depth to BR (ft)	Depth to GW (ft)	Disp. Sys. Depth Below Grade (ft)	Min. Separation Between Drip & GW Mound (ft)	Max. Mound Height (ft)	Hyd. Cond.[1] (ft/d)	Slope (%)	Flux Area (ft^2)	(ft^3/ day)	(gpd)
1	**73,000**	620	ChB	0.00	10.0	10.0	1.0	1.0	8.0	7.8	7.0%	4,960	2,708	**20,257**
2	**151,000**	430	ChB	0.00	10.0	10.0	1.0	1.0	8.0	7.8	8.0%	3,440	2,147	**16,056**
3	**92,000**	520	ChC, ChD	0.00	10.0	10.0	1.0	1.0	8.0	7.8	8.0%	4,160	2,596	**19,417**
4	**31,000**	360	ChD, ChC	0.00	10.0	10.00	1.0	1.0	8.0	7.8	7.0%	2,880	1,572	**11,762**
	347,000												Total	**67,492**

Old Pound Road Potential Drainfield Zones Capacity Analysis Summary				
Depth to Bedrock (ft)	10	10	10	10
GW Depth above bedrock (ft)	0	0	1	2
Drip Separation to Mounded GW (ft)	1	2	2	2
Estimated Capacity (gpd)	67,492	59,056	50,619	42,183

It is noted at 80,000 gpd code design flow, average flow is expected to be 40,000 gpd. Consequently, provided that groundwater does not exceed 2 feet above bedrock and groundwater flow patterns from additional data/analysis are consistent with the estimates in this Report, it is Lombardo Associates, Inc.'s opinion that the Old Pound Site has sufficient disposal capacity for the proposed Scotts Corner 80,000 gpd wastewater system. Exact layout and loading of the drip disposal system is a design issue that would be addressed during design process, which occurs after Sewer District formation and bonding.

Pending NYSDEC and WCDoH review, a MODFLOW analysis of the site's capacity may be required for NYSDEC/WCDoH acceptance. To eliminate uncertainties, LAI recommends such an analysis after groundwater elevation data is collected in March – April 2021. In addition to site capacity confirmation, the MODFLOW analysis is used for disposal system design and operation.