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CLIENT:	RDM Group 1 International Blvd., Suite 410 Mahwah, NJ 07430	PROJECT: PROJ. No.: DATE:	Mid-Hudson Industrial Park Town of Montgomery, N.Y. 20420 April 20, 2023

GEOTECHNICAL INVESTIGATION AND ASSESSMENT REPORT

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1. PROJECT DESCRIPTION

This geotechnical investigation report combines and summarizes the findings of three previous reports from the past two years, adapted to changes made to the project design during that period, and includes some new field data. The previous reports were dated March 9, 2021 (Geotechnical Investigation Report, project number 21420,) December 30, 2022 (Geotechnical Investigation Report, project number 22404,) and March 17, 2023 (Supplemental Geotechnical Investigation, project number 22404.) These investigations included the drilling of soil borings, excavation of test pits, measurement of groundwater elevations and field infiltration rate testing for stormwater controls.

The investigation was performed for use in the design and construction of three large structures, some high retaining walls and related stormwater controls. The attached plans show the locations of the borings and test pits, and of the proposed buildings and related features. The proposed warehouses are: a 214,000 square foot building on Neelytown Road (Lot 1, 'East Building;') a 250,070 square foot building on Beaver Dam Road, north of Neelytown Road (Lot 3, 'Southwest Building;') and a 664,200 square foot building immediately to the north on Beaver Dam Road (Lot 2, 'Northwest Building.') A large parking area is proposed on the northwest leg of Lot 2, which extends behind the adjacent FedEx Ground property and north to the I-84 right-of-way. The proposed stormwater controls include a combination of surface and subsurface infiltration and detention practices, the majority of which will be in the area between the three buildings. The proposed facility layout is greatly influenced by a large hill in the northwest part of the site, covering more than half of Lot 2, and by a large wetland area in the southeast part, which includes most of the east half of Lot 3, the southeast corner of Lot 2 and part of the south and west sides of Lot 1.

At Lot 1, on Neelytown Road, the proposed first floor elevation of the building is 420.0 feet, with existing elevations of 415 to 420 feet in most of this area, reaching about 425 feet on a small hill at the north end. Subsurface stormwater controls are proposed along the west side of the building. Surface practices are proposed near the building's southwest corner and near the north half of its east side, and in the northwest corner of the lot, with this last system shared by Lot 2.

The northwest Lot 2 building has a proposed floor elevation of 424.0 feet; the existing elevations are about 406 to 412 feet over the eastern and southeastern two-thirds of this building area, with the northwest third extending into the end of a long hill, which reaches 466 feet elevation at the proposed northwest building corner; the hill continues to climb beyond the building area, reaching elevations of 510 feet or greater, outside the project area but close to the northeast corner of the proposed northwest parking lot. The parking lot would be cut into the west slope of this hill, creating three tiers of parking aligned north-south, with retaining walls between the tiers and on the uphill side of the cut. Surface stormwater controls are proposed at the south end of the northwest parking area and to the east of the northeast building corner, with the latter system shared with Lot 1, as noted above. A subsurface system is proposed along the south side of the building; during major storms additional capacity will be provided by a shared surface practice on the north end of Lot 3.

The Lot 3 building, in the south part of the site, has a proposed floor elevation of 424.0 feet. Current elevations are about 410 feet along the north end of the building footprint, 406 to 411 feet along the east side, 407 to 414 feet in the south part, and 410 to 417 feet in the middle and west sections, with two dwellings and some outbuildings currently occupying the higher ground. Subsurface stormwater controls are proposed to the south of the building and along its east side. Surface stormwater practices are proposed to the north of the building and to the east of the eastern subsurface system.

Several significant retaining walls are proposed, to allow the proposed development to take place. Three retaining walls less than fifteen feet high are proposed on Lot 1; these are expected to be built using conventional segmental retaining wall (SRW) construction. An approximately six- to thirteen-foot high wall is proposed along the south side of the south entrance from Neelytown Road, to raise the grade above the adjacent wetland. Another wall, about four to eight feet high, would start near the east end of this wall, also to raise the grade above the wetlands. It would wrap around some of the proposed surface stormwater controls, then extend north along the west side of the loading dock apron until it meets the rising grade to the south. The third wall, typically four feet to nine feet tall and also raising the grade above adjacent wetlands and low areas, would begin near the south entrance and extend north past the east side of some of the surface stormwater controls.

On Lot 3 a long wall with a typical height of twelve to seventeen feet is proposed, running north from the lot entrance then northeast past the southeast building corner. It will then wrap around one of the surface stormwater controls, at a height of about six feet, partly forming the berm for the practice. After passing the pond, the wall will continue north a short distance onto Lot 2, at a height of about seventeen feet. A second wall about six to twelve feet tall will begin at the northeast building corner and will run northwest between Lot 3 and the south edge of Lot 2, then turn north and end a short distance onto Lot 2.

On Lot 2, the above-noted wall that began on Lot 1 will continue north along the entire east side of the Lot 2 building, at a height of about seven to seventeen feet; a second wall will be situated between this wall and the building, with a height of about eight feet. The wall entering the southwest corner of Lot 2 from Lot 3 will end as noted with parallel wall about sixteen feet high beginning here and extending a short distance onto Lot 3; these two walls bracket the Lot 3 entrance road.

In the northwest parking area, retaining walls about ten to eighteen feet high will be built between the three proposed tiers of parking and will wrap around surface stormwater controls at the south end. These and the other above-noted walls are expected to be built as segmental block walls. A third wall is proposed in this area, between the upper tier of parking and the cut slope of the hillside. This wall will only be about four to five feet high, but will retain a high two-on-one slope, and a more robust wall will likely be required at this location.

The west upper wall of the parking lot will continue south toward the Lot 3 building, then will turn ninety degrees east and will rapidly increase to about thirty feet in height as the bottom elevation drops, then decrease as the top descends, ending about midway across the north side of the building. This wall will also have a two-on-one backslope and a segmental retaining wall will likely be inadequate here.

SETTING AND GEOLOGY

The site is mostly abandoned agricultural land, with a silo and some building remnants in the low areas, three houses with outbuildings on the section along Beaver Dam Road and two houses with outbuildings near the intersection of Neelytown and Beaver Dam Roads. The south and middle parts of the site are low-lying and relatively flat, with light brush and small tree growth, a small pond and a small natural stream which flows to the south. Water is discharged onto the north part of the site by a culvert from the adjacent FedEx Ground facility, which begins on the north side of that side and runs south under the front parking lot. The west and northwest parts of the site are on the end of the above-mentioned hill, which is partly tree-covered, with slopes of about ten to fifteen percent on its east side and a slope of about thirty percent on the west side.

The local bedrock is Ordovician-age siltstone, shale and sandstone of the Normanskill formation. This is medium-hard, medium-gray sedimentary rock, thinly-bedded and moderately folded. It weathers readily when exposed in cuts, typically shedding gravel-size pieces of rock. Where it is covered by soils, the upper two to five feet of the bedrock usually weathers to the extent that it can be easily excavated, but the deeper rock tends to be relatively hard and tight, and sometimes the weathered zone is very thin or is absent. The surface of the shale bedrock in the local region is generally flat or gently undulating due to glacial erosion, with isolated hills formed by soil deposits and on harder knobs of rock.

The New York State Surficial Geologic Map (Albany, 1989) indicates that the local soils consist of lacustrine silt and clay, deposited in a glacial lake that was impounded in the Wallkill Valley by the retreating ice front, which formed a recessional moraine crossing the valley through Walden. Sandy, silty and clayey deposits were encountered in the low areas of the site, over shallow bedrock, but there is also a large till deposit which forms the hill in the northwest part of the site.

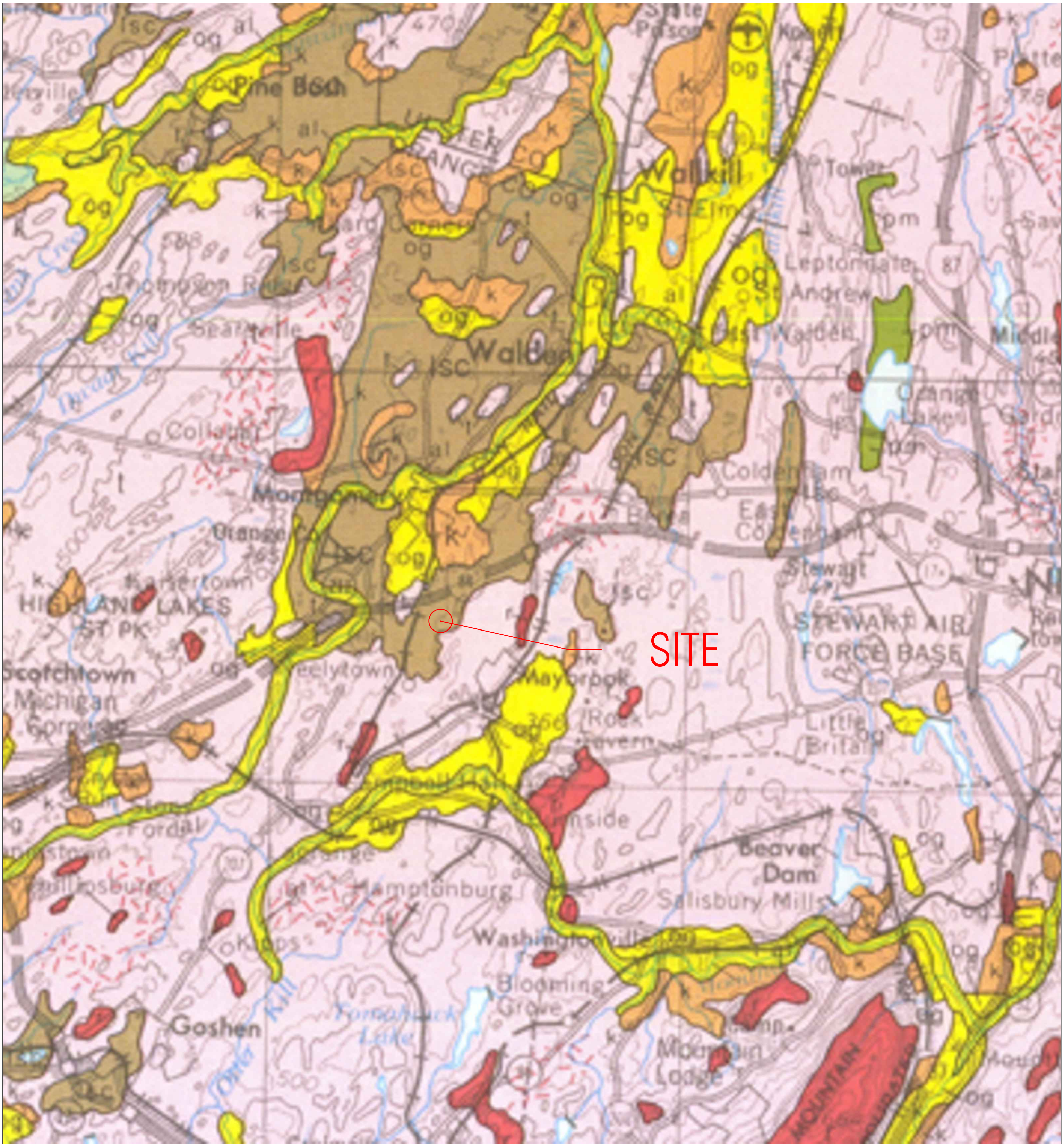
The USDA Soil Survey indicates that the native topsoil types in the lower, mostly flat area of the site are predominately Hoosic gravelly sandy loam and Alden silt loam, with some Erie gravelly silt loam and some smaller areas of Raynham silt loam, Rock outcrop-Nassau complex and Bath-Nassau complex soils. Hoosic soils typically form over sandy to gravelly glacial outwash, Alden soils form in low spots that have been silted-in, usually on top of glacial till, and Erie soils typically form over deep deposits of clayey glacial till. Raynham soils form over deposits of silt and very fine sand, of glacial or post-glacial origin. Bath and Nassau soils form over thin deposits of stony, silty glacial till, with bedrock typically at 1.5 to 4.5 feet depth.

The borings in the low areas did not encounter any true till, except for a two-foot thick layer of gravelly till, just above the weathered rock layer in boring B4. Some of the shallow soils were of the Alden type, while the deeper soils and some of the shallow soils were sandy outwash or lacustrine deposits, typical of Hoosic soils, or had a texture and structure intermediate between outwash and till. The Soil Survey also indicates a small area of Rock outcrop-Nassau soils extending south into the northeast corner of the east building; borings B14 encountered shallow bedrock at about five feet depth (EL 408) on top of the small knob in that area. The soil there may have originally been till, but has been altered by frost heave and other natural processes.

The hill in the northwest part of the site is shown by the Soil Survey as an area of mostly Pittsfield gravelly loam, with some Erie gravelly silt loam and with Rock outcrop-Nassau complex soils on its east and west slopes, extending close to the proposed northwest building. Pittsfield soils form over glacial till, typically with a silty sand texture, while Erie soils usually form over clayey till, as noted above. The hill is a drumlin, an elongated hill formed under moving glacial ice which consists of densely-consolidated till. There appears to be a high point in the bedrock in the west part of the proposed parking area which may have served as the anchor point for deposition of the drumlin.

Shallow bedrock was indicated on the west side of the hill, low on the slope in the proposed west parking tier area, where shale was encountered at about ten feet depth; borings farther up the hill were drilled to depths of 29 to 54 feet without encountering rock. From personal observation during construction of the FedEx Ground site immediately to the north, there was no shallow bedrock in the east slope of the hill where it is indicated by the Soil Survey map.

Approximate location of the project site, shown on part of the Bedrock Geologic Map of New York (1970.) The site is in the middle of a wide belt of Ordovician-age sedimentary bedrock consisting mostly of gray siltstone, shale and greywacke sandstone. The bedrock at the site is shown as Normanskill Formation (yellow with red stripes, symbol On,) which is the oldest member of this Ordovician sequence, with the Austin Glen Formation (yellow with red stipple) overlying it, which in turn lies below the Quassaic quartzite. These units form the bedrock of most of the Wallkill River valley. Older Ordovician carbonate rocks, the Wappinger Dolostone (symbol Ow) and the Balmville Limestone (Oba) outcrop about a mile south of the site, on the opposite side of the railroad; that bedrock was faulted into place and overlies the shale.



Approximate location of the project site, shown on a partial copy of the Surficial Geologic Map of New York (N.Y. State Museum, 1989.) The map indicates that the site is in an area of lacustrine silt and clay deposits (brown symbol 'lsc') associated with a recessional glacial moraine crossing the Wallkill Valley. Nearby soils include till (pink,) outwash sand and gravel (yellow) and kames (orange.) Kames form where sand and gravel are deposited on or against stagnant, melting ice. Shallow bedrock is indicated with a red stipple pattern and exposed rock is shown in red with the symbol 'r.'

EXPLANATION

al — Recent deposits
Generally confined to floodplains within a valley,
oxidized, non-calcareous, fine sand to gravel,
in larger valleys may be overlain by silt,
subject to frequent flooding, thickness 1-10 meters.

alf — Alluvial fan
Fan shaped accumulations,
poorly stratified silt, sand and boulders,
at the foot of steep slopes,
generally permeable.

b — Beach
Sand and gravel deposit at marine shoreline,
thickness variable.

bi — Barrier island
Sand and gravel deposit as barrier island,
south shore of Long Island,
may have associated dunes,
thickness variable.

pm — Swamp deposits
Peat-muck, organic silt and sand in poorly drained areas,
un-oxidized,
may be overlying marl and lake silts,
potential land instability,
thickness generally 2-20 meters.

ld — Lacustrine delta
Coarse to fine gravel and sand,
stratified, generally well sorted,
deposited at a lake shoreline,
thickness variable (3-15 meters).

lsc — Lacustrine silt and clay
Generally laminated silt and clay,
deposited in proglacial lakes,
generally calcareous,
potential land instability,
thickness variable (up to 100 meters).

ls — Lacustrine sand
Sand deposits associated with large bodies of water,
generally a near-shore deposit or near a sand source,
well sorted, stratified,
generally quartz sand,
thickness variable (2-20 meters).

og — Outwash sand and gravel
Coarse to fine gravel with sand,
proglacial fluvial deposition,
well rounded and stratified,
generally finer texture away from ice border,
thickness variable (2-20 meters).

fg — Fluvial sand and gravel
Deposits of sand and gravel,
occasional laterally continuous lenses of silt,
deposition farther from glacier,
age uncertain.

k — Kame deposits
Includes kames, eskers, kame terraces, kame deltas,
coarse to fine gravel and/or sand,
deposition adjacent to ice,
lateral variability in sorting, coarseness and thickness,
locally firmly cemented with calcareous cement,
thickness variable (10-30 meters).

km — Kame moraine
Variable texture (size and sorting) from boulders to sand,
deposition at an ice margin during deglaciation,
positive constructional relief,
locally cemented with calcareous cement,
thickness variable (10-30 meters).

tm — Till moraine
More variably sorted than till,
generally more permeable than till,
deposition adjacent to ice,
more variably drained,
may include ablation till,
thickness variable (10-30 meters).

t — Till
Variable texture (e.g. clay, silt-clay, boulder clay),
usually poorly sorted diamict,
deposition beneath glacier ice,
relatively impermeable (loamy matrix),
variable clast content — ranging from abundant well-rounded
diverse lithologies in valley tills to relatively
angular, more limited lithologies in upland tills,
tends to be sandy in areas underlain by gneiss or sandstone,
potential land instability on steep slopes,
thickness variable (1-50 meters).

af — Artificial fill

r — Bedrock
Exposed or generally within 1 meter of surface.

Bedrock stipple overprint
Bedrock may be within 1-3 meters of surface,
may sporadically crop out,
variable mantle of rock debris and glacial till.

MAP SYMBOLS

Contact

.3 Dated radiocarbon locality

MAP KEY
NEW YORK STATE SURFICIAL GEOLOGIC MAP

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2. SOIL INVESTIGATION AND TEST RESULTS

A total of twenty-three soil borings were drilled in and near the proposed building areas, six on February 17-18, 2021, during the initial investigation, an additional fourteen between November 11 and 17, 2022, and three more in the proposed northwest parking area on January 23-25, 2023. Borings were drilled by the hollow-stem auger method, using track-mounted drill rigs. Drilling was performed by General Borings, Inc. of Prospect, Connecticut. The initial subsurface investigation was supervised and witnessed by Wyeth Patton, with the second and third phases inspected by Warren Patton, each under the direction of Kevin Patton, P.E. Soil sampling and testing were performed by the Standard Penetration Test (SPT,) using an Automatic Hammer during the second phase and a Safety Hammer on a cable with a free-spooling drum for the initial phase, in accordance with ASTM D1586 (Standard Method for Penetration Test and Split-Barrel Sampling of Soils.) The SPT provides the Blow Count "N" Value, equal to the number of blows of the 140-pound steel hammer that were required to drive the 2-inch outside diameter split-spoon sampling tube into the soil, over a twelve-inch increment.

Soil samples are also recovered by the Standard Penetration Test, and additional tests were performed in the field and lab, as noted on the soil boring logs, using a hand penetrometer to test bearing capacity. Soil type and moisture condition must be considered when interpreting the hand penetrometer test results. Strong cohesive soils tend to have high SPT blow counts and high hand penetrometer tests results, and weak soils tend to have low blow counts and low penetrometer results; dense soils that are sensitive to disturbance, such as wet silt, may have high blow counts but low penetrometer results. This test can only be performed on relatively undisturbed samples containing little or no gravel.

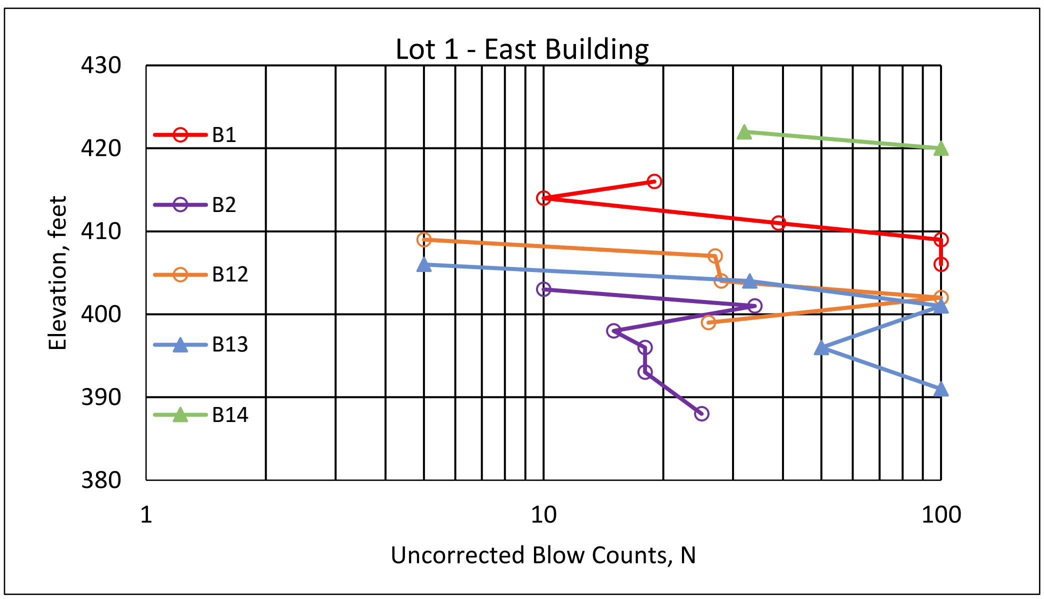
Test pits were also excavated at the site, primarily for the evaluation of the proposed stormwater control areas. Stormwater infiltration tests were performed where applicable, per the methods described in NYSDEC Stormwater Design Manual Appendix D. Test pits were excavated to just above the proposed test depths, with the last six to twelve inches dug by hand. Standpipes were seated in the holes, with bentonite clay placed around the perimeter to make a seal, and the pipes were carefully backfilled. They were then pre-soaked and tested on the following day. Each test measured the drop in water level within the test pipe, from an initial level of 24 inches above the pipe bottom. Groundwater depth measurements were also made at locations near each of the infiltration tests. Standpipes fitted with slotted well points were installed in test pits and the water depth was measured after allowing it to stabilize; when practical, up to three measurements were made on different days. The groundwater depth determinations were all made during the wet season and are believed to be at or close to the seasonal high water levels for the soil.

Laboratory testing was performed on representative soil samples, for moisture content, particle size distribution and Atterberg Limits. An unconfined compressive strength (UCS) test with strain measurements was also performed in the laboratory on a sample of the deep, hard till. Soil strengths measured with the UCS test are usually on par with those from hand penetrometer tests. USCS classifications of the soil, per ASTM D2487 and D2488, are provided on the logs and on the subsurface profile drawings.

2.1. Soil Boring Blow Count and Laboratory Data

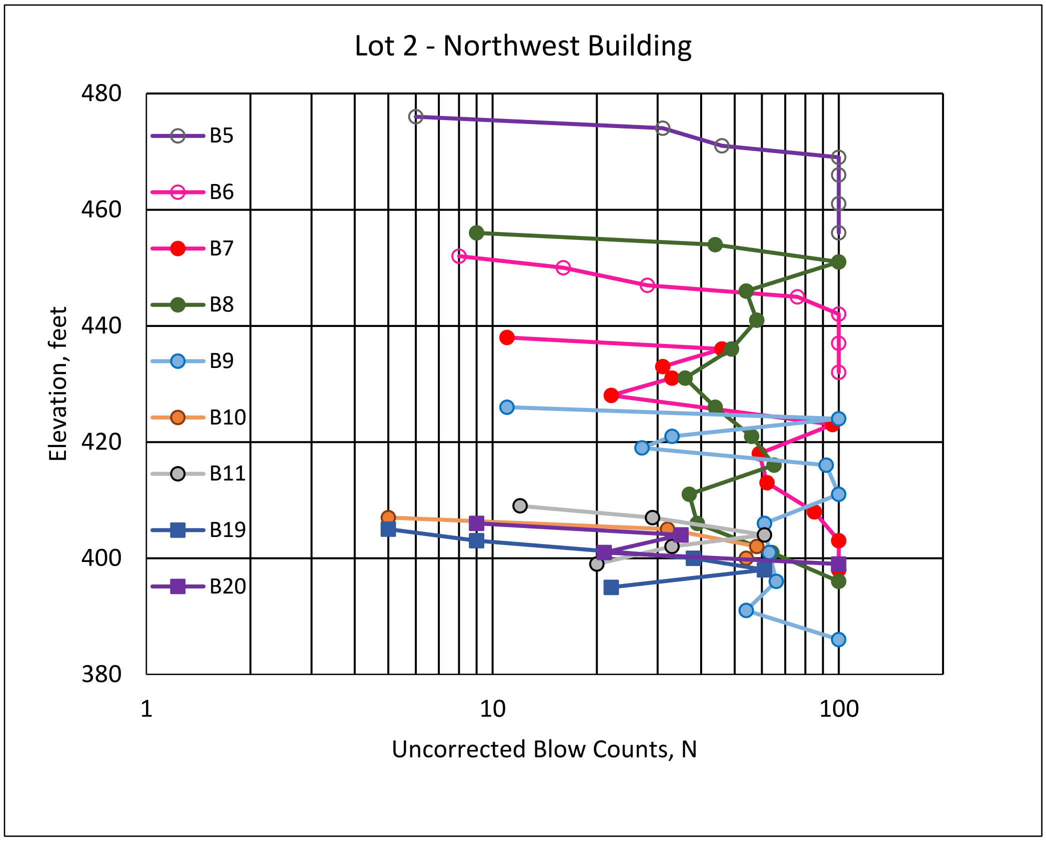
Field Blow Count Values, N **Lot 1 - East Building**					
	B1	B2	B12	B13	B14
Elevation:	417	404	410	407	423
Depth, ft.: 1	19	10	5	5	32
3	10	34	27	33	50/2″
6	39	15	28	68/9″	
8	50/0″	18	50/2″		
11	50/2″	18	26	50	
16		25		50/1″	
Auger Refusal, ft	11.0	-		15.0	5.0

Natural Moisture Content, Percent			
Depth, feet	B1	B2	B12
1	15.2	21.6	17.0
3	22.8	14.8	9.4
6	12.5	20.5	6.8
8	14.4	12.5	12.1
10			8.3
11		13.8	14.0



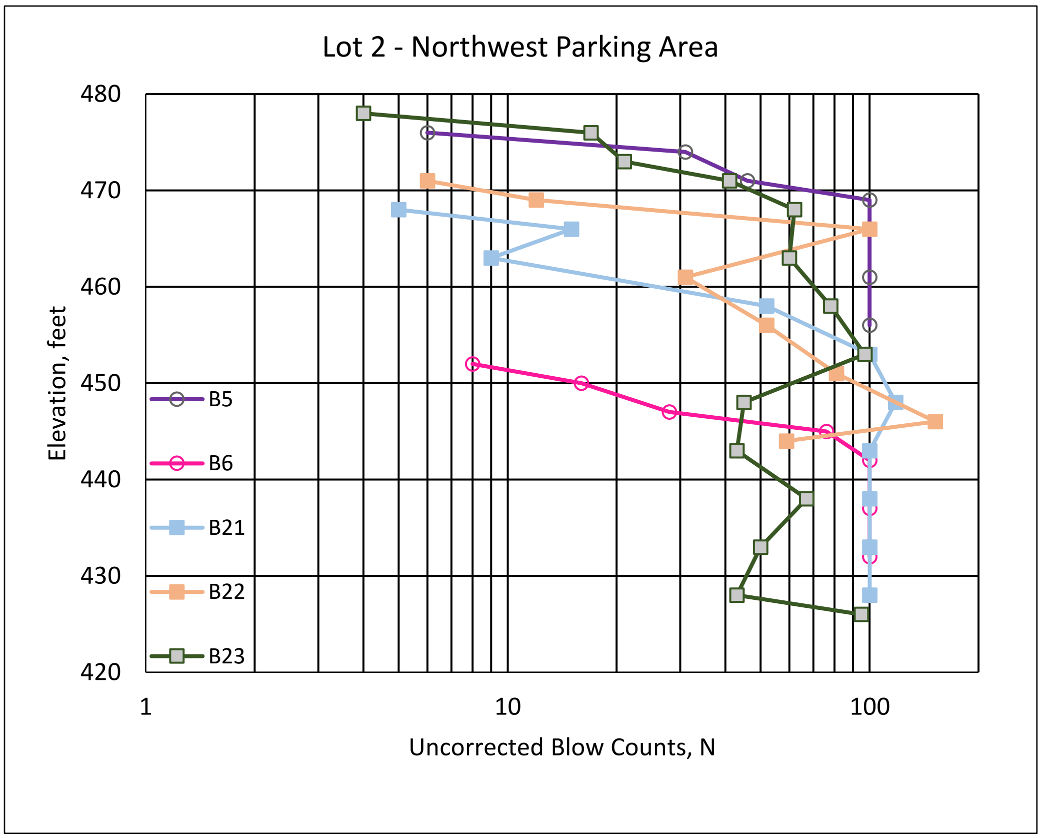
Field Blow Count Values, N Lot 2 - Northwest Building									
	B5	B6	B7	B8	B9	B10	B11	B19	B20
Elevation:	477	453	439	457	427	408	410	406	407
Depth, ft.: 1	6	8	11	9	11	5	12	5	9
3	31	16	46	44	87/8″	32	29	9	35
6	46	28	31	69/9″	33	58	61	38	21
8	86/8″	76	33	-	27	54	33	61	72/8″
11	50/5″	50/3″	22	54	92		20	22	
16	50/5″	50/4″	96	58	112/9″				
21	50/2″	112/7″	59	49	61				
26			62	36	63				
31			85	44	66				
36			91/10″	56	54				
41			89/9″	65	60/3″				
46				37					
51				39					
56				64					
61				50/1″					
Auger Refusal, ft	23.0	19.1				9.5			

Natural Moisture Content, Percent						
Depth, feet	B5	B6	B8	B9	B11	B19
1	32.2	17.0	7.9	15.9	8.6	12.7
3	14.4	16.6	5.7	5.8	5.5	7.6
6				8.3		5.7
8	22.1	9.7			9.5	6.6
11			9.5	8.7		9.6
16	13.9	9.8	6.4			
21				5.9		
26				11.3		
31				11.1		
36			9.5	9.6		
41			11.2	6.9		
46			24.3			
51			22.7			
52			11.1			



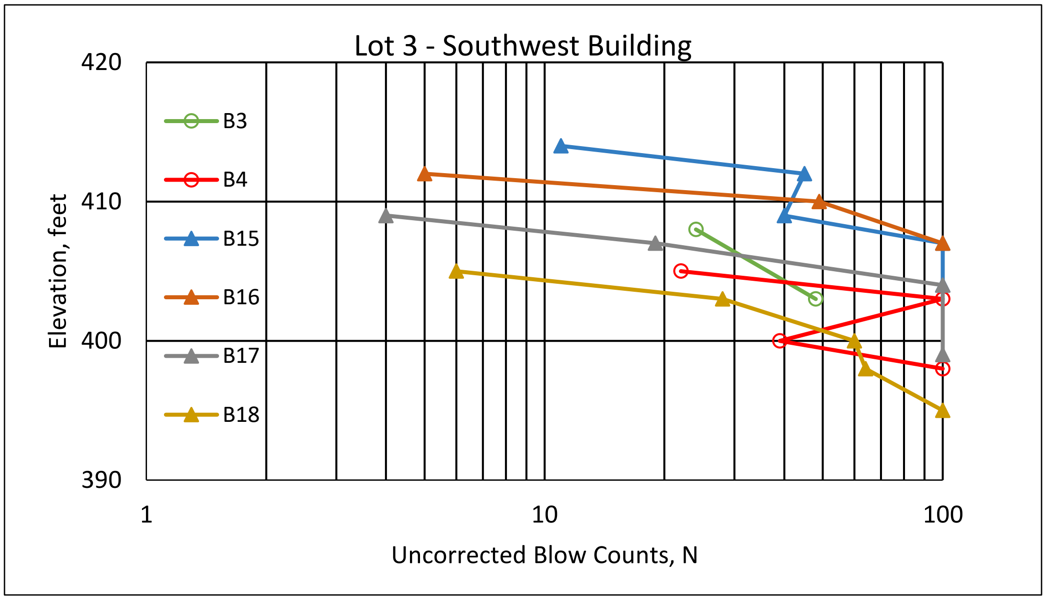
Field Blow Count Values, N Lot 2 - Northwest Parking Area			
	B21	B22	B23
Elev.:	469	472	479
Depth, ft.: 1	5	6	4
3	15	12	17
6	9	50/1"	21
8			41
11	52	31	62
16	94/10"	52	60
21	118	81	78
26	50/2"	152	97
28		59	
31	60/4"		45
36	55/5"		43
41	99/9"		67
46			50
51			43
53			95

Natural Moisture Content, Percent			
Depth, feet	B21	B22	B23
1	8.3		14.7
3	10.6	13.6	12.8
6	12.3		32.3
8			10.2
11	9.5	10.5	9.1
16	7.8		6.1
21	7.1		8.7
26	6.9	6.7	7.0
28		8.1	9.1
41	4.7		
46			10.3
51			9.9
53			9.0



Field Blow Count Values, N Lot 3 - Southwest Building						
	B3	B4	B15	B16	B17	B18
Elev.:	409	406	415	413	410	406
Depth, ft.: 1	24	22	11	5	4	6
3	--	98/9″	45	49	19	28
6	48	39	40	75/7″	50/4″	60
8		88/11″	50/2″			64
11			50/2″		50/1″	50/1″
Auger Refusal, ft	9.0	10.0		8.0		

Natural Moisture Content, Percent			
Depth, feet	B3	B4	B18
1		16.7	9.4
3		6.9	4.3
6	13.7	12.0	3.5
8		10.0	4.4



SOIL TEXTURE			
Particle Size Analysis			
Sample		B6-S3	B6-S7
Depth		6 feet	19 feet
SPT N Value		28	112/7″
Type		Brown Till	Gray Till
USCS Class		CL-ML	CL-ML
Sieve Size	mm	Percent Passing by Weight	
¾″	19.0	100	100
#4	4.75	82	99
#10	2.00	75	97
#40	0.425	66	93
#200	0.075	52	88
Hydrometer	0.050	48	84
	0.005	19	43
	0.002	9	16
Atterberg Limits			
Liquid Limit		21	22
Plastic Limit		16	17
Plasticity Index		5	5

SOIL TEXTURE					
Particle Size Analysis					
Sample		B7-S4	B8-S3	B8-S7	B9-S4
Depth		8 feet	6 feet	26 feet	8 feet
SPT N Value		33	69/9″	36	27
Type		Brown Till	Brown Till	Gray Till	Sandy Clay
USCS Class		ML	SM	CL	CL
Sieve Size	mm	Percent Passing by Weight			
¾″	19.0	100	100	100	100
#4	4.75	91	84	96	100
#10	2.00	85	76	86	98
#40	0.425	75	65	76	94
#200	0.075	58	49	64	83
Hydrometer	0.050	56	46	62	77
	0.005	26	20	41	26
	0.002	17	14	31	12
Atterberg Limits					
Liquid Limit		-	-	27	25
Plastic Limit		-	-	14	17
Plasticity Index		Not Tested	Not Tested	13	8

Soil Density, Strength and Elasticity	
Sample	B8-S10
Depth	41 feet
Type	Gray Clay Till
SPT Blow Counts	65
Moist Density, pcf	144
Dry Density, pcf	130
Percent Moisture	11.2
Peak Strength, psf	14,380
Test Modulus, psi per inch	1860

The Standard Penetration Test results (blow counts) close to the surface varied considerably; in the upper five feet of the soil profile, most of the SPT results indicated medium-dense to dense conditions, but about a third of the results indicated loose or soft soils, associated with the topsoil, subsoil and frost-affected zone. At depths greater than five feet all but one of the SPT tests had blow counts of fifteen or greater, indicating soils that were at least medium-dense/stiff (blow counts of ten to thirty,) with the majority of the tests indicating dense/very stiff (N=30 to 50) or very dense/hard soils (N=50 or greater.) The one lower test result was at six feet depth in boring B21, the proposed northwest parking area, with N=9 in wet, stiff clayey till. At depths greater than twenty feet, the minimum recorded blow count value was thirty-six, and the majority of the SPT values were greater than fifty. Boring B2 was the only location that did not follow the general trend. This boring was drilled approximately 250 feet west from the southwest corner of the proposed east building, close to the wetland area, and encountered wet medium-dense sandy soils from five feet depth to the end of the boring at fourteen feet.

Moisture content tests were performed on samples from a representative group of the soil borings, to determine the typical soil moisture profile. Most of the test results were normal for densely-consolidated inorganic soils. Test results were somewhat low (about four percent moisture) for the samples from boring B18 at depths of three to six feet; this material was weathered shale with minor veins of soil. The samples from boring B8 at 46 and 51 feet depth had higher moisture contents (24% and 23%) than the soils above and below (10% to 11%,) which corresponds to a change in soil type; dense gray glaciolacustrine clay was present at approximately 44 to 51 feet, with dense to very dense gray clay till above it and below it. At boring B23, in the proposed northwest parking area, the sample from six feet depth had a moisture content of 32.3%; this was in wet silty clay which had a good blow count value (N=21) but the recovered sample was soft, indicating somewhat loosely-consolidated clay with a very stiff in-situ condition, sensitive to disturbance.

The particle size analyses and Atterberg Limits tests were performed on representative soil samples of the glacial till and related soil types from the borings, primarily those most likely to be used as fill, or that will support foundations, and/or that may be retained or sloped for a deep cut in the northwest hill. Note that the split-spoon sampling method which was used to collect the samples excludes particles that are medium gravel-size or larger. The gravel fraction may be under-represented; cobbles and boulders are also present in some of the soils but are not represented by the tests. The samples were predominately fine-grained; while sample B8-S3 was classified as 'SM, Silty Sand with Gravel,' it had 49 percent passing the #200 sieve, and if that number had been fifty percent it would have been 'ML, Sandy Silt.' The six samples had silt and clay contents (minus-#200) of 49 to 88 percent, averaging 66 percent, and had gravel contents of zero to eighteen percent, averaging eight percent. The Atterberg Limits tests indicated that the fine fraction of the more clayey soils consists of silty clay and low-plasticity lean clay; these soils typically have a narrow range of moisture contents at which they can be efficiently compacted, and tend to be resistant to detrimental shrink-swell behavior.

The unconfined compressive strength test gave results with the typical characteristics of the local over-consolidated glacial till; its moist and dry density values are very high for natural soils, its moisture content was low for a predominately clayey soil, and its peak strength was high. The test modulus value is similar to the subgrade modulus of the in-situ soil, and is also very high, indicating that very little deflection will occur under load. The properties of this soil change significantly when it is disturbed or when it is compacted as fill, and it can become very soft if subjected to vehicle traffic while in a wet or very moist condition.

2.2. Subsurface Profile and Summary of Soil Conditions

Subsurface conditions encountered in the borings are described in the boring logs, are summarized in the drawings attached to this report, and are discussed below.

LOT 1, EAST BUILDING

The top of weathered shale bedrock was encountered at depths of two feet to ten feet in this area. The shallowest location was at boring B13, where the auger was advanced through weathered rock from two feet to fifteen feet depth before meeting refusal on harder rock. Boring B14 was drilled on the knob at the northeast corner of the proposed building, and encountered probable bedrock at five feet depth, roughly elevation 418. The top of weathered rock was at elevation 405 or lower in the other borings. Boring B2 was drilled approximately 250 feet west from the southwest corner of the proposed building, and stopped at fourteen feet depth without encountering bedrock. Shallow bedrock was encountered only near Neelytown Road at the adjacent FedEx Ground site.

The soils in the east building area consisted of mostly of layered silty sand, sand, silty clayey sand and silty gravelly sand, with sandy silt and sandy silty clay near the surface. The upper 1.5 to 3.5 feet of the soils was generally loose, changing to medium-dense, then to dense or very dense conditions in the underlying weathered shale bedrock. Very moist to wet conditions were encountered below depths of four to five feet in the building area, except at boring B12, where very moist conditions began at the surface, changing to wet soils at seven feet depth.

LOT 2, NORTHWEST BUILDING

The borings in the low part of the proposed building area (borings B10, B11, B19 and B20) encountered about two feet of loose sandy silt, or sand and silt, over medium-dense to very dense silty sand and gravel, gravelly silty sand, gravelly sand, sandy silty clayey gravel, and similar soils. In boring B19 the loose soils extended to about three feet depth. In boring B10 the top of weathered shale bedrock was encountered at seven feet depth, approximately elevation 401, and it was deeper in the other borings.

Five borings were drilled on the hill in the northwest part of the site. The first two, B5 and B6, were drilled during the first phase of the investigation, and were about 150 feet north and 300 feet northwest from the proposed northwest building corner, near the top of the hill and near the top of its steep western face. These borings met refusal at relatively high elevations in the hill, with B5 stopping at 23 feet depth and B6 at nineteen feet, elevations of approximately 454 and 434 feet. Borings B7, B8 and B9 were drilled on the hill, with B7 and B8 located high on the hill, and B9 toward the bottom of the hill. Boring B9 encountered medium-dense to very dense silt to about seven feet depth, elevation 420, then a two-foot layer of medium-dense/very stiff clay, over very dense silty to clayey till, with weathered shale encountered at forty feet depth, elevation 387. Borings B7 and B8 encountered variable (USCS classes ML, CL-ML, SM,) medium-dense to very dense layered till in the upper eight to sixteen feet, then dense to very dense clay till, USCS class CL, extending from approximately elevation 421 to 398 feet (end-of-hole) in boring B7 and from about 449 feet to EOH at 397 feet in B8. There was a layer of dense glacial lake clay in boring B8 between elevations of approximately 414 and 407. No sand layers were encountered, but it is typical for this type of deposit to have occasional veins or lenses of sand or silt in the dense till; these are usually a source of water seepage, sometimes drying up after they have drained, and sometimes developing into springs or seeps on the face of the cut.

NORTHWEST PARKING AREA

Borings B21, B22 and B23 were drilled in the proposed northwest parking area, and borings B5 and B6, discussed above, were drilled just to the south. Boring B23, toward the southeast end of the lot, encountered about seven feet of loose to medium-dense clay and silty clay over very dense till, mostly sandy clay and clayey sand, with some sandy silty clay and sandy silt. Boring B21, near the center of the lot, encountered about nine feet of loose to medium-dense sandy silty clay and silty clayey sand, over very dense till similar to boring B23, but with silty sand included and sandy silt more abundant. Boring B22, in the north-center part of the proposed parking area, encountered about four feet of loose to medium-dense silty clay and sandy clay, over medium-dense to very dense till, consisting of sandy clay and gravelly clayey sand. The upper zone of looser soils was generally wet, with the underlying very dense till in a moist condition. In boring B22 the wet zone extended to about 21 feet depth, and in boring B23 a deeper wet zone was encountered below 36 feet depth.

Supplemental data from the test pits indicated the presence of shale bedrock at approximately ten feet depth in the west tier of the proposed parking area. Weathered shale was present at approximately elevation 410 in test pit P41, in the south part of the west tier, and at about 425 feet in test pit P43, to the north of center in the west tier, respectively about ten feet and five feet below proposed finished grade. These elevations are fairly consistent with those on the other side of the hill, where the top of weathered bedrock was encountered at elevations of 388 to 413 feet.

LOT 3, SOUTHWEST BUILDING

In the middle to north portions of the proposed building, there was typically about two feet of loose sandy silt at the surface, sometimes over medium-dense sand and silty sand, with the top of weathered shale bedrock at depths of two to four feet (elevations of ±402 to 413 feet.) In the south part of the building area, boring B16 encountered two feet of loose silt over six feet of dense silt and sandy silt, with the top of rock indicated at about eight feet depth, elevation 405. The soils were mostly in a moist condition, with very moist soil at the surface in boring B15. The soils were wet at borings B3 and B4, near the north end of the proposed building, and at boring B15, near the south end, and were moist at the other locations.

2.3. Stormwater Control Areas

LOT 1, EAST BUILDING

Shallow groundwater and shallow bedrock were encountered in most of the proposed stormwater control areas on Lot 1. In the potential surface control areas on the east side of the building groundwater was at 15 to 28 inches below the surface. In the proposed surface control area west from the north end of the building groundwater was at 29 inches depth; the infiltration rate was 14.5 inches per hour, but was tested at greater depth. In the area of proposed surface controls to the southwest of the building, groundwater was at nine inches to forty inches depth, and infiltration rates were zero and 3.25 inches per hour at about 3.5 to four feet depth. At the proposed subsurface control system along the west side of the building, the groundwater depth ranged from about 22 to 39 inches, and the infiltration rates were 18.75 to 24 inches per hour at depths of about two to four feet.

Table 1. Lot 1, East Side			
SWPPP Unit	Bioretention 6	Basin 8	Basin 5
Location	North	Middle	South
Exist. Grade	415-421	412-414	410-412
Groundwater Elev.	415.4	411.8	408.2
Groundwater Depth	19.5 in	15 in	28 in
Bedrock Elev.	406	408.0	400
Perc Rate	-	-	-
Tests	B1	P24	P25, B12
Notes	Shallow groundwater	Shallow groundwater	Appears to be suitable.

Table 2. Lot 1, West Side				
SWPPP Unit	Bioretention 7	Basin 7	Bioretention 4	Basin 6
Location	NW	W side of Bldg.	SW corner	SW corner - far
Exist. Grade	406-412	404-411	404-405	404
Groundwater Elev.	<404.75	404.6, 402.7, 404.8, 405.1	403.1, 400.7	402.8, 400.7
Groundwater Depth	29 in	22.5, 33.0, 38.75, 36.25 in, S to N	11.75 in	9 in, 39.5 in
Bedrock Elev.	-	-	-	-
Perc Rate	14.5”/hr	24, 24, 18.75”/hr	3.25”/hr	⅛”/hr
Tests	P29	P49, P50, P51, P53	P18, B2	P21, B2
Notes	Appears suitable	Some shallow groundwater.	Shallow groundwater.	Some shallow GW, no perc

Seasonal High Groundwater Elevation
The seasonal high groundwater level in the potential Lot 1 East Side stormwater control areas is 15 to 28 inches below existing grade, deepest toward the south end. In the Lot 1 West Side areas, the proposed Bioretention 4 and Basin 6 areas are almost surrounded by wetlands, and the high groundwater level is nine to twelve inches below grade. At proposed Basin 7, along the west side of the proposed building, the depth is 36 inches at the north end, decreasing steadily to 22 inches at the south end. In proposed Bioretention Area 7, the high groundwater level is at 29 inches below grade; it may be deeper toward the south end, based on the results for the adjacent practice on Lot 2.
The groundwater measurements throughout the project area were made during the wet season; the Soil Survey indicates that groundwater is typically shallowest in the local soils during the December

through April period, and all of the measurements were taken in February, March and early April. The measurements during the initial investigation were taken after allowing thirteen days for the groundwater level to stabilize, and during the later phases of the investigation long times were allowed for water level stabilization, and repeat measurements were taken several days or weeks apart, with the shallowest level reported. These values are believed to be at or close to the seasonal high groundwater level for the various parts of the site.

LOT 2 – NORTHWEST BUILDING

Surface stormwater controls are proposed near the northeast corner of the building and in the northwest parking lot. In the northeast area groundwater was at 76 and 78 inches in test pits close to the proposed building and was at twenty inches in a test pit farther east. No infiltration tests were performed in this area, but moderate to fast rates are expected here. At the proposed subsurface system along the south side of the building, groundwater was at depths of nine inches to more than 54 inches, and infiltration rates were 7.75 to 21 inches per minute at depths of 19 to 22 inches. In the northwest parking area, surface stormwater controls are proposed near the south end. Most of this area is a deep cut, and very dense clayey soils are expected at the elevation of the proposed controls.

Table 3. Lot 2					
SWPPP Unit	Basin 9	Bioretention 8	Bioretention 9	Basin 5(b)	Basin 10A-10B
Location	NE -far	NE - close	N side east	South side	West side
Exist. Grade	406-412	408-412	411-426	404-408	423-466
GW Elevation	405.8	403.6, 405.0	411.1, 410.3	<401.5 - 403.9	-
GW Depth	20 in	76, 78 in	11, 39 in	17.5, >54, 9.0, 29.25 in	-
Bedrock Elev.	-	-	-	-	388
Perc Rate	-	-	-	7.75 to 21”hr, avg. 16.6”/hr	-
Tests	P30	P33, P34	P35, P36	P15, P15B, P16B, P17B	B8, B9 (offset)
Notes	Shallow GW	Appears to be suitable	Some shallow groundwater.	Some shallow groundwater.	Clay till, very dense.

Table 4. Lot 2 NW Parking				
SWPPP Unit	Bioretention 10	Bioretention 11	Basin 11A-B-C-D	Basin 12A-B-C-D
Location	SE	SW	NE	NW
Exist. Grade	456-487	421-454	450-482	407-450
GW Elevation	-	<423	<427, <443	411.0, 430.6
GW Depth	-	>10 ft	-	10 ft, 4.4 ft
Bedrock Elev.	<425	-	-	410, 425
Perc Rate	-	-	-	-
Tests	B23	P40	B21, B22	P41, P43
Notes	Clay till, dense.	Short test pit.	Clayey till, very dense.	Shallow GW, Shallow bedrock

Seasonal High Groundwater Elevation
In the area near the proposed Lot 2 building, the high groundwater level in the potential stormwater

control areas is 20 inches in Basin 9 and 76 inches in Bioretention 8. In the potential Bioretention 9 area, the high groundwater level was at 11 inches below grade, becoming deeper to the west as the surface elevation increases; it as thirty-nine inches in the middle of this area, and is probably at three to four feet depth in the west end. In the proposed Basin 5 area along the proposed building's south side, the seasonal high groundwater depth is affected by the surface topography, with deeper groundwater under the higher, better-drained locations; its typical depth in 29 inches, but it becomes shallow (9 inches) in the center part of the proposed practice. The potential Basin 10A-10B area is in a deep cut and clay soils are indicated; moist soil conditions were indicated in the two adjacent borings.

In the proposed northwest parking area the soil borings indicated perched water at the surface; the soils were in a moist, drained condition at the bottom of the proposed deep cut in borings B21 and B22, but were very moist to wet in boring B23. Test pits on the west side of this area encountered groundwater at 4.4 and 10 feet depth, over relatively shallow bedrock, which was encountered in the hill only on its west side near Beaverdam Road. The seasonal high groundwater depth in this area appears to be two to four feet, in a perched water table.

LOT 3 – SOUTHWEST BUILDING

Surface stormwater controls are proposed at the north end of the building on Lot 3. A triangular basin is proposed, which will be built up above the existing grades, and another linear control will be constructed along the north side of that basin; groundwater was at 78 inches and 68+ inches in the area of the linear feature, and infiltration rates there were eight and thirteen inches per hour. Additional surface controls are proposed between the building and the wetland to the east; groundwater was about eight to 25 inches below grade there, and infiltration rates were about 19 to 24 inches per hour at depths of 9.5 and 24 inches. Subsurface control practices are proposed to the east and south of the building. At the south end, groundwater was about 22 to 46 inches below grade and the infiltration rates were 12 and 24 inches per hour at depths of 27 and 16 inches. In the proposed subsurface control area along the east side of the building, groundwater was 48 to 85+ inches deep and the infiltration rate was 14 to 20 inches per hour at depths of 19 to 39 inches.

Table 5. Lot 3 East			
SWPPP Unit	Basin 2	Bioretention 2	Basin 3
Location	East - far	East - Middle	East side of Bldg.
Exist. Grade	403-406	405-410	406-410
GW Elevation	403.7	410.1, 405.0, 403.8	400.7, 402.5, <405.5, <402.4, 406.0
GW Depth	9 in	25.4”, 7.75”, 38”	75.75, >48, 48, >85 in
Bedrock Elev.	-	-	-
Perc Rate	-	19.25”/hr	18.5, 20”/hr (south)
Tests	P7	P9, P11, B4	P44, P45, P46, P47, P48, B17
Notes	Shallow groundwater	Some shallow groundwater	Appears suitable.

Table 6. Lot 3 North & South Ends				
SWPPP Unit	Bioretention 3	Basin 4	Basin 1	Bioretention 1
Location	North	N. triangle	South	S. end
Exist. Grade	401-411	398-417	408	406
GW Elev.	404.5	-	405.6	402.1
GW Depth	39.5, 78, >68 in	-	22.25 in	46.25
Bedrock Elev.	405-406 weathered	-	398	-
Perc Rate	-	-	24”/hr	12”/hr
Tests	P12-1, P12-2, B3	Same as Bioretention 3	P1	P4
Notes	Somewhat shallow bedrock	No tests – near dwelling	Shallow groundwater	Appears suitable.

Seasonal High Groundwater Elevation
In the proposed Basin 2 area along the wetland, the seasonal high groundwater level is at 9 inches below grade. In the Bioretention 2 area the high groundwater level is at 8 inches depth in the low north part of the proposed practice and 24 inches in the higher south end. In proposed Basin 3 the high water level is 48 inches below grade. In the proposed Bioretention Area 3 the seasonal high groundwater level is at 39 inches depth, in Basin 1 it is 22 inches and in Bioretention Area 1 it is at 46 inches. The Basin 4 area was not investigated due to the current site use; this location is downgrade from the adjacent parts of the site and the seasonal high groundwater level is probably within two feet of the surface.

3. EVALUATION

3.1. Subgrade Preparation

The conditions encountered in the investigation were evaluated for their impacts on construction methods, structural-geotechnical design, and long-term performance. The evaluation indicates that the subgrade conditions throughout the proposed building areas are suitable for the use of shallow spread footing foundations and slabs-on-grade, subject to performing the required subgrade preparation operations, as described below. Site conditions are generally expected to be favorable for retaining wall construction, however the loads on the retaining walls will be very high where the walls retain high cuts in the native, predominately clayey soils. In regards to stormwater control, significant portions of the site do not appear to be well-suited for the use of infiltration practices; in many areas the soils are excessively fine-grained, and where granular soils are present groundwater tends to be shallow. Some of the proposed stormwater control areas have not yet been investigated. Additional borings and/or test pits, and appropriate field tests, are required to assess both the proposed stormwater control areas and the proposed retaining wall locations.

ALL AREAS

Remove all existing pavement, topsoil, soft subsoil, stumps and large roots from the subgrade surface, in all building and wall foundation areas. In stormwater control areas, soft soils may be left in place, provided they are compatible with subsequent construction. Remove existing slabs and foundations in their entirety from below new foundation areas, and to at least twenty-four inches below bottom-of-slab in slab-on-grade areas, and as needed to prevent interference with the new construction. Remove uncontrolled fill in its entirety from below new foundation areas and from below slab-on-grade areas unless otherwise approved by the Engineer.

Excavate to the design subgrade elevation, or deeper if required to reach suitable subgrade soils, which shall be undisturbed native soils, free from topsoil, fine organics and root masses. The subgrade shall have a stiff/ medium-dense or harder consistency (except in stormwater infiltration areas); some surface drainage improvement and dewatering or draining of the excavations may be required to develop and maintain acceptable subgrade conditions and to minimize over-excavation.

Trim to the required subgrade elevation using excavation methods that minimize disturbance of the final soil surface. The subgrade shall not be compacted below stormwater infiltration practices; in other areas, compact the surface as needed to consolidate any soil that was loosened during excavation. Remove any pockets or small zones of unsuitable materials that are encountered, and replace them with controlled compacted fill. Contact the Engineer prior to performing any significant extra excavation. Where old foundations, stumps or boulders are removed, or where other over-excavation work is performed to prepare subgrade areas, the sides of the excavation shall be trimmed back to stable soil as each lift is placed; as the backfill is compacted, extra care shall be taken to ensure thorough compaction where the edges of each lift meet the sides of the excavation. Where deficient soil is removed from below footing locations, the remediated area shall extend at least one foot out from the footing per foot of depth (1 to 1 splay.)

Where bedrock is present and excavation is performed by ripping, hammering and/or blasting, remove the rock to an approximately level and uniform elevation, with a slope of ten percent or less in areas below footings. If the rock subgrade surface has open fractures, level and seat the surface by tracking back-and-forth over it with a bulldozer or excavator, or spade it with the excavator bucket in tight areas, then compact the surface with several passes of a vibratory trench roller or a single-drum soil roller. A layer up to four inches thick of Structural Fill or ¾-inch to 1½-inch crushed stone may be placed over the rock surface to facilitate compaction. Remove loose rock from vertical steps in the foundation.

Footings may bear directly on the prepared soil or rock subgrade, or on controlled compacted fill placed over the subgrade. For typical bearing conditions on rock, a layer of compacted granular site-borrow soil or Structural Fill six to twelve inches thick is recommended between the bottoms of the footings and the top of bedrock, to reduce the effects of the varying bearing conditions between bedrock and soil, and to facilitate the setting of forms. Highly weathered and decomposed shale is equivalent to very dense soil, and this cushion layer may be omitted. Where fine-grained native soil is present at the bearing elevation, a layer up to four inches thick of Structural Fill or equivalent site-borrow soil may be placed in the footing bottom to protect the soil surface, after properly preparing the surface to a level and stable condition. This layer shall be thoroughly compacted with a vibratory plate tamper or roller, and its surface shall not extend above the design bearing elevation. Footing bearing surfaces shall be free from frost, mud and loose soil or standing water, when concrete is placed. Rock surfaces should be thoroughly moistened prior to placing concrete.

EAST BUILDING

There will be about four feet to ten feet of fill (from existing grade to top of slab) in most of this building area, becoming steadily deeper toward the south end. The exception is the northeast corner, where a knob rises to about elevation 425, nine feet above the proposed slab elevation, and where boring B14 encountered dense silty gravel and sand to the top of shale bedrock, indicated at elevation 418. Some rock excavation will be required in this area, while in the rest of the building area is expected to require excavation to about two feet depth to remove wet and soft materials prior to placing fill. Excavation by ripping and hammering should be sufficient to remove the rock to the required depth, without blasting. There is a silo and some other minor concrete ruins to be removed on the west side of the building area.

SOUTHWEST BUILDING

This building will also be on fill, about four to six feet thick in the middle, and ten to fourteen feet in most of the remaining area, with the deepest sections at the north end and in the southeast quarter. There are two dwellings to be demolished here, along with some outbuildings. Stripping to a depth of one to two feet is expected to be sufficient to reach suitable subgrade soils to begin the fill in most areas. Weathered shale was encountered at two to five feet depth in most of this building area.

NORTHWEST BUILDING

The western seventy percent of this building will be on a fill, mostly with a nominal thickness of ten feet to sixteen feet. The northwest thirty percent of the building will be in a cut, with an average depth of about 22 feet and a maximum of about 44 feet, at the northwest building corner. In the fill areas, the required stripping depth is expected to be about one to three feet, to reach suitable subgrade soils. In the cut areas, sandy silty till and sandy silty clayey till are expected to be the dominant soil types in the upper part of the cut, changing to mostly sandy clayey till in the deeper part of the cut. With the exception of local deficiencies, suitable soils are expected to be present at the subgrade elevation in the deeper cut areas, and in the shallow part of the cut where it is at least three feet below existing grade, but with more variability and local deficiencies in the shallower sections.

3.2. Excavation

The borings indicate that the existing native soils may be excavated using conventional heavy equipment, such as tracked excavators and bulldozers. For mass excavations in the glacial till, extra-heavy equipment should be used if it is available; large excavators such as the CAT 330 and bulldozers such as the D8 are somewhat undersized for large-volume excavation of this soil. Scraper pans may be used for mass cuts in the glacial till; the pans will likely need a bulldozer pusher when cutting into the borrow area surface, and moderate interference from boulders should be expected.

While the native glacial till is hard to excavate, it softens easily when subjected to construction traffic. Rollers, wheel loaders and other heavy equipment should be sized appropriately for the subgrade conditions. Traffic from dump trucks, concrete mixers, semi-trailers and similar heavy vehicles should be minimized on the exposed surface of the subgrade and on compacted fine-grained fills.

The investigation indicates that the shallow soils which will be encountered in the building excavations are likely to be a mix of OSHA Type A, requiring a minimum slope of 0.75-to-1 in shallow excavations, with benching permitted, OSHA Type B, requiring a minimum slope of 1-to-1 in shallow excavations, also with benching permitted, and OSHA Type C, requiring a minimum slope of 1.5 horizontal to one vertical in shallow excavations, with benching not permitted. The deeper soils are expected to be OSHA Type A. An engineered excavation design is required for cuts of twenty feet depth or greater. Soil types and excavation requirements must be confirmed by a qualified representative of the Contractor during construction.

Minor rock excavation is expected to be required in the north end of the east building area. The local bedrock is shale which was highly weathered in most locations, but may be harder where this knob formed. A large bulldozer with a ripper tooth should be able to excavate the shallow rock. A large excavator with a hydraulic hoe-ram may be required to excavate into the deeper bedrock.

Shoring of the building excavations and most other excavations should not be required, as in most cases there is sufficient distance from the property line to the estimated limits of the work area to allow the use of conventional excavation slopes. The exception is the proposed retaining wall system parallel to the north side of the northwest building; the proposed two-tiered wall will be close to the property line, likely requiring excavation over the line for construction of a cantilever wall, or requiring tie-backs extending onto the adjacent property for temporary shoring or for permanent installation of a soil-nail or soldier pile wall. Past experience has shown that high vertical faces with extensive stand-up time may be safely excavated in the dense glacial till types at the site, when performed in conformance with an engineered design. The design of any necessary shoring or other support-of-excavation is the responsibility of the Contractor and is not included in this report.

Groundwater seepage rates in the building excavations are expected to be slow, but will likely be persistent, at least during wet seasons. Occasional zones of concentrated seepage may be encountered, including some initial short-term drainage of greater volume from zones of perched water. Persistent springs or seeps that develop in cuts may warrant the installation of special drainage, and should be evaluated on a case-by-case basis. Groundwater seepage and stormwater should be removed promptly from the excavations, and the groundwater elevation should be maintained at least one foot below the soil surface in foundation and slab construction areas. When dewatering open excavations, the water level should be drawn down at a controlled rate to minimize sloughing, allowing the water to drain from the soil in the sides of the excavation.

3.3. Fill Materials and CLSM

All fill placed below foundations and slabs shall consist of Structural Fill or Structural Fill HD, as described below, or shall be suitable site-borrow soil, as described below, or shall be other imported fill of a quality at least equal to that of the site-borrow fill. Fill placed during winter weather should be granular material containing little or no silt and clay, typically with no more than twelve percent non-plastic fines or five percent clayey fines, passing the #200 sieve.

In warehouse slab-on-grade areas, Structural Fill or select site-borrow fill with a high gravel content should be used for the final one to two lifts of fill, for support of construction vehicle traffic and to protect against slab movement under heavy forklift traffic.

Soils excavated from the site are expected to be of fair quality for re-use as fill and backfill for foundations, slabs and pavement areas. Most of the potential borrow soil is clayey to silty glacial till, containing little to some sand, trace to little gravel and few cobbles and boulders. The native soils can be used as fill, and when properly compacted will provide acceptable support, but they are moisture-sensitive and are typically difficult to work with, especially when the weather is other than warm and dry. Boulders and large cobbles must be removed from the borrow fill. Large clumps of clayey soil must be broken up; this typically requires spreading the fill in a thin lift and tracking back-and-forth over it repeatedly with a heavy bulldozer, while the soil is in a relatively dry condition. Disking is not typically effective as a method of breaking up this clayey soil, due mainly to the hardness of the soil clods, with boulders also interfering with disking.

Structural Fill, if imported for use below foundations and slabs, shall be good-quality bank-run sand and gravel or crushed stone, and should be a well-graded product complying with the gradation limits below. Structural Fill may also be used as foundation backfill. Structural Fill HD (Heavy Duty) should be used in areas to be protected from heavy construction traffic and where subgrade stabilization and/or enhanced drainage is needed.

Sieve size		Structural Fill	Structural Fill HD
Inch	mm	Percent Passing by Weight	
4″	100	100	100
1½″	37.5	50-100	50-95
#4	4.75	20-70	20-50
#40	0.425	5-40	5-25
#200	0.075	0-20	0-10

All fill materials shall be composed of sound, durable particles, shall be free from frost or snow, garbage, construction debris or other deleterious material, and shall be substantially free from organic matter and roots. Recycled crushed concrete and masonry from a registered source may be acceptable for some applications above the water table, subject to approval by the Designer of Record. Fill shall not be placed over frozen or unstable soil, unless approved by the Engineer.

Pipe bedding in utility trenches may act as a drainage path for groundwater seepage. If coarse granular bedding is used in sloping trenches, it should be interrupted periodically by sections of well-graded bedding, to regulate the flow of this seepage. Avoid the use of coarse stone as pipe bedding if erodible soils such as fine sand or cohesionless silt are present, or provide a geotextile layer or a filter zone of compacted well-graded fill between these soils and the pipe bedding.

CLSM (Controlled Low-Strength Material, aka flowable fill or k-crete,) may be used under footings and foundations when specifically approved by the Engineer, and may also be used to backfill trenches or other excavations, typically where rapid fill placement is required, fill areas are narrow, or the use of conventional compaction methods is not practical. For support of footings, a CLSM mix consisting of sand, cement and water, with a 56-day compressive strength of 75 to 200 psi, is appropriate. CLSM may produce high fluid pressures during placement, and caution must be used for placements against foundation walls, near unbraced cuts, etc. Pipes or tanks can also float if not properly restrained during placement. CLSM should not be placed against unprotected aluminum; CLSM containing flyash should not be used in contact with cast iron or ductile iron. Hardened CLSM masses may also adversely affect groundwater flow, possibly causing erosion under or along the CLSM, particularly in sloping trenches.

Other Fill Materials:

- Crushed stone base course for slabs-on-grade should consist of ASTM C33 #56 or #57 stone (⅜- to ¾-inch size,) or as required by the slab system design.
- Crushed stone or gravel for footing drains should consist of ASTM C33 #5, #56 or #57 stone (¾-inch or ⅜-¾-inch size.)
- Well-graded granular subbase material (NYSDOT Item 733-04 'Item 4' or similar) should be used under sidewalks and exterior slabs.

3.4. Fill Placement and Compaction

Soil surfaces, including the surface of the subgrade and of previously-placed fill materials, shall be prepared to a stiff and essentially unyielding condition prior to placing each new lift of fill. Bedrock surfaces to receive fill shall be free from voids or loose areas and the rock surface shall be free from large loose pieces of stone. Use mid-size equipment to compact the site-borrow fill or similar materials. Vibratory trench rollers, and single-drum soil rollers with a nominal size of three to seven tons, should be appropriate for the observed site conditions. Larger rollers may be used when compacting well-graded granular fill over essentially unyielding surfaces, and may be suitable for use on the site-borrow fill when conditions are optimal.

Fill shall be placed in controlled lifts, with each lift compacted to the required density at a moisture content close to optimum moisture, as determined by ASTM D1557. When the moisture content of fill which will support footings or slabs is within two percent of optimum, fill may be placed in lifts with compacted thicknesses of up to twelve inches. If the moisture content is two to 2.5 percent from optimum, reduce the maximum thickness to eight inches, and if it is more than 2.5 percent from optimum, discontinue compaction. Do not place or compact fill when the air temperature is less than 25°F. Use a reduced lift thickness if required to obtain the specified percent compaction and when using small compaction equipment.

Where fill will be placed against slopes, bench the fill into the slope to create a stair-step interface, for improved stability and groundwater control. Lightly scarify the surface of the existing soil prior to placing the fill, and key the fill into the subgrade at the toe of the slope. When the fill is more than five feet high against a slope of twenty percent or more, the key should be at least two feet deep and ten feet wide.

For cut slopes or fill slopes with a height of thirty feet or more, and a slope of one in three or greater, terraces should be provided at vertical intervals of thirty feet or less, to control drainage and debris. The terraces should be at least six feet wide, but where more than one is required, the terrace nearest mid-height of the slope should have a width of at least twelve feet, for maintenance access. Drainage swales shall be provided on terraces. Refer to the optional Appendix J of the Building Code for additional details.

Backfill placed against foundation walls should be compacted with trench rollers or with similar equipment which will not produce damaging stresses on the wall. Place backfill equally on opposite sides of the foundation unless otherwise indicated by the specifications or drawings. Foundation walls acting as retaining walls should be braced (i.e. by installation of the floor framing) before placing backfill, unless otherwise indicated on the drawings or approved by the Engineer.

Open-graded stone base course material for slabs-on-grade should be graded level and seated with one or more compaction passes, to help resist displacement during slab area preparation and concrete placement.

Where the native clay soil is used for fill, careful preparation, placement and compaction methods must be employed, and the fill section must be properly designed.

- Prepare the fill by drying it to a somewhat crumbly consistency, then thoroughly break up the soil clods so that they are no larger than two-thirds of the lift thickness (e.g. smaller than eight inches for a twelve-inch thick lift.)
- Mix and spread the fill so that the larger clods are well-mixed with finer pulverized soil; remove boulders during preparation and placement. Condition the fill if needed to the reach the proper compaction moisture content, mixing the fill so that the moisture is uniform throughout the lift thickness.
- Re-work any 'clod clusters,' where the fill is lacking in fines, to a well-graded condition, by pulverizing, mixing and/or adding fine fill material.
- Compact the clay fill with a mid-size single-drum vibratory roller, or with a dual-drum trench roller where access is limited; a heavy roller will tend to produce rutting, and a light roller will not adequately compact the soil. A roller with a sheep's-foot or tamping foot drum is preferred, both because it tends to knead and compact the soil clods, and because the irregular compacted surface promotes the dispersed vertical drainage of water infiltration, versus the surface produced by a smooth-drum roller, which promotes lateral seepage movement, potentially causing local saturation and the creation of soft spots.
- Drainage must be provided at the bottom of any significant fill sections, to minimize water accumulation in the base of the clay, which can cause softening and settlement. A layer of granular

fill, such as 'Structural Fill,' at least one foot thick, is typically sufficient, provided the granular layer is free to drain laterally and/or vertically. Where the vertical drainage into a clay subgrade is to be provided, trim the clay subgrade carefully to a suitable surface without disturbance, and do not compact the clay prior to placing the granular fill; this will promote infiltration, but the rate may still be slow.

- The top of the fill must also be provided with proper drainage, particularly below parking lots, lawns, and in other areas of surface water infiltration. The final lift of clay fill should be at least two feet below the proposed top-of-pavement elevation in paved areas, to provide sufficient depth for drainage and for protection of the clay subgrade during construction and paving. In landscaped areas, the top of the clay fill should also be at least two feet deep, to allow for a sufficient thickness of fill with a suitable moisture capacity to support vegetation.
- The top of the clay fill must be carefully graded to avoid low spots, where surface water infiltration can accumulate; it should be pitched gently toward underdrains or other outlets, and not made perfectly level.
- Installation of a layer of geotextile between the top of the clay fill and the pavement subbase and landscaping fill is recommended. The geotextile will promote the retention of water from surface infiltration in the pavement base and drainage layers and in the landscaping, and will reduce concentrated infiltration into the clay fill.
- Surface water infiltration in the shallow fill materials and in the clay fill will tend to seek curbs, utility trenches and similar discontinuities, and subsurface drainage should be provided from these features; where water concentration along utilities needs to be minimized, use well-graded bedding material.
- Embankment slopes constructed with clay fill should be built slightly wide, then trimmed back, to allow thorough compaction near the edge. The fill placed in the outer zone (six feet wide, or one third of the fill height above, whichever is greater) should be compacted at a moisture content no more than one percent above optimum, leaving the soil clods slightly crumbly and creating some initial lateral permeability.
- The surfaces of embankment slopes should be scarified prior to placing topsoil, and small benches or one- to two-foot wide steps should be provided at frequent intervals to protect against sliding of the topsoil. The topsoil should be well-graded and relatively free-draining for erosion resistance, and should be placed at the minimum required thickness when the slope is steeper than three-on-one.

3.5. Compaction Requirements

Compact each lift of fill supporting slabs or foundations with at least six one-way compaction passes, even if the required compaction percentage is obtained with fewer passes. Each compaction pass shall be made at a slow walking speed (less than four feet per second,) with the equipment passing completely over all areas of the fill. Where the fill material consists of clayey site-borrow soil, the compacted fill shall be essentially free from open and interconnected voids between the clods. Fill materials shall be compacted to at least the percentage of the ASTM D1557 maximum dry density given in the table below. For coarse-graded fill materials with more than thirty percent retained on the ¾-inch sieve, the ASTM D4253 Maximum Index Density test may be substituted for the D1557 test.

Location	Minimum Percent Compaction
Below footings, foundations and slabs	95
Exterior Foundation Backfill in Landscaped Areas	90
Mass fills below parking areas	95, top three feet 92 at greater depth

3.6. Testing

The prepared subgrade shall be inspected to verify that it has been prepared in conformance with the requirements of this report, prior to placing fill or foundations. Recommended test procedures and frequencies are provided below.

PROOF-ROLLING: Proof-rolling of the prepared subgrade soil is not required, but may be performed to determine the limits of a soft area. Use an appropriately–sized vehicle, to avoid damaging wet and/or fine-grained, but otherwise acceptable soils. Observe the effects of the moving vehicle; if the soil exhibits excessive deflection, rutting or cracking, additional excavation or drying of the subgrade may be required.

BEARING CAPACITY: The prepared subgrade surface throughout the foundation and slab areas area shall be probed thoroughly to check for soft spots. The foundation subgrade shall be in a dense and unyielding condition, substantially free from soft areas and/or loose material. If these conditions are not encountered at the bearing elevation, testing shall be performed with a Static Cone Penetrometer or equivalent device in foundation bearing areas. If the design bearing capacity is not indicated within three inches of the bearing surface, the soil conditions shall be corrected and/or, if approved by the Engineer, the footing depth may be increased to reach acceptable soil. The slab subgrade areas shall be densely consolidated and sufficiently stiff to prevent rutting or displacement during slab base course and concrete placement operations. Where fractured rock or bedrock is present at the bearing elevation, it shall be visually inspected to verify that it is generally level and free from accumulations of loose material, and that in areas where it is fractured, the fractured mass is in a dense and stable condition, free from large open voids.

COMPACTION TESTING: Compaction testing shall be performed for each lift of fill supporting foundations, with testing performed while the work is in progress. Testing is also recommended for the fill supporting slabs or pavement, exterior backfill and for fill placed in embankments. Compaction tests of fill and backfill supporting foundations and slabs should be performed in at least one location per 1000 square feet of fill surface, per lift. In mass fill areas, this frequency may be reduced to one test per 2500 square feet, when the surface of the fill is at least three feet below the proposed bottom-of-footing elevation. Compaction tests should be performed with a nuclear moisture-density gauge, per ASTM Test Method D6938, unless otherwise approved. Required percent compaction values are provided above.

CLSM: When flowable fill is used to support footings or foundations, at least one set of three 6x12-inch test cylinders shall be cast from each day’s placement, per ASTM D4832. Test the cylinders for unit weight and for compliance with the specified strength requirements. Cast additional cylinders if early tests are needed.

3.7. Geosynthetic Materials

Geosynthetic materials are expected be used for reinforcement and drainage applications at the site on an as-needed basis, or where required by Code, such as for footing drains. Geosynthetic materials shall be installed over a smooth and evenly shaped subgrade, to avoid 'tenting' of the material over voids or high points. The geosynthetic shall be installed substantially free from wrinkles, and fill material shall be placed and spread in a manner which pushes the wrinkles out but which does not otherwise displace the geosynthetic material. Vehicles shall not drive on the exposed geosynthetics. The following material types are recommended.

Drainage Separation: For footing drains and similar applications, a woven drainage geotextile with at least 4% open area, with an apparent opening size of 0.21mm (#70) or smaller, should be installed around the open-graded drainage stone. Non-woven geotextiles are not recommended for use in this application, due to the presence of fine particles in the native soil that will tend to clog the fabric. If drains are installed in the clayey to silty on-site soils, a filter zone should be provided between the soil and the geotextile, consisting of at least three inches of clean sand, bank-run sand and gravel or Structural Fill on the sides and top.

Subgrade Reinforcement: Typically, a woven reinforcing geotextile with a grab tensile strength of at least 200 pounds should be used where needed to improve the stability of soft subgrade soils. Geogrids may be used instead of woven geotextiles, especially if free drainage is desired. A minimum of twelve inches of granular fill cover is typically required to fully mobilize the strength of the reinforcing geosynthetic.

Subgrade Separation: Where fines from the subgrade may infiltrate into an overlying granular layer, and strengthening of the subgrade and some vertical drainage is desirable, a non-woven geotextile should be used. A four-ounce nominal weight fabric is suitable for light- to moderate-duty applications; heavier fabric should be used where it will be subjected to heavy traffic, especially when it is placed in contact with sharp or very coarse-graded materials.

Woven reinforcement geotextiles will usually act as an infiltration barrier when installed in a continuous horizontal layer, and non-woven separation geotextile may also work as a barrier; this may or may not be desirable, depending on the installation location and conditions, and should be considered when specifying or using these products.

4. DESIGN VALUES AND RECOMMENDATIONS

Soil engineering properties and recommendations for design are provided in this section; additional important design considerations are also discussed in the other sections of this report. The design values assume that the buildings will be supported by conventional spread footing foundations with slab-on-grade floors, as described in the previous sections, on fill and/or on undisturbed native soil or rock, and will be provided with proper drainage.

4.1. Bearing Capacity and Soil Pressure for Buildings

Allowable Bearing Capacity, q_a	
Footings bearing at least 42 inches below finished grade, with a minimum width of 18 inches	4000 psf
Footings bearing at least 18 inches below finished grade, with a minimum width of 24 inches	4000 psf
Minor Footings and Slab Haunches bearing at least 12 inches below finished grade, with a minimum width of 12 inches	2500 psf

Soil Properties	Low/Fill Areas, Shallow Cuts and Site-borrow Fill	Deep Cut Areas Undisturbed Soil
Typical Soils	Silty Sand, Silty Sandy Gravel, Sand, Silt, Silty Clay	Silty to Clayey Till. Dense, Very Dense
Soil Moist Density, γ, lbs/cu ft	130	144
Effective Internal Angle of Friction, $\emptyset$	32°	34°
Coefficient of Active Earth Pressure, k_a	0.31	0.28
Coefficient of Passive Earth Pressure, k_p	3.25	3.54
Coefficient of At-Rest Earth Pressure, k_o	0.47	0.44
Lateral Bearing Capacity (psf per ft below grade)	210	255
Coefficient of Friction (vs. concrete)	0.35	0.40
Modulus of Subgrade Reaction, k, psi per inch	225	350
NOTE: These values apply to foundation and slab design. They should not be used for the design of retaining walls, except as noted.		

Footings subject to frost shall bear at least 42 inches below finished grade, or shall be otherwise protected from frost. Bearing elevations of footings shall be established such that a line drawn between the bottoms of two adjacent footings is not steeper than 30 degrees between the closest points on the footings. (Slope of 1 vertical to 1.75 horizontal.)

Up to one inch of settlement and ¾-inch of local differential settlement should be anticipated for new foundations bearing on compacted controlled fill. Footings bearing on undisturbed native soil in deep cuts are expected to exhibit less than one quarter inch of settlement.

4.2. Control of Groundwater and Soil Gases

Some groundwater seepage should be expected in excavations and below-grade areas during and after construction. The subgrade soils in the low part of the site in particular are expected to be wet at a shallow depth, and some groundwater control may be needed during stripping and initial fill placement operations. Proper drainage should be provided during construction, so that stormwater does not pool on top of the subgrade or around footings, causing softening which will be difficult to correct. Conventional damp-proofing of slabs-on-grade, with installation over a vapor barrier and an open-graded stone base course, is appropriate. Footing drains are not required for the proposed construction, however persistent groundwater movement should be expected through the northwest building area, moving north-to-south from the remaining hill, under the building and toward the wetlands; this seepage should be intercepted at the adjacent building walls, using conventional footing drains, and/or near the base of the cut. Stormwater infiltration from the parking and landscaped area should be diverted away from the building.

Construction dewatering is discussed elsewhere in this report. For the completed construction, the elevations shown on the plans indicate that foundation drains should be able to discharge by gravity from the proposed building areas.

Soil gases that could normally be expected to impact the structure are water vapor and radon. Thorough foundation damp-proofing, as noted above, placement of dense concrete in slabs-on-grade, (low water-to-cementitious ratio, thoroughly consolidated,) and sealing of all wall-to-slab joints, concrete cracks, pipe penetrations, drainage sumps, etc. are usually effective in controlling transmission of these gases to interior spaces. If an open-graded base course is used under the slab, a passive vapor mitigation system can be included, using small-diameter PVC pipes. The potential for these gases to adversely impact the use of the building is estimated to be low, if the above recommended practices are used, and normal interior ventilation is provided.

4.3. Seismic and Expansive Properties

Seismic Design Values: The Seismic Site Class and Seismic Design Category for the proposed construction were determined per section 1613 of the New York State Building Code and ASCE 7-16. Seismic values for the site were obtained from the current database maintained by the Applied Technology Council, Redwood City, Cal., and are consistent with the published maps in the Building Code. Values were as follow.

Occupancy Category	I/II/III	
Seismic Site Class	C- Very Dense Soil and Soft Rock	
IBC Seismic Design Category	**SDC - B**	
Maximum Acceleration	0.2 sec S_S 1.0 sec S_1	0.219 g 0.056 g
Maximum Spectral Response Acceleration	0.2 sec S_{MS} 1.0 sec S_{M1}	0.285 g 0.083 g
5% Damped Spectral Response	0.2 sec S_{DS} 1.0 sec S_{D1}	0.190 g 0.056 g

The seismic design values are based on the "risk adjusted maximum probable earthquake." These are not the maximum values that *could* occur, they are values that are not likely to be exceeded during the service life of a typical structure.

Liquefaction Potential: The soils encountered in the investigation have very low liquefaction susceptibility. Liquefaction is typically associated with thick deposits of loose poorly-graded sand situated below the water table, and may also occur in loose, poorly-graded cohesionless silt. A similar phenomenon, cyclic softening, can occur in saturated soft clays. Those soils are also prone to shifting or spreading during seismic events when they are situated near a slope, even if the slope is gentle. The soils encountered in the borings have textures, drainage conditions, locations and/or sufficient consolidation (density) to resist liquefaction or unusual movement during the design seismic event. No special mitigation measures are required.

Expansive Soils and Frost Heave: The soils encountered in the investigation have a low potential for expansion due to shrinking and swelling resulting from moisture changes. This behavior is typically associated with high-plasticity silt and clay soils. Physical testing and qualitative examination indicate that the soil properties do not meet the criteria for potentially expansive soils as defined in section 1803.5.3 of the Code. No mitigation measures are required. The on-site soils are moderately to highly susceptible to frost heave. Frost heave can be minimized by providing good drainage and by thoroughly compacting the soil. Well-graded granular fill should be used in areas where frost heave could result in damage. The bedrock is a non-expansive type. Some shales exhibit expansive behavior, but it is not known to occur with the local bedrock type. The weathered samples recovered from the borings did not have a composition that is associated with this problem.

4.4. Retaining Walls

The drilling of additional borings is recommended along the proposed extents of the major retaining walls. Test pits could be substituted for borings for the low walls which will retain building-area fills, to confirm acceptable bearing conditions.

For soil conditions substantially similar to those encountered in the borings, the allowable soil bearing capacity for conventional segmental block retaining walls for the building pad fills is 4000 psf, and for reinforced concrete retaining walls in cut areas, the allowable bearing capacity is 6000 psf. These values use a safety factor of two.

For segmental retaining wall construction in the fill areas, the silty to clayey site-borrow is not recommended for use in the geogrid-reinforced zone behind the wall; select granular fill material should be used for that application, and the properties of the retained site-borrow fill or undisturbed native soil beyond the reinforced zone may be taken from the table for foundation design in section 4.1 of this report.

Retaining walls for the proposed deep cuts are expected to consist of reinforced concrete cantilever walls, and/or soldier pile-and-lagging walls, and/or soil-nail walls. Soil nails or tie-backs will be required for practical construction of any walls higher than about eighteen feet, other than cantilever walls. For these walls, with a relatively narrow backfill zone behind the wall, the forces acting on the walls will be governed by the long-term stability of the native soils. The following design values are recommended.

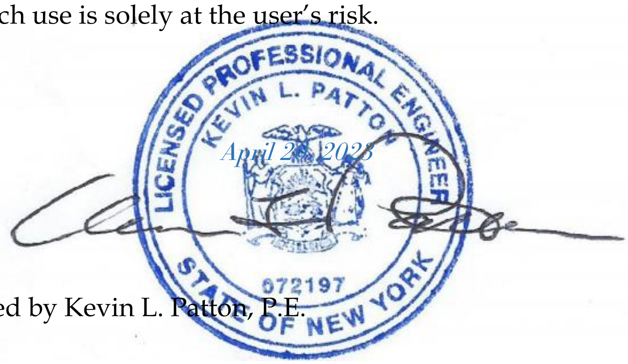
Retained Native Soil Properties for Retaining Walls (excluding SRWs.)		
Soil Properties	Upper Ten Feet	Deeper Soils
Typical Soils	Layered Till and Silt	Very Dense Till
Soil Moist Density, γ, lbs/cu ft	130	144
Effective Internal Angle of Friction, $\emptyset$	18^{o}	22^{o}
Coefficient of Active Earth Pressure, k_a	0.53	0.45
Coefficient of Passive Earth Pressure, k_p	1.89	2.20
Coefficient of At-Rest Earth Pressure, k_o	0.69	0.63
Active Pressure Pa, psf per foot	34	33

These design values should be applied to the retained native soils behind the wall and to the soils in the foundation zone to a depth of one foot below finished grade. Design values for the soils in the deeper portions of the foundation zone and for base friction may be taken from the table for building foundations in Section 4.1 of this report.

5. NOTES AND LIMITATIONS

Please see the attached pages for additional information. Subsurface conditions encountered during construction shall be compared to the soil boring logs and this report; any significant variations from anticipated conditions must be evaluated for their effect on the design. This report summarizes the results of a limited investigation and does not purport to predict every variation in subsurface conditions. Elevations, slopes, contours, project layout and similar or related data provided in this report were interpreted from the drawings, from field data or from other information which was provided, unless otherwise noted.

This geotechnical investigation was conducted to evaluate the engineering properties of the soils at the site, to aid in the design and construction of the proposed work. The investigation did not include evaluation of the potential effects of the proposed construction on other properties, nor did it include inspection of, or sampling for, items of environmental concern such as the presence of soil contaminants or of regulated wetlands, and did not include review of local zoning regulations, codes, floodplain boundaries or similar matters, unless specifically referenced in the report. This investigation was conducted solely for the use of the Client, the Client's Project Designers and Agents and the Authorities Having Jurisdiction; this report should not be used by others, nor for any use other than its stated purpose, without contacting the Engineer. Any such use is solely at the user's risk.



Prepared by Kevin L. Patton, P.E.

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Soil Technical Notes:
Soil Classifications, Descriptions and Properties

The USCS (Unified Soil Classification System) was used to classify the soils in this report. The USCS is described in ASTM D2487 (laboratory test method) and D2488 (visual-manual method.) The USCS classification gives a ‘Group Symbol’ and ‘Group Name’ based on particle size distribution (gradation,) clay properties (Atterberg Limits) and basic composition (mineral or organic.)

USCS Soil Classes

<u>Soils with less than 5% passing the #200 sieve</u>:

GW, GP, SW, SP – Well-graded gravel, Poorly-graded gravel, Well-graded sand, Poorly-graded sand.

<u>Soils with 12% to 50% passing the #200 sieve</u>:

GC, GM, GC-GM, SC, SM, SC-SM – Clayey gravel, Silty gravel, Silty clayey gravel, Clayey sand, Silty sand, Silty clayey sand.

<u>Soils with 5% to 12% passing the #200 sieve</u> use a dual symbol, such as SW-SC (Clayey well-graded sand.)

<u>Soils with more than 50% passing the #200 sieve</u>:

CL-ML, ML, CL, MH, CH, OL, OH – Silty clay, Silt, Lean clay, Elastic silt, Fat clay, Organic silt, Organic clay.

<u>Highly organic soils</u>:

PT – Peat.

The soil group name is modified with the term ‘with sand’ or ‘with gravel’ added if the soil contains more than 15% of these materials; clays and silts with 30% or more plus-#200 material are described as ‘sandy’ or ‘gravelly’ (whichever is predominate.) Examples – GM, Silty gravel with sand; CL, Gravelly lean clay.

Particle size

>12” (300mm)	Boulders
12” to 3” (300-75mm)	Cobbles
3” to #4 (75-4.75mm)	Gravel
#4 to #200 (4.75-0.075mm)	Sand
<#200 (0.075mm)	Silt & Clay

Organic Soils

Highly organic soils such as peat are visually classified. Partly organic soils, with a mix of organic and mineral matter, are classified visually and by Atterberg Limits tests.

Moisture Content

Moisture is visually estimated and samples are usually tested. Soil moisture capacity varies with texture and compaction.

Typical examples:
GW, moist at 3%, saturated at 9%
SP, moist at 6%, saturated at 20%.
CL, moist at 12%, saturated at 33%.

Fine- and Coarse-grained Soils

The USCS classification applies to the material smaller than the 3-inch sieve.

‘Fine-Grained Soils’ (silts and clays) have more than 50% passing the #200 sieve and are classified by their Atterberg Limits.

‘Coarse-Grained Soils’ (sands and gravels) have less than 50% passing the #200 sieve. When more than 50% of the plus-200 material is retained on the #4 sieve the general soil type is gravel, and if more than 50% is finer than the #4 sieve, it is sand.

Clean coarse-grained soils are classified as well-graded (Classes GW, SW) or poorly-graded (GP, SP.) Well-graded soils have a wider range of sizes and are typically more stable. Poorly-graded soils are usually more permeable.

Atterberg Limits

Test is performed on the clay, silt and fine sand fraction of the soil:
Liquid Limit (LL) – moisture content (%) at which soil becomes very soft.
Plastic Limit (PL) – moisture content at which soil crumbles.
Plasticity Index (PI) = LL minus PL

Higher PI values may indicate reduced permeability and increased drying shrinkage.

LL > 50 indicates soil with a higher potential to shrink and swell due to changing moisture content.

Silts have lower PI values, and behave like very fine sand; most silts also contain some clay. Behavior of clays is partly controlled by electrochemical forces and varies among the several clay minerals.

Color

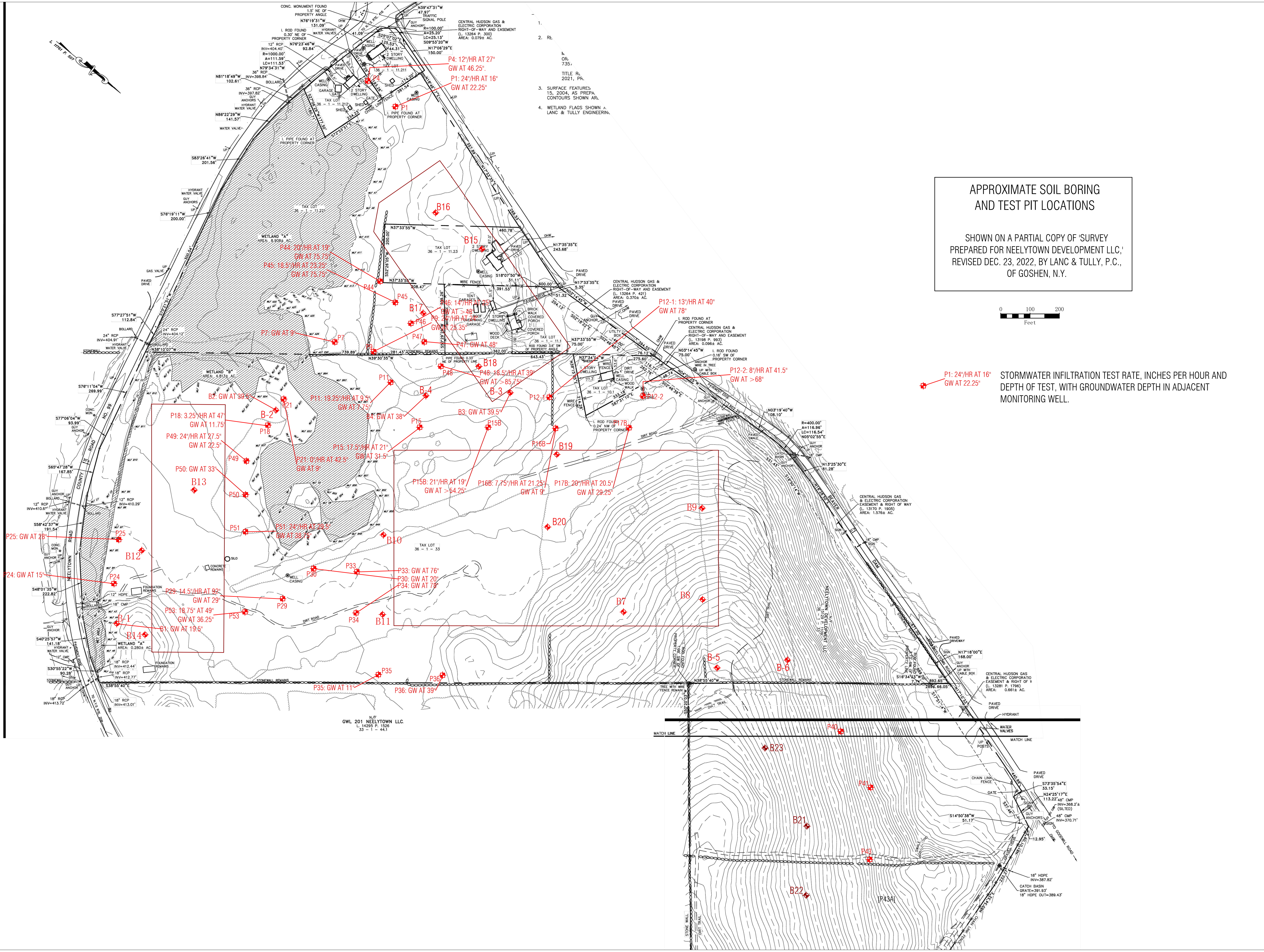
Soil color sometimes indicates groundwater conditions, with subdued colors below the water table and mottled (mixed) colors in the zone of seasonal water table fluctuation. Color changes tend to be more prominent in fine-grained soils.

Relative Quantities

Estimated percentages in descriptions:
<5% - Trace
5-10% - Traces
10-25% - Little
25-35% - Some
‘And’ - Approx. equal amounts
‘Few’ - <10% (cobbles and boulders)

USDA Soil Classification

USDA classifications are based on the relative amounts of sand, silt and clay in the soil fraction passing the #10 (2mm) sieve. ‘Gravelly’ indicates more than 15% of #10 to 3” size. ‘Channery’ indicates 15 to 35% thin flat pieces up to 6” long.



APPROXIMATE SOIL BORING AND TEST PIT LOCATIONS

SHOWN ON A PARTIAL COPY OF 'SURVEY PREPARED FOR NEELYTOWN DEVELOPMENT LLC,' REVISED DEC. 23, 2022, BY LANC & TULLY, P.C., OF GOSHEN, N.Y.

0 100 200 Feet

P1: 24"/HR AT 16' GW AT 22.25' — STORMWATER INFILTRATION TEST RATE, INCHES PER HOUR AND DEPTH OF TEST, WITH GROUNDWATER DEPTH IN ADJACENT MONITORING WELL.

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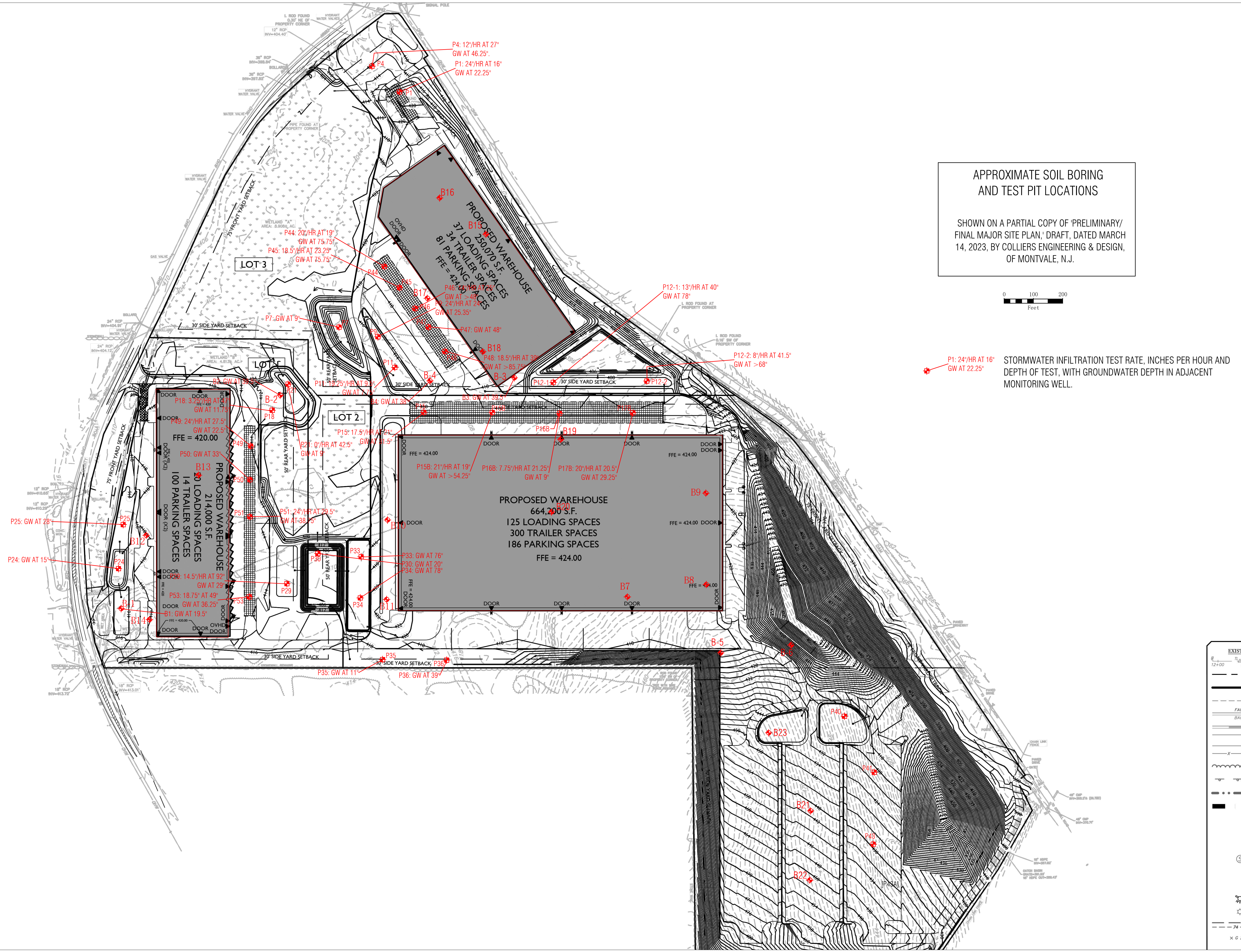
MID-HUDSON INDUSTRIAL PARK

NEELYTOWN ROAD, TOWN OF MONTGOMERY, N.Y.

BORING, TEST PIT AND PERC TEST LOCATIONS

REV.	DATE	BY
1	4/3/2023	KLP
0	3/17/2023	KLP

B-101



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MID-HUDSON INDUSTRIAL PARK

NEELYTOWN ROAD, TOWN OF MONTGOMERY, N.Y.

BORING, TEST PIT AND PERC TEST LOCATIONS ON PROPOSED PLAN

REV.	DATE	BY
1	4/3/2023	KLP
0	3/17/2023	KLP

B-102

GENERALIZED SUBSURFACE PROFILE

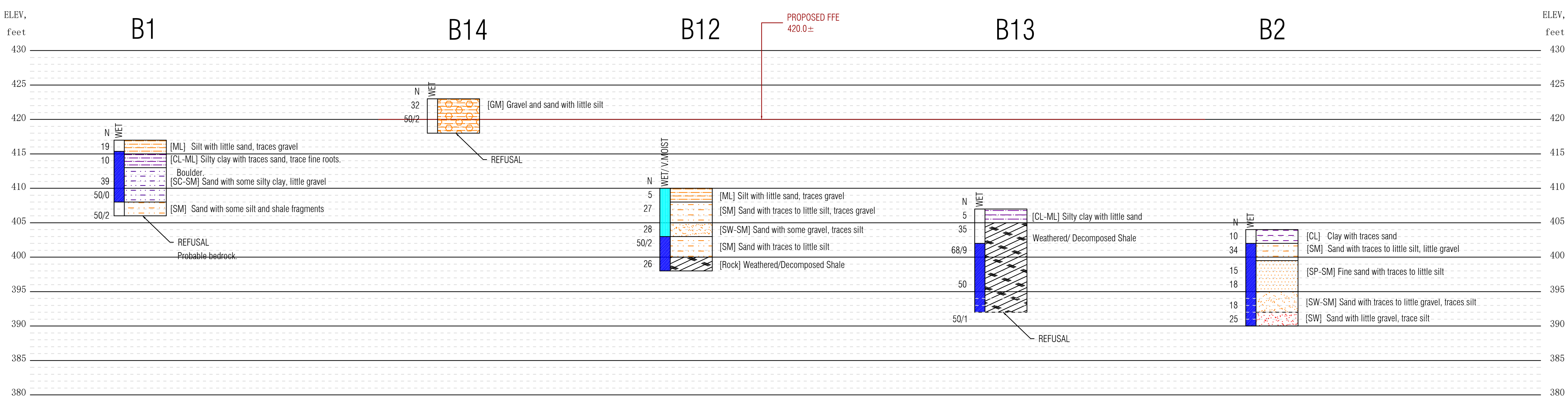
NO HORIZONTAL SCALE.
USCS SOIL CLASSIFICATIONS ARE IN BRACKETS.

IN GENERAL, RED PATTERNS INDICATE RELATIVELY CLEAN SANDY OR GRAVELLY SOILS, PURPLE PATTERNS INDICATE SOILS WITH SIGNIFICANT CLAY CONTENT AND ORANGE PATTERNS INDICATE SOILS WITH A SIGNIFICANT SILT CONTENT.

A THIN LAYER OF TOPSOIL WAS PRESENT AT MOST LOCATIONS.

THESE SECTIONS ARE GENERALIZED REPRESENTATIONS OF THE SUBSURFACE PROFILE, BASED ON THE SUBSURFACE EXPLORATION DATA, OBSERVATIONS, RESEARCH, AND OTHER RELEVANT INFORMATION. THE SOILS INFORMATION PRESENTED HEREIN SHOULD BE INTERPRETED IN CONJUNCTION WITH THE INFORMATION FROM THE BORING LOGS AND THE GEOTECHNICAL INVESTIGATION REPORT. SITE CONDITIONS MAY DIFFER FROM THOSE ENCOUNTERED AT THE BORING LOCATIONS.

EAST BUILDING



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MID-HUDSON INDUSTRIAL PARK
NEELYTOWN ROAD, TOWN OF MONTGOMERY, N.Y.
SUBSURFACE PROFILE - SHEET 1 OF 5

REV.	DATE	BY
0	3/17/2023	KLP
1	4/3/2023	KLP

GENERALIZED SUBSURFACE PROFILE

NO HORIZONTAL SCALE.
USCS SOIL CLASSIFICATIONS ARE IN BRACKETS.

IN GENERAL, RED PATTERNS INDICATE RELATIVELY CLEAN SANDY OR GRAVELLY SOILS, PURPLE PATTERNS INDICATE SOILS WITH SIGNIFICANT CLAY CONTENT AND ORANGE PATTERNS INDICATE SOILS WITH A SIGNIFICANT SILT CONTENT.

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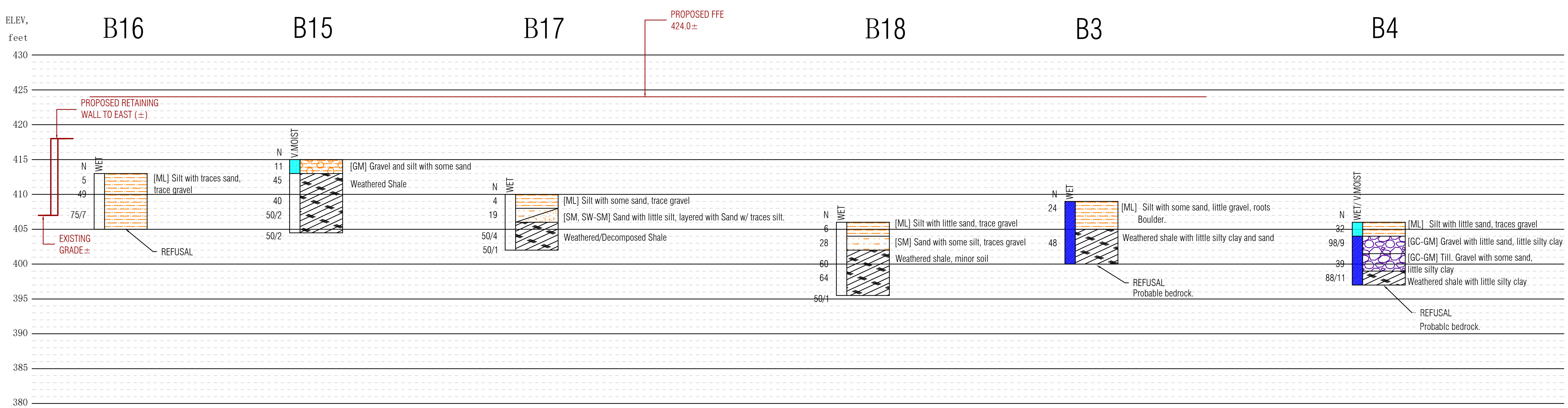
SOUTHWEST BUILDING



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MID-HUDSON INDUSTRIAL PARK

NEELYTOWN ROAD, TOWN OF MONTGOMERY, N.Y.

SUBSURFACE PROFILE - SHEET 2 OF 5

REV.	DATE	BY
1	4/3/2023	KLP
0	3/17/2023	KLP

GENERALIZED SUBSURFACE PROFILE

NO HORIZONTAL SCALE.
USCS SOIL CLASSIFICATIONS ARE IN BRACKETS.

IN GENERAL, RED PATTERNS INDICATE RELATIVELY CLEAN SANDY OR GRAVELLY SOILS, PURPLE PATTERNS INDICATE SOILS WITH SIGNIFICANT CLAY CONTENT AND ORANGE PATTERNS INDICATE SOILS WITH A SIGNIFICANT SILT CONTENT.

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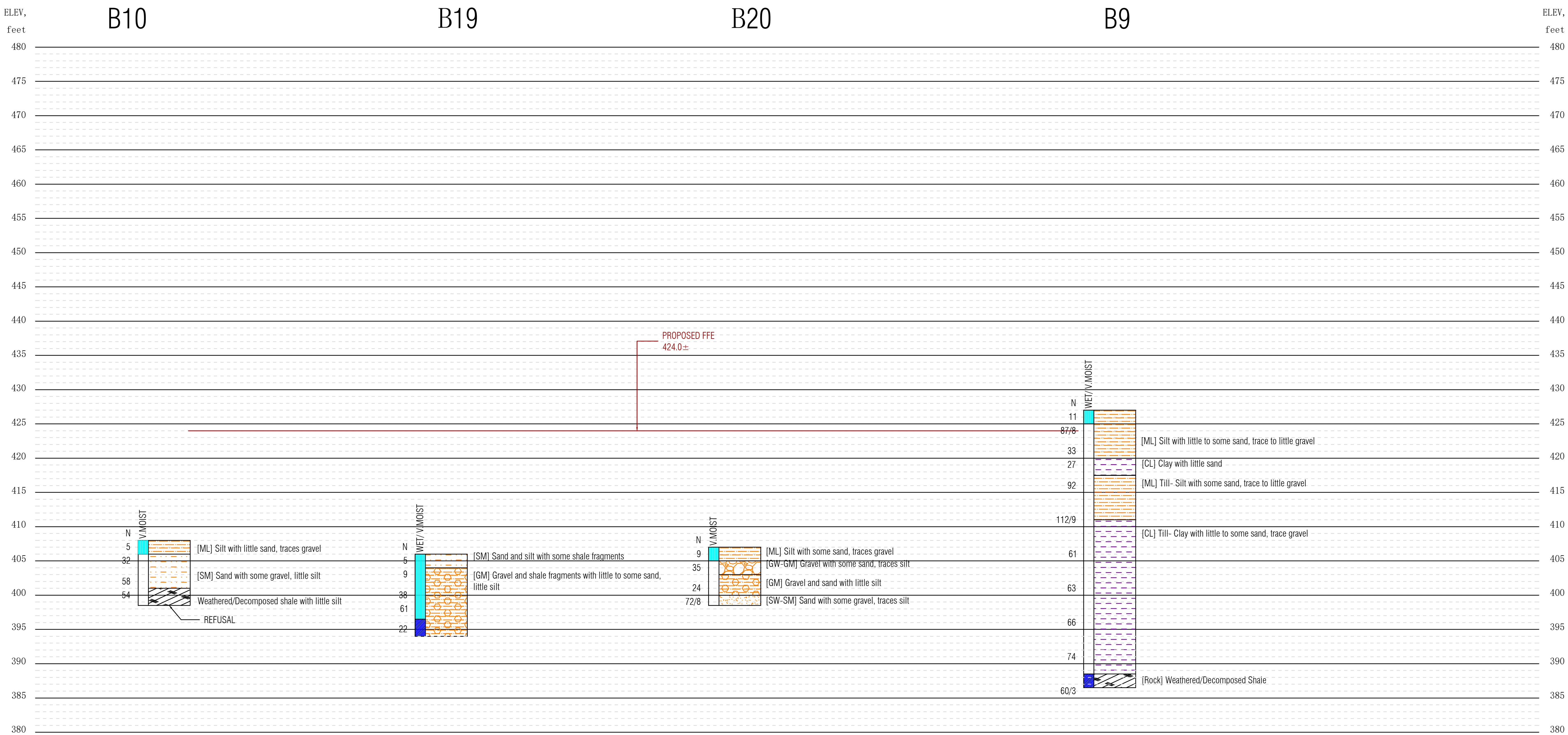
NORTHWEST BUILDING
SOUTH HALF



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MID-HUDSON INDUSTRIAL PARK
NEELYTOWN ROAD, TOWN OF MONTGOMERY, N.Y.
SUBSURFACE PROFILE - SHEET 3 OF 5

REV.	DATE	BY
0	3/17/2023	KLP
1	4/3/2023	KLP

GENERALIZED SUBSURFACE PROFILE

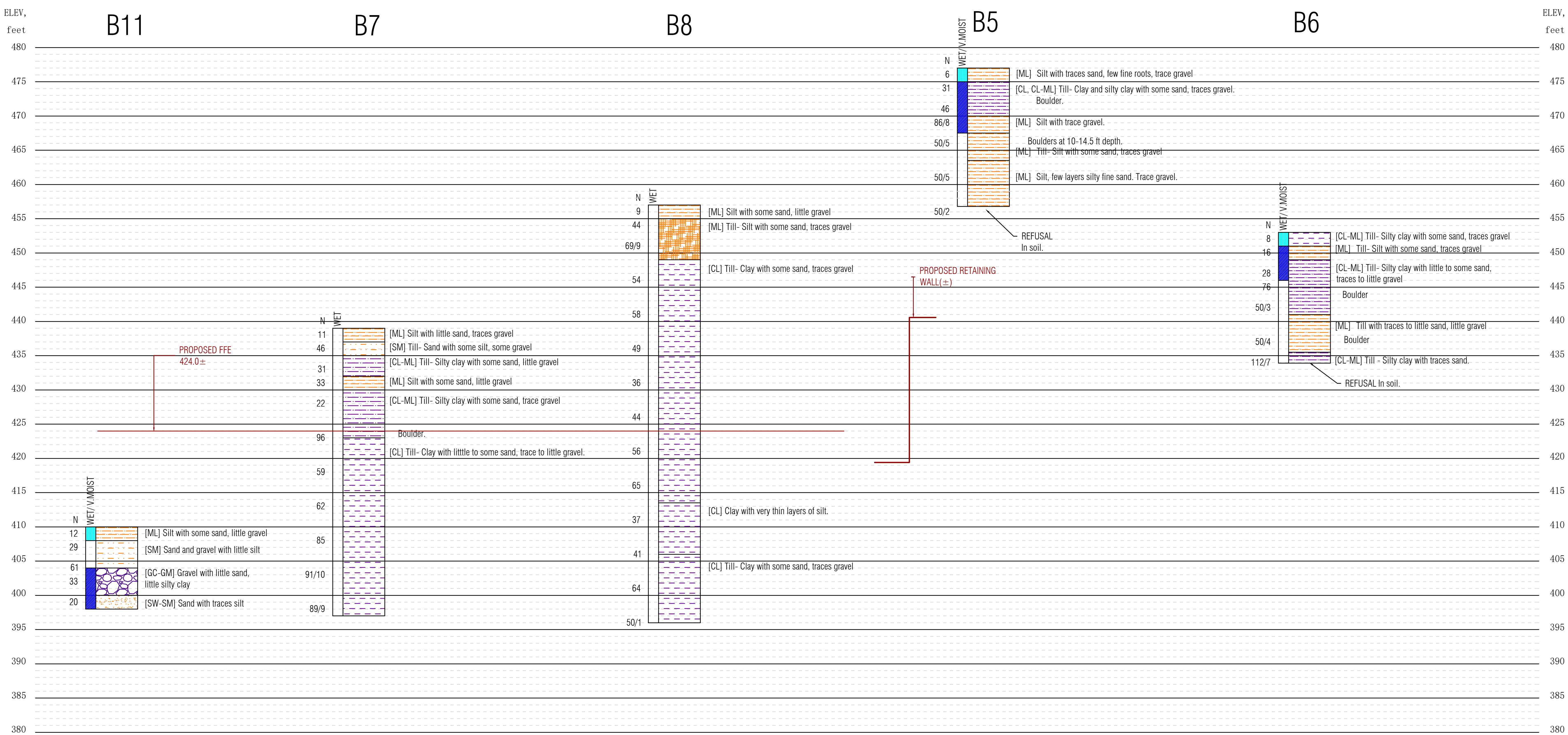
NO HORIZONTAL SCALE.
USCS SOIL CLASSIFICATIONS ARE IN BRACKETS.

IN GENERAL, RED PATTERNS INDICATE RELATIVELY CLEAN SANDY OR GRAVELLY SOILS, PURPLE PATTERNS INDICATE SOILS WITH SIGNIFICANT CLAY CONTENT AND ORANGE PATTERNS INDICATE SOILS WITH A SIGNIFICANT SILT CONTENT.

A THIN LAYER OF TOPSOIL WAS PRESENT AT MOST LOCATIONS.

NORTHWEST BUILDING
NORTH SIDE

THESE SECTIONS ARE GENERALIZED REPRESENTATIONS OF THE SUBSURFACE PROFILE, BASED ON THE SUBSURFACE EXPLORATION DATA, OBSERVATIONS, RESEARCH, AND OTHER RELEVANT INFORMATION. THE SOILS INFORMATION PRESENTED HEREIN SHOULD BE INTERPRETED IN CONJUNCTION WITH THE INFORMATION FROM THE BORING LOGS AND THE GEOTECHNICAL INVESTIGATION REPORT. SITE CONDITIONS MAY DIFFER FROM THOSE ENCOUNTERED AT THE BORING LOCATIONS.



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MID-HUDSON INDUSTRIAL PARK

NEELYTOWN ROAD, TOWN OF MONTGOMERY, N.Y.

SUBSURFACE PROFILE - SHEET 4 OF 5

REV.	DATE	BY
0	3/17/2023	KLP
1	4/3/2023	KLP

GENERALIZED SUBSURFACE PROFILE

NORTHWEST PARKING

NO HORIZONTAL SCALE.
USCS SOIL CLASSIFICATIONS ARE IN BRACKETS.

IN GENERAL, RED PATTERNS INDICATE RELATIVELY CLEAN SANDY OR GRAVELLY SOILS, PURPLE PATTERNS INDICATE SOILS WITH SIGNIFICANT CLAY CONTENT AND ORANGE PATTERNS INDICATE SOILS WITH A SIGNIFICANT SILT CONTENT.

A THIN LAYER OF TOPSOIL WAS PRESENT AT MOST LOCATIONS.

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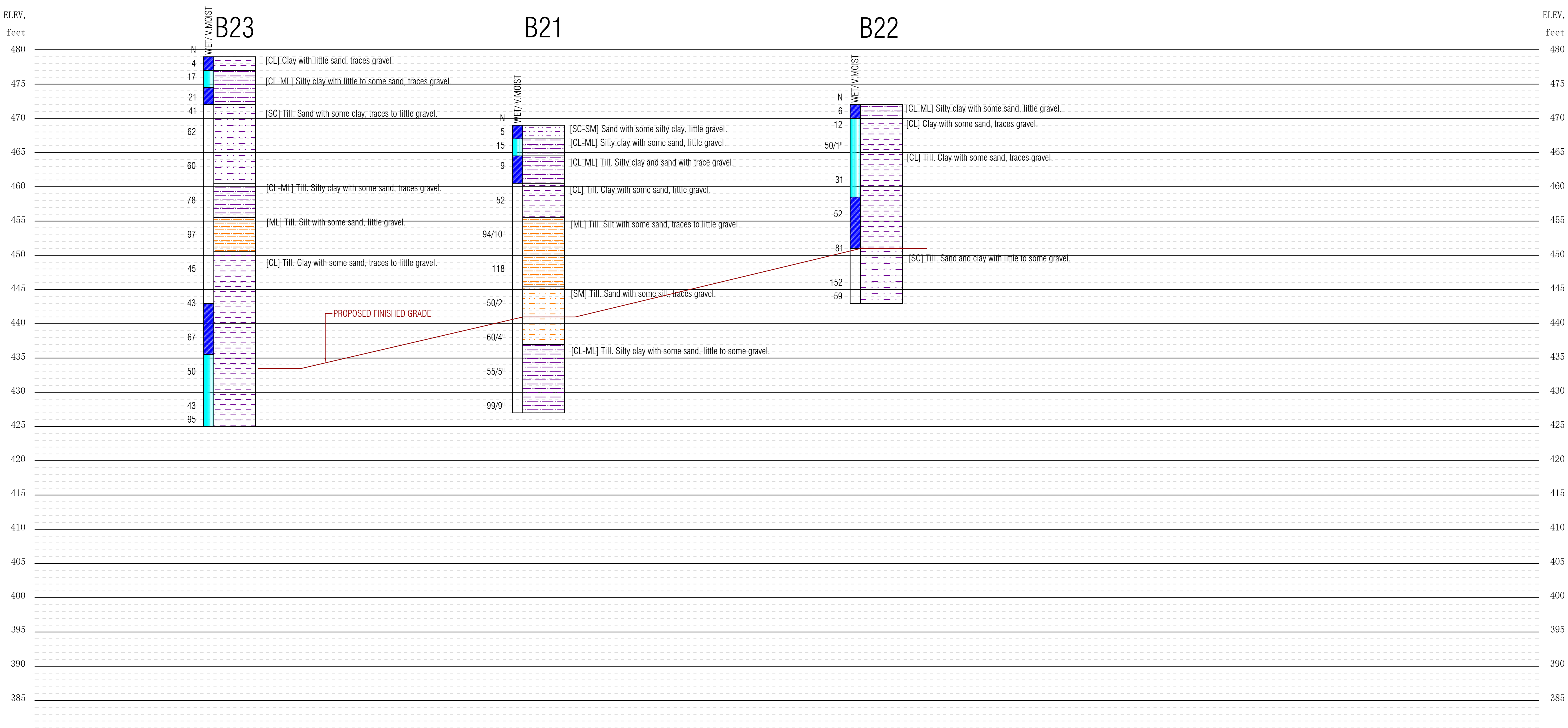

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MID-HUDSON INDUSTRIAL PARK
NEELYTOWN ROAD, TOWN OF MONTGOMERY, N.Y.
SUBSURFACE PROFILE - SHEET 5 OF 5

REV.	DATE	BY
1	4/3/2023	KLP
0	3/17/2023	KLP

KEVIN L. PATTON, P.E.
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CLIENT:	RDM Group		
PROJECT:	Mid-Hudson Industrial Park, Montgomery, N.Y.		
DATE:	2/17/2021	Project No.:	21106
WEATHER:	Sunny, 20-30F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Stormwater area - NE corner of site	**BORING NO. B-1**
DRILLER AND HELPER:	Tom McGovern, Tommy			
HAMMER TYPE:	Safety, drum and cable, manual trip.	APPROX. ELEV.:	417	
INSPECTOR:	Wyeth Patton	WATER DEPTH:	19.5 inches after 13 days	

ELEVATION REVISED 12-22-2022

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT 0-6	SPT 6-12	SPT 12-18	SPT 18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	8	ML	7	**8**	**11**	7	Moist	Silt with little sand, traces gravel	
										Greyish brown	
2-4	**S2**	SS	10	CL-ML	5	**5**	**5**	11	Moist	Silty clay with traces sand, trace fine roots	
										Pale grey, orange, slight blocky fine	PEN=2.3 ksf
5										structure.	Grinding 5'
5-7	**S3**	SS	20	SC-SM	16	**20**	**19**	11	Wet	Sand with some silty clay, little gravel.	
										Angular shaley sand and gravel particles.	Olive brown
7-9	**S4**	SS	6	SC-SM	18	**50/0**			Wet	Same. Angular particles, with less shale.	Refusal 8'
										Mottled olive brown, gray	Offset 5 feet
10											Grinding 9'
10-12	**S5**	SS	1	SM	50/2				Moist	Sand with some silt, with dark grey shale	
										fragments. Brown and grey. Small sample.	
										Refusal at 8 feet and at 11 feet (two	
15										locations) in weathered shale.	
										A monitoring well was installed to measure	
										groundwater depth. The well has a 4-foot	
										screen section at the bottom with solid pipe	
										above.	
20											
										Bottom depth of well: 11.0 feet	
										The reported water depth is the depth	
										below the ground surface.	
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPE: SS - SPLIT SPOON C - CORE T - UNDISTURBED TUBE AUG - AUGER CUTTINGS
PEN - HAND PENETROMETER TOR - TORVANE V - VANE SHEAR

KEVIN L. PATTON, P.E.	CLIENT:	RDM Group		
36 PATTON ROAD	PROJECT:	Mid-Hudson Industrial Park, Montgomery, N.Y.		
NEWBURGH, NY 12550	DATE:	2/17/2021	Project No.:	21106
PATTONGEOTECH.COM 845 275-7732	WEATHER:	Sunny, 20-30F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Stormwater area - SE part of site	BORING NO.	B-2
DRILLER AND HELPER:	Tom McGovern, Tommy				
HAMMER TYPE:	Safety, drum and cable, manual trip.	APPROX. ELEV.:	404		
INSPECTOR:	Wyeth Patton	WATER DEPTH:	39.5 inches after 13 days		

ELEVATION REVISED 12-22-2022

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	12	CL	2	**4**	**6**	11	Moist	5" topsoil- mottled brown and grey silt. Clay with traces sand. Pale grey, orange. PEN= 3.7 ksf	Strong fine mottling.
2-4	**S2**	SS	16	SM	13	**16**	**18**	18	Wet	Sand with traces to little silt, little gravel. Crudely layered, finer and coarser beds. Grey and olive brown.	
5											
5-7	**S3**	SS	10	SP-SM	7	**7**	**8**	9	Wet	Fine sand with traces to little silt Brown	
7-9	**S4**	SS	8	SP-SM, SM	11	**10**	**8**	8	Wet	Same, with lenses/layers of Sand with little gravel, little silt. Olive brown.	
10											
10-12	**S5**	SS	10	SW-SM	7	**9**	**9**	15	Wet	Sand with traces to little gravel, traces silt, with some silty lenses/ layers. Olive brown	
12-14	**S6**	SS	12	SW	16	**14**	**11**	50/3	Wet	Sand with little gravel, trace silt Brownish grey	
15											
										Stopped in Soil at 14 feet.	
20											
										A monitoring well was installed to measure groundwater depth. The well has a 4-foot screen section at the bottom with solid pipe above.	
25											
										Bottom depth of well: 14.0 feet The reported water depth is the depth below the ground surface.	
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPE SS - SPLIT SPOON C - CORE T - UNDISTURBED TUBE AUG - AUGER CUTTINGS
PEN - HAND PENETROMETER TOR - TORVANE V - VANE SHEAR

KEVIN L. PATTON, P.E. 36 PATTON ROAD NEWBURGH, NY 12550 PATTONGEOTECH.COM 845 275-7732				
	CLIENT:	RDM Group		
	PROJECT:	Mid-Hudson Industrial Park, Montgomery, N.Y.		
	DATE:	2/17/2021	Project No.:	21106
	WEATHER:	Sunny, 20-30F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Stormwater area - South side, west	BORING NO.	B-3
DRILLER AND HELPER:	Tom McGovern, Tommy				
HAMMER TYPE:	Safety, drum and cable, manual trip.	APPROX. ELEV.:	409		
INSPECTOR:	Wyeth Patton	WATER DEPTH:	52.0 inches after 13 days		

ELEVATION REVISED 12-22-2022

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT 0-6	SPT 6-12	SPT 12-18	SPT 18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	4	ML	18	**14**	**10**	50/1	Wet	Silt with some sand, little gravel, roots	
										Brown	Grinding 2-3'
5											
5-7	**S2**	SS	10	Rock	45	**20**	**28**	50/1	Wet	Weathered shale with little silty clay and sand	
										Olive grey. GC-GM texture.	
											Refusal 9'
10											
										A monitoring well was installed to measure groundwater depth. The well has a 4-foot screen section at the bottom with solid pipe above.	
15											
										Bottom depth of well: 9.0 feet	
										The reported water depth is the depth	
										below the ground surface.	
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary — MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPE: SS - SPLIT SPOON; C - CORE; T - UNDISTURBED TUBE; AUG - AUGER CUTTINGS; PEN - HAND PENETROMETER; TOR - TORVANE; V - VANE SHEAR

KEVIN L. PATTON, P.E. 36 PATTON ROAD NEWBURGH, NY 12550 PATTONGEOTECH.COM 845 275-7732	CLIENT:	RDM Group		
	PROJECT:	Mid-Hudson Industrial Park, Montgomery, N.Y.		
	DATE:	2/17/2021	Project No.:	21106
	WEATHER:	Sunny, 20-30F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Stormwater area - South side, east	BORING NO.	B-4
DRILLER AND HELPER:	Tom McGovern, Tommy				
HAMMER TYPE:	Safety, drum and cable, manual trip.	APPROX. ELEV.:	406		
INSPECTOR:	Wyeth Patton	WATER DEPTH:	38.0 inches after 13 days		

ELEVATION REVISED 12-22-2022

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT 0-6	SPT 6-12	SPT 12-18	SPT 18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	6	ML	4	**6**	**16**	21	Very Moist	Silt with little sand, traces gravel. Fine friable texture. Brown	
2-4	**S2**	SS	10	GC-GM	44	**48**	**50/3**		Wet	Gravel with little sand, little silty clay Olive brown	
5											
5-7	**S3**	SS	8	GC-GM	20	**22**	**17**	45	Wet	Till- Angular gravel with some sand, little silty clay. Olive brown	
7-9	**S4**	SS	6	Rock	43	**38**	**50/5**		Wet	Angular shale fragments. Gravel with some silt traces to little silty clay. Grey. GC-GM texture.	
10											
										Refusal at 10 feet.	
15											
										A monitoring well was installed to measure groundwater depth. The well has a 4-foot screen section at the bottom with solid pipe above.	
20											
										Bottom depth of well: 10.0 feet The reported water depth is the depth below the ground surface.	
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD:	HSA - Hollow-Stem Auger	MR - Mud-Rotary		MEASUREMENTS IN FEET AND INCHES
SAMPLE/TEST TYPE	SS - SPLIT SPOON	C - CORE	T - UNDISTURBED TUBE	AUG - AUGER CUTTINGS
	PEN - HAND PENETROMETER		TOR - TORVANE	V - VANE SHEAR

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CLIENT:	RDM Group		
PROJECT:	Mid-Hudson Industrial Park, Montgomery, N.Y.		
DATE:	2/18/2021	Project No.:	21106
WEATHER:	Snow, 20-25F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	NW part of site, top of hill	**BORING NO.**	**B-5**
DRILLER AND HELPER:	Tom McGovern, Tommy				
HAMMER TYPE:	Safety, drum and cable, manual trip.	APPROX. ELEV.:	477		
INSPECTOR:	Wyeth Patton	WATER DEPTH:			

ELEVATION REVISED 12-22-2022

Feet	SAMPLE #	Type	Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	5	ML	3	**4**	**2**	2	Moist	Silt with traces sand, few fine roots, trace gravel	
										Brown	
2-4	**S2**	SS	9	CL	33	**21**	**10**	10	Very Moist	Till- clay with some sand, traces gravel	
										Brown. PEN= 2.7 ksf	Boulder 4'
5											
5-7	**S3**	SS	2	CL-ML	17	**25**	**21**	23	Very Moist	Topsoil: Silty clay with little sand, few roots	Possible mixing
										Brown. Small sample.	from a tree falling.
7-9	**S4**	SS	10	ML	25	**36**	**50/2**		Very Moist/	Silt with trace gravel. Massive structure.	
									Wet	Light Brown. PEN= 3.2 ksf	
10											Grinding 10'
10-12	**S5**	SS	4	ML	50/5				Moist	Till- Silt with some sand, traces gravel	
										Brown	Grinding 12'
											Grinding 14-14 1/2'
15											
15-17	**S6**	SS	7	ML	44	**50/5**			Moist	Silt, layer of silty fine sand, trace gravel	
										Light Brown.	
20											
20-22	**S7**	SS	0	--	50/2				.--	No recovery	
											Cuttings-mud at
										Auger refusal in soil at 23.0 feet	22 feet
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD:	HSA - Hollow-Stem Auger	MR - Mud-Rotary		MEASUREMENTS IN FEET AND INCHES
SAMPLE/TEST TYPE	SS - SPLIT SPOON	C - CORE	T - UNDISTURBED TUBE	AUG - AUGER CUTTINGS
	PEN - HAND PENETROMETER		TOR - TORVANE	V - VANE SHEAR

KEVIN L. PATTON, P.E.	CLIENT:	RDM Group		
36 PATTON ROAD	PROJECT:	Mid-Hudson Industrial Park, Montgomery, N.Y.		
NEWBURGH, NY 12550	DATE:	2/18/2021	Project No.:	21106
PATTONGEOTECH.COM 845 275-7732	WEATHER:	Snow, 20-25F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	NW part of site, west side of hilltop	BORING NO.	B-6
DRILLER AND HELPER:	Tom McGovern, Tommy				
HAMMER TYPE:	Safety, drum and cable, manual trip.	APPROX. ELEV.:	453		
INSPECTOR:	Wyeth Patton	WATER DEPTH:			

ELEVATION REVISED 12-22-2022

Feet	SAMPLE #	Type	Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	8	CL-ML	3	**3**	**5**	10	Very Moist	Till- Silty clay with some sand, traces gravel	
										Brown. PEN= 2.5 ksf	
2-4	**S2**	SS	12	ML	4	**7**	**9**	10	Very Moist/	Till- Silt with some sand, traces gravel.	
									Wet	Brown. PEN= 2.0 ksf	
5											
5-7	**S3**	SS	20	CL-ML	5	**15**	**13**	17	Very Moist/	Till- Silty clay with some sand, traces to little	
									Wet	gravel. Brown. PEN=2.0 ksf (two ksf)	
7-9	**S4**	SS	20	CL-ML	11	**28**	**48**	50/1	Moist	Till- Silty clay with little sand, traces gravel	
										Brown. PEN= 20 ksf (twenty ksf)	
10											Grinding 10'
10-12	**S5**	SS	1	--	50/3				Moist	Cobble Fragment	Very hard drilling
											10-15'
15											
15-17	**S6**	SS	2	ML	50/4				Moist	Till- Silt with little sand, little gravel	Grinding 16'
										Light Brown.	
18-20	**S7**	SS	8	CL-ML	64	**62**	**50/1**		Moist	Till- Silty clay with traces sand.	
20										Medium Grey. PEN = 22 ksf	Very dense till
										Auger refusal in soil at 18 feet	
										Maximum depth (split spoon) 19.1 feet.	
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD:	HSA - Hollow-Stem Auger	MR - Mud-Rotary		MEASUREMENTS IN FEET AND INCHES
SAMPLE/TEST TYPE	SS - SPLIT SPOON	C - CORE	T - UNDISTURBED TUBE	AUG - AUGER CUTTINGS
	PEN - HAND PENETROMETER		TOR - TORVANE	V - VANE SHEAR

KEVIN L. PATTON, P.E.
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PATTONGEOTECH.COM 845 275-7732

CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion		
DATE:	11/14/2022	Project No.:	22404
WEATHER:	Mostly cloudy, 25-40F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed NW building, north side, west, on hill	**BORING NO. B7**
DRILLER AND HELPER:	James Casson, --			
HAMMER TYPE:	Safety Hammer	APPROX. ELEV.:	439	
INSPECTOR:	Warren Patton	WATER DEPTH:		

Feet	SAMPLE #	Type	Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	18	ML	4	**3**	**8**	11	Slightly	Silt with little sand, traces gravel	
									moist	Orangeish brown	
2-4	**S2**	SS	15	SM	18	**23**	**23**	47	Slightly	Till- Sand with some silt, some gravel	
									moist	Brown	
5											
5-7	**S3**	SS	22	CL-ML	16	**21**	**10**	15	Moist	Till- Silty clay with some sand, little gravel	PEN 16ksf
										Brown, mottled	
7-9	**S4**	SS	24	ML	17	**18**	**15**	15	Moist	Till- Silt with some sand, traces gravel	PEN 12ksf
										Brown, slight mottling	
10											
10-12	**S5**	SS	24	CL-ML	8	**10**	**12**	12	Moist	Till- Silty clay with some sand, trace gravel	PEN 11ksf
										Brown	
15											
15-17	**S6**	SS	<1	-	38	**47**	**49**	57	-	Cobble fragment.	
20											
20-22	**S7**	SS	24	CL	28	**29**	**30**	41	Moist	Till- clay with some sand, trace gravel	PEN 25+ ksf
										Dark Grey	
25											
25-27	**S8**	SS	24	CL	27	**24**	**38**	49	Moist	Till- clay with little sand, traces gravel	PEN 22ksf
										Grey	
30											
30-32	**S9**	SS	24	CL	25	**40**	**45**	55/5	Moist	Till- Clay with some sand, little gravel	PEN 18ksf
										Grey	
35											
35-37	**S10**	SS	24	CL	46	**41**	**50/4**		Moist	Till. Same, with cobble fragment.	PEN 24ksf
										Grey.	
40											
40-42	**S11**	SS	12	CL	26	**39**	**50/3**		Moist	Till. Clay with some sand, little gravel.	PEN 22ksf
										(Same.) Grey.	
										Stopped in soil.	
45											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPE SS - SPLIT SPOON C - CORE T - UNDISTURBED TUBE AUG - AUGER CUTTINGS
PEN - HAND PENETROMETER TOR - TORVANE V - VANE SHEAR

KEVIN L. PATTON, P.E.
36 PATTON ROAD
NEWBURGH, NY 12550
PATTONGEOTECH.COM 845 275-7732

CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion		
DATE:	11/15/2022	Project No.:	22404
WEATHER:	Showers, 20-40F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed NW building, northwest, on hill	**BORING NO.**	**B8**
DRILLER AND HELPER:	James Casson, --				
HAMMER TYPE:	Safety Hammer	APPROX. ELEV.:	457		
INSPECTOR:	Warren Patton	WATER DEPTH:			**Pg 1 of 2**

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	24	ML	3	**3**	**6**	14	Moist	Silt with some sand, little gravel and shale fragments. Orangeish brown	
2-4	**S2**	SS	23	ML	19	**22**	**22**	26	Slightly moist	Till- Silt with some sand, trace gravel Yellowish brown, slight mottling	
5											
5-7	**S3**	SS	10	ML	20	**19**	**50/3**		Moist	Till- Silt with some sand, traces gravel Brown with strong orange and grey mottling	PEN 11ksf
10											
10-12	**S4**	SS	24	CL	12	**23**	**31**	43	Moist	Till- Clay with some sand, traces gravel Grey	PEN 23ksf
15											
15-17	**S5**	SS	24	CL	21	**18**	**40**	42	Moist	Till- Clay with some sand, traces gravel. Cobble fragment. Grey	PEN 25ksf
20											
20-22	**S6**	SS	0	-	27	**23**	**26**	30	-	No Recovery	
25											
25-27	**S7**	SS	20	CL	19	**15**	**21**	28	Moist	Till- Clay with some sand, traces gravel Grey	PEN 23ksf
30											
30-32	**S8**	SS	<1	-	12	**16**	**28**	37	-	Cobble Fragment	
35											
35-37	**S9**	SS	22	CL	33	**29**	**27**	30	Moist	Till- Clay with some sand, traces gravel Grey	PEN 25ksf
40											
40-42	**S10**	SS	24	CL	16	**31**	**34**	40	Moist	Same Grey	PEN 18ksf
45											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPE: SS - SPLIT SPOON C - CORE T - UNDISTURBED TUBE AUG - AUGER CUTTINGS
PEN - HAND PENETROMETER TOR - TORVANE V - VANE SHEAR

KEVIN L. PATTON, P.E.	CLIENT:	RDM Group		
36 PATTON ROAD	PROJECT:	Neelytown Expansion		
NEWBURGH, NY 12550	DATE:	11/15/2022	Project No.:	22404
PATTONGEOTECH.COM 845 275-7732	WEATHER:	Showers, 20-40F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed NW building, northwest, on hill	BORING NO.	B8
DRILLER AND HELPER:	James Casson, --				
HAMMER TYPE:	Safety Hammer	APPROX. ELEV.:	457		
INSPECTOR:	Warren Patton	WATER DEPTH:			Pg 2 of 2

Feet	SAMPLE			USCS SOIL CLASS	SPT TEST, BLOWS/6"				MOISTURE	DESCRIPTION	NOTES
	#	Type	Rec.		0-6	6-12	12-18	18-24			
45-47	**S11**	SS	24	CL	27	**15**	**22**	30	Moist	Clay, with trace very thin layers of light grey silt. Grey.	PEN 11ksf
5											
50-52	**S12**	SS	24	CL	14	**18**	**23**	24	Moist	Same- Clay layers 2 to 3mm thick, with paper-thin silt layers. Change to Clay with little sand, trace fine gravel (Till.) Grey.	PEN 14ksf PEN 13ksf
10											
55-57	**S13**	SS	0	-	18	**28**	**36**	53	-	No Recovery	
15											
60-62	**S14**	SS	<1	-	44	**50/1**			-	Cobble fragments Stopped in soil.	
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD:	HSA - Hollow-Stem Auger	MR - Mud-Rotary		MEASUREMENTS IN FEET AND INCHES
SAMPLE/TEST TYPE	SS - SPLIT SPOON	C - CORE	T - UNDISTURBED TUBE	AUG - AUGER CUTTINGS
	PEN - HAND PENETROMETER		TOR - TORVANE	V - VANE SHEAR

KEVIN L. PATTON, P.E.
36 PATTON ROAD
NEWBURGH, NY 12550
PATTONGEOTECH.COM 845 275-7732

CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion		
DATE:	11/16/2022	Project No.:	22404
WEATHER:	Light rain, 35-45F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed NW building, west side, on hill	**BORING NO.**	**B9**
DRILLER AND HELPER:	James Casson, --				
HAMMER TYPE:	Safety Hammer	APPROX. ELEV.:	427		
INSPECTOR:	Warren Patton	WATER DEPTH:			

Feet	SAMPLE			USCS SOIL CLASS	SPT TEST, BLOWS/6"				MOISTURE	DESCRIPTION	NOTES
	#	Type	Rec.		0-6	6-12	12-18	18-24			
0-2	**S1**	SS	20	ML	2	**2**	**9**	22	Very Moist	Silt with some sand, trace gravel	PEN 3.2ksf
										Orangeish brown	
2-4	**S2**	SS	8	ML	24	**37**	**50/2**		Slightly moist	Silt with some sand, little gravel	PEN 12ksf
										Yellowish brown. Slightly mottled	
5											
5-7	**S3**	SS	14	ML	13	**16**	**17**	19	Moist	Same	PEN 11ksf
										Yellowish brown, fine mottling	
7-9	**S4**	SS	18	CL	15	**13**	**14**	15	Moist	Clay with little sand	PEN 13ksf
										Yellowish brown. Slight mottling	
10											
10-12	**S5**	SS	19	ML	20	**34**	**58**	50/3	Moist	Till- Silt with some sand, little gravel	PEN 9ksf
										Olive brown	
15											
15-17	**S6**	SS	0	-	40	**62**	**50/3**		-	No Recovery	
20											
20-22	**S7**	SS	24	CL	25	**31**	**30**	49	Moist	Till- Clay with some sand, traces gravel	PEN 20ksf
										Grey	
25											
25-27	**S8**	SS	24	CL	26	**34**	**29**	36	Moist	Till- Clay with little sand, trace gravel	PEN 25+ksf
										Grey	
30											
30-32	**S9**	SS	24	CL	18	**30**	**36**	33	Moist	Same	PEN 25+ksf
										Grey	
35											
35-37	**S10**	SS	16	CL	19	**28**	**46**	53	Moist	Same with cobble fragment	PEN 25+ksf
										Grey	
40											
40-42	**S11**	SS	3	Rock	60/3				Wet	Weathered/ decomposed shale	
										Dark grey	
45											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPE SS - SPLIT SPOON C - CORE T - UNDISTURBED TUBE AUG - AUGER CUTTINGS
PEN - HAND PENETROMETER TOR - TORVANE V - VANE SHEAR

KEVIN L. PATTON, P.E.
36 PATTON ROAD
NEWBURGH, NY 12550
PATTONGEOTECH.COM 845 275-7732

CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion		
DATE:	11/17/2022	Project No.:	22404
WEATHER:	Partly cloudy, 30-45F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed NW building, east side	**BORING NO. B10**
DRILLER AND HELPER:	James Casson, --			
HAMMER TYPE:	Safety Hammer	APPROX. ELEV.:	408	
INSPECTOR:	Warren Patton	WATER DEPTH:		

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT 0-6	SPT 6-12	SPT 12-18	SPT 18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	8	ML	2	**3**	**2**	3	Very Moist	Silt with little sand, traces gravel	PEN 3.0ksf
										Brown, faint mottling	
2-4	**S2**	SS	16	SM	7	**14**	**18**	39	Sl. Moist	Sand with some gravel, little silt.	
										Olive brown	
5											
5-7	**S3**	SS	18	SM	16	**28**	**30**	50	Moist	Sand with some gravel, little silt, with silty	
										lenses or layers. Olive Grey	
7-9	**S4**	SS	24	Rock	32	**25**	**29**	26	Moist	Weathered/Decomposed shale with little silt	
										Olive brown, mottled	Refusal 9 1/2'
10											
15											
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD:	HSA - Hollow-Stem Auger	MR - Mud-Rotary		MEASUREMENTS IN FEET AND INCHES
SAMPLE/TEST TYPE	SS - SPLIT SPOON	C - CORE	T - UNDISTURBED TUBE	AUG - AUGER CUTTINGS
	PEN - HAND PENETROMETER		TOR - TORVANE	V - VANE SHEAR

KEVIN L. PATTON, P.E.	CLIENT:	RDM Group	
36 PATTON ROAD	PROJECT:	Neelytown Expansion	
NEWBURGH, NY 12550	DATE:	11/17/2022	Project No.: 22404
PATTONGEOTECH.COM 845 275-7732	WEATHER:	Partly cloudy, 30-45F	

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed NW building, northeast corner	**BORING NO.**	**B11**
DRILLER AND HELPER:	James Casson, --				
HAMMER TYPE:	Safety Hammer	APPROX. ELEV.:	410		
INSPECTOR:	Warren Patton	WATER DEPTH:			

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	12	ML	2	**3**	**9**	8	Very Moist	Silt with some sand, little gravel	PEN 4.5ksf
										Orangeish brown. Slight mottling	
2-4	**S2**	SS	8	SM	8	**11**	**18**	18	Moist	Sand and gravel with little silt. Shaley.	
										Olive brown	
5											
5-7	**S3**	SS	0	-	20	**29**	**32**	29	-	No Recovery	
7-9	**S4**	SS	8	GC-GM	26	**15**	**18**	20	Wet	Gravel with little sand, little silty clay.	
										Brown.	
10											
10-12	**S5**	SS	1	SW-SM	6	**9**	**11**	8	Wet	Sand with traces silt	
										Olive brown. Small sample.	
15											
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPE: SS - SPLIT SPOON C - CORE T - UNDISTURBED TUBE AUG - AUGER CUTTINGS PEN - HAND PENETROMETER TOR - TORVANE V - VANE SHEAR

KEVIN L. PATTON, P.E.	CLIENT:	RDM Group		
36 PATTON ROAD	PROJECT:	Neelytown Expansion		
NEWBURGH, NY 12550	DATE:	11/17/2022	Project No.:	22404
PATTONGEOTECH.COM 845 275-7732	WEATHER:	Partly cloudy, 30-45F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed east building, east side	**BORING NO.** **B12**
DRILLER AND HELPER:	James Casson, --			
HAMMER TYPE:	Safety Hammer	APPROX. ELEV.:	410	
INSPECTOR:	Warren Patton	WATER DEPTH:		

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	12	ML	2	**2**	**3**	10	Very Moist	Silt with little sand, traces gravel	PEN 7ksf
										Brown-grey-orange, fine mottling	
2-4	**S2**	SS	9	SM	11	**14**	**13**	13	Very Moist	Sand with traces to little silt, traces gravel	PEN 9ksf
										Olive brown. Slight mottling	
5											
5-7	**S3**	SS	24	SW-SM	10	**11**	**17**	28	Very Moist	Sand with some gravel, traces silt	
										Brown	
7-9	**S4**	SS	2	SM	50/2				Wet	Sand with traces to little silt, little gravel	
										Brown. Small Sample	
10											
10-12	**S5**	SS	18	Rock	7	**11**	**15**	15	Wet	Weathered/Decomposed shale, minor soil	
										veins/seams. Orange-brown, change to grey.	
15											
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD:	HSA - Hollow-Stem Auger	MR - Mud-Rotary		MEASUREMENTS IN FEET AND INCHES
SAMPLE/TEST TYPE	SS - SPLIT SPOON	C - CORE	T - UNDISTURBED TUBE	AUG - AUGER CUTTINGS
	PEN - HAND PENETROMETER		TOR - TORVANE	V - VANE SHEAR

KEVIN L. PATTON, P.E.	CLIENT:	RDM Group	
36 PATTON ROAD	PROJECT:	Neelytown Expansion	
NEWBURGH, NY 12550	DATE:	11/17/2022	Project No.: 22404
PATTONGEOTECH.COM 845 275-7732	WEATHER:	Partly cloudy, 30-45F	

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed east building, southwest	**BORING NO.** **B13**
DRILLER AND HELPER:	James Casson, --			
HAMMER TYPE:	Safety Hammer	APPROX. ELEV.:	407	
INSPECTOR:	Warren Patton	WATER DEPTH:		

Feet	SAMPLE			USCS SOIL CLASS	SPT TEST, BLOWS/6"				MOISTURE	DESCRIPTION	NOTES
	#	Type	Rec.		0-6	6-12	12-18	18-24			
0-2	**S1**	SS	5	CL-ML	2	**3**	**2**	3	Very Moist	Silty clay with little sand	PEN 4.2ksf
										Dark olive brown	
2-4	**S2**	SS	18	Rock	4	**8**	**27**	50/1	Sl. Moist	Weathered/decomposed shale	
										Olive grey	
5											
5-7	**S3**	SS	12	Rock	37	**18**	**50/3**		Wet	Weathered/decomposed shale- Sand-size with	
										some gravel, little silty clay. Olive brown	
10											
10-12	**S4**	SS	1	Rock	39	**30**	**20**	31	Wet	Shale fragments. Sand-size with some gravel,	
										little silt. Olive brown.	
15											
15-17	**S5**	SS	0	-	50/1				-	No Recovery	Refusal 15'
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPE SS - SPLIT SPOON C - CORE T - UNDISTURBED TUBE AUG - AUGER CUTTINGS
PEN - HAND PENETROMETER TOR - TORVANE V - VANE SHEAR

KEVIN L. PATTON, P.E.
36 PATTON ROAD
NEWBURGH, NY 12550
PATTONGEOTECH.COM 845 275-7732

CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion		
DATE:	11/17/2022	Project No.:	22404
WEATHER:	Partly cloudy, 30-45F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed east building, northeast, on knob	**BORING NO. B14**
DRILLER AND HELPER:	James Casson, --			
HAMMER TYPE:	Safety Hammer	APPROX. ELEV.:	423	
INSPECTOR:	Warren Patton	WATER DEPTH:		

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	16	GM	2	**18**	**14**	10	Moist	Angular gravel and sand (grey siltstone and sandstone) with little silt.	
2-4	**S2**	SS	<1	GM	50/2				Moist	Same. Small sample.	
5											Refusal 5'
10											
15											
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPE: SS - SPLIT SPOON C - CORE T - UNDISTURBED TUBE AUG - AUGER CUTTINGS
PEN - HAND PENETROMETER TOR - TORVANE V - VANE SHEAR

KEVIN L. PATTON, P.E.	CLIENT:	RDM Group		
36 PATTON ROAD	PROJECT:	Neelytown Expansion		
NEWBURGH, NY 12550	DATE:	11/11/2022	Project No.:	22404
PATTONGEOTECH.COM 845 275-7732	WEATHER:	Rain, 45-70F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed SW building, middle of west side	BORING NO.	B15
DRILLER AND HELPER:	James Casson, --				
HAMMER TYPE:	Safety Hammer	APPROX. ELEV.:	415		
INSPECTOR:	Warren Patton	WATER DEPTH:			

Feet	SAMPLE			USCS SOIL	SPT TEST, BLOWS/6"				MOISTURE	DESCRIPTION	NOTES
	#	Type	Rec.	CLASS	0-6	6-12	12-18	18-24			
0-2	**S1**	SS	10	GM	3	**6**	**5**	6	Very Moist	Gravel (Shale) and silt with some sand, trace roots. Brown. Slight mottling	
2-4	**S2**	SS	20	Rock	16	**23**	**22**	22	Moist	Gravel and sand (weathered shale) with little silt. Olive brown	
5											
5-7	**S3**	SS	24	Rock	19	**20**	**20**	40	Moist	Same, less weathered	
7-9	**S4**	SS	0	-	50/2				-	No Recovery	
10											
10-12	**S5**	SS	1	Rock	50/2				-	Rock fragments- very fine sandstone, siltstone. Small Sample.	
15											
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD:	HSA - Hollow-Stem Auger	MR - Mud-Rotary		MEASUREMENTS IN FEET AND INCHES
SAMPLE/TEST TYPE	SS - SPLIT SPOON	C - CORE	T - UNDISTURBED TUBE	AUG - AUGER CUTTINGS
	PEN - HAND PENETROMETER		TOR - TORVANE	V - VANE SHEAR

KEVIN L. PATTON, P.E. 36 PATTON ROAD NEWBURGH, NY 12550 PATTONGEOTECH.COM 845 275-7732				
	CLIENT:	RDM Group		
	PROJECT:	Neelytown Expansion		
	DATE:	11/11/2022	Project No.:	22404
	WEATHER:	Rain, 45-70F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed SW building, southwest	**BORING NO.** **B16**
DRILLER AND HELPER:	James Casson, --			
HAMMER TYPE:	Safety Hammer	APPROX. ELEV.:	413	
INSPECTOR:	Warren Patton	WATER DEPTH:		

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	16	ML	2	**3**	**2**	3	Moist	Silt with traces sand, trace gravel, tr. fine	PEN 5.2 ksf
										roots. Orangeish brown	
2-4	**S2**	SS	24	ML	10	**24**	**25**	20	Moist	Silt with traces sand, trace gravel	
										Brown-orange-white, Strong mottling	
5											
5-7	**S3**	SS	24	ML	10	**25**	**50/1**		Moist	Silt with little sand, traces gravel, shale	
										fragments. Strong brown-orange-white	
										mottling.	Refusal 8'
10											
15											
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD:	HSA - Hollow-Stem Auger	MR - Mud-Rotary		MEASUREMENTS IN FEET AND INCHES
SAMPLE/TEST TYPE	SS - SPLIT SPOON	C - CORE	T - UNDISTURBED TUBE	AUG - AUGER CUTTINGS
	PEN - HAND PENETROMETER		TOR - TORVANE	V - VANE SHEAR

KEVIN L. PATTON, P.E.
36 PATTON ROAD
NEWBURGH, NY 12550
PATTONGEOTECH.COM 845 275-7732

CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion		
DATE:	11/11/2022	Project No.:	22404
WEATHER:	Rain, 45-70F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed SW building, middle of west side	**BORING NO.** **B17**
DRILLER AND HELPER:	James Casson, --			
HAMMER TYPE:	Safety Hammer	APPROX. ELEV.:	410	
INSPECTOR:	Warren Patton	WATER DEPTH:		

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	10	ML	3	**2**	**2**	3	Moist	Silt with some sand, trace gravel	
										Brown	
2-4	**S2**	SS	3	SM,	8	**9**	**10**	21	Moist	Sand with little silt, little gravel, layered	
				SW-SM						with Sand with traces silt. Brown, gray.	
5											
5-7	**S3**	SS	3	Rock	50/4				Moist	Sand size fragments of weathered/	
										decomposed shale, with little silt and gravel.	
										Olive grey	
10											
10-12	**S5**	SS	<1	Rock	50/1				-	Rock fragments. Siltstone. Fresh to stained	
										Small sample.	
15											
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPE SS - SPLIT SPOON C - CORE T - UNDISTURBED TUBE AUG - AUGER CUTTINGS
PEN - HAND PENETROMETER TOR - TORVANE V - VANE SHEAR

KEVIN L. PATTON, P.E.	CLIENT:	RDM Group		
36 PATTON ROAD	PROJECT:	Neelytown Expansion		
NEWBURGH, NY 12550	DATE:	11/11/2022	Project No.:	22404
PATTONGEOTECH.COM 845 275-7732	WEATHER:	Rain, 45-70F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed SW building, northwest	BORING NO.	B18
DRILLER AND HELPER:	James Casson, --				
HAMMER TYPE:	Safety Hammer	APPROX. ELEV.:	406		
INSPECTOR:	Warren Patton	WATER DEPTH:			

Feet	SAMPLE			USCS SOIL CLASS	SPT TEST, BLOWS/6"				MOISTURE	DESCRIPTION	NOTES
	#	Type	Rec.		0-6	6-12	12-18	18-24			
0-2	**S1**	SS	14	ML	2	**2**	**4**	7	Moist	Silt with little sand, trace gravel, trace fine roots	
										Orangeish brown	
2-4	**S2**	SS	20	SM	14	**11**	**17**	34	Sl. Moist	Sand with some silt, traces gravel. Changes to	
				Rock						weathered shale. Yellowish brown	
5											
5-7	**S3**	SS	24	Rock	28	**33**	**27**	30	Sl. Moist	Sand size weathered shale with some silt and	
										gravel. Grey	
7-9	**S4**	SS	24	Rock	24	**25**	**39**	50/3	Sl. Moist	Weathered/ decomposed shale. Vein of silty sand	
										Grey	
10											
10-12	**S5**	SS	<1	Rock	50/1				-	Rock fragments, siltstone. Fresh to stained	
										Grey. Small sample.	
15											
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD:	HSA - Hollow-Stem Auger	MR - Mud-Rotary		MEASUREMENTS IN FEET AND INCHES
SAMPLE/TEST TYPE	SS - SPLIT SPOON	C - CORE	T - UNDISTURBED TUBE	AUG - AUGER CUTTINGS
	PEN - HAND PENETROMETER		TOR - TORVANE	V - VANE SHEAR

KEVIN L. PATTON, P.E.	CLIENT:	RDM Group	
36 PATTON ROAD	PROJECT:	Neelytown Expansion	
NEWBURGH, NY 12550	DATE:	11/11/2022	Project No.: 22404
PATTONGEOTECH.COM 845 275-7732	WEATHER:	Rain, 45-70F	

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed NW building, middle of south side	BORING NO.	B19
DRILLER AND HELPER:	James Casson, --				
HAMMER TYPE:	Safety Hammer	APPROX. ELEV.:	406		
INSPECTOR:	Warren Patton	WATER DEPTH:			

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	14	SM	2	**2**	**3**	3	Very Moist	Sand and silt with some shale fragments Brown	
2-4	**S2**	SS	8	GM	5	**4**	**5**	17	Very Moist	Gravel and shale fragments with some sand, little silt. Brown	
5											
5-7	**S3**	SS	10	GM	30	**18**	**20**	17	Very Moist	Shale fragments with little sand, little silt Brown	
7-9	**S4**	SS	24	GM	25	**34**	**27**	27	Very Moist	Weathered/decomposed shale fragments with little sand, little silt. Grey and Brown.	
10											
10-12	**S5**	SS	6	GM	11	**11**	**11**	12	Wet	Gravel and shale fragments with some sand, little silt. Olive brown	
15											
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPE SS - SPLIT SPOON C - CORE T - UNDISTURBED TUBE AUG - AUGER CUTTINGS PEN - HAND PENETROMETER TOR - TORVANE V - VANE SHEAR

KEVIN L. PATTON, P.E.	CLIENT:	RDM Group		
36 PATTON ROAD	PROJECT:	Neelytown Expansion		
NEWBURGH, NY 12550	DATE:	11/11/2022	Project No.:	22404
PATTONGEOTECH.COM 845 275-7732	WEATHER:	Rain, 45-70F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed NW building, middle	BORING NO.	B20
DRILLER AND HELPER:	James Casson, --				
HAMMER TYPE:	Safety Hammer	APPROX. ELEV.:	407		
INSPECTOR:	Warren Patton	WATER DEPTH:			

Feet	SAMPLE			USCS SOIL CLASS	SPT TEST, BLOWS/6"				MOISTURE	DESCRIPTION	NOTES
	#	Type	Rec.		0-6	6-12	12-18	18-24			
0-2	**S1**	SS	12	ML	3	**3**	**6**	12	Very Moist	Silt with some sand, traces gravel. Becomes shale	PEN 2.8ksf
										Orangeish brown	
2-4	**S2**	SS	14	GW-GM	13	**16**	**19**	17	Moist	Gravel with some sand, traces silt.	
										Olive brown	
5											
5-7	**S3**	SS	20	GM	10	**11**	**13**	11	Moist	Gravel and sand with little silt	
										Olive brown	
7-9	**S4**	SS	5	SW-SM	16	**22**	**50/2**		Moist	Sand with some gravel (subrounded shale	
										gravel,) traces silt. Olive brown	
10											
15											
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD:	HSA - Hollow-Stem Auger	MR - Mud-Rotary		MEASUREMENTS IN FEET AND INCHES
SAMPLE/TEST TYPE	SS - SPLIT SPOON	C - CORE	T - UNDISTURBED TUBE	AUG - AUGER CUTTINGS
	PEN - HAND PENETROMETER		TOR - TORVANE	V - VANE SHEAR

KEVIN L. PATTON, P.E.
36 PATTON ROAD
NEWBURGH, NY 12550
PATTONGEOTECH.COM 845 275-7732

CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion, Montgomery, NY		
DATE:	1/24/2023	Project No.:	22404
WEATHER:	Clear, 37°		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed NW parking area, middle of middle tier	**BORING NO.**	**B21**
DRILLER AND HELPER:	Jim Casson, Howie				
HAMMER TYPE:	Automatic Hammer	APPROX. ELEV.:	469		
INSPECTOR:	Warren Patton	WATER DEPTH:			

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	14	SC-SM	2	**2**	**3**	4	Wet	Sand with some silty clay, little gravel	
										Yellowish brown, faint mottling	
2-4	**S2**	SS	9	CL-ML	7	**7**	**8**	12	Very Moist	Silty clay with some sand, little gravel	
										Brown, faint mottling	
5											
5-7	**S3**	SS	20	CL-ML	7	**5**	**4**	11	Wet	Till- Silty clay and sand with trace gravel	PEN 11 ksf
										Mottled brown and grey	TOR 1000 psf/
											340 psf sheared
10											
10-12	**S4**	SS	12	CL	17	**24**	**28**	22	Moist	Till-Clay with some sand, little gravel	
										Pale yellowish brown	
15											
15-17	**S5**	SS	16	ML	21	**44**	**50/4**		Moist	Till- Silt with some sand, little gravel	PEN 15 ksf
										Pale yellowish brown	
20											
20-22	**S6**	SS	20	ML	49	**61**	**57**	50/4	Moist	Till- Silt with some sand, traces gravel	PEN 12 ksf
										Grey	
25											
25-27	**S7**	SS	9	SM	63	**50/2**			Moist	Till- Sand with some silt, traces gravel	
										Grey	
30											
30-32	**S8**	SS	<1	-	60/4				-	Cobble fragments	
										Small sample.	
35											
35-37	**S9**	SS	5	CL-ML	74	**55/5**			Moist	Till- Silty clay with some sand, little gravel	
										Grey.	
40											
40-42	**S10**	SS	12	CL-ML	44	**49**	**50/3**		Moist	Till- Silty clay with some sand, some gravel	
										Grey.	
45											

COMMENTS:

DRILLING METHOD:	HSA - Hollow-Stem Auger	MR - Mud-Rotary		MEASUREMENTS IN FEET AND INCHES
SAMPLE/TEST TYPES	SS - SPLIT SPOON	C - CORE	T - UNDISTURBED TUBE	AUG - AUGER CUTTINGS
	PEN - HAND PENETROMETER		TOR - TORVANE	V - VANE SHEAR

KEVIN L. PATTON, P.E. **36 PATTON ROAD** **NEWBURGH, NY 12550** **PATTONGEOTECH.COM 845 275-7732**				
	CLIENT:	RDM Group		
	PROJECT:	Neelytown Expansion, Montgomery, NY		
	DATE:	1/25/2023	Project No.:	22404
	WEATHER:	Snow, 36°		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed NW parking area, N end of middle tier	**BORING NO.**	**B22**
DRILLER AND HELPER:	Jim Casson, Howie				
HAMMER TYPE:	Automatic Hammer	APPROX. ELEV.:	472		
INSPECTOR:	Warren Patton	WATER DEPTH:			

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	9	CL-ML	2	**2**	**4**	3	Wet	Silty clay with some sand, little gravel	PEN 3.0ksf
										Yellowish Brown, fine mottling	
2-4	**S2**	SS	15	CL	7	**5**	**7**	9	Very Moist	Clay with some sand, traces gravel	PEN 7.0ksf
										Brown with fine grey mottling	
5											
5-7	**S3**	SS	0	-	50/1				-	No Recovery	
10											
10-12	**S4**	SS	24	CL	13	**12**	**19**	26	Very Moist	Till- Clay with some sand, traces gravel	PEN 10ksf
										Brown.	
15											
15-17	**S5**	SS	1	CL	18	**24**	**28**	25	Wet	Same.	Small Sample
											Drill cuttings, 15-20 feet: Grey clay with
20											some sand, traces
20-22	**S6**	SS	0	-	15	**31**	**50**	44	-	No Recovery	gravel.
25											
25-27	**S7**	SS	22	SC	25	**82**	**70**	55	Moist	Till- Sand with some clay, some gravel. Shale	PEN 25ksf
										cobble fragments. Pale yellowish brown.	
27-29	**S8**	SS	18	SC	25	**22**	**37**	32	Moist	Till- Sand and clay with little gravel	PEN 18ksf
										Olive grey	
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPES: SS - SPLIT SPOON C - CORE T - UNDISTURBED TUBE AUG - AUGER CUTTINGS
PEN - HAND PENETROMETER TOR - TORVANE V - VANE SHEAR

KEVIN L. PATTON, P.E.
36 PATTON ROAD
NEWBURGH, NY 12550
PATTONGEOTECH.COM 845 275-7732

CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion, Montgomery, NY		
DATE:	1/23/2023	Project No.:	22404
WEATHER:	Light Snow, 34°		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed NW parking area, SE Stormwater Area	BORING NO. **B23**
DRILLER AND HELPER:	Jim Casson, Howie			
HAMMER TYPE:	Automatic Hammer	APPROX. ELEV.:	479	
INSPECTOR:	Warren Patton	WATER DEPTH:		**Pg 1 of 2**

Feet	SAMPLE #	Type	Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
0-2	**S1**	SS	12	CL	1	**2**	**2**	4	Wet	Clay with little sand, traces gravel, few fine roots	PEN 0.9ksf
										Brown, faint mottling	
2-4	**S2**	SS	20	CL-ML	10	**6**	**11**	16	Very Moist	Silty clay with some sand, traces gravel	PEN 6ksf
										Brown, faint mottling	
5											
5-7	**S3**	SS	12	CL-ML	10	**10**	**11**	11	Wet	Silty clay with little sand, traces fine gravel	PEN 0.9ksf
										Olive brown, fine mottling	TOR 480psf/ 200psf
7-9	**S4**	SS	24	SC	12	**17**	**24**	24	Moist	Till- Sand with some clay, traces gravel	sheared.
										Pale yellowish brown	PEN 21ksf
10											
10-12	**S5**	SS	22	SC	24	**27**	**35**	38	Moist	Same	PEN 21ksf
15											
15-17	**S6**	SS	24	SC	23	**18**	**42**	41	Moist	Till- Sand and clay with traces to little gravel	PEN 22ksf,
										Medium dark grey	PEN 13ksf
20											
20-22	**S7**	SS	18	CL-ML	55	**35**	**43**	50/2"	Moist	Till- Silty clay with some sand, traces fine gravel	PEN 23ksf
										Medium Grey	
25											
25-27	**S8**	SS	18	ML	35	**54**	**43**	38	Moist	Till- Silt with some sand, little gravel	PEN 10ksf
										Grey	
30											
30-32	**S9**	SS	24	CL	21	**14**	**31**	28	Moist	Till- Clay with some sand, little gravel	PEN 23ksf
										Olive grey	
35											
35-37	**S10**	SS	0	-	18	**24**	**19**	27	-	No Recovery	
40											
40-42	**S11**	SS	<1	CL	30	**32**	**35**	31	Wet	Till- Clay with some sand	Small Sample
										Olive Grey	
45											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPES: SS - SPLIT SPOON C - CORE T - UNDISTURBED TUBE AUG - AUGER CUTTINGS
PEN - HAND PENETROMETER TOR - TORVANE V - VANE SHEAR

KEVIN L. PATTON, P.E.	CLIENT:	RDM Group	
36 PATTON ROAD	PROJECT:	Neelytown Expansion, Montgomery, NY	
NEWBURGH, NY 12550	DATE:	1/23/2023	Project No.: 22404
PATTONGEOTECH.COM 845 275-7732	WEATHER:	Light Snow, 34°	

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Proposed NW parking area, SE Stormwater Area	**BORING NO.**	**B23**
DRILLER AND HELPER:	Jim Casson, Howie				
HAMMER TYPE:	Automatic Hammer	APPROX. ELEV.:	479		
INSPECTOR:	Warren Patton	WATER DEPTH:			**Pg 2 of 2**

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
45-47	**S12**	SS	24	CL	17	**22**	**28**	34	Very Moist	Till- Clay with little sand, little gravel	PEN 11ksf
										Olive grey	
50											
50-52	**S13**	SS	18	CL	20	**20**	**23**	33	Very Moist	Till- Clay with some sand, traces gravel	PEN 26 ksf
										Olive Grey	
52-54	**S14**	SS	16	CL	30	**40**	**55**	56	Very Moist	Same.	PEN 18ksf
										Olive Grey	TOR 1740 psf/
55											520 psf sheared.
60											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPES: SS - SPLIT SPOON C - CORE T - UNDISTURBED TUBE AUG - AUGER CUTTINGS
PEN - HAND PENETROMETER TOR - TORVANE V - VANE SHEAR

KEVIN L. PATTON, P.E.
36 PATTON ROAD
NEWBURGH, NY 12550
845 275-7732 PATTONGEOTECH.COM

CLIENT:	RDM Group		
PROJECT:	Mid-Hudson Industrial Park, Montgomery, N.Y.		
PROJECT No.:	21106	SAMPLE LOT No.:	210218-1
DATE SAMPLED:	2/17-18/21	DATE TESTED:	2/26/2021
SAMPLED BY:	Wyeth Patton	TESTED BY:	Wyeth Patton

MOISTURE CONTENT OF SOIL

TEST METHOD: ASTM D2216

SAMPLE NO.	DEPTH, FT.	% MOISTURE
B1 S1	1	15.2
B1 S2	3	22.8
B1 S3	6	12.5
B1 S4	8	14.4
B2 S1	1	21.6
B2 S2	3	14.8
B2 S3	6	20.5
B2 S4	8	12.5
B2 S5	11	13.8
B3 S2	6	13.7
B4 S1	1	16.7
B4 S2	3	6.9
B4 S3	6	12.0
B4 S4	8	10.0
B5 S1	1	32.2
B5 S2	3	14.4
B5 S4	8	22.1
B5 S6	16	13.9
B6 S1	1	17.0
B6 S2	3	16.6
B6 S4	8	9.7
B6 S6	16	9.8

Moisture content is expressed as a percent of the dry mass of the soil.

Reviewed by: *Kevin Patton*

Form NMC

KEVIN L. PATTON, P.E.
36 PATTON ROAD
NEWBURGH, NY 12550
845 275-7732 PATTONGEOTECH.COM

CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion, Montgomery, N.Y.		
PROJECT No.:	22404	SAMPLE LOT No.:	221117-1
DATE SAMPLED:	11/11-17/2022	DATE TESTED:	12/16/2022
SAMPLED BY:	Warren Patton	TESTED BY:	Wyeth Patton

MOISTURE CONTENT OF SOIL

TEST METHOD: ASTM D2216

SAMPLE NO.	DEPTH,FT.	% MOISTURE
B8 S1	1	7.9
B8 S2	3	5.7
B8 S4	11	9.5
B8 S5	16	6.4
B8 S9	36	9.5
B8 S11	46	24.3
B8 S12-top	51	22.7
B8 S12	52	11.1
B9 S1	1	15.9
B9 S2	3	5.8
B9 S3	6	8.3
B9 S5	11	8.7
B9 S7	21	5.9
B9 S8	26	11.3
B9 S9	31	11.1
B9 S10	36	9.6
B9 S11	41	6.9

Moisture content is expressed as a percent of the dry mass of the soil.

Reviewed by: *Kevin Patton*

Form NMC

KEVIN L. PATTON, P.E.
36 PATTON ROAD
NEWBURGH, NY 12550
845 275-7732 PATTONGEOTECH.COM

CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion, Montgomery, N.Y.		
PROJECT No.:	22404	SAMPLE LOT No.:	221117-1
DATE SAMPLED:	11/11-17/2022	DATE TESTED:	12/16/2022
SAMPLED BY:	Warren Patton	TESTED BY:	Wyeth Patton

MOISTURE CONTENT OF SOIL

TEST METHOD: ASTM D2216

B11 S1	1	8.6
B11 S2	3	5.5
B11 S4	8	9.5
B12 S1	1	17.0
B12 S2	3	9.4
B12 S3	6	6.8
B12 S4	8	12.1
B12 S5	10	8.3
B12 S5	11	14.0
B16 S1	1	16.6
B16 S2	3	6.6
B16 S3	6	7.9
B18 S1	1	9.4
B18 S2	3	4.3
B18 S3	6	3.5
B18 S4	8	4.4
B19 S1	1	12.7
B19 S2	3	7.6
B19 S3	6	5.7
B19 S4	8	6.6
B19 S5	11	9.6

Moisture content is expressed as a percent of the dry mass of the soil.

Reviewed by: *Kevin Patton*

Form NMC

KEVIN L. PATTON, P.E.
36 PATTON ROAD
NEWBURGH, NY 12550
845 275-7732 PATTONGEOTECH.COM

CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion		
PROJECT No.:	22404	SAMPLE LOT No.:	230125-1
DATE SAMPLED:	01/23-25/2023	DATE TESTED:	2/15/2023
SAMPLED BY:	Warren Patton	TESTED BY:	Warren Patton

MOISTURE CONTENT OF SOIL

TEST METHOD: ASTM D2216

SAMPLE NO.	DEPTH,FT.	% MOISTURE
B21 S1	1	8.3
B21 S2	3	10.6
B21 S3	6	12.3
B21 S4	11	9.5
B21 S5	16	7.8
B21 S6	21	7.1
B21 S7	26	6.9
B21 S10	41	4.7
B22 S2	3	13.6
B22 S4	11	10.5
B22 S7	26	6.7
B22 S8	28	8.1
B23 S1	1	14.7
B23 S2	3	12.8
B23 S3	6	32.3
B23 S4	8	10.2
B23 S5	11	9.1
B23 S6	16	6.1
B23 S7	21	8.7
B23 S8	26	7.0
B23 S9	31	9.1
B23 S12	46	10.3
B23 S13	51	9.9
B23 S14	53	9.0

Moisture content is expressed as a percent of the dry mass of the soil.

Reviewed by: *Kevin Patton*

KEVIN L. PATTON, P.E.

36 PATTON ROAD
NEWBURGH, NY 12550
845 275-7732 PATTONGEOTECH.COM

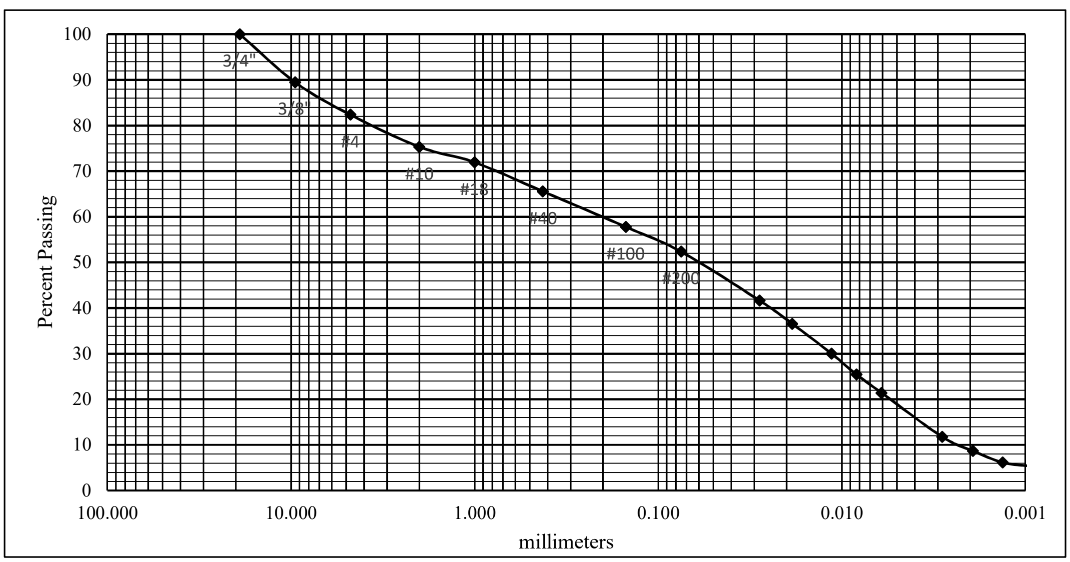
CLIENT:	RDM Group		
PROJECT:	Mid-Hudson Industrial Park, Montgomery, N.Y.		
PROJECT No.:	21106	SAMPLE LOT No.:	210218-1
DATE SAMPLED:	2/17-18/21	DATE TESTED:	2/26/2021
SAMPLED BY:	Wyeth Patton	TESTED BY:	Wyeth Patton

SIEVE-AND-HYDROMETER ANALYSIS TEST REPORT

TEST METHOD(s): ASTM D422, AASHTO T88

Sample Location	B6-S3
Depth	6 feet

Sieve Size		Percent Retained	Percent Passing	Specification
inches	mm			
3/4"	19.0	0	100	
3/8"	9.5	11	89	
#4	4.75	7	82	
#10	2.00	7	75	
#18	1.00	3	72	
#40	0.425	6	66	
#100	0.150	8	58	
#200	0.075	6	52	
Hydrometer Analysis	0.050	4	48	
	0.020	10	38	
	0.010	10	28	
	0.005	9	19	
	0.002	10	9	
	0.001	4	5	



USDA Particle Size Classification:		
Gravel, 2.00mm to 3"	25	**USDA Textural Class:** Gravelly Silt Loam
Sand, 2.00 to 0.050mm:	27	**USCS Classification (ASTM D2487/D2488):**
Silt, 0.050 to 0.002mm:	39	CL-ML, Sandy Silty Clay
Clay, <0.002mm	9	
Total	100	Atterberg Limits were determined by: Test

Reviewed by: *Kevin Patton*

Form HYD

KEVIN L. PATTON, P.E.

36 PATTON ROAD
NEWBURGH, NY 12550
845 275-7732 PATTONGEOTECH.COM

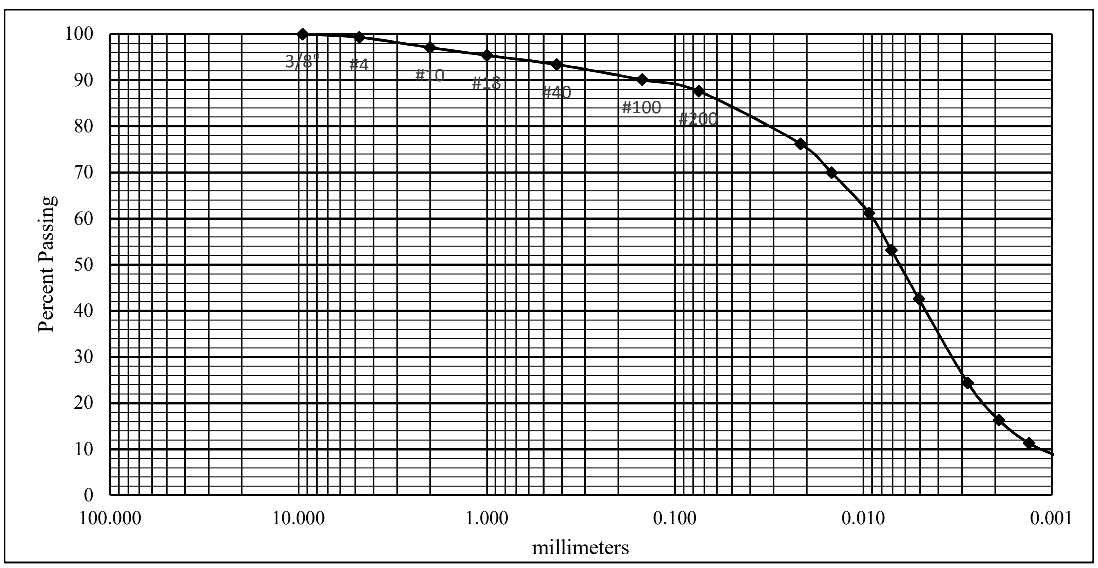
CLIENT:	RDM Group		
PROJECT:	Mid-Hudson Industrial Park, Montgomery, N.Y.		
PROJECT No.:	21106	SAMPLE LOT No.:	210218-1
DATE SAMPLED:	2/17-18/21	DATE TESTED:	2/26/2021
SAMPLED BY:	Wyeth Patton	TESTED BY:	Wyeth Patton

SIEVE-AND-HYDROMETER ANALYSIS TEST REPORT

TEST METHOD(s): ASTM D422, AASHTO T88

Sample Location	B6-S7
Depth	19 feet

Sieve Size		Percent Retained	Percent Passing	Specification
inches	mm			
3/8"	9.5	0	100	
#4	4.75	1	99	
#10	2.00	2	97	
#18	1.00	2	95	
#40	0.425	2	93	
#100	0.150	3	90	
#200	0.075	2	88	
Hydrometer Analysis	0.050	4	84	
	0.020	9	75	
	0.010	12	63	
	0.005	20	43	
	0.002	27	16	
	0.001	7	9	



USDA Particle Size Classification:		**USDA Textural Class:** Silt Loam
Gravel, 2.00mm to 3"	3	
Sand, 2.00 to 0.050mm:	13	**USCS Classification (ASTM D2487/D2488):**
Silt, 0.050 to 0.002mm:	68	CL-ML, Silty Clay
Clay, <0.002mm	16	
Total	100	Atterberg Limits were determined by: Test

Reviewed by: *Kevin Patton*

Form HYD

KEVIN L. PATTON, P.E.

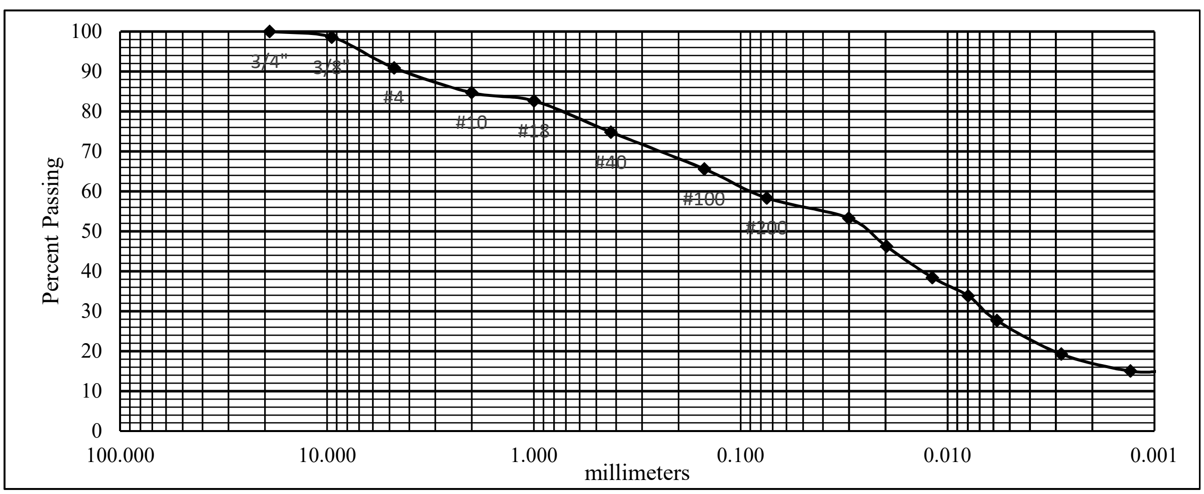
36 PATTON ROAD
NEWBURGH, NY 12550
845 275-7732   PATTONGEOTECH.COM

CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion, Montgomery, N.Y.		
PROJECT No.:	22404	SAMPLE LOT No.:	221117-1
DATE SAMPLED:	11/11-17/2022	DATE TESTED:	12/5/2022
SAMPLED BY:	Warren Patton	TESTED BY:	Wyeth Patton

SIEVE-AND-HYDROMETER ANALYSIS TEST REPORT
TEST METHOD(s): ASTM D422, AASHTO T88

Sample Location	B7-S4
Depth	8 feet

Sieve Size		Percent Retained	Percent Passing	Specification
inches	mm			
3/4"	19.0	0	100	
3/8"	9.5	1	99	
#4	4.75	8	91	
#10	2.00	6	85	
#18	1.00	2	83	
#40	0.425	8	75	
#100	0.150	9	66	
#200	0.075	8	58	
Hydrometer Analysis	0.050	2	56	
	0.020	10	46	
	0.010	10	36	
	0.005	10	26	
	0.002	9	17	
	0.001	3	14	



USDA Particle Size Classification:	
Gravel, 3" to 2.00mm	15
Sand, 2.00 to 0.050mm:	29
Silt, 0.050 to 0.002mm:	39
Clay, <0.002mm	17
Total	100

USDA Textural Class: Gravelly Loam

USCS Classification (ASTM D2487/D2488):
ML, Sandy Silt

Atterberg Limits were determined by: Estimated (ASTM D2488)

Reviewed by: *Kevin Patton*

Form HYD

KEVIN L. PATTON, P.E.
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NEWBURGH, NY 12550
845 275-7732 PATTONGEOTECH.COM

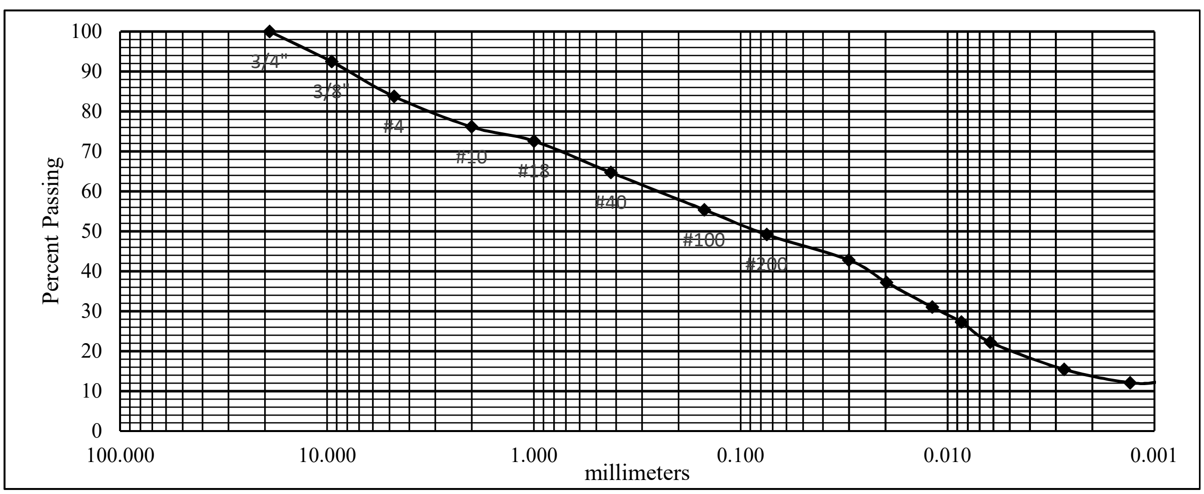
CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion, Montgomery, N.Y.		
PROJECT No.:	22404	SAMPLE LOT No.:	221117-1
DATE SAMPLED:	11/11-17/2022	DATE TESTED:	12/5/2022
SAMPLED BY:	Warren Patton	TESTED BY:	Wyeth Patton

SIEVE-AND-HYDROMETER ANALYSIS TEST REPORT

TEST METHOD(s): ASTM D422, AASHTO T88

Sample Location	B8-S3
Depth	6 feet

Sieve Size		Percent Retained	Percent Passing	Specification
inches	mm			
3/4"	19.0	0	100	
3/8"	9.5	8	92	
#4	4.75	8	84	
#10	2.00	8	76	
#18	1.00	3	73	
#40	0.425	8	65	
#100	0.150	10	55	
#200	0.075	6	49	
Hydrometer Analysis	0.050	3	46	
	0.020	9	37	
	0.010	8	29	
	0.005	9	20	
	0.002	6	14	
	0.001	2	12	



USDA Particle Size Classification:		**USDA Textural Class:** Gravelly Loam
Gravel, 3" to 2.00mm	24	
Sand, 2.00 to 0.050mm:	30	**USCS Classification (ASTM D2487/D2488):**
Silt, 0.050 to 0.002mm:	32	SM, Silty Sand with Gravel
Clay, <0.002mm	14	
Total	100	Atterberg Limits were determined by: Estimated (ASTM D2488)

Reviewed by: *Kevin Patton*

Form HYD

KEVIN L. PATTON, P.E.

36 PATTON ROAD

NEWBURGH, NY 12550

845 275-7732 PATTONGEOTECH.COM

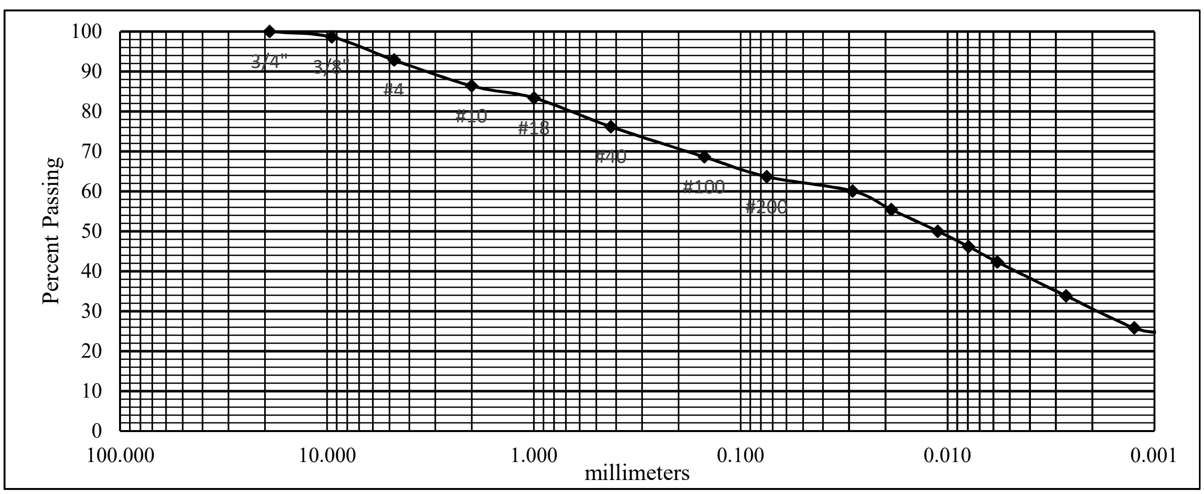
CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion, Montgomery, N.Y.		
PROJECT No.:	22404	SAMPLE LOT No.:	221117-1
DATE SAMPLED:	11/11-17/2022	DATE TESTED:	12/5/2022
SAMPLED BY:	Warren Patton	TESTED BY:	Wyeth Patton

SIEVE-AND-HYDROMETER ANALYSIS TEST REPORT

TEST METHOD(s): ASTM D422, AASHTO T88

Sample Location	B8-S7
Depth	26 feet

Sieve Size		Percent Retained	Percent Passing	Specification
inches	mm			
3/4"	19.0	0	100	
3/8"	9.5	1	99	
#4	4.75	6	93	
#10	2.00	7	86	
#18	1.00	3	83	
#40	0.425	7	76	
#100	0.150	7	69	
#200	0.075	5	64	
Hydrometer Analysis	0.050	2	62	
	0.020	6	56	
	0.010	7	49	
	0.005	8	41	
	0.002	10	31	
	0.001	6	25	



USDA Particle Size Classification:	
Gravel, 3" to 2.00mm	14
Sand, 2.00 to 0.050mm:	24
Silt, 0.050 to 0.002mm:	31
Clay, <0.002mm	31
Total	100

USDA Textural Class: Clay Loam

USCS Classification (ASTM D2487/D2488):

CL, Sandy Clay

Atterberg Limits were determined by: Test

Reviewed by: *Kevin Patton*

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NEWBURGH, NY 12550
845 275-7732 PATTONGEOTECH.COM

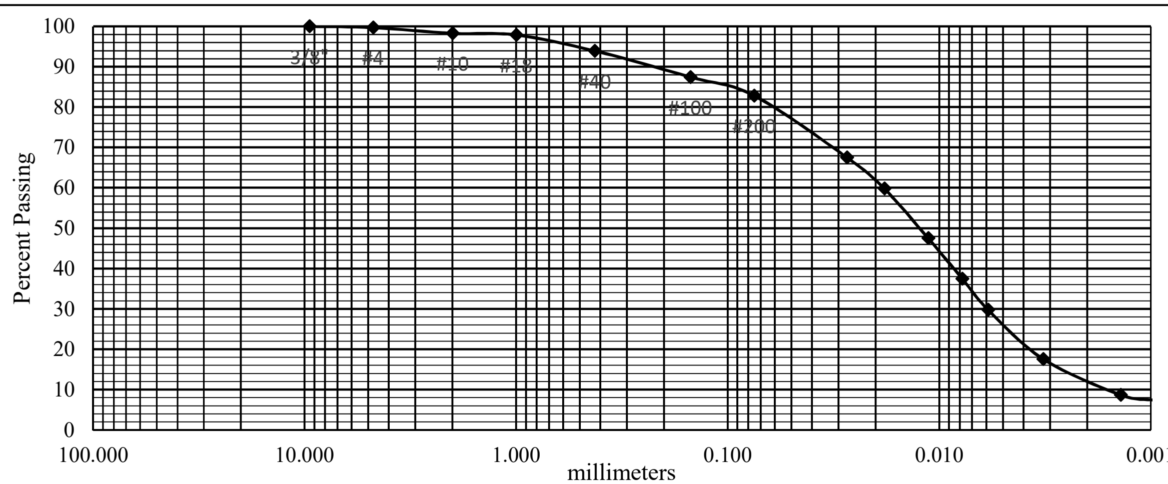
CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion, Montgomery, N.Y.		
PROJECT No.:	22404	SAMPLE LOT No.:	221117-1
DATE SAMPLED:	11/11-17/2022	DATE TESTED:	12/5/2022
SAMPLED BY:	Warren Patton	TESTED BY:	Wyeth Patton

SIEVE-AND-HYDROMETER ANALYSIS TEST REPORT

TEST METHOD(s): ASTM D422, AASHTO T88

Sample Location	B9-S4
Depth	8 feet

Sieve Size		Percent Retained	Percent Passing	Specification
inches	mm			
3/8"	9.5	0	100	
#4	4.75	0	100	
#10	2.00	2	98	
#18	1.00	0	98	
#40	0.425	4	94	
#100	0.150	7	87	
#200	0.075	4	83	
Hydrometer Analysis	0.050	6	77	
	0.020	15	62	
	0.010	18	44	
	0.005	18	26	
	0.002	14	12	
	0.001	4	8	



USDA Particle Size Classification:	
Gravel, 3" to 2.00mm	2
Sand, 2.00 to 0.050mm:	21
Silt, 0.050 to 0.002mm:	65
Clay, <0.002mm	12
Total	100

USDA Textural Class: Silt Loam

USCS Classification (ASTM D2487/D2488):
CL, Clay with Sand

Atterberg Limits were determined by: Test

Reviewed by: *Kevin Patton*

Form HYD

KEVIN L. PATTON, P.E.
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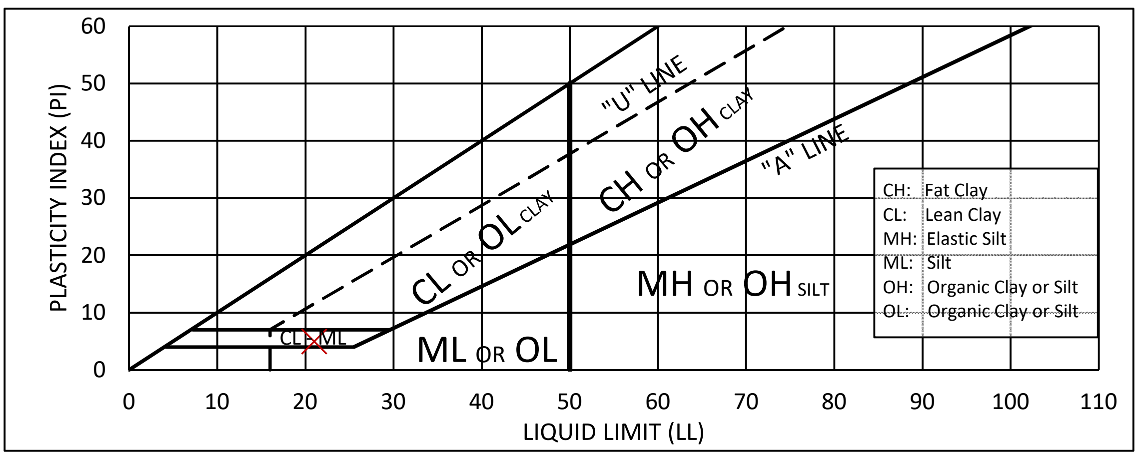
NEWBURGH, NY 12550
845 275-7732 PATTONGEOTECH.COM

CLIENT:	RDM Group		
PROJECT:	Mid-Hudson Industrial Park, Montgomery, N.Y.		
PROJECT No.:	21106	SAMPLE LOT No.:	210218-1
DATE SAMPLED:	2/17-18/21	DATE TESTED:	2/26/2021
SAMPLED BY:	Wyeth Patton	TESTED BY:	Wyeth Patton

ATTERBERG LIMITS TEST

TEST METHODS: ASTM D4318/ AASHTO T89, T90

Sample Location	B6-S3
Depth	6 feet
Percent Passing #40	66
Liquid Limit (LL)	**21**
Plastic Limit (PL)	**16**
Plasticity Index (PI)	**5**
USCS Class of -#40	CL-ML



LL, PL and PI values are percent moisture of the soil by dry mass.

Test is performed on the 'matrix' fraction of the soil, finer than the #40 (0.425mm) sieve.

The Liquid Limit is the moisture content at which the matrix fraction of the soil changes from a stiff to a flowing consistency. The plastic limit is the moisture content at which it changes from cohesive to crumbly. The Plasticity Index is the Liquid Limit minus the Plastic Limit.

Reviewed by: *Kevin Patton*

Form ABL

KEVIN L. PATTON, P.E.
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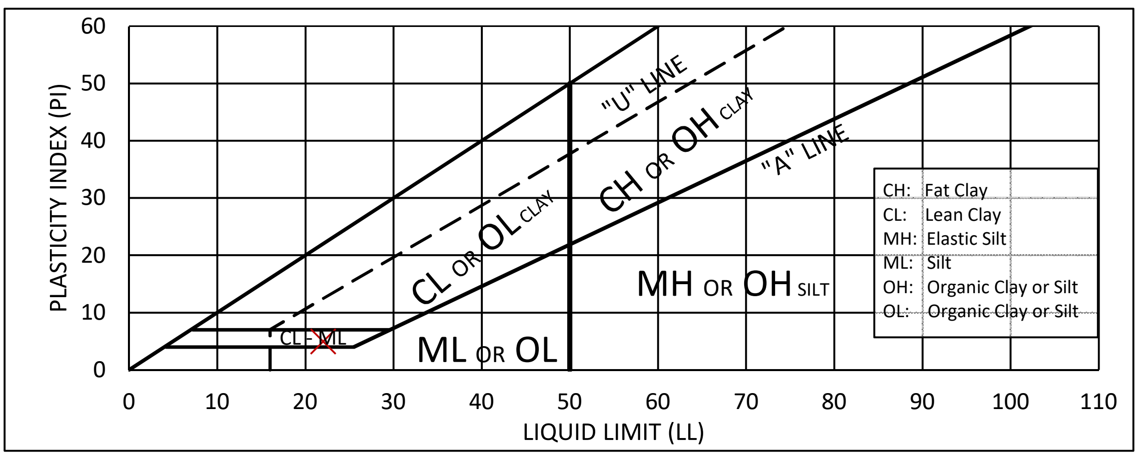
NEWBURGH, NY 12550
845 275-7732 PATTONGEOTECH.COM

CLIENT:	RDM Group		
PROJECT:	Mid-Hudson Industrial Park, Montgomery, N.Y.		
PROJECT No.:	21106	SAMPLE LOT No.:	210218-1
DATE SAMPLED:	2/17-18/21	DATE TESTED:	2/26/2021
SAMPLED BY:	Wyeth Patton	TESTED BY:	Wyeth Patton

ATTERBERG LIMITS TEST

TEST METHODS: ASTM D4318/ AASHTO T89, T90

Sample Location	B6-S7
Depth	19 feet
Percent Passing #40	93
Liquid Limit (LL)	**22**
Plastic Limit (PL)	**17**
Plasticity Index (PI)	**5**
USCS Class of -#40	CL-ML



LL, PL and PI values are percent moisture of the soil by dry mass.

Test is performed on the 'matrix' fraction of the soil, finer than the #40 (0.425mm) sieve.

The Liquid Limit is the moisture content at which the matrix fraction of the soil changes from a stiff to a flowing consistency. The plastic limit is the moisture content at which it changes from cohesive to crumbly. The Plasticity Index is the Liquid Limit minus the Plastic Limit.

Reviewed by: *Kevin Patton*

Form ABL

KEVIN L. PATTON, P.E.
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NEWBURGH, NY 12550
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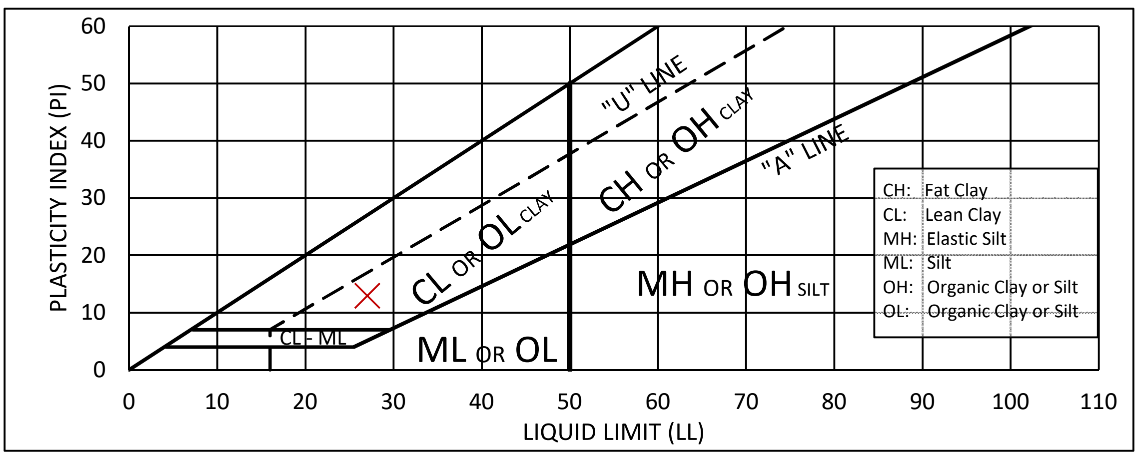
CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion, Montgomery, N.Y.		
PROJECT No.:	22404	SAMPLE LOT No.:	221117-1
DATE SAMPLED:	11/11-17/2022	DATE TESTED:	12/5/2022
SAMPLED BY:	Warren Patton	TESTED BY:	Wyeth Patton

ATTERBERG LIMITS TEST

TEST METHODS: ASTM D4318/ AASHTO T89, T90

Sample Location	B8-S7
Depth	26 feet
Percent Passing #40	76
Liquid Limit (LL)	**27**
Plastic Limit (PL)	**14**
Plasticity Index (PI)	**13**
USCS Class of -#40	CL, Lean Clay



LL, PL and PI values are percent moisture of the soil by dry mass.

Test is performed on the 'matrix' fraction of the soil, finer than the #40 (0.425mm) sieve.

The Liquid Limit is the moisture content at which the matrix fraction of the soil changes from a stiff to a flowing consistency. The plastic limit is the moisture content at which it changes from cohesive to crumbly. The Plasticity Index is the Liquid Limit minus the Plastic Limit.

Reviewed by: *Kevin Patton*

Form ABL

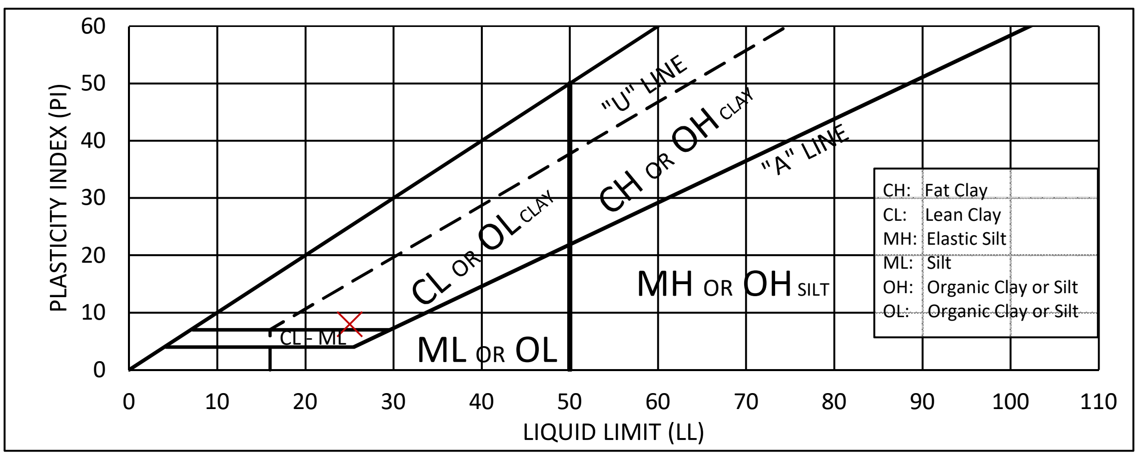
KEVIN L. PATTON, P.E.
36 PATTON ROAD
NEWBURGH, NY 12550
845 275-7732 PATTONGEOTECH.COM

CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion, Montgomery, N.Y.		
PROJECT No.:	22404	SAMPLE LOT No.:	221117-1
DATE SAMPLED:	11/11-17/2022	DATE TESTED:	12/5/2022
SAMPLED BY:	Warren Patton	TESTED BY:	Wyeth Patton

ATTERBERG LIMITS TEST

TEST METHODS: ASTM D4318/ AASHTO T89, T90

Sample Location	B9-S4
Depth	8 feet
Percent Passing #40	94
Liquid Limit (LL)	**25**
Plastic Limit (PL)	**17**
Plasticity Index (PI)	**8**
USCS Class of -#40	CL, Lean Clay



LL, PL and PI values are percent moisture of the soil by dry mass.

Test is performed on the 'matrix' fraction of the soil, finer than the #40 (0.425mm) sieve.

The Liquid Limit is the moisture content at which the matrix fraction of the soil changes from a stiff to a flowing consistency. The plastic limit is the moisture content at which it changes from cohesive to crumbly. The Plasticity Index is the Liquid Limit minus the Plastic Limit.

Reviewed by: *Kevin Patton*

Form ABL

KEVIN L. PATTON, P.E.
36 PATTON ROAD
NEWBURGH, NY 12550
845 275-7732 PATTONGEOTECH.COM

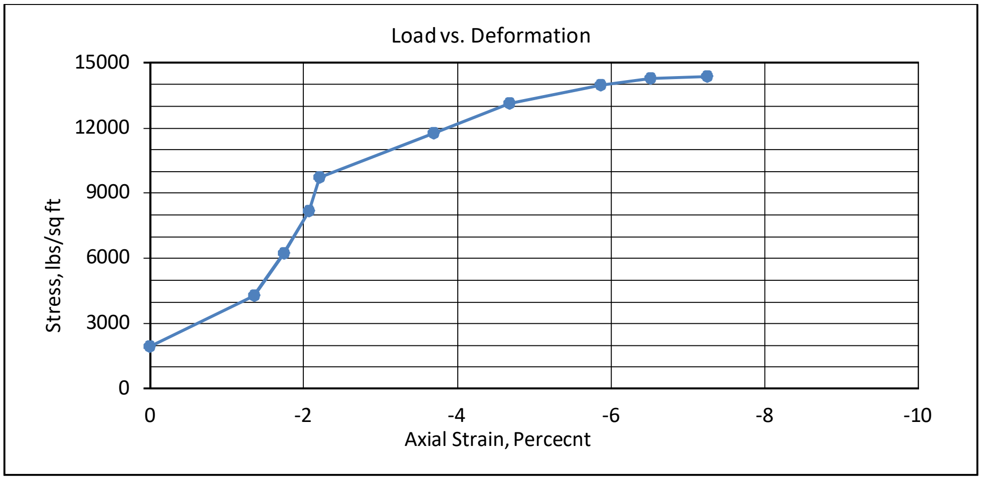
CLIENT:	RDM Group		
PROJECT:	Neelytown Expansion, Montgomery, N.Y.		
PROJECT NO.:	22404	SAMPLE LOT NO.:	221117-1
DATE SAMPLED:	11/15/2022	DATE TESTED:	12/7/2022
SAMPLED BY:	Warren Patton	TESTED BY:	Kevin Patton

Unconfined Compressive Strength of Soil

APPARATUS: Rimac Press, Manually Operated

Sample No.	B8-S10
Depth	41 feet
Moist Density, pcf	144.0
Dry Density, pcf	129.5
Percent Moisture	11.2

Test Sample Length, Inches	2.535
Sample Diameter, Inches	1.374
Length/Diam. Ratio	1.85
Description: Gray Till. Clay with some sand, traces gravel.	



Test Load, lbs	Stress, lbs/sq ft	Deflection, inch	Strain, Percent
20	1940	0	0 (Seating)
44	4280	-0.03	-1.4
64	6220	-0.04	-1.7
84	8160	-0.05	-2.1
100	9720	-0.06	-2.2
121	11760	-0.09	-3.7
135	13120	-0.12	-4.7
144	13990	-0.15	-5.9
147	14280	-0.17	-6.5
148	14380	-0.18	-7.3

Summary of Test Results

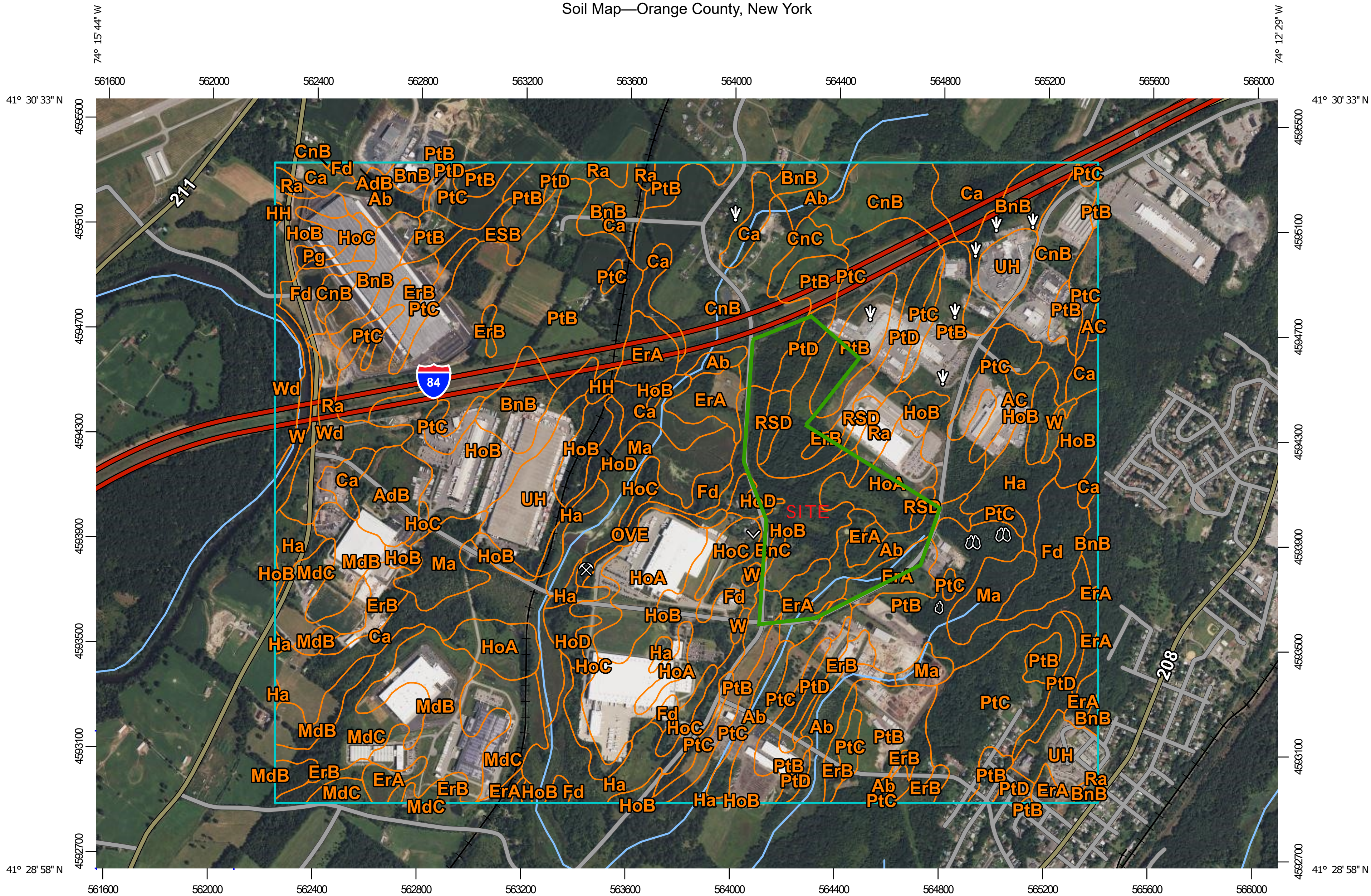
Nominal Strength of Soil, lbs/sq ft	9700
Peak Stress, lbs/sq ft	14380
Strain at Peak Stress, %	7.3
Stress at 15% Strain	N/A
Deformation Modulus*, psi per inch	1860
Moisture Condition	Moist
Failure Mode	Shear

*Calculated from these data points:

Stress, psf	4280	9720
Strain, %	1.4	2.2

Note: Visible crack at 13120 psf load.

Reviewed by: *Kevin Patton*



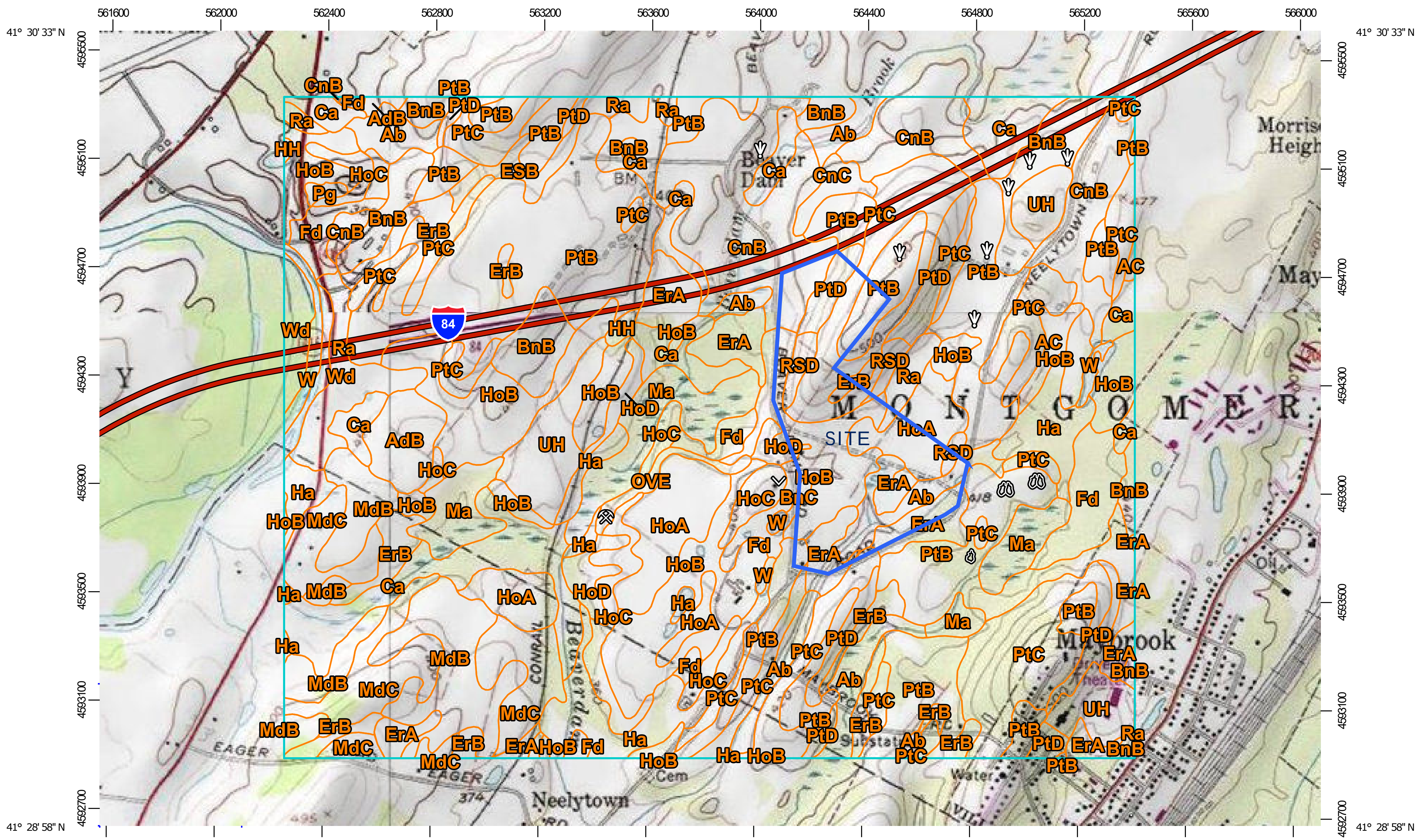
Map Scale: 1:20,700 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 300, 600, 1200, 1800

Feet: 0, 1000, 2000, 4000, 6000

N

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 18N WGS84



Map Scale: 1:20,700 if printed on A landscape (11" x 8.5") sheet.

Meters: 0 300 600 1200 1800

Feet: 0 1000 2000 4000 6000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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

Transportation

Interstate Highways

Background

Topographic Map

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Orange County, New York
Survey Area Data: Version 23, Sep 10, 2022

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ab	Alden silt loam	62.3	3.3%
AC	Alden extremely stony soils	8.0	0.4%
AdB	Allard silt loam, 3 to 8 percent slopes	21.4	1.1%
BnB	Bath-Nassau channery silt loams, 3 to 8 percent slopes	66.6	3.5%
BnC	Bath-Nassau channery silt loams, 8 to 15 percent slopes	1.6	0.1%
Ca	Canandaigua silt loam	119.3	6.2%
CnB	Chenango gravelly silt loam, 3 to 8 percent slopes	143.7	7.5%
CnC	Chenango gravelly silt loam, 8 to 15 percent slopes	7.6	0.4%
ErA	Erie gravelly silt loam, 0 to 3 percent slopes	62.8	3.3%
ErB	Erie gravelly silt loam, 3 to 8 percent slopes	43.8	2.3%
ESB	Erie extremely stony soils, gently sloping	10.0	0.5%
Fd	Fredon loam	48.0	2.5%
Ha	Halsey silt loam	68.7	3.6%
HH	Histic Humaquepts, ponded	2.8	0.1%
HoA	Hoosic gravelly sandy loam, 0 to 3 percent slopes	72.4	3.8%
HoB	Hoosic gravelly sandy loam, 3 to 8 percent slopes	182.9	9.6%
HoC	Hoosic gravelly sandy loam, 8 to 15 percent slopes	39.5	2.1%
HoD	Hoosic gravelly sandy loam, 15 to 25 percent slopes	18.1	0.9%
Ma	Madalin silt loam	68.9	3.6%
MdB	Mardin gravelly silt loam, 3 to 8 percent slopes	76.8	4.0%
MdC	Mardin gravelly silt loam, 8 to 15 percent slopes	72.9	3.8%
OVE	Otisville and Hoosic soils, steep	7.0	0.4%
Pg	Pits, gravel	2.2	0.1%
PtB	Pittsfield gravelly loam, 3 to 8 percent slopes	337.2	17.7%
PtC	Pittsfield gravelly loam, 8 to 15 percent slopes	194.0	10.2%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
PtD	Pittsfield gravelly loam, 15 to 25 percent slopes	41.3	2.2%
Ra	Raynham silt loam	39.7	2.1%
RSD	Rock outcrop-Nassau complex, hilly	9.7	0.5%
UH	Udorthents, smoothed	52.4	2.7%
W	Water	11.0	0.6%
Wd	Wayland soils complex, non-calcareous substratum, 0 to 3 percent slopes, frequently flooded	17.2	0.9%
Totals for Area of Interest		**1,910.1**	**100.0%**

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

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Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–Orange County, New York														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
Ab—Alden silt loam														
Alden	80	C/D	0-9	Silt loam	OL, ML	A-7, A-5	0- 0- 0	0- 0- 0	85-95-100	75-92-100	60-85-100	35-70-85	40-45-50	5-10-15
			9-36	Silt loam, silty clay loam, very fine sandy loam	CL, CL-ML	A-4, A-6	0- 0- 1	0- 0- 3	85-90-100	75-85-100	60-75-95	35-60-90	20-28-35	5-10-15
			36-60	Gravelly fine sandy loam, loam, silty clay loam	CL, CL-ML, GC, SC	A-2, A-4, A-6	0- 0- 3	0- 2- 5	65-80-95	50-70-92	35-55-90	20-35-85	20-28-35	5-10-15

Engineering Properties–Orange County, New York														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
BnC—Bath-Nassau channery silt loams, 8 to 15 percent slopes														
Bath	50	C	0-9	Channery silt loam	ML, GM, SM	A-2, A-4	0- 0- 0	0- 2- 15	65-85-96	50-75-95	40-65-90	30-55-80	30-35-40	5-8 -10
			9-29	Channery loam, channery silt loam, silt loam	ML, GM, SM	A-2, A-4	0- 0- 0	0- 2- 15	65-80-95	50-70-95	40-65-90	30-55-80	20-28-35	NP-4 -7
			29-51	Channery loam, very channery silt loam, channery sandy loam	GC-GM, ML, GM, SM	A-2, A-1, A-4	0- 0- 0	0- 5- 15	45-65-90	30-50-75	15-45-70	10-40-65	15-20-25	NP-3 -6
			51-57	Unweathered bedrock	—	—	0- 0- 0	0- 0- 0	—	—	—	—	—	—
Nassau	30	D	0-10	Channery silt loam	ML, GM, SM	A-2, A-4	0- 0- 0	0- 5- 15	55-70-90	45-60-75	35-55-70	25-50-65	25-31-37	1-6 -10
			10-17	Very channery silt loam, very channery loam	GC-GM, GM	A-2, A-1, A-4	0- 0- 0	0- 9- 25	45-50-70	25-35-50	15-25-50	10-20-45	20-28-35	1-6 -10
			17-21	Unweathered bedrock	—	—	0- 0- 0	0- 0- 0	—	—	—	—	—	—

Engineering Properties–Orange County, New York														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
ErA—Erie gravelly silt loam, 0 to 3 percent slopes														
Erie	75	D	0-10	Gravelly silt loam	ML, GM, SM	A-2, A-4	0- 0- 0	0- 2- 5	65-85-90	50-75-75	35-65-70	20-60-65	30-35-40	5-8 -10
			10-18	Channery fine sandy loam, channery silt loam, channery loam	CL, CL-ML, GC, SC	A-2, A-1, A-4	0- 0- 2	0- 2- 10	65-85-90	50-75-75	35-65-70	20-55-65	15-20-25	5-8 -10
			18-56	Channery silt loam, channery silty clay loam, very channery loam	CL, GC, SC	A-2, A-6	0- 2- 5	0- 2- 20	50-80-85	35-70-70	25-65-70	20-55-65	25-30-35	10-13-15
			56-70	Channery silt loam, channery silty clay loam, very channery loam	CL, GC, SC	A-2, A-4, A-6	0- 2- 5	0- 2- 25	50-80-85	35-70-70	25-65-70	20-55-65	25-30-35	10-13-15
HoA—Hoosic gravelly sandy loam, 0 to 3 percent slopes														
Hoosic	80	A	0-6	Gravelly sandy loam	GM, ML, SM	A-2, A-1, A-5, A-4	0- 0- 0	0- 5- 10	50-70-90	35-60-75	15-40-65	10-20-50	30-38-45	2-6 -10
			6-31	Gravelly sandy loam, very gravelly sandy loam, gravelly loam	SC-SM, SP-SM, GM, SM	A-2, A-1, A-4	0- 0- 0	0- 7- 10	50-65-90	35-50-75	15-30-65	10-15-50	20-25-30	2-5 -8
			31-60	Very gravelly sand, very gravelly loamy sand, extremely gravelly loamy sand	GW, GM, SM, GP	A-1	0- 0- 0	0- 8- 15	40-50-75	30-35-50	15-20-30	0- 2- 15	—	NP

Engineering Properties–Orange County, New York														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
HoB—Hoosic gravelly sandy loam, 3 to 8 percent slopes														
Hoosic	80	A	0-6	Gravelly sandy loam	ML, GM, SM	A-2, A-1, A-5, A-4	0- 0- 0	0- 5- 10	50-70-90	35-60-75	15-40-65	10-20-50	30-38 -45	2-6 -10
			6-28	Gravelly sandy loam, very gravelly sandy loam, gravelly loam	SC-SM, SP-SM, GM, SM	A-2, A-1, A-4	0- 0- 0	0- 7- 10	50-65-90	35-50-75	15-30-65	10-15-50	20-25 -30	2-5 -8
			28-60	Very gravelly sand, very gravelly loamy sand, extremely gravelly loamy sand	GW, GM, GP, SM	A-1	0- 0- 0	0- 8- 15	40-50-75	30-35-50	15-20-30	0- 2- 15	—	NP
PtC—Pittsfield gravelly loam, 8 to 15 percent slopes														
Pittsfield	75	B	0-9	Gravelly loam	ML, SM	A-2, A-4	0- 0- 0	0- 2- 10	75-85-90	70-75-75	50-60-65	30-45-50	15-28 -40	NP-3 -6
			9-31	Fine sandy loam, gravelly loam, gravelly sandy loam	ML, SM	A-2, A-1, A-4	0- 0- 3	0- 2- 10	70-80-95	65-70-92	35-60-85	20-45-70	15-18 -20	NP-2 -4
			31-60	Fine sandy loam, loam, gravelly sandy loam	ML, SM	A-2, A-1, A-4	0- 1- 3	0- 3- 10	70-75-95	65-65-92	35-35-85	20-20-70	15-18 -20	NP-2 -3

Engineering Properties–Orange County, New York														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
Ra—Raynham silt loam														
Raynham, poorly drained	50	C/D	0-8	Silt loam	CL-ML, ML	A-4	0- 0- 0	0- 0- 0	100-100-100	95-100-100	80-95-100	45-80-90	15-20-25	NP-3 -5
			8-26	Silt loam, silt, very fine sandy loam	CL-ML, ML	A-4	0- 0- 0	0- 0- 0	100-100-100	95-100-100	80-95-100	45-80-90	15-20-25	NP-3 -5
			26-60	Silt loam, silt, very fine sandy loam	CL-ML, ML	A-4	0- 0- 0	0- 0- 0	100-100-100	95-100-100	80-95-100	45-80-90	15-20-25	NP-3 -5
Raynham, somewhat poorly drained	25	C/D	0-8	Silt loam	CL-ML, ML	A-4	0- 0- 0	0- 0- 0	100-100-100	95-100-100	80-95-100	45-80-90	15-20-25	NP-3 -5
			8-26	Silt loam, silt, very fine sandy loam	CL-ML, ML	A-4	0- 0- 0	0- 0- 0	100-100-100	95-100-100	80-95-100	45-80-90	15-20-25	NP-3 -5
			26-60	Silt loam, silt, very fine sandy loam	CL-ML, ML	A-4	0- 0- 0	0- 0- 0	100-100-100	95-100-100	80-95-100	45-80-90	15-20-25	NP-3 -5
RSD—Rock outcrop-Nassau complex, hilly														
Rock outcrop	55		0-60	Unweathered bedrock	—	—	0- 0- 0	0- 0- 0	—	—	—	—	—	—
Nassau	35	D	0-10	Channery silt loam	ML, GM, SM	A-2, A-4	0- 0- 0	0- 5- 15	55-70-90	45-60-75	35-55-70	25-50-65	25-31-37	1-6 -10
			10-18	Very channery silt loam, very channery loam	GC-GM, GM	A-2, A-1, A-4	0- 0- 0	0- 9- 25	45-50-70	25-35-50	15-25-50	10-20-45	20-28-35	1-6 -10
			18-22	Unweathered bedrock	—	—	0- 0- 0	0- 0- 0	—	—	—	—	—	—

Data Source Information

Soil Survey Area: Orange County, New York
Survey Area Data: Version 23, Sep 10, 2022