Appendices

Appendix B-1

Crack Mapping

October 15, 2019

NJ DEP, Dam Safety & Flood Control
P.O. Box 419
Trenton, NJ 08625

Ref: File # 25-169

"Estling Lake Spillway – Crack Mapping & Repair

The spillway of the Estling Lake Dam is an arched masonry design comprised of large granite blocks of varied size with a stepped drop box arrangement. The cut granite blocks were dry fit with mortared outside joints. Blocks are stacked in a staggered arrangement with each course approximately 18 inches in height. The spillway crest is formed by granite block capstones overlaid with a thin layer (less than 1 inch) of cement. The front (upstream) face of the arched spillway is also overlaid with a cement facing for the top two layers of block, or approximately 36 inches in height from crest.

The formal inspection report for the Estling Lake Dam issued August 21, 2018 indicated cracks were found at the spillway, primarily in the capstones at the spillway crest. The extent of the cracks could not be full determined under normal water flow conditions. On September 16, 2019 the low-level outlet pipe valve was opened to lower the upstream water level (by permit) to facilitate a more detailed inspection of the cracks. Twelve (12) cracks were found in the capstone cement overlay and are located as shown in the attached Sketch 1. All cracks were parallel to the water flow but most did not extend the full depth of the capstone (approximately 36 inches). One crack did extend the full depth of the capstone and propagated down the front facing cement overlay for one course of granite block (approximately 18 inches in height from crest) located as point A as shown on Sketch 1. Additionally, a 41-inch long horizontal crack was found between courses two and three of granite block (approximately 36 inches in height from crest) located as point B as shown on Sketch 1. All cracks found were in the cement overlay at an underlying joint between granite blocks. Such cracks do not compromise the structural integrity of the spillway. All cracks were wire brushed and filled with hydraulic cement. Additionally, joints between granite blocks were inspected and were repointed, as necessary, with hydraulic cement. The low-level outlet pipe valve was closed on September 24, 2019 to allow the upstream lake water to rise to normal level.

Other Items from 2018 “Recommendations”

In addition to the above, it was recommended that Estling Lake Corporation (“ELC”) restore the spalling concrete on the culvert wing walls while NJ Transit repair the spalling concrete in the culvert. The spalling concrete on the abutment

wall that was poured over the wing walls is really part of the culvert design and NJ Transit should repair this when work is done to the culvert.

It was also recommended that ELC replace the missing low-level intake trash rack grate. GOE International was contracted by ELC and completed this shortly after the inspection report was completed. GOE also inspected the intake area. ELC recently verified that the grates were in place and functioning.

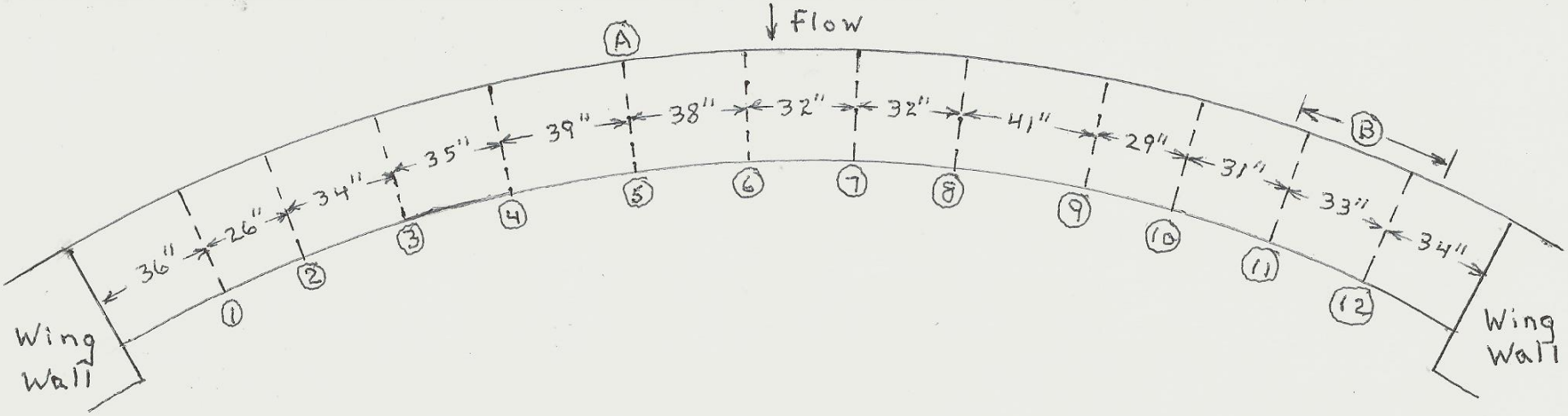
Although NJ Transit will respond regarding the vegetation management recommendation, ELC continues to clear all vegetation in the area of the wing walls.

Please direct to my attention, email or via phone, questions concerning the above.

Thank you.

Richard Price
President of ELC
richardpricejr@gmail.com
646-894-0679

cc: Eugenia Taylor, NJ Transit
cc: David Althaver, NJ Transit
cc: Mike De Angelis, ELC
cc: Alf Edwards, ELC



Estling Lake Spillway

Crack Mapping - 9/24/19

Sketch 1

Scale
~ 1/4" = 1'

Appendix E-1

Overtopping Erosion Model Backup

Estling Lake Dam Overtopping Erosion Assessment
Model Input Parameters

Calculation:	M.Valdez	1/9/2020
Detailed QC & Update:	J.Gagnon	1/14/2020
QC Review:	J.Cambridge	1/14/2020

Model: NRCS WinDAMc, Version 1.1 Released May 2016
Resources:
X-SECTIONS-ESTLING.pdf
ESTLING-PLAN1.pdf

2. VERTICAL DATUM–NAVD 1988 AND HORIZONTAL DATUM–NJ STATE PLANE COORDINATE SYSTEM NAD83: BASED ON GPS OBSERVATIONS BY MATRIX NEW WORLD ON 06/01/2018 AND REFERENCED TO CONTINUOUSLY OPERATING REFERENCE STATIONS (CORS) NETWORK, NATIONAL GEODETIC SURVEY MONUMENTS: CORS STATION "NJSC, NJMT.

ESTLING-PLAN2.pdf
ESTLING-PLAN3.pdf
ESTLING-PLAN4.pdf

Primary culvert outlet is Station 1825+82.46, which defines HydroCAD overtopping areas East and West of culvert
Identify low points along the AmerCOM Survey Railroad Embankment Profile:
areas below el 525 ft NAVD88

Overtopping Section	Station		
East OT:	1825+50	PROFILE-ESTLING2.pdf	
	1826+00	PROFILE-ESTLING3.pdf	
West OT:	1831+25	PROFILE-ESTLING4.pdf	
	1837+25 to 1832+25	PROFILE-ESTLING6.pdf	PROFILE-ESTLING5.pdf
	1838+25 lowest in crest profile	PROFILE-ESTLING7.pdf	
	1839+25 second lowest	PROFILE-ESTLING7.pdf	

Areas of concern noted in Michael Vecchio's 12/19/2019 email
Station 1823+83.40
Station 1830+76.69
Station 1836+71.40 lowest crest cross section

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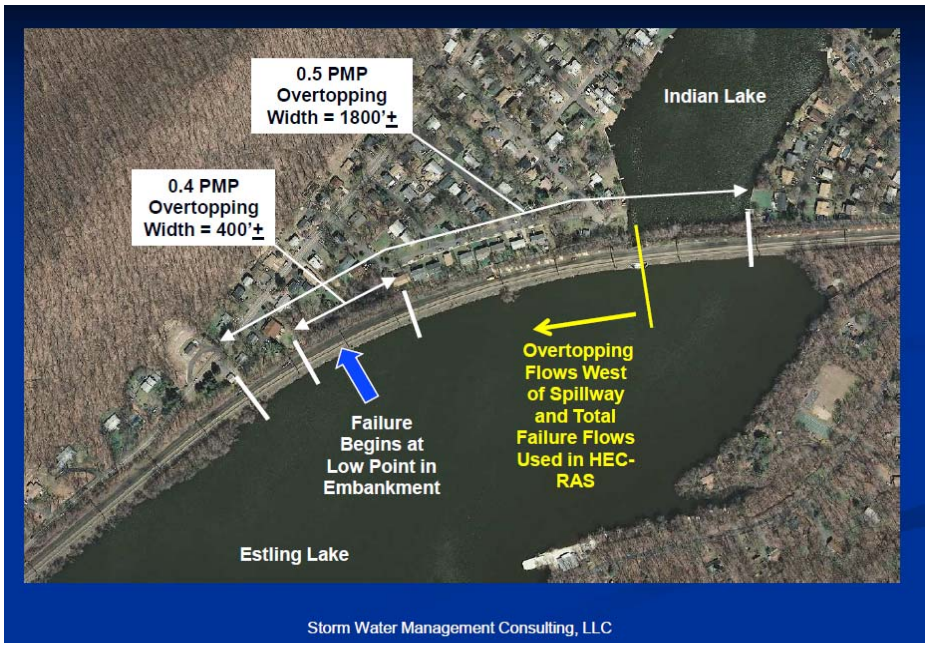


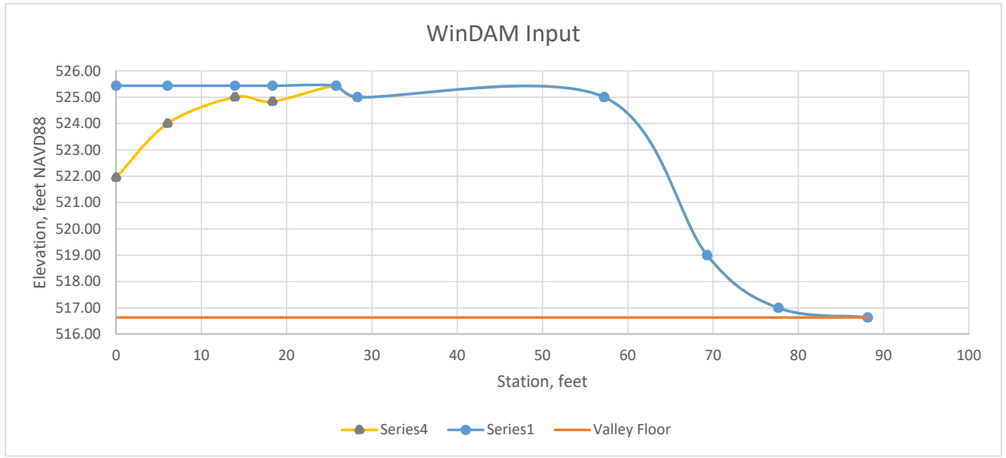
Rail Embankment Ovetopping modeled as Auxiliary Spillway. West Overtopping Section is critical overtopping discharge section, based on the SWM HydroCAD model and report.

Spillway Geometry (Survey Cross Section Station 1836+71.40):

	1	2	3	4	5	6	7	8	9	10
STA(WinDAM)	0	6.034	13.934	18.334	25.8	28.3	57.234	69.3	77.666	88.134
Survey Elev, NAVD88	521.95	524.00	525.00	524.83	525.43	525.00	525.00	519.00	517.00	516.63
WinDAM Elev, NAVD88	525.43	525.43	525.43	525.43	525.43	525.00	525.00	519.00	517.00	516.63
Mannings n	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Vegetal Cover Factor	0	0	0	0	0	0	0	0	0	0
Maintenance Code	1	1	1	1	1	1	1	1	1	1
Railroad ballast/riprap	525.43	525.43	525.43	525.43	525.43	525.00	525.00	519.00	517.00	516.63
Material 1 (Stratum 1b), Elev	525.1	525.1	525.1	525.1	525.1	524.67	524.67	518.67	516.67	516.3
Material 2 (Stratum 2), Elev	*511.43*	*511.43*	*511.43*	*511.43*	*511.43*	*511.00*	*511.00*	*505.00*	*503.00*	*502.63*
Material 3 (Stratum 3), Elev	*500.86*	*500.86*	*500.86*	*500.86*	*500.86*	*500.43*	*500.43*	*494.43*	*492.43*	*492.06*
Valley Floor	516.63	516.63	516.63	516.63	516.63	516.63	516.63	516.63	516.63	516.63

Average of Boring B2, B3, B4

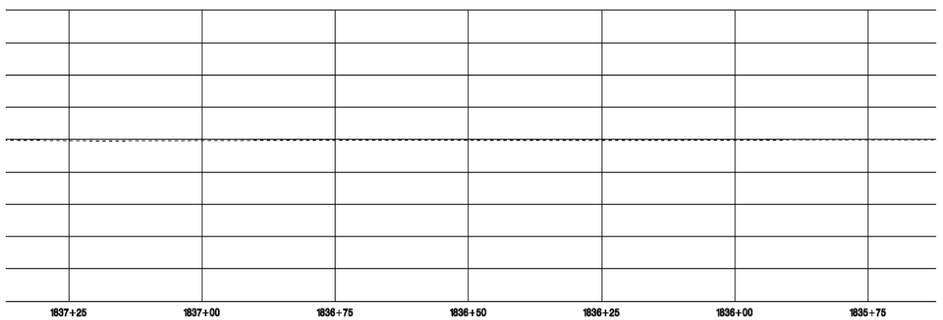
Upstream Slope (H/V)	1.3
Upstream Mannings	0.035
Dam Crest Width (ft)	57.2
Dam Crest Mannings	0.035
Downstream Slope (H/V)	3.7
Downstream Mannings	0.035
Elev. To Start Routing, ft NAVD88)	525.43
Valley Floor, ft NAVD88	516.63



Spillway Parameters

Width, ft	200
Side slope ratio (H/V)	25

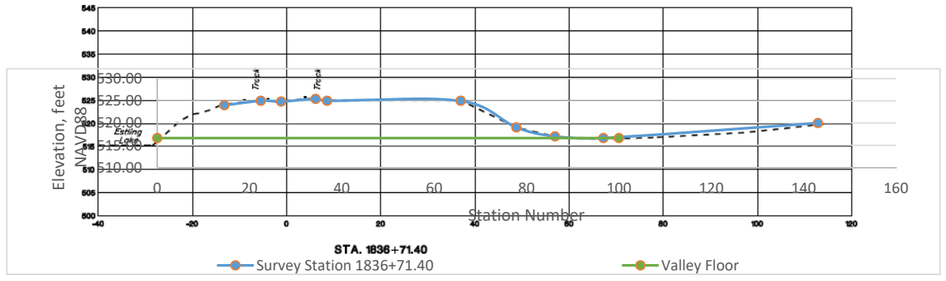
NOTE that from the Survey Cross Sections, Station 1836+71.40 seems like the lowest point, but the railroad embankment profile does not show a dip in elevation in this area:



Low point based on Survey Cross Sections identified as Station 1836.71.40

Survey Station 1836+71.40

STA(Survey)	Elev, ft NAV	STA(WinDAM)
0	515.20	
8.5	521.95	0
14.534	524.00	6.034
22.434	525.00	13.934
26.834	524.83	18.334
34.3	525.43	25.8
36.8	525.00	28.3
65.734	525.00	57.234
77.8	519.00	69.3
86.166	517.00	77.666
96.634	516.63	88.134
143.1	520.00	134.6



Geotech Information for Spillway Soil Material Properties:

Stratum	Depth Encountered				
	B-1 Longitudinal	B-2 Longitudinal	B-2 Section A-A	B-3 Section A-A	Average
1a	NA	NA	NA	NA	NA
1b	0	0	0	0	0.00
2	8.2	16.2	15.8	15.8	14.00
3	10.7	30.2	28.7	28.7	24.58

		Plasticity Index	Dry Density (Avg) pcf	Headcut Index	Rep. Diameter (avg) inches	% clay
	Ballast	0	140	0.12 (GM)	1	0
Average of B2, B3, B4	Material 1 (Stratum 1b)	0	134	0.05 (CL/ML/Fill)	0.2861	13.00%
	Material 2 (Stratum 2)	0	128	0.05 (CL/ML/Fill)	0.2861	13.00%
	Material 3 (Stratum 3)	0	119	0.05 (CL/ML/Fill)	0.2861	13.00%
			127			

Average of B2, B3, B4	Total Unit Weight, pcf	114	
	Erodibility (kd), ft/h/psf	10	Per WinDAM Embankment Soil Input (NRCS Visser, 2015)
	Undrained Shear Strength, psf	2100	
	Critical Shear Stress, psf	0	

Geologic Unit No	Description	Total Unit Weight	c
		pcf	psf
1	Layer 1: Fill	134	0
2	Later 2: CL,ML,CL-ML	128	2100
3	Layer 3: SM	119	0
4	Later 4: SM,SC	116	0
5	Layer 5: SM	122	0
6	Layer 6: GP,GP-GM, SP	135	0
7	Layer 7: SP-SM,SM,SC-SM	117	0
8	Layer 8: GP-GM	135	0
9	Layer 9: SC,CL	120	4000
	Average	**125**	**678**

[2019 0717 Estling Lake Final Geotechnical Report.pdf]

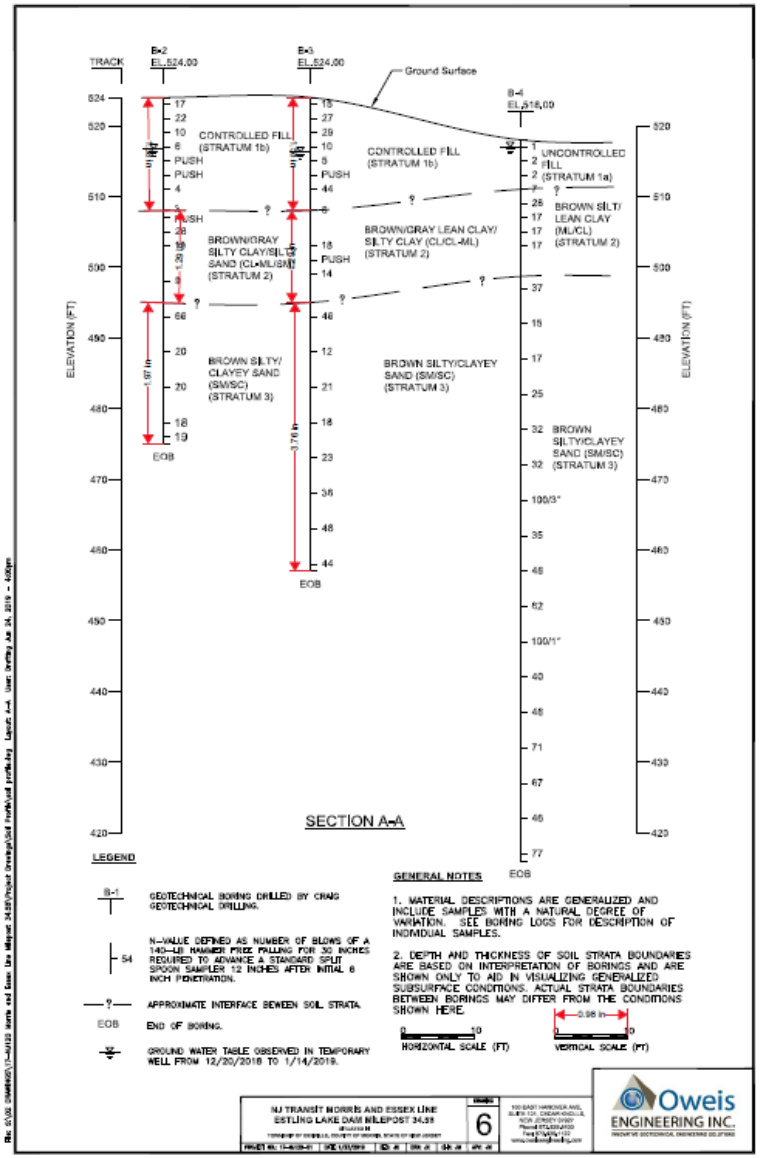


Table 2. Summary of Soil Strength Properties

	Total unit weight γ (pcf)	Friction angle $\phi°$	Cohesion c' (psi)	Undrained shear strength S_u (psi)
Stratum 1a ①	105 to 115	27 to 32	0	n/a
Stratum 1b ②	120 to 130	31 to 35	0	n/a
Stratum 2 ③	115 to 125	33 to 35	2.2 to 2.4	13.3
Stratum 3 ④	120 to 130	35 to 40	0	n/a

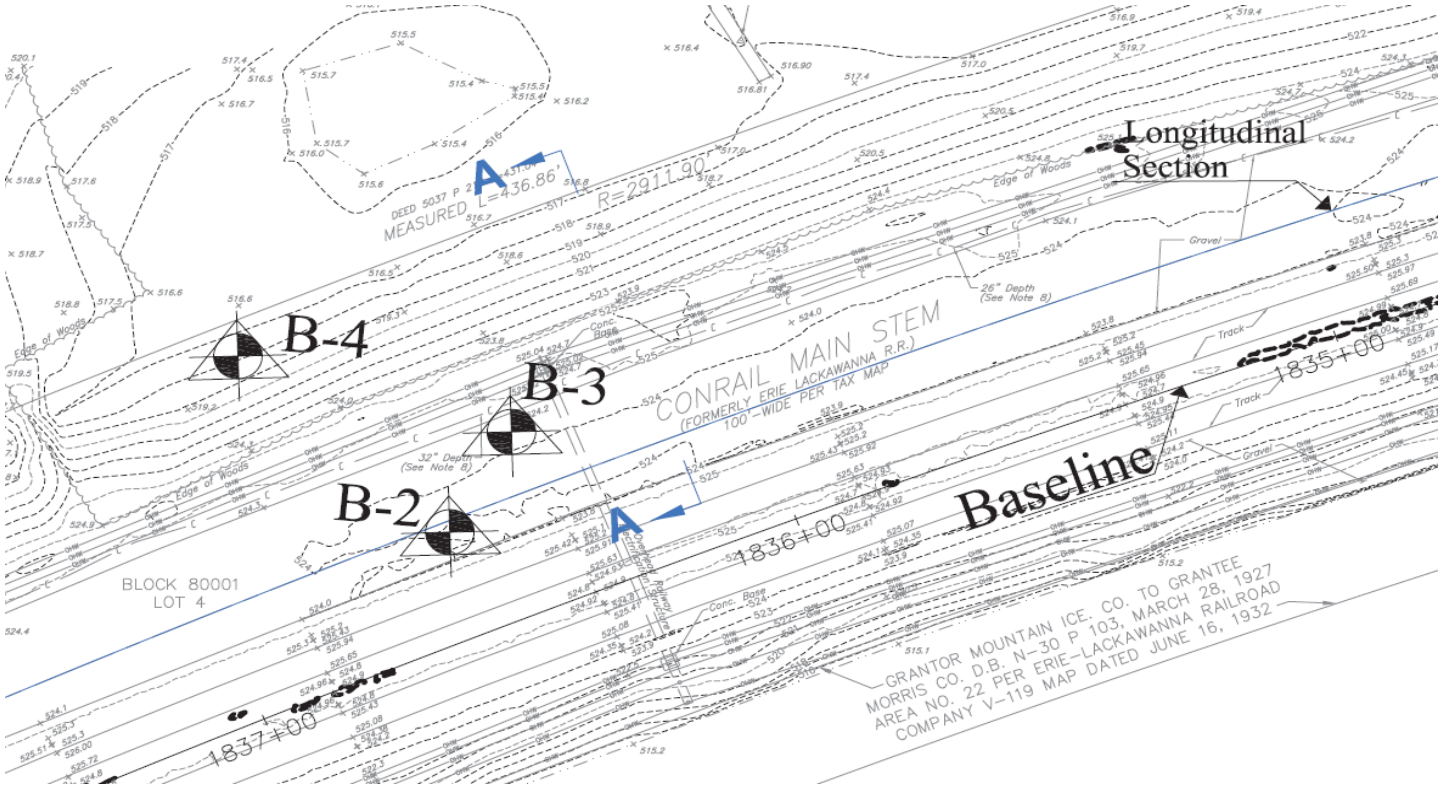
Note: ①Soil properties of Stratum 1a are estimated based on SPT N values of B-4 and B-8. See Appendix-F.
②Soil properties of Stratum 1b are derived from laboratory testing results of B-2/UD-2. See Appendix-B.
③Soil properties of Stratum 2 are derived from laboratory testing results of B-1/UD-1&B-3/UD-2. See Appendix-B.
④Soil properties of Stratum 3 are estimated based on SPT N values of B-1 and B-5. See Appendix-F.

Stratum 1b: Controlled Fill - This Stratum was encountered in all of the borings on the top of embankment (B-1, B-2, B-3, B-5, B-6, B-9 and B-10). This Stratum consisted of brown or gray silty/clayey sand with gravel or poorly graded gravel with silty sand. SPT N values vary from 4 bpf to 44 bpf with an average value of 17. The Stratum was encountered from the existing ground surface to approximately 4 feet to 22.5 feet below grade.

Stratum 2: Clay/ Silty Clay/ Silt (CL/ CL-ML/ ML) - Stratum 2 was encountered in all borings except B-8, overlain by Stratum 1a or Stratum 1b. Stratum 2 was comprised of brown/gray lean clay or silt with sand and gravel. The thickness of Stratum 2 varies from 2 feet to 23.5 feet. The top of Stratum 2 was encountered at approximately 4 feet to 22.5 feet below the existing ground surface. The bottom of Stratum 2 was encountered at approximately 7 feet to 46 feet below existing ground surface. SPT N values were variable, ranging from 3 to 28 blows per foot with an average value of 16.

Stratum 3: Sand with Silt and Gravel (SM/SP-SM/GP-GM) - Stratum 3 was encountered in all borings. Stratum 3 is comprised of brown or gray silty/clayey sand with gravel or poorly graded gravel with silt and sand. This stratum was overlain by Stratum 2. All the borings were terminated in this stratum. The top of Stratum 3 is at approximately 7 feet to 46 feet below the existing grade. SPT N values were variable, ranging from 7 bpf to 100 blows for 1 inch with an average value of bigger than 45. Boulders are also encountered in Stratum 3 at 55 feet in B-6 and at 39 feet in B-7.

Boring Location Plan 2013 Layout-2.pdf



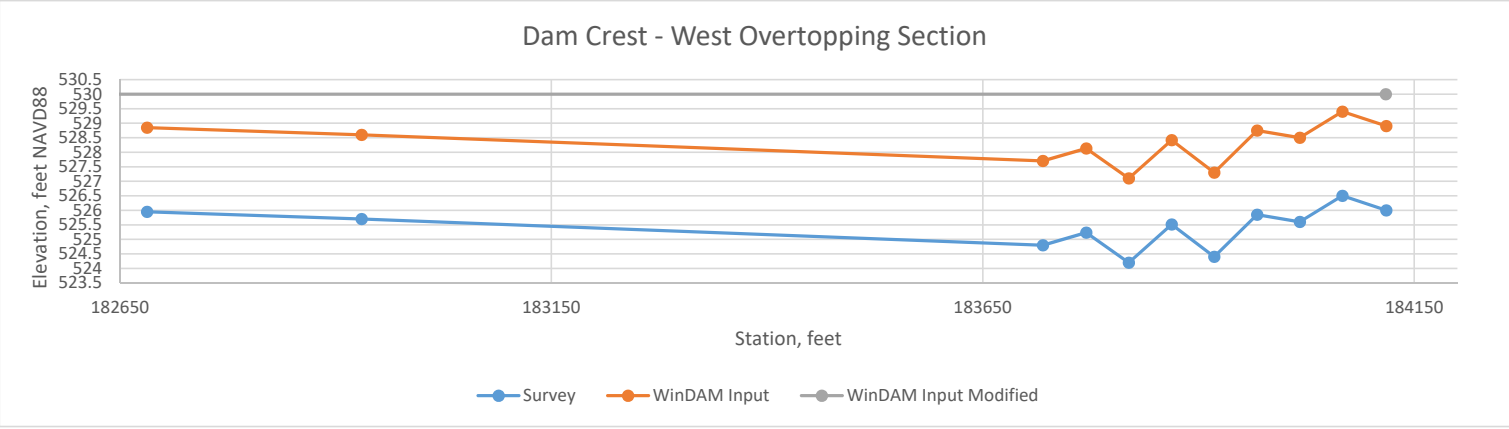
Rail Embankment critical overtopping discharge section, based on the SWM HydroCAD model and report.

Dam Crest Profile: input for WinDAM model

	1	2	3	4	5	6	7	8	9	10	11
STA (windam)	0.00	50.95	100.23	149.67	199.43	248.70	298.43	347.68	397.98	1187.70	1436.28
Elev, ft NAVD88	526.00	526.50	525.60	525.85	524.40	525.52	524.20	525.23	524.80	525.70	525.95
Elev WinDAM,ft NAVD88	528.90	529.40	528.50	528.75	527.30	528.42	527.10	528.13	527.70	528.60	528.85
Modified Elev, ft NAVD88	530.00	530.00	530.00	530.00	530.00	530.00	530.00	530.00	530.00	530.00	530.00

Dam Crest Profile: defined from Station 1819+80 to 1841+20 for the West Overtopping Section

	STA (Plans)	STA (windam)	Elev, ft NAVD88	WinDAM Elev, ft NAVD88	
West OT:	184117.616	0	526	528.9	
	184066.666	50.95	526.5	529.4	
	184017.384	100.232	525.6	528.5	
	183967.95	149.666	525.85	528.75	
	183918.184	199.432	**524.4**	527.3	
	183868.916	248.7	525.5168	528.4168	
	183819.184	298.432	**524.2**	527.1	*Set Spillway crest and add/subtract differences to remainder of values
	183769.934	347.682	525.2332	528.1332	Spillway crest is controlling high elevation on crest berm
	183719.634	397.982	**524.8**	527.7	near downstream slope
	182929.916	1187.7	525.7	528.6	
	182681.334	1436.282	525.95	528.85	
Primary Discharge Culvert	182582.466	1535.15	**524.15**		
East OT:	182482.466	1635.15	526.0668		
	182125	1992.616	526.2168		
	181983.4	2134.216	526.4332		



Reservoir Storage Volume:

NOTE: Starting reservoir elevation is modeled as the rail embankment crest to only model inflow=overtopping outflow and not resimulate reservoir routing that was performed by SWM in HydroCAD.

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Elevation, ft NGVD29	Elevation, ft NAVD88	Cumulative Storage (ac-ft)
504	503.18	0.000
505	504.18	3.100
506	505.18	12.824
507	506.18	30.704
508	507.18	57.155
509	508.18	91.847
510	509.18	134.252
511	510.18	184.049
512	511.18	240.409
513	512.18	302.143
514	513.18	368.716
515	514.18	439.926
516.7	515.88	567.277
520	519.18	833.917
540	539.18	3083.917

***Note:** Conversion to NAVD 1988 Vertical Datum = -0.82 Feet

Summary for Pond ELD: Updated Estling Lake Dam

Inflow Area = 4,198.000 ac, 9.79% Impervious, Inflow Depth > 13.16" for 0.5 PMP event
Inflow = 13,769.47 cfs @ 39.69 hrs, Volume= 4,602.887 af
Outflow = 11,219.43 cfs @ 40.51 hrs, Volume= 4,486.009 af, Atten= 19%, Lag= 49.2 min
Primary = 6,540.02 cfs @ 40.51 hrs, Volume= 3,940.737 af
Secondary = 4,230.03 cfs @ 40.51 hrs, Volume= 510.318 af
Tertiary = 449.38 cfs @ 40.51 hrs, Volume= 34.954 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Starting Elev= 514.70' Surf.Area= 72.176 ac Storage= 418.057 af
Peak Elev= 527.26' @ 40.51 hrs Surf.Area= 105.071 ac Storage= 1,525.198 af (1,107.141 af above start)

Plug-Flow detention time= 282.8 min calculated for 4,065.130 af (88% of inflow)
Center-of-Mass det. time= 117.0 min (2,684.8 - 2,567.8)

Volume	Invert	Avail.Storage	Storage Description
#1	504.00'	3,083.917 af	**See Woidt HEC-1 (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
504.00	0.181	0.000	0.000
505.00	6.019	3.100	3.100
506.00	13.430	9.725	12.824
507.00	22.330	17.880	30.704
508.00	30.571	26.450	57.155
509.00	38.814	34.692	91.847
510.00	45.995	42.404	134.252
511.00	53.600	49.798	184.049
512.00	59.120	56.360	240.409
513.00	64.348	61.734	302.143
514.00	68.797	66.572	368.716
515.00	73.624	71.210	439.926
516.70	76.200	127.350	567.277
520.00	85.400	266.640	833.917
540.00	139.600	2,250.000	3,083.917

IDF discharge from Powder Mill Pond Dam:

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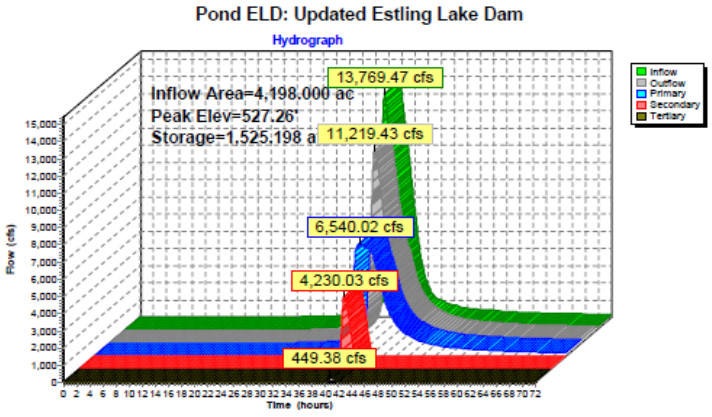
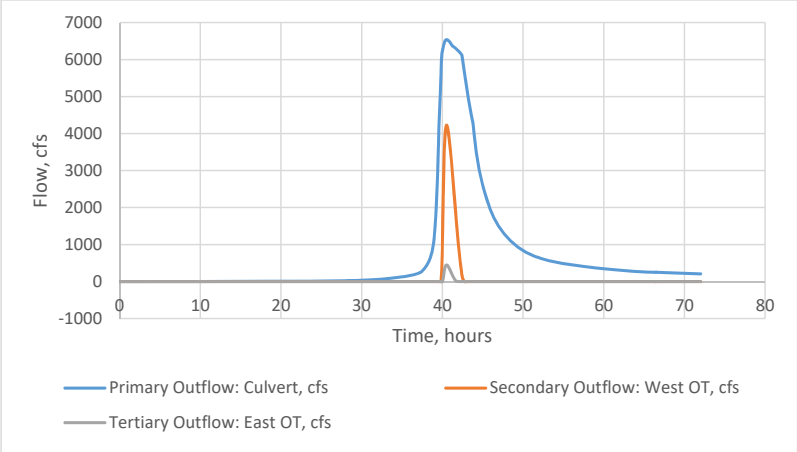
Primary OutFlow Max=6,539.68 cfs @ 40.51 hrs HW=527.26' TW=512.30' (Dynamic Tailwater)
└1=Woidt Culvert Flows (Custom Controls 6,539.68 cfs)

Secondary OutFlow Max=4,227.39 cfs @ 40.51 hrs HW=527.26' TW=512.30' (Dynamic Tailwater)
└2=Western Overtopping from HEC-RAS - Half Flows (Custom Controls 4,227.39 cfs)

Tertiary OutFlow Max=448.75 cfs @ 40.51 hrs HW=527.26' TW=512.30' (Dynamic Tailwater)
└3=Eastern Embankment Overtopping from HEC-RAS (Custom Controls 448.75 cfs)





Please note that the secondary and tertiary outflow hydrographs in the attached represent flow over the western and eastern portions of the Estling embankment. These are defined by the location of the Dam's spillway and bridge.

Estling Lake Dam - Updated 0.5 PMP Without Failure and Updated Dams Outflow Hydrographs to HDR - 1-13-20.csv

Appendix S-1

Boring Locations

REFRENCES :

1. VERTICAL DATUM-NAVD 1988 AND HORIZONTAL DATUM-NJ STATE PLANE COORDINATE SYSTEM NAD83: BASED ON GPS OBSERVATIONS BY MATRIX NEW WORLD ON 06/01/2018 AND REFERENCED TO CONTINUOUSLY OPERATING REFERENCE STATIONS (CORS) NETWORK, NATIONAL GEODETIC SURVEY MONUMENTS: CORS STATION "NJSC, NJMT".

PROPOSED BORING AND OBSERVATION WELL LOCATION DETAILS

Boring No.	Approximate Surface Elevation (FT.)	Station	Offset from Baseline	Final Boring Depth (FT.)
B-1	524	1839+32	31 R	62

Note: Boring locations are approximate. Measured by hand from existing site features.

LEGENDS

Symbol	Description
(boring symbol)	Proposed Boring
(boring with triangle symbol)	Proposed boring with Observation well

LEGEND

- CURB LINE
- DEPRESSED OR FLUSH CURB
- EDGE OF PAVEMENT
- MANHOLE
- SANITARY MANHOLE
- SANITARY CLEANOUT
- WATER VALVE
- UTILITY POLE
- GUY ANCHOR
- BOLLARD
- DECIDUOUS TREE
- SURVEY CONTROL POINT
- OVERHEAD WIRES
- COMMUNICATION UTILITY LINE
- WATER EDGE LINE
- FENCE LINE
- SEWER PIPE
- TREE LINE
- MAJOR CONTOUR
- MINOR CONTOUR
- FF=526.18 × FINISH FLOOR ELEVATION
- TC=525.50 × TOP OF CURB ELEVATION
- G=525.00 × GUTTER ELEVATION
- TW=525.50 × TOP OF WALL ELEVATION
- BW=525.50 × BOTTOM OF WALL ELEVATION
- 525.00× 526.0× SPOT ELEVATION

MATCH LINE- SHEET 2

DATE	DESCRIPTION	No.	
			SUBMISSIONS

DATE	DESCRIPTION	No.	
			REVISIONS

Date: ______

Oweis ENGINEERING INC.

NJ TRANSIT CAPITAL PLANNING AND PROGRAMS ONE PENN PLAZA EAST NEWARK, NJ 07105

Project no 17-NJ120

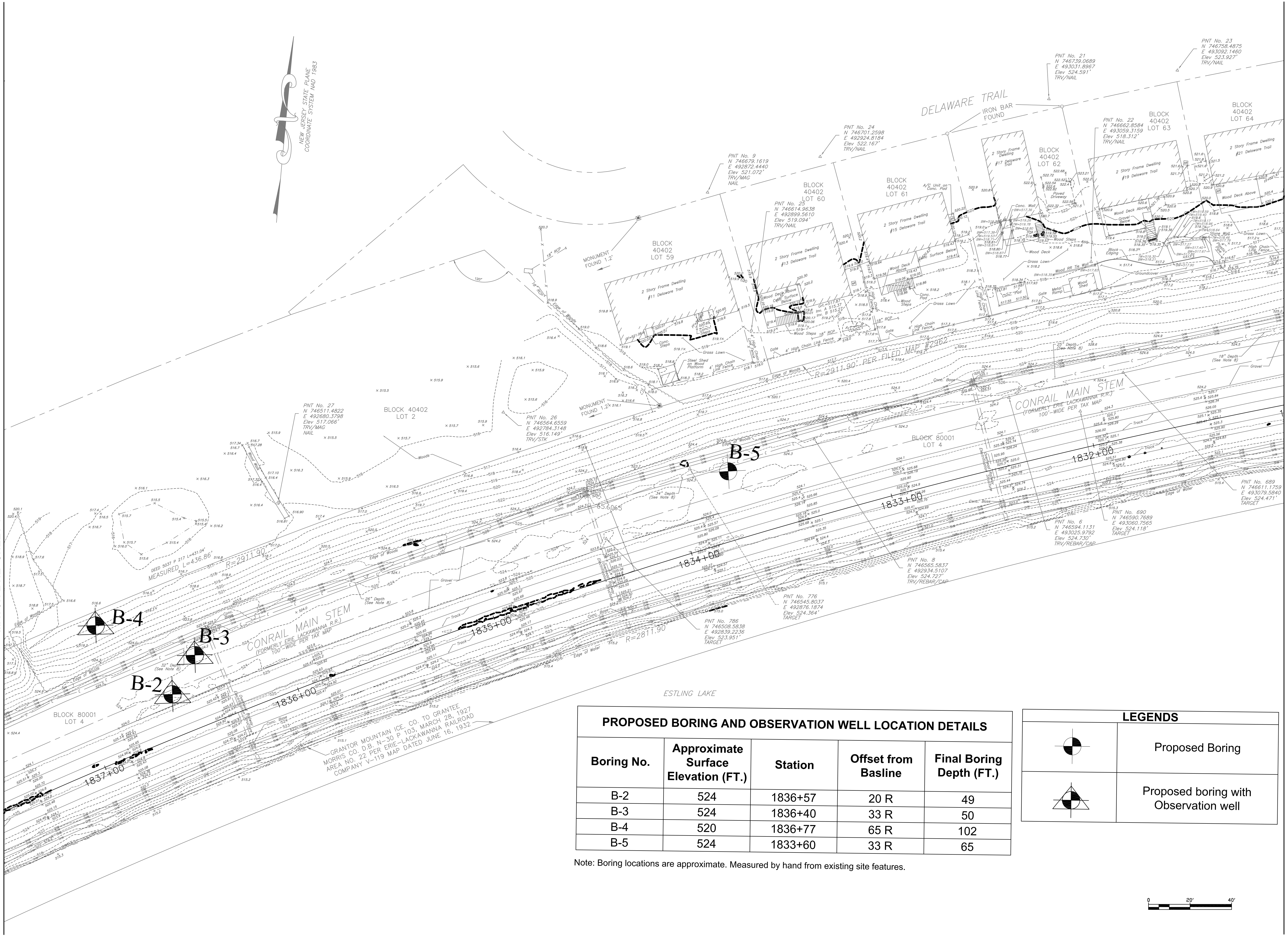
NJ TRANSIT MORRIS AND ESSEX LINE ESTLING LAKE DAM MILEPOST 34.58

SITUATED IN

TOWNSHIP OF DENVILLE, COUNTY OF MORRIS, STATE OF NEW JERSEY

PROPOSED BORINGS AND OBSERVATION WELLS LOCATION

Scale	1: 20
Date	1/17/2019
Des.	JM
Dwn.	RS
Chkd.	JM
Drawing 1	Sheet 1 of 4



PROPOSED BORING AND OBSERVATION WELL LOCATION DETAILS

Boring No.	Approximate Surface Elevation (FT.)	Station	Offset from Basline	Final Boring Depth (FT.)
B-2	524	1836+57	20 R	49
B-3	524	1836+40	33 R	50
B-4	520	1836+77	65 R	102
B-5	524	1833+60	33 R	65

Note: Boring locations are approximate. Measured by hand from existing site features.

LEGENDS

Symbol	Description
(boring symbol)	Proposed Boring
(boring symbol with triangle)	Proposed boring with Observation well

No.	DESCRIPTION	DATE
REVISIONS		
SUBMISSIONS		

Date: ______

Oweis ENGINEERING INC.

NJ TRANSIT CAPITAL PLANNING AND PROGRAMS ONE PENN PLAZA EAST NEWARK, NJ 07105

Project no 17-NJ120

NJ TRANSIT MORRIS AND ESSEX LINE ESTLING LAKE DAM MILEPOST 34.58

SITUATED IN TOWNSHIP OF DENVILLE, COUNTY OF MORRIS, STATE OF NEW JERSEY

PROPOSED BORINGS AND OBSERVATION WELLS LOCATION

Scale	1:20
Date	1/17/2019
Des.	JM
Dwn.	RS
Chkd.	JM
Drawing 2	Sheet 2 of 4

PROPOSED BORING AND OBSERVATION WELL LOCATION DETAILS

Boring No.	Approximate Surface Elevation (FT.)	Station	Offset	**Final Boring Depth (FT.)**
B-6	525	1827+06	21 R	57
B-7	519	1827+34	66 R	52
B-8	522	1830+89	58 R	57
B-9	524	1830+90	29 R	57

Note: Boring locations are approximate. Measured by hand from existing site features.

LEGENDS

Symbol	Description
(boring symbol)	Proposed Boring
(boring with triangle symbol)	Proposed boring with Observation well

DATE	DESCRIPTION	No.

SUBMISSIONS

DATE	DESCRIPTION	No.

REVISIONS

Date: ________

Oweis ENGINEERING INC.

NJ TRANSIT CAPITAL PLANNING AND PROGRAMS ONE PENN PLAZA EAST NEWARK, NJ 07105

Project no 17-NJ120

NJ TRANSIT MORRIS AND ESSEX LINE ESTLING LAKE DAM MILEPOST 34.58

SITUATED IN TOWNSHIP OF DENVILLE, COUNTY OF MORRIS, STATE OF NEW JERSEY

PROPOSED BORINGS AND OBSERVATION WELLS LOCATION

Scale	1:20
Date	1/17/2019
Des.	JM
Dwn.	RS
Chkd.	JM
Drawing 3	Sheet 3 of 4

PROPOSED BORING AND OBSERVATION WELL LOCATION DETAILS

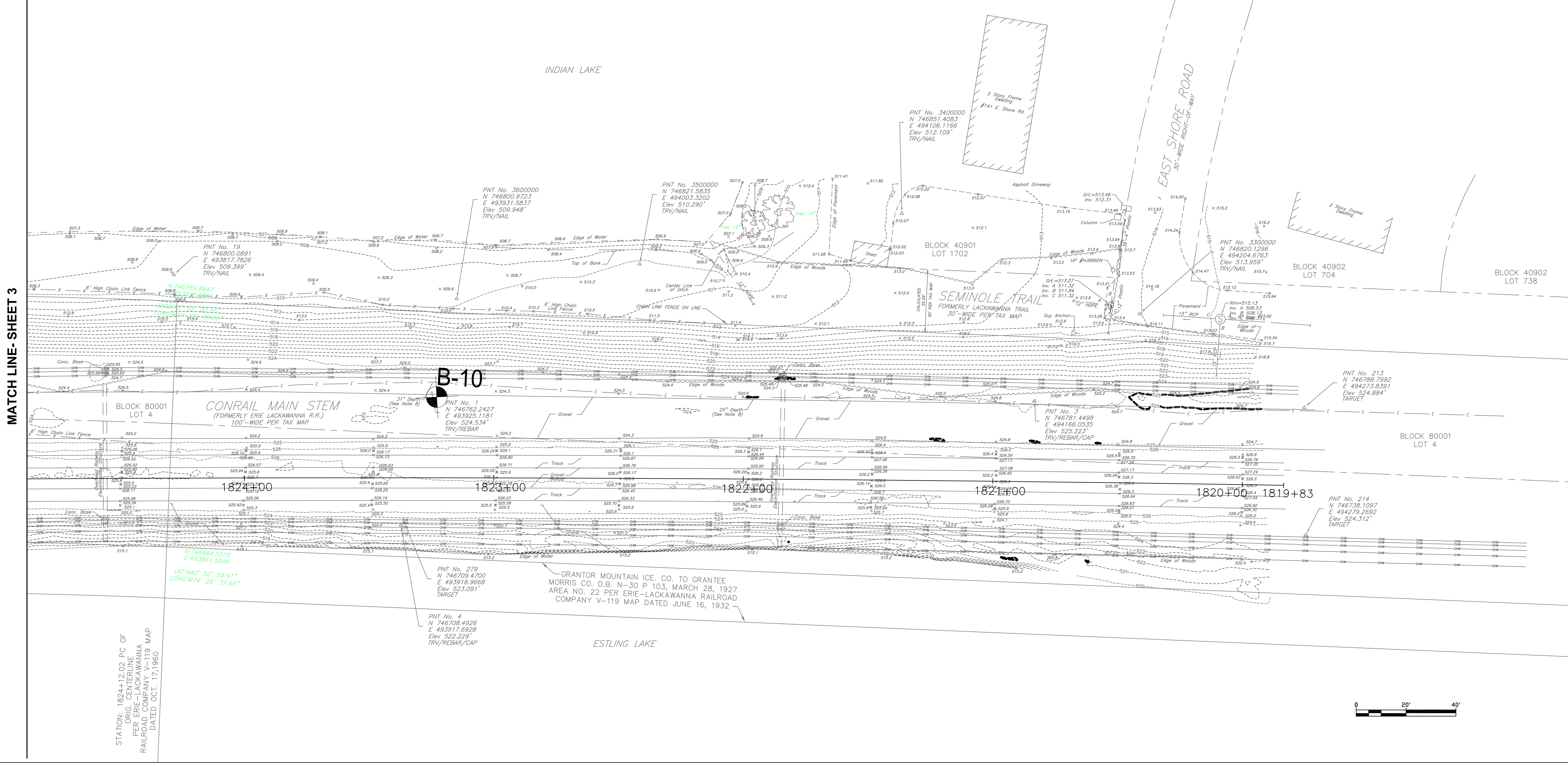
Boring No.	Approximate Surface Elevation (FT.)	Station	Offset	**Final Boring Depth (FT.)**
B-10	525	1823+23	32 R	65

Note: Boring locations are approximate. Measured by hand from existing site features.

LEGENDS

(boring symbol)	Proposed Boring
(boring with triangle symbol)	Proposed boring with Observation well

NEW JERSEY STATE PLANE COORDINATE SYSTEM NAD 1983



MATCH LINE- SHEET 3
INDIAN LAKE
EAST SHORE ROAD
30'-WIDE RIGHT-OF-WAY
2 Story Frame Dwelling
#141 E. Shore Rd.
PNT No. 3400000
N 746851.4083
E 494106.1166
Elev 512.109'
TRV/NAIL
PNT No. 3600000
N 746800.9723
E 493931.5837
Elev 509.948'
TRV/NAIL
PNT No. 3500000
N 746821.5835
E 494003.3202
Elev 510.290'
TRV/NAIL
PNT No. 19
N 746800.0891
E 493817.7826
Elev 509.399'
TRV/NAIL
BLOCK 40901
LOT 1702
BLOCK 40902
LOT 704
BLOCK 40902
LOT 738
SEMINOLE TRAIL
FORMERLY LACKAWANNA TRAIL
30'-WIDE PER TAX MAP
PNT No. 3300000
N 746820.1296
E 494204.6763
Elev 513.959'
TRV/NAIL
B-10
BLOCK 80001
LOT 4
CONRAIL MAIN STEM
(FORMERLY ERIE LACKAWANNA R.R.)
100'-WIDE PER TAX MAP
PNT No. 1
N 746762.2427
E 493925.1181
Elev 524.534'
TRV/REBAR
PNT No. 3
N 746781.4498
E 494166.0535
Elev 525.223'
TRV/REBAR/CAP
PNT No. 213
N 746788.7992
E 494273.8391
Elev 524.884'
TARGET
BLOCK 80001
LOT 4
1824+00
1823+00
1822+00
1821+00
1820+00
1819+83
PNT No. 214
N 746738.1097
E 494279.2692
Elev 524.312'
TARGET
PNT No. 279
N 746709.4700
E 493918.9668
Elev 523.091'
TARGET
PNT No. 4
N 746708.4926
E 493917.6928
Elev 522.229'
TRV/REBAR/CAP
GRANTOR MOUNTAIN ICE. CO. TO GRANTEE
MORRIS CO. D.B. N-30 P 103, MARCH 28, 1927
AREA NO. 22 PER ERIE-LACKAWANNA RAILROAD
COMPANY V-119 MAP DATED JUNE 16, 1932
ESTLING LAKE
STATION: 1824+12.02 PC OF
ORIG. CENTERLINE
PER ERIE-LACKAWANNA
RAILROAD COMPANY V-119 MAP
DATED OCT. 17,1960
0
20'
40'

DATE	DESCRIPTION	No.

SUBMISSIONS

DATE	DESCRIPTION	No.

REVISIONS

Date:

Oweis ENGINEERING INC.

NJ TRANSIT
CAPITAL PLANNING AND PROGRAMS
ONE PENN PLAZA EAST NEWARK, NJ 07105

Project no 17-NJ120

NJ TRANSIT MORRIS AND ESSEX LINE
ESTLING LAKE DAM MILEPOST 34.58

SITUATED IN
TOWNSHIP OF DENVILLE, COUNTY OF MORRIS, STATE OF NEW JERSEY

PROPOSED BORINGS AND OBSERVATION WELLS LOCATION

Scale	1: 20
Date	1/17/2019
Des.	JM
Dwn.	RS
Chkd.	JM
Drawing 4	Sheet 4 of 4

Appendix S-2

Laboratory Testing Results

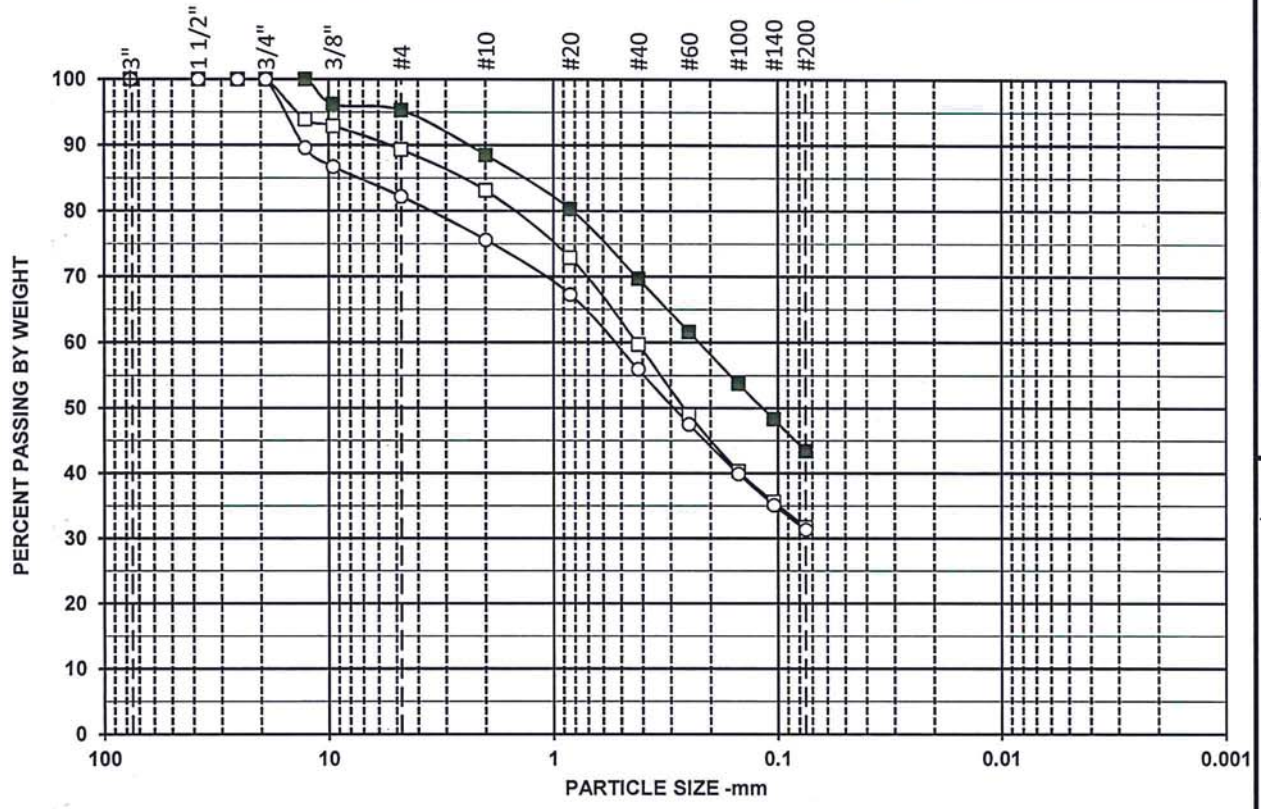
Parsons #649173
Morris & Essex Embankment
LABORATORY TESTING DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS									STRENGTH				REMARKS
NO.	NO.		WATER CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLAS. INDEX	USCS SYMB. (1)	SIEVE MINUS NO. 200	HYDRO. % MINUS 2 μm	TOTAL UNIT WEIGHT	DRY UNIT WEIGHT	Type Test	PEAK DEVIATOR STRESS	PEAK SHEAR STRENGTH	AXIAL STRAIN @ PEAK STRESS	/ TEST ID
		(ft)	(%)	(-)	(-)	(-)		(%)	(%)	(pcf)	(pcf)		(psi)	(psi)	(%)	
B-1	S-2	2-4	13.8				SC	31.7								
B-1	S-3	4-6	16.0				SC	43.4								
B-1	UD-1	8-10								132.5						
B-1	UD-1	8.5	21.1													
B-1	UD-1A	8.8	20.6	32	16	16	CL			131.1	108.7	UU@10	26.7	13.4	15.0	UU038c
B-1	S-8	25-27	9.4				SM	31.3								
B-2	S-2	2-4	6.8				SM	13.7								
B-2	S-4	6-8	18.4				SC	46.9								
B-2	UD-2	11-12								134.4						
B-2	UD-2	11.15	11.5													
B-2	UD-2A	11.45	14.5	20	15	5	SC-SM	35.6	6			DS				DS1909
B-2	UD-3	17-18														
B-2	S-11	30-32	9.4				SM	19.9								
B-2	S-14	45-47	12.3				SC	36.5								
B-3	S-2	2-4	6.0				SP-SM	10.8								
B-3	S-5	8-10	16.2				SC	43.6								
B-3	UD-1	10-12								132.7						
B-3	UD-1	10.3	13.7													
B-3	UD-1A	10.6	12.8				SM	30.6								
B-3	UD-1	10.85	12.7													
B-3	S-7	15-17	18.3	42	14	28	CL	71.4	17							
B-3	UD-2	22-24								124.9						
B-3	UD-2	22.2	25.8													
B-3	UD-2A	22.5	27.6							127.9	100.2	CIU@5		45.6	10.6	T4429
B-3	UD-2B	23.0	30.4	28	21	7	CL-ML	98.2	17	125.0	95.9	CIU@15		69.5	11.4	T4430
B-3	UD-2C	23.5	29.5							123.9	95.7	CIU@30		51.1	7.2	T4431
B-3	S-11	35-37	11.2				SC	29.3								
B-3	S-14	50-52	10.3				SC	29.7								

Parsons #649173
Morris & Essex Embankment
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS									STRENGTH				REMARKS / TEST ID
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2 μm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	Type Test	PEAK DEVIATOR STRESS (psi)	PEAK SHEAR STRENGTH (psi)	AXIAL STRAIN @ PEAK STRESS (%)	
B-4	S-3	4-6	29.0				SW	4.7								
B-4	S-6	10-12	29.6				ML	93.5								
B-4	S-8	14-16	30.2	28	20	8	CL	97.4	16							
B-4	S-9	20-22	9.7				SM	42.4								
B-4	S-10	25-27	12.7				SM	36.5								
B-4	S-13	40-42	9.9				SM	34.7								
B-4	S-17	60-62	13.4				SM	39.6								
B-4	S-22	85-87	9.7	28	14	14	SC	29.4	10							
B-4	S-25	100-102	20.2				CL	73.5								
B-5	S-2B	2-4	7.0				SM	25.5								
B-5	S-4	6-8	13.2				SM	42.9								
B-6	S-2	2-4	5.7				SM	18.1								
B-6	S-4	6-8	8.5				SM	21.6								
B-6	S-6	10-12	5.5				GP-GM	10.2								
B-6	S-8	20-22	25.1				ML	97.7								
B-7	SA-1	0-2	15.7				SM	22.4								
B-7	S-1	8-10	11.2				GP-GM	10.1								
B-7	S-6A	18-20	23.4				ML	97.2	11							
B-7	S-8	25-27	6.1				GP-GM	10.5								
B-8	S-2	2-4	6.7				SW	4.2								
B-8	S-4	6-8	17.9				GC	45.9								
B-8	S-7	15-17	23.2				SM	13.6								
B-8	S-8	20-22	9.3				GP	4.9								
B-9	S-2	2-4	4.7				GM	15.2								
B-9	S-3	4-6	21.5				CL	54.2								
B-9	S-5	10-12	8.2				SM	21.5								
B-10	S-2	2-4	4.9				SM	12.5								
B-10	S-5	8-10	9.2				SM	22.5								
B-10	S-11	35-37	23.2				ML	92.2	11							

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.



Symbol	□	■	○
Boring	B-1	B-1	B-1
Sample	S-2	S-3	S-8
Depth	2-4	4-6	25-27
% +3"	0.0	0.0	0.0
% Gravel	10.7	4.7	17.8
% SAND	57.6	51.9	50.9
%C SAND	6.2	6.8	6.6
%M SAND	23.4	18.8	19.7
%F SAND	28.0	26.3	24.6
% FINES	31.7	43.4	31.3
D_{100} (mm)	19.050	12.700	19.050
D_{60} (mm)	0.426	0.225	0.538
D_{30} (mm)			
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	100.0
4"	100.0	100.0	100.0
3"	100.0	100.0	100.0
1 1/2"	100.0	100.0	100.0
1"	100.0	100.0	100.0
3/4"	100.0	100.0	100.0
1/2"	93.9	100.0	89.6
3/8"	92.9	96.2	86.7
#4	89.3	95.3	82.2
#10	83.1	88.5	75.6
#20	72.9	80.3	67.3
#40	59.7	69.7	55.9
#60	49.0	61.6	47.5
#100	40.3	53.7	39.9
#140	35.6	48.3	35.1
#200	31.7	43.4	31.3
5μ m			
2μ m			
1μ m			

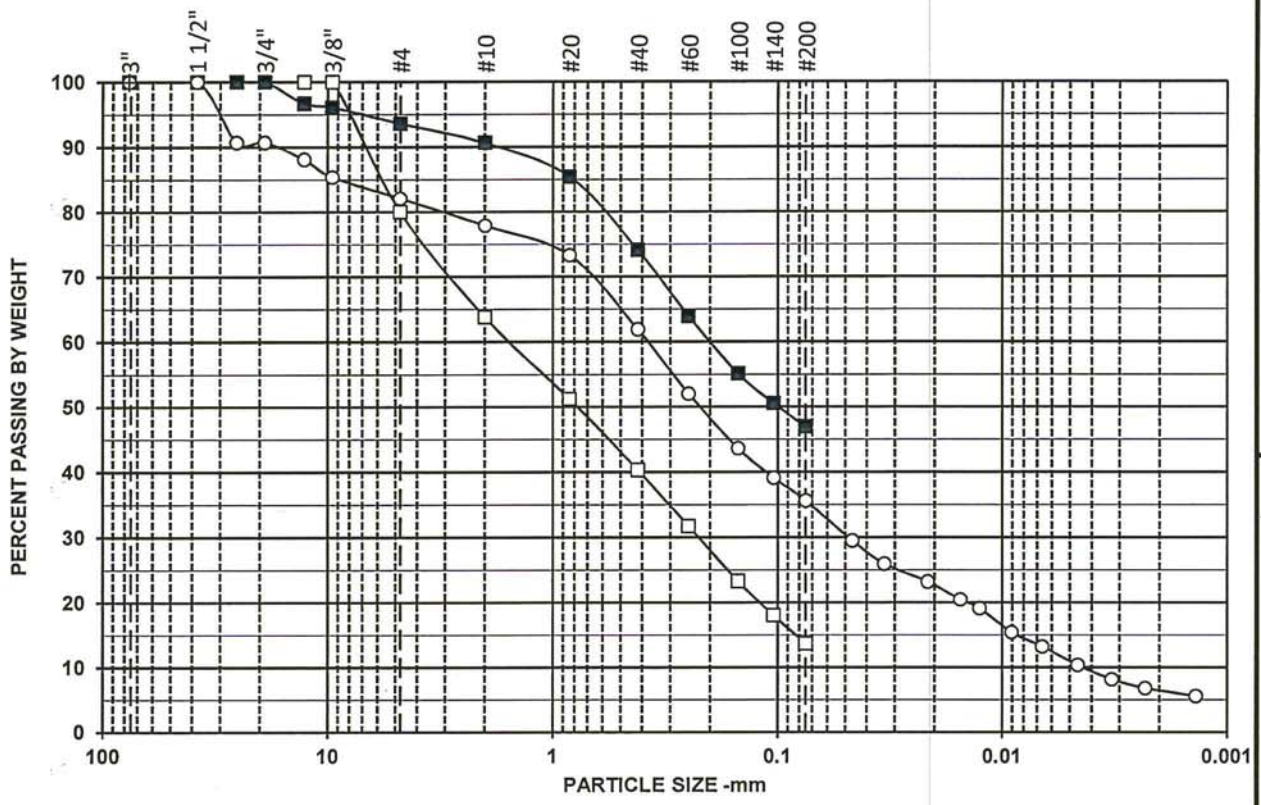
SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	13.8				SC		Brown, Clayey sand	02/06/19
■	16.0				SC		Brown, Clayey sand	02/06/19
○	9.4				SM		Brown, Silty sand with gravel	02/06/19

Parsons #649173

TerraSense, LLC #8197-19001

Morris & Essex Embankment

PARTICLE SIZE DISTRIBUTION



SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	6.8				SM		Brown, Silty sand with gravel	02/06/19
■	18.4				SC		Brown, Clayey sand	02/06/19
○	14.5	20	15	5	SC-SM		Grayish brown, Silty, clayey sand with gravel	02/11/19

Parsons #649173

TerraSense, LLC #8197-19001

Morris & Essex Embankment

Symbol	□	■	○
Boring	B-2	B-2	B-2
Sample	S-2	S-4	UD-2A
Depth	2-4	6-8	11.45
% +3"	0.0	0.0	0.0
% Gravel	20.0	6.4	17.9
% SAND	66.3	46.7	46.5
%C SAND	16.2	3.0	4.2
%M SAND	23.5	16.5	16.0
%F SAND	26.6	27.2	26.3
% FINES	13.7	46.9	35.6
D_{100} (mm)	9.530	19.050	38.100
D_{60} (mm)	1.539	0.199	0.379
D_{30} (mm)	0.225		0.048
D_{10} (mm)			0.004
Cc			1.400
Cu			87.3

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	100.0
4"	100.0	100.0	100.0
3"	100.0	100.0	100.0
1 1/2"	100.0	100.0	100.0
1"	100.0	100.0	90.7
3/4"	100.0	100.0	90.7
1/2"	100.0	96.7	88.1
3/8"	100.0	96.1	85.4
#4	80.0	93.6	82.1
#10	63.8	90.6	77.9
#20	51.2	85.4	73.3
#40	40.3	74.1	61.9
#60	31.7	63.9	52.0
#100	23.3	55.1	43.6
#140	18.0	50.5	39.1
#200	13.7	46.9	35.6
5μ m			11
2μ m			6
1μ m			5

PARTICLE SIZE DISTRIBUTION

TerraSense Analysis File: GrainSizeV4R4(11/17)

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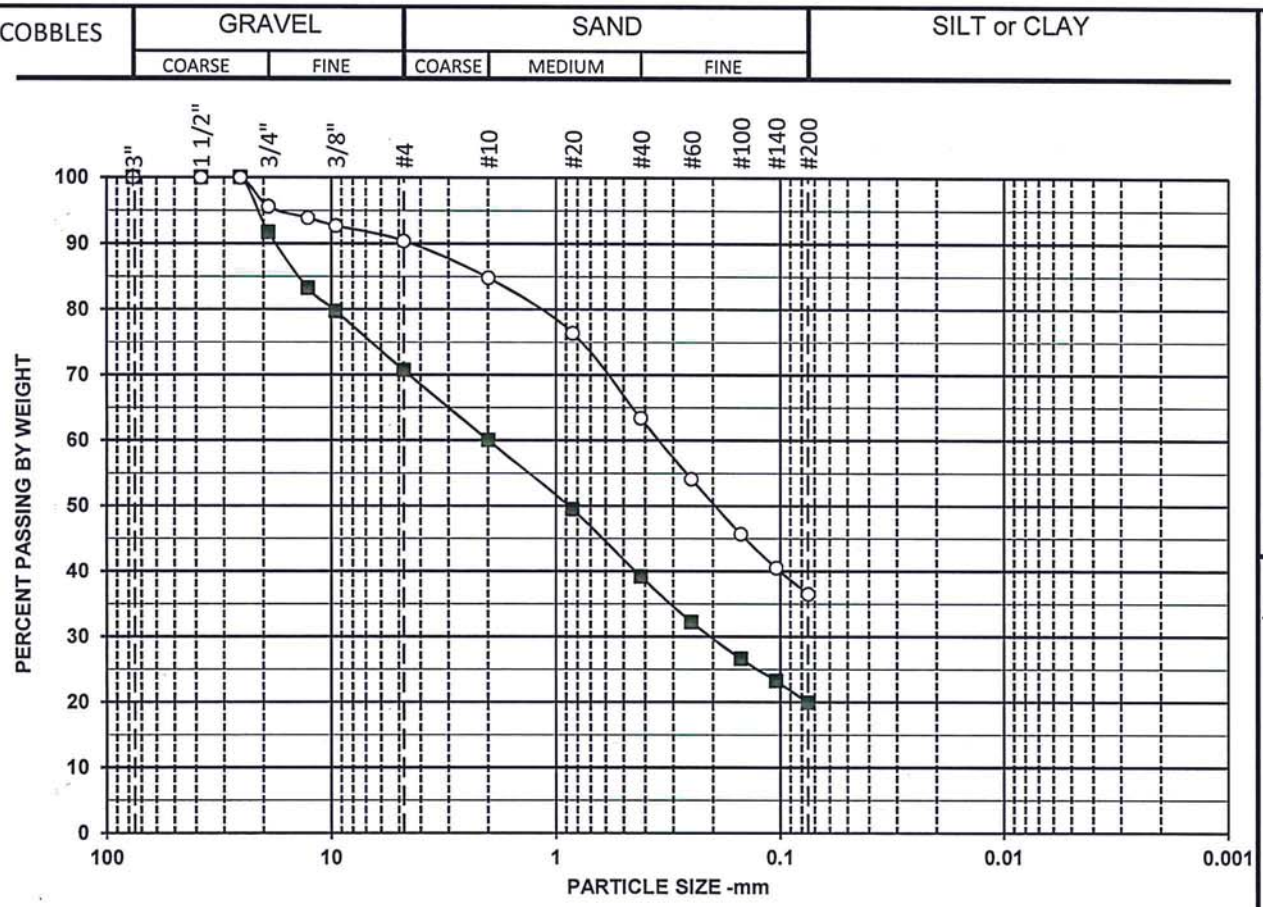

Symbol	□	■	○
Boring		B-2	B-2
Sample		S-11	S-14
Depth		30-32	45-47
% +3"		0.0	0.0
% Gravel		29.3	9.6
% SAND		50.8	53.9
%C SAND		10.7	5.6
%M SAND		20.8	21.4
%F SAND		19.3	26.9
% FINES		19.9	36.5
D_{100} (mm)		25.400	25.400
D_{60} (mm)		1.999	0.346
D_{30} (mm)		0.204	
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"		100.0	100.0
4"		100.0	100.0
3"		100.0	100.0
1 1/2"		100.0	100.0
1"		100.0	100.0
3/4"		91.7	95.6
1/2"		83.2	93.9
3/8"		79.7	92.7
#4		70.7	90.4
#10		60.0	84.8
#20		49.4	76.4
#40		39.2	63.4
#60		32.2	54.1
#100		26.6	45.7
#140		23.2	40.5
#200		19.9	36.5
5μ m			
2μ m			
1μ m			

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□								
■	9.4				SM		Brown, Silty sand with gravel	02/06/19
○	12.3				SC		Brown, Clayey sand	02/06/19

Parsons #649173

TerraSense, LLC #8197-19001

Morris & Essex Embankment

PARTICLE SIZE DISTRIBUTION

TerraSense Analysis File: GrainSizeV4R4(11/17)

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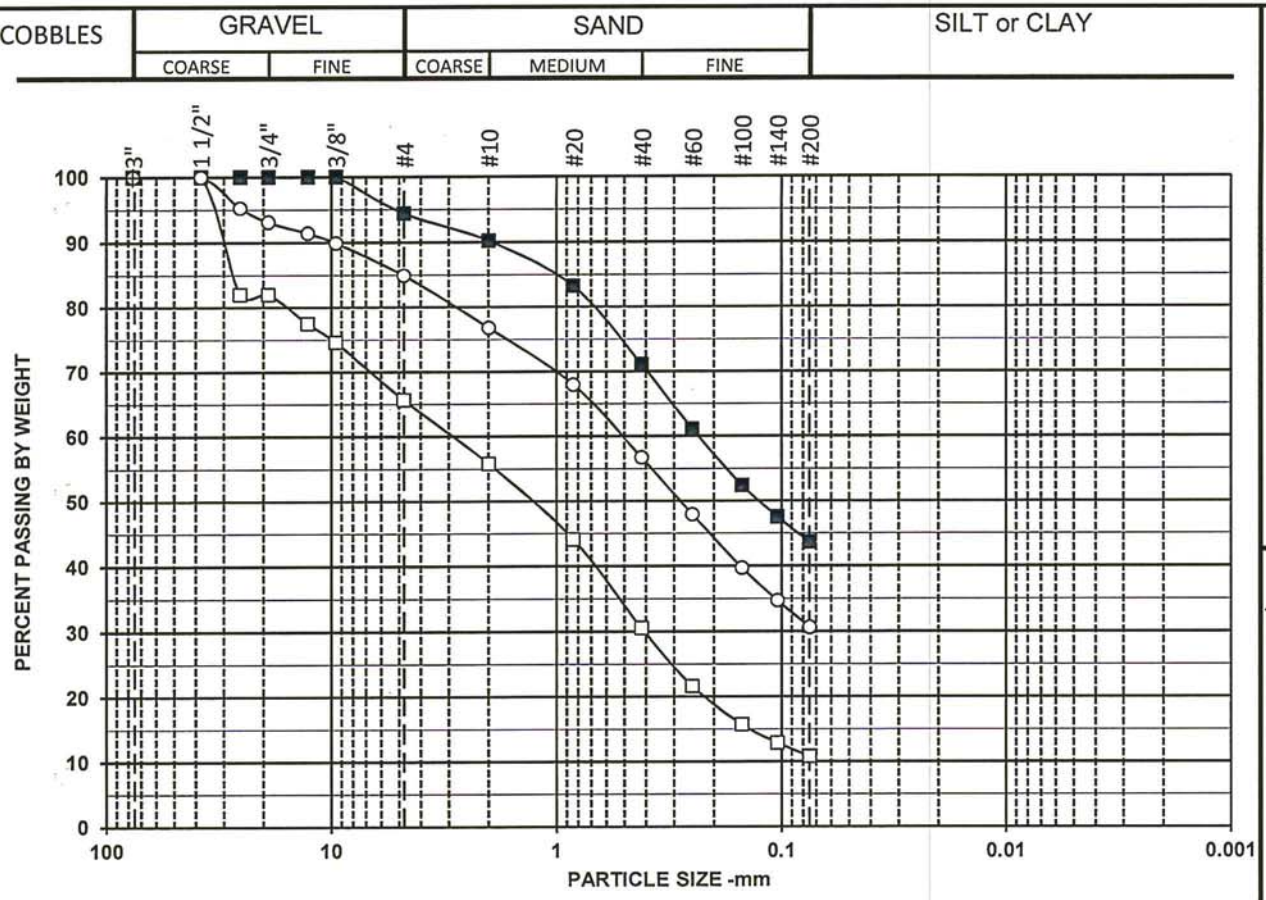

Symbol	□	■	○
Boring	B-3	B-3	B-3
Sample	S-2	S-5	UD-1A
Depth	2-4	8-10	10.60
% +3"	0.0	0.0	0.0
% Gravel	34.3	5.6	15.1
% SAND	54.9	50.8	54.3
%C SAND	9.9	4.2	8.1
%M SAND	25.3	19.1	20.1
%F SAND	19.7	27.5	26.1
% FINES	10.8	43.6	30.6
D_{100} (mm)	38.100	9.530	38.100
D_{60} (mm)	2.886	0.233	0.514
D_{30} (mm)	0.407		
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	100.0
4"	100.0	100.0	100.0
3"	100.0	100.0	100.0
1 1/2"	100.0	100.0	100.0
1"	82.0	100.0	95.3
3/4"	82.0	100.0	93.1
1/2"	77.5	100.0	91.4
3/8"	74.6	100.0	89.9
#4	65.7	94.4	84.9
#10	55.8	90.2	76.8
#20	44.1	83.2	68.0
#40	30.5	71.1	56.7
#60	21.6	61.1	47.9
#100	15.7	52.4	39.7
#140	12.9	47.5	34.7
#200	10.8	43.6	30.6
5μ m			
2μ m			
1μ m			

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	6.0				SP-SM		Dark brown, Poorly graded sand with silt and gravel	02/06/19
■	16.2				SC		Yellowish brown, Clayey sand	02/06/19
○	12.8				SM		Brown, Silty sand with gravel	02/08/19

Parsons #649173

TerraSense, LLC #8197-19001

Morris & Essex Embankment

PARTICLE SIZE DISTRIBUTION

TerraSense Analysis File: GrainSizeV4R4(11/17)

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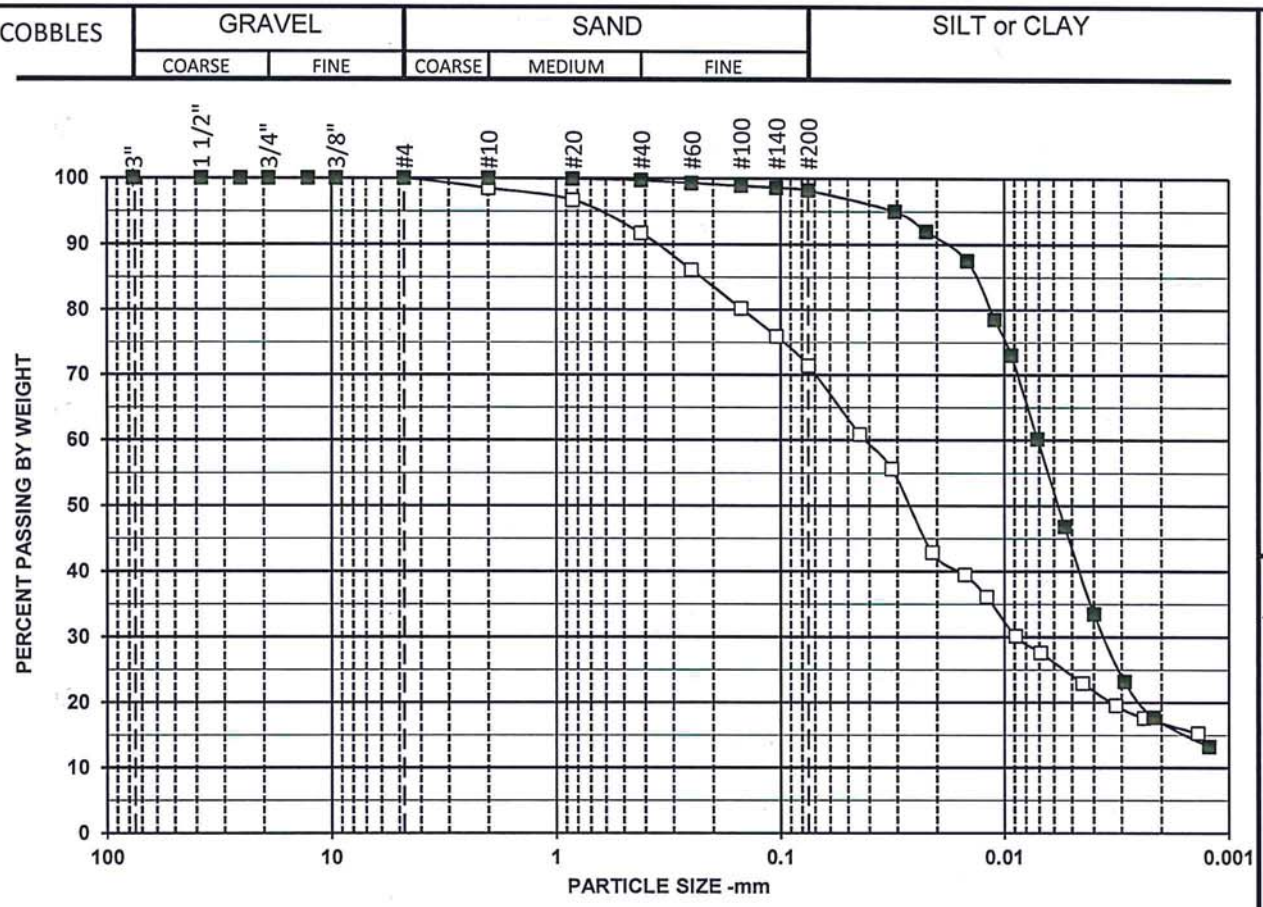

Symbol	□	■	○
Boring	B-3	B-3	
Sample	S-7	UD-2B	
Depth	15-17	23	
% +3"	0.0	0.0	
% Gravel	0.0	0.0	
% SAND	28.6	1.8	
%C SAND	1.5	0.0	
%M SAND	6.8	0.3	
%F SAND	20.3	1.5	
% FINES	71.4	98.2	
D_{100} (mm)	4.750	2.000	
D_{60} (mm)	0.042	0.007	
D_{30} (mm)	0.009	0.004	
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	
4"	100.0	100.0	
3"	100.0	100.0	
1 1/2"	100.0	100.0	
1"	100.0	100.0	
3/4"	100.0	100.0	
1/2"	100.0	100.0	
3/8"	100.0	100.0	
#4	100.0	100.0	
#10	98.5	100.0	
#20	96.7	99.9	
#40	91.7	99.7	
#60	86.1	99.3	
#100	80.2	98.9	
#140	75.9	98.6	
#200	71.4	98.2	
5μ m	24	44	
2μ m	17	17	
1μ m	14	12	

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	18.3	42	14	28	CL		Brownish gray, Lean clay with sand	02/15/19
■		28	21	7	CL-ML		Gray, Silty clay varved	02/15/19
○								

Parsons #649173

TerraSense, LLC #8197-19001

Morris & Essex Embankment

PARTICLE SIZE DISTRIBUTION

TerraSense Analysis File: GrainSizeV4R4(11/17)

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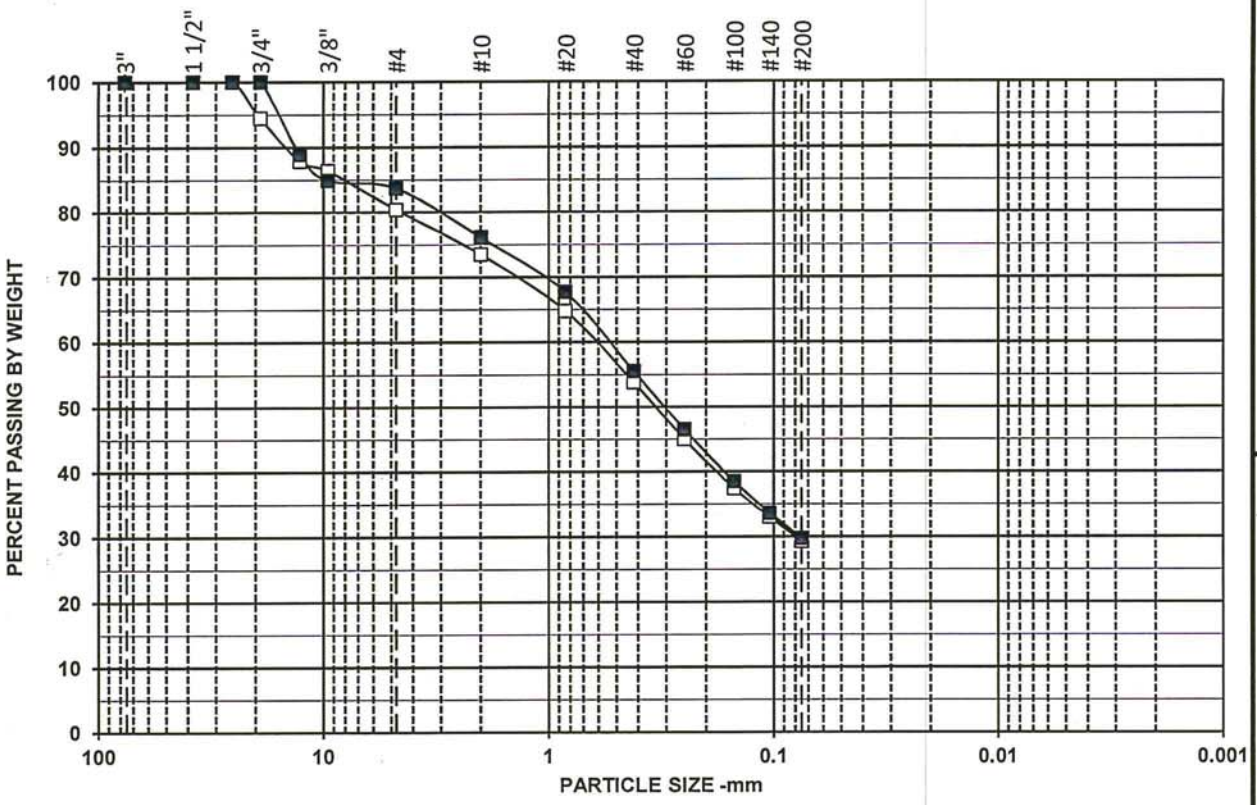

Symbol	□	■	○
Boring	B-3	B-3	
Sample	S-11	S-14	
Depth	35-37	50-52	
% +3"	0.0	0.0	
% Gravel	19.6	16.3	
% SAND	51.1	54.0	
%C SAND	6.9	7.6	
%M SAND	19.7	20.6	
%F SAND	24.5	25.8	
% FINES	29.3	29.7	
D_{100} (mm)	25.400	19.050	
D_{60} (mm)	0.620	0.542	
D_{30} (mm)	0.080	0.077	
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	
4"	100.0	100.0	
3"	100.0	100.0	
1 1/2"	100.0	100.0	
1"	100.0	100.0	
3/4"	94.5	100.0	
1/2"	87.9	88.9	
3/8"	86.4	84.9	
#4	80.4	83.7	
#10	73.5	76.1	
#20	64.8	67.7	
#40	53.8	55.5	
#60	45.0	46.5	
#100	37.4	38.5	
#140	33.0	33.6	
#200	29.3	29.7	
5μ m			
2μ m			
1μ m			

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	11.2				SC		Yellowish brown, Clayey sand with gravel	02/06/19
■	10.3				SC		Brown, Clayey sand with gravel	02/06/19
○								

Parsons #649173

TerraSense, LLC #8197-19001

Morris & Essex Embankment

PARTICLE SIZE DISTRIBUTION

TerraSense Analysis File: GrainSizeV4R4(11/17)

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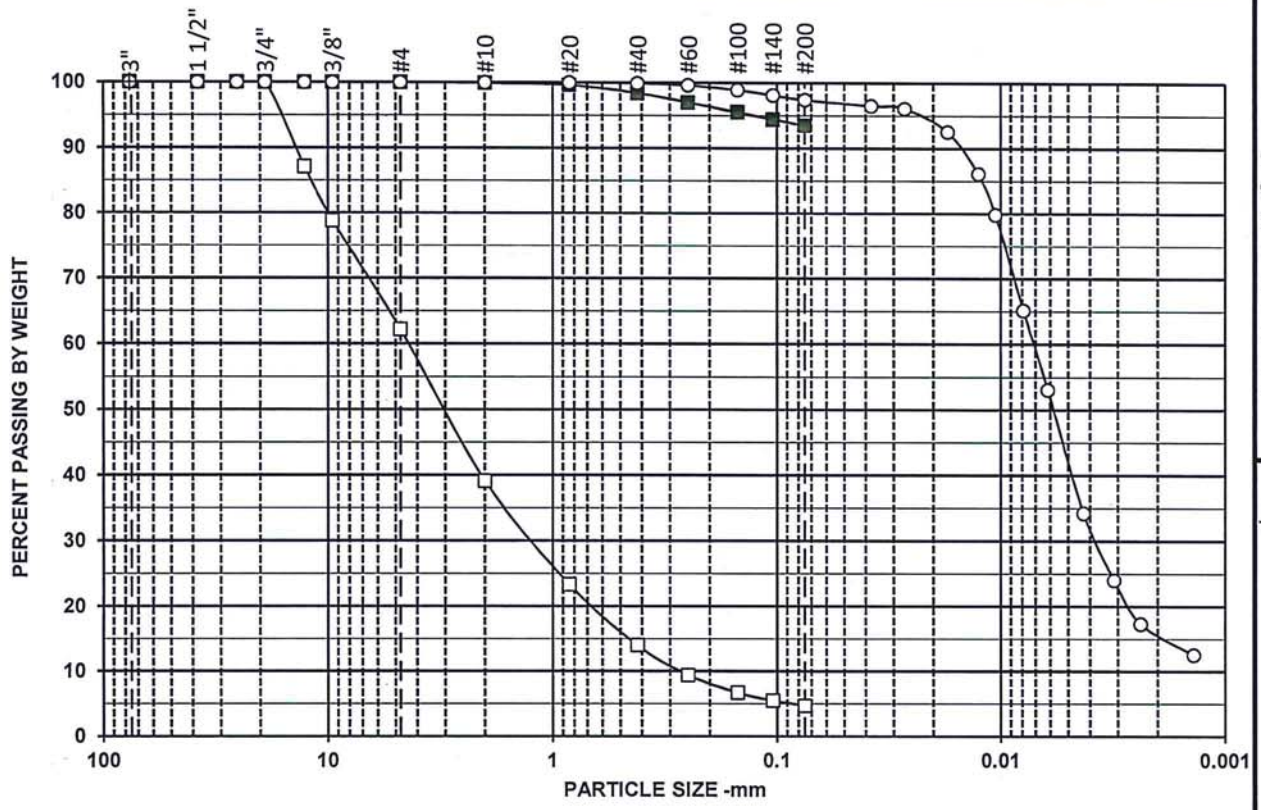


Symbol	□	■	○
Boring	B-4	B-4	B-4
Sample	S-3	S-6	S-8
Depth	4-6	10-12	14-16
% +3"	0.0	0.0	0.0
% Gravel	37.8	0.0	0.0
% SAND	57.5	6.5	2.6
%C SAND	23.1	0.1	0.0
%M SAND	25.1	1.5	0.1
%F SAND	9.3	4.9	2.5
% FINES	4.7	93.5	97.4
D_{100} (mm)	19.050	4.750	2.000
D_{60} (mm)	4.374		0.007
D_{30} (mm)	1.214		0.004
D_{10} (mm)	0.266		
Cc	1.300		
Cu	16.4		

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	100.0
4"	100.0	100.0	100.0
3"	100.0	100.0	100.0
1 1/2"	100.0	100.0	100.0
1"	100.0	100.0	100.0
3/4"	100.0	100.0	100.0
1/2"	87.1	100.0	100.0
3/8"	78.8	100.0	100.0
#4	62.2	100.0	100.0
#10	39.1	99.9	100.0
#20	23.3	99.6	100.0
#40	14.0	98.4	99.9
#60	9.4	97.0	99.6
#100	6.7	95.5	98.9
#140	5.5	94.4	98.1
#200	4.7	93.5	97.4
5μ m			42
2μ m			16
1μ m			10

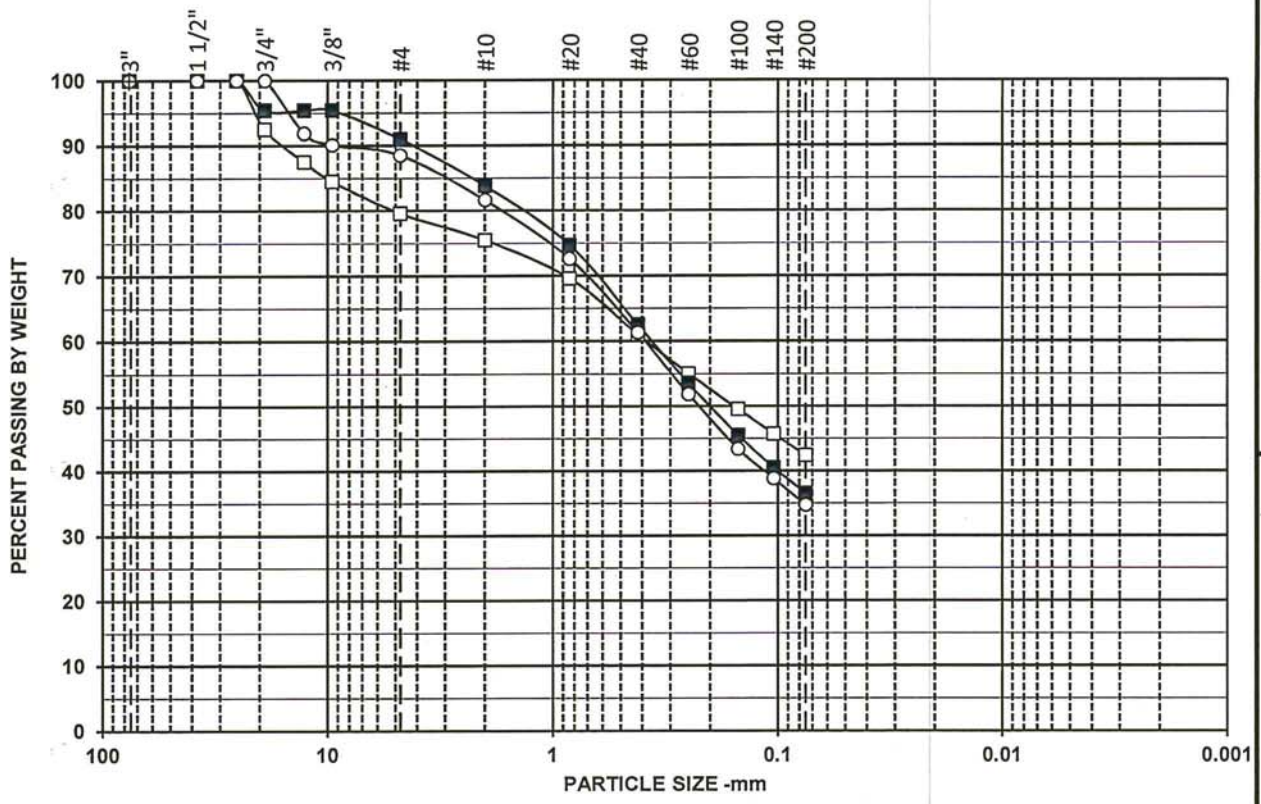
SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	29.0				SW		Brown, Well-graded sand with gravel	02/06/19
■	29.6				ML		Brown, Silt	02/06/19
○	30.2	28	20	8	CL		Brown, Lean clay	02/15/19

Parsons #649173

TerraSense, LLC #8197-19001

Morris & Essex Embankment

PARTICLE SIZE DISTRIBUTION



Symbol	□	■	○
Boring	B-4	B-4	B-4
Sample	S-9	S-10	S-13
Depth	20-22	25-27	40-42
% +3"	0.0	0.0	0.0
% Gravel	20.4	9.0	11.5
% SAND	37.2	54.5	53.8
%C SAND	4.1	7.2	6.9
%M SAND	14.5	21.3	20.3
%F SAND	18.6	26.0	26.6
% FINES	42.4	36.5	34.7
D_{100} (mm)	25.400	25.400	19.050
D_{60} (mm)	0.384	0.363	0.390
D_{30} (mm)			
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	100.0
4"	100.0	100.0	100.0
3"	100.0	100.0	100.0
1 1/2"	100.0	100.0	100.0
1"	100.0	100.0	100.0
3/4"	92.5	95.4	100.0
1/2"	87.5	95.4	91.9
3/8"	84.5	95.4	90.1
#4	79.6	91.0	88.5
#10	75.5	83.8	81.6
#20	69.6	74.7	72.6
#40	61.0	62.5	61.3
#60	55.0	53.5	51.8
#100	49.5	45.5	43.4
#140	45.7	40.5	38.8
#200	42.4	36.5	34.7
5μ m			
2μ m			
1μ m			

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	9.7				SM		Brown, Silty sand with gravel	02/06/19
■	12.7				SM		Brown, Silty sand	02/06/19
○	9.9				SM		Brown, Silty sand	02/06/19

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Morris & Essex Embankment

PARTICLE SIZE DISTRIBUTION

TerraSense Analysis File: GrainSizeV4R4(11/17)

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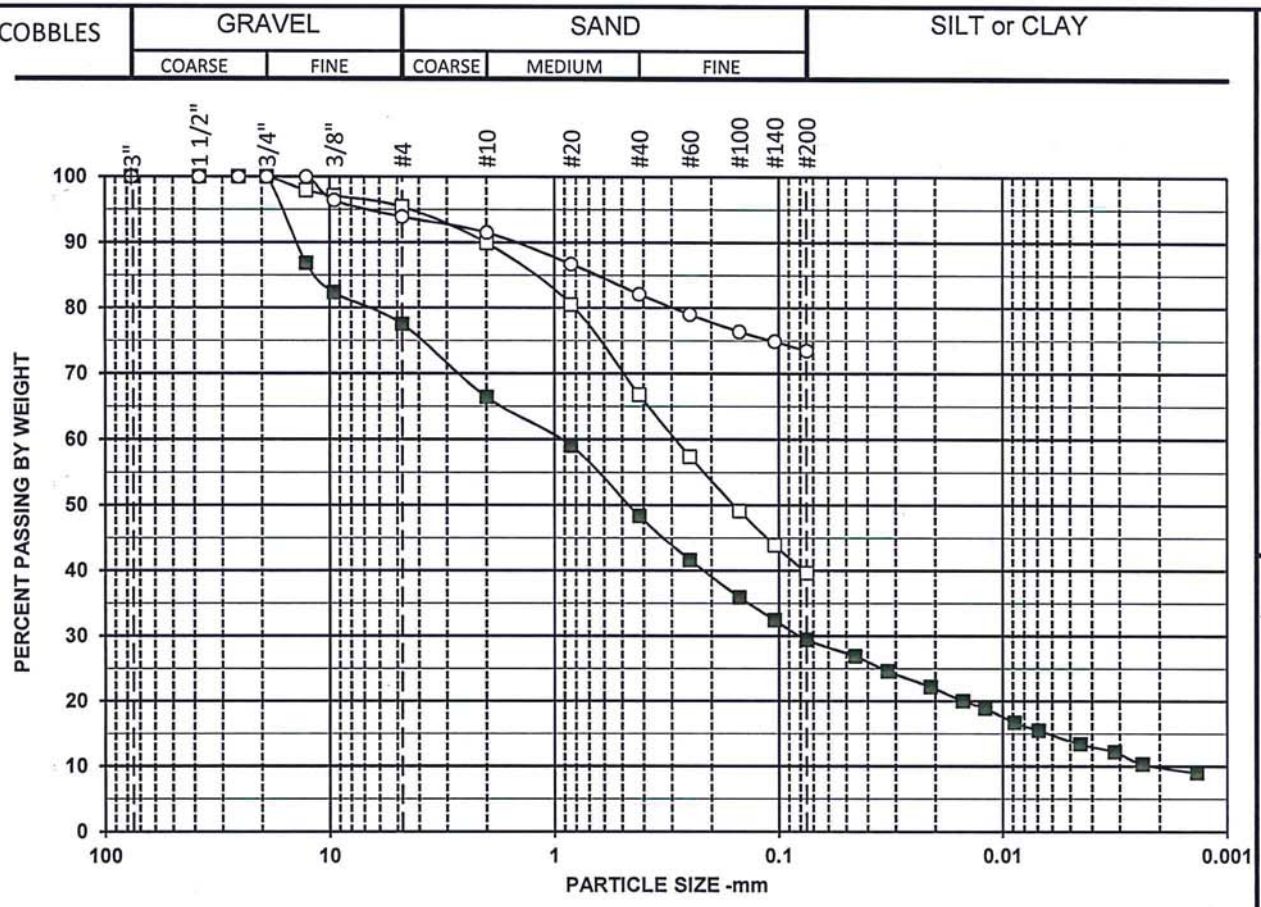

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	13.4				SM		Brown, Silty sand	02/06/19
■	9.7	28	14	14	SC		Brown, Clayey sand with gravel	02/15/19
○	20.2				CL		Brown, Lean clay with sand	02/06/19

Parsons #649173

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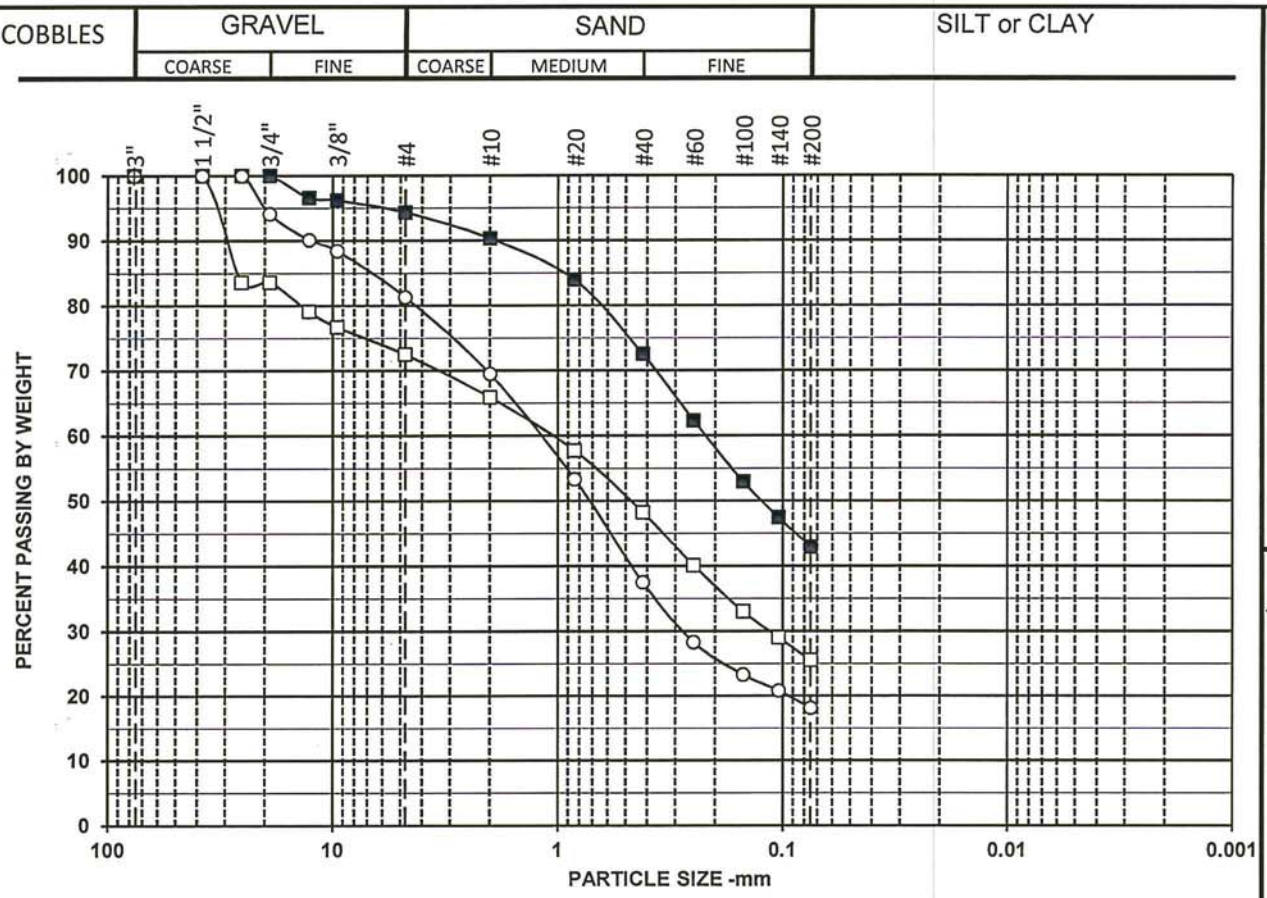
Symbol	□	■	○
Boring	B-4	B-4	B-4
Sample	S-17	S-22	S-25
Depth	60-62	85-87	100-102
% +3"	0.0	0.0	0.0
% Gravel	4.6	22.5	6.1
% SAND	55.8	48.1	20.4
%C SAND	5.5	11.1	2.4
%M SAND	23.1	18.1	9.4
%F SAND	27.2	18.9	8.6
% FINES	39.6	29.4	73.5
D_{100} (mm)	19.050	19.050	12.700
D_{60} (mm)	0.288	0.945	
D_{30} (mm)		0.080	
D_{10} (mm)		0.002	
Cc		3.300	
Cu		455.1	

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	100.0
4"	100.0	100.0	100.0
3"	100.0	100.0	100.0
1 1/2"	100.0	100.0	100.0
1"	100.0	100.0	100.0
3/4"	100.0	100.0	100.0
1/2"	97.9	86.8	100.0
3/8"	97.1	82.3	96.4
#4	95.4	77.5	93.9
#10	89.9	66.4	91.5
#20	80.5	59.0	86.7
#40	66.8	48.3	82.1
#60	57.4	41.6	79.0
#100	49.1	35.9	76.4
#140	43.9	32.4	74.9
#200	39.6	29.4	73.5
5μ m		14	
2μ m		10	
1μ m		8	

PARTICLE SIZE DISTRIBUTION



Symbol	□	■	○
Boring	B-5	B-5	B-6
Sample	S-2B	S-4	S-2
Depth	2-4	6-8	2-4
% +3"	0.0	0.0	0.0
% Gravel	27.5	5.7	18.7
% SAND	47.0	51.4	63.2
%C SAND	6.6	4.0	11.8
%M SAND	17.7	17.8	32.0
%F SAND	22.7	29.6	19.4
% FINES	25.5	42.9	18.1
D_{100} (mm)	38.100	19.050	25.400
D_{60} (mm)	1.072	0.220	1.203
D_{30} (mm)	0.114		0.274
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	100.0
4"	100.0	100.0	100.0
3"	100.0	100.0	100.0
1 1/2"	100.0	100.0	100.0
1"	83.6	100.0	100.0
3/4"	83.6	100.0	94.1
1/2"	79.1	96.6	90.1
3/8"	76.7	96.2	88.4
#4	72.5	94.3	81.3
#10	65.9	90.3	69.5
#20	57.7	83.9	53.3
#40	48.2	72.5	37.5
#60	40.1	62.3	28.3
#100	33.0	52.9	23.3
#140	29.0	47.4	20.8
#200	25.5	42.9	18.1
5μ m			
2μ m			
1μ m			

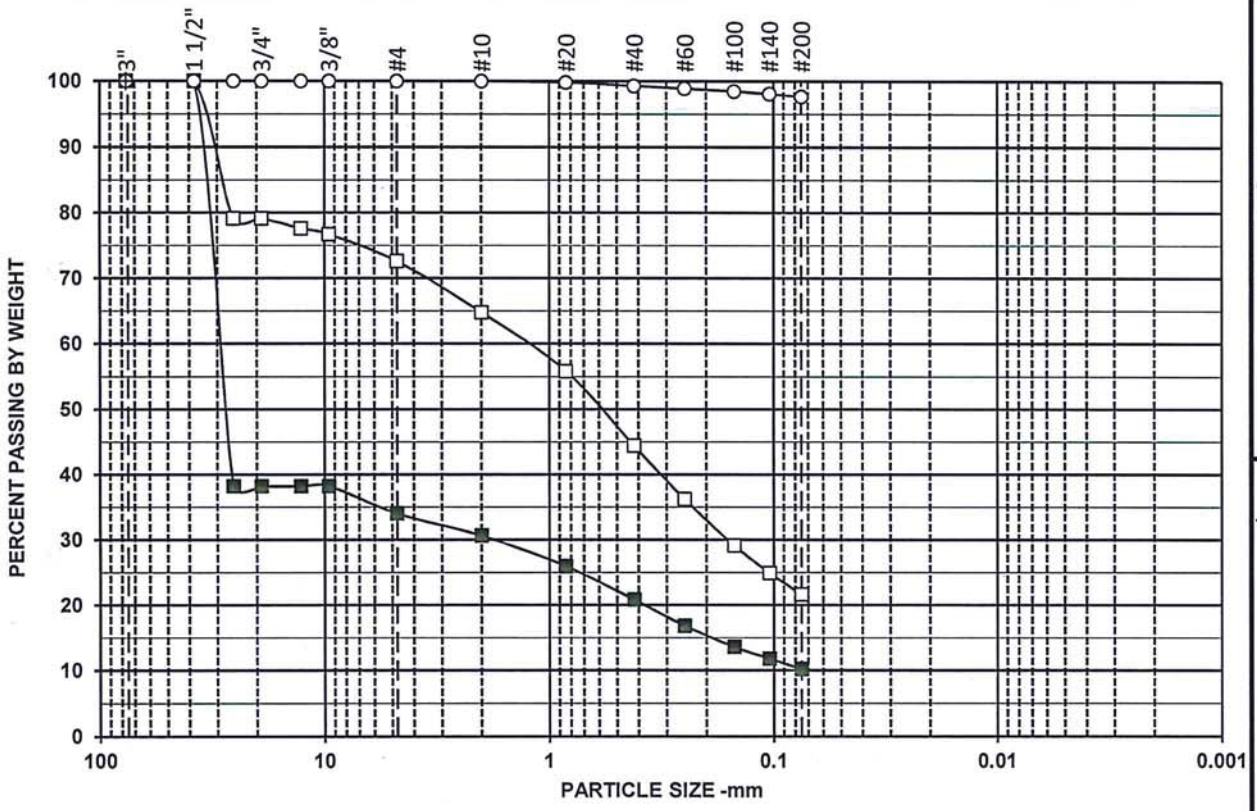
SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	7.0				SM		Brown, Silty sand with gravel	02/06/19
■	13.2				SM		Yellowish brown, Silty sand	02/06/19
○	5.7				SM		Brown, Silty sand with gravel	02/06/19

Parsons #649173

TerraSense, LLC #8197-19001

Morris & Essex Embankment

PARTICLE SIZE DISTRIBUTION



SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	8.5				SM		Brown, Silty sand with gravel	02/06/19
■	5.5				GP-GM		Brown, Poorly graded gravel with silt and sand	02/06/19
○	25.1				ML		Brown, Silt	02/06/19

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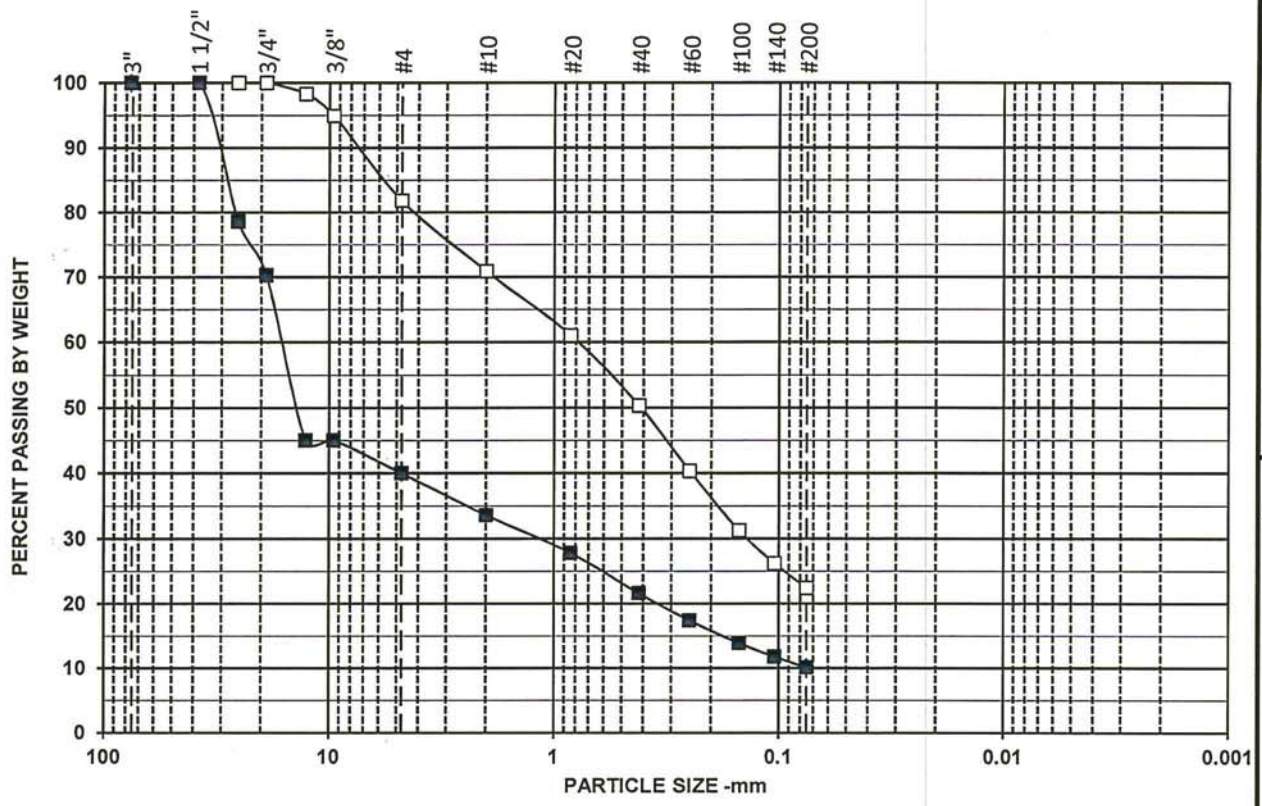
Symbol	□	■	○
Boring	B-6	B-6	B-6
Sample	S-4	S-6	S-8
Depth	6-8	10-12	20-22
% +3"	0.0	0.0	0.0
% Gravel	27.4	66.0	0.0
% SAND	51.0	23.8	2.3
%C SAND	7.8	3.4	0.0
%M SAND	20.4	9.8	0.7
%F SAND	22.8	10.6	1.6
% FINES	21.6	10.2	97.7
D_{100} (mm)	38.100	38.100	4.750
D_{60} (mm)	1.259	29.306	
D_{30} (mm)	0.160	1.790	
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	100.0
4"	100.0	100.0	100.0
3"	100.0	100.0	100.0
1 1/2"	100.0	100.0	100.0
1"	79.1	38.2	100.0
3/4"	79.1	38.2	100.0
1/2"	77.6	38.2	100.0
3/8"	76.7	38.2	100.0
#4	72.6	34.0	100.0
#10	64.8	30.6	100.0
#20	55.8	25.9	99.8
#40	44.4	20.8	99.3
#60	36.2	16.8	98.9
#100	29.1	13.6	98.5
#140	24.9	11.8	98.1
#200	21.6	10.2	97.7
5μ m			
2μ m			
1μ m			

PARTICLE SIZE DISTRIBUTION



Symbol	□	■	○
Boring	B-7	B-7	
Sample	SA-1	S-1	
Depth	0-2	8-10	
% +3"	0.0	0.0	
% Gravel	18.2	60.0	
% SAND	59.4	29.9	
%C SAND	10.9	6.4	
%M SAND	20.6	12.0	
%F SAND	27.9	11.5	
% FINES	22.4	10.1	
D_{100} (mm)	19.050	38.100	
D_{60} (mm)	0.788	16.151	
D_{30} (mm)	0.137	1.168	
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	
4"	100.0	100.0	
3"	100.0	100.0	
1 1/2"	100.0	100.0	
1"	100.0	78.6	
3/4"	100.0	70.3	
1/2"	98.3	45.0	
3/8"	94.9	45.0	
#4	81.8	40.0	
#10	70.9	33.6	
#20	61.0	27.8	
#40	50.3	21.6	
#60	40.3	17.4	
#100	31.2	13.9	
#140	26.2	11.8	
#200	22.4	10.1	
5μ m			
2μ m			
1μ m			

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	15.7				SM		Dark brown, Silty sand with gravel organic mat'l noted	02/06/19
■	11.2				GP-GM		Dark brown, Poorly graded gravel with silt and sand	02/06/19
○								

Parsons #649173

TerraSense, LLC #8197-19001

Morris & Essex Embankment

PARTICLE SIZE DISTRIBUTION

TerraSense Analysis File: GrainSizeV4R4(11/17)

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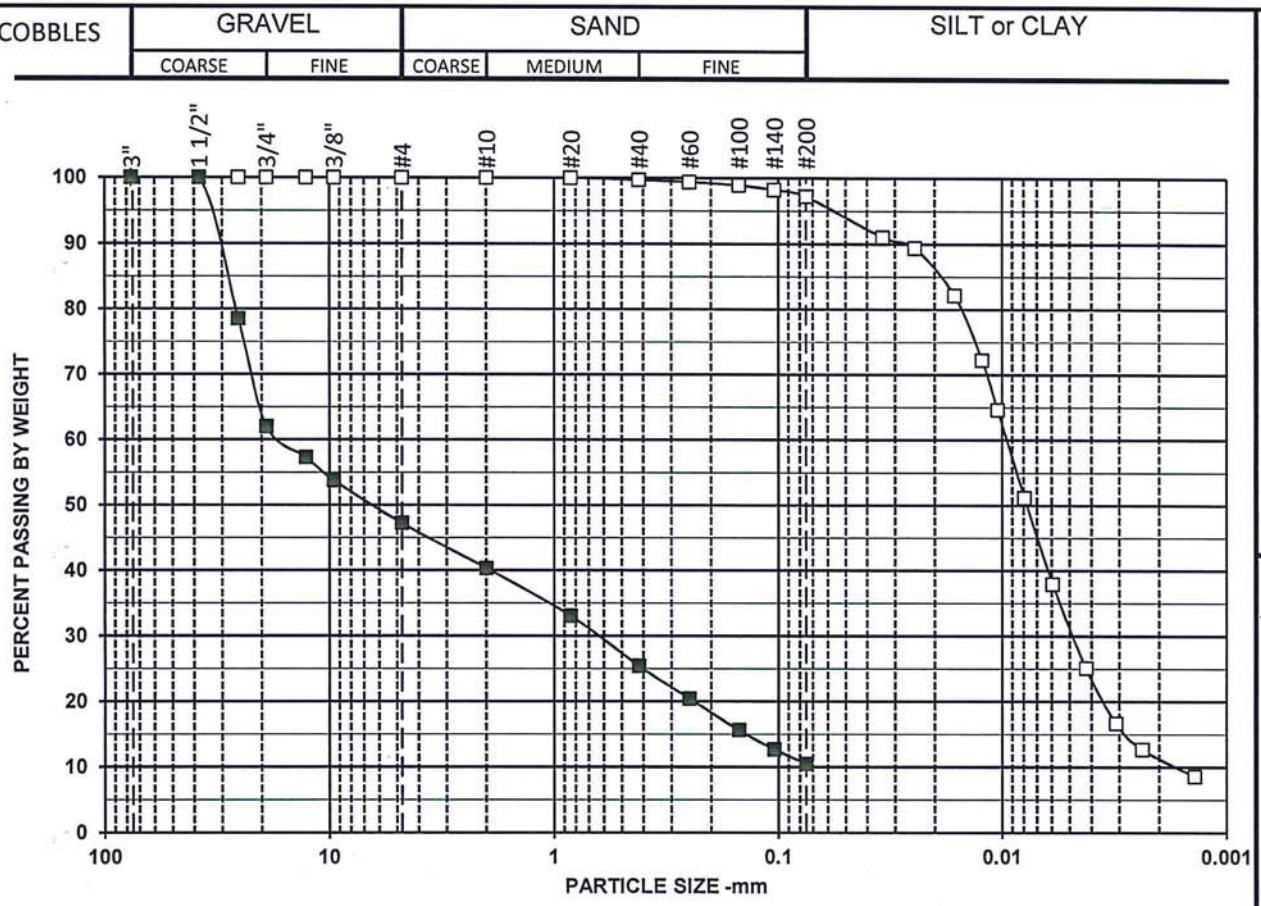

Symbol	□	■	○
Boring	B-7	B-7	
Sample	S-6A	S-8	
Depth	18-20	25-27	
% +3"	0.0	0.0	
% Gravel	0.0	52.8	
% SAND	2.8	36.7	
%C SAND	0.0	6.9	
%M SAND	0.3	14.9	
%F SAND	2.5	14.9	
% FINES	97.2	10.5	
D_{100} (mm)	2.000	38.100	
D_{60} (mm)	0.010	16.031	
D_{30} (mm)	0.005	0.639	
D_{10} (mm)	0.002		
Cc	1.500		
Cu	5.7		

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	
4"	100.0	100.0	
3"	100.0	100.0	
1 1/2"	100.0	100.0	
1"	100.0	78.5	
3/4"	100.0	62.0	
1/2"	100.0	57.3	
3/8"	100.0	53.7	
#4	100.0	47.2	
#10	100.0	40.3	
#20	100.0	33.0	
#40	99.7	25.4	
#60	99.4	20.4	
#100	98.9	15.6	
#140	98.2	12.7	
#200	97.2	10.5	
5μ m	31		
2μ m	11		
1μ m	6		

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	23.4				ML		Brown, Silt	02/15/19
■	6.1				GP-GM		Brown, Poorly graded gravel with silt and sand	02/06/19
○								

Parsons #649173

TerraSense, LLC #8197-19001

Morris & Essex Embankment

PARTICLE SIZE DISTRIBUTION

TerraSense Analysis File: GrainSizeV4R4(11/17)

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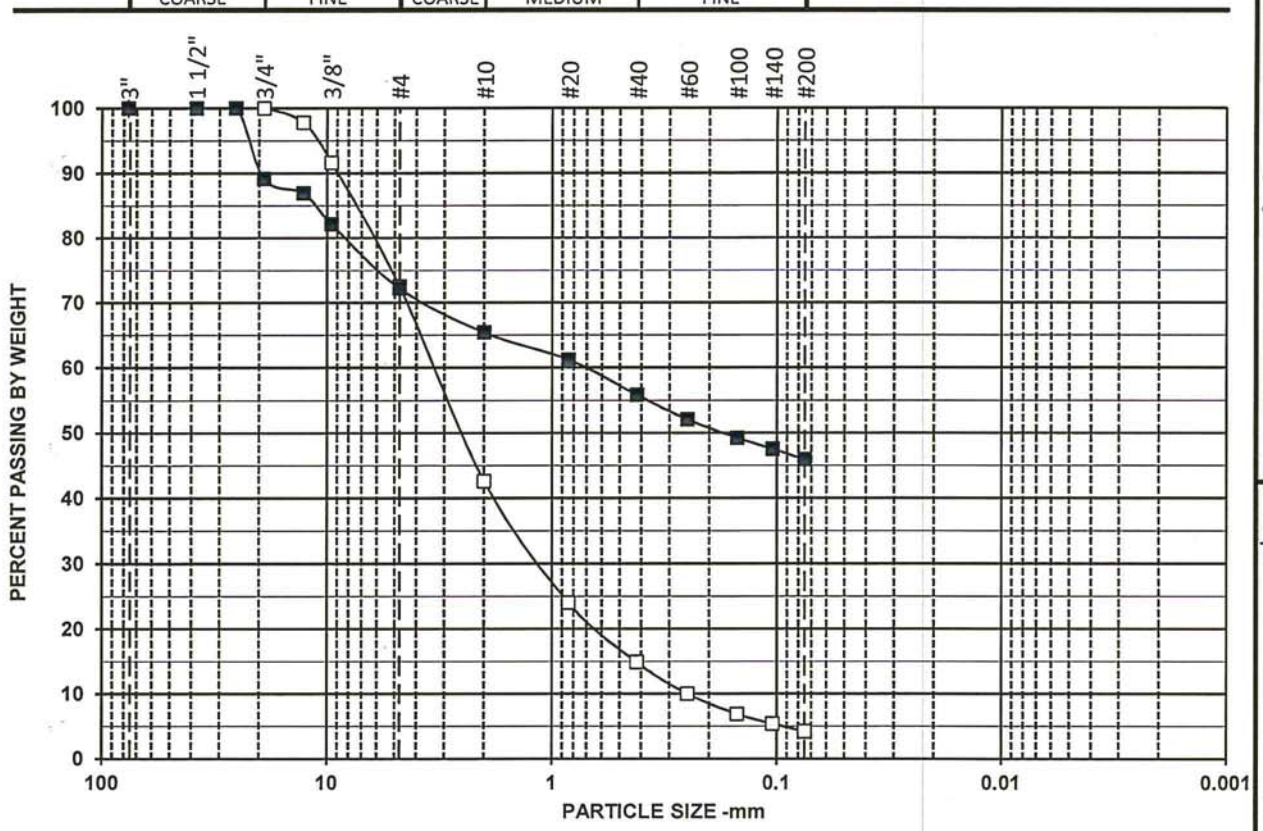

Symbol	□	■	○
Boring	B-8	B-8	
Sample	S-2	S-4	
Depth	2-4	6-8	
% +3"	0.0	0.0	
% Gravel	27.5	27.8	
% SAND	68.3	26.3	
%C SAND	29.9	6.8	
%M SAND	27.7	9.6	
%F SAND	10.7	9.9	
% FINES	4.2	45.9	
D_{100} (mm)	19.050	25.400	
D_{60} (mm)	3.308	0.720	
D_{30} (mm)	1.112		
D_{10} (mm)	0.249		
Cc	1.500		
Cu	13.3		

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	
4"	100.0	100.0	
3"	100.0	100.0	
1 1/2"	100.0	100.0	
1"	100.0	100.0	
3/4"	100.0	89.1	
1/2"	97.8	86.9	
3/8"	91.6	82.1	
#4	72.5	72.2	
#10	42.6	65.4	
#20	24.0	61.2	
#40	14.9	55.8	
#60	10.0	52.0	
#100	6.9	49.2	
#140	5.4	47.5	
#200	4.2	45.9	
5μ m			
2μ m			
1μ m			

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	6.7				SW		Black, Well-graded sand with gravel	02/06/19
■	17.9				GC		Brown, Clayey gravel with sand roots noted	02/06/19
○								

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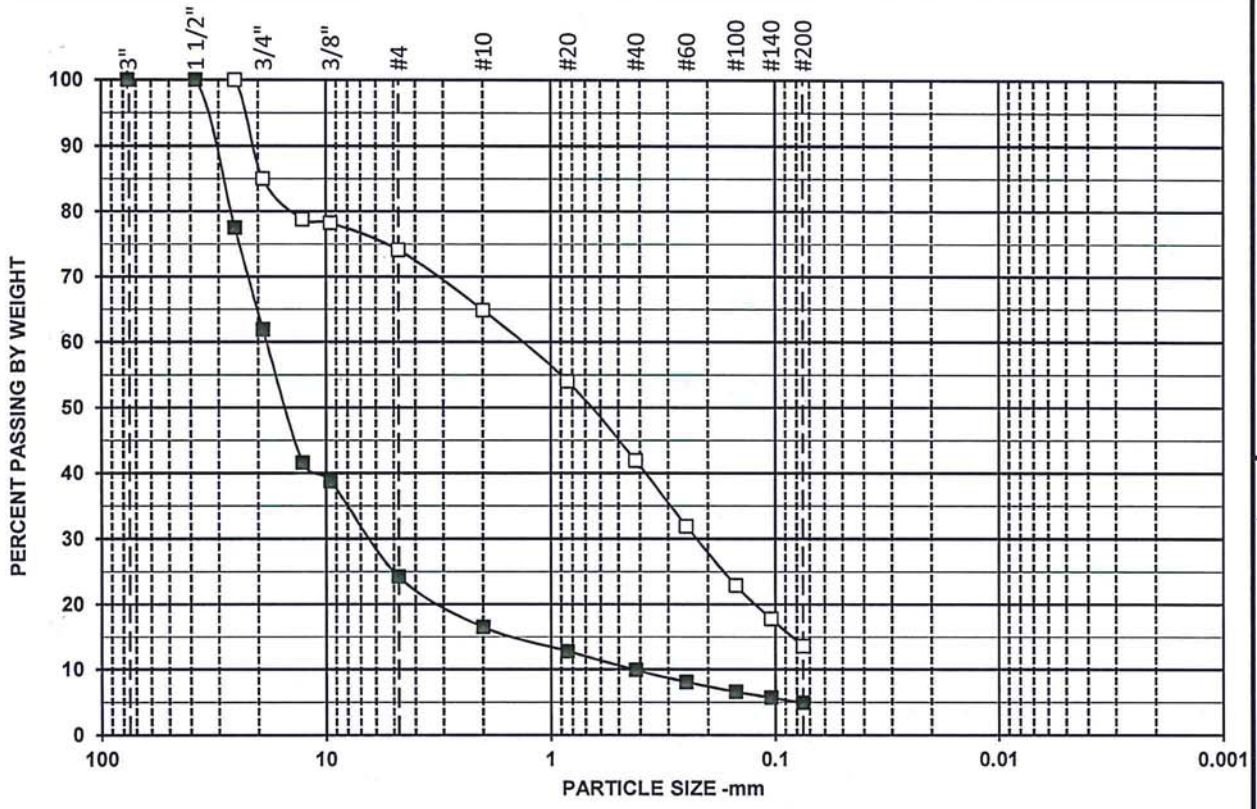
PARTICLE SIZE DISTRIBUTION



Symbol	□	■	○
Boring	B-8	B-8	
Sample	S-7	S-8	
Depth	15-17	20-22	
% +3"	0.0	0.0	
% Gravel	25.9	75.8	
% SAND	60.5	19.3	
%C SAND	9.2	7.7	
%M SAND	23.0	6.6	
%F SAND	28.3	5.0	
% FINES	13.6	4.9	
D_{100} (mm)	25.400	38.100	
D_{60} (mm)	1.354	18.341	
D_{30} (mm)	0.224	6.274	
D_{10} (mm)		0.429	
Cc		5.000	
Cu		42.7	

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	
4"	100.0	100.0	
3"	100.0	100.0	
1 1/2"	100.0	100.0	
1"	100.0	77.5	
3/4"	85.0	61.9	
1/2"	78.8	41.6	
3/8"	78.2	38.7	
#4	74.1	24.2	
#10	64.9	16.5	
#20	54.0	12.8	
#40	41.9	9.9	
#60	31.9	8.1	
#100	22.9	6.6	
#140	17.8	5.7	
#200	13.6	4.9	
5μ m			
2μ m			
1μ m			

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	23.2				SM		Brown, Silty sand with gravel	02/06/19
■	9.3				GP		Brown, Poorly graded gravel with sand	02/06/19
○								

Parsons #649173

TerraSense, LLC #8197-19001

Morris & Essex Embankment

PARTICLE SIZE DISTRIBUTION

TerraSense Analysis File: GrainSizeV4R4(11/17)

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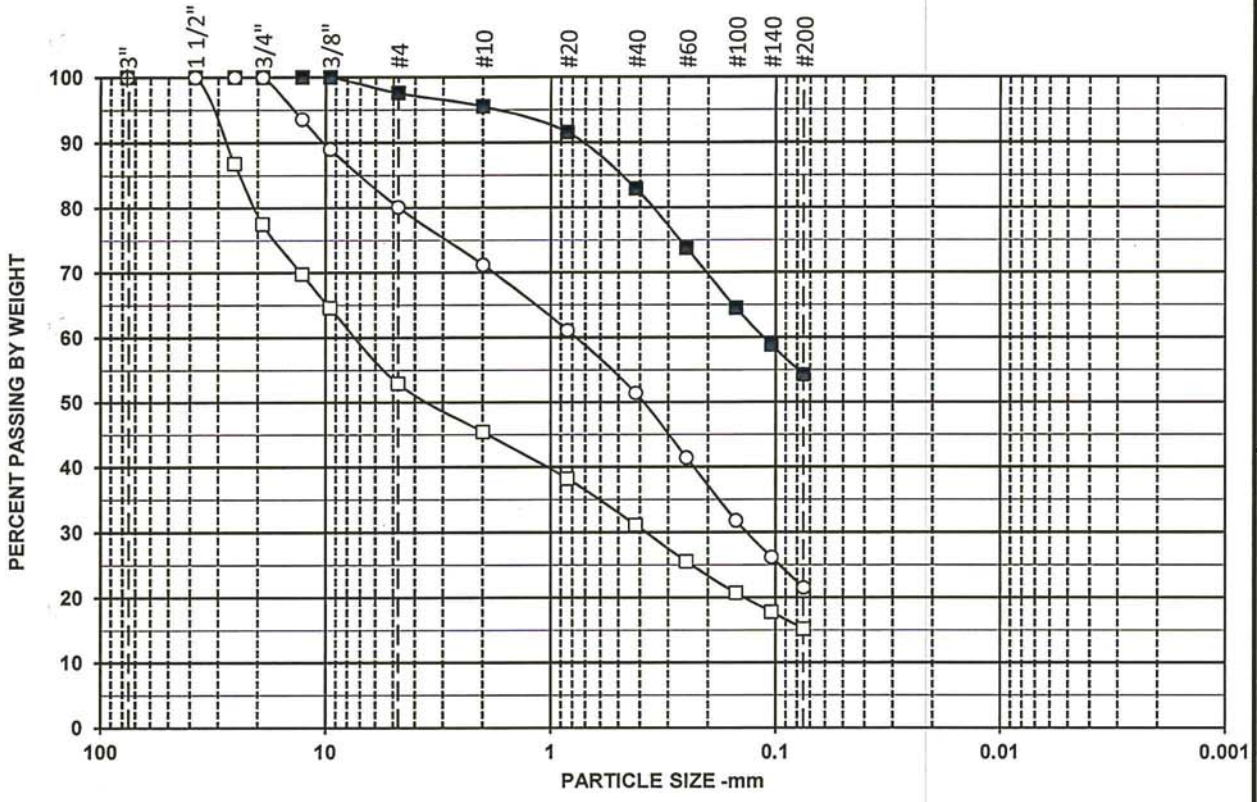


Symbol	□	■	○
Boring	B-9	B-9	B-9
Sample	S-2	S-3	S-5
Depth	2-4	4-6	10-12
% +3"	0.0	0.0	0.0
% Gravel	47.1	2.4	19.9
% SAND	37.7	43.4	58.6
%C SAND	7.5	2.1	8.9
%M SAND	14.3	12.6	19.8
%F SAND	15.9	28.7	29.9
% FINES	15.2	54.2	21.5
D_{100} (mm)	38.100	9.530	19.050
D_{60} (mm)	7.245	0.112	0.777
D_{30} (mm)	0.378		0.133
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	100.0
4"	100.0	100.0	100.0
3"	100.0	100.0	100.0
1 1/2"	100.0	100.0	100.0
1"	86.8	100.0	100.0
3/4"	77.5	100.0	100.0
1/2"	69.8	100.0	93.6
3/8"	64.6	100.0	89.0
#4	52.9	97.6	80.1
#10	45.4	95.5	71.2
#20	38.2	91.5	61.1
#40	31.1	82.9	51.4
#60	25.5	73.7	41.4
#100	20.7	64.5	31.8
#140	17.8	58.8	26.2
#200	15.2	54.2	21.5
5μ m			
2μ m			
1μ m			

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	4.7				GM		Brown, Silty gravel with sand	02/06/19
■	21.5				CL		Brown, Sandy lean clay	02/06/19
○	8.2				SM		Brown, Silty sand with gravel	02/06/19

Parsons #649173

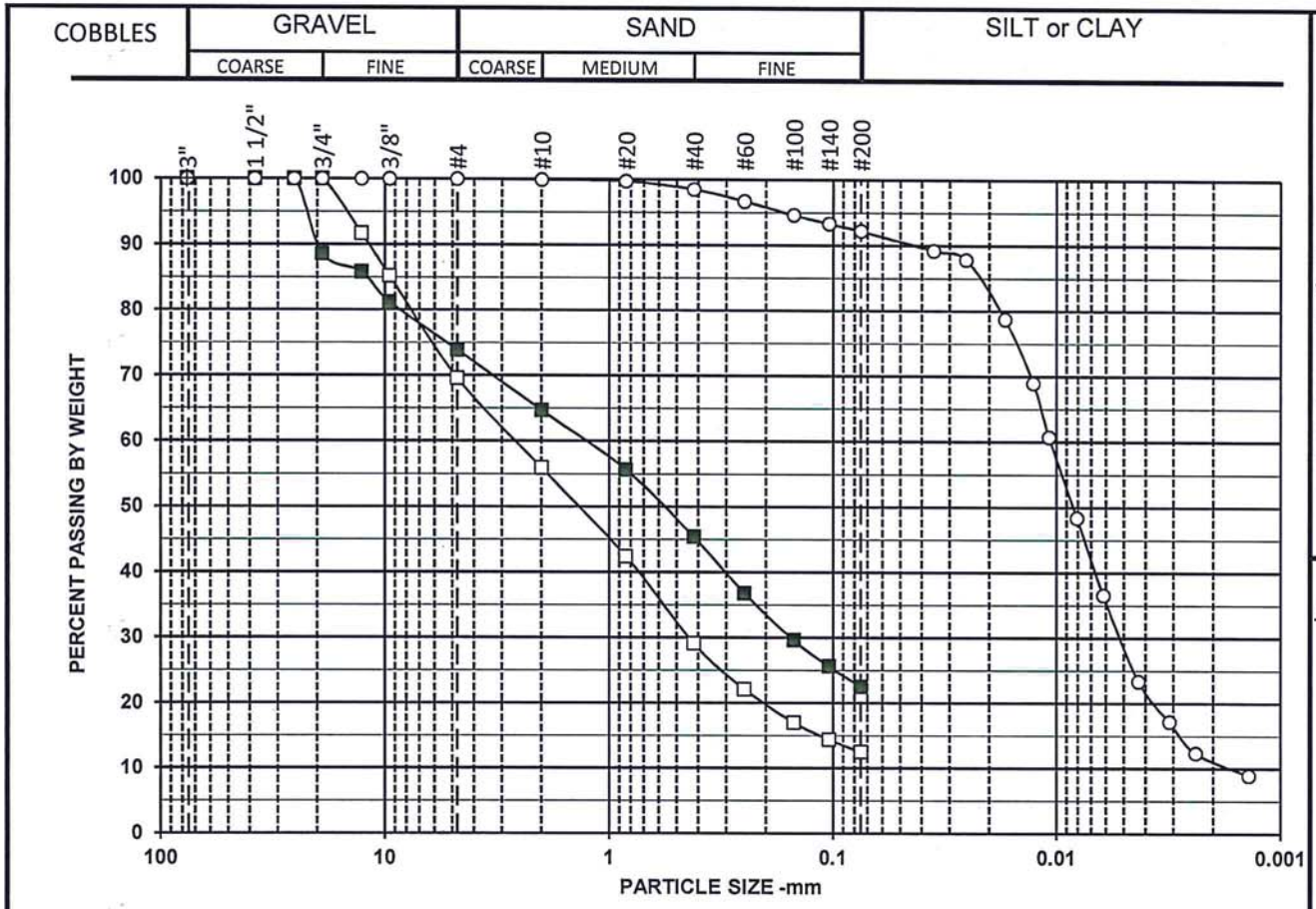
TerraSense, LLC #8197-19001

Morris & Essex Embankment

PARTICLE SIZE DISTRIBUTION

TerraSense Analysis File: GrainSizeV4R4(11/17)

Siev1p.xlsx 2/28/2019



Symbol	□	■	○
Boring	B-10	B-10	B-10
Sample	S-2	S-5	S-11
Depth	2-4	8-10	35-37
% +3"	0.0	0.0	0.0
% Gravel	30.4	26.1	0.0
% SAND	57.1	51.4	7.8
%C SAND	13.7	9.2	0.1
%M SAND	26.8	19.3	1.4
%F SAND	16.6	22.9	6.3
% FINES	12.5	22.5	92.2
D_{100} (mm)	19.050	25.400	4.750
D_{60} (mm)	2.590	1.278	0.011
D_{30} (mm)	0.439	0.154	0.005
D_{10} (mm)			0.002
Cc			1.500
Cu			6.5

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	100.0
4"	100.0	100.0	100.0
3"	100.0	100.0	100.0
1 1/2"	100.0	100.0	100.0
1"	100.0	100.0	100.0
3/4"	100.0	88.6	100.0
1/2"	91.7	85.8	100.0
3/8"	85.2	81.2	100.0
#4	69.6	73.9	100.0
#10	55.9	64.7	99.9
#20	42.4	55.6	99.7
#40	29.1	45.4	98.5
#60	22.1	36.8	96.7
#100	17.0	29.6	94.6
#140	14.4	25.6	93.3
#200	12.5	22.5	92.2
5μ m			29
2μ m			11
1μ m			7

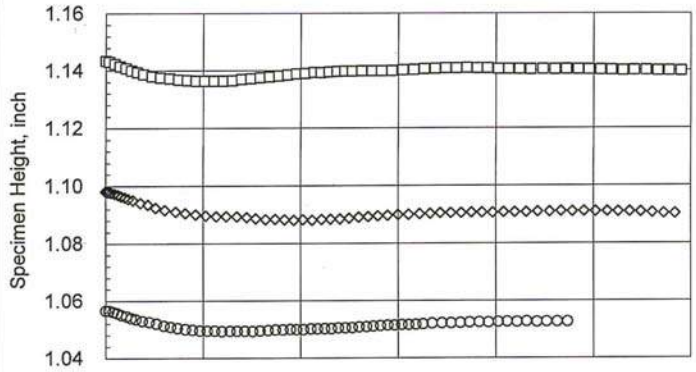
SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	4.9				SM		Brown, Silty sand with gravel	02/15/19
■	9.2				SM		Brown, Silty sand with gravel	02/15/19
○	23.2				ML		Brown, Silt	02/15/19

Parsons #649173

TerraSense, LLC #8197-19001

Morris & Essex Embankment

PARTICLE SIZE DISTRIBUTION



SAMPLE INFORMATION

Boring: B-2 UD-2 (-#8) Depth: 11.45 feet
Type: Laboratory compacted - medium dense
Description: SC-SM, gray silty clayey sand
as tested on material passing sieve #8

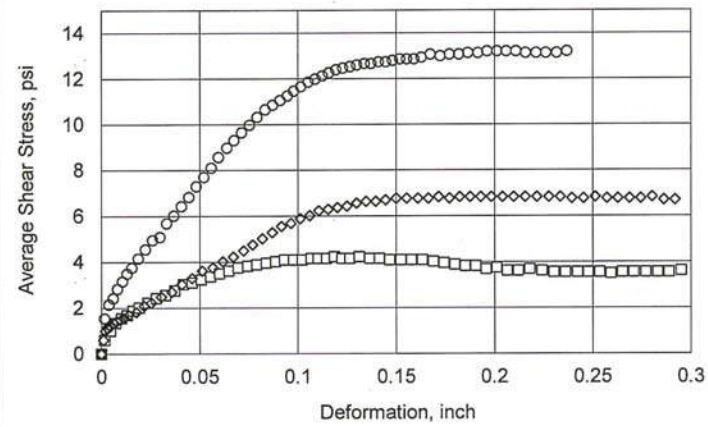
TEST INFORMATION

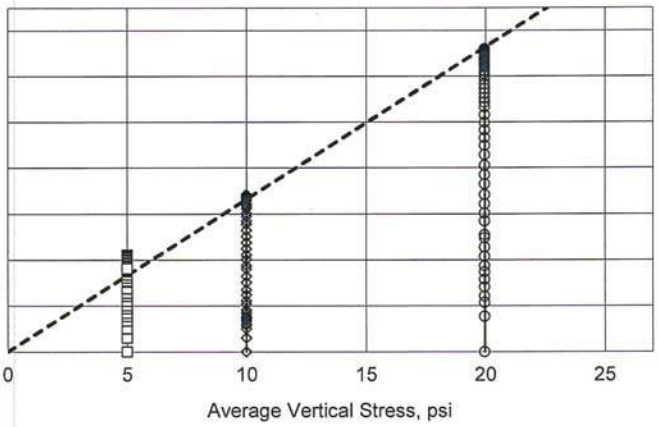
Symbol	Stage	Vertical Stress psi	Deformation Rate inch/min.
□	3	5.0	0.0013
◊	5	10.0	0.0012
○	7	20.0	0.0012

TEST SUMMARY

Peak Effective Friction Angle: 40.2°, cohesion = 0.0psi (first stage only)
Final Effective Friction Angle: 33.6°, cohesion = 0.0psi (Shown)

REMARKS:





Prepared by: GT Checked by: GET	Parsons **TerraSense, LLC**	649173 8197-19001	Morris & Essex Embankment	**STAGED DRAINED DIRECT SHEAR** **SERIES SUMMARY** Boring: B-2 Sample: UD-2 (-#8) Depth: 11.45 ft

DRAINED DIRECT SHEAR TEST SERIES

Description of Material Tested	SIEVE	Atterberg Limits			Compaction Test		
	MINUS NO. 200 (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	ASTM STD.	OPT. WATER CONTENT (%)	MAX . DRY UNIT WGT. (pcf)
SC-SM, gray silty clayey sand							

TEST DATA SUMMARY

Sample No	Stage No	Initial Molding Conditions		w_o	γ_{to}	γ_{do}	$\sigma'_{v,c}$	Deformation rate	at Peak Shear Stress at High Deformation		
Specimen		% Comp.	W-W(opt) (%)	w_c (estimated) (%)	γ_{tc} (estimated) (pcf)	γ_{dc} (estimated) (pcf)	(psi) $\varepsilon_{v,c}$ (%)	(inch/min) t_c (days)	ΔL (inch)	τ_h (psi)	Φ' for c'=0
B-2 UD-2 (-#8)	Stage 3			19.8	139.3	116.3	5.00	1.3E-3	0.12	4.22	40.2
				16.4	138.7	119.2	2.4	0.61	0.28	3.55	35.4
B-2 UD-2 (-#8)	Stage 5						9.99	1.2E-3	0.17	6.83	34.4
				14.5	140.5	122.7	6.3	1.27	0.27	6.77	34.1
B-2 UD-2 (-#8)	Stage 7						19.95	1.2E-3	0.20	13.20	33.5
				12.7	141.7	125.7	9.8	1.17	0.22	13.13	33.3

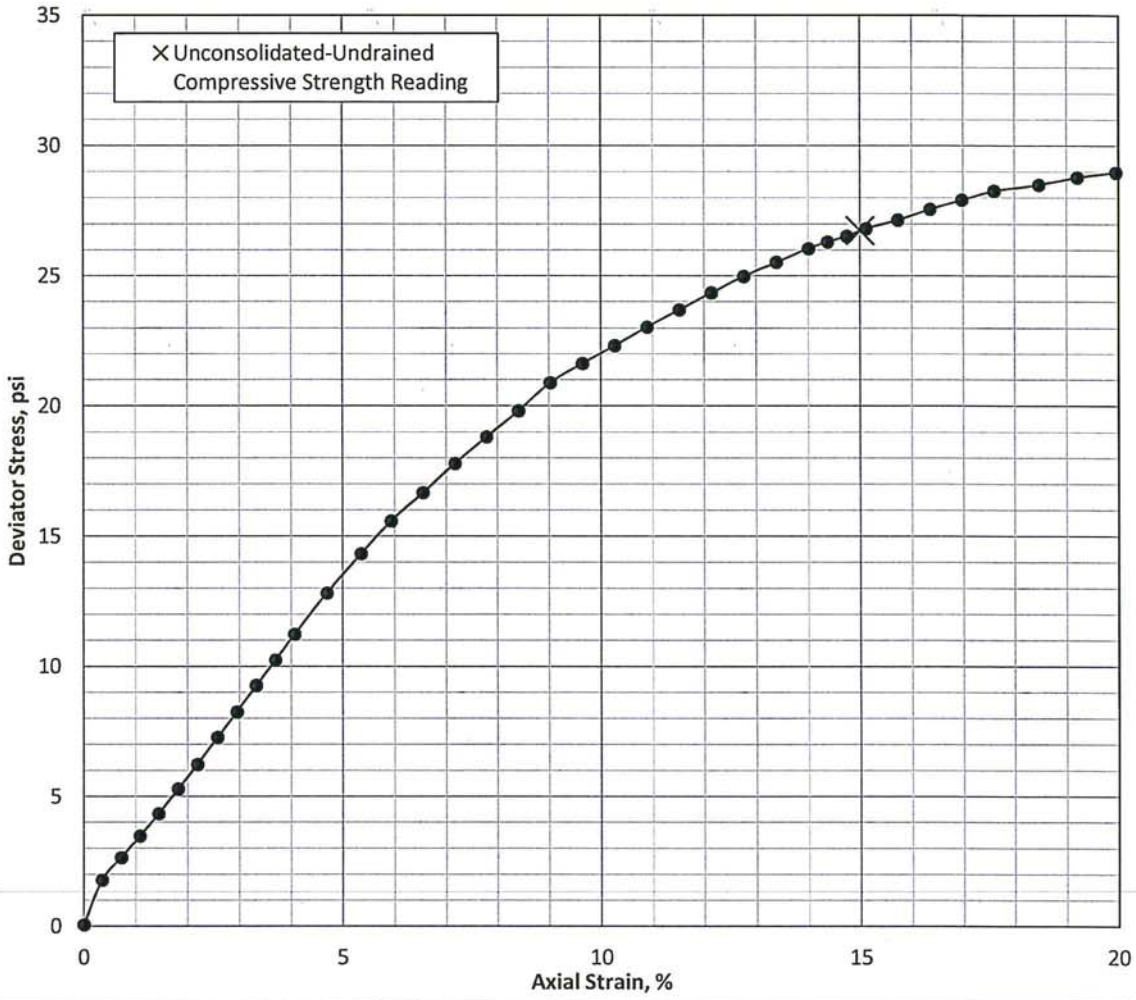
Series Strength Envelope Summary

Failure Criterion	Φ' (degree)	c' (psi)
1. Peak shear stress*	40.2	0.0
2. High deformation	33.6	0.0

* First shear stage only

	Parsons	649173	Morris & Essex Embankment	DRAINED DIRECT SHEAR SERIES SUMMARY
Checked by: GET	TerraSense, LLC	8197-19001		Sample: B-2UD-2 (-#8) Depth: 11.45 ft

UNCONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH TEST, ASTM METHOD D2850



Specimen and Material Property Information

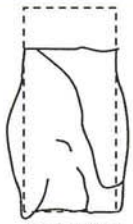
Sample Type: Intact tube sample

Description and/or Classification: CL, greenish brown clay with sand

Cell Pressure (psi)	Water [1] Content (%)	Wet Unit Weight (pcf)	Dry Unit [1] Weight (pcf)	Void Ratio (-)	Saturation [2] (%)	Length (inch)	Diameter (inch)	L/D (-)	LL/ PL (-)	PI (-)	Specific [2] Gravity (-)
0 (Initial)	20.6	131.1	108.7	0.61	95.0	5.968	2.870	2.1	32	16	2.80
10.0	20.6	131.6	109.1	0.60	95.8	5.961	2.867	2.1	16		

Failure Summary

U-U Compressive Strength (psi)	U-U Shear Strength, s_u (psi)	Strain to Peak (%)	Strain Rate (%/min)
26.7	13.35	15.0	0.74



FAILURE SKETCH

Remarks and Notes:

(1) Water Content determined after shear from partial specimen.

(2) Assumed specific gravity

Tested by: MB Reviewed by: GET

Test Date: 2/7/2019 Review Date: 2/28/2019

Parsons Project # 649173	**Morris & Essex Embankment**	**UNCONSOLIDATED-UNDRAINED COMPRESSION TEST**
TerraSense, LLC Project # 8197-19001		Boring: B-1 Sample: UD-1 Section: A Depth: 8.8 ft.

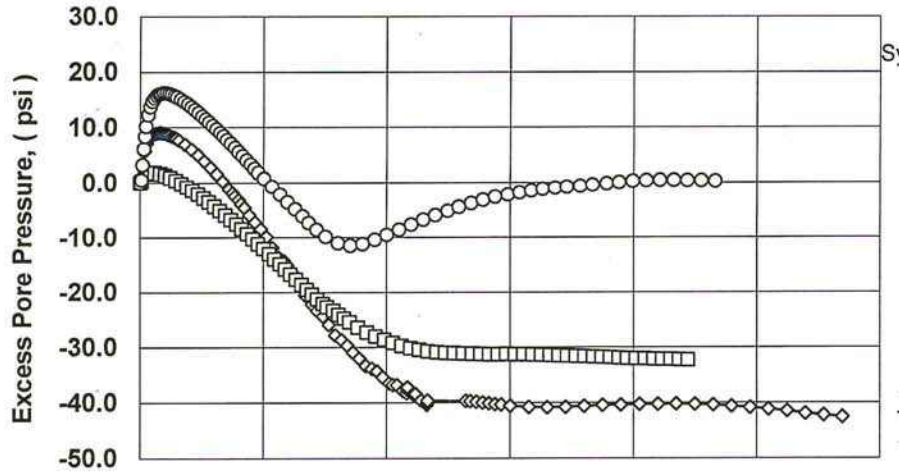
SUMMARY FOR STATIC CIU' TRIAXIAL TESTS SPECIMENS

Test No	Boring No	Sample Section No	Depth	USCS Group Symbol	w_o	$\gamma_{t,o}$	$\gamma_{d,o}$	$\sigma'_{c,max}$	$\sigma'_{v,c}$	$\varepsilon_{a,c}$	B factor (%)	at Peak Deviator Stress					
												at Peak Obliquity					
			Elev	Gs	w_c	$\gamma_{t,c}$	$\gamma_{d,c}$	OCR	$\frac{\sigma'_{h,c}}{\sigma'_{v,c}}$	$\varepsilon_{v,c}$	ε_{rate}	ε_a	$\frac{\sigma_1 - \sigma_3}{2}$	$\frac{\sigma'_1 + \sigma'_3}{2}$	σ'_1 / σ'_3	A factor	ϕ' for c'=0
			(ft)		(%)	(pcf)	(pcf)			(%)	(%/hr)	(%)	(psi)	(psi)			
T4429	B-3	UD-2	22.5	CL-ML	27.6	127.9	100.2	5.00	5.00	0.1	98.4	10.6	45.55	80.29	3.62	-0.326	34.6
		A		(2.90)	26.1	129.9	103.0	1.0	1.0	2.8	1.3	2.3	12.56	19.61	4.56	-0.082	39.8
T4430	B-3	UD-2	23	CL-ML	30.4	125.0	95.9	15.00	15.00	2.0	100.0	11.4	69.53	124.08	3.55	-0.284	34.1
		B		(2.90)	25.2	130.9	104.5	1.0	1.0	8.3	0.7	3.1	25.51	38.92	4.80	0.031	40.9
T4431	B-3	UD-2	23.5	CL-ML	29.5	123.9	95.7	30.00	30.00	0.7	100.0	7.2	51.07	89.61	3.65	-0.084	34.7
		C		(2.90)	27.8	128.1	100.2	1.0	1.0	4.5	1.0	3.5	32.95	55.17	4.0	0.118	36.7

Test No	Description of Material Tested and Remarks
T4429	CL-ML, Gray silty clay, some fine sand layers, varved.
T4430	CL-ML, Gray silty clay, varved.
T4431	CL-ML, Gray silty clay

Strength Envelope Summary						
Test Series	Failure Criteria	ϕ' (deg)	c' (psi)	α' (deg)	a' (psi)	Correlation Coefficient
1	1	33.0	2.444	28.6	2.050	1.000
	2	35.2	2.229	30.0	1.821	0.994
Failure Criteria:	1 - Peak Deviator Stress 2 - Peak Obliquity					

Parsons	Project No. 649173	**Morris & Essex Embankment**	**CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements B-3 UD-2 22-24 ft. SUMMARY**
TerraSense, LLC	Project No. 8197-19001		

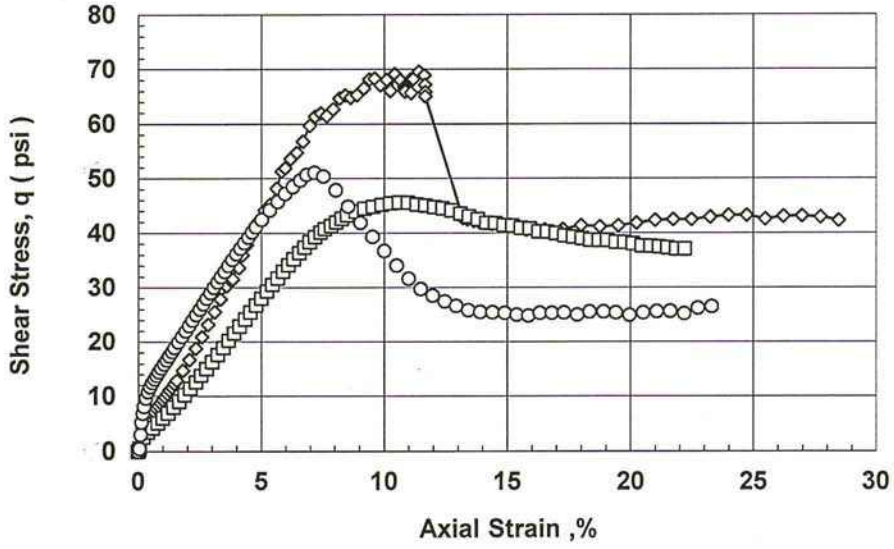


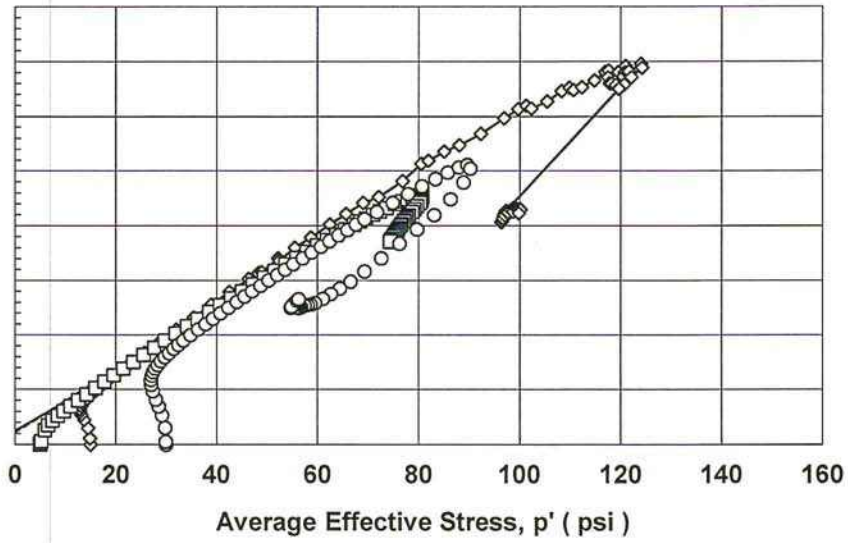
LEGEND AND SUMMARY INFORMATION

Symbol	Test	Boring	Sample	Depth (ft)	w_o (%)	γ_{to} (pcf)	σ'_c (psi)
□	T4429	B-3	UD-2	22.5	27.6	127.9	5.00
◊	T4430	B-3	UD-2	23.0	30.4	125.0	15.00
○	T4431	B-3	UD-2	23.5	29.5	123.9	30.00

SERIES SUMMARY

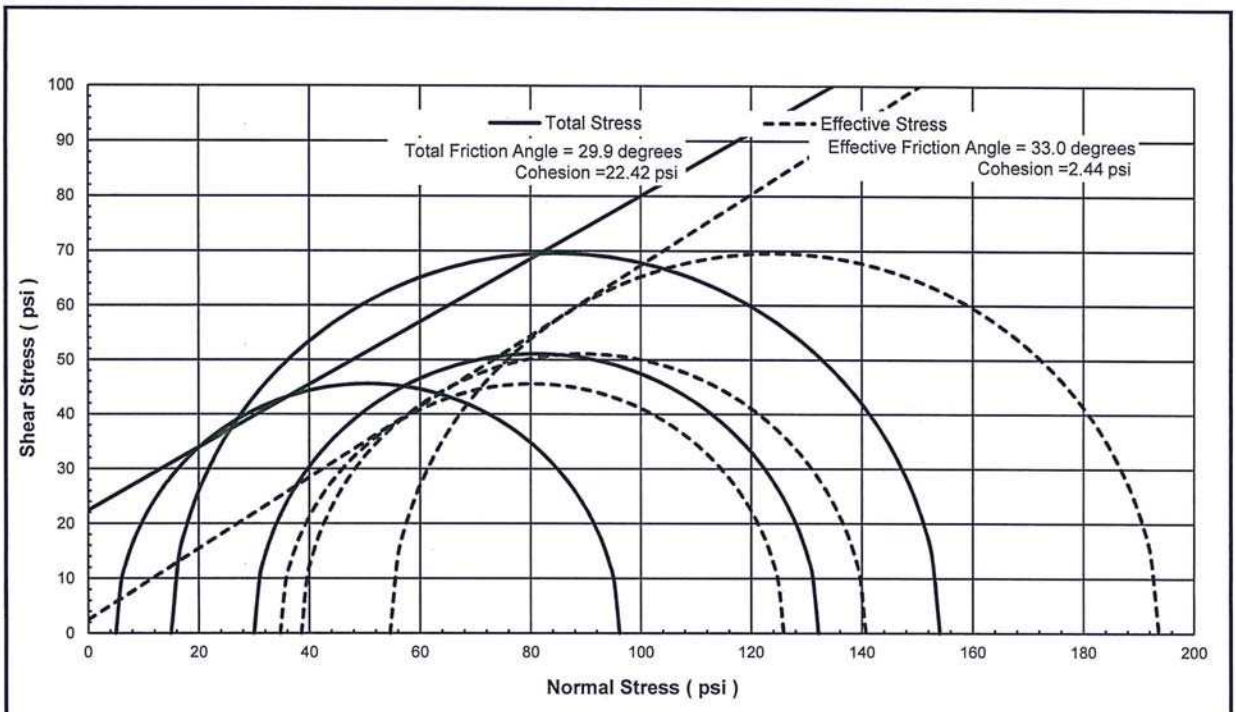
Notation	Failure Criteria	c' (psi)	Φ' (degrees)
——	Peak Deviator Stress	2.44	33.0
	Peak Obliquity	2.23	35.2



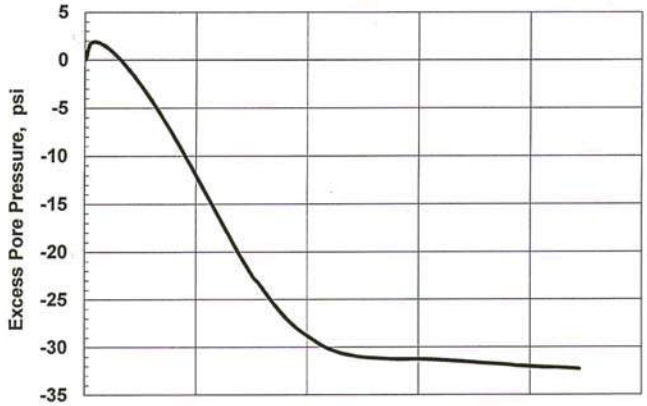


Parsons	Project No. 649173	Morris & Essex Embankment	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements B-3 UD-2 22-24 ft. SUMMARY
TerraSense, LLC	Project No. 8197-19001		

Prepared by: CMJ
Checked by: G. Thomas



Parsons	Project No. 649173	**Morris & Essex Embankment**	**Mohr Circles of Total and Effective Stresses at Peak** CIU' Triaxial Test B-3 UD-2 22-24 ft. SUMMARY
TerraSense, LLC	Project No. 8197-19001		

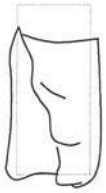


SAMPLE INFORMATION

Boring: B-3 Sample: UD-2 Depth: 22.5 ft
Type: Intact tube sample
Description: CL-ML, Gray silty clay, some fine sand layers, varved.

SPECIMEN INFORMATION (Initial)

Height: 5.88 inch Diameter: 2.87 inch Area: 6.47 in²
Water Content: 27.6 % Total Unit Weight: 127.9 pcf

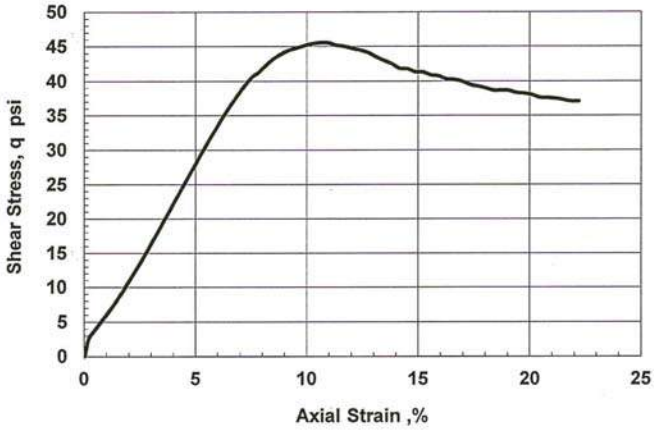


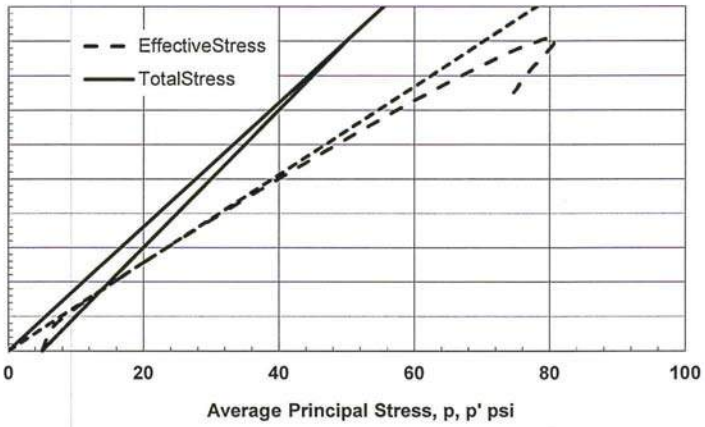
Failure Sketch

TEST SUMMARY

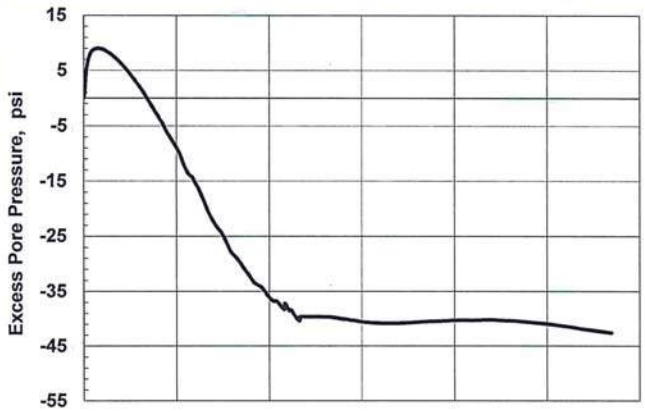
Consolidation Stresses: 5.00 psi vertical, 5.00 psi lateral
Water Content: 26.1 % Total Unit Weight: 129.9 pcf
B Coefficient: 98.4 Strain Rate: 0.022 %/min
Peak Shear Strength: 45.55 psi @ 10.6 % Strain
Peak Total Friction Angle: 64.3°
Peak Effective Friction Angle: 39.8°

REMARKS:





Test by: BB	Parsons	Project No. 649173	Morris & Essex Embankment	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements
Checked by: GET	TerraSense, LLC	Project No. 8197-19001		Boring: B-3 Sample: UD-2 Depth: 22.5 ft



SAMPLE INFORMATION

Boring: B-3 Sample: UD-2 Depth: 23 ft
Type: Intact tube sample
Description: CL-ML, Gray silty clay, varved.
LL = 28 PL = 21 PI = 7

SPECIMEN INFORMATION (Initial)

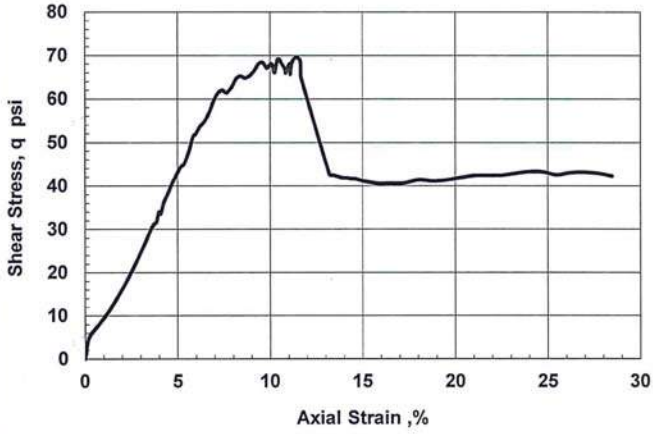
Height: 5.87 inch Diameter: 2.87 inch Area: 6.49 in²
Water Content: 30.4 % Total Unit Weight: 125.0 pcf

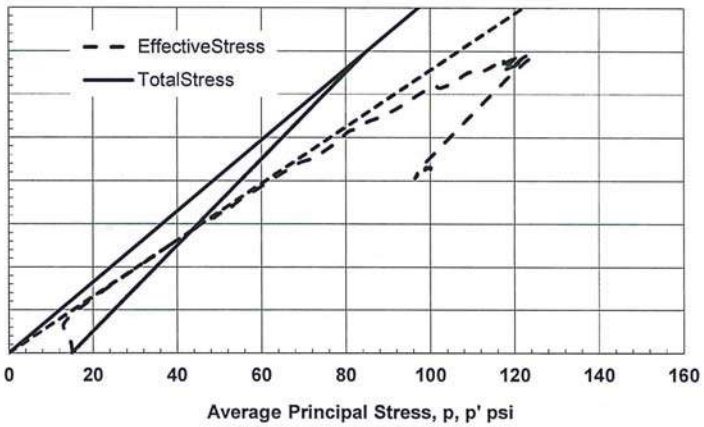
TEST SUMMARY

Consolidation Stresses: 15.00 psi vertical, 15.00 psi lateral
Water Content: 25.2 % Total Unit Weight: 130.9 pcf
B Coefficient: 100 Strain Rate: 0.011 %/min
Peak Shear Strength: 69.53 psi @ 11.4 % Strain
Peak Total Friction Angle: 55.3°
Peak Effective Friction Angle: 40.9°

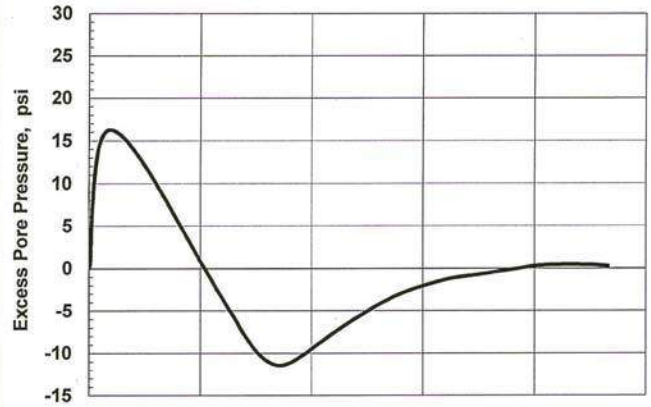
REMARKS:

Failure Sketch





Test by: BB	Parsons	Project No. 649173	Morris & Essex Embankment	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements
Checked by: GET	**TerraSense, LLC**	Project No. 8197-19001		Boring: B-3 Sample: UD-2 Depth: 23 ft

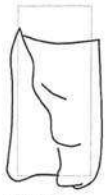


SAMPLE INFORMATION

Boring: B-3 Sample: UD-2 Depth: 23.5 ft
Type: Intact tube sample
Description: CL-ML, Gray silty clay

SPECIMEN INFORMATION (Initial)

Height: 5.86 inch Diameter: 2.86 inch Area: 6.43 in²
Water Content: 29.5 % Total Unit Weight: 123.9 pcf

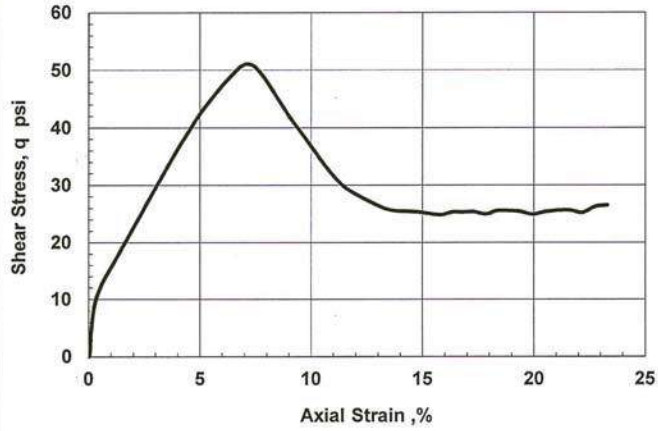


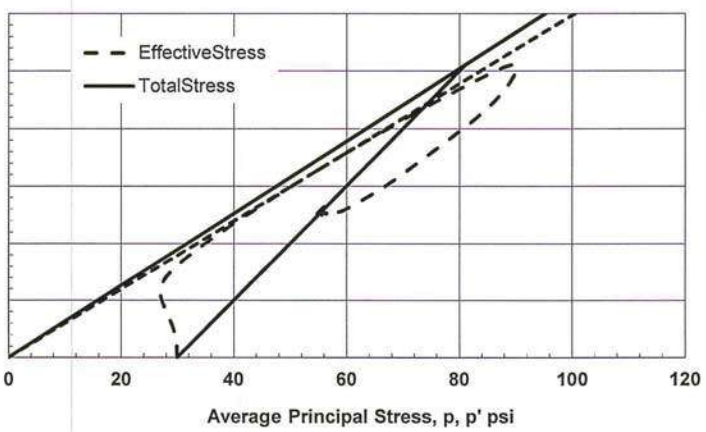
Failure Sketch

TEST SUMMARY

Consolidation Stresses: 30.00 psi vertical, 30.00 psi lateral
Water Content: 27.8 % Total Unit Weight: 128.1 pcf
B Coefficient: 100 Strain Rate: 0.017 %/min
Peak Shear Strength: 51.07 psi @ 7.2 % Strain
Peak Total Friction Angle: 39.0°
Peak Effective Friction Angle: 36.7°

REMARKS:





Test by: BB	Parsons	Project No. 649173	Morris & Essex Embankment	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements
Checked by: GET	**TerraSense, LLC**	Project No. 8197-19001		Boring: B-3 Sample: UD-2 Depth: 23.5 ft

Appendix S-3

Boring Logs

OWEIS ENGINEERING INC.

PROJECT	MORRIS AND ESSEX LINE MILEPOSTS 34.58	**BORING NO.**	B-1
LOCATION	Mileposts 34.8, Township of Denville, New Jersey	**SHEET NO.**	1 OF 4
CLIENT	Parsons	**PROJECT NO.**	17-NJ120-01
BORING LOCATION	See boring location plan	**SURFACE ELEV.**	±S24 ft
LATITUDE	40° 52.932' N **LONGITUDE** 74° 29.941' W	**VER. DATUM**	NAVD 88
		HOR. DATUM	NAD 83

EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

DRILLING RIG	CME SS LT
CASING	
4" dia.	2S ' depth
dia.	depth
ADVANCEMENT METHOD	Mud rotary
DRILL RODS	NWJ
ROTARY BIT DIAMETER, IN.	3-7/8"
DRILLING MUD USED	Quik-Gel
AUGER	N/A
SAMPLERS	
HAMMER TYPE	Auto Hammer
WEIGHT	140 lbs **DROP** 30" **RATE** Auto
D-SAMPLER	2" Split spoon
U-SAMPLER	Shelby Tube
OTHER	na
ROCK CORING	
CORING FEED	na
CORE BARREL	na
CORE BIT	na

REMARKS

1. Drove 8 ft of casing and added Quik gel in mud tub.
2. Driller mentioned he lost 5 ft of casing inside borehole. So, he had to move (towards N.E.) few ft to start again. 10:35 AM.
3. Drove casing to 10 ft bgs.
4. Drove casing upto 25 ft bgs.

LEGEND

TV = Torvane Shear Strength, TSF
CT = Coring Time, minutes/foot
CB = Casing Blows Per Foot
OLT = Other Lab Testing Performed
PP = Pocket Penetrometer Unconfined Compressive Strength, TSF

REMARK TYPES

LC = Lost Circulation
HD = Hard Drilling
RC = Rig Chatter
CBJ = Core Barrel Jam
PO = Petroleum Odor
CW = Change in Wash
SS = Slickensided
EOB = End Of Boring
ML = Mudline

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATIONS

PIEZOMETER__ MONITORING WELL__ INSTALLED yes/(no) **SKETCH PROVIDED ELSEWHERE** NA

PAY QUANTITIES

2" DIA. SAMPLE BORING	**LIN. FT.** 62	**NO. OF 3" UNDISTURBED SAMPLES**	1
CORE DRILLING IN ROCK	**LIN. FT.** 0	**OTHER** 0	

BORING CONTRACTOR Craig Geotechnical Drilling
DRILLER Mike Gorski **HELPER(S):** Sergio
OEI OBSERVER R.Sirsat **DATE:** 1/7/2019 Monday
CLASSIFICATION CHECK U.S.C.S.

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT MORRIS AND ESSEX LINE MILEPOSTS 34.58 — BORING NO. B-1
PROJECT NO. 17-NJ120-01 — SHEET 2 OF 4
LOCATION Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±524 ft
OEI OBSERVER R. Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
		S-1	1	18-13	11	Fill: Gray poorly graded gravel with black silt and sand	FILL	1	D		
				16-11		(Angular gravel)	(1b)				
			2					2			
		S-2	3	13-17	10	Possible fill: Brown clayey sand	FILL	3			
				8-S		(medium dense)	(1b)				
			4					4			
		S-3	5	14-9	18	Brown clayey sand	FILL	5	M		
				7-6		(medium dense)	(1b)				
9:59 AM			6					6			
		S-4A				Brown clayey sand with gravel	FILL				
			7	8-16	1S		(1b)	7	M-W		
		S-4B		6-S		Brown clayey sand	FILL				
10:35 AM			8			(medium dense)	(1b)	8	W		1
11:05 AM		UD-1	9	PUSH	13	Greenish brown clay with sand	CL	9			2
							(2)				
			10					10			3
11:31 AM		S-S	11	27-34	17	Brown silty sand with gravel	SM	11	W		
				30-36		(very dense)	(3)				
			12					12			
			13					13			
			14					14			
			15					15			
		S-6	16	12-11	16	Brown silty sand with gravel	SM	16	W	PP	
				11-11		(medium dense)	(3)			~0.20	
			17					17			
			18					18			
			19					19			
			20					20			
		S-7	21	22-7	6	Same	SM	21	W	PP ~0.12S	
				6-13			(3)				
			22					22			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.S8 — BORING NO. B-1
PROJECT NO.: 17-NJ120-01 — SHEET 3 OF 4
LOCATION: Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±524 ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			23					23			
			24					24			
			2S					2S		PP ~0.2S	
		S-8	26	10-12 13-3S	14	Brown silty sand with gravel (medium dense)	SM (3)	26			
			27					**27**			4 RC at ~27.S'
			28					28			
			29					29			
			30					30			
		S-9	31	9-1S 17-20	12	Same	SP-SM (3)	31		PP ~0.10	
			32					**32**			
			33					33			
			34			(Failed attempt to take tube, Driller couldn't push more than 6" and tube bent)		34			
12:55 PM			3S					3S			
		S-10	36	100/S"	9	Poorly graded black gravel with sand (Top S" coulde be washed out gravel and sand)	GP	36			
			37			(very dense)	(3)	**37**			
			38					38			
			39					39			
			40					40		PP ~0.10	
		S-11	41	15-24 23-S9	12	Brown silty sand with gravel (very dense)	SP-SM (3)	41			
1:18 PM			42					**42**			RC

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.S8
PROJECT NO.: 17-NJ120-01
LOCATION: Mileposts 34.8, Township of Denville, New Jersey
BORING NO.: B-1
SHEET 4 OF 4
GROUND ELEVATION: ±524 ft
OEI OBSERVER: R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			43					43			RC
			44					44			
			45					45			
		S-12	46	10-9	16	Same	SM	46			RC
				46-31			(3)				
			47					47			
1:36 PM			48					48			
			49					49			RC
			50					50			RC
1:48 PM		S-13A	51	65-14	14	boulder fragments		51			
		S-13B		17-26		Brown silty sand with gravel	SM				
			52			(dense)	(3)	52			
			53					53			
			54					54			
			55					55			
		S-14A	56	12-19	8			56			
		S-14B		21-20		Brown silty sand with gravel	SM				
2:20 PM			57			(dense)	(3)	57			
			58					58			RC
			59					59			
2:27 PM			60					60			
		S-15	61	100/3"	1.5	Poorly graded gravel with silt and sand	GP-GM	61			
						(very dense)	(3)				
2:31 PM			62			End of boring at 62 ft bgs		62			

OWEIS ENGINEERING INC.

PROJECT	MORRIS AND ESSEX LINE MILEPOSTS 34.58	**BORING NO.**	B-2
LOCATION	Mileposts 34.8, Township of Denville, New Jersey	**SHEET NO.**	1 OF 4
CLIENT	Parsons	**PROJECT NO.**	17-NJ120-01
BORING LOCATION	See boring location plan	**SURFACE ELEV.**	±S24 ft
LATITUDE	40°52.954' N **LONGITUDE** 74°29.886' W	**VER. DATUM**	NAVD 88
		HOR. DATUM	NAD 83

EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

DRILLING RIG	CME 55 LT
CASING	
4" dia.	20 ' depth
dia.	depth
ADVANCEMENT METHOD	Mud rotary
DRILL RODS	NWJ
ROTARY BIT DIAMETER, IN.	3-7/8"
DRILLING MUD USED	Quik-Gel
AUGER	N/A
SAMPLERS	
HAMMER TYPE	Auto Hammer
WEIGHT	140 lbs **DROP** 30" **RATE** Auto
D-SAMPLER	2" 5plit spoon
U-SAMPLER	Shelby Tube
OTHER	NA
ROCK CORING	
CORING FEED	NA
CORE BARREL	NA
CORE BIT	NA

REMARKS

December 15, 2018

1. Two pieces of casing were separated while drilling to 8 ft. to clear the hole for undisturbed sample. Lost the lower one piece of casing underground moved boring location 2 ft towards east.

LEGEND

TV = Torvane Shear Strength, TSF
CT = Coring Time, minutes/foot
CB = Casing Blows Per Foot
OLT = Other Lab Testing Performed
PP = Pocket Penetrometer
Unconfined Compressive Strength, TSF

REMARK TYPES

LC = Lost Circulation
HD = Hard Drilling
RC = Rig Chatter
CBJ = Core Barrel Jam
PO = Petroleum Odor
CW = Change in Wash
SS = Slickensided
EOB = End Of Boring
ML = Mudline

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATIONS
See ground water table summary					

PIEZOMETER__ **MONITORING WELL**__ **INSTALLED** (yes/no) **SKETCH PROVIDED ELSEWHERE** ____

PAY QUANTITIES

2" DIA. SAMPLE BORING	**LIN. FT.** 49	**NO. OF 3" UNDISTURBED SAMPLES**	3
CORE DRILLING IN ROCK	**LIN. FT.** 0	**OTHER** 0	
BORING CONTRACTOR	Craig Geotechnical Drilling		
DRILLER	Mike Gorski	**HELPER(S):** Sergio	
OEI OBSERVER	S.Gao	**DATE:**	12/15/2018 Saturday
CLASSIFICATION CHECK	U.S.C.S.		

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT MORRIS AND ESSEX LINE MILEPOSTS 34.58 — BORING NO. B-2
PROJECT NO. 17-NJ120-01 — SHEET 2 OF 4
LOCATION Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±524 ft
OEI OBSERVER S.Gao

OAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
12.15.2018 Saturday 1000 AM S.Gao		S-1	1 2	6-9 8-10	7	Fill: 8lack/dark gray C Gravel (Angular-chrushed stone) with silt		1 2	M		
		S-2	3 4	9-9 13-11	6	Fill: Brown silty sand with gravel	Fill (1b)	3 4	M		
		S-3	5 6	14-6 4-6	6	Fill: 8rown silty sand		5 6	M		
		S-4	7 8	4-3 3-4	11	Possible Fill: Brown clayey sand at center of sample (loose)		7 8	M-W	PP=0.S ~ 0.7S tsf	
		UD-1	9 10	PUSH (Bottom End of tube bent)	0*	(S-S) *Retrieved sample:Gray silty clay with sand, with a few pieces of coarse crushed stone 9'9"		9 10			1
		UD-2	11 12	PUSH (Bottom End of tube bent)	12	Possible Fill: Grayish brown silty clayey sand with gravel (fine angular stone within the bottom of the sample)	FILL (1b)	11 12	W		
		S-6	13 14	1-2 2-3	24	Possible Fill: Grayish brown silty clayey sand with gravel (angular stone at center of the sample) (loose)		13 14	W	PP=0.25 tsf	
			15					15			
		S-7	16 17	1-1 2-3	8			16 17	W	PP= 0~ 0.2S tsf	
		UD-3	18	PUSH (Bottom End of tube bent)	10	18'2"		18			
		S-8	19 20	6-13 1S-1S	1S	8rown silt with sand seams (dense)		19 20	W	PP= 2S~ 4.0 tsf	
		S-9	21 22	S-9 10-11	18	Brown silt with sand and clay seams (medium dense)	ML (2)	21 22	W	PP=3.S ~4.0 tsf	

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.58
PROJECT NO.: 17-NJ120-01
LOCATION: Mileposts 34.8, Township of Denville, New Jersey
BORING NO. B-2
SHEET 3 OF 4
GROUND ELEVATION ±524 ft
OEI OBSERVER S.Gao

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE OEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			23					23			
			24					24			
			25					25			
		5-10	26	3-4	20	Gray/brown silt with clay seams	ML	26	W	PP=	
			27	5-5		(medium dense)	(2)	27		2.5~	
										4.0 tsf	
			28					28			
			29					29			
			30					30			
		S-11	31	6-27	13	Brown silty sand with gravel	SM	31	W		
			32	39-50		(very dense)	(3)	32			
			33					33			
			34					34			
			35					35			
		S-12	36	9-10	15	Brown silty sand with gravel	SM	36	W		
			37	10-10		(medium dense)	(3)	37			
			38					38			RC@
			39					39			38'~
			40					40			40'
		5-13	41	14-10	8	Brown clayey sand	SC	41	W		
			42	10-11		(medium dense)	(3)	42			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.S8
PROJECT NO.: 17-NJ120-01
LOCATION: Mileposts 34.8, Township of Denville, New Jersey

BORING NO. 8-2
SHEET 4 OF 4
GROUND ELEVATION ±524 ft
OEI OBSERVER S.Gao

DAILY PROGRESS	SYMBOL	SAMPLE NO.	OEPTH (ft)	BLOWS/6"	REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CDNDITIDN	FIELO TESTS	REMARKS (TYPE)
			43					43			
			44					44			
			45					45			
		5-14	46	13-10	10	Brown clayey sand	5C	46			
			47	8-17		(medium dense)	(3)	47	W		
		5-15	48	13-8	6	same		48			
			49	11-11				49			
			50			End of boring at 49 ft bgs.		50			
			51					51			
			52					52			
			53					53			
			54					54			
			55					55			
			56					56			
			57					57			
			58					58			
			59					59			
			60					60			
			61					61			
			62					62			

OWEIS ENGINEERING INC.

PROJECT	MORRIS AND ESSEX LINE MILEPOSTS 34.58	**BORING NO.**	B-3
LOCATION	Mileposts 34.8, Township of Denville, New Jersey	**SHEET NO.**	1 OF 5
CLIENT	Parsons	**PROJECT NO.**	17-NJ120-01
BORING LOCATION	See boring location plan	**SURFACE ELEV.**	±524 ft
LATITUDE	40° 52.958' N **LONGITUDE** 74° 29.887' W	**VER. DATUM**	NAVD 88
		HOR. DATUM	NAD 83

EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

DRILLING RIG	CME 55 LT
CASING	
4" dia.	20 ft depth
dia.	depth
ADVANCEMENT METHOD	Mud rotary
DRILL RODS	NWJ
ROTARY BIT DIAMETER, IN.	3-7/8"
DRILLING MUD USED	Quik gel
AUGER	N/A
SAMPLERS	
HAMMER TYPE	Auto Hammer
WEIGHT	140 lbs **DROP** 30" **RATE** Auto
D-SAMPLER	2" Split spoon
U-SAMPLER	Shelby tube
OTHER	NA
ROCK CORING	
CORING FEED	NA
CORE BARREL	NA
CORE BIT	NA

REMARKS

1. Drove casing to 10 ft bgs and added Quik gel in mud tub.
2. Drove casing to 17 ft.
3. Drove casing to 20 ft.

LEGEND

TV = Torvane Shear Strength, TSF
CT = Coring Time, minutes/foot
CB = Casing Blows Per Foot
OLT = Other Lab Testing Performed
PP = Pocket Penetrometer
Unconfined Compressive Strength, TSF

REMARK TYPES

LC = Lost Circulation
HD = Hard Drilling
RC = Rig Chatter
CBJ = Core Barrel Jam
PO = Petroleum Odor
CW = Change in Wash
SS = Slickensided
EOB = End Of Boring
ML = Mudline

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATIONS
See ground water table summary					

PIEZOMETER__ **MONITORING WELL**__ **INSTALLED** (yes)/no **SKETCH PROVIDED ELSEWHERE** _____

PAY QUANTITIES

2" DIA. SAMPLE BORING	**LIN. FT.** 67	**NO. OF 3" UNDISTURBED SAMPLES**	2
CORE DRILLING IN ROCK	**LIN. FT.**	**OTHER**	

BORING CONTRACTOR Craig Geotechnical Drilling
DRILLER Mike **HELPER(S):** Sergio
OEI OBSERVER R.Sirsat **DATE:** 01/09/2019 Wednesday
CLASSIFICATION CHECK U.S.C.S.

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT MORRIS AND ESSEX LINE MILEPOSTS 34.58 | BORING NO. 8-3
PROJECT NO. 17-NJ120-01 | SHEET 2 OF 5
LOCATION Mileposts 34.8, Township of Denville, New Jersey | GROUND ELEVATION ±524 ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
01.09.2019 Wednesday 8:40 AM		S-1	1 2	9-7 8-11	8	Fill: Poorly graded gravel with black sand (Angular gravel)	FILL (1b)	1 2	D		
8:48		S-2	3 4	13-11 16-16	11	Possible fill: Brown and black poorly graded sand with silt and gravel (dense)	FILL (1b)	3 4	D		
8:50		S-3	5 6	11-17 12-8	7	Possible fill: Dark Gray poorly graded gravel with sand (dense)	FILL (1b)	5 6	M-W		
8:53		S-4	7 8	8-5 5-4	8	Brown, black poorly graded sand with silt and gravel (medium dense)	FILL (1b)	7 8	M-W		
9:28		S-5	9 10	7-4 1-1	17	Yellowish brown clayey sand (loose)	FILL (1b)	9 10	W	PP ~0.0 1	
9:52		UD-1	11 12	PUSH	16	Brown silty sand with gravel	FILL (1b)	11 12	W		
9:58		S-6	13 14	6-11 33-13	6	White and gray, gray poorly graded gravel with silt and sand (very dense)	FILL (1b)	13 14			
			15					15			
10:02		S-7	16 17	4-3 3-4	16	Brown gray lean clay with sand (medium stiff)	CL (2)	16 17			2
			18 19	PUSH	0	Failed tube attempt (Tube crushed from bottom when pulled out)		18 19			
			20					20			3
		S-8	21 22	7-8 10-9	21	Gray lean clay (very stiff)	CL (2)	21 22		PP ~0.125	

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.58 — BORING NO. B-3
PROJECT NO.: 17-NJ120-01 — SHEET 3 OF 5
LOCATION: Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±524 ft
OEI OBSERVER: R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	DEPTH (ft)	BLOWS/6"	REC (in)	SAMPLE DESCRIPTION	STRATA	OEPTH (ft)	MOISTURE CONOITION	FIELD TESTS	REMARKS (TYPE)
10:40 AM		UD-2	23	PUSH	19.5	Gray silty sand	CL-ML (2)	23			
			24					24			
11:00 AM		S-9	25	7-7	23.5	Brown silty clay (traces of light gray clay)	CL-ML (2)	25			
			26	7-7		(stiff)		26			
11:09 AM			27					27			
			28					28			
			29					29			
			30					30			
		S-10	31	18-24	7.5	Brown silty sand with gravel	SM (3)	31	W	PP ~ 0.12S	
			32	22-19		(very dense)		32			
			33					33			
			34					34			
			35					35			
		S-11	36	5-5	10	Yellow brown clayey sand with gravel	SC (3)	36	W		
			37	7-12		(medium dense)		37			
			38					38			
			39					39			
			40					40			
		S-12	41	18-12	14	Same	SC (3)	41	W	PP ~ 0.125	
11:44 AM			42	9-9		(medium dense)		42			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.S8
PROJECT NO.: 17-NJ120-01
LOCATION: Mileposts 34.8, Township of Denville, New Jersey
BORING NO.: B-3
SHEET 4 OF: 5
GROUND ELEVATION: ±S24 ft
OEI OBSERVER: R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			43					43			
			44					44			
			45					45			
		5-13	46	10-10	11.5	5ame	SC	46			
			47	8-11			(3)	47			
			48					48			
			49					49			
			50					50			PP
											~ 0.0
		5-14	51	8-11	14.5	Brown clayey sand wiwth gravel	5C	51			
				12-32		(medium dense)	(3)				
12:47 PM			52					52			
			53					53			
			54					54			
			55					5S			PP
											~ 0.125
		S-1S	56	15-20	10	Brown silty sand with gravel	SM	56			
				16-53		(dense)	(3)				
			57					57			
			58					58			
			59					59			
			60					60			
											PP
		5-16	61	15-18	7	5ame	5M	61			~0.05
1:10 PM				30-21			(3)				
			62					62			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.S8
PROJECT NO.: 17-NJ120-01
LOCATION: Mileposts 34.8, Township of Denville, New Jersey
BORING NO.: B-3
SHEET S OF: S
GROUND ELEVATION: ±524 ft
OEI OBSERVER: R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MDISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			63					63			
			64					64			
			65					65			
1:3S PM		S-17	66 67	15-19 25-20	12	Brown silty sand with gravel (very dense)	5M (3)	66 67			
			68			End of boring at 67 ft bgs.		68			
			69					69			
			70					70			
			71					71			
			72					72			
			73					73			
			74					74			
			75					75			
			76					76			
			77					77			
			78					78			
			79					79			
			80					80			
			81					81			
			82					82			

OWEIS ENGINEERING INC.

PROJECT	MORRIS AND ESSEX LINE MILEPOSTS 34.S8	**BORING NO.**	B-4
LOCATION	Mileposts 34.8, Township of Denville, New Jersey	**SHEET NO.**	1 OF 6
CLIENT	Parsons	**PROJECT NO.**	17-NJ120-01
BORING LOCATION	See boring location plan	**SURFACE ELEV.**	±S20 ft
LATITUDE	40° 52.9S9' N **LONGITUDE** 74° 29.899' W	**VER. DATUM**	NAVD 88
		HOR. DATUM	NAD 83

EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

DRILLING RIG	CME SS LT
CASING	
4" dia.	SS' depth
dia.	depth
ADVANCEMENT METHOD	Mud rotary
DRILL RODS	NWJ
ROTARY BIT DIAMETER, IN.	3-7/8"
DRILLING MUD USED	Quik gel
AUGER	N/A
SAMPLERS	
HAMMER TYPE	Auto Hammer
WEIGHT	140 lbs **DROP** 30" **RATE** Auto
D-SAMPLER	2" Split spoon
U-SAMPLER	NA
OTHER	NA
ROCK CORING	
CORING FEED	NA
CORE BARREL	NA
CORE BIT	NA

REMARKS

1. Drove casing up to 10 ft.
2. Added quik gel to mud tub and cleared up to 12 ft.
3. Drove casing to 1S ft (8:59 AM).
4. Drove casing to 30 ft, original casing up to 15 ft was sinking below according to driller.
S. R.C.
6. Driller drove casing from 30 ft to S0 ft bgs. (11:01 to 11:38 AM).
7. RC at 70'7".
8. Driller drove casing up to SS ft.

LEGEND

TV = Torvane Shear Strength, TSF
CT = Coring Time, minutes/foot
CB = Casing Blows Per Foot
OLT = Other Lab Testing Performed
PP = Pocket Penetrometer
Unconfined Compressive Strength, TSF

REMARK TYPES

LC = Lost Circulation
HD = Hard Drilling
RC = Rig Chatter
CBJ = Core Barrel Jam
PO = Petroleum Odor
CW = Change in Wash
SS = Slickensided
EOB = End Of Boring
ML = Mudline

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATIONS
See ground water table summary					

PIEZOMETER__ **MONITORING WELL**__ **INSTALLED** (Yes) No **SKETCH PROVIDED ELSEWHERE** _____

PAY QUANTITIES

2" DIA. SAMPLE BORING	**LIN. FT.** 102	**NO. OF 3" UNDISTURBED SAMPLES**	0
CORE DRILLING IN ROCK	**LIN. FT.**	**OTHER** 0	

BORING CONTRACTOR Craig Geotechnical Drilling
DRILLER Mike **HELPER(S):** Sergio
OEI OBSERVER R.Sirsat **DATE:** 12/14/2018 & 12/17/2018
CLASSIFICATION CHECK U.S.C.S.

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT MORRIS AND ESSEX LINE MILEPOSTS 34.S8 — BORING NO. 8-4
PROJECT NO. 17-NJ120-01 — SHEET 2 OF 6
LOCATION Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±520 ft
OEI OBSERVER R.Sirsat

OAILY PROGRESS	SYMBOL	SAMPLE NO.	OEPTH (ft)	BLOWS/6"	REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONOITION	FIELD TESTS	REMARKS (TYPE)
Dec 14-2018 ~ 08:0S AM		S-1	1	2/24"	10	Fill: Poorly graded gravel with sand		1			
						(Black gravel and charred wood pieces)	Fill				
			2				(1a)	2			
		S-2	3	3/24"	8	Same		3			
			4					4			
		S-3	S	3/24"	10	Fill: Brown well graded sand with gravel	Fill	**5**	M-W		
						(Black gravel and charred wood pieces)	(1a)				
			6					6			
		S-4	7	1-2	11	Same		7	M-W		
				S-9		Brown silt	ML				
			8				(2)	8			
		S-S	9	10-12	16	Brown and black silt (traces of clay) (very stiff)	ML	9	M-W		
				16-13			(2)				
			10					**10**			
		S-6	11	9-7	17	Brown Silt	ML	11	M-W		1
				10-12		(very stiff)	(2)				2
			12					12			
		S-7	13	4-9	14	Brown lean clay	CL	13			
				8-8		(very stiff)	(2)				
8:45			14					14	W		
		S-8	1S	9-8	24	Silt (W/ traces of clay) with gravel (8")		**15**			
				9-7		Brown lean clay (16")	CL				3
			16			(very stiff)	(2)	16			
8:59			17					17			
			18					18			
			19					19			
			20					**20**			
		S-9	21	22-21	12	Brown silty sand with gravel	SM	21	W		
				16-19		(dense)	(3)				
9:18			22					22			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.SB
PROJECT NO.: 17-NJ120-01
LOCATION: Mileposts 34.8, Township of Denville, New Jersey
BORING NO.: B-4
SHEET 3 OF 6
GROUND ELEVATION: ±520 ft
OEI OBSERVER: R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	DEPTH (ft)	BLOWS/6"	REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			23					23			
			24					24			
			25					25			
		S-10	26	11-8	21	Brown silty sand	5M	26	W		
			27	7-6		(medium dense)	(3)	**27**			4
9:24			28					28			
			29					29			
10:01			30					30			
		S-11	31	8-9	18	Brown silty sand with gravel		31	W		
			32	8-12		(medium dense)		**32**			
10:02			33				SM	33			
			34				(3)	34			
			35					35			
		S-12	36	8-8	12	Brown silty sand with gravel		36	W		
			37	17-12		(medium dense)		**37**			
10:12			38					38			
			39					39			
			40					40			
		S-13	41	9-12	15	Brown silty sand	5M	41	W		
			42	20-14		(dense)	(3)	**42**			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.58 — BORING NO. B-4
PROJECT NO.: 17-NJ120-01 — SHEET 4 OF 6
LOCATION: Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±520 ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			43					43			5. RC
			44					44			
10:34			45					45			
		5-14	46	16-18	16	Brown silty sand	5M (3)	46			
			47	14-10		(dense)		47			
			48					48			
			49					49			
			50					50			
		5-15	51	100/3"	2	Poorly graded gravel with sand and silt (gravel in tip)	GP (3)	51			R.C.
			52			(very dense)		52			
			53					53			6
			54					54			
			55					55			
		5-16	56	15-16	16	Brown silty sand	5M (3)	56			
			57	19-20		(dense)		57			
			58					58			
			59					59			
			60					60			
		5-17	61	16-20	18	Same	SM (3)	61			
			62	26-34				62			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.58
PROJECT NO.: 17-NJ120-01
LOCATION: Mileposts 34.8, Township of Denville, New Jersey
BORING NO.: 8-4
SHEET S OF: 6
GROUND ELEVATION: ±520 ft
OEI OBSERVER: R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			63					63			
			64					64			
			65					65			
		S-18	66	23-24	9	Same	SM	66			
			67	38-34			(3)	67			
1:45			68					68			
			69					69			
11/17/2018			70					70			7 & 8
		S-19	71	33-100/1"	8	Same	SM	71			RC
9:30			72			(very dense)	(3)	72			
			73					73			
			74					74			
10:25			75					75			
		S-20	76	11-20	16	Brown clayey sand with gravel	SC	76			
			77	20-30		(hard)	(3)	77			
			78					78			
			79					79			
			80					80			
		S-21	81	28-23		Brown clayey sand with gravel	SC	81			
			82	23-53		(hard)	(3)	82			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.5B
PROJECT NO.: 17-NJ120-01
LOCATION: Mileposts 34.B, Township of Denville, New Jersey

BORING NO. B-4
SHEET 6 OF 6
GROUND ELEVATION ±520 ft
OEI OBSERVER R.Sirsat

OAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (In)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			83					83			
			84					84			
			85					85			
		S-22	86	14-39	1S	Brown clayey sand with gravel	SC	86			
			87	32-32		(hard)	(3)	87			
			88					88			
			89					89			
			90					90			
		S-23	91	24-33	22			91			
			92	29-45		Same	5C (3)	92			
			93					93			
			94					94			
			95					95			
		S-24	96	15-20	24	Same	5C	96			
			97	26-30			(3)	97			
			98					98			
			99					99			
			100					100			
		S-2S	101	42-41	12	Brown lean clay with sand	CL	101			
			102	36-50/1"		End of boring at 102 ft bgs.	(2)	102			RC

OWEIS ENGINEERING INC.

PROJECT	MORRIS AND ESSEX LINE MILEPOSTS 34.58	**BORING NO.**	B-5
LOCATION	Mileposts 34.8, Township of Denville, New Jersey	**SHEET NO.**	1 OF 5
CLIENT	Parsons	**PROJECT NO.**	17-NJ120-01
BORING LOCATION	See boring location plan	**SURFACE ELEV.**	±S24 ft
LATITUDE	40° 52.97S'N **LONGITUDE** 74° 29.832'W	**VER. DATUM**	NAVD 88
		HOR. DATUM	NAD 83

EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

DRILLING RIG CME 55 LT

CASING

4" dia. 40' depth

dia. depth

ADVANCEMENT METHOD Mud rotary

DRILL RODS NWJ

ROTARY BIT DIAMETER, IN. 3-7/8"

DRILLING MUD USED Quik Gel

AUGER N/A

SAMPLERS

HAMMER TYPE Auto Hammer

WEIGHT 140 lbs **DROP** 30" **RATE** Auto

D-SAMPLER 2" Split spoon

U-SAMPLER Shelby Tube

OTHER NA

ROCK CORING

CORING FEED NA

CORE BARREL NA

CORE BIT NA

REMARKS

12/20/2018

1. Driller drove 10 ft casing (8 ft bgs and 2 ft stick up).
2. Drove casing to 12 ft bgs.
3. Drove casing up to 15 ft bgs.
4. Added quik gel in mud tub.
5. Drove casing to 30 ft bgs.
6. Drove casing to 35 ft bgs.
7. Drove casing to 40 ft bgs.
8. Added more quik gel in mud tub.
9. R.C. and lost some mud/water from mud tub (added water in mud tub).
10. Added quik gel (12:43)

LEGEND

TV = Torvane Shear Strength, TSF
CT = Coring Time, minutes/foot
CB = Casing Blows Per Foot
OLT = Other Lab Testing Performed
PP = Pocket Penetrometer
Unconfined Compressive Strength, TSF

REMARK TYPES

LC = Lost Circulation
HD = Hard Drilling
RC = Rig Chatter
CBJ = Core Barrel Jam
PO = Petroleum Odor
CW = Change in Wash
SS = Slickensided
EOB = End Of Boring
ML = Mudline

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATIONS

PIEZOMETER __ **MONITORING WELL** __ **INSTALLED** yes (no) **SKETCH PROVIDED ELSEWHERE** _____

PAY QUANTITIES

2" DIA. SAMPLE BORING **LIN. FT.** 67 **NO. OF 3" UNDISTURBED SAMPLES** 1

CORE DRILLING IN ROCK **LIN. FT.** _____ **OTHER** _____

BORING CONTRACTOR Craig Geotechnical Drilling

DRILLER Mark Aquino **HELPER(S):** Sergio P. Nararret

OEI OBSERVER R.Sirsat **DATE:** 12/20/2018 Thursday

CLASSIFICATION CHECK U.S.C.S.

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.58 — BORING NO. B-5
PROJECT NO. 17-NJ120-01 — SHEET 2 OF 5
LOCATION: Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±524 ft
OE: OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	DEPTH (ft)	BLOWS/6"	REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
9:15 AM						Fill:					
12.20.2018		5-1	1	24-21	16	Poorly graded gravel with silt and sand	Fill	1			
				14-11		(Black-gray charred wood pieces)	(1b)				
			2					2			
		S-2	3	12-9	22			3			
				12-12		Brown silty sand with gravel			M-W		
			4			(medium dense)	Fill	4			
							(1b)				
		S-3	5	6-6	9	Same	Fill	**5**	M-W		
				5-5		(medium dense)	(1b)				
			6					6			
		5-4	7	7-4	8	Yellowish brown silty sand	Fill	7	W		
				4-4		(loose)	(1b)				
9:30 AM			8					8			1
		S-5	9	1-2	8	Gray silty clay	CL-ML				
				1-2	6" Empty		(2)	9	W		
					10	Brown lean clay with sand	CL				
10:06AM			10			(soft)	(2)	**10**			
waited		UD-1	11	PUSH	0	No recovery in tube		11	W		
20 min											2
10:26AM			12					12			
		5-6	13	16-12	13	Brown silty sand with gravel	SM	13	W		
				9-11		(medium dense)	(3)				
			14					14			
			15					**15**			
		5-7	16	7-6	13	Same	SM	16	W		
				5-6			(3)				
10:49AM			17					17			3
											4
			18					18			
			19					19			
10:58AM			20					**20**			
		S-8	21	9-8	0.S	Gravel		21			
				6-6							
			22					22			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.58 — BORING NO. 8-S
PROJECT NO.: 17-NJ120-01 — SHEET 3 OF S
LOCATION: Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±524 ft
OEI OBSERVER: R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	DEPTH (ft)	BLOWS/6"	REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			23					23			
			24					24			
			25					25			
		S-9	26	6-5	0			26			
			27	6-5				27			5
			28					28			
			29					29			
			30					30			
		S-10	31	11-26	12	Dark gray poorly graded gravel with silt and sand	GP-GM	31			
			32	16-13		(gravel in tip) (dense)	(3)	32			6
			33					33			
			34					34			
			35					35			
		S-11	36	3-6	6	Dark gray, reddish brown gravel poorly graded gravel with	GP-GM	36			
			37	7-7		sand (medium dense)	(3)	37			7
			38					38			
			39					39			
			40					40			
12:06 PM		S-12	41	7-7	10	Brown silty sand with gravel	SM	41			
			42	7-7		(medium dense)	(3)	42			8

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.S8
PROJECT NO.: 17-NJ120-01
LOCATION: Mileposts 34.8, Township of Denville, New Jersey

BORING NO. B-5
SHEET 4 OF S
GROUND ELEVATION ±524 ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			43					43			
			44					44			
			45					45			
		S-13	46	13-10	9	Brown silty sand with gravel	SM	46			
			47	8-10		(medium dense)	(3)	47			
			48					48			
			49					49			
12:25 PM			50					50			
		S-14	51	8-8	13	Same	SM	51			
			52	9-7		Silty/lean clay with sand (traces of clay)	(3)	52			R.C.
			53					53			9. LC &
			54					54			RC
			55					55			
		5-15	56	13-2	5	Brown silty sand with gravel	5M	56			
12:38 PM			57	5-6		(loose)	(3)	57			10
			58					58			
			59					59			
			60					60			
		5-16	61	12-11	24	Brown silty sand with gravel	5M	61	W		
			62	10-10		(medium dense)	(3)	62			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.58
PROJECT NO.: 17-NJ120-01
LOCATION: Mileposts 34.8, Township of Denville, New Jersey
BORING NO. B-5
SHEET 5 OF 5
GROUND ELEVATION ±524 ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			63					63			
			64					64			
1:08 AM			65					65			
		S-17	66	15-14	5	Brown poorly graded gravel with silt and sand	GP-GM	66	W		
			67	10-12		(medium dense)	(3)	67			
1:16 AM			68			End of boring at 67 feet bgs.		68			
			69					69			
			70					70			
			71					71			
			72					72			
			73					73			
			74					74			
			75					75			
			76					76			
			77					77			
			78					78			
			79					79			
			80					80			
			81					81			
			82					82			

OWEIS ENGINEERING INC.

PROJECT	MORRIS AND ESSEX LINE MILEPOSTS 34.58	**BORING NO.**	B-6
LOCATION	Mileposts 34.8, Township of Denville, New Jersey	**SHEET NO.**	1 OF 4
CLIENT	Parsons	**PROJECT NO.**	17-NJ120-01
BORING LOCATION	See boring location plan	**SURFACE ELEV.**	±525 ft
LATITUDE	40° 53.003' N **LONGITUDE** 74° 29.688' W	**VER. DATUM**	NAVD 88
		HOR. DATUM	NAD 83

EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

DRILLING RIG	CME 55 LT
CASING	
4" dia.	50' depth
dia.	depth
ADVANCEMENT METHOD	Mud rotary
DRILL RODS	NWJ
ROTARY BIT DIAMETER, IN.	3-7/8"
DRILLING MUD USED	Quick Gel
AUGER	N/A
SAMPLERS	
HAMMER TYPE	Auto Hammer
WEIGHT	140 lbs **DROP** 30" **RATE** Auto
D-SAMPLER	2" Split spoon
U-SAMPLER	N/A
OTHER	N/A
ROCK CORING	
CORING FEED	N/A
CORE BARREL	N/A
CORE BIT	N/A

REMARKS

1. Hand dug from 0 ft to 4 ft.
2. Driller drove casing up to 15 ft.
3. L.C. when drill rod passed 15 feet. Water dropped in mud tub.
4. RC.
5. RC.
6. RC.
7. L.C.
8. Driller drove casing up to 50 feet.

LEGEND

TV = Torvane Shear Strength, T5F
CT = Coring Time, minutes/foot
CB = Casing Blows Per Foot
OLT = Other Lab Testing Performed
PP = Pocket Penetrometer
Unconfined Compressive Strength, TSF

REMARK TYPES

LC = Lost Circulation
HD = Hard Drilling
RC = Rig Chatter
CBJ = Core Barrel Jam
PO = Petroleum Odor
CW = Change in Wash
SS = Slickensided
EOB = End Of Boring
ML = Mudline

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATIONS
See ground water table summary					

PIEZOMETER__ **MONITORING WELL**__ **INSTALLED** (yes)/no **SKETCH PROVIDED ELSEWHERE** _____

PAY QUANTITIES

2" DIA. SAMPLE BORING **LIN. FT.** 57 **NO. OF 3" UNDISTURBED SAMPLES** 0
CORE DRILLING IN ROCK **LIN. FT.** _____ **OTHER** NA
BORING CONTRACTOR Craig Geotechnical Drilling
DRILLER Mike **HELPER(S):** Sergio
OEI OBSERVER R.Sirsat **DATE:** 12/09/2018 Sunday
CLASSIFICATION CHECK U.S.C.S.

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT MORRIS AND ESSEX LINE MILEPOSTS 34.58 — BORING NO. B-6
PROJECT NO. 17-NJ120-01 — SHEET 2 OF 4
LOCATION Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±525 ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
12/9/2018 8:20 AM		S-1	1	Hand dug		Fill: Dark gray gravel (ballast)		1			Hand dug up to 4 ft
			2					2			
		S-2	3	Hand dug		Brown silty sand with gravel	Fill (1b)	3			
			4					4			1
9:55 AM		S-3	S	11-17	23	Same	Fill	5	M		
			6	12-7		(dense)	(1b)	6			
		S-4	7	7-6	20	Same	Fill	7			
			8	4-5		(medium dense)	(1b)	8			
		S-5	9	10-7	1S	Same (boulder fragments)		9			
			10	7-7				10			
		S-6	11	5-6	8	Brown poorly graded gravel with silt and sand	Fill	11			
			12	7-7		(medium dense)	(1b)	12			2
10:15AM			13					13			
			14					14			
			1S					15			3
		S-7	16	13-39	4	Boulder fragments		16			4
			17	S0/1"				17			
			18					18			
			19					19			
1:30PM			20					20			
		S-8	21	6-8	20	Brown silt	ML	21			
			22	11-6		(very stiff)	(2)	22			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.S8 — BORING NO. B-6
PROJECT NO.: 17-NJ120-01 — SHEET 3 OF 4
LOCATION: Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±52S ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	DEPTH (ft)	BLOWS/6"	REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			23					23			
			24					24			
			25					25			
		S-9	26	9-10	15	Gray silt	ML	26			
				10-12		(very stiff)	(2)				
			27					27			
			28					28			
			29					29			
			30					30			
		S-10	31	7-17	12	Brown silty sand with gravel	SM	31			
				25-21		(dense)	(3)				
			32					32			
12:20 PM			33					33			
			34					34			5
			35					35			6
		S-11	36	16-35	12	Gray poorly graded gravel with sand	GP	36			7
				19-13		(very dense)	(3)				
			37					37			
			38					38			
			39					39			
			40					40			
		S-12	41	16-39	10	Gray silty sand with gravel	SM	41			
				22-29		(very dense)	(3)				
			42					42			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.S8
PROJECT NO.: 17-NJ120-01
LOCATION: Mileposts 34.8, Township of Denville, New Jersey

BORING NO. B-6
SHEET 4 OF 4
GROUND ELEVATION ±525 ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	DEPTH (ft)	BLOWS/6"	REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			43					43			
			44					44			
			45					45			
		S-13	46	14 - 16	10	Brown silty sand		46			
			47	14 - 12		(dense)		47			
			48					48			
			49				SM	49			
			50				(3)	50			8
		S-14	51	28 - 25	12	Brown silty sand with gravel		51			
			52	46 - 24		(very dense)		52			
2:30 PM			53					53			
			54					54			
			55					55			
		S-15	56	50/1"		Gray/white rock fragment		56			
3:05PM 12/9/2018 End			S7			(very dense)		S7			
			58			End of boring at 57 ft bgs.		58			
			59					59			
			60					60			
			61					61			
			62					62			

OWEIS ENGINEERING INC.

PROJECT	MORRIS AND ESSEX LINE MILEPOSTS 34.58	**BORING NO.**	B-7
LOCATION	Mileposts 34.8, Township of Denville, New Jersey	**SHEET NO.**	1 OF 4
CLIENT	Parsons	**PROJECT NO.**	17-NJ120-01
BORING LOCATION	See boring location plan	**SURFACE ELEV.**	±519 ft
LATITUDE	40° 53.008' N **LONGITUDE** 74° 29.696' W	**VER. DATUM**	NAVD 88
		HOR. DATUM	NAD 83

EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

DRILLING RIG	CME 55 LT
CASING	
4" dia.	39' depth
dia.	depth
ADVANCEMENT METHOD	Mud rotary
DRILL RODS	NWJ
ROTARY BIT DIAMETER, IN.	3-7/8"
DRILLING MUD USED	Quik Gel
AUGER	N/A
SAMPLERS	
HAMMER TYPE	Auto Hammer
WEIGHT	140 lbs **DROP** 30" **RATE** Auto
D-SAMPLER	2" Split spoon
U-SAMPLER	
OTHER	
ROCK CORING	
CORING FEED	Hydraulic
CORE BARREL	NX
CORE BIT	Diamond bit

REMARKS

1. Drove 10 ft of casing.
2. Added Quik Gel in mud tub.
3. Drove casing to 15 ft.
4. Drove casing to 25 ft. (Driller mentioned he hit gravel at 25 ft to 27 ft.
5. Drove casing to 30 ft (Hard driving).
6. Hard drilling at 29 ft , driller hit 6" boulder. Cleared at 12:03 PM.
7. R.C. at 36 ft 10 in.
8. Losing water.
9. Driller placed casing up to 39 ft and started coring. It was only boulder and recovered 7" rock core.
10. Borehole collapsed because casing was only up to 39 ft. Later driller tried to drove casing down below 39 ft but casing couldn't pass boulder.

LEGEND

TV = Torvane Shear Strength, TSF
CT = Coring Time, minutes/foot
CB = Casing Blows Per Foot
OLT = Other Lab Testing Performed
PP = Pocket Penetrometer
Unconfined Compressive Strength, TSF

REMARK TYPES

LC = Lost Circulation
HD = Hard Drilling
RC = Rig Chatter
CBJ = Core Barrel Jam
PO = Petroleum Odor
CW = Change in Wash
SS = Slickensided
EOB = End Of Boring
ML = Mudline

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATIONS
See ground water table summary					

PIEZOMETER__ **MONITORING WELL**__ **INSTALLED** (yes)/no **SKETCH PROVIDED ELSEWHERE** ____

PAY QUANTITIES

2" DIA. SAMPLE BORING	**LIN. FT.** 52	**NO. OF 3" UNDISTURBED SAMPLES**	0
CORE DRILLING IN ROCK	**LIN. FT.**	**OTHER**	
BORING CONTRACTOR	Craig Geotechnical Drilling		
DRILLER Mike		**HELPER(S):** Sergio	
OEI OBSERVER R.Sirsat		**DATE:**	12/12/2018-12/13/2018
CLASSIFICATION CHECK	U.S.C.S.		

BORING LOG

DOCUMENT 30008
REV 1 3/2015

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT MORRIS AND ESSEX LINE MILEPOSTS 34.S8 — BORING NO. 8-7
PROJECT NO. 17-NJ120-01 — SHEET 2 OF 4
LOCATION Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±519 ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
12.12.18 9:15 AM		SA-1	1	S-7 13-4	12	Fill: Dark brown silty sand with gravel (wood and leaf pieces)		1	D-M		
			2				Fill (1a)	2	D-M		
		SA-2	3	4-S 6-2	8	Same		3			
			4					4			
		SA-3	5		3	White, gray silty sand with gravel	Fill	S	D-M		
			6			(wood/root pieces)	(1a)	6			
		SA-4	7	2-2 2-2	1	Poorly graded gravel with sand	Fill	7	M-W		
			8			(Crushed gravel pieces) (loose)	(1a)	8			
9:30 AM		S-1	9	4-7 10-9	6	Dark brown poorly graded gravel with silt and sand	Fill	9	M-W		
			10			(medium dense)	(1a)	10			1
		S-2A	11	8-4 2-3	13	Brown sandy silt		11	M-W		
		S-2B	12			Dark brown-gray sandy silt (medium stiff)	ML (2)	12			2
		S-3A	13	1-7 12-10	22	Brown silt with sand (very stiff)	ML	13	W		
		S-3B	14			Brown silt	(2)	14			
		S-4	15	7-14 10-12	24	Same		1S	W		
			16			Brown silt (medium dense)	ML (2)	16			3
10:25 AM		S-5	17	S-6 8-13	21	Same	ML (2)	17	W		
			18					18			
10:40 AM		S-6	19	1S-16 12-13	18	Brown silt (very stiff)	ML (2)	19	W		
			20					20			
10:43 AM		S-7	21	7-S 6-6	20	Gray lean clay with sand (stiff)	CL (2)	21	W		
			22					22			4

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.58 — BORING NO. B-7
PROJECT NO.: 17-NJ120-01 — SHEET 3 OF 4
LOCATION: Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±519 ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			23					23			
			24					24			
			25					25			
		S-8	26	25 - 27	10	Brown poorly graded gravel with silt and sand	GP-GM	26	W		
			27	30 - 26		(very dense)	(3)	27			5
			28					28			
			29					29			6. HD
12:00 PM			30					30			
		S-9	31	24 - 20	11	Brown, black, red, white (Mica) poorly graded gravel with sand (dense)	GP	31			
			32	20 - 24			(3)	32			
			33					33			
			34					34			
			35					35			
		S-10	36	15 - 15	14	Brown silty sand	SM	36			
			37	20 - 46		(a gravel/rock piece in tip) (dense)	(3)	37			7. RC
12:2S PM			38					38			8. L.C.
			39					39			
12:S1 PM						Attempted core at 39 ft bgs				Stone core 39'- 39'7"	
12/12/2018			40			7" Boulder recovery		40			
			41					41			
			42					42			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.58 — BORING NO. 8-7
PROJECT NO. 17-NJ120-01 — SHEET 4 OF 4
LOCATION: Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±519 ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			43					43			
			44					44			
			45					45			
8:16 AM 12/13/2018		S-11	46	23-20	8	Brown silty sand with gravel	5M	46			
			47	17-23		(dense)	(3)	47			
			48					48			
			49					49			
			50					50			
		5-12	51	21 - 28	11	5ame	SM	51	W		
			52	22 - 20			(3)	52			10
			53			End of boring at 52 ft bgs.		53			
			54					54			
			55					55			
			56					56			
			57					57			
			58					58			
			59					59			
			60					60			
			61					61			
			62					62			

OWEIS ENGINEERING INC.

PROJECT	MORRI5 AND E5SEX LINE MILEPO5T5 34.58	**BORING NO.**	B-8
LOCATION	Mileposts 34.8, Township of Denville, New Jersey	**SHEET NO.**	1 OF 4
CLIENT	Parsons	**PROJECT NO.**	17-NJ120-01
BORING LOCATION	5ee boring location plan	**SURFACE ELEV.**	±522ft
LATITUDE	40° 52.958' N **LONGITUDE** 74° 29.887' W	**VER. DATUM**	NAVD 88
		HOR. DATUM	NAD 83

EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

DRILLING RIG	CME 55 LT
CASING	
4" dia.	40 ft depth
dia.	depth
ADVANCEMENT METHOD	Mud rotary
DRILL RODS	NWJ
ROTARY BIT DIAMETER, IN.	3-7/8"
DRILLING MUD USED	Quik Gel
AUGER	N/A
SAMPLERS	
HAMMER TYPE	Auto Hammer
WEIGHT	140 lbs **DROP** 30" **RATE** Auto
D-SAMPLER	2" 5plit spoon
U-SAMPLER	NA
OTHER	
ROCK CORING	
CORING FEED	NA
CORE BARREL	NA
CORE BIT	NA

REMARKS

1. Drove casing up to 8 ft and then casing dropped 1 ft according to driller.
2. Drove casing to 15 ft.
3. Drove casing to 20 ft.
4. Hard droving of casing roughly at 15ft bgs. Driller mentioned he couldn't pass casing beyond 15ft bgs. (10:20 AM)
5. Hard drilling and RC at ~ 18ft and 19ft.
6. Drove casing to 30 ft bgs (11:27 AM).
7. Drove casing uo to 35 ft bgs (11:40).
8. Drove casing up to 40 ft bgs.
9. Lost some water in mud tub during 5-13 spoon.

LEGEND

TV = Torvane Shear 5trength, TSF
CT = Coring Time, minutes/foot
CB = Casing Blows Per Foot
OLT = Other Lab Testing Performed
PP = Pocket Penetrometer
Unconfined Compressive 5trength, TSF

REMARK TYPES

LC = Lost Circulation
HD = Hard Drilling
RC = Rig Chatter
CBJ = Core Barrel Jam
PO = Petroleum Odor
CW = Change in Wash
55 = 5lickensided
EOB = End Of Boring
ML = Mudline

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATIONS
See ground water table summary					

PIEZOMETER__ **MONITORING WELL**__ **INSTALLED** (yes)/no **SKETCH PROVIDED ELSEWHERE** _____

PAY QUANTITIES

2" DIA. SAMPLE BORING	**LIN. FT.** 57	**NO. OF 3" UNDISTURBED SAMPLES**	0
CORE DRILLING IN ROCK	**LIN. FT.**	**OTHER** 0	

BORING CONTRACTOR Craig Geotechnical Drilling
DRILLER Mike **HELPER(S):** Sergio
OEI OBSERVER R.Sirsat **DATE:** 12/27/2018 Thursday
CLASSIFICATION CHECK U.S.C.S.

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT MORRIS AND ESSEX LINE MILEPOSTS 34.S8 — BORING NO. B-8
PROJECT NO. 17-NJ120-01 — SHEET 2 OF 4
LOCATION Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±522ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
8:20 AM		S-1	1	1-1	13	Fill: Gray poorly graded gravel with black silt and sand	Fill	1	D		
				1-2		(Charred leafs and wood pieces)	(1a)				
			2					2			
8:42 AM		S-2	3	1-1	12	Black well graded sand with gravel	Fill (1a)	3	D		
				1-1							
			4					4			
8:4S AM		S-3	5	2-2	12	Gravel (Charred wood, leaf and gravel)	Fill (1a)	5	M-W		
				2-2		Brown silty sand with gravel	FILL				
			6			(loose)	(1a)	6			
		S-4	7	2-2	20	Brown clayey gravel with sand	FILL	7	M-W		
				2-3		(loose)	(1a)				
			8					8			1
		S-S	9	16-24	6	Black and white silty sand with gravel	SM	9	W		
				28-36		(gravel in tip)	(3)				
			10			(very dense)		10			
		S-6	11	2S-S0/5"	9	Brown silty sand with gravel	SM	11	W		
						(very dense)	(3)				
9:20 AM			12					12			2
			13					13			
			14					14			
			1S					15			3
		S-7	16	16-17	19	Brown silty sand with gravel	SM	16	W		4
				20-18		(dense)	(3)				
10:00 AM			17					17			HD
			18					18			S
			19					19			
			20					20			
		S-8	21	22-19	10	Brown poorly graded gravel with sand	GP	21	W		
				17-13		(dense)	(3)				
			22					22			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.58 — BORING NO. B-8
PROJECT NO.: 17-NJ120-01 — SHEET 3 OF 4
LOCATION: Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±522ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			23					23			
			24					24			
			25					25			
		5-9	26	28-30	9	Gray and white poorly graded gravel with silt and sand		26	W		
				23-17		(very dense)					
10:42 AM			27					27			6
			28				GP-GM	28			RC
							(3)				
			29					29			
11:28 AM			30					30			
		S-10	31	21-20	8	Red brown and gray poorly graded gravel with brown		31	W		7
				10-14		silt and sand					
			32			(dense)		32			
11:30 AM			33					33			
			34					34			
11:48 AM			35					35			
		5-11	36	17-28		Same		36			
				25-24		Brown poorly graded sand with gravel					
			37			(very dense)	SP	37			8
11:50 AM			38				(3)	38			
			39					39			
			40					40			
		5-12	41	46-31	5	Gray poorly graded gravel with brown sand	GP	41	W		
				38-72		(very dense)	(3)				
			42					42			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.58 — BORING NO. B-8
PROJECT NO. 17-NJ120-01 — SHEET 4 OF 4
LOCATION: Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±522ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			43					43			
			44					44			
			45					45			
		S-13	46	56-100/3"	9	Silty sand with gravel	GP-GM	46	W		RC
			47			(very dense)	(3)	47			LC
			48					48			
			49					49			
			50					50			
		S-14	51	34-19	11	Brown silty sand with gravel	SM	51			
			52	15-14		(dense)	(3)	52			
			53					53			
			54					54			
			55					55			
		S-15	56	20-65	16	Brown silty sand with gravel	SM	56			
			57	10-17		(very dense)	(3)	57			
1:08 PM											
			58			End of boring at 57 ft bgs.		58			
			59					59			
			60					60			
			61					61			
			62					62			

OWEIS ENGINEERING INC.

PROJECT	MORRIS AND ESSEX LINE MILEPOSTS 34.S8	**BORING NO.**	B-9
LOCATION	Mileposts 34.8, Township of Denville, New Jersey	**SHEET NO.**	1 OF 4
CLIENT	Parsons	**PROJECT NO.**	17-NJ120-01
BORING LOCATION	See boring location plan	**SURFACE ELEV.**	±S24ft
LATITUDE	40° 52.975' N **LONGITUDE** 74° 29.832' W	**VER. DATUM**	NAVD 88
		HOR. DATUM	NAD 83

EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

DRILLING RIG CME SS LT
CASING
4" dia. 35 ft depth
dia. depth
ADVANCEMENT METHOD Mud rotary
DRILL RODS NWJ
ROTARY BIT DIAMETER, IN. 3-7/8"
DRILLING MUD USED Quik Gel
AUGER N/A
SAMPLERS
HAMMER TYPE Auto Hammer
WEIGHT 140 lbs **DROP** 30" **RATE** Auto
D-SAMPLER 2" and 3" Split spoon
U-SAMPLER Shelby tube
OTHER
ROCK CORING
CORING FEED NA
CORE BARREL NA
CORE BIT NA

REMARKS

1. Drove casing up to 6ft.
2. Took tube sample, placed tube in ground for 28 minutes.
3. Drove casing up to 10 ft and added quik gel.
4. Drove casing up to 35 ft, gravel collapsing the borehole.
5. Driller cleaned up to 60ft and borehole collapsed.

LEGEND

TV = Torvane Shear Strength, TSF
CT = Coring Time, minutes/foot
CB = Casing Blows Per Foot
OLT = Other Lab Testing Performed
PP = Pocket Penetrometer
Unconfined Compressive Strength, TSF

REMARK TYPES

LC = Lost Circulation
HD = Hard Drilling
RC = Rig Chatter
CBJ = Core Barrel Jam
PO = Petroleum Odor
CW = Change in Wash
SS = Slickensided
EOB = End Of Boring
ML = Mudline

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATIONS
See ground water table summary					

PIEZOMETER __ **MONITORING WELL** __ **INSTALLED** (yes)/no **SKETCH PROVIDED ELSEWHERE**

PAY QUANTITIES

2" DIA. SAMPLE BORING **LIN. FT.** 57 **NO. OF 3" UNDISTURBED SAMPLES** 1
CORE DRILLING IN ROCK **LIN. FT.** **OTHER** 0
BORING CONTRACTOR Craig Geotechnical Drilling
DRILLER Mike **HELPER(S):** Sergio
OEI OBSERVER R.Sirsat **DATE:** 01/02/2019 Wednesday
CLASSIFICATION CHECK U.S.C.S.

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT MORRIS AND ESSEX LINE MILEPOSTS 34.S8 — BORING NO. B-9
PROJECT NO. 17-NJ120-01 — SHEET 2 OF 4
LOCATION Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±524ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
		S-1	1	20-12	10	Fill: Gray gravel with sand (Charred wood pieces)	Fill	1	D		
			2	15-18			(1b)	2			
		5-2	3	12-11	11	Brown silty gravel with sand	Fill	3	D-M		
9:19 AM			4	13-10		(medium dense)	(1b)	4			
		5-3	5	8-11	19	Brown sandy lean clay	CL	5	D-M		
9:23 AM			6	8-6		(medium dense)	(2)	6			1
9:43 AM		UD-1	7	PUSH	0			7	W		
10:11 AM			8					8			2
		5-4A	9	2-2	24	Brown silty sand	SM	9	W		
10:15 AM		5-4B	10	12-14		(medium dense)	(3)	10			3
		5-5A	11	21-37	24	Brown silty sand with gravel	SM	11	W		
		S-5B	12	54-8		(very dense)	(3)	12			
			13					13			
			14					14			RC
			15					15			
		5-6	16	22-24	14	Brown silty sand with gravel	SM	16	W		
10:43 AM			17	21-19		(very dense)	(3)	17			
			18					18			
			19					19			
			20					20			
		S-7	21	15-13	19	Brown silty sand with gravel	SM	21	W		
			22	4-4			(3)	22			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT MORRIS AND ESSEX LINE MILEPOSTS 34.58 BORING NO. 8-9
PROJECT NO. 17-NJ120-01 SHEET 3 OF 4
LOCATION Mileposts 34.8, Township of Denville, New Jersey GROUND ELEVATION ±524ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	DEPTH (ft)	BLOWS/6"	REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			23					23			
			24					24			
			25					25			
		S-8	26	15-30	14	Red brown, gray and white poorly graded gravel with silt and		26			
			27	25-21		sand (very dense)		27			
			28				GP-GM (3)	28			
			29					29			
			30					30			
		S-9	31	16-17	4	White, black and brown, burgundy, gray poorly graded gravel with sand (dense)		31			
			32	13-24				32			4
			33					33			
			34					34			
			35					35			
		S-10	36	12-14	0	Brown silty sand with gravel(zero recover with 2" split spoon 17" recovery with 3" split spoon) (dense)	SM (3)	36			
			37	20-17				37			
11:58 AM			38					38			
			39					39			
			40					40			
		S-11	41	20-21	12	Gray silty sand with gravel (very dense)		41			
12:15 PM			42	43-31				42			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.58 — BORING NO. B-9
PROJECT NO.: 17-NJ120-01 — SHEET 4 OF 4
LOCATION: Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±524ft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			43					43			
			44					44			
			45					45			
		S-12	46	22-26	19	Brown silty sand with gravel	5M	46			
			47	49-21		(very dense)	(3)	47			
			48					48			
			49					49			
			50					50			
		S-13	51	23-21	23	Same	SM (3)	51			
12:43 PM			52	23-24				52			
			53					53			
			54					54			
			55					55			
1:00 PM		5-14	56	14-23	10	Brown silty sand with gravel	SM	56			
1:35 PM			57	17-34		(dense)	(3)	57			5
			58			End of boring at 57ft bgs.		58			
			59					59			
			60					60			
			61					61			
			62					62			

OWEIS ENGINEERING INC.

PROJECT	MORRIS AND ESSEX LINE MILEPOSTS 34.S8	**BORING NO.**	B-10
LOCATION	Mileposts 34.8, Township of Denville, New Jersey	**SHEET NO.**	1 OF 5
CLIENT	Parsons	**PROJECT NO.**	17-NJ120-01
BORING LOCATION	See boring location plan	**SURFACE ELEV.**	±525ft
LATITUDE	40° 53.010' N **LONGITUDE** 74° 29.609' W	**VER. DATUM**	NAVD 88
		HOR. DATUM	NAD 83

EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

DRILLING RIG CME SS LT
CASING
4" dia. 2S ft depth
dia. depth
ADVANCEMENT METHOD Mud rotary
DRILL RODS NWJ
ROTARY BIT DIAMETER, IN. 3-7/8"
DRILLING MUD USED Quik Gel
AUGER N/A
SAMPLERS
HAMMER TYPE Auto Hammer
WEIGHT 140 lbs **DROP** 30" **RATE** Auto
D-SAMPLER 2" Split spoon
U-SAMPLER Shelby tube
OTHER
ROCK CORING
CORING FEED NA
CORE BARREL NA
CORE BIT NA

REMARKS

1. Drove 1Sft casing bgs.
2. Drove casing up to 2S ft bgs and added quik gel.

LEGEND

TV = Torvane Shear Strength, TSF
CT = Coring Time, minutes/foot
CB = Casing Blows Per Foot
OLT = Other Lab Testing Performed
PP = Pocket Penetrometer
Unconfined Compressive Strength, TSF

REMARK TYPES

LC = Lost Circulation
HD = Hard Drilling
RC = Rig Chatter
CBJ = Core Barrel Jam
PO = Petroleum Odor
CW = Change in Wash
SS = Slickensided
EOB = End Of Boring
ML = Mudline

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATIONS

PIEZOMETER__ **MONITORING WELL**__ **INSTALLED** yes (no) **SKETCH PROVIDED ELSEWHERE** ____

PAY QUANTITIES

2" DIA. SAMPLE BORING **LIN. FT.** 65ft 1in **NO. OF 3" UNDISTURBED SAMPLES** 1
CORE DRILLING IN ROCK **LIN. FT.** ____ **OTHER** 0
BORING CONTRACTOR Craig Geotechnical Drilling
DRILLER Mike **HELPER(S):** Sergio
OEI OBSERVER R.Sirsat **DATE:** 01/04/2019 Friday
CLASSIFICATION CHECK U.S.C.S.

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT MORRIS AND ESSEX LINE MILEPOSTS 34.S8 — BORING NO. B-10
PROJECT NO. 17-NJ120-01 — SHEET 2 OF 4
LOCATION Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±S2Sft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
9:1S AM		S-1	1	18-12	11	Fill: Gray poorly graded gravel with sand	Fill	1	D		
				8-9			(1b)				
			2					2			
9:25 AM						Same					
		S-2	3	11-10	1S	Brown silty sand with gravel	Fill	3	D		
				8-7		(medium dense)	(1b)				
			4					4			
		5-3	5	8-S	10	Brown silty sand with gravel	Fill	**5**	M		
				7-7		(medium dense)	(1b)				
			6					6			
		S-4	7	11-8	7	Brown silty sand with gravel	Fill	7	M		
				5-4		(traces of dark gray/black clay)	(1b)				
			8			(medium dense)		8			
		5-5	9	5-4	9	Brown silty sand with gravel	Fill	9	M		
				4-4		(loose)	(1b)				
			10				(1b)	**10**			
		5-6	11	6-5	6	same		11	M		
				4-2		(medium dense)	Fill				
9:40 AM			12				(1b)	12			1
			13					13			
			14					14			
			15					**15**			
		S-7	16	8-5	9	Gray poorly graded sand with silt and gravel	Fill	16	W		
				4-13		(medium dense)	(1b)				
10:10 AM			17					17			RC
			18					18			RC
			19					19			
			20					**20**			
		S-8	21	5-4	10	same	Fill	21			
				3-5		(loose)	(1b)				
10:22			22					22			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.58 — BORING NO. B-10
PROJECT NO.: 17-NJ120-01 — SHEET 3 OF 4
LOCATION: Mileposts 34.8, Township of Denville, New Jersey — GROUNO ELEVATION ±52Sft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELO TESTS	REMARKS (TYPE)
			23					23			
			24					24			
10:28 AM		UD-1	25	PU5H	15	Crushed angular gravel (Top)		25			
10:S1 AM			26	Bottom bent		Gray sandy silt	ML (2)	26			
10:S3 AM		S-9	27 28	6-4 4-5	19	Brown silt (medium stiff)	ML (2)	27 28			2
			29					29			
			30					30			
11:18 AM		5-10	31 32	7-10 12-11	15	Brown silt (very stiff)	ML (2)	31 32			
			33					33			
			34					34			
			35					35			
11:27 AM		5-11	36 37	9-9 9-10	15	5ame	ML (2)	36 37			
			38					38			
			39					39			
			40					40			
11:3S AM		S-12	41 42	13-10 8-8	10	Brown Silt (very stiff)	ML (2)	41 42			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.S8 — BORING NO. 8-10
PROJECT NO.: 17-NJ120-01 — SHEET 4 OF 4
LOCATION: Mileposts 34.8, Township of Denville, New Jersey — GROUND ELEVATION ±52Sft
OEI OBSERVER R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	DEPTH (ft)	BLOWS/6"	REC (in)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			43					43			
			44					44			
			45					45			
		S-13	46	6-61	10	Same	ML	46			RC
			47	50/1"		Brown silty, clayey sand (gravel fragment in tip)	SC-SM	47			
			48			(very dense)	(3)	48			HD
			49					49			
			50					50			
		5-14	51	28-30	12	Brown silty sand with gravel	5M	51			
12:1S PM			52	29-25		(very dense)	(3)	52			
			53					53			
			54					54			
			5S					55			
		5-15	56	36-52	10	Same	SM	56			
12:30 PM			57	40-57			(3)	57			
			58					58			
			59					59			
			60					60			
		5-16	61	32-31	19	Brown silty sand	5M	61			
12:49 PM			62	34-32		(very dense)	(3)	62			

BORING LOG

Oweis ENGINEERING INC.
INNOVATIVE GEOTECHNICAL ENGINEERING SOLUTIONS

PROJECT: MORRIS AND ESSEX LINE MILEPOSTS 34.58
PROJECT NO.: 17-NJ120-01
LOCATION: Mileposts 34.8, Township of Denville, New Jersey
BORING NO.: B-10
SHEET S OF: S
GROUND ELEVATION: ±525ft
OEI OBSERVER: R.Sirsat

DAILY PROGRESS	SYMBOL	SAMPLE NO.	DEPTH (ft)	BLOWS/6"	REC (In)	SAMPLE DESCRIPTION	STRATA	DEPTH (ft)	MOISTURE CONDITION	FIELD TESTS	REMARKS (TYPE)
			63					63			RC
			64					64			
			65					65			
		S-17	66	50/1"	0	A small piece of stone		66			
			67					67			
						End of boring at 65ft 1 inch bgs.					
			68					68			
			69					69			
			70					70			
			71					71			
			72					72			
			73					73			
			74					74			
			75					75			
			76					76			
			77					77			
			78					78			
			79					79			
			80					80			
			81					81			
			82					82			

Appendix S-4

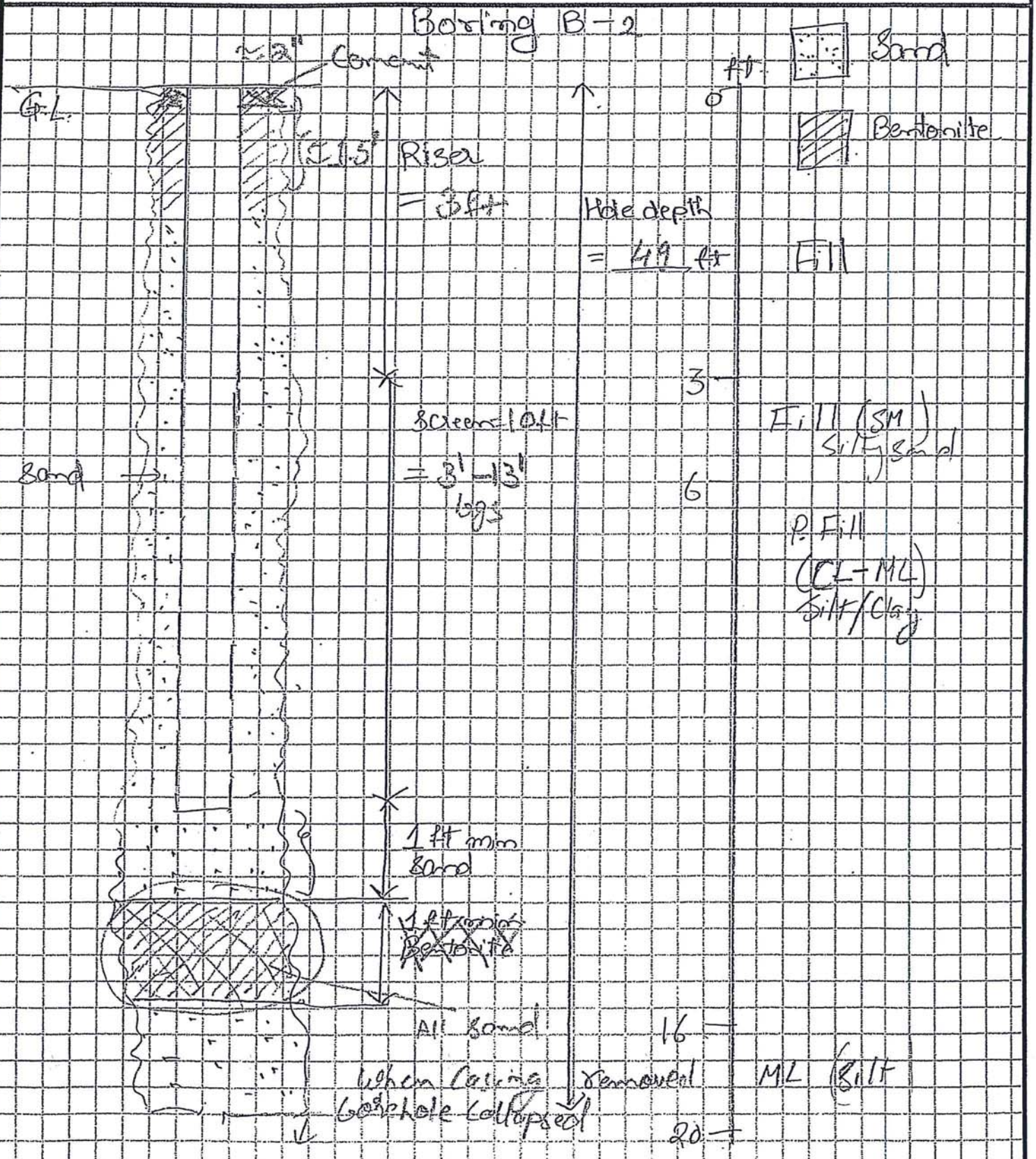
Configuration of Monitoring Wells

OWEIS ENGINEERING COMPUTATIONS

PROJECT NAME: NJT Morris & Essex | CALCULATED BY: R.S. | DATE:

PROJECT NUMBER: 17-NJ120-01 | CHECKED BY: | DATE:

SHEET: ____ OF ____ | SCALE: Not to Scale.

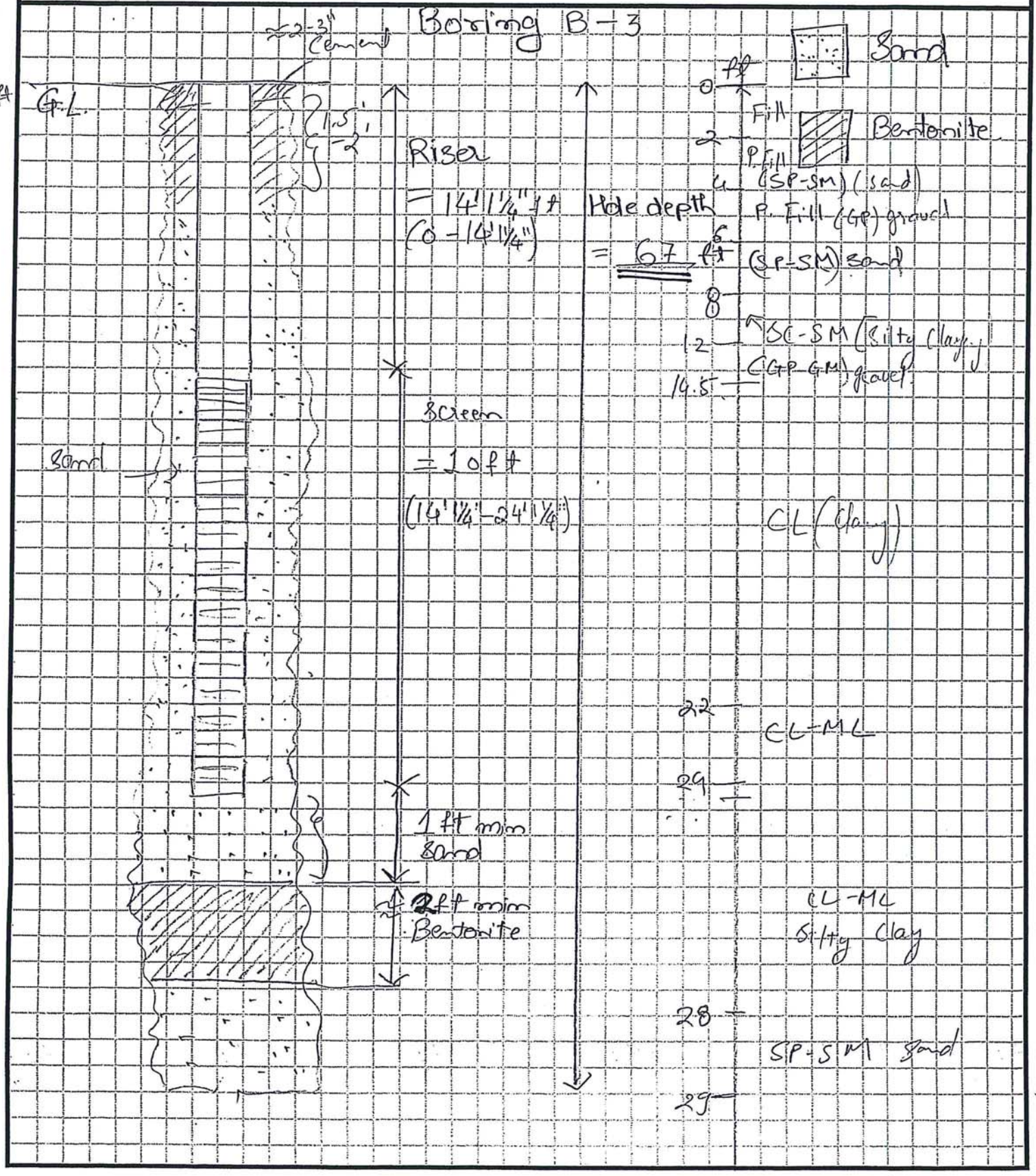


OWEIS ENGINEERING COMPUTATIONS

PROJECT NAME: NJT Morris & Essex | CALCULATED BY: R.S. | DATE:

PROJECT NUMBER: 17-NJ120-01 | CHECKED BY: | DATE:

SHEET: ___ OF ___ | SCALE: Not to Scale.

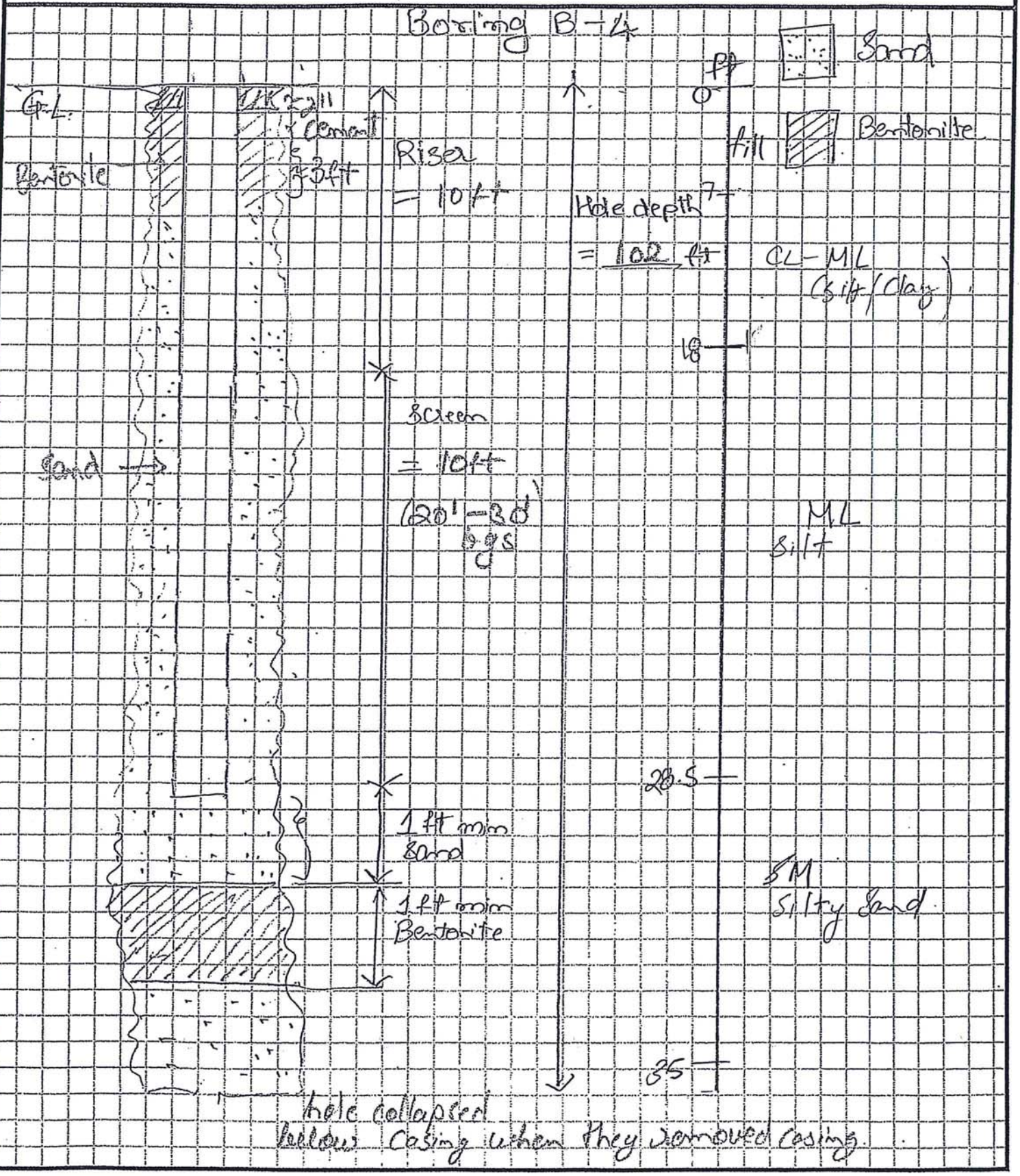


OWEIS ENGINEERING COMPUTATIONS

PROJECT NAME: NJT MORRIS & ESSEX | CALCULATED BY: R.S. | DATE:

PROJECT NUMBER: 17-NJ120-01 | CHECKED BY: | DATE:

SHEET: ___ OF ___ | SCALE: Not to Scale.

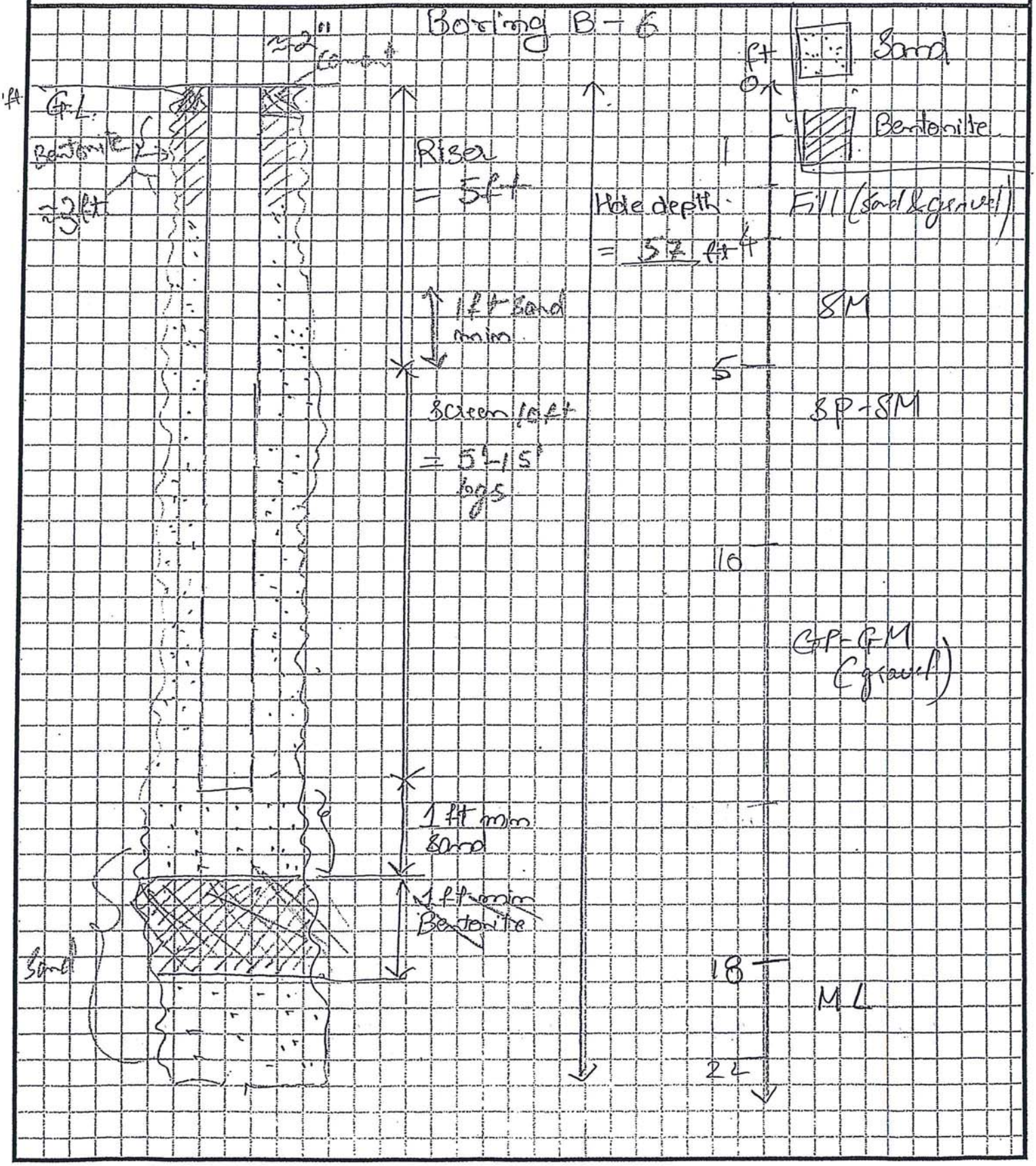


OWEIS ENGINEERING COMPUTATIONS

PROJECT NAME: NJT Morris & Essex | CALCULATED BY: R.S. | DATE:

PROJECT NUMBER: 17-NJ120-01 | CHECKED BY: | DATE:

SHEET: ___ OF ___ | SCALE: Not to Scale.

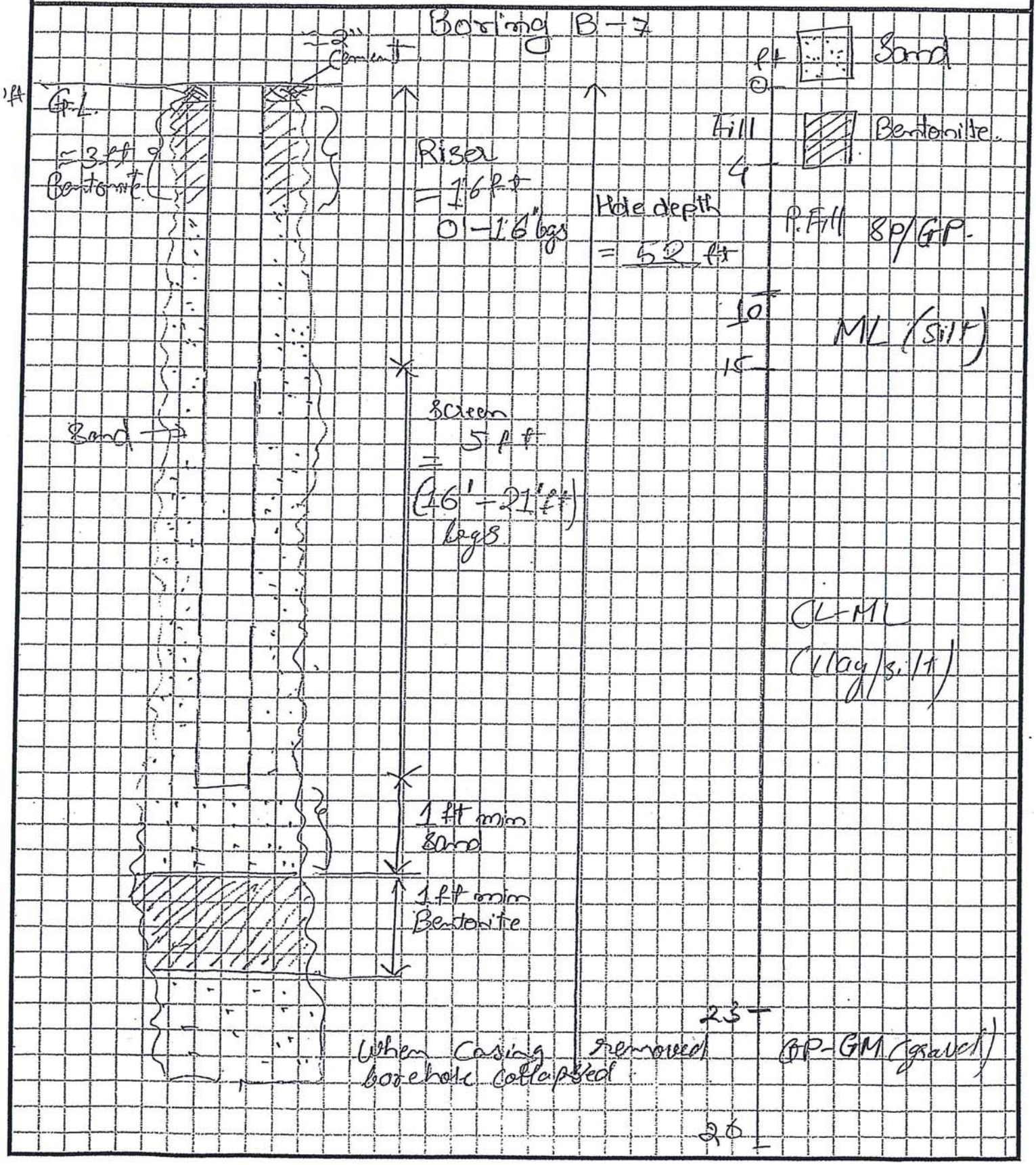


OWEIS ENGINEERING COMPUTATIONS

PROJECT NAME: NJT Morris & Essex | CALCULATED BY: R.S. | DATE:

PROJECT NUMBER: 17-NJ120-01 | CHECKED BY: | DATE:

SHEET: ___ OF ___ | SCALE: Not to Scale.

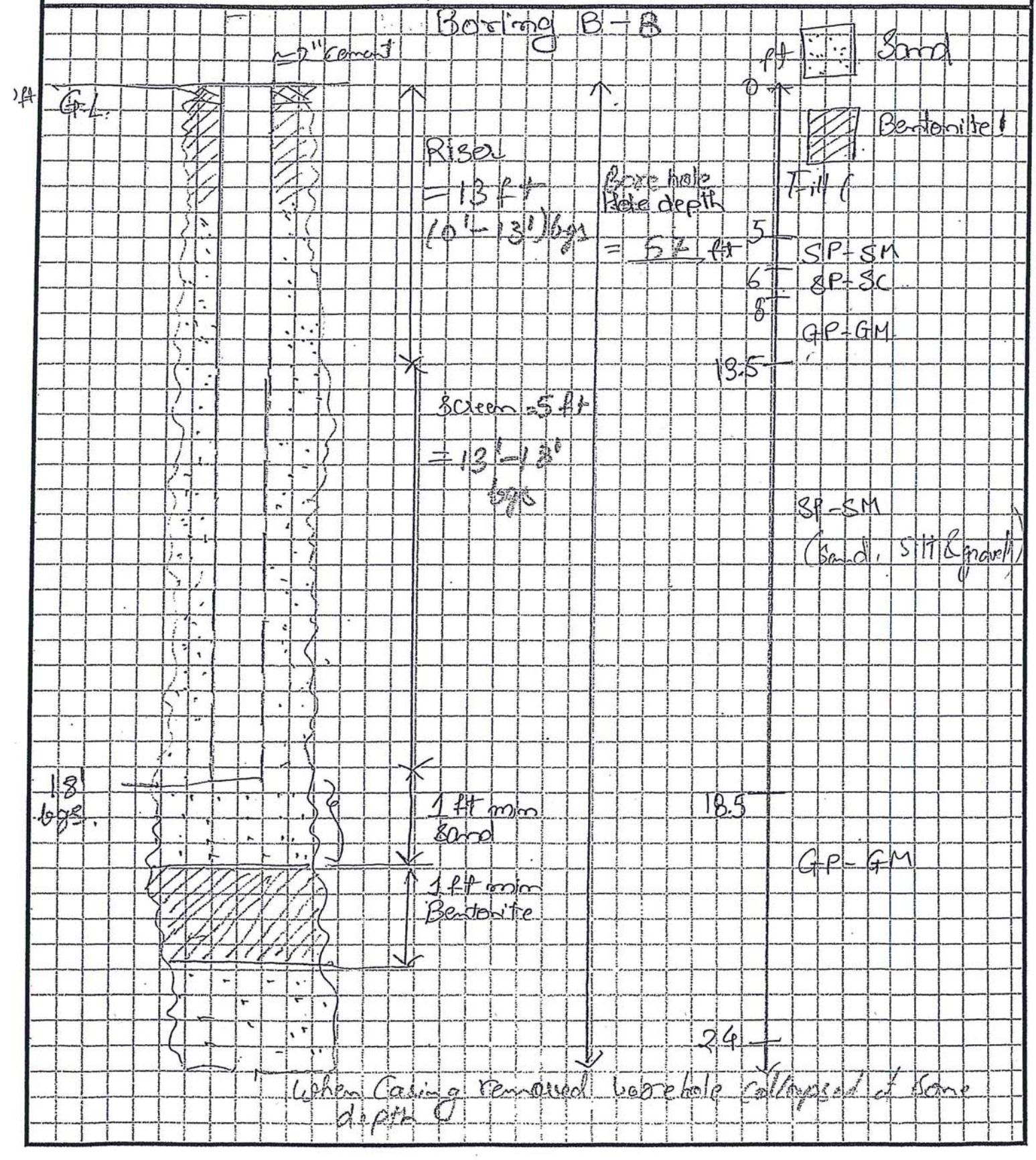


OWEIS ENGINEERING COMPUTATIONS

PROJECT NAME: NJT MORRIS & ESSEX | CALCULATED BY: R.S. | DATE:

PROJECT NUMBER: 17-NJ120-01 | CHECKED BY: | DATE:

SHEET: ___ OF ___ | SCALE: Not to Scale.

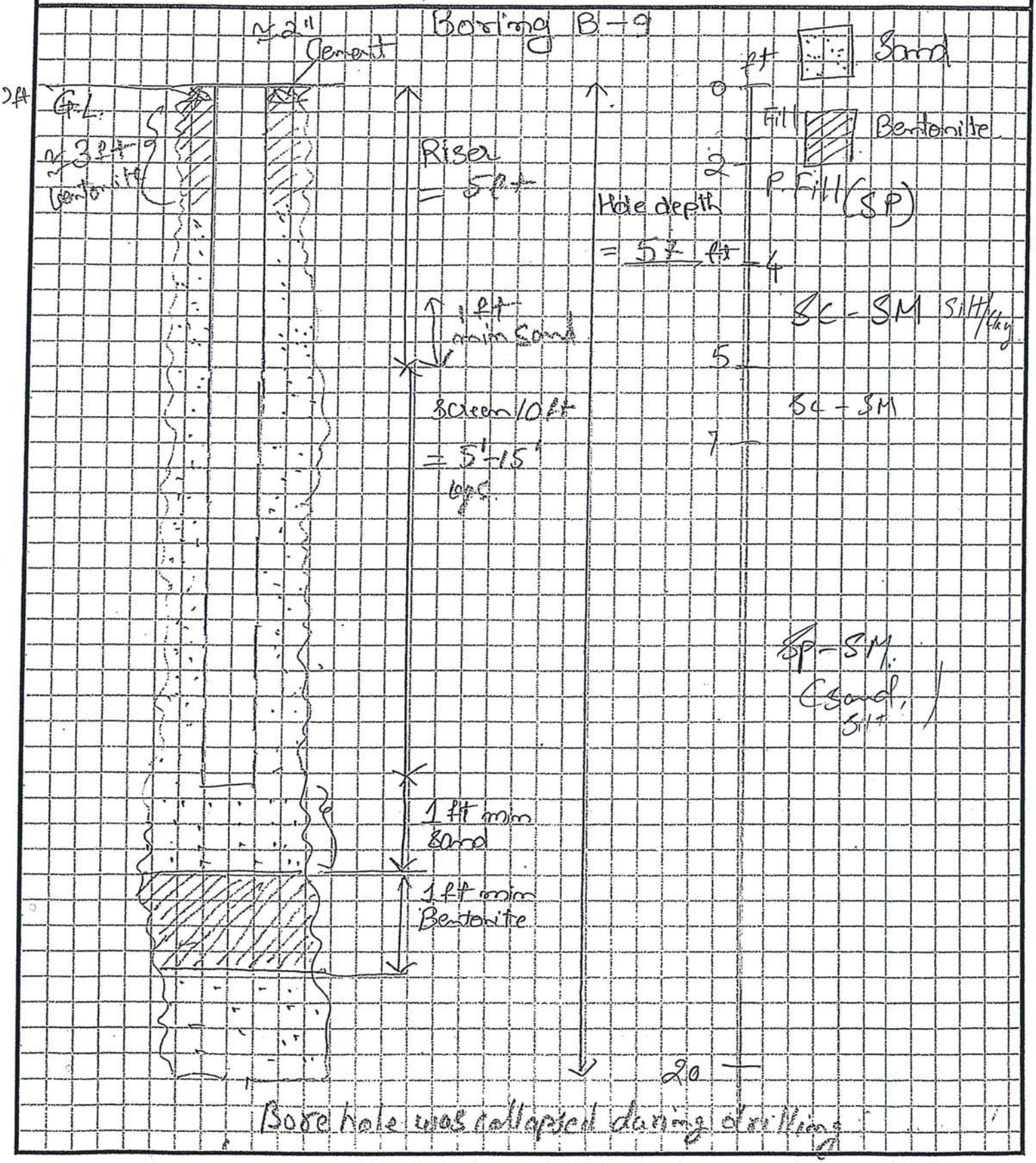


OWEIS ENGINEERING COMPUTATIONS

PROJECT NAME: NJT Morris & Essex | CALCULATED BY: R.S. | DATE:

PROJECT NUMBER: 17-NJ120-01 | CHECKED BY: | DATE:

SHEET: ___ OF ___ | SCALE: Not to Scale.



Oweis Engineering Inc.

WELL GAUGING
FIELD REPORT

DOCUMENT D30011
REV 1 12/18

OEI Project Number: 17-NJ120-01
OEI Project Name: NJT Morris & Essex Transilt line
Client: Parsons

Date: 1/14/2019
OEI Inspector: R.Sirsat & S. Gao
Water Level Meter I.D. No 2

Monitoring Well/ Piezometer ID No.	Time	DTW (feet)	DTB (feet)	TOC Elevation (feet)	Groundwater Elevation (feet)	Remarks
B-3	1:10 PM	7.72	24.10	524.00	516.28	
B-3	2:05 PM	7.72	24.10	524.00	516.28	

Notes:

DTB - Depth to Bottom (of well), measured from TOC at each location.

DTW - Depth to Water, measured from TOC at each location.

TOC - Top of casing (well casing).

bgs. = below ground surface

All elevations are estimated based on contours provided on boring location plan.

Oweis Engineering Inc.

WELL GAUGING
FIELD REPORT

DOCUMENT D30011
REV 1 12/18

OEI Project Number: 17-NJ120-01
OEI Project Name: NJT Morris & Essex Transilt line
Client: Parsons

Date: 1/9/2019
OEI Inspector: R.Sirsat
Water Level Meter I.D. No 2

Monitoring Well/ Piezometer ID No.	Time	DTW (feet)	DTB (feet)	TOC Elevation (feet)	Groundwater Elevation (feet)	Remarks
B-2	8:30 AM	7.32	13.00	524.00	516.68	
B-2	2:30 PM	7.32	13.00	524.00	516.68	
B-4	8:34 AM	3.16	30.40	520.00	516.84	
B-4	2:20 PM	3.16	30.40	520.00	516.84	
B-6	7:54 AM	13.34	15.00	525.00	511.66	
B-6	2:48 PM	13.35	15.00	525.00	511.65	
B-7	8:00 AM	7.48	21.00	519.00	511.52	
B-7	2:54 PM	7.49	21.00	519.00	511.51	
B-8	8:16 AM	7.38	18.00	522.00	514.62	
B-8	2:43 PM	7.37	18.00	522.00	514.63	
B-9	8:11 AM	9.06	15.00	524.00	514.94	
B-9	2:38 PM	9.06	15.00	524.00	514.94	

Notes:

DTB - Depth to Bottom (of well), measured from TOC at each location.

DTW - Depth to Water, measured from TOC at each location.

TOC - Top of casing (well casing).

bgs. = below ground surface

All elevations are estimated based on contours provided on boring location plan.

Oweis Engineering Inc.

WELL GAUGING
FIELD REPORT

DOCUMENT D30011
REV 1 12/18

OEI Project Number: 17-NJ120-01
OEI Project Name: NJT Morris & Essex Transilt line
Client: Parsons

Date: 1/4/2019
OEI Inspector: R.Sirsat
Water Level Meter I.D. No 2

Monitoring Well/ Piezometer ID No.	Time	DTW (feet)	DTB (feet)	TOC Elevation (feet)	Groundwater Elevation (feet)	Remarks
B-2	7:54 AM	7.14	13.00	524.00	516.86	
B-2	1:56 PM	7.14	13.00	524.00	516.86	
B-4	7:49 AM	3.01	30.40	520.00	516.99	removed 2.4 ft stick-up
B-4	1:49 PM	2.96	30.40	520.00	517.04	removed 2.4 ft stick-up
B-6	7:35 AM	13.26	15.00	525.00	511.74	
B-6	2:21 PM	13.26	15.00	525.00	511.74	
B-8	7:42 AM	7.04	18.00	522.00	514.96	removed 3.2 ft stick-up
B-8	2:09 PM	7.06	18.00	522.00	514.94	removed 3.2 ft stick-up

Notes:

DTB - Depth to Bottom (of well), measured from TOC at each location.

DTW - Depth to Water, measured from TOC at each location.

TOC - Top of casing (well casing).

bgs. = below ground surface

All elevations are estimated based on contours provided on boring location plan.

Oweis Engineering Inc.

WELL GAUGING
FIELD REPORT

DOCUMENT D30011
REV 1 12/18

OEI Project Number: 17-NJ120-01
OEI Project Name: NJT Morris & Essex Transilt line
Client: Parsons

Date: 1/2/2019
OEI Inspector: R.Sirsat
Water Level Meter I.D. No 2

Monitoring Well/ Piezometer ID No.	Time	DTW (feet)	DTB (feet)	TOC Elevation (feet)	Groundwater Elevation (feet)	Remarks
B-2	2:31 PM	5.20	13.00	524.00	518.80	
B-4	7:55 AM	2.97	30.40	520.00	517.03	removed 2.4 ft stick-up
B-4	2:37 PM	2.94	30.40	520.00	517.06	removed 2.4 ft stick-up
B-6	7:35 AM	13.18	15.00	525.00	511.82	
B-6	2:52 PM	13.18	15.00	525.00	511.82	
B-8	7:45 AM	7.01	18.00	522.00	514.99	removed 3.2 ft stick-up
B-8	2:43 PM	7.03	18.00	522.00	514.97	removed 3.2 ft stick-up

Notes:

DTB - Depth to Bottom (of well), measured from TOC at each location.

DTW - Depth to Water, measured from TOC at each location.

TOC - Top of casing (well casing).

bgs. = below ground surface

All elevations are estimated based on contours provided on boring location plan.

Oweis Engineering Inc.

WELL GAUGING
FIELD REPORT

DOCUMENT D30011
REV 1 12/18

OEI Project Number: 17-NJ120-01
OEI Project Name: NJT Morris & Essex Transilt line
Client: Parsons

Date: 12/28/2018
OEI Inspector: R.Sirsat & S. Gao
Water Level Meter I.D. No 2

Monitoring Well/ Piezometer ID No.	Time	DTW (feet)	DTB (feet)	TOC Elevation (feet)	Groundwater Elevation (feet)	Remarks
B-4	8:14 AM	3.00	30.40	520.00	517.00	removed 2.4 ft stick-up of B-4. Rain
B-6	7:50 AM	13.25	15.00	525.00	511.75	Rain
B-8	8:30 AM	7.06	18.00	522.00	514.94	removed 3.2 ft stick-up of B-8. Rain
B-8	9:40 AM	6.93	18.00	522.00	515.07	removed 3.2 ft stick-up of B-8. Rain

Notes:

DTB - Depth to Bottom (of well), measured from TOC at each location.

DTW - Depth to Water, measured from TOC at each location.

TOC - Top of casing (well casing).

bgs. = below ground surface

All elevations are estimated based on contours provided on boring location plan.

Oweis Engineering Inc.

WELL GAUGING
FIELD REPORT

DOCUMENT D30011
REV 1 12/18

OEI Project Number: 17-NJ120-01
OEI Project Name: NJT Morris & Essex Transilt line
Client: Parsons

Date: 12/27/2018
OEI Inspector: R.Sirsat
Water Level Meter I.D. No 2

Monitoring Well/ Piezometer ID No.	Time	DTW (feet)	DTB (feet)	TOC Elevation (feet)	Groundwater Elevation (feet)	Remarks
B-4	7:40 AM	3.12	30.40	520.00	516.88	removed 2.4 ft stick-up of B-4
B-4	1:54 PM	3.14	30.40	520.00	516.86	removed 2.4 ft stick-up of B-4
B-6	8:10 AM	13.27	15.00	525.00	511.73	
B-6	1:47 PM	13.29	15.00	525.00	511.71	

Notes:

DTB - Depth to Bottom (of well), measured from TOC at each location.

DTW - Depth to Water, measured from TOC at each location.

TOC - Top of casing (well casing).

bgs. = below ground surface

All elevations are estimated based on contours provided on boring location plan.

Oweis Engineering Inc.

WELL GAUGING
FIELD REPORT

DOCUMENT D30011
REV 1 12/18

OEI Project Number: 17-NJ120-01
OEI Project Name: NJT Morris & Essex Transilt line
Client: Parsons

Date: 12/20/2018
OEI Inspector: R.Sirsat
Water Level Meter I.D. No 2

Monitoring Well/ Piezometer ID No.	Time	DTW (feet)	DTB (feet)	TOC Elevation (feet)	Groundwater Elevation (feet)	Remarks
B-2	8:05 AM	7.29	13.00	524.00	516.71	
B-4	7:48 AM	3.40	30.40	520.00	516.60	removed 2.4 ft stick-up of B-4
B-4	2:00 PM	3.39	30.40	520.00	516.61	removed 2.4 ft stick-up of B-4
B-4	2:30 PM	3.39	30.40	520.00	516.61	removed 2.4 ft stick-up of B-4
B-6	8:35 AM	13.47	15.00	525.00	511.53	
B-6	1:40 PM	13.47	15.00	525.00	511.53	

Notes:

DTB - Depth to Bottom (of well), measured from TOC at each location.

DTW - Depth to Water, measured from TOC at each location.

TOC - Top of casing (well casing).

bgs. = below ground surface

All elevations are estimated based on contours provided on boring location plan.

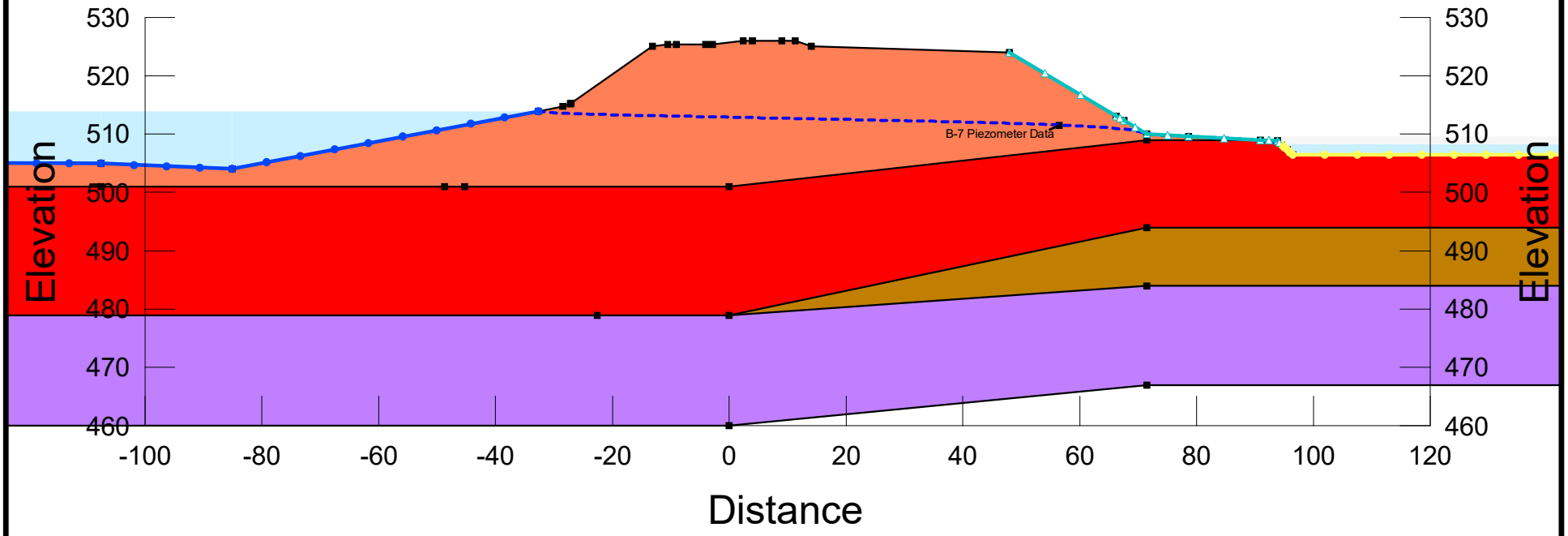
Appendix S-5

Analyses Results

STA 1823+83.40

Figure A

Color	Name	Model	Sat Kx (ft/d)	Ky'/Kx' Ratio	Rotation (°)	Volumetric Water Content	Compressibility (/psf)
	Layer 1: FILL	Saturated Only	66.6856	1	0	0.24	0
	Layer 2: CL, ML, CL-ML (long term)	Saturated Only	1.512	0.25	0	0.4	0
	Layer 6: GP, GP-GM, SP	Saturated Only	4.1083	1	0	0.17	0
	Layer 7: SP-SM, SM, SC-SM	Saturated Only	4.1083	1	0	0.26	0



Prepared by:

HDR

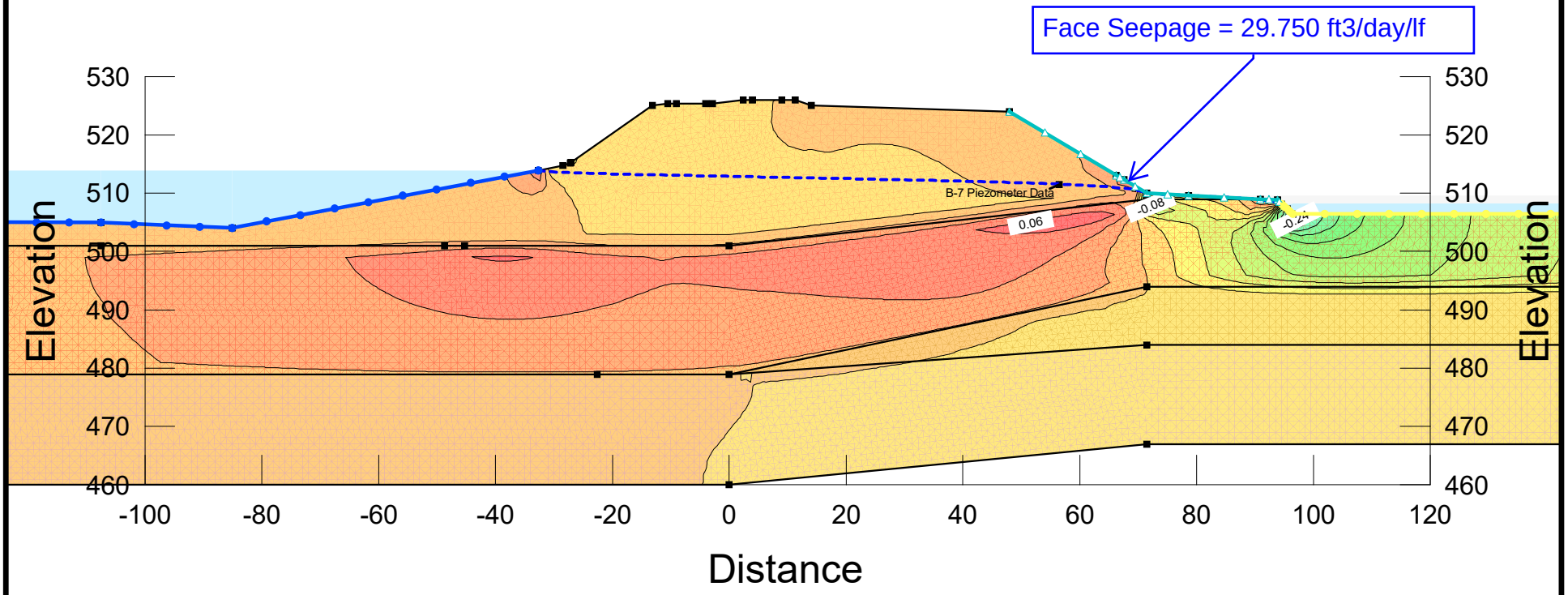
Seepage Analyses

File Name: STA 1823+83.40.gsz
Name: Normal Pool
Method: Steady-State

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure B

Color	Name	Model	Sat Kx (ft/d)	Ky'/Kx' Ratio	Rotation (°)	Volumetric Water Content	Compressibility (/psf)
	Layer 1: FILL	Saturated Only	66.6856	1	0	0.24	0
	Layer 2: CL, ML, CL-ML (long term)	Saturated Only	1.512	0.25	0	0.4	0
	Layer 6: GP, GP-GM, SP	Saturated Only	4.1083	1	0	0.17	0
	Layer 7: SP-SM, SM, SC-SM	Saturated Only	4.1083	1	0	0.26	0



Prepared by:

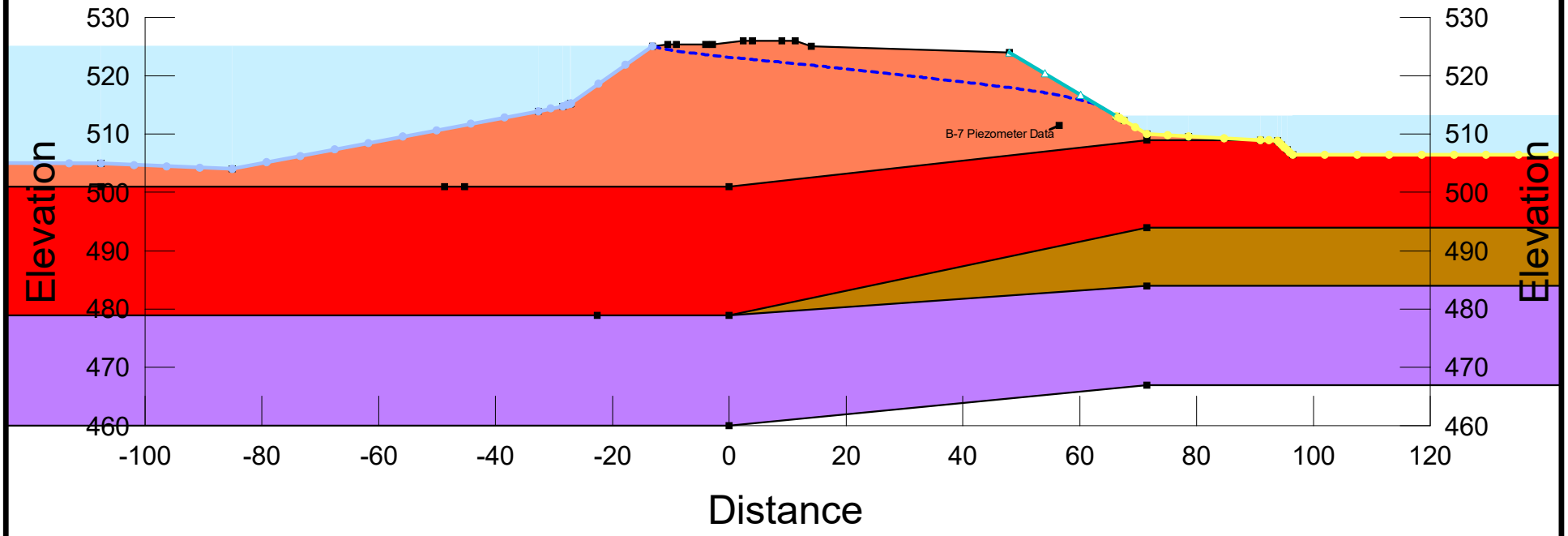
Seepage Analyses

File Name: STA 1823+83.40.gsz
Name: Normal Pool
Method: Steady-State

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure C

Color	Name	Model	Sat Kx (ft/d)	Ky'/Kx' Ratio	Rotation (°)	Volumetric Water Content	Compressibility (/psf)
	Layer 1: FILL	Saturated Only	66.6856	1	0	0.24	0
	Layer 2: CL, ML, CL-ML (long term)	Saturated Only	1.512	0.25	0	0.4	0
	Layer 6: GP, GP-GM, SP	Saturated Only	4.1083	1	0	0.17	0
	Layer 7: SP-SM, SM, SC-SM	Saturated Only	4.1083	1	0	0.26	0



Prepared by:

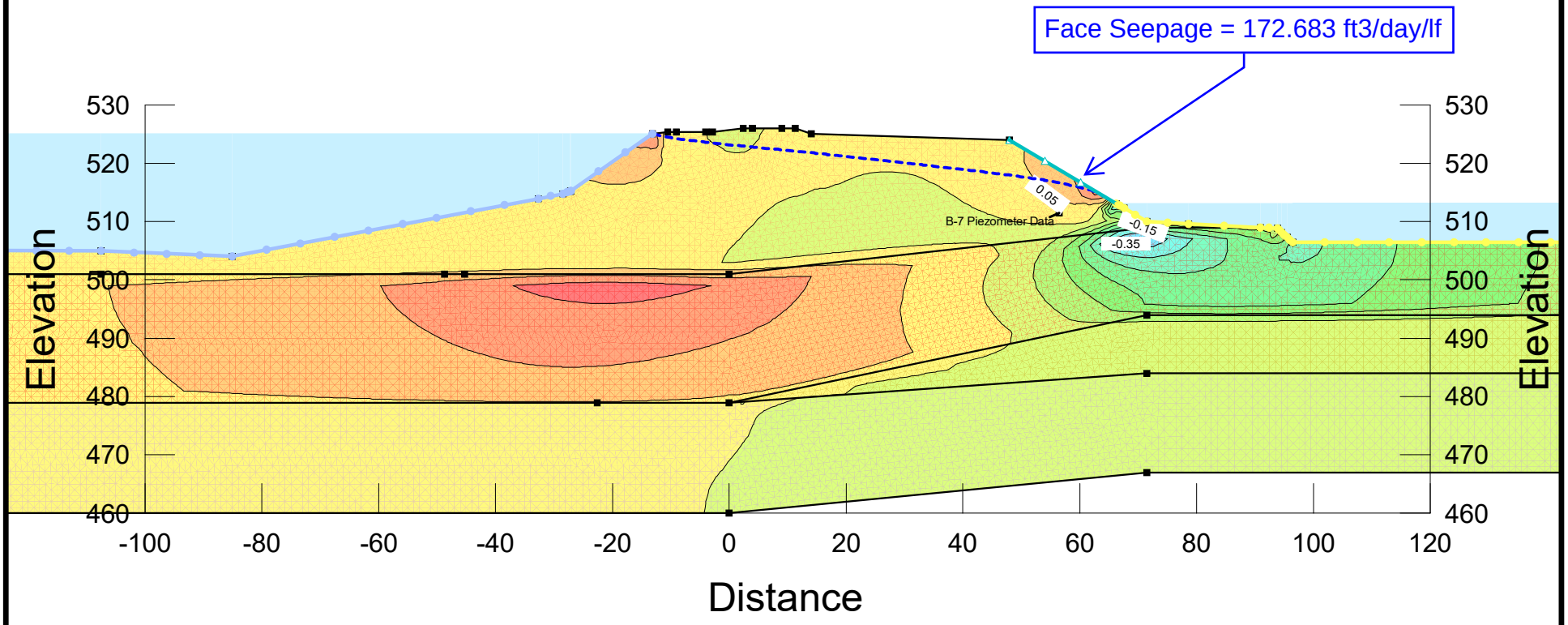
Seepage Analyses

File Name: STA 1823+83.40.gsz
Name: 0.5 PMF
Method: Transient

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure D

Color	Name	Model	Sat Kx (ft/d)	Ky'/Kx' Ratio	Rotation (°)	Volumetric Water Content	Compressibility (/psf)
	Layer 1: FILL	Saturated Only	66.6856	1	0	0.24	0
	Layer 2: CL, ML, CL-ML (long term)	Saturated Only	1.512	0.25	0	0.4	0
	Layer 6: GP, GP-GM, SP	Saturated Only	4.1083	1	0	0.17	0
	Layer 7: SP-SM, SM, SC-SM	Saturated Only	4.1083	1	0	0.26	0



Prepared by:

Seepage Analyses

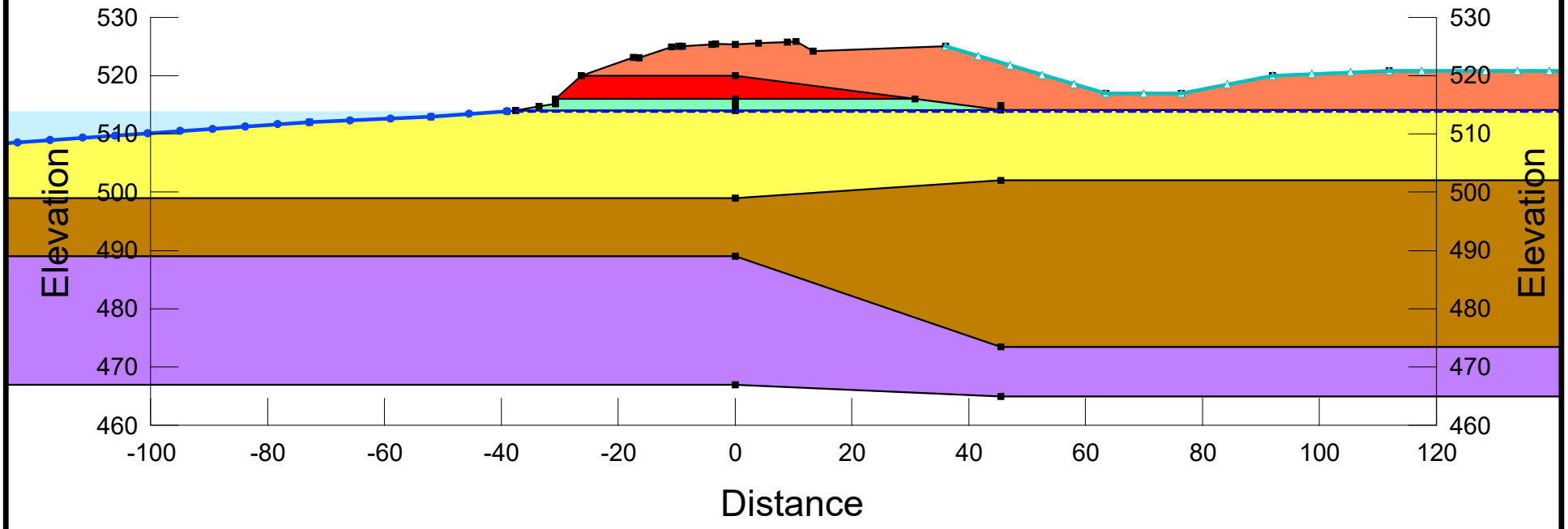
File Name: STA 1823+83.40.gsz
Name: 0.5 PMF
Method: Transient

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

STA 1830+76.69

Figure E

Color	Name	Model	Sat Kx (ft/d)	Ky'/Kx' Ratio	Rotation (°)	Volumetric Water Content	Compressibility (/psf)
	Layer 1: FILL	Saturated Only	66.6856	1	0	0.24	0
	Layer 2: CL, ML, CL-ML (long term)	Saturated Only	1.512	0.25	0	0.4	0
	Layer 4: SM, SC	Saturated Only	0.6905	1	0	0.23	0
	Layer 5: SM	Saturated Only	4.1083	1	0	0.31	0
	Layer 6: GP, GP-GM, SP	Saturated Only	4.1083	1	0	0.17	0
	Layer 7: SP-SM, SM, SC-SM	Saturated Only	4.1083	1	0	0.26	0



Prepared by:

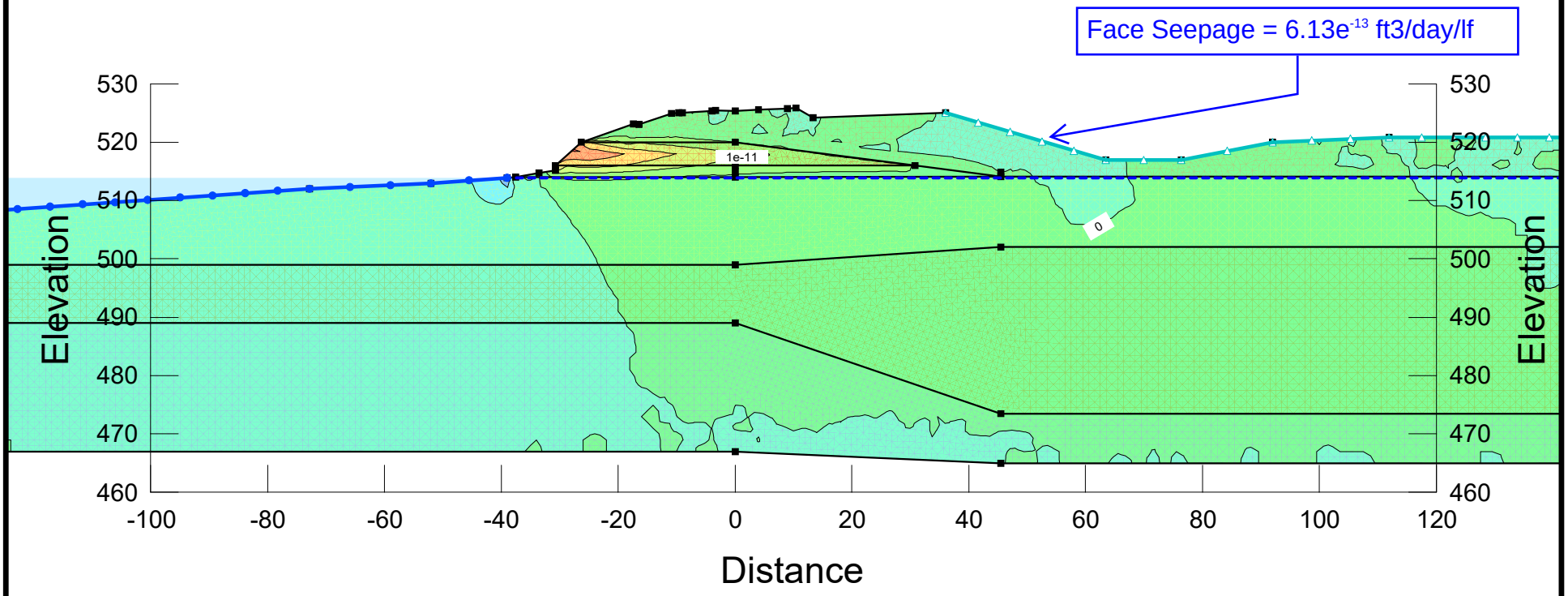
Seepage Analyses

File Name: STA 1830+76.69.gsz
Name: Normal Pool
Method: Steady-State

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure F

Color	Name	Model	Sat Kx (ft/d)	Ky'/Kx' Ratio	Rotation (°)	Volumetric Water Content	Compressibility (/psf)
	Layer 1: FILL	Saturated Only	66.6856	1	0	0.24	0
	Layer 2: CL, ML, CL-ML (long term)	Saturated Only	1.512	0.25	0	0.4	0
	Layer 4: SM, SC	Saturated Only	0.6905	1	0	0.23	0
	Layer 5: SM	Saturated Only	4.1083	1	0	0.31	0
	Layer 6: GP, GP-GM, SP	Saturated Only	4.1083	1	0	0.17	0
	Layer 7: SP-SM, SM, SC-SM	Saturated Only	4.1083	1	0	0.26	0



Prepared by:

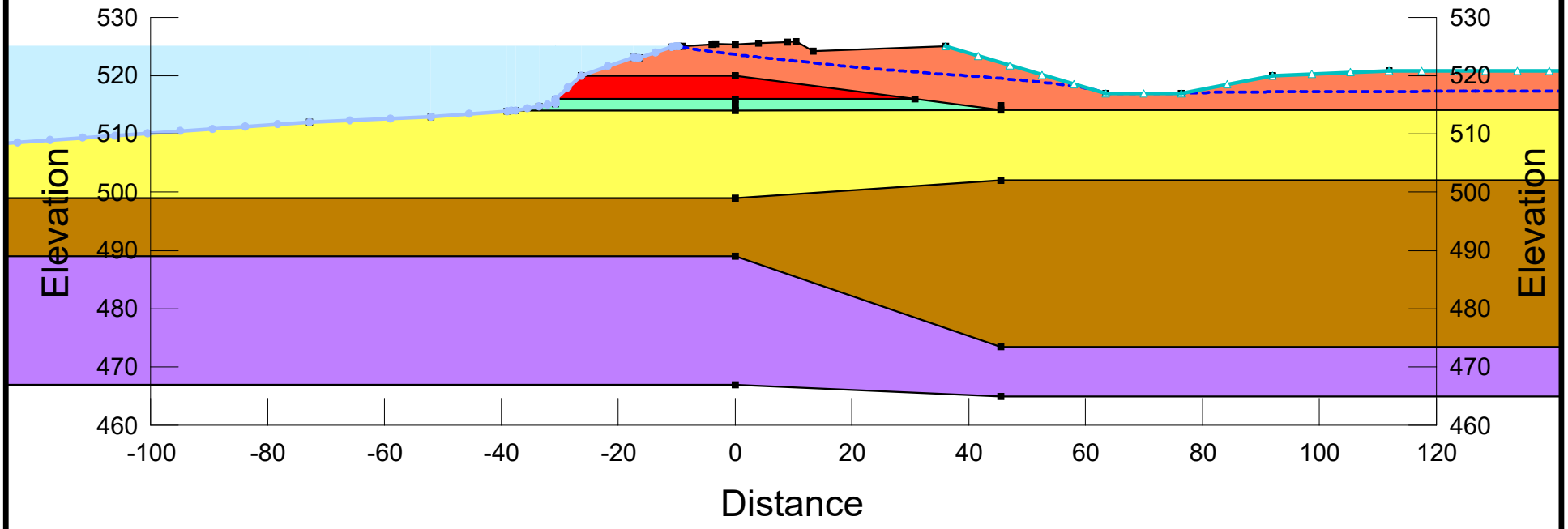
Seepage Analyses

File Name: STA 1830+76.69.gsz
Name: Normal Pool
Method: Steady-State

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure G

Color	Name	Model	Sat Kx (ft/d)	Ky'/Kx' Ratio	Rotation (°)	Volumetric Water Content	Compressibility (/psf)
	Layer 1: FILL	Saturated Only	66.6856	1	0	0.24	0
	Layer 2: CL, ML, CL-ML (long term)	Saturated Only	1.512	0.25	0	0.4	0
	Layer 4: SM, SC	Saturated Only	0.6905	1	0	0.23	0
	Layer 5: SM	Saturated Only	4.1083	1	0	0.31	0
	Layer 6: GP, GP-GM, SP	Saturated Only	4.1083	1	0	0.17	0
	Layer 7: SP-SM, SM, SC-SM	Saturated Only	4.1083	1	0	0.26	0



Prepared by:

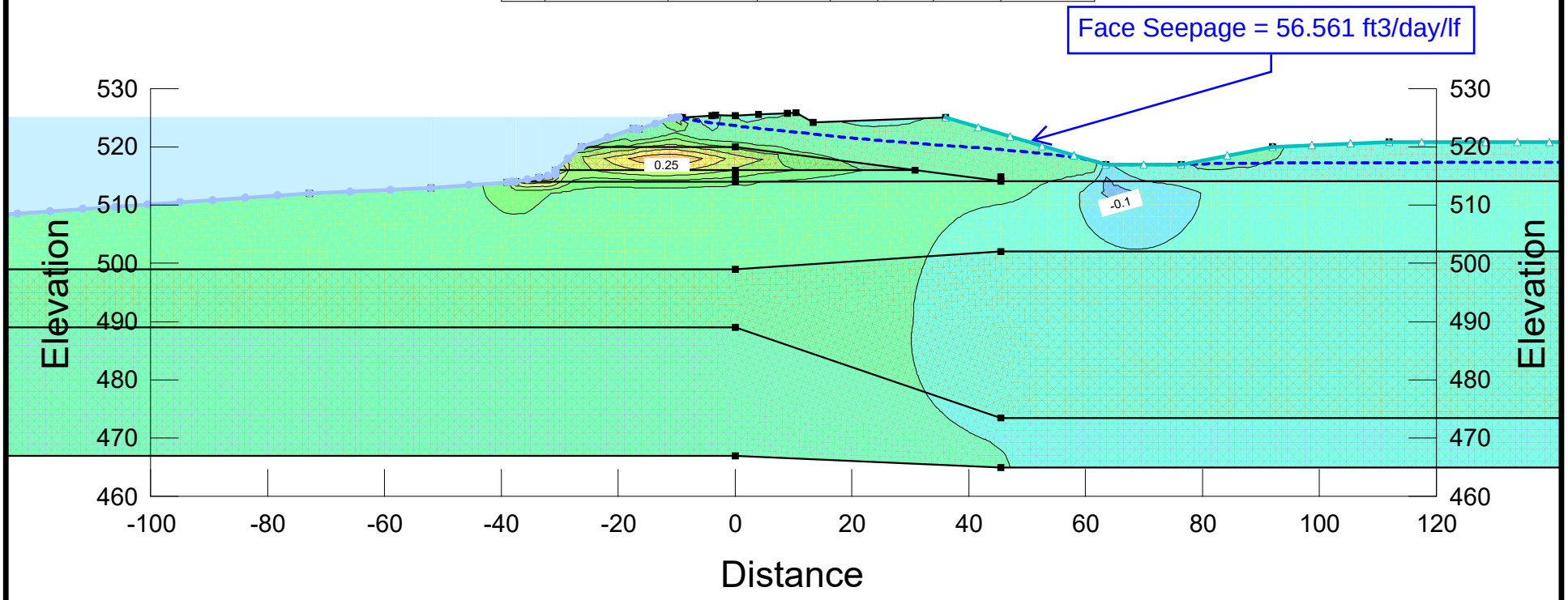
Seepage Analyses

File Name: STA 1830+76.69.gsz
Name: 0.5 PMF
Method: Transient

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure H

Color	Name	Model	Sat Kx (ft/d)	Ky'/Kx' Ratio	Rotation (°)	Volumetric Water Content	Compressibility (/psf)
	Layer 1: FILL	Saturated Only	66.6856	1	0	0.24	0
	Layer 2: CL, ML, CL-ML (long term)	Saturated Only	1.512	0.25	0	0.4	0
	Layer 4: SM, SC	Saturated Only	0.6905	1	0	0.23	0
	Layer 5: SM	Saturated Only	4.1083	1	0	0.31	0
	Layer 6: GP, GP-GM, SP	Saturated Only	4.1083	1	0	0.17	0
	Layer 7: SP-SM, SM, SC-SM	Saturated Only	4.1083	1	0	0.26	0



Prepared by:

Seepage Analyses

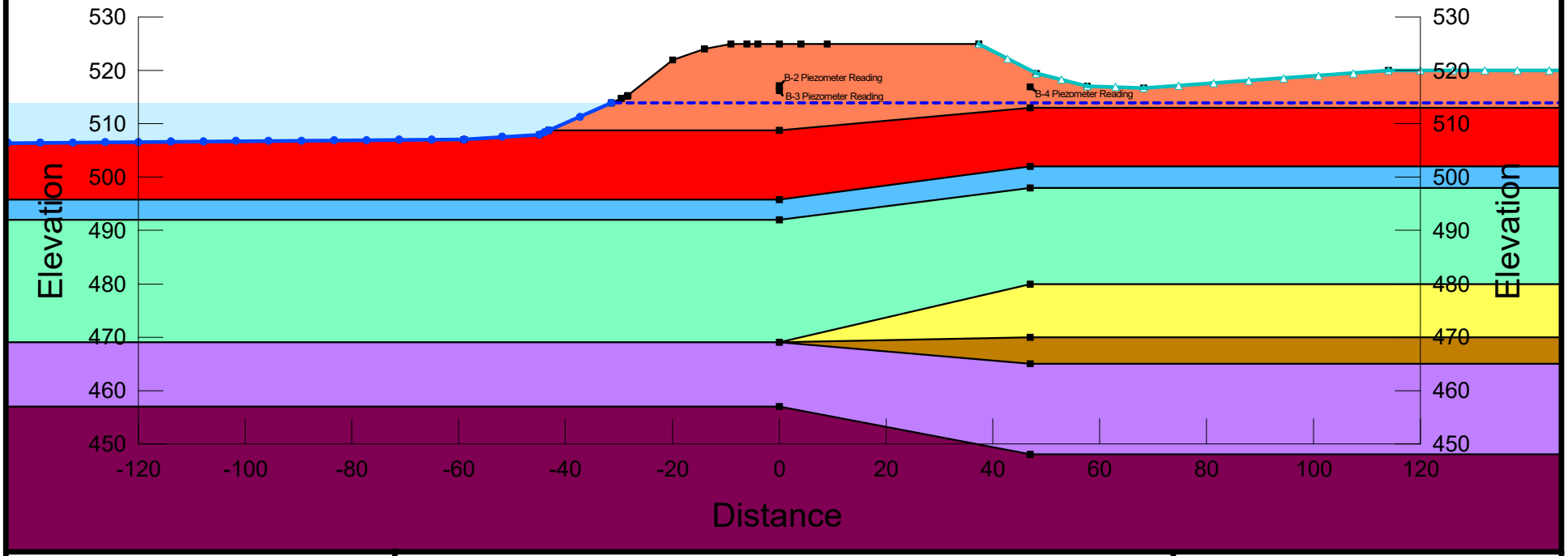
File Name: STA 1830+76.69.gsz
Name: 0.5 PMF
Method: Transient

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

STA 1836+71.40

Figure I

Color	Name	Model	Sat Kx (ft/d)	Ky'/Kx' Ratio	Rotation (°)	Volumetric Water Content	Compressibility (/psf)
	Layer 1: FILL	Saturated Only	66.6856	1	0	0.24	0
	Layer 2: CL, ML, CL-ML (long term)	Saturated Only	1.512	0.25	0	0.4	0
	Layer 3: SM	Saturated Only	4.1083	1	0	0.2	0
	Layer 4: SM, SC	Saturated Only	0.6905	1	0	0.23	0
	Layer 5: SM	Saturated Only	4.1083	1	0	0.31	0
	Layer 6: GP, GP-GM, SP	Saturated Only	4.1083	1	0	0.17	0
	Layer 7: SP-SM, SM, SC-SM	Saturated Only	4.1083	1	0	0.26	0
	Layer 9: SC, CL (long term)	Saturated Only	0.0227	0.25	0	0.28	0



Prepared by:

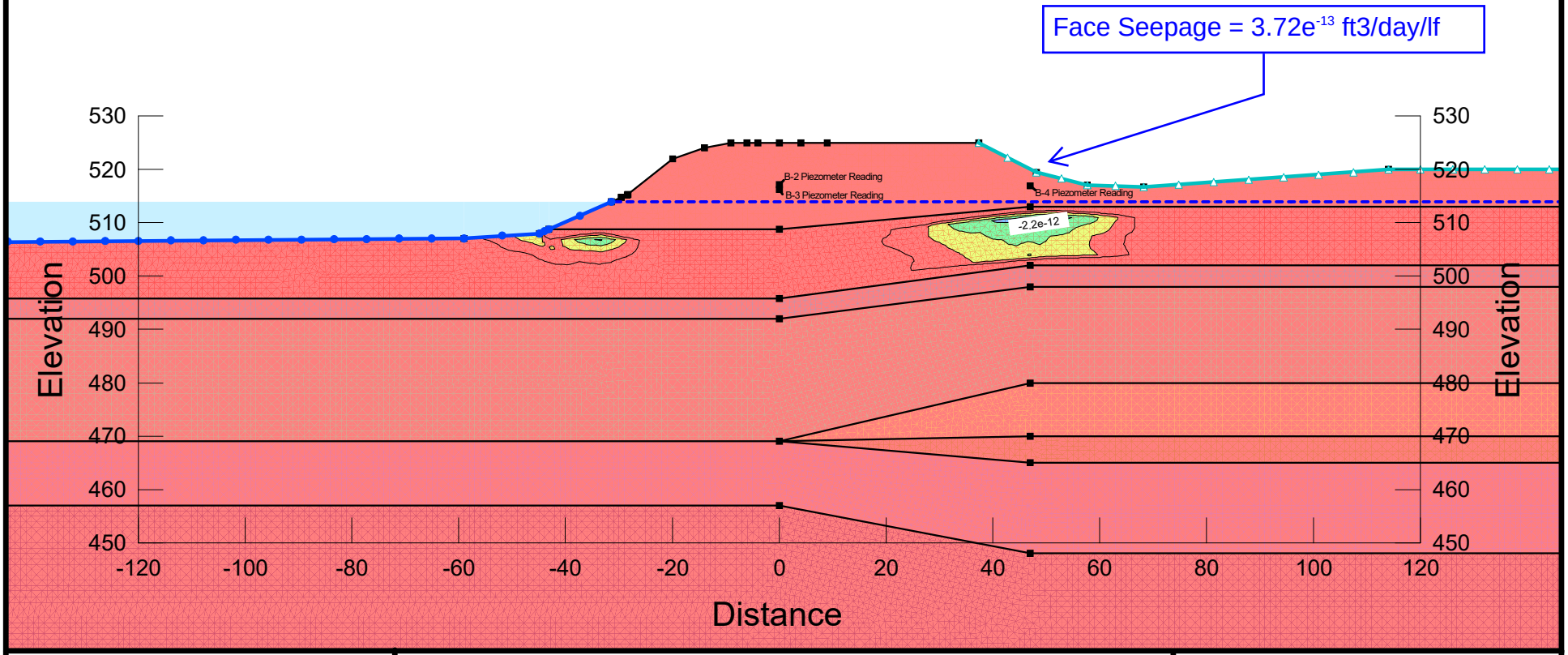
Seepage Analyses

File Name: STA 1836+71.40.gsz
Name: Normal Pool
Method: Steady-State

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure J

Color	Name	Model	Sat Kx (ft/d)	Ky'/Kx' Ratio	Rotation (°)	Volumetric Water Content	Compressibility (/psf)
	Layer 1: FILL	Saturated Only	66.6856	1	0	0.24	0
	Layer 2: CL, ML, CL-ML (long term)	Saturated Only	1.512	0.25	0	0.4	0
	Layer 3: SM	Saturated Only	4.1083	1	0	0.2	0
	Layer 4: SM, SC	Saturated Only	0.6905	1	0	0.23	0
	Layer 5: SM	Saturated Only	4.1083	1	0	0.31	0
	Layer 6: GP, GP-GM, SP	Saturated Only	4.1083	1	0	0.17	0
	Layer 7: SP-SM, SM, SC-SM	Saturated Only	4.1083	1	0	0.26	0
	Layer 9: SC, CL (long term)	Saturated Only	0.0227	0.25	0	0.28	0



Prepared by:

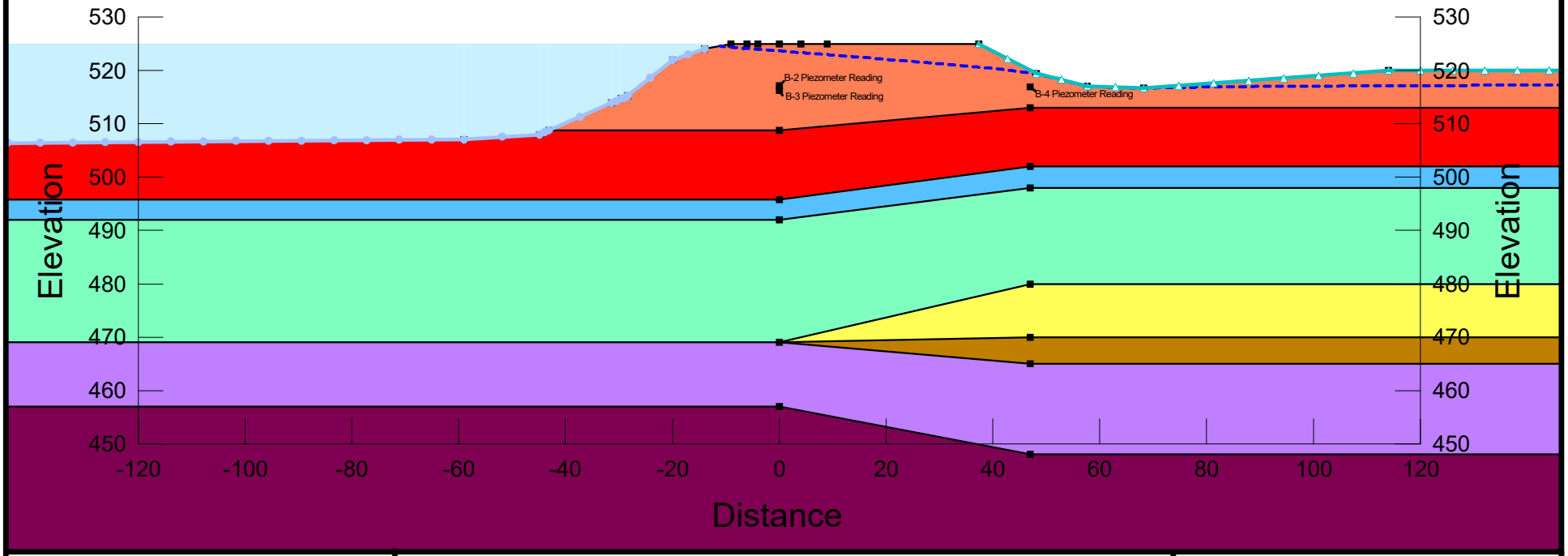
Seepage Analyses

File Name: STA 1836+71.40.gsz
Name: Normal Pool
Method: Steady-State

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure K

Color	Name	Model	Sat Kx (ft/d)	Ky'/Kx' Ratio	Rotation (°)	Volumetric Water Content	Compressibility (/psf)
	Layer 1: FILL	Saturated Only	66.6856	1	0	0.24	0
	Layer 2: CL, ML, CL-ML (long term)	Saturated Only	1.512	0.25	0	0.4	0
	Layer 3: SM	Saturated Only	4.1083	1	0	0.2	0
	Layer 4: SM, SC	Saturated Only	0.6905	1	0	0.23	0
	Layer 5: SM	Saturated Only	4.1083	1	0	0.31	0
	Layer 6: GP, GP-GM, SP	Saturated Only	4.1083	1	0	0.17	0
	Layer 7: SP-SM, SM, SC-SM	Saturated Only	4.1083	1	0	0.26	0
	Layer 9: SC, CL (long term)	Saturated Only	0.0227	0.25	0	0.28	0



Prepared by:

HDR

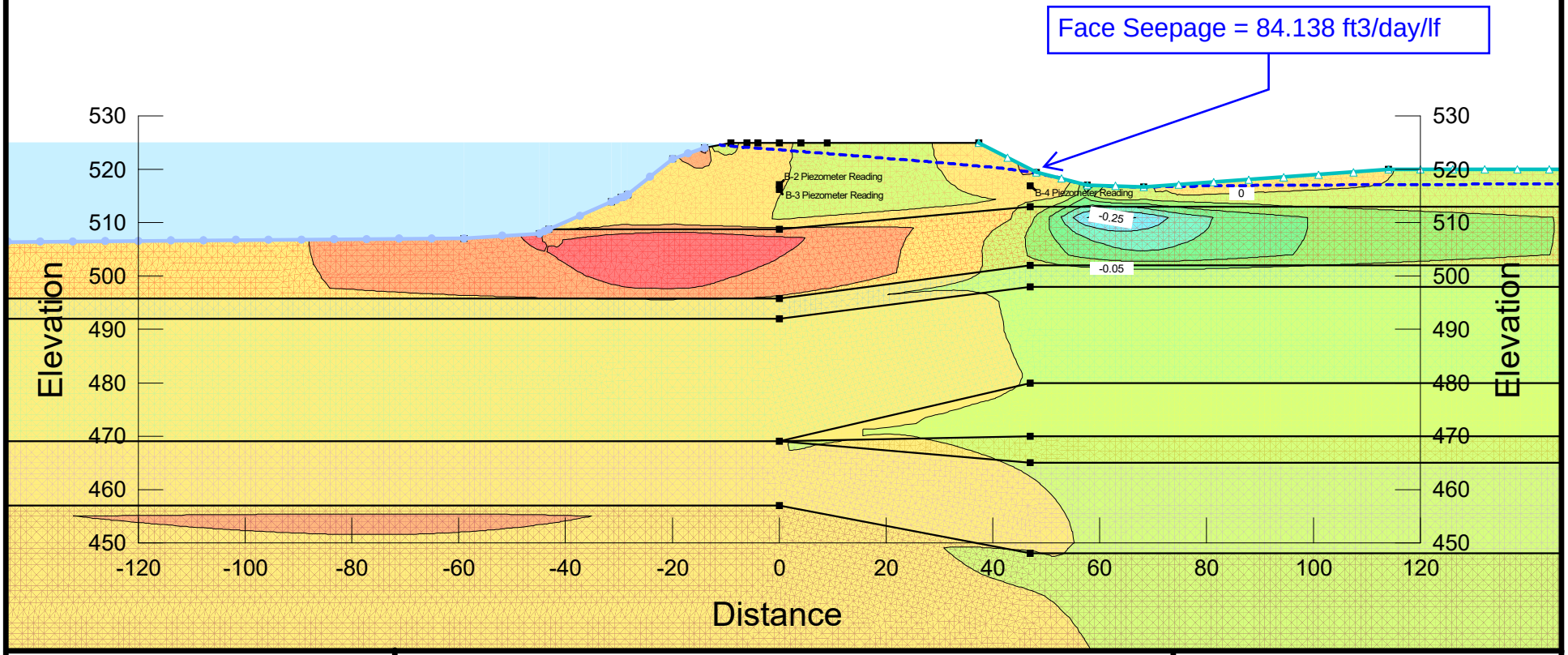
Seepage Analyses

File Name: STA 1836+71.40.gsz
Name: 0.5 PMF
Method: Transient

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure L

Color	Name	Model	Sat Kx (ft/d)	Ky'/Kx' Ratio	Rotation (°)	Volumetric Water Content	Compressibility (/psf)
	Layer 1: FILL	Saturated Only	66.6856	1	0	0.24	0
	Layer 2: CL, ML, CL-ML (long term)	Saturated Only	1.512	0.25	0	0.4	0
	Layer 3: SM	Saturated Only	4.1083	1	0	0.2	0
	Layer 4: SM, SC	Saturated Only	0.6905	1	0	0.23	0
	Layer 5: SM	Saturated Only	4.1083	1	0	0.31	0
	Layer 6: GP, GP-GM, SP	Saturated Only	4.1083	1	0	0.17	0
	Layer 7: SP-SM, SM, SC-SM	Saturated Only	4.1083	1	0	0.26	0
	Layer 9: SC, CL (long term)	Saturated Only	0.0227	0.25	0	0.28	0



Prepared by:

Seepage Analyses

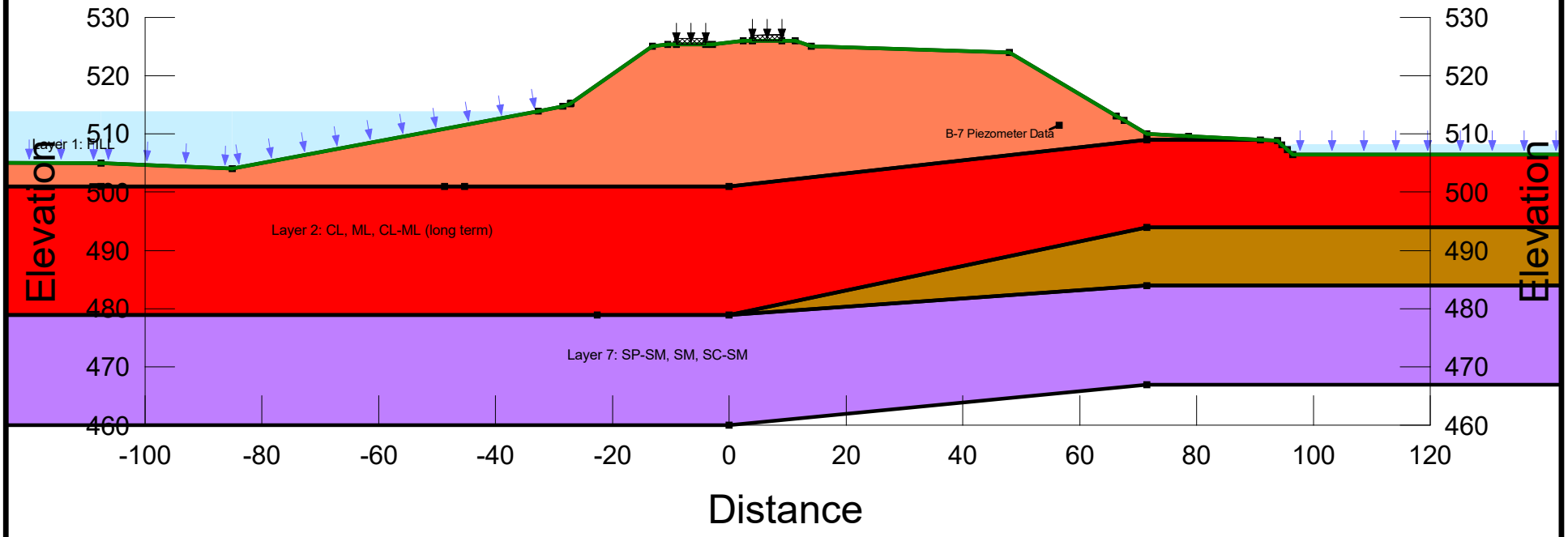
File Name: STA 1836+71.40.gsz
Name: 0.5 PMF
Method: Transient

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

STA 1823+83.40

Figure M

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0



Prepared by:

HDR

Slope Stability

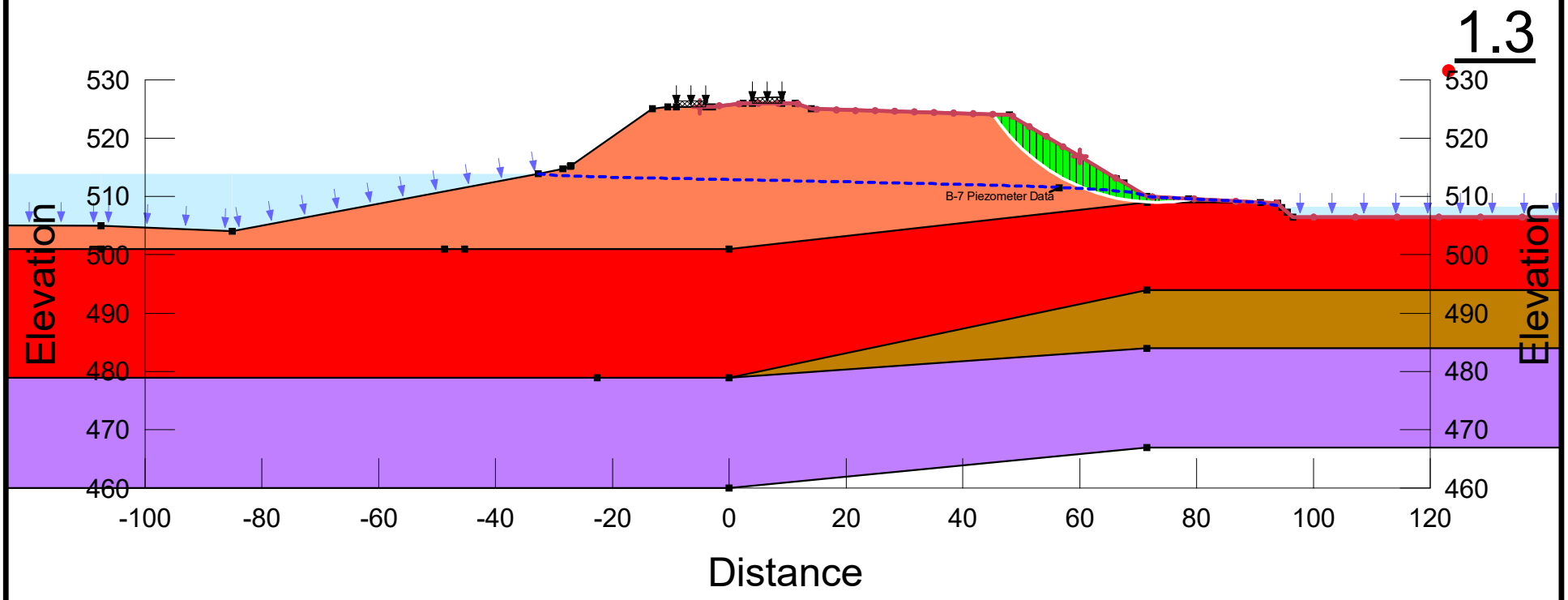
File Name: STA 1823+83.40.gsz
Name: Model Geometry
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure N

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0

Radius: 33.697993 ft
Center: (73.264281, 542.69618) ft



Prepared by:

Slope Stability

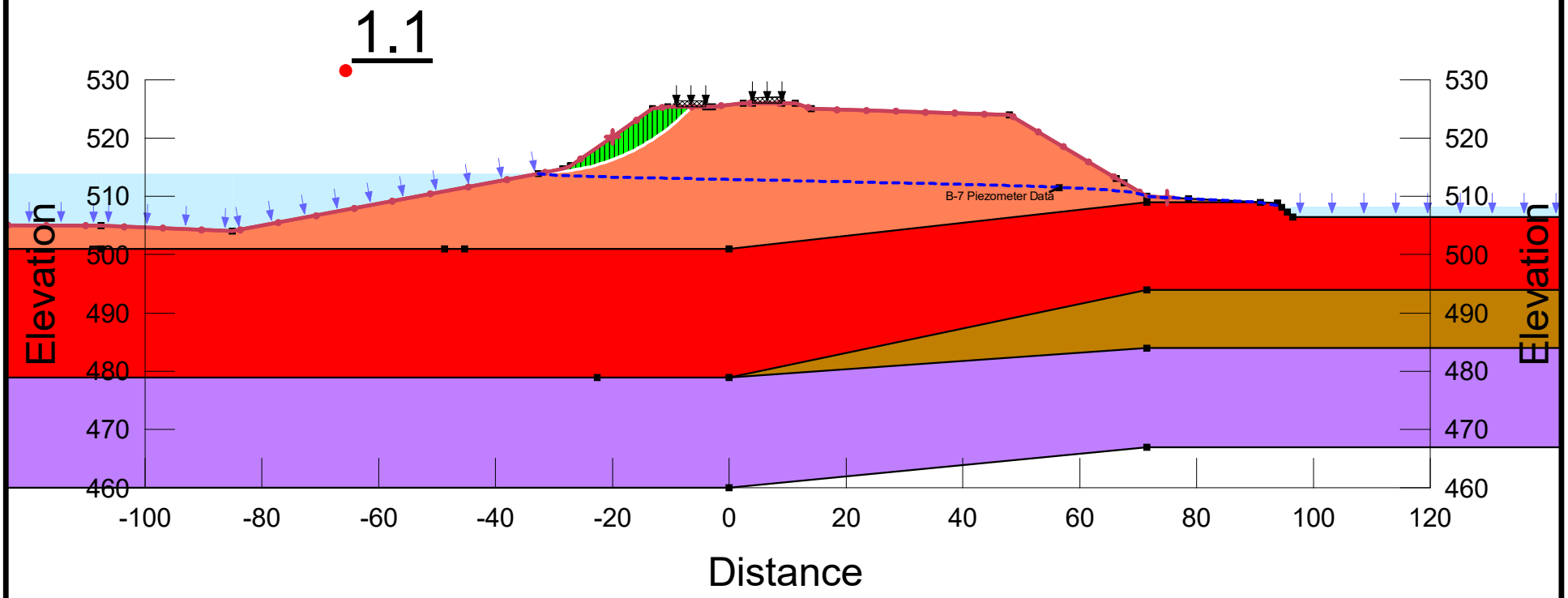
File Name: STA 1823+83.40.gsz
Name: LTSS DS
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure O

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0

Radius: 34.659455 ft
Center: (-32.031533, 548.77626) ft



Prepared by:

Slope Stability

File Name: STA 1823+83.40.gsz
Name: LTSS US
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

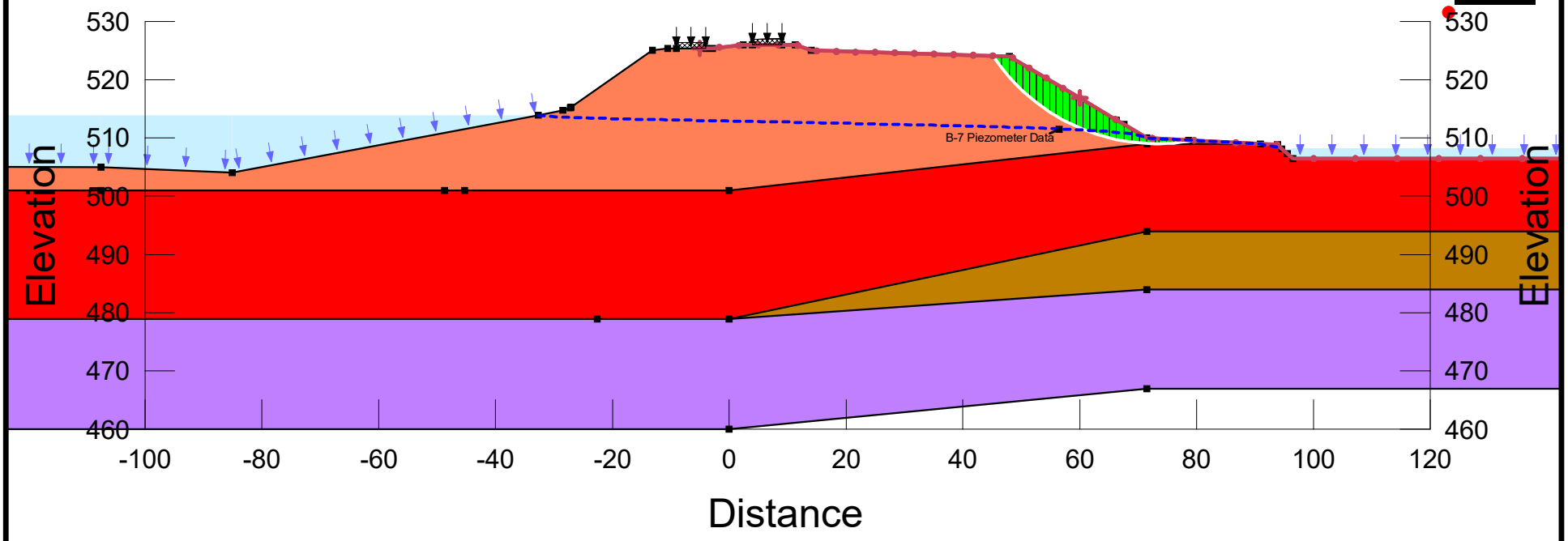
Figure P

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (short term)	Mohr-Coulomb	128	2,100	0	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0

Radius: 33.697993 ft
Center: (73.264281, 542.69618) ft

Horizontal Acceleration = 0.16g

0.9



Prepared by:

HDR

Slope Stability

File Name: STA 1823+83.40.gsz
Name: Pseudostatic DS
Method: Spencer

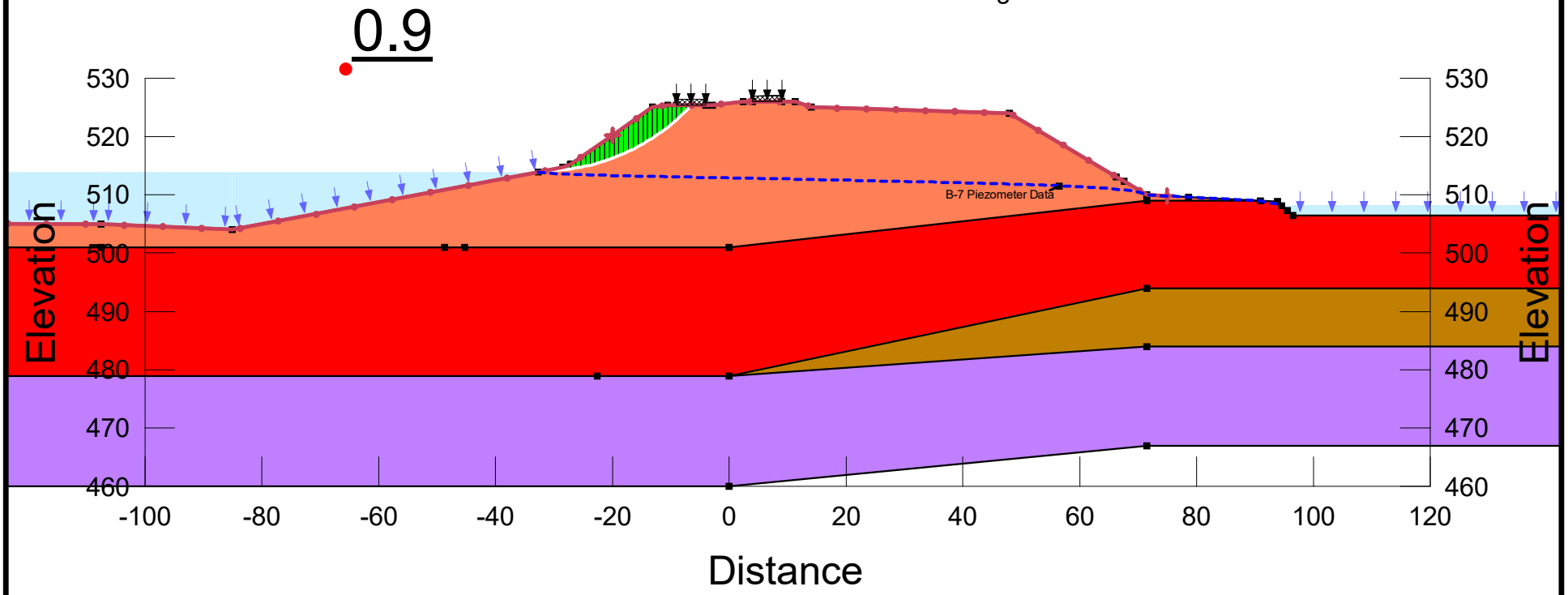
Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure Q

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (short term)	Mohr-Coulomb	128	2,100	0	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0

Radius: 34.659455 ft
Center: (-32.031533, 548.77626) ft

Horizontal Acceleration = 0.16g



Prepared by:

HDR

Slope Stability

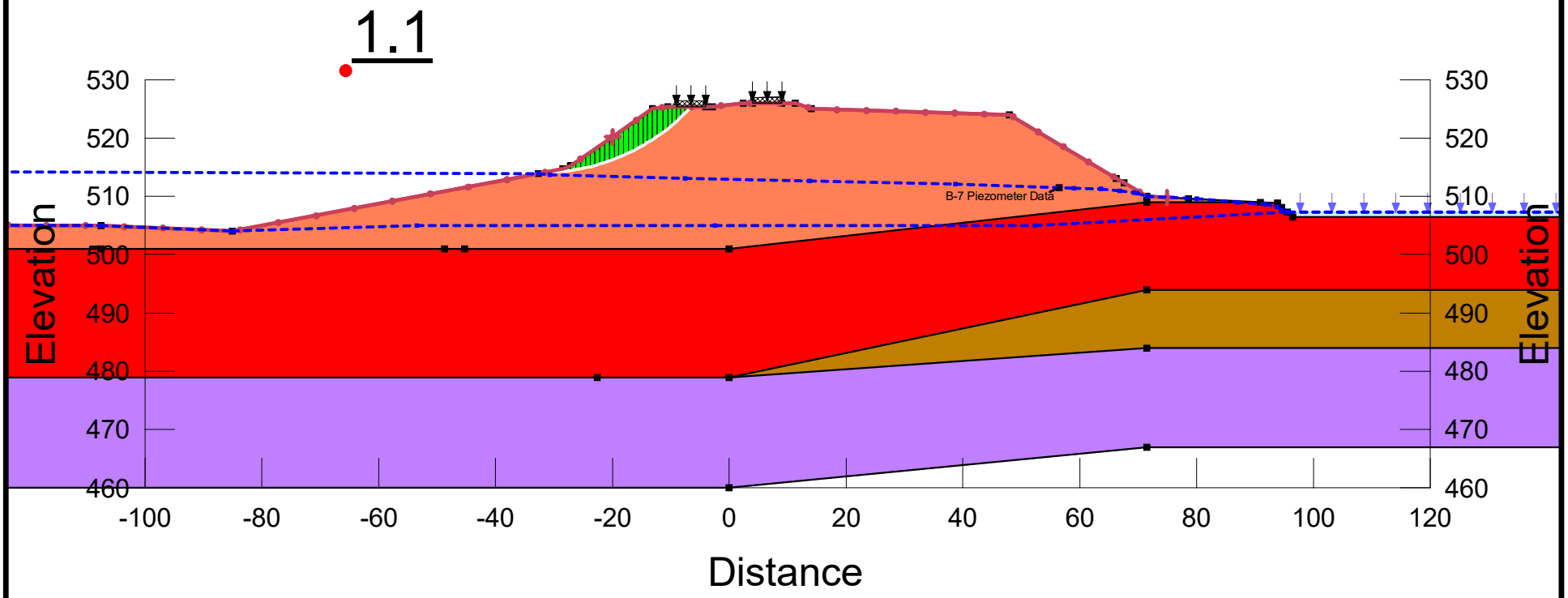
File Name: STA 1823+83.40.gsz
Name: Pseudostatic US
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure R

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)	Cohesion R (psf)	Phi R (°)	Piezometric Line	Piezometric Line After Drawdown
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0	0	33.6	1	2
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0	2,100	0	1	2
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0	0	35	1	2
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0	0	0	1	2

Radius: 34.659455 ft
Center: (-32.031533, 548.77626) ft



Prepared by:

HDR

Slope Stability

File Name: STA 1823+83.40.gsz
Name: Normal Pool RDD
Method: Spencer

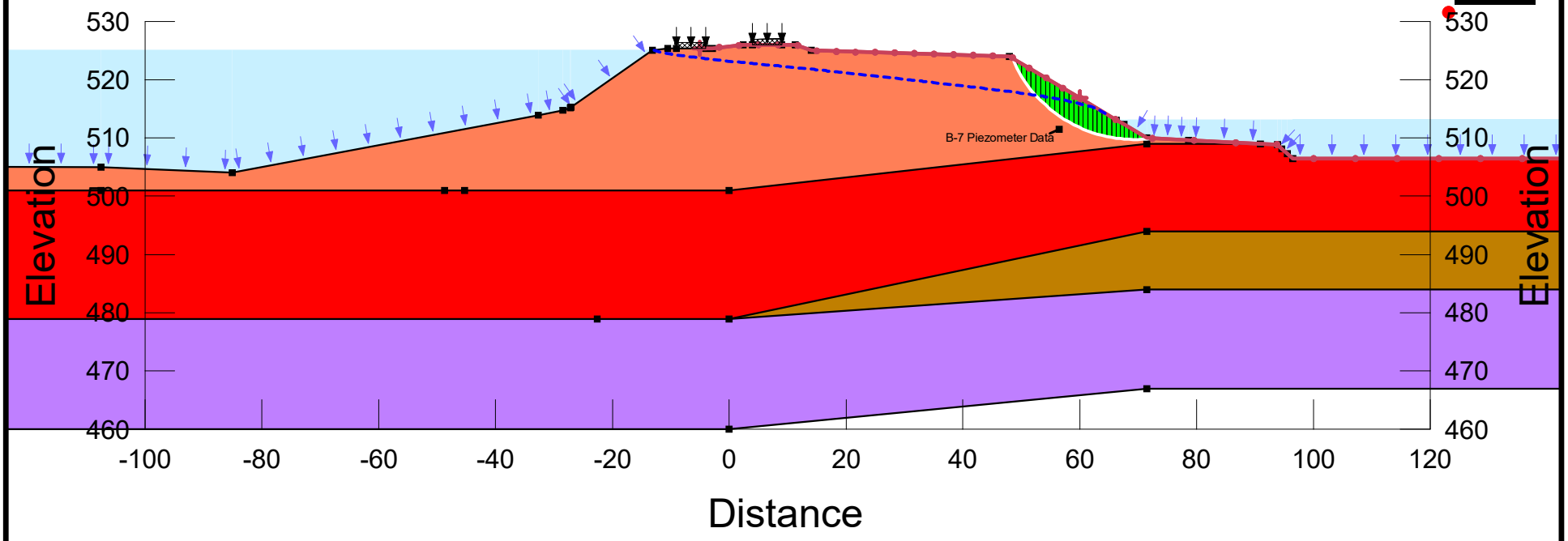
Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure S

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0

Radius: 22.592156 ft
Center: (69.343207, 532.33868) ft

1.0



Prepared by:

HDR

Slope Stability

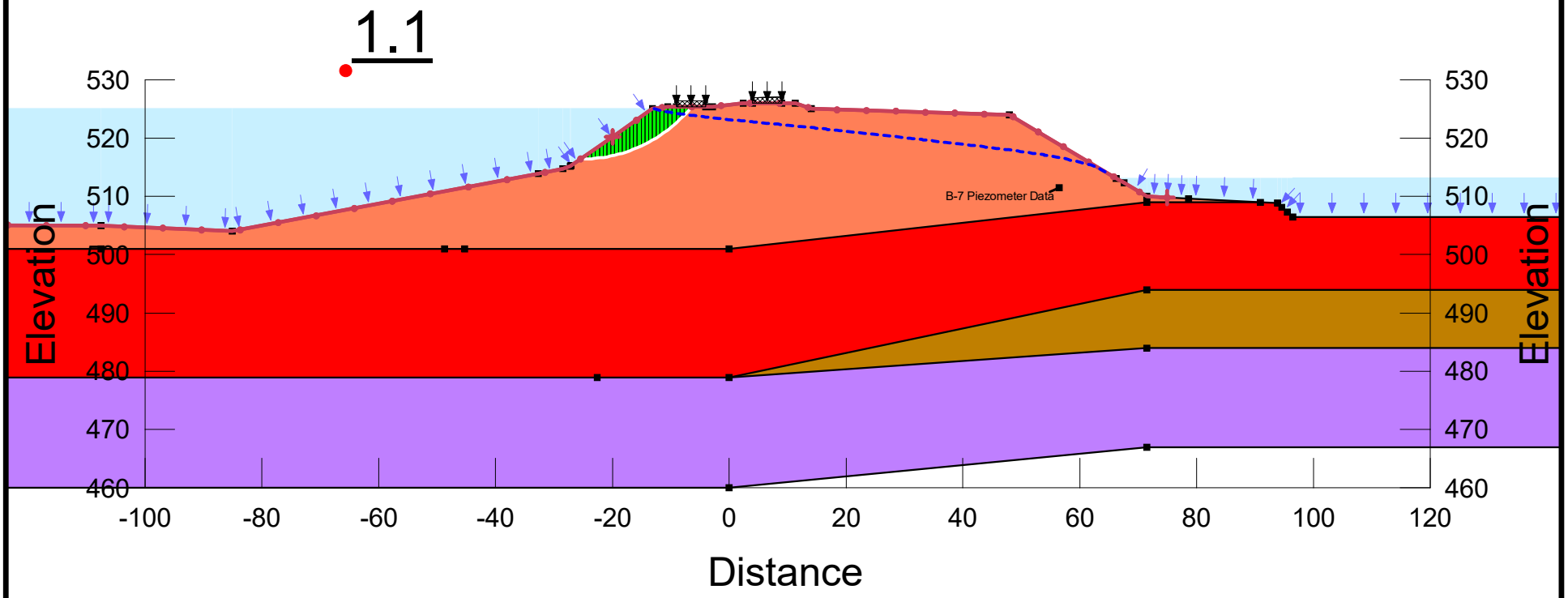
File Name: STA 1823+83.40.gsz
Name: LTSS DS (2)
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure T

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0

Radius: 23.938573 ft
Center: (-25.132069, 540.35773) ft



Prepared by:

Slope Stability

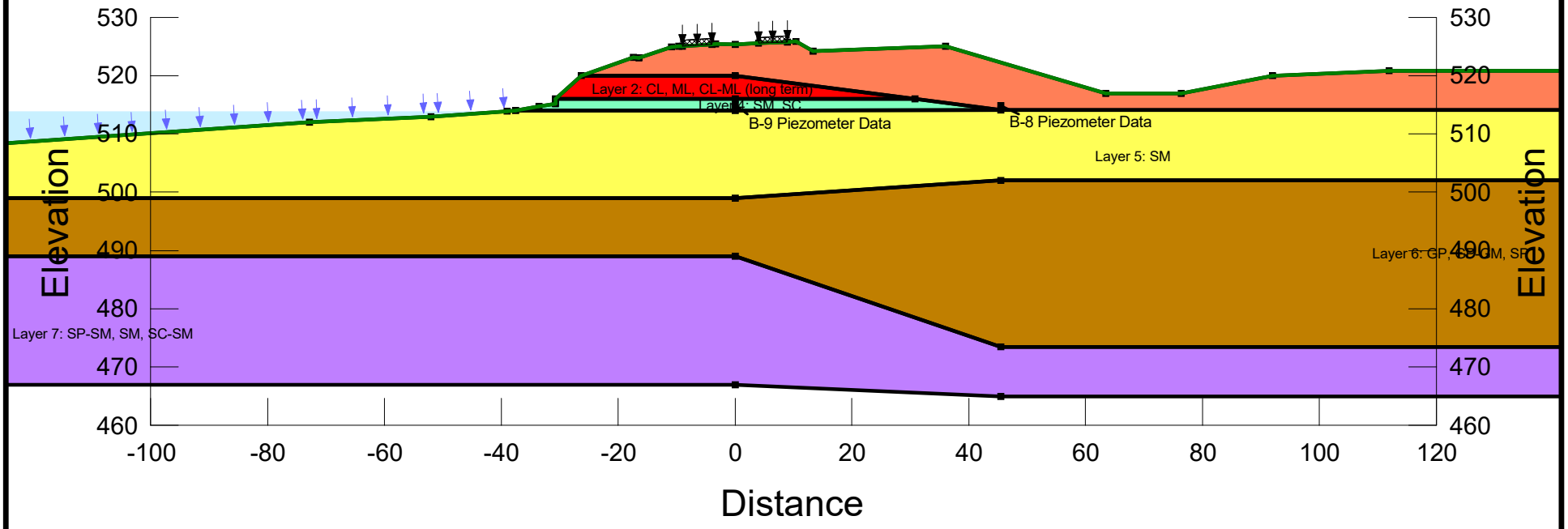
File Name: STA 1823+83.40.gsz
Name: LTSS US (2)
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

STA 1830+76.69

Figure U

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0
	Layer 5: SM	Mohr-Coulomb	122	0	35	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0



Prepared by:

HDR

Slope Stability

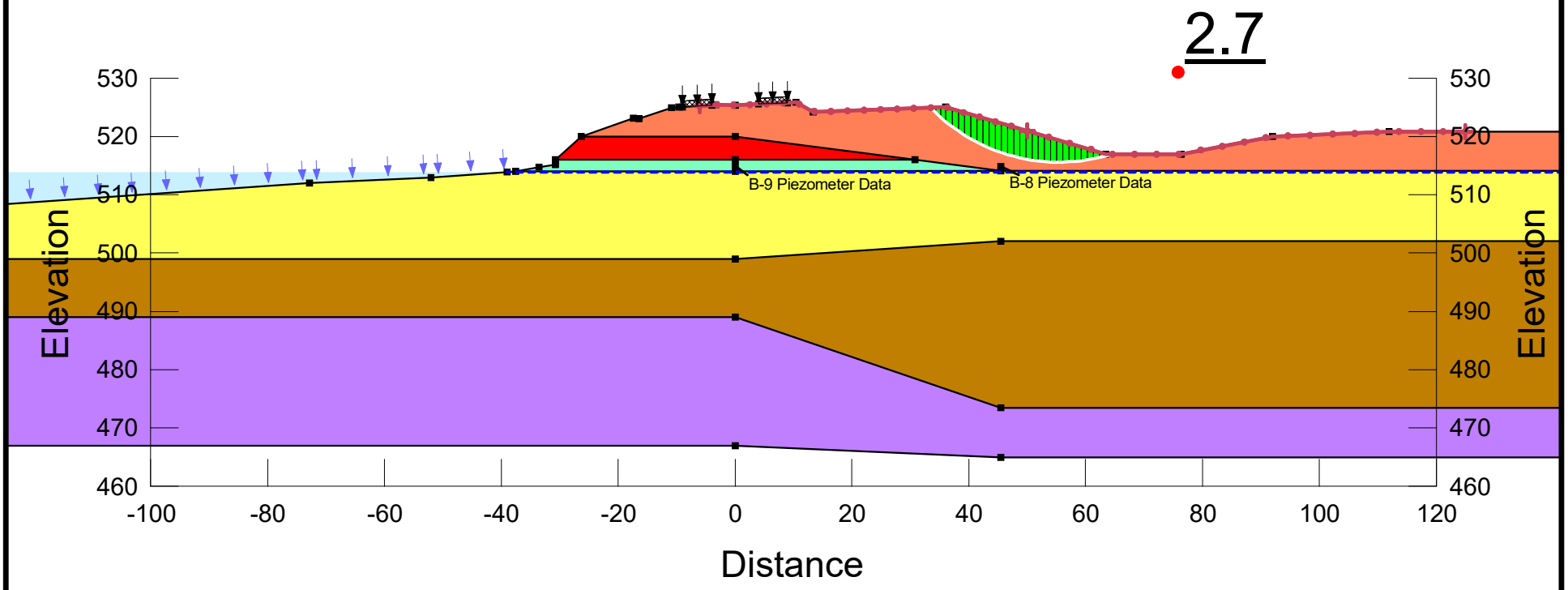
File Name: STA 1830+76.69.gsz
Name: Model Geometry
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure V

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0
	Layer 5: SM	Mohr-Coulomb	122	0	35	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0

Radius: 30.572208 ft
Center: (55.452407, 546.16868) ft



Prepared by:

Slope Stability

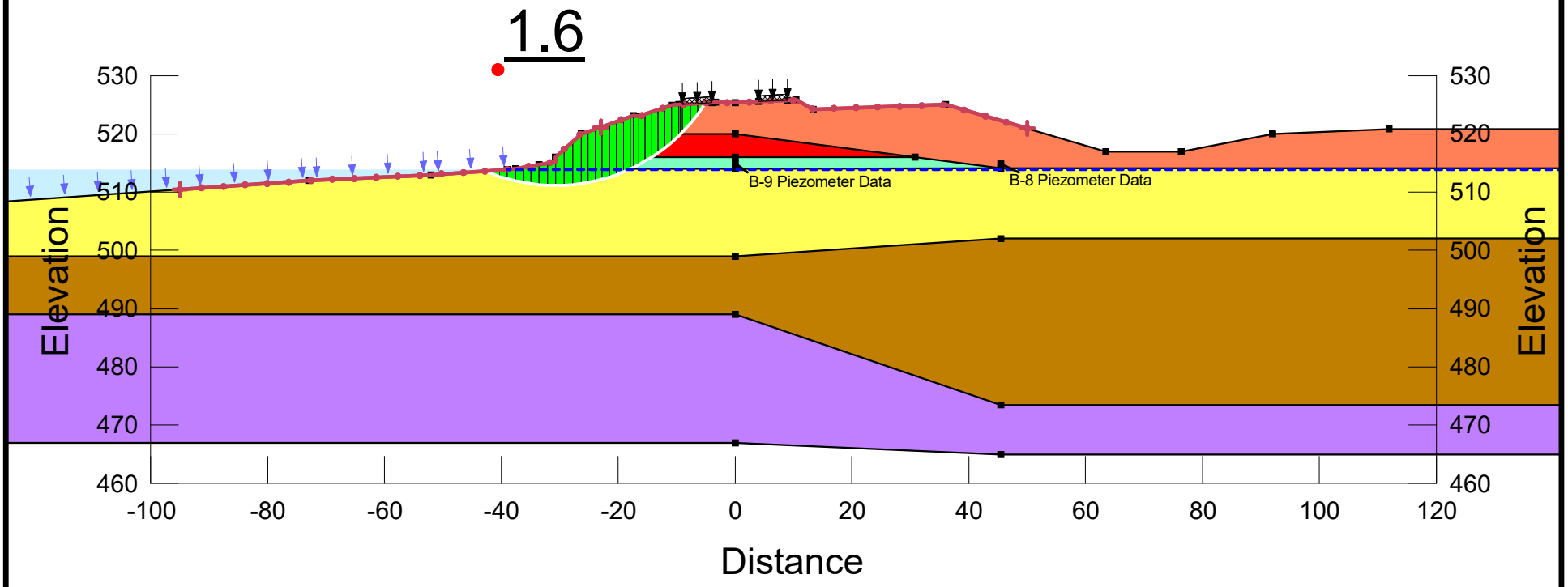
File Name: STA 1830+76.69.gsz
Name: LTSS DS
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure W

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0
	Layer 5: SM	Mohr-Coulomb	122	0	35	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0

Radius: 30.431057 ft
Center: (-30.739811, 541.59789) ft



Prepared by:

HDR

Slope Stability

File Name: STA 1830+76.69.gsz
Name: LTSS US
Method: Spencer

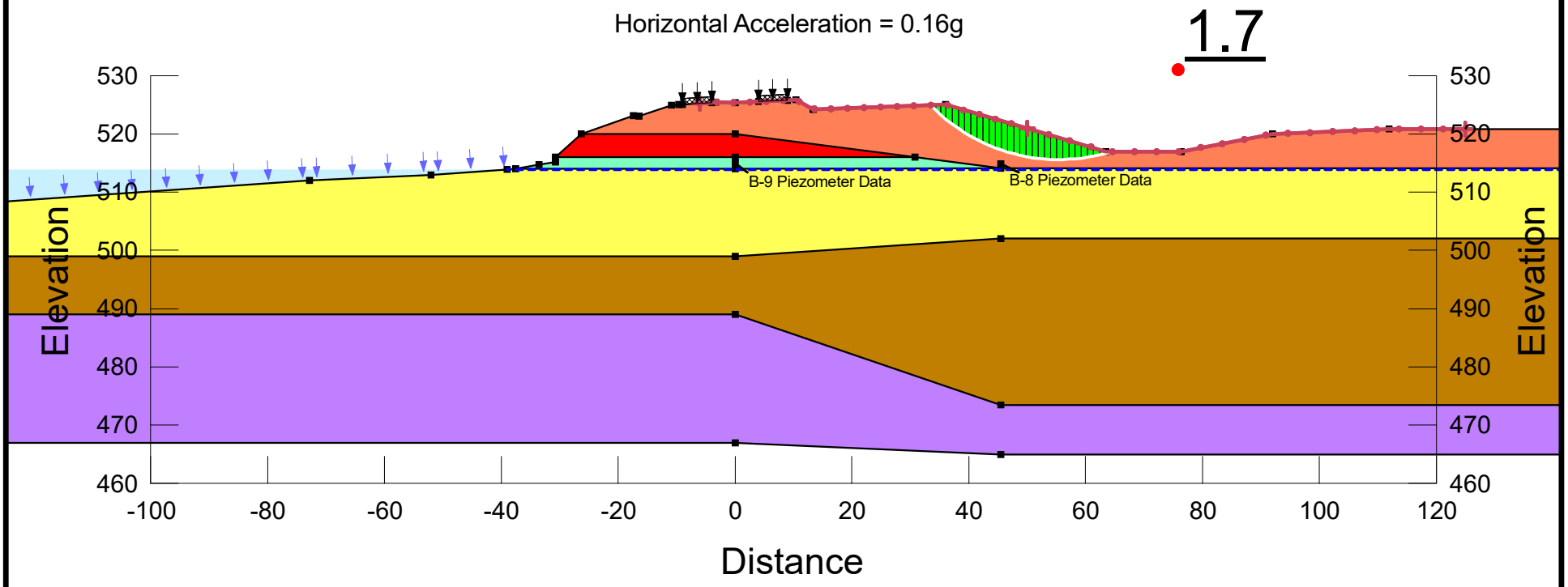
Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure X

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (short term)	Mohr-Coulomb	128	2,100	0	0
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0
	Layer 5: SM	Mohr-Coulomb	122	0	35	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0

Radius: 30.572208 ft
Center: (55.452407, 546.16868) ft

Horizontal Acceleration = 0.16g



Prepared by:

HDR

Slope Stability

File Name: STA 1830+76.69.gsz
Name: Pseudostatic DS
Method: Spencer

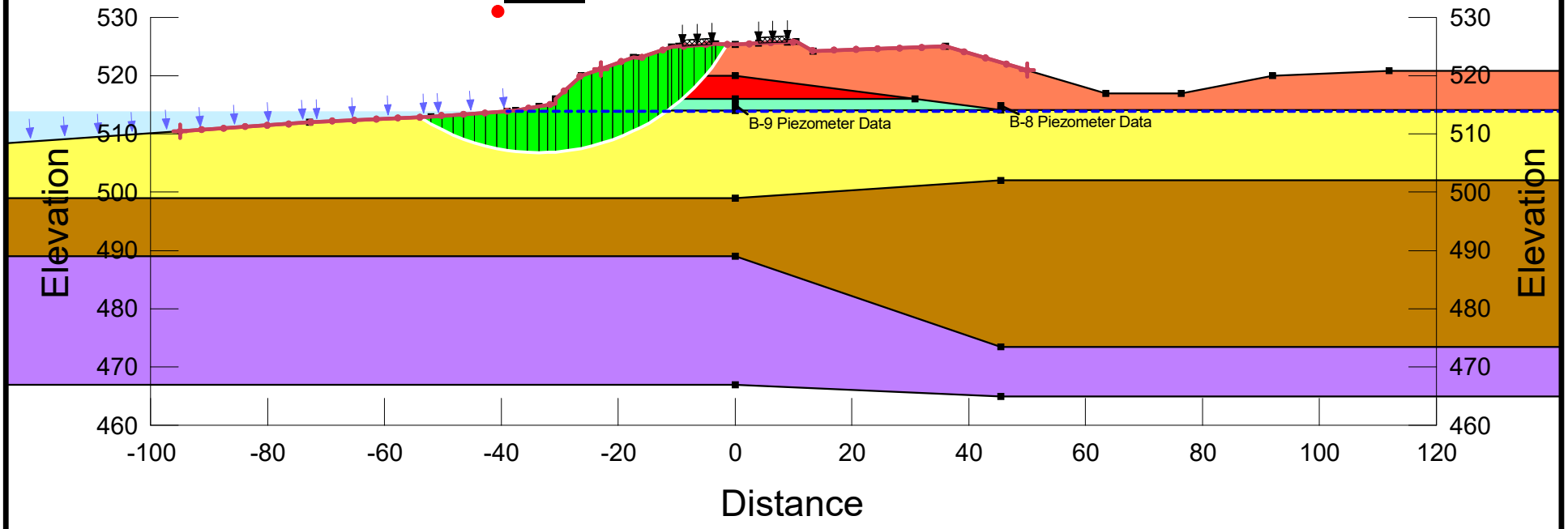
Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure Y

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (short term)	Mohr-Coulomb	128	2,100	0	0
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0
	Layer 5: SM	Mohr-Coulomb	122	0	35	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0

Radius: 37.228285 ft
Center: (-33.522588, 544.03149) ft

1.4 Horizontal Acceleration = 0.16g



Prepared by:

HDR

Slope Stability

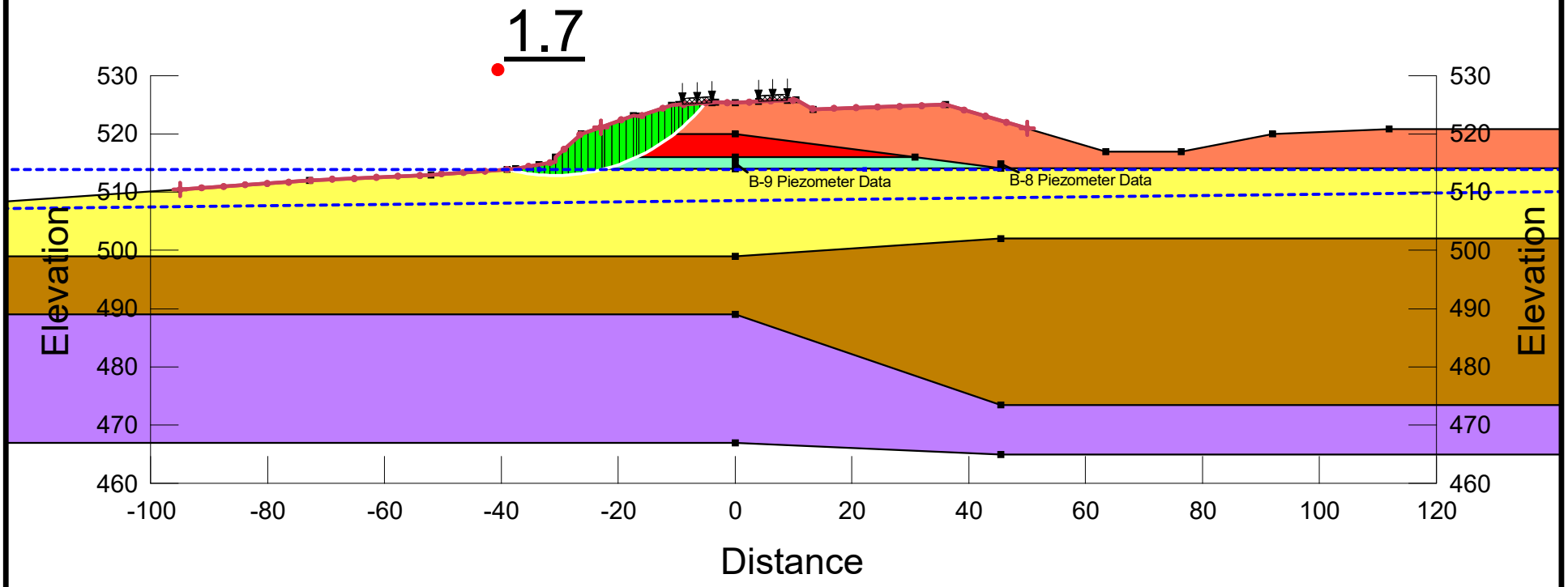
File Name: STA 1830+76.69.gsz
Name: Pseudostatic US
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure Z

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)	Cohesion R (psf)	Phi R (°)	Piezometric Line	Piezometric Line After Drawdown
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0	0	33.6	1	2
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0	2,100	0	1	2
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0	0	34	1	2
	Layer 5: SM	Mohr-Coulomb	122	0	35	0	0	35	1	2
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0	0	35	1	2
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0	0	0	1	2

Radius: 33.068359 ft
Center: (-30.876666, 545.94585) ft



Prepared by:

Slope Stability

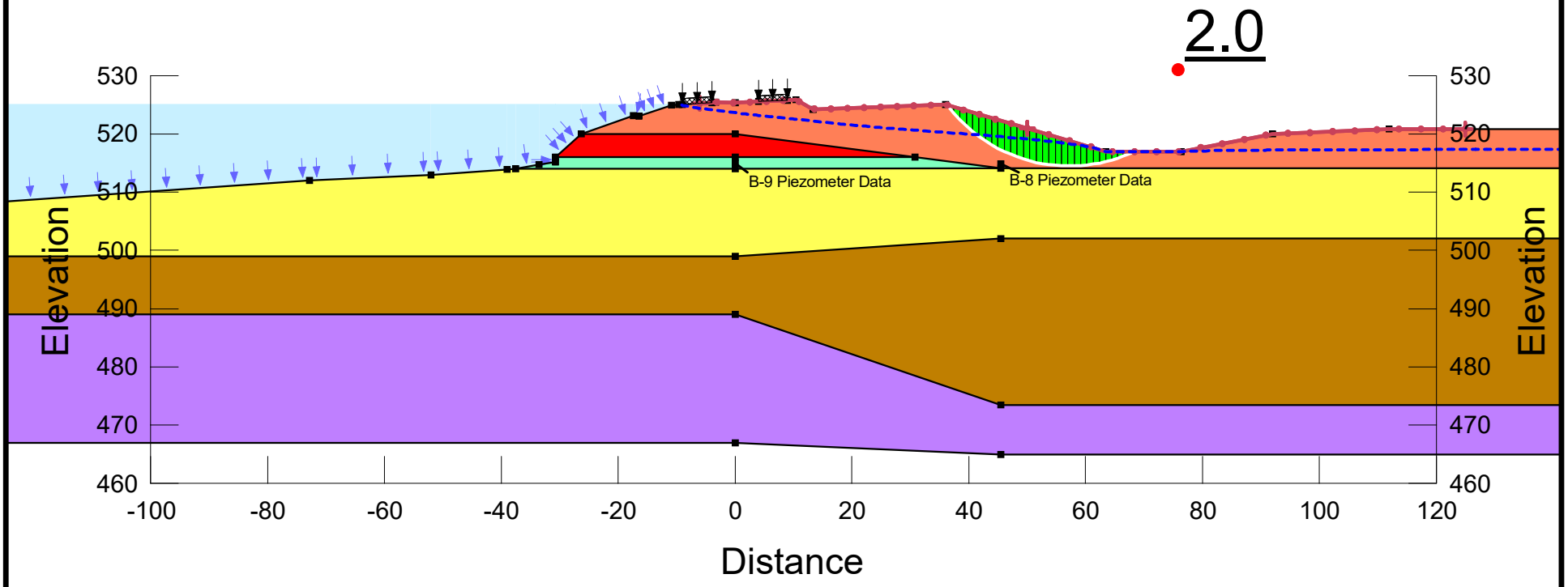
File Name: STA 1830+76.69.gsz
Name: Normal Pool RDD
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure AA

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0
	Layer 5: SM	Mohr-Coulomb	122	0	35	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0

Radius: 26.142363 ft
Center: (57.224322, 540.632) ft



Prepared by:

HDR

Slope Stability

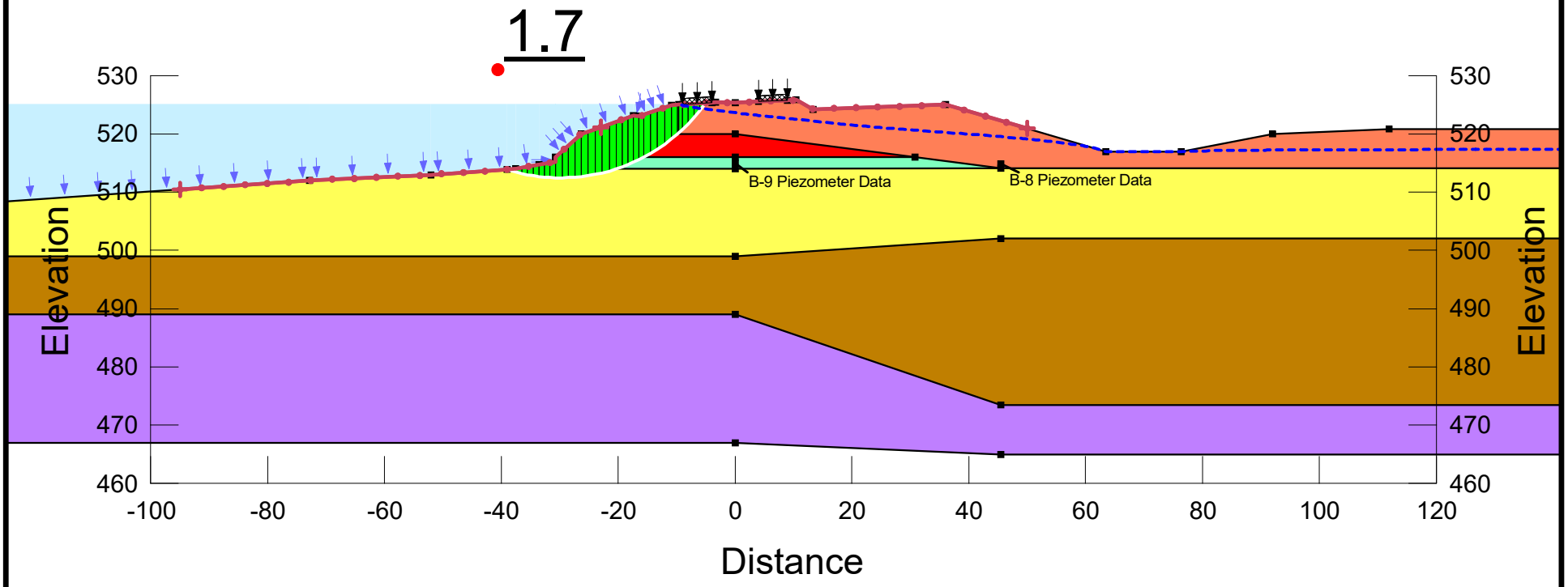
File Name: STA 1830+76.69.gsz
Name: LTSS DS (2)
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure AB

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0
	Layer 5: SM	Mohr-Coulomb	122	0	35	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0

Radius: 30.349328 ft
Center: (-29.825517, 542.8186) ft



Prepared by:

HDR

Slope Stability

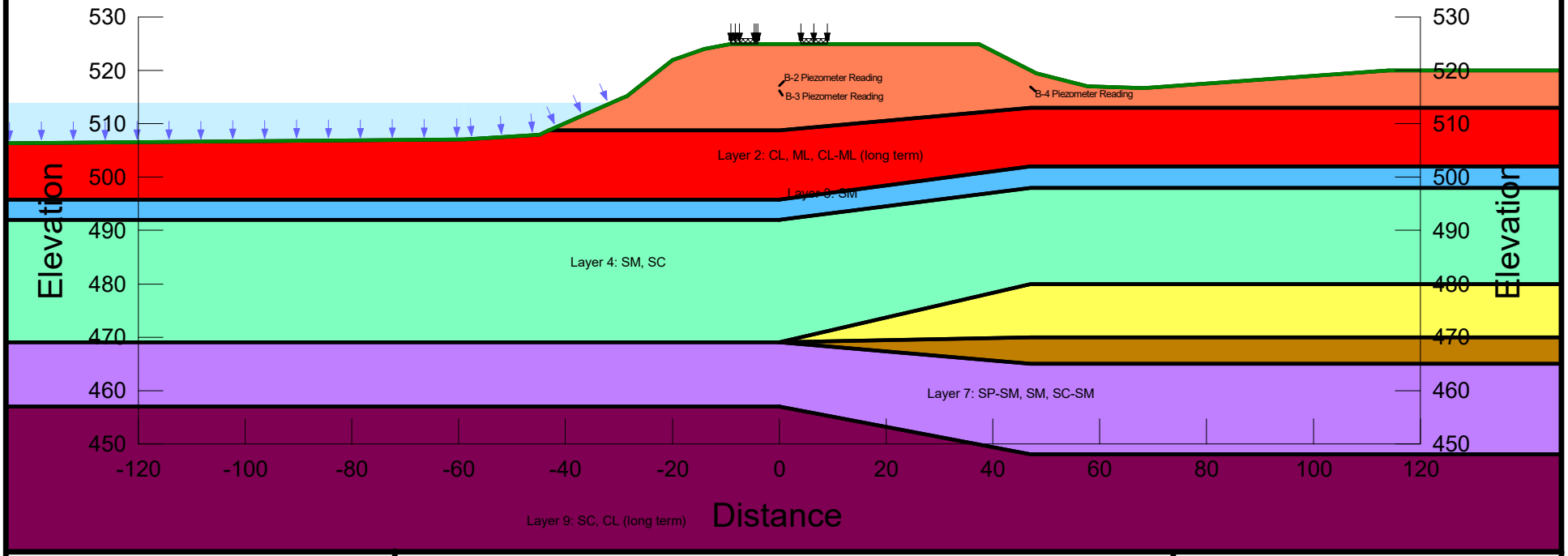
File Name: STA 1830+76.69.gsz
Name: LTSS US (2)
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

STA 1836+71.40

Figure AC

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0
	Layer 3: SM	Mohr-Coulomb	119	0	35	0
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0
	Layer 5: SM	Mohr-Coulomb	122	0	35	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0
	Layer 9: SC, CL (long term)	Mohr-Coulomb	120	50	28	0



Prepared by:

HDR

Slope Stability

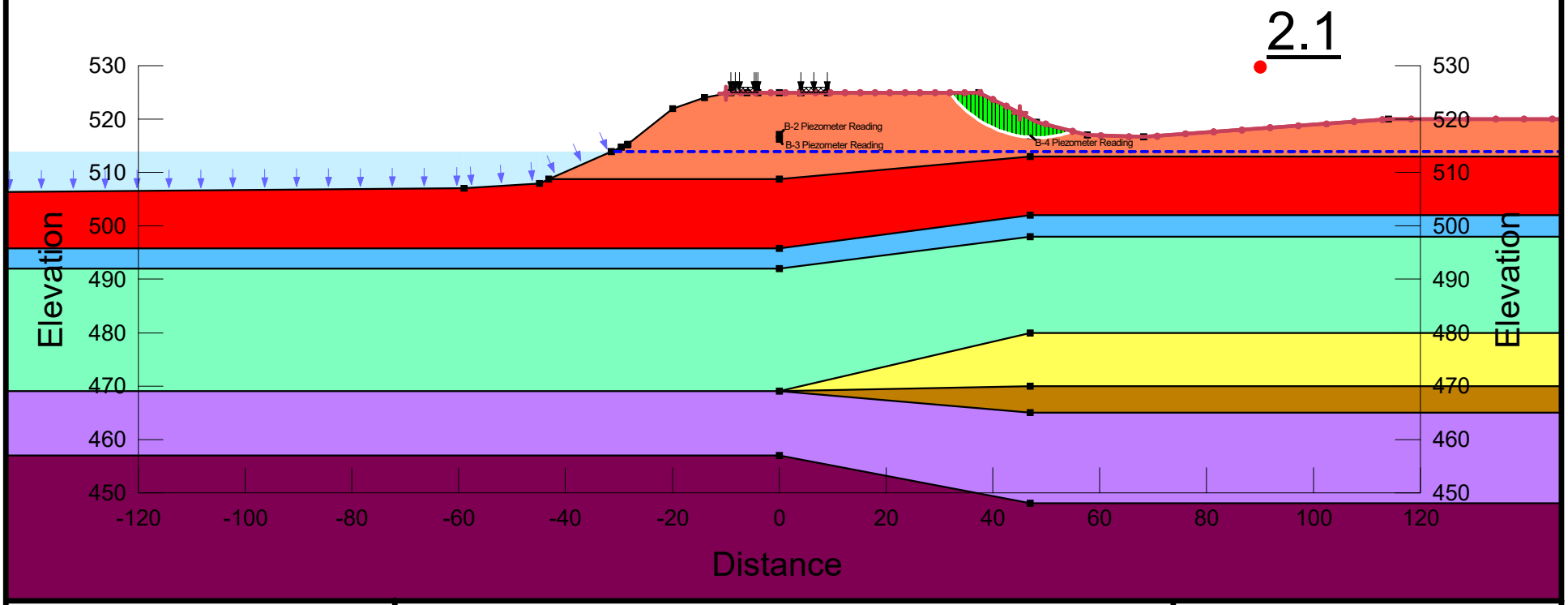
File Name: STA 1836+71.40.gsz
Name: Model Geometry
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure AD

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0
	Layer 3: SM	Mohr-Coulomb	119	0	35	0
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0
	Layer 5: SM	Mohr-Coulomb	122	0	35	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0
	Layer 9: SC, CL (long term)	Mohr-Coulomb	120	50	28	0

Radius: 20.12101 ft
Center: (48.305535, 536.708) ft



Prepared by:

Slope Stability

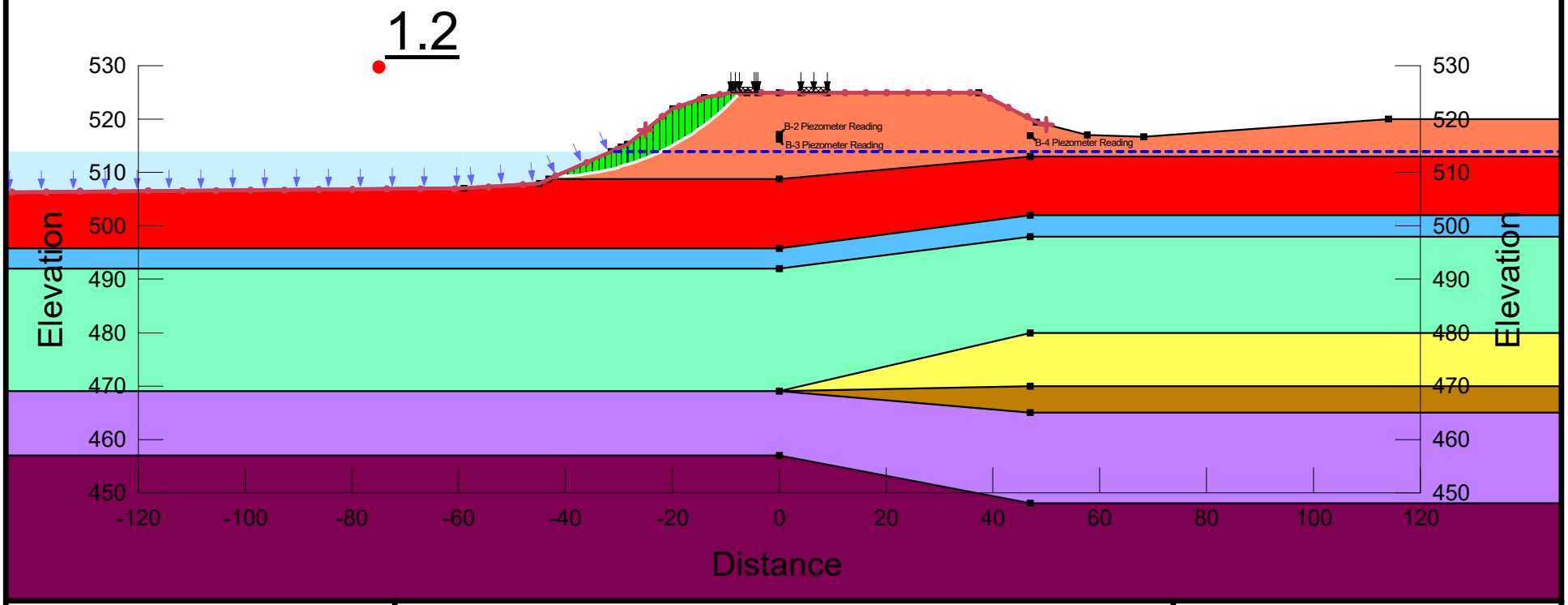
File Name: STA 1836+71.40.gsz
Name: LTSS DS
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure AE

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0
	Layer 3: SM	Mohr-Coulomb	119	0	35	0
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0
	Layer 5: SM	Mohr-Coulomb	122	0	35	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0
	Layer 9: SC, CL (long term)	Mohr-Coulomb	120	50	28	0

Radius: 48.041255 ft
Center: (-42.804653, 557.33556) ft



Prepared by:

HDR

Slope Stability

File Name: STA 1836+71.40.gsz
Name: LTSS US
Method: Spencer

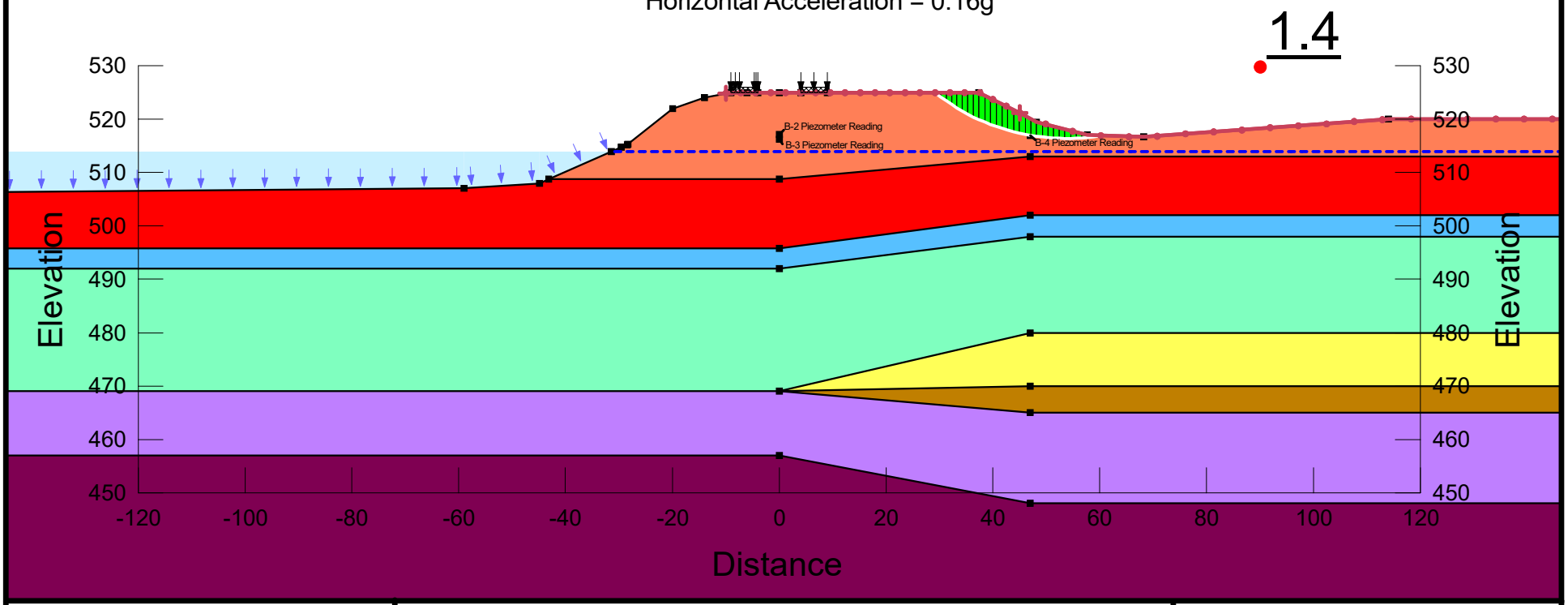
Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure AF

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (short term)	Mohr-Coulomb	128	2,100	0	0
	Layer 3: SM	Mohr-Coulomb	119	0	35	0
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0
	Layer 5: SM	Mohr-Coulomb	122	0	35	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0
	Layer 9: SC, CL (short term)	Mohr-Coulomb	120	4,000	0	0

Radius: 39.406774 ft
Center: (53.730087, 555.79655) ft

Horizontal Acceleration = 0.16g



Prepared by:

HDR

Slope Stability

File Name: STA 1836+71.40.gsz
Name: Pseudostatic DS
Method: Spencer

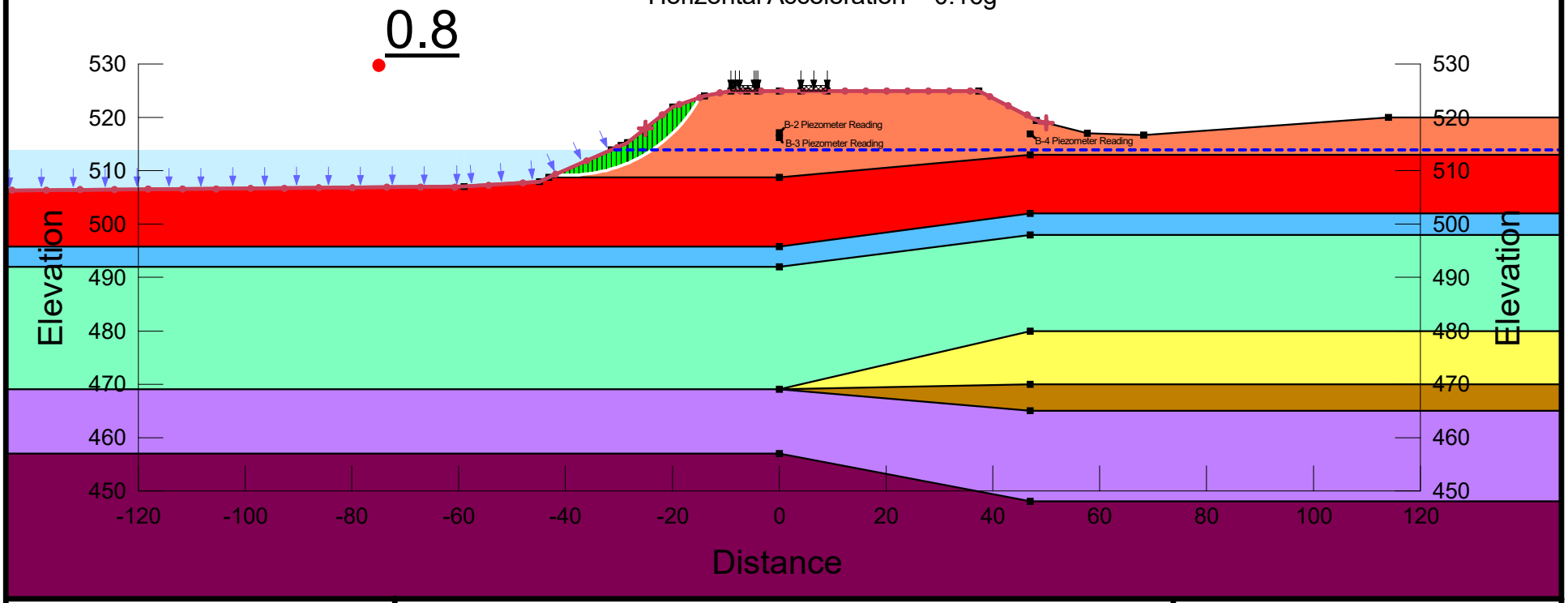
Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure AG

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (short term)	Mohr-Coulomb	128	2,100	0	0
	Layer 3: SM	Mohr-Coulomb	119	0	35	0
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0
	Layer 5: SM	Mohr-Coulomb	122	0	35	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0
	Layer 9: SC, CL (short term)	Mohr-Coulomb	120	4,000	0	0

Radius: 27.759168 ft
Center: (-39.334181, 536.94223) ft

Horizontal Acceleration = 0.16g



Prepared by:

Slope Stability

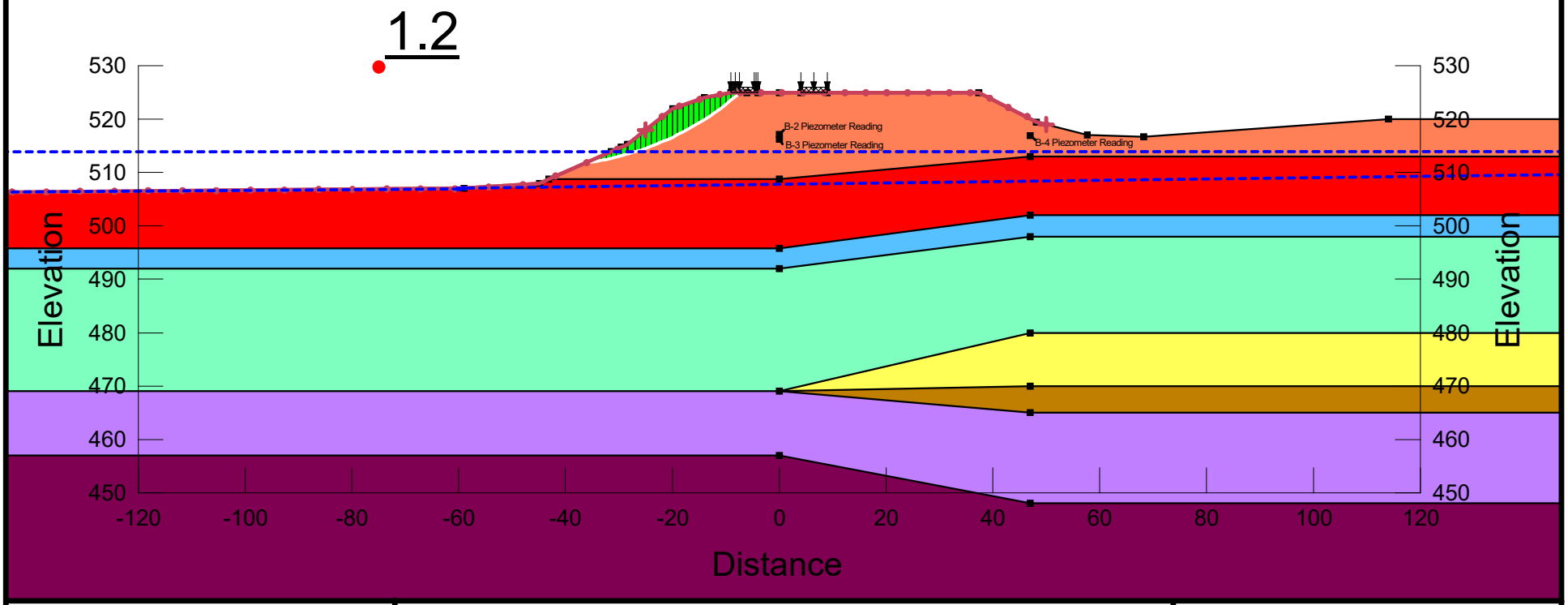
File Name: STA 1836+71.40.gsz
Name: Pseudostatic US
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure AH

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)	Cohesion R (psf)	Phi R (°)	Piezometric Line	Piezometric Line After Drawdown
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0	0	33.6	1	2
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0	2,100	0	1	2
	Layer 3: SM	Mohr-Coulomb	119	0	35	0	0	35	1	2
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0	0	34	1	2
	Layer 5: SM	Mohr-Coulomb	122	0	35	0	0	35	1	2
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0	0	35	1	2
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0	0	0	1	2
	Layer 9: SC, CL (long term)	Mohr-Coulomb	120	50	28	0	4,000	0	1	2

Radius: 54.663466 ft
Center: (-43.380149, 566.0426) ft



Prepared by:

HDR

Slope Stability

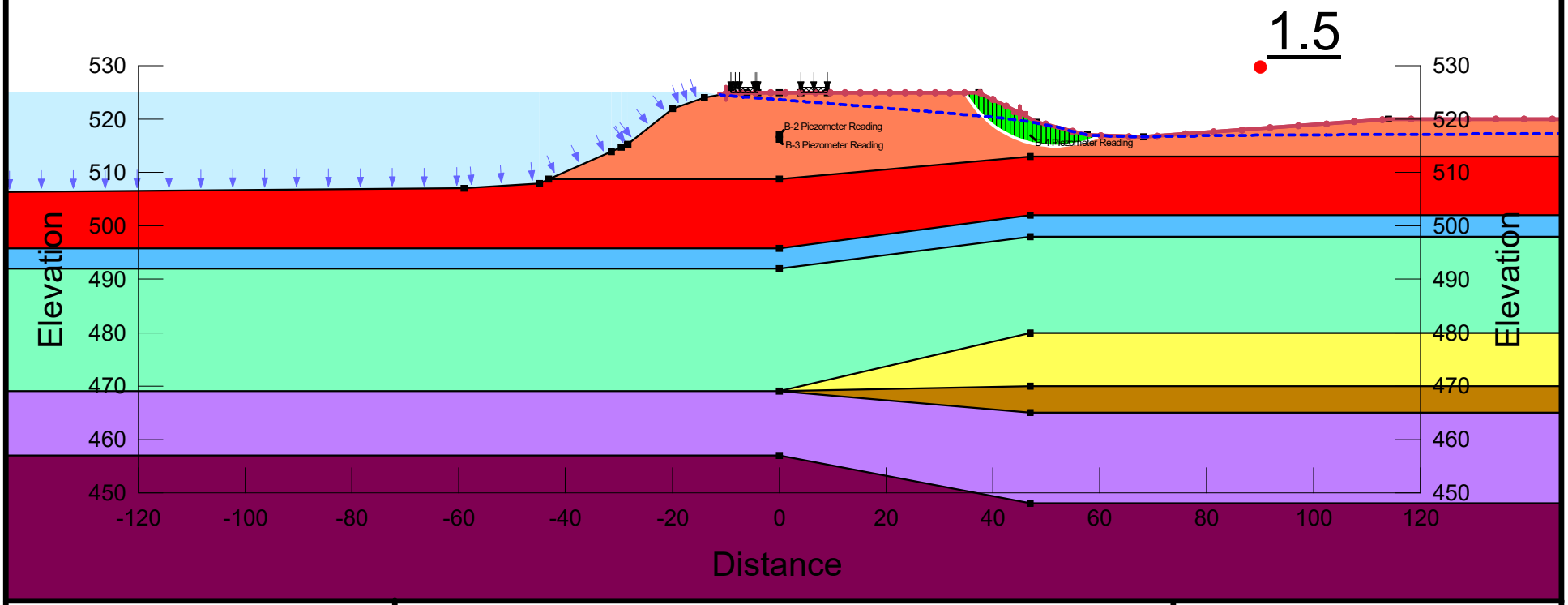
File Name: STA 1836+71.40.gsz
Name: Normal Pool RDD
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure AI

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0
	Layer 3: SM	Mohr-Coulomb	119	0	35	0
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0
	Layer 5: SM	Mohr-Coulomb	122	0	35	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0
	Layer 9: SC, CL (long term)	Mohr-Coulomb	120	50	28	0

Radius: 19.388351 ft
Center: (51.713232, 534.36938) ft



Prepared by:

HDR

Slope Stability

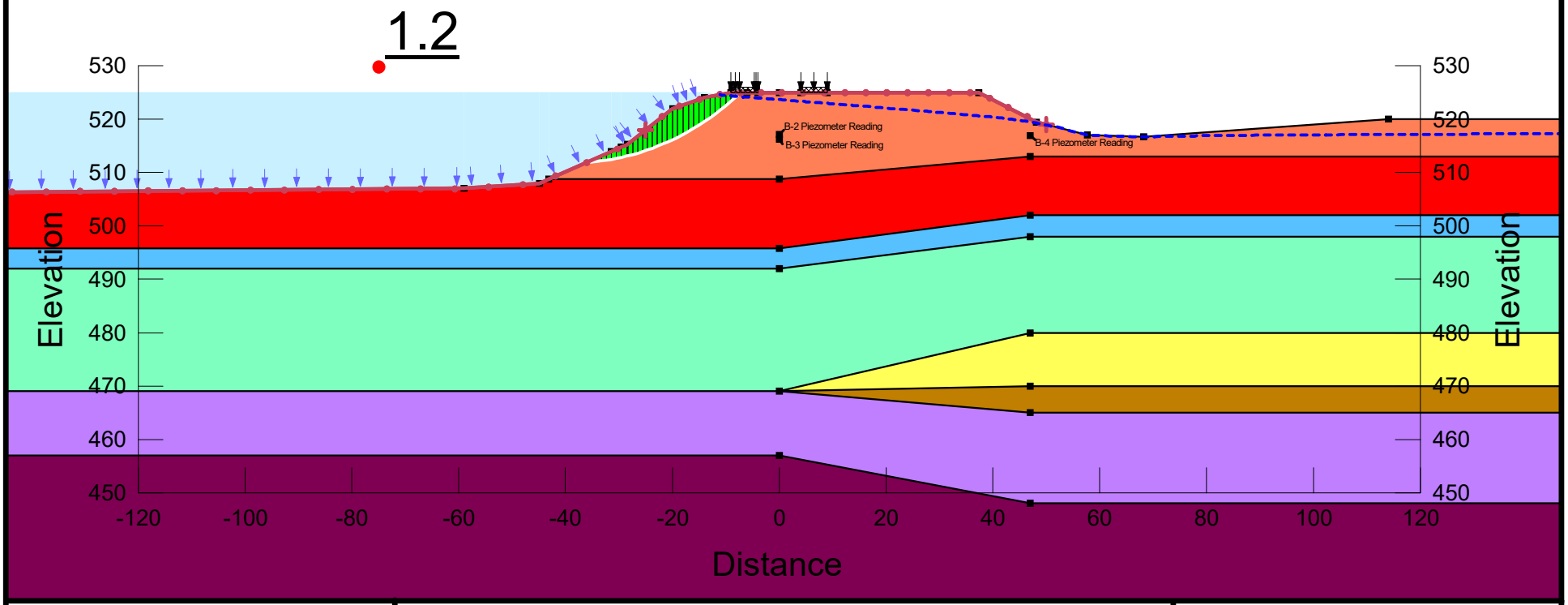
File Name: STA 1836+71.40.gsz
Name: LTSS DS (2)
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019

Figure AJ

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	Layer 1: FILL	Mohr-Coulomb	134	0	33.6	0
	Layer 2: CL, ML, CL-ML (long term)	Mohr-Coulomb	128	350	33	0
	Layer 3: SM	Mohr-Coulomb	119	0	35	0
	Layer 4: SM, SC	Mohr-Coulomb	116	0	34	0
	Layer 5: SM	Mohr-Coulomb	122	0	35	0
	Layer 6: GP, GP-GM, SP	Mohr-Coulomb	135	0	35	0
	Layer 7: SP-SM, SM, SC-SM	Mohr-Coulomb	117	0	35	0
	Layer 9: SC, CL (long term)	Mohr-Coulomb	120	50	28	0

Radius: 46.139005 ft
Center: (-39.653627, 557.86968) ft



Prepared by:

HDR

Slope Stability

File Name: STA 1836+71.40.gsz
Name: LTSS US (2)
Method: Spencer

Project: NJT Estling Lake
Project No: 10193843
Location: Denville Township, NJ
Created By: DTM
Date: 12/19/2019