Summary for Subcatchment 1S: West Subbasin

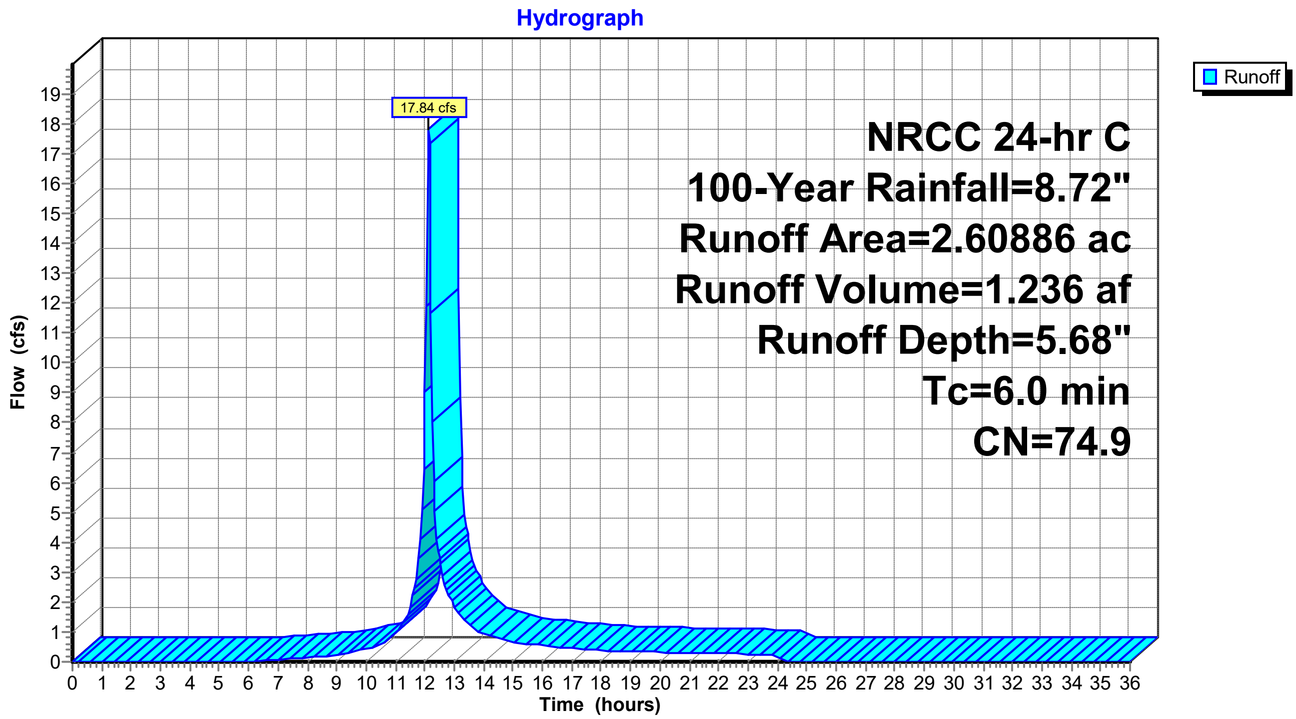
Runoff = 17.84 cfs @ 12.13 hrs, Volume= 1.236 af, Depth= 5.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.72"

	Area (ac)	CN	Description
	0.36972	49.0	50-75% Grass cover, Fair, HSG A
*	0.32028	98.0	Impervious, HSG A
	1.91886	76.0	Gravel roads, HSG A
	2.60886	74.9	Weighted Average
	2.28858		87.72337% Pervious Area
	0.32028		12.27663% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum TC**

Subcatchment 1S: West Subbasin



Hydrograph for Subcatchment 1S: West Subbasin

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.05	0.00	0.00
1.00	0.10	0.00	0.00
1.50	0.16	0.00	0.00
2.00	0.21	0.00	0.00
2.50	0.27	0.00	0.00
3.00	0.33	0.00	0.00
3.50	0.39	0.00	0.00
4.00	0.46	0.00	0.00
4.50	0.53	0.00	0.00
5.00	0.60	0.00	0.00
5.50	0.67	0.00	0.00
6.00	0.75	0.00	0.01
6.50	0.83	0.01	0.04
7.00	0.92	0.02	0.06
7.50	1.02	0.03	0.09
8.00	1.13	0.06	0.13
8.50	1.25	0.09	0.17
9.00	1.38	0.12	0.22
9.50	1.54	0.18	0.31
10.00	1.72	0.25	0.43
10.50	1.94	0.35	0.56
11.00	2.25	0.51	0.95
11.50	2.73	0.78	1.74
12.00	4.15	1.77	**9.04**
12.50	5.99	3.26	**3.48**
13.00	6.47	3.68	1.88
13.50	6.78	3.94	1.23
14.00	7.00	4.14	0.97
14.50	7.18	4.30	0.82
15.00	7.34	4.44	0.67
15.50	7.47	4.55	0.59
16.00	7.59	4.66	0.55
16.50	7.70	4.76	0.51
17.00	7.80	4.85	0.46
17.50	7.89	4.93	0.42
18.00	7.97	5.00	0.37
18.50	8.05	5.07	0.35
19.00	8.12	5.14	0.34
19.50	8.19	5.20	0.33
20.00	8.26	5.26	0.32
20.50	8.33	5.32	0.31
21.00	8.39	5.38	0.30
21.50	8.45	5.44	0.29
22.00	8.51	5.49	0.28
22.50	8.56	5.54	0.27
23.00	8.62	5.59	0.26
23.50	8.67	5.64	0.25
24.00	**8.72**	**5.68**	0.23
24.50	8.72	5.68	0.00
25.00	8.72	5.68	0.00

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
25.50	8.72	5.68	0.00
26.00	8.72	5.68	0.00
26.50	8.72	5.68	0.00
27.00	8.72	5.68	0.00
27.50	8.72	5.68	0.00
28.00	8.72	5.68	0.00
28.50	8.72	5.68	0.00
29.00	8.72	5.68	0.00
29.50	8.72	5.68	0.00
30.00	8.72	5.68	0.00
30.50	8.72	5.68	0.00
31.00	8.72	5.68	0.00
31.50	8.72	5.68	0.00
32.00	8.72	5.68	0.00
32.50	8.72	5.68	0.00
33.00	8.72	5.68	0.00
33.50	8.72	5.68	0.00
34.00	8.72	5.68	0.00
34.50	8.72	5.68	0.00
35.00	8.72	5.68	0.00
35.50	8.72	5.68	0.00
36.00	8.72	5.68	0.00

Summary for Subcatchment 2S: East Subbasin

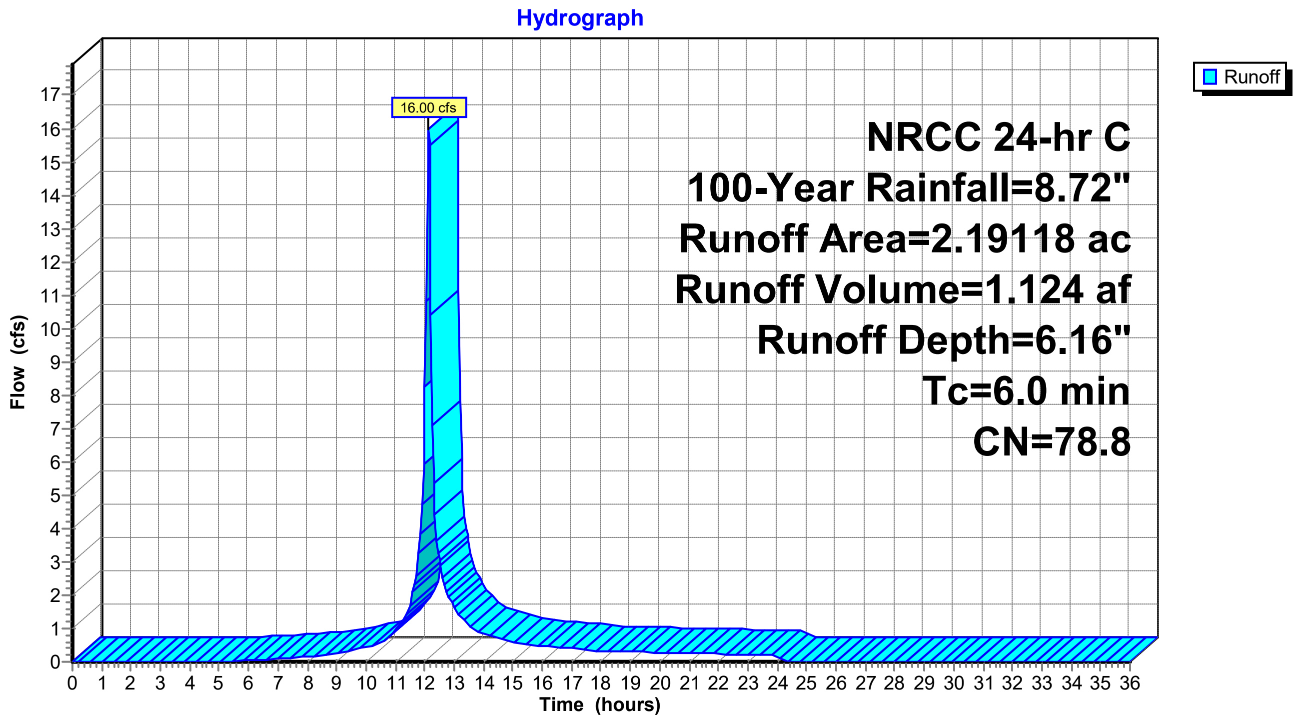
Runoff = 16.00 cfs @ 12.13 hrs, Volume= 1.124 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.72"

	Area (ac)	CN	Description
	0.25459	49.0	50-75% Grass cover, Fair, HSG A
*	0.59040	98.0	Impervious, HSG A
	1.34619	76.0	Gravel roads, HSG A
	2.19118	78.8	Weighted Average
	1.60078		73.05561% Pervious Area
	0.59040		26.94439% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum TC**

Subcatchment 2S: East Subbasin



Hydrograph for Subcatchment 2S: East Subbasin

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.05	0.00	0.00
1.00	0.10	0.00	0.00
1.50	0.16	0.00	0.00
2.00	0.21	0.00	0.00
2.50	0.27	0.00	0.00
3.00	0.33	0.00	0.00
3.50	0.39	0.00	0.00
4.00	0.46	0.00	0.00
4.50	0.53	0.00	0.00
5.00	0.60	0.00	0.01
5.50	0.67	0.01	0.03
6.00	0.75	0.02	0.04
6.50	0.83	0.03	0.07
7.00	0.92	0.05	0.09
7.50	1.02	0.07	0.13
8.00	1.13	0.11	0.16
8.50	1.25	0.15	0.20
9.00	1.38	0.20	0.24
9.50	1.54	0.27	0.33
10.00	1.72	0.36	0.44
10.50	1.94	0.48	0.57
11.00	2.25	0.66	0.94
11.50	2.73	0.98	1.66
12.00	4.15	2.07	**8.27**
12.50	5.99	3.65	**3.07**
13.00	6.47	4.08	1.65
13.50	6.78	4.36	1.07
14.00	7.00	4.56	0.84
14.50	7.18	4.73	0.71
15.00	7.34	4.87	0.58
15.50	7.47	4.99	0.52
16.00	7.59	5.10	0.48
16.50	7.70	5.20	0.44
17.00	7.80	5.30	0.40
17.50	7.89	5.38	0.36
18.00	7.97	5.46	0.32
18.50	8.05	5.53	0.31
19.00	8.12	5.60	0.30
19.50	8.19	5.66	0.29
20.00	8.26	5.73	0.28
20.50	8.33	5.79	0.27
21.00	8.39	5.85	0.26
21.50	8.45	5.90	0.25
22.00	8.51	5.96	0.24
22.50	8.56	6.01	0.23
23.00	8.62	6.06	0.22
23.50	8.67	6.11	0.21
24.00	**8.72**	**6.16**	0.20
24.50	8.72	6.16	0.00
25.00	8.72	6.16	0.00
25.50	8.72	6.16	0.00
26.00	8.72	6.16	0.00
26.50	8.72	6.16	0.00
27.00	8.72	6.16	0.00
27.50	8.72	6.16	0.00
28.00	8.72	6.16	0.00
28.50	8.72	6.16	0.00
29.00	8.72	6.16	0.00
29.50	8.72	6.16	0.00
30.00	8.72	6.16	0.00
30.50	8.72	6.16	0.00
31.00	8.72	6.16	0.00
31.50	8.72	6.16	0.00
32.00	8.72	6.16	0.00
32.50	8.72	6.16	0.00
33.00	8.72	6.16	0.00
33.50	8.72	6.16	0.00
34.00	8.72	6.16	0.00
34.50	8.72	6.16	0.00
35.00	8.72	6.16	0.00
35.50	8.72	6.16	0.00
36.00	8.72	6.16	0.00

Summary for Pond 4P: Infiltration Basin 1

Inflow Area = 2.60886 ac, 12.27663% Impervious, Inflow Depth = 5.68" for 100-Year event
Inflow = 17.84 cfs @ 12.13 hrs, Volume= 1.236 af
Outflow = 15.62 cfs @ 12.17 hrs, Volume= 1.116 af, Atten= 12%, Lag= 2.5 min
Discarded = 0.28 cfs @ 12.17 hrs, Volume= 0.441 af
Primary = 15.34 cfs @ 12.17 hrs, Volume= 0.676 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 111.51' @ 12.17 hrs Surf.Area= 6,393.14196 sf Storage= 15,981 cf

Plug-Flow detention time= 240.7 min calculated for 1.116 af (90% of inflow)
Center-of-Mass det. time= 190.9 min (1,009.7 - 818.8)

Volume	Invert	Avail.Storage	Storage Description
#1	107.50'	19,421 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

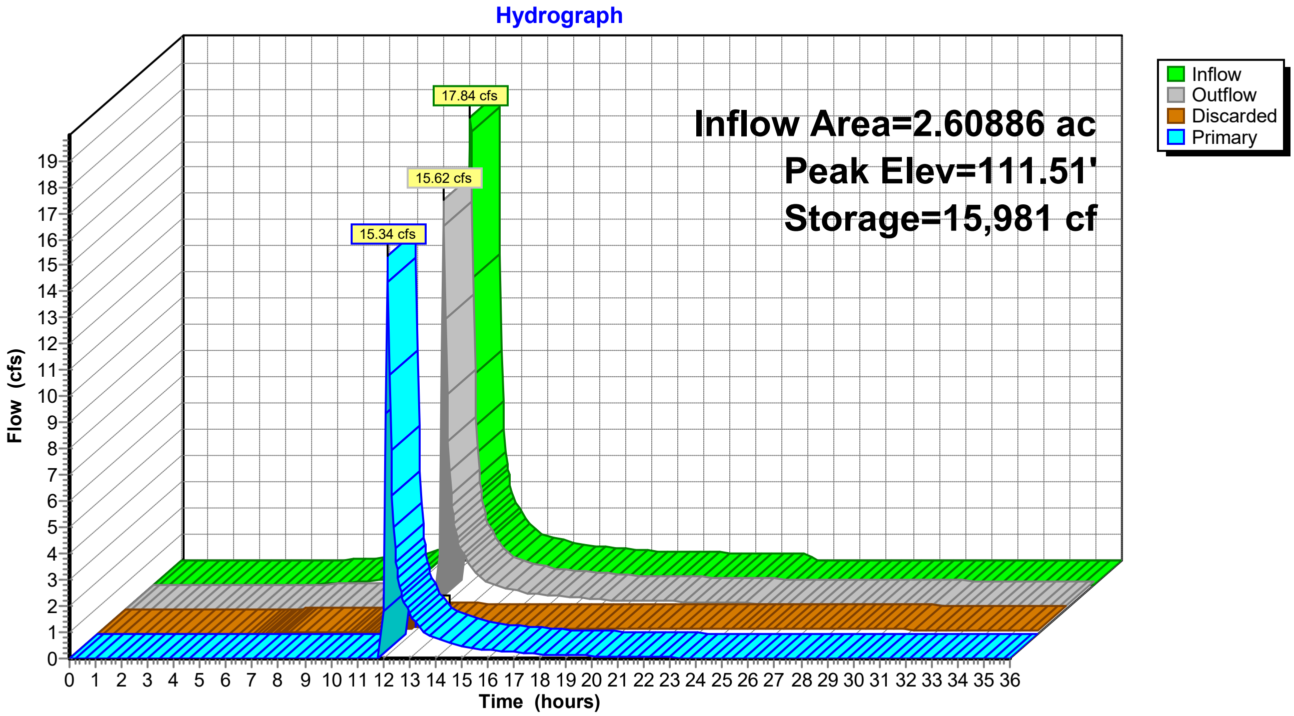
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
107.50	2,277.07000	250.8	0	0	2,277.07000
108.00	2,659.90790	261.4	1,233	1,233	2,727.69773
109.00	3,477.27120	282.6	3,059	4,292	3,684.90775
110.00	4,358.48500	303.9	3,910	8,202	4,721.37547
111.00	5,302.94520	325.0	4,823	13,025	5,823.17619
112.00	7,554.86440	357.6	6,396	19,421	7,626.58502

Device	Routing	Invert	Outlet Devices
#1	Discarded	107.50'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 104.90'
#2	Primary	110.95'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 Width (feet) 10.00 16.00

Discarded OutFlow Max=0.27 cfs @ 12.17 hrs HW=111.49' (Free Discharge)
↑**1=Exfiltration** (Controls 0.27 cfs)

Primary OutFlow Max=14.61 cfs @ 12.17 hrs HW=111.49' (Free Discharge)
↑**2=Custom Weir/Orifice** (Weir Controls 14.61 cfs @ 2.34 fps)

Pond 4P: Infiltration Basin 1



Hydrograph for Pond 4P: Infiltration Basin 1

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	107.50	0.00	0.00	0.00
1.00	0.00	0	107.50	0.00	0.00	0.00
2.00	0.00	0	107.50	0.00	0.00	0.00
3.00	0.00	0	107.50	0.00	0.00	0.00
4.00	0.00	0	107.50	0.00	0.00	0.00
5.00	0.00	0	107.50	0.00	0.00	0.00
6.00	0.01	9	107.50	0.00	0.00	0.00
7.00	0.06	72	107.53	0.04	0.04	0.00
8.00	0.13	223	107.60	0.06	0.06	0.00
9.00	0.22	627	107.76	0.06	0.06	0.00
10.00	0.43	1,502	108.10	0.08	0.08	0.00
11.00	0.95	3,399	108.73	0.11	0.11	0.00
12.00	**9.04**	**11,845**	**110.77**	**0.22**	**0.22**	**0.00**
13.00	**1.88**	**13,514**	**111.09**	**2.03**	**0.24**	**1.80**
14.00	0.97	13,182	111.03	1.00	0.23	0.77
15.00	0.67	13,070	111.01	0.70	0.23	0.47
16.00	0.55	13,003	111.00	0.56	0.23	0.33
17.00	0.46	12,952	110.99	0.48	0.23	0.25
18.00	0.37	12,900	110.98	0.39	0.23	0.16
19.00	0.34	12,875	110.97	0.35	0.23	0.12
20.00	0.32	12,862	110.97	0.33	0.23	0.10
21.00	0.30	12,849	110.97	0.30	0.23	0.08
22.00	0.28	12,835	110.96	0.28	0.23	0.06
23.00	0.26	12,809	110.96	0.26	0.23	0.04
24.00	0.23	12,780	110.95	0.24	0.23	0.01
25.00	0.00	12,052	110.81	0.22	0.22	0.00
26.00	0.00	11,282	110.66	0.21	0.21	0.00
27.00	0.00	10,545	110.51	0.20	0.20	0.00
28.00	0.00	9,838	110.36	0.19	0.19	0.00
29.00	0.00	9,162	110.22	0.18	0.18	0.00
30.00	0.00	8,515	110.07	0.18	0.18	0.00
31.00	0.00	7,896	109.93	0.17	0.17	0.00
32.00	0.00	7,306	109.79	0.16	0.16	0.00
33.00	0.00	6,742	109.65	0.15	0.15	0.00
34.00	0.00	6,205	109.52	0.15	0.15	0.00
35.00	0.00	5,693	109.38	0.14	0.14	0.00
36.00	0.00	5,205	109.25	0.13	0.13	0.00

Summary for Pond 8P: Infiltration Basin 2

Inflow Area = 2.19118 ac, 26.94439% Impervious, Inflow Depth = 6.16" for 100-Year event
Inflow = 16.00 cfs @ 12.13 hrs, Volume= 1.124 af
Outflow = 14.69 cfs @ 12.15 hrs, Volume= 1.046 af, Atten= 8%, Lag= 1.5 min
Discarded = 0.17 cfs @ 12.15 hrs, Volume= 0.285 af
Primary = 14.52 cfs @ 12.15 hrs, Volume= 0.761 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 112.29' @ 12.15 hrs Surf.Area= 5,149.57814 sf Storage= 10,666 cf

Plug-Flow detention time= 173.3 min calculated for 1.045 af (93% of inflow)
Center-of-Mass det. time= 136.2 min (945.6 - 809.4)

Volume	Invert	Avail.Storage	Storage Description
#1	109.00'	14,829 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

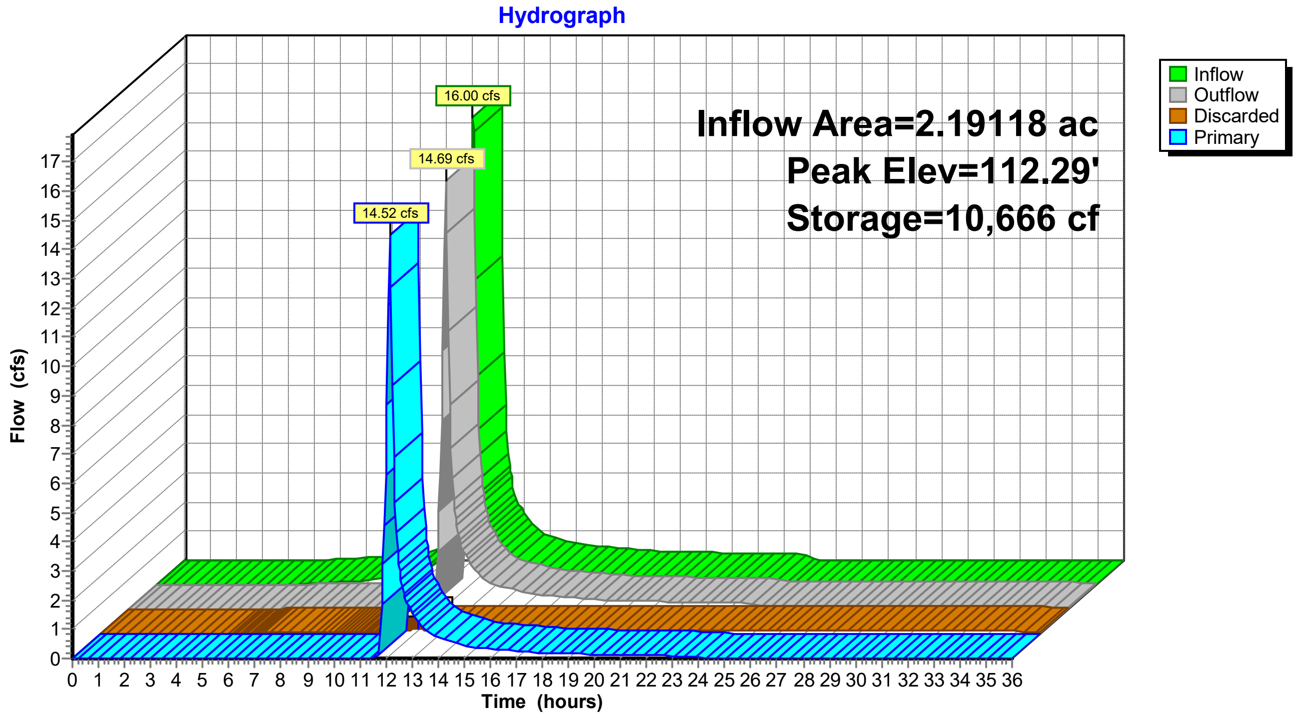
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
109.00	1,697.00420	282.0	0	0	1,697.00420
110.00	2,578.13020	307.6	2,122	2,122	2,933.77585
111.00	3,560.81360	340.3	3,056	5,179	4,650.57125
112.00	4,637.17960	369.9	4,087	9,266	6,360.71574
113.00	6,544.00000	406.0	5,563	14,829	8,623.18928

Device	Routing	Invert	Outlet Devices
#1	Discarded	109.00'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 104.00'
#2	Primary	111.75'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 1.00 Width (feet) 10.00 13.00 16.00

Discarded OutFlow Max=0.17 cfs @ 12.15 hrs HW=112.28' (Free Discharge)
└─**1=Exfiltration** (Controls 0.17 cfs)

Primary OutFlow Max=14.37 cfs @ 12.15 hrs HW=112.28' (Free Discharge)
└─**2=Custom Weir/Orifice** (Weir Controls 14.37 cfs @ 2.32 fps)

Pond 8P: Infiltration Basin 2



Hydrograph for Pond 8P: Infiltration Basin 2

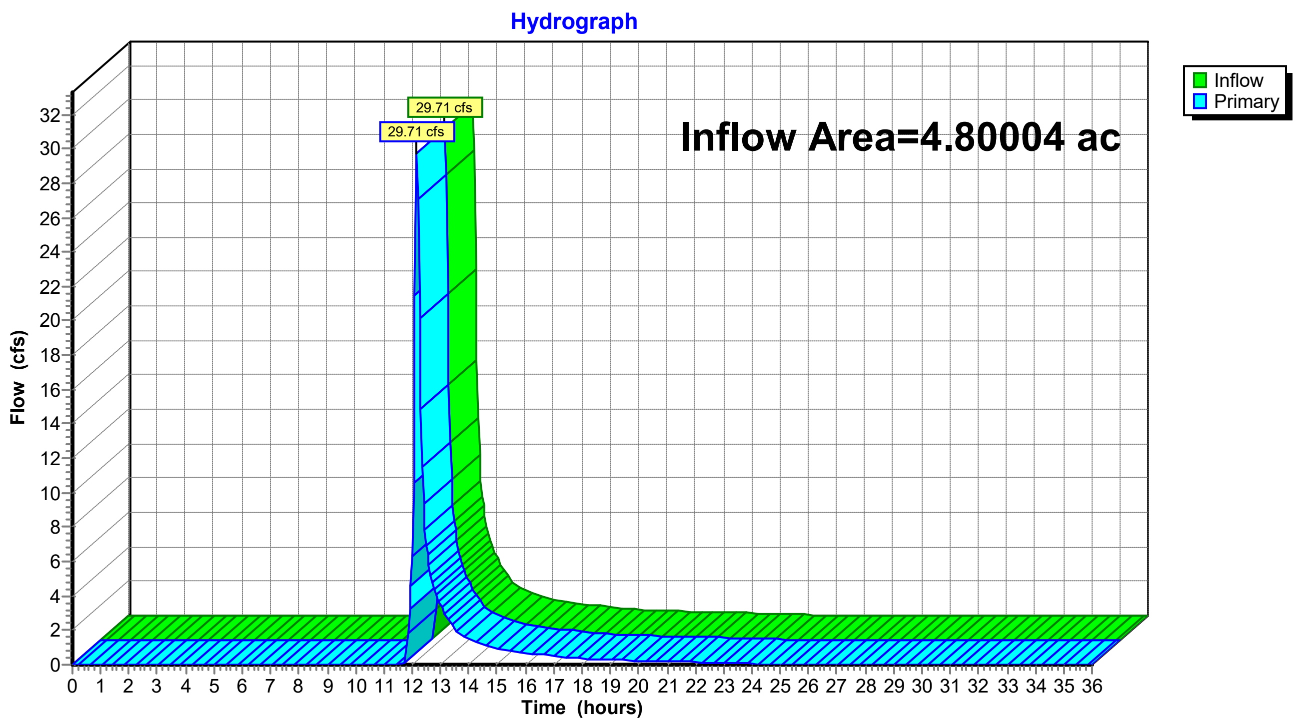
Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	109.00	0.00	0.00	0.00
1.00	0.00	0	109.00	0.00	0.00	0.00
2.00	0.00	0	109.00	0.00	0.00	0.00
3.00	0.00	0	109.00	0.00	0.00	0.00
4.00	0.00	0	109.00	0.00	0.00	0.00
5.00	0.01	5	109.00	0.00	0.00	0.00
6.00	0.04	49	109.03	0.03	0.03	0.00
7.00	0.09	150	109.09	0.04	0.04	0.00
8.00	0.16	444	109.25	0.05	0.05	0.00
9.00	0.24	982	109.51	0.05	0.05	0.00
10.00	0.44	1,969	109.94	0.07	0.07	0.00
11.00	0.94	3,921	110.63	0.09	0.09	0.00
12.00	**8.27**	**9,583**	**112.07**	**6.47**	**0.15**	**6.32**
13.00	**1.65**	**8,724**	**111.88**	**1.75**	**0.14**	**1.61**
14.00	0.84	8,480	111.83	0.87	0.14	0.73
15.00	0.58	8,392	111.81	0.60	0.14	0.46
16.00	0.48	8,349	111.80	0.49	0.14	0.35
17.00	0.40	8,310	111.79	0.41	0.14	0.27
18.00	0.32	8,270	111.78	0.34	0.14	0.20
19.00	0.30	8,252	111.78	0.30	0.14	0.16
20.00	0.28	8,242	111.77	0.28	0.14	0.14
21.00	0.26	8,232	111.77	0.26	0.14	0.12
22.00	0.24	8,222	111.77	0.24	0.14	0.10
23.00	0.22	8,212	111.77	0.22	0.14	0.08
24.00	0.20	8,202	111.76	0.20	0.14	0.07
25.00	0.00	7,750	111.66	0.13	0.13	0.00
26.00	0.00	7,274	111.55	0.13	0.13	0.00
27.00	0.00	6,816	111.43	0.12	0.12	0.00
28.00	0.00	6,375	111.32	0.12	0.12	0.00
29.00	0.00	5,950	111.21	0.12	0.12	0.00
30.00	0.00	5,542	111.10	0.11	0.11	0.00
31.00	0.00	5,149	110.99	0.11	0.11	0.00
32.00	0.00	4,771	110.88	0.10	0.10	0.00
33.00	0.00	4,409	110.78	0.10	0.10	0.00
34.00	0.00	4,061	110.67	0.09	0.09	0.00
35.00	0.00	3,728	110.57	0.09	0.09	0.00
36.00	0.00	3,409	110.46	0.09	0.09	0.00

Summary for Link 3L: Wetland

Inflow Area = 4.80004 ac, 18.97234% Impervious, Inflow Depth = 3.59" for 100-Year event
Inflow = 29.71 cfs @ 12.16 hrs, Volume= 1.437 af
Primary = 29.71 cfs @ 12.16 hrs, Volume= 1.437 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link 3L: Wetland



Hydrograph for Link 3L: Wetland

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00
0.50	0.00	0.00	0.00
1.00	0.00	0.00	0.00
1.50	0.00	0.00	0.00
2.00	0.00	0.00	0.00
2.50	0.00	0.00	0.00
3.00	0.00	0.00	0.00
3.50	0.00	0.00	0.00
4.00	0.00	0.00	0.00
4.50	0.00	0.00	0.00
5.00	0.00	0.00	0.00
5.50	0.00	0.00	0.00
6.00	0.00	0.00	0.00
6.50	0.00	0.00	0.00
7.00	0.00	0.00	0.00
7.50	0.00	0.00	0.00
8.00	0.00	0.00	0.00
8.50	0.00	0.00	0.00
9.00	0.00	0.00	0.00
9.50	0.00	0.00	0.00
10.00	0.00	0.00	0.00
10.50	0.00	0.00	0.00
11.00	0.00	0.00	0.00
11.50	0.00	0.00	0.00
12.00	**6.32**	0.00	**6.32**
12.50	**6.94**	0.00	**6.94**
13.00	3.41	0.00	3.41
13.50	2.10	0.00	2.10
14.00	1.50	0.00	1.50
14.50	1.21	0.00	1.21
15.00	0.93	0.00	0.93
15.50	0.76	0.00	0.76
16.00	0.68	0.00	0.68
16.50	0.60	0.00	0.60
17.00	0.52	0.00	0.52
17.50	0.44	0.00	0.44
18.00	0.36	0.00	0.36
18.50	0.30	0.00	0.30
19.00	0.28	0.00	0.28
19.50	0.26	0.00	0.26
20.00	0.24	0.00	0.24
20.50	0.22	0.00	0.22
21.00	0.20	0.00	0.20
21.50	0.18	0.00	0.18
22.00	0.16	0.00	0.16
22.50	0.14	0.00	0.14
23.00	0.12	0.00	0.12
23.50	0.10	0.00	0.10
24.00	0.08	0.00	0.08
24.50	0.00	0.00	0.00
25.00	0.00	0.00	0.00

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
25.50	0.00	0.00	0.00
26.00	0.00	0.00	0.00
26.50	0.00	0.00	0.00
27.00	0.00	0.00	0.00
27.50	0.00	0.00	0.00
28.00	0.00	0.00	0.00
28.50	0.00	0.00	0.00
29.00	0.00	0.00	0.00
29.50	0.00	0.00	0.00
30.00	0.00	0.00	0.00
30.50	0.00	0.00	0.00
31.00	0.00	0.00	0.00
31.50	0.00	0.00	0.00
32.00	0.00	0.00	0.00
32.50	0.00	0.00	0.00
33.00	0.00	0.00	0.00
33.50	0.00	0.00	0.00
34.00	0.00	0.00	0.00
34.50	0.00	0.00	0.00
35.00	0.00	0.00	0.00
35.50	0.00	0.00	0.00
36.00	0.00	0.00	0.00

East Basin- Hantush Method for Mounding Analysis

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

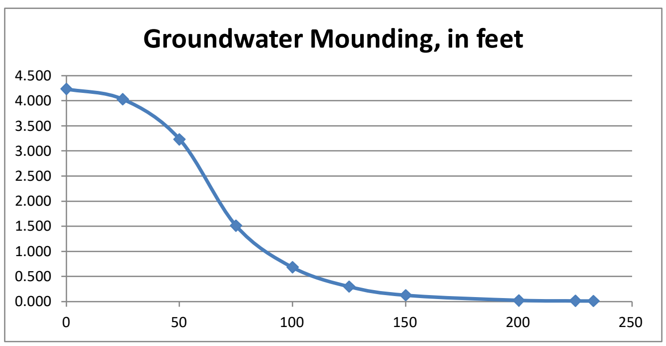
Input Values		
4.8200	*R*	**Recharge (infiltration) rate (feet/day)**
0.320	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
31.17	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
59.570	x	**1/2 length of basin (x direction, in feet)**
7.125	y	**1/2 width of basin (y direction, in feet)**
2.280	t	**duration of infiltration period (days)**
10.000	hi(0)	**initial thickness of saturated zone (feet)**

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

14.234	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
4.234	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
4.234	0
4.028	25
3.231	50
1.513	75
0.684	100
0.299	125
0.126	150
0.025	200
0.016	225
0.014	233

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Drawdown Requirement: 72 hours

10-Year Storm Runoff Volume: 9,807 cubic feet
Bottom Area of Basin: 1697 square feet
K= 1.02 in/hr
Drawdown time (Td) = 67.99 hours

West Basin- Hantush Method for Mounding Analysis

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

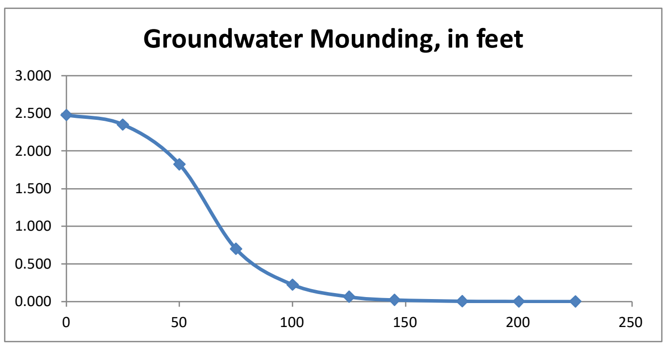
use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
2.0400	***R***	**Recharge (infiltration) rate (feet/day)**
0.320	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
31.17	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
59.915	**x**	**1/2 length of basin (x direction, in feet)**
13.420	**y**	**1/2 width of basin (y direction, in feet)**
1.166	**t**	**duration of infiltration period (days)**
10.000	**hi(0)**	**initial thickness of saturated zone (feet)**
12.478	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
2.478	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
2.478	**0**
2.350	**25**
1.821	**50**
0.701	**75**
0.226	**100**
0.065	**125**
0.022	**145**
0.005	**175**
0.003	**200**
0.003	**225**

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Drawdown Requirement: 72 hours

10-Year Storm Runoff Volume: 12,800 cubic feet
Bottom Area of Basin: 2,277.07 square feet
K = 1.02 in/hr
Drawdown time (Td) = 66.13 hours

Attachment D

Other Documents

1. Operation & Maintenance Plan
2. Illicit Discharge Compliance Statement
3. Laboratory Soil Analysis Results
4. Geotechnical Engineering Report

Operation and Maintenance Plan (O&M)

This Operations and Maintenance Plan provides for the inspection and maintenance of structural Best Management Practices (BMPs) associated with the Cranberry Point Energy Storage Site in Carver, MA. It also outlines procedures associated with emergency maintenance procedures following a fire at the Site.

This document has been prepared in accordance with the requirements of the Stormwater Regulations included in the Massachusetts Wetlands Protection Act Regulations (310 CMR 10).

Responsible Party
Cranberry Point Energy Storage LLC is the owner of the site and will be responsible for the maintenance of the project site and associated stormwater management features. In the event that the property changes ownership, the new property owners will be given this Stormwater Report and provided with this Operation and Maintenance Plan.

Safety
The project site is in an isolated area with a gate blocking off access from the main road. There is a chain link fence separating the battery storage area from the infiltration basin and forebay areas.

Budget
Costs associated with inspection and maintenance of stormwater BMPs will be minimal. These costs are expected to be less than $3,000 per year, but could increase if the number of significant rain events increases or major BMP repairs are needed.

Location
The following stormwater BMPs are shown in the Proposed Grading and Stormwater Management Sheet of the Plans.

Stormwater Best Management Practices: Operation & Maintenance Measures

Best Management Practice	Mow	Inspect	Clean	Repair	Notes
Infiltration basin	Twice a year mow the buffer area, side slopes, and basin bottom	After every major storm during the first 3 months of operation and twice a year thereafter and when there are discharges through the high outlet orifice	Twice a Year remove trash, debris, grass clippings, and accumulated organic matter	As Needed Based on Inspection	Preventative maintenance should be performed twice a year
Sediment Forebay	Bi-monthly During Growing Season	Monthly	Four times per year and when sediment depth is between 3 and 6 feet	As Needed Based on Inspection	-

Check Dam	NA	After Significant Rainfall Events	Remove Sediment as Needed	As Needed Based on Inspection	-
Emergency Spillway	NA	After Significant Rainfall Events	Remove Sediment as Needed	As Needed Based on Inspection	-
Catch Basins	NA	After Significant Rainfall Events	Vacuum out twice per year. Remove sediment when more than 50% filled.	As Needed Based on Inspection	Preventative maintenance should be performed twice per year.
Drainage Outfall	NA	After Significant Rainfall Events	Remove debris and sediment as needed.	As Needed Based on Inspection.	-

Emergency Maintenance Procedures

In the event of a fire at the Cranberry Point Energy Storage Site that triggers the release of fire-fighting foams or any other hazardous substances, emergency maintenance measures must be implemented to eliminate downstream migration of residual of fire-fighting materials within seven (7) calendar days of the incident. All stormwater drainage conduits on the portion of the site impacted by the fire suppression activity (e.g. west or east) shall be jetted, and all sediment accumulated in the sumps of catch basins shall be removed. The top six inches of topsoil within the affected infiltration basin and sediment forebays shall be excavated and replaced and reseeded per the initial design. All excavated material shall be disposed of off-site as appropriate.

Illicit Discharge Compliance Statement

Site Address: 31 R Main Street, Carver, Massachusetts

Owner: Cranberry Point Energy Storage, LLC (d.b.a. Plus Power)

Plan Reference: Cranberry Point Energy Storage Project, AECOM, July 2021

As required by Standard 10 of the Massachusetts Stormwater Standards, I, the undersigned, being the authorized owner/responsible party of the above referenced property do hereby certify that no illicit discharges exist on the site and that the stormwater management system, as shown on the above referenced plan, does not contain or permit any illicit discharges to enter the stormwater management system. Furthermore, discharges from outside the site are prohibited. Illicit discharges do not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.

To prevent illicit discharges to the stormwater management system, procedures contained in the property Stormwater Pollution Prevention Plan will be followed.

Further, I certify that the stormwater management system as shown on the referenced plan will be maintained in accordance with the Operation and Maintenance Plan included in the Stormwater Report.

Name: ________________________

Signed: ________________________

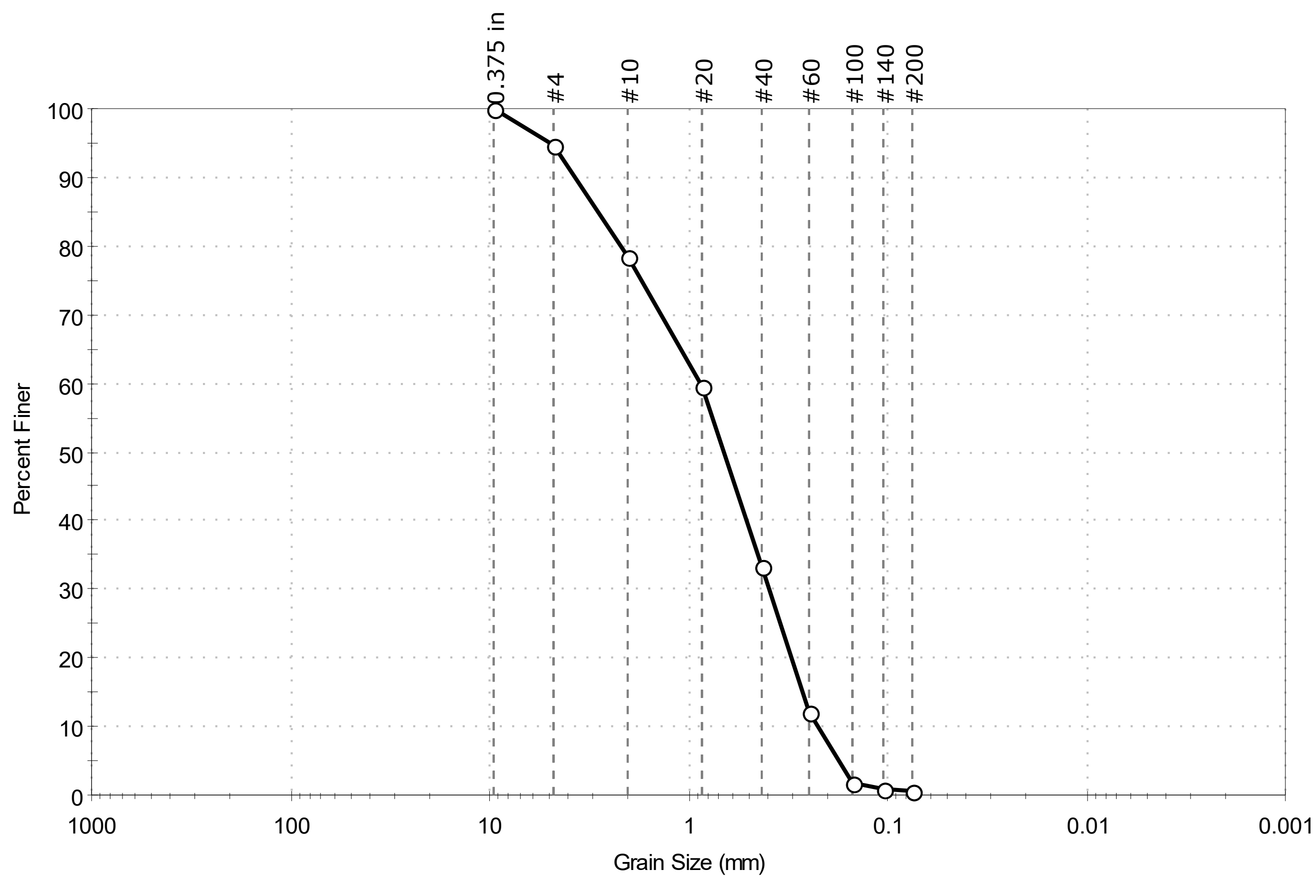
Date: ________________________

GeoTesting EXPRESS

Client:	AECOM				
Project:	Carver Energy Storage				
Location:	Carver, MA			Project No:	GTX-309348
Boring ID:	---	Sample Type:	jar	Tested By:	ckg
Sample ID:	TP-1A	Test Date:	12/28/18	Checked By:	emm
Depth :	4 ft	Test Id:	488207		

Test Comment: ---
Visual Description: Moist, yellowish brown sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	5.2	94.2	0.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	95		
#10	2.00	79		
#20	0.85	60		
#40	0.42	33		
#60	0.25	12		
#100	0.15	2		
#140	0.11	1		
#200	0.075	0.6		

Coefficients

D_{85} =2.8158 mm
D_{30} =0.3913 mm
D_{60} =0.8615 mm
D_{15} =0.2692 mm
D_{50} =0.6588 mm
D_{10} =0.2260 mm
C_u =3.812
C_c =0.786

Classification

ASTM Poorly graded SAND (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

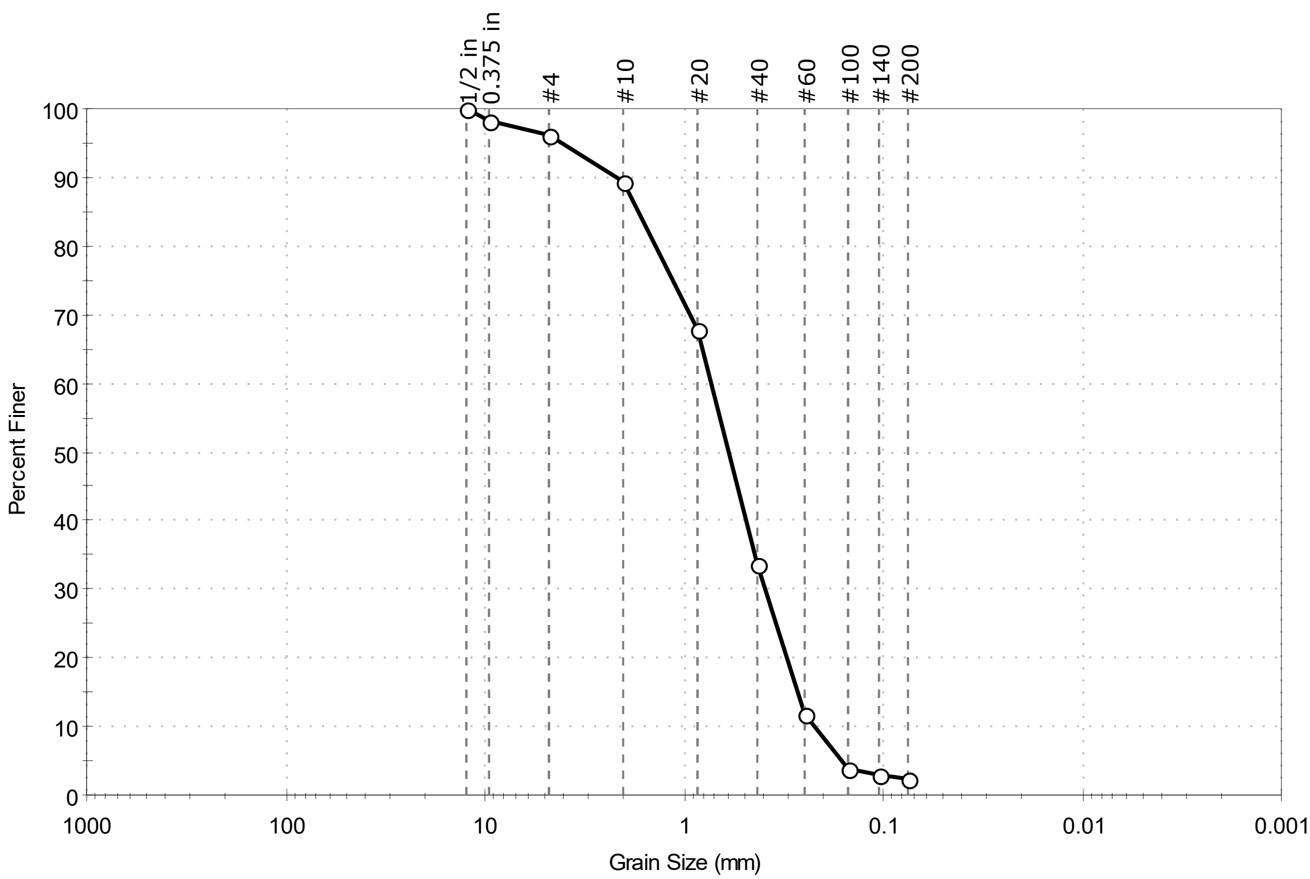
printed 12/28/2018 11:11:18 AM

GeoTesting EXPRESS

Client:	AECOM				
Project:	Carver Energy Storage				
Location:	Carver, MA			Project No:	GTX-309348
Boring ID:	---	Sample Type:	jar	Tested By:	ckg
Sample ID:	TP-2	Test Date:	12/28/18	Checked By:	emm
Depth :	4 ft	Test Id:	488208		

Test Comment: ---
Visual Description: Moist, yellowish brown sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	3.7	93.9	2.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1/2 in	12.50	100		
0.375 in	9.50	98		
#4	4.75	96		
#10	2.00	90		
#20	0.85	68		
#40	0.42	33		
#60	0.25	12		
#100	0.15	4		
#140	0.11	3		
#200	0.075	2.4		

Coefficients

D_{85} =1.6725 mm
D_{30} =0.3902 mm
D_{60} =0.7252 mm
D_{15} =0.2704 mm
D_{50} =0.5928 mm
D_{10} =0.2224 mm
C_u =3.261
C_c =0.944

Classification

ASTM Poorly graded SAND (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

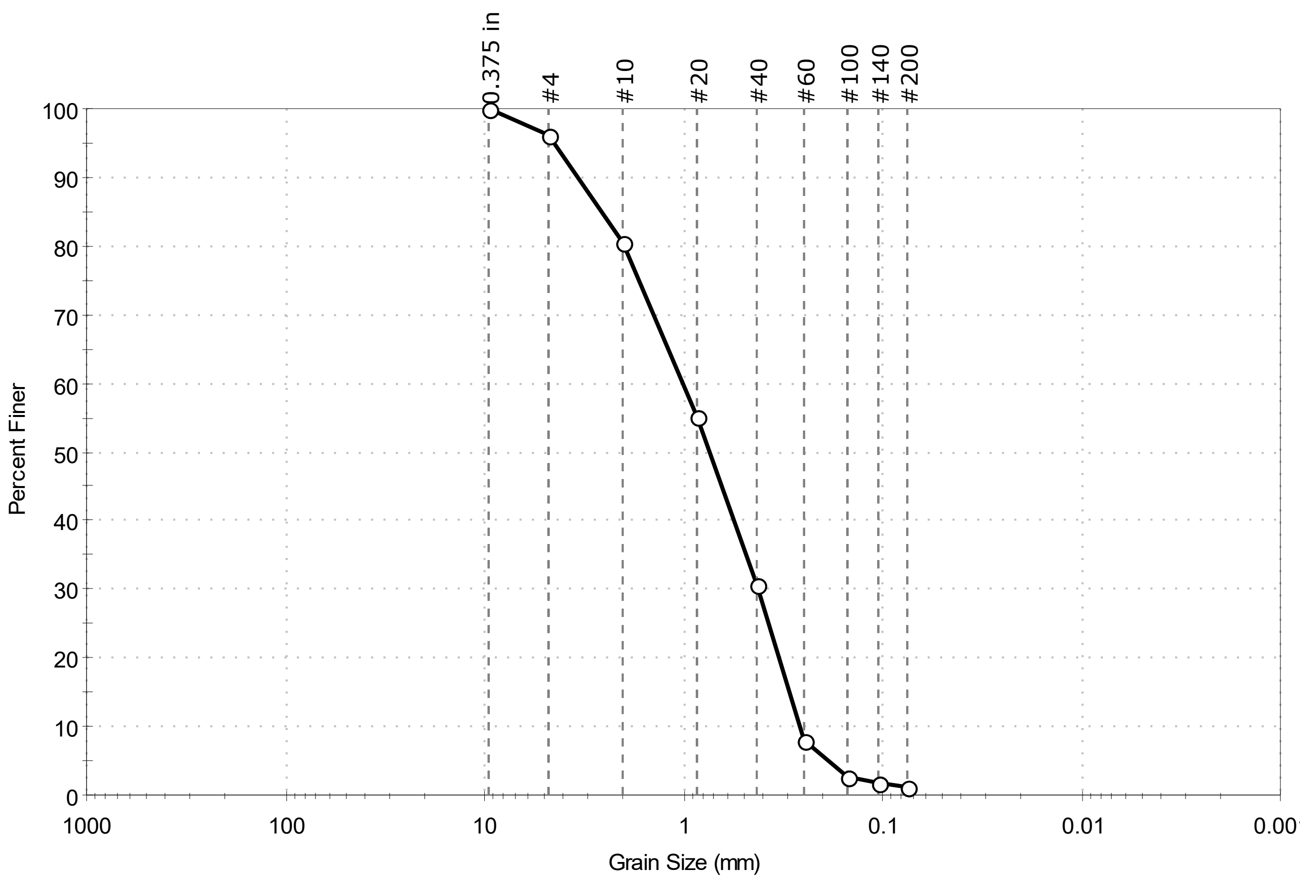
printed 12/28/2018 11:11:20 AM

GeoTesting EXPRESS

Client:	AECOM				
Project:	Carver Energy Storage				
Location:	Carver, MA			Project No:	GTX-309348
Boring ID:	---	Sample Type:	jar	Tested By:	ckg
Sample ID:	TP-3	Test Date:	12/28/18	Checked By:	emm
Depth :	4 ft	Test Id:	488206		

Test Comment: ---
Visual Description: Moist, yellowish brown sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	3.9	95.0	1.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	96		
#10	2.00	81		
#20	0.85	55		
#40	0.42	31		
#60	0.25	8		
#100	0.15	3		
#140	0.11	2		
#200	0.075	1.1		

Coefficients

D_{85} =2.5513 mm
D_{30} =0.4187 mm
D_{60} =1.0000 mm
D_{15} =0.2947 mm
D_{50} =0.7346 mm
D_{10} =0.2621 mm
C_u =3.815
C_c =0.669

Classification

ASTM Poorly graded SAND (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

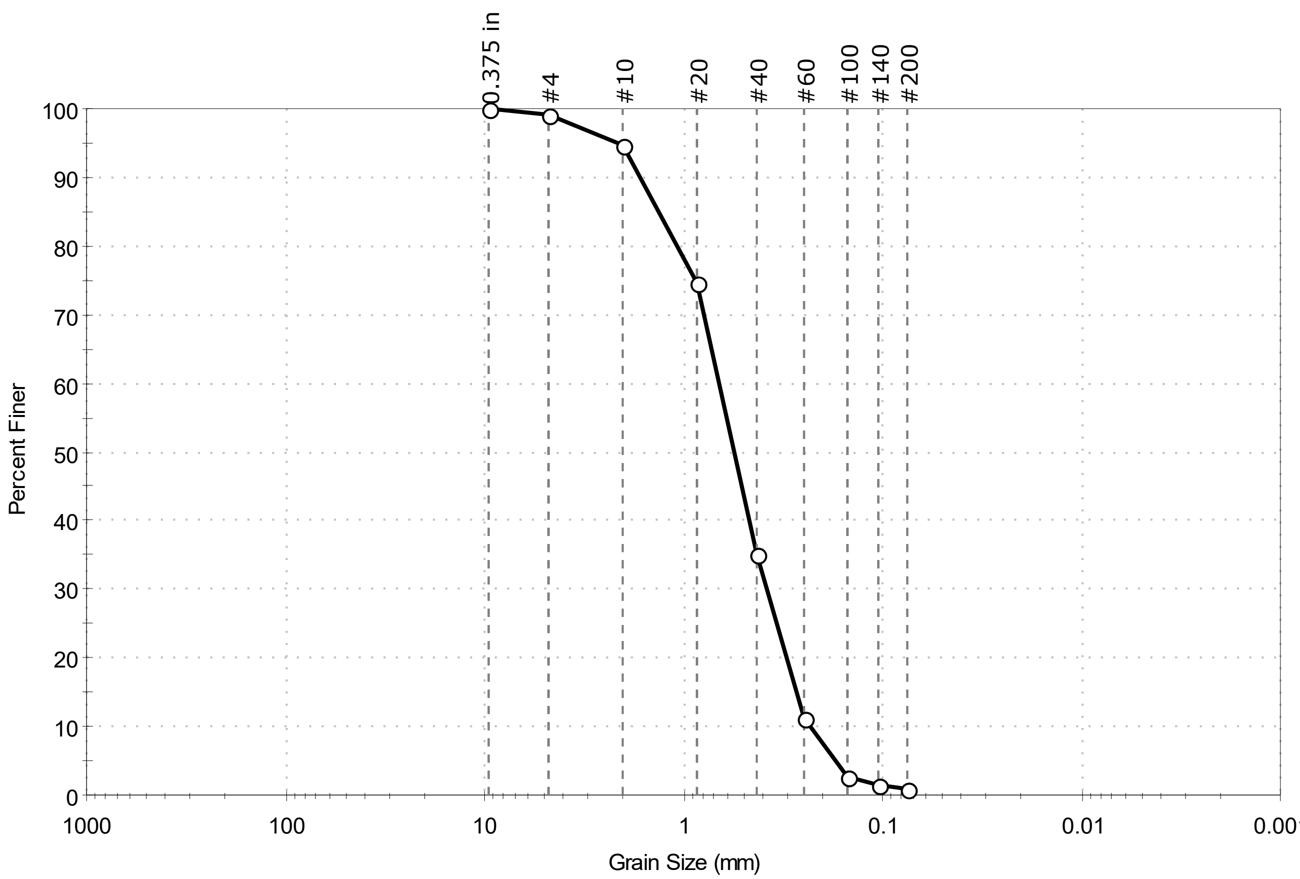
Sand/Gravel Hardness : HARD

printed 12/28/2018 11:11:21 AM

GeoTesting EXPRESS

Client:	AECOM				
Project:	Carver Energy Storage				
Location:	Carver, MA			Project No:	GTX-309348
Boring ID:	---	Sample Type:	jar	Tested By:	ckg
Sample ID:	TP-4	Test Date:	12/28/18	Checked By:	emm
Depth :	4 ft	Test Id:	488205		
Test Comment:	---				
Visual Description:	Moist, yellowish brown sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.0	98.0	1.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	95		
#20	0.85	75		
#40	0.42	35		
#60	0.25	11		
#100	0.15	3		
#140	0.11	2		
#200	0.075	1.0		

Coefficients

D_{85} =1.3175 mm
D_{30} =0.3790 mm
D_{60} =0.6565 mm
D_{15} =0.2722 mm
D_{50} =0.5509 mm
D_{10} =0.2331 mm
C_u =2.816
C_c =0.939

Classification

ASTM Poorly graded SAND (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ---

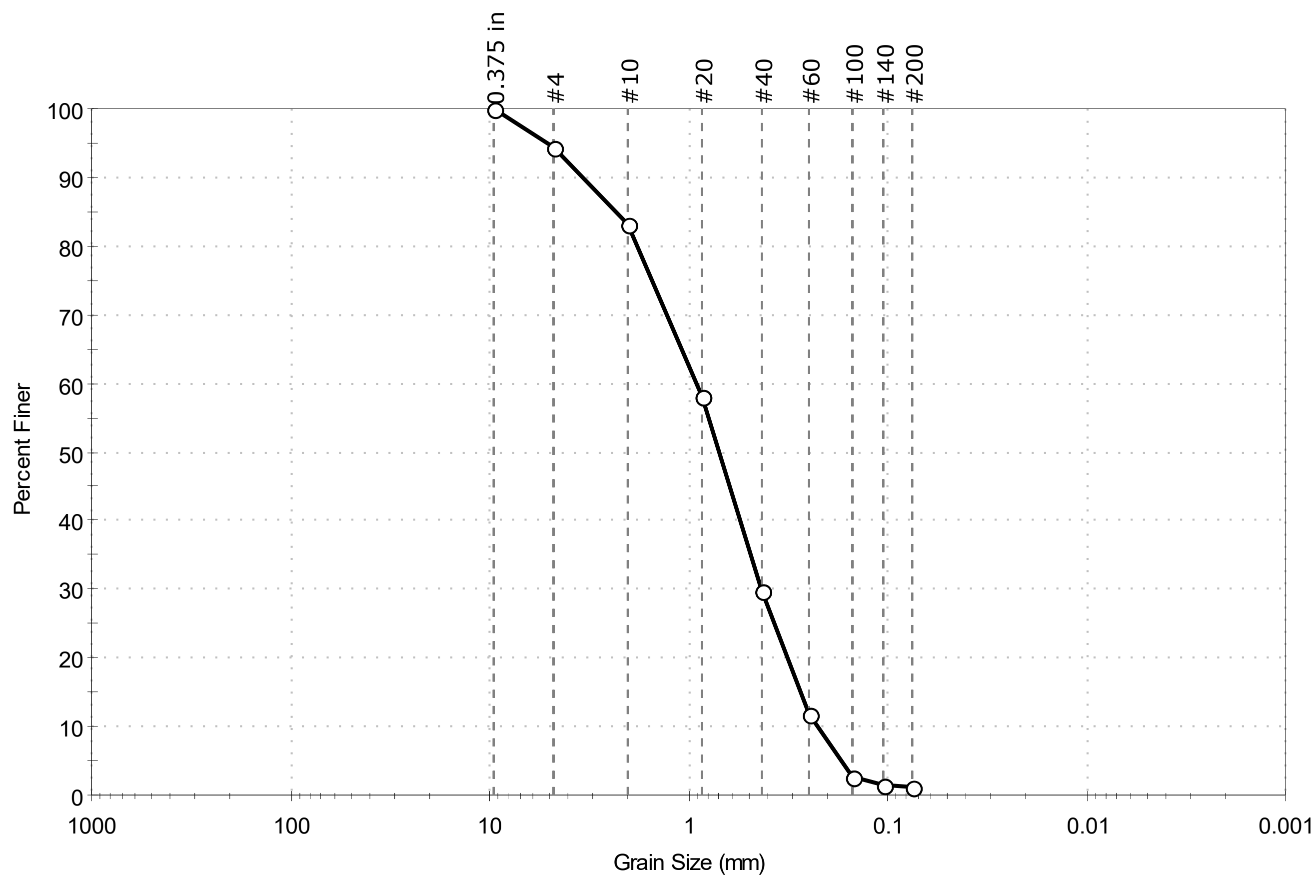
Sand/Gravel Hardness : ---

GeoTesting EXPRESS

Client:	AECOM				
Project:	Carver Energy Storage				
Location:	Carver, MA			Project No:	GTX-309348
Boring ID:	---	Sample Type:	jar	Tested By:	ckg
Sample ID:	TP-5	Test Date:	12/28/18	Checked By:	emm
Depth :	4 ft	Test Id:	488204		

Test Comment: ---
Visual Description: Moist, yellowish brown sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	5.5	93.2	1.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	95		
#10	2.00	83		
#20	0.85	58		
#40	0.42	30		
#60	0.25	12		
#100	0.15	3		
#140	0.11	2		
#200	0.075	1.3		

Coefficients

D_{85} =2.3110 mm D_{30} =0.4271 mm
D_{60} =0.9041 mm D_{15} =0.2748 mm
D_{50} =0.6958 mm D_{10} =0.2259 mm
C_u =4.002 C_c =0.893

Classification

ASTM Poorly graded SAND (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

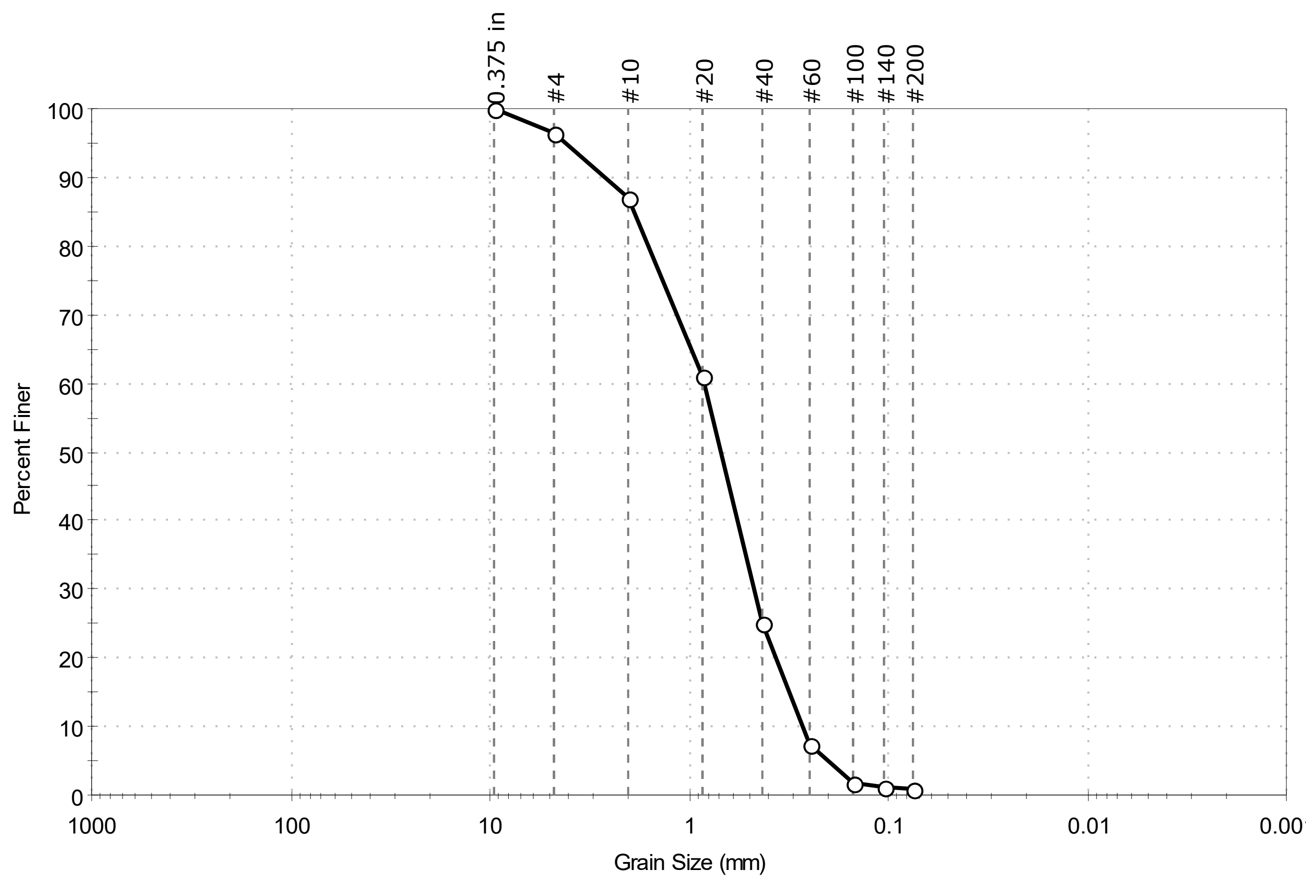
Sand/Gravel Hardness : HARD

printed 12/28/2018 11:11:24 AM

GeoTesting EXPRESS

Client:	AECOM				
Project:	Carver Energy Storage				
Location:	Carver, MA			Project No:	GTX-309348
Boring ID:	---	Sample Type:	jar	Tested By:	ckg
Sample ID:	TP-8	Test Date:	12/28/18	Checked By:	emm
Depth :	4 ft	Test Id:	488209		
Test Comment:	---				
Visual Description:	Moist, yellowish brown sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	3.5	95.7	0.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	97		
#10	2.00	87		
#20	0.85	61		
#40	0.42	25		
#60	0.25	7		
#100	0.15	2		
#140	0.11	1		
#200	0.075	0.8		

Coefficients

D_{85} =1.8644 mm D_{30} =0.4674 mm

D_{60} =0.8318 mm D_{15} =0.3140 mm

D_{50} =0.6864 mm D_{10} =0.2701 mm

C_u =3.080 C_c =0.972

Classification

ASTM Poorly graded SAND (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

GEOTECHNICAL ENGINEERING REPORT

Proposed Cranberry Point Energy Storage Facility
Main Street
Carver, Massachusetts

Prepared For:

Plus Power
PO Box 170684
San Francisco, California

Prepared By:

McArdle Gannon Associates, Inc.
Engineers & Consultants
300 Oak Street, Suite 460
Pembroke, Massachusetts 02359

MGA No. G0841
June 2021

McArdle Gannon Associates, Inc.
Engineers & Consultants

June 21, 2021
MGA No. G0841

Allyson Sand
Developer
Plus Power
PO Box 170684
San Francisco, California 94117

RE: Geotechnical engineering report for the Proposed Cranberry Point Energy Storage Facility on Main Street in Carver, Massachusetts.

Allyson:

The results of our geotechnical engineering studies at the referenced project site are summarized in the attached report. Our studies have been performed in accordance with our agreement with Plus Power dated December 11, 2020. The information contained in this report is subject to the Statement of Limitations attached as Appendix A.

The general subsurface profile encountered within the test borings consists of existing fill soils or topsoil and subsoil underlain by natural granular soils (generally sand over silt) over glacial till deposits at depth. The presence of loose granular soils that are considered susceptible to liquefaction and existing fill, forest mat, and subsoil within the structure areas are the primary subsurface conditions impacting the proposed site development.

We estimate about 2± to 2.5± inches of settlement due to the potential liquefaction of the loose natural soils during an earthquake based upon the conditions encountered at the boring locations (discussed in greater detail in the report). Provided that the Owner understands and is willing to accept the risk of potential settlement and possible subsequent damage to the structures during an earthquake, constructing the proposed structures on shallow foundations with a slab on grade would be acceptable. Alternatively, ground improvement or deep foundations would likely be required.

Our geotechnical recommendations for use in the design and earthwork construction of shallow spread footing foundations and slabs on grade for the proposed structures are discussed in this report. Our findings, conclusions and recommendations, test boring logs, laboratory test results, along with locus and exploration location plans, are included in the report.

We look forward to assisting you further as the design progresses and during the earthwork construction phase of the project. If you have any questions or require additional information, please do not hesitate to call.

Regards,

MCARDLE GANNON ASSOCIATES, INC.

Sherry L. Holmes, P.E.
Geotechnical Engineer

John J. Gannon
Principal

SLH/JJG/slh

TABLE OF CONTENTS

FIGURES

APPENDICES

1.00 INTRODUCTION

This report summarizes the results of our geotechnical engineering studies conducted at the site of the proposed Cranberry Point Energy Storage Facility on Main Street in Carver, Massachusetts. A site locus is attached as Figure No. 1 of this report. Our objective has been to assess the subsurface conditions at the site and provide geotechnical engineering recommendations for use in the design and earthwork construction of structure foundations and slabs.

This report has been prepared in accordance with our agreement with Plus Power dated December 11, 2020. The information contained in this report is subject to the Statement of Limitations attached as Appendix A.

1.10 Site and Project Description

Our understanding of the site and proposed project is based on our discussions with you and Carlos Anaya of Plus Power, our site visits, and our review of the following documents:

- Plans entitled “Site Plan,” Figure 1; “Topographic Plan,” Figures 4 and 5; and “Tree Location Plan,” Figure 6, dated January 8, 2019, by Beals + Thomas, Inc. (BTI),
- A plan entitled “General Arrangement Plan”, Drawing No. GA01, dated November 13, 2020 by Asset Engineering Company (AEC), and
- Documents entitled “Megapack Installation Manual – Rev. 2.5” and “Megapack 2 Specification,” by Tesla.

The subject property is located off the southwestern side of Main Street (Route 58) in Carver, Massachusetts. N-Star Electric Transmission Easements border the site to the north and west and cranberry bogs and wooded areas to the south. An existing cellular phone tower is located at the northeastern corner of the site.

The majority of the site is wooded with clearings at a paved drive off Main Street and other access paths. Ground surface contours shown on the referenced “Topographic Plan” indicate that the ground surface at the site varies between about Elevation 106± to 136± feet.

According to the referenced “General Arrangement Plan,” the Cranberry Energy Storage facility proposed at the site will consist of ninety-seven (97) Tesla type Megapack Batteries and forty-nine (49) inverter step-up transformers. The project is conceptual at this time and proposed site grading and structural information were not available for our review.

Based on information included in the referenced Megapack documents, we understand that the Megapacks are typically about 23.5± to 30± feet by 5.4± feet and have a maximum weight of between 56,000 to 84,000 pounds.

2.00 SUBSURFACE EXPLORATIONS

MGA observed and logged test borings at the site to assess the subsurface conditions. An MGA representative described the conditions encountered in general accordance with Burmister descriptions. BTI survey located the test borings and provided ground surface elevations at each location. The exploration locations and elevations discussed in this report and shown on the attached Figure 2: Exploration Location Plan are approximate.

2.10 Test Borings

Geosearch, Inc. (Geosearch) of Sterling, Massachusetts performed 8 soil test borings (B-1 through B-8) at the site between January 4 through 6, 2021 with an all-terrain vehicle (ATV) mounted drill rig. An MGA representative observed and logged the borings.

Geosearch generally advanced the borings through topsoil, subsoil, and/or fill into natural granular soils (sand or silt) or glacial till soils to depths between 17± and 71± feet below ground surface (bgs) using 4-1/4 inch inside diameter hollow stem augers or 4 inch inside diameter flush jointed casing.

Geosearch generally conducted continuous Standard Penetration Tests (SPT) at 5± foot intervals during advancement of the borings. Geosearch accomplished the SPT by driving a standard two-inch outside diameter split spoon sampler a distance of up to twenty-four inches (or to refusal) with a 140-pound automatic hammer falling a distance of thirty inches at each sampling depth.

The number of blows required to drive the sampler in six-inch increments is recorded on the boring logs attached in Appendix B. The sum of the blows required to drive the sampler from the 6 to 12 and 12 to 18-inch increments, defined as the Standard Penetration Resistance of the soil, is a measure of soil density and strength based upon empirically derived correlations.

The soil samples retrieved in the 2 inch outside diameter (1-3/8 inch inside diameter) split spoon sampler following each standard penetration test were visually described in the field using Burmister soil descriptions. The descriptions are shown on the boring logs attached in Appendix B. Note that these descriptions do not account for soil fractions larger than 1-3/8 inches in diameter that may be present within the strata sampled.

Geosearch installed 2-inch diameter PVC monitoring wells in completed borings B-7 and B-8 upon completion for our use to measure stabilized groundwater levels.

3.00 LABORATORY SOIL TESTING

We performed seven (7) wash sieves, two (2) sieve-hydrometers, seven (7) moisture content analyses, and three (3) electric and thermal resistivity tests on soil samples obtained during the explorations for use in our studies. We performed the tests to verify our field descriptions and to gain a preliminary understanding of the engineering behavior of the soils tested. The test results are attached as Appendix C. A summary of the laboratory gradation test results is presented in

Table I below. Note that the test results are from the recovered samples within the split spoon sampler (1-3/8 inch minus fraction).

TABLE I. SUMMARY OF LABORATORY GRADATION TEST RESULTS					
Boring Number	**Sample Number**	**Depth (ft)**	**Strata Description**	**Moisture Content (%)**	**% Fines (< No. 200 Sieve)**
B-1	S-2	4-6	Natural Sand	5.0	5.8
B-1	S-6	24-26	Natural Silt	25.9	88.7
B-2	S-3	9-11	Natural Sand	20.5	5.8
B-3	S-2	4-6	Natural Sand	6.7	3.5
B-4	S-4	9-11	Natural Sand	19.9	8.5
B-5	S-3	10-12	Natural Sand	4.9	2.2
B-6	S-2	4-6	Natural Sand	24.6	2.3
B-7	S-1	0-2	Natural Sand	---	3.1
B-8	S-3	10-12	Natural Sand	---	4.0

4.00 SUBSURFACE CONDITIONS

In general, the subsurface profile encountered in the test borings at the site consists of 0 to 1.5± feet of existing fill or forest mat/subsoil soils underlain by natural granular deposits (sand over silt) over glacial till at depth.

The approximate bottom of forest mat/subsoil and/or existing fill depths and elevations are shown adjacent to each test boring location on the attached Figure No. 2. Additional detailed information can be found on the test boring logs attached in Appendix B.

The following is a general description of the subsurface strata encountered in the subsurface explorations at the site:

<u>Forest Mat/Subsoil</u>: A forest mat layer covers the ground surface at borings B-1 through B-3 and B-8. Where encountered, the forest mat is about 0.2± to 0.3± foot thick and generally consists of black, fine to medium sand with about 20 to 40 percent silt and about 10 to 20 percent organic matter.

An approximately 0.3± to 1± foot thick layer of subsoil was encountered below the topsoil or fill soils or at ground surface at the majority of boring locations, with the exception of B-6 and B-7. The subsoil generally consists of orange, fine to medium sand with about 15 to 25 percent silt, and up to about 15 percent organic matter.

<u>Fill</u>: An approximately 0.7± to 1± foot thick layer of existing fill was encountered at ground surface in borings B-5 and B-6. The fill generally consists of orange-brown/dark brown, fine to medium sand with about 10 to 20 percent silt, and up to about 15 percent organic matter.

Natural Granular Soils: The top of the natural granular soils (generally sand over silt) was generally encountered at about 0± to 1.5± feet below ground surface (bgs) at the test boring locations, corresponding to about Elevation 108.4± to 119.3± feet.

Natural sand generally consists of loose to medium dense, tan/brown, fine to medium/fine to coarse sand with about 2 to 10 percent silt, and about 0 to 15 percent fine/fine to coarse gravel.

Natural silt/sand & silt soils were encountered below the sand at about 12± to 25± feet bgs in the majority of the borings, with the exception of B-8, corresponding to Elevation 93.1± to 102± feet. The silt generally consists of loose to medium dense, tan/brown, silt with about 5 to 15 percent fine/fine to medium sand.

Refer to Appendix C for gradation curves of the 1-3/8 inch minus fraction of the natural granular soils collected from borings B-1 through B-8.

Natural Glacial Till Soils: Natural glacial till soils were encountered below the silt at about 70± feet bgs in boring B-1, corresponding to about Elevation 48.1± feet. The glacial till generally consists of very dense, tan, fine to coarse sand with about 35 to 45 percent fine to coarse gravel, and about 20 to 35 percent silt.

Groundwater: Groundwater levels for our study were recorded in the explorations at the times and under the conditions noted on the logs. Stabilized groundwater readings at 4.4± and 13± feet were measured in the monitoring wells installed at borings B-7 and B-8, respectively, on January 8, 2021. These depths correspond to about Elevation 104± to 104.9± feet.

Groundwater was encountered at about 15± feet bgs in borings B-5 and B-6, corresponding to about Elevation 105.8± and 97.1± feet, respectively. These may not represent the stabilized groundwater levels. Groundwater was not measured in the remaining borings due to the addition of water during drilling.

It should be noted that groundwater levels at the site will fluctuate due to varying climatic, surface and subsurface conditions. Therefore, groundwater levels encountered during construction and thereafter may differ from those reported herein. Specific to this site, groundwater may become perched within and on silty natural soils during wet weather conditions. Detailed descriptions of the subsurface conditions encountered are shown on the test boring logs attached in Appendix B.

5.00 CONCLUSIONS AND RECOMMENDATIONS

The primary subsurface conditions impacting the project are the presence of loose soil deposits and surficial topsoil/subsoil or existing fill overlying natural soils at the location of borings conducted at the site.

As discussed in Section 5.40 on page 9 of this report, the very loose to loose sand and silt soils encountered at some of the boring locations are considered susceptible to liquefaction during an earthquake. We estimate that about 2± to 2.5± inches of settlement could occur in these soils due to the liquefaction resulting from the 9th Edition of the Massachusetts State Building Code (MSBC) specified peak ground acceleration. These estimates are based upon widely spaced borings and the peak ground acceleration per the MSBC. Actual settlements (total and differential) could be greater depending on the subsurface conditions and the actual magnitude of the earthquake. Settlements of this magnitude could cause damage to, but are not likely to cause collapse of the structures (i.e. not a life safety issue).

We anticipate that the structures could be supported on shallow spread foundations and slabs on grade designed to accommodate total and differential movement resulting from a seismic event. If the risk of settlement of shallow spread footings and slabs on grade during a Code Designed earthquake event is not deemed acceptable to the Owner or the project team, ground improvement or deep foundations would need to be utilized for support of the structures. MGA can provide additional details for ground improvement or deep foundations during final design if required.

In addition, the existing fill soils and forest mat/subsoil encountered at the boring locations are not considered suitable for support of the proposed foundations and slabs. The erratic density, composition, soft consistency, organic content, and thickness of these materials results in these soils being unpredictable as an engineering material. These soils should be removed and replaced with compacted granular fill.

Our conclusions and recommendations for the project are based on the results of the explorations and laboratory tests discussed above and are addressed under the following subheadings:

5.10 Earthwork

Existing pavement, utilities, asphalt, slabs, foundations, vegetation, fill, forest mat, topsoil, and subsoil should be removed to firm natural soils from within the proposed structure stress zones. The stress zone is defined as the structure footprint plus the volume defined by a line drawn from the bottom outside edge of the exterior foundation or slab on a 45-degree angle down to firm, natural granular soils. Excavations between about 0± to 1.5± bgs are anticipated to remove the fill and forest mat/subsoil based upon the borings performed at the site. Actual excavation depths required to remove these soils may vary.

Natural granular soils that are disturbed during the excavation should be re-compacted prior to the placement of the initial lift of Granular Fill. Compacted lifts of Granular Fill placed within the proposed structure areas should be placed in 12-inch maximum thick lifts up to proposed slab subgrade elevations. Each lift should be compacted to at least 95 percent of the materials maximum dry density as determined by ASTM D1557 Method C. Granular Fill shall be free from ice and snow, roots, sod, rubbish and other deleterious or organic matter. Granular Fill shall conform to the following gradation requirements shown in Table II:

TABLE II. GRANULAR FILL	
Sieve Size	*Percent Passing by Weight*
*	100
No. 4	30 – 95
No. 40	10 – 70
No. 200	0 – 15**
*Two thirds (2/3) of the loose lift thickness. **0 – 8 for free-draining fill behind foundation/retaining walls.	

We anticipate that the majority of the on-site sand soils would be considered suitable for re-use as Granular Fill provided that these soils can be densified to the required compaction percentages in a firm and stable condition. The excavated soils will be considered suitable for reuse provided oversized boulders (larger than two thirds (2/3) of the loose lift thickness (i.e., 8 inches for a 12-inch-thick lift)) are removed and the moisture content is controlled so that adequate compaction can be achieved. Some of the on-site sand soils appear to be well below the typical optimum moisture content for these types of soils. Based on our experience, it is likely that the contractor will need to add water to the sand soils during compaction in order to achieve the required compaction percentages.

Forest mat, topsoil, subsoil, and natural silt soils are not considered suitable for reuse as Granular Fill. These soils could be reused in landscaped areas or removed the site.

5.20 Foundations and Allowable Bearing Capacities

5.20a Shallow Foundations

We anticipate that spread footing foundations will be considered suitable to support the proposed equipment structures provided the subgrades are prepared as recommended above and the structures can be designed to mitigate the risk of settlement due to a design earthquake (discussed further in Sections 5.00 and 5.40). We anticipate that the foundation subgrade will primarily consist of compacted Granular Fill or natural granular soils.

Foundation excavations should be performed using an excavator equipped with a smooth-edged bucket. Alternatively, granular subgrades that are disturbed during excavation should be re-compacted with a large vibratory plate compactor. In our experience, foundation subgrades consisting of clean natural sand soils can become disturbed due to foot traffic during construction. A 3-6 inch thick layer of ¾ inch compacted crushed stone could be placed over the natural soil subgrades to prevent the subgrades from disturbance. If used, Crushed Stone should be compacted with a hand operated vibratory plate compactor to an unyielding condition.

Provided that the foundation areas are prepared as described above, the foundations may be designed utilizing a preliminary maximum allowable soil bearing capacity of up to one and one-half tons per square foot (1.5 TSF). Note that the recommended allowable bearing capacity is considered preliminary and should be confirmed by MGA once the proposed grading and structural loads are provided for our review.

To protect the integrity of the foundation bearing conditions, no utility lines should be allowed to pass beneath or within the stress zone of the footings. Rather, efforts should be made to move utilities or lower footing elevations to satisfy this recommendation.

Regardless of the recommended allowable bearing capacity, continuous wall footings should be at least 24 inches wide and column footings should be no less than 36 inches wide in the least lateral dimension. Exterior footings should be founded at least four feet (4’) below the finish exterior and slab grade for frost protection.

Foundations should not be poured on frozen soil. Foundations should be backfilled as soon as possible during freezing temperatures. Footing areas should be protected by temporary heated enclosures if left open prior to backfilling during freezing temperatures.

Foundations and sub-slab utilities should be backfilled with Granular Fill placed in compacted lifts for slab support. Each lift should be compacted to at least 95 percent of the materials maximum dry density as determined by ASTM D1557 Method C.

5.20b Foundation Alternatives

If the recommended maximum allowable bearing capacity is not sufficient to adequately support the proposed structure loads, the structures could be supported on deep foundations or ground improvement could be utilized to improve the existing soil profile to provide a higher allowable bearing capacity. In addition, if the risk of settlement of a shallow foundation system due to a design earthquake (discussed further in Sections 5.00 and 5.40) is deemed unacceptable by the Owner or project team, deep foundations or ground improvement could be utilized.

If necessary, a deep foundation system consisting of driven or drilled piles could be considered for support of the proposed structures. The type of pile suitable for a particular project depends on the local subsurface soil conditions, the anticipated loading, the amount of allowable settlement, and the compatibility of the chosen pile with site constraints and other construction requirements. Piles could consist of driven piles (timber, concrete-filled steel pipe piles, pre-stressed concrete, ductile iron piles, etc.) or drilled piles (drilled mini-piles, drilled piers, helical piles, etc.). Since the anticipated structural loading is not available for review, we are unable to adequately assess the suitability of the various pile types at this time. We are available to provide further recommendations for pile design during final design if this option is chosen.

Ground improvement could also be considered to improve the allowable bearing capacity and to possibly mitigate potential settlement due to the design earthquake. In this case, aggregate piers (APs) with traditional shallow footings and slab-on-grade construction would likely be utilized. APs are a ground improvement technique that uses high modulus stone columns to improve the existing soil profile. The APs displace soil laterally to densify the soil, increase soil stiffness, and reinforce the soil profile by creating a stiff composite soil mass. This provides an improved soil crust that may reduce the likelihood of settlement at the ground surface due to liquefaction of underlying soil layers. Based our experience with APs/RIs, we anticipate that the soils could be improved to provide an allowable bearing capacity of up to 2 tons per square foot (2 tsf) by implementing this technique. A specialty contractor would provide the actual allowable soil bearing capacity and anticipated settlements with supporting design analysis.

5.30 Slab Support

Provided that the proposed structure areas are prepared as described in the preceding sections, slab-on-grade construction is recommended. The slab should bear directly on a 12-inch minimum thick Sand and Gravel Fill or Dense Graded Aggregate Fill base course layer compacted to at least 95 percent of the material's maximum dry density (ASTM D-1557).

The Sand and Gravel base course material should consist of hard, durable sand and gravel meeting the gradation requirements shown in the following Table III.

TABLE III.	
SAND AND GRAVEL FILL	
Sieve Size	*Percent Passing by Weight*
4 inches	100
½ inch	50 – 85
No. 4	40 – 75
No. 10	30 – 60
No. 40	10 – 35
No. 100	5 – 20
No. 200	2 – 8

The dense graded aggregate material shall consist of hard durable particles of fragments of stone and natural or crushed sand meeting the gradation requirements shown below in Table IV.

TABLE IV.	
DENSE GRADED AGGREGATE FILL	
Sieve Size	*Percent Passing by Weight*
2 inches	100
1.5 inches	70-100
0.75 inch	50-85
No. 4	30-55
No. 50	8-24
No. 200	2 – 8

Alternatively, slabs could be supported on an 8-inch minimum thick layer of compacted Crushed Stone. Three-quarter inch crushed stone should meet the gradation requirements shown below in Table V. Crushed Stone should be compacted to an unyielding surface.

TABLE V.	
¾ INCH CRUSHED STONE FILL	
Sieve Size	*Percent Passing by Weight*
1 inch	100
¾ inch	90-100
½ inch	10-50
3/8 inch	0 – 20
No. 4	0 – 5

Slabs constructed on compacted base course layers over subgrades prepared as recommended herein can be designed using a Modulus of Subgrade Reaction (k) up to 150 pounds per cubic inch (k = 150 pci). The modulus provided is based on a 12-inch square plate and should be adjusted accordingly for slab size. Similar to the foundation recommendations, the recommended modulus is considered preliminary and should be confirmed by MGA once the proposed grading and slab structural loads are provided for our review.

5.40 Seismic Design Criteria

5.40a Liquefaction Potential

Very loose to loose sand soils and silt soils were encountered below the water table at boring locations B-1 and B-6. Loose granular soils below the water table can liquefy under cyclic loading caused by an earthquake. We initially identified seven (7) samples determined to be potentially susceptible to liquefaction based on Figure 1804.6c in the MSBC.

We conducted a liquefaction assessment on these seven (7) samples determined to be potentially susceptible to liquefaction (B-1, S-9 through S-13; and B-6, S-5 and S-6). The assessment was performed in accordance with "Standard Penetration Test-Based Probabilistic and Deterministic Assessment of Seismic Soil Liquefaction Potential" by Cetin, Seed, Kiureghian, Tokimatsu, Harder, Kayen and Moss as published in Vol. 130, No. 12 of the *ASCE Journal of Geotechnical and Geoenvironmental Engineering / December 2004*.

We considered an earthquake with a peak ground acceleration of 0.225g in accordance with Section 1803.5.12.2.2.2 of the MSBC. Our analysis indicates that the likelihood of the design earthquake triggering liquefaction of the loose sand/silt deposits at the site varies from about 50 to 95 percent.

Should an earthquake with a peak ground acceleration of 0.225g occur at the site, there is a 50% to 95% chance that portions of the very loose to loose sand/silt deposits encountered at the boring locations could liquefy and settlement of the site and proposed structures may result. The samples that are considered susceptible to liquefaction were encountered between about 19± to 60± feet below existing grades.

We estimate that liquefaction of 10± to 31± feet thick loose zones encountered at the boring locations during the design earthquake could cause level ground at the site to settle between about 2± to 2.5± inches. Actual settlements (total and differential) could be greater at locations where loose soils are thicker than encountered at the boring locations and during a higher peak ground acceleration event.

The project structural engineer should determine if additional structural design requirements are warranted based upon the anticipated settlement due to the design earthquake.

5.40b Site Seismic Class

Provided that foundations are designed and constructed as recommended herein, the site of the proposed facility is considered a Site Class E soil site in accordance with Section 1613 of the Ninth Edition of The Massachusetts State Building Code (MSBC). In accordance with table 1604.11 in the MSBC, maximum considered earthquake response accelerations factors of S_S=0.182 and S_1=0.061 should be utilized in the structural design for the town of Carver.

5.50 Lateral Earth Pressures on Foundation/Retaining Walls

Retaining walls and foundation walls with unbalanced loading should be designed to resist lateral earth pressures. For unrestrained retaining walls (active condition) that are allowed to rotate after construction we recommend an equivalent fluid pressure of 45 pcf times the height of the walls be considered in the structural design. For foundation walls (rigid walls, at-rest pressures) we recommend an equivalent fluid pressure of 65 pcf times the height of the walls be considered in the structural design.

These values are for horizontal backfilled and assume that the walls (where backfill behind the walls is exposed to rainfall) are backfilled with “clean” free draining Granular Fill (less than 8 percent passing the No. 200 sieve) or Sand and Gravel within at least 3 feet of the walls and are drained so that no water pressure develops behind the wall.

Where the calculated earth pressure behind walls is less than 250 pounds per square foot (psf), it should be increased to 250 psf to account for stresses created by compaction within 5 feet of the wall. Walls should also be designed for appropriate sloping backfill, surcharge (e.g., floor loads), and seismic loads per Section 1610.2 of the Massachusetts State Building Code.

For retaining walls and foundation walls where backfill behind the wall is exposed to rainfall, a 6-inch diameter perforated PVC pipe surrounded by Crushed Stone and wrapped in a non-woven geotextile should be provided at the heel of each retaining wall (above the bottom of footing) to provide discharge of penetrating surface and rain water. As previously indicated, backfill placed within a 3-foot lateral distance behind these walls should be free draining and have less than 8 percent fines passing the No. 200 sieve.

The minimum factors of safety for sliding and overturning under static loads should be 1.5 and 2 respectively. Passive pressure at the toe of the walls should not be included as a resisting force when analyzing for overturning and sliding.

5.60 Lateral Load Resistance

The following coefficients of friction may be used to calculate ultimate sliding resistance between the soil-bearing cast-in-place concrete footings and various bearing materials:

Bearing Material	Recommended Sliding Coefficient
Crushed Stone	0.6
Controlled, Compacted Sand and Gravel	0.5
Controlled, Compacted Granular Fill	0.4
Natural Undisturbed Granular Soils	0.35

The allowable net (passive minus active) lateral resistance provided by the backfill surrounding the foundation elements can be estimated using an equivalent fluid unit weight of 250 pounds per cubic foot (pcf). This value assumes that granular backfill is systematically placed and compacted in lifts within 5 feet laterally against structure elements. The top of the passive zone should be 6 inches below the top of the adjacent soil or backfill surface. If the horizontal distance between nearby footings, walls, or grade beams is less than twice the height of the subject structural element, the passive pressure should be discounted proportionately to the distance (full pressure at twice the height away) to accommodate interaction of the elements.

If additional sliding resistance is needed, such as for footings that are not buried at a sufficient depth to develop passive soil resistance, footings can be constructed with “keys.”

5.70 Pavement Area Earthwork and Recommended Pavement Sections

Forest mat, topsoil, subsoil, and vegetation are not considered suitable to remain in place below the proposed pavements. Therefore, we recommend that these materials be removed from the proposed pavement areas.

We anticipate that the existing fill will be suitable for the support of the proposed pavement provided that the surface of the existing fill is systematically densified. Densifying existing fills in-place beneath proposed pavement areas to provide a uniformly densified zone of soil on which additional fill can be properly placed and compacted and/or pavement sections can be constructed is recommended.

To accomplish the densification operation, the pavement area should be cut to subgrade elevation. Where existing fill soils are encountered, the contractor should compact the fill surface in the presence of MGA by making at least 10 passes with a vibratory drum compactor having a minimum drum weight of 10,000 pounds. Areas of the fill surface that are observed to be weak and unstable under the action of the compactor should be explored with shallow test pits.

The unstable materials should be excavated and replaced with compacted material meeting the recommended gradation specification for Granular Fill. The fill should be placed in controlled lifts and each lift should be compacted to at least 95 percent of the materials' maximum dry density as determined by ASTM D1557 in accordance with the project specifications.

Once the forest mat, topsoil, subsoil, and vegetation are removed from the proposed pavement fill areas and the existing fill subgrade is densified as described above, Granular Fill should be placed in compacted lifts up to the proposed pavement subgrade elevations. The Granular Fill should be placed in 12-inch maximum thick lifts and each lift should be compacted to at least 95 percent of the material's maximum dry density as determined by ASTM D-1557 Method C.

Proposed pavement layout and site grading was not available for our review. In addition, no pavement traffic information or requirements were provided for our review. Based on the subsurface conditions encountered in the test borings, we recommend the following heavy-duty and general duty pavement sections:

TABLE VI. RECOMMENDED HEAVY DUTY PAVEMENT SECTION	
Layer	*Minimum Thickness*
Bituminous Concrete Top Course	2"
Bituminous Concrete Binder Course	2"
Dense Graded Aggregate Course	4"
Sand and Gravel Base Course	10"

The 4-inch layer of Dense Graded Aggregate over a 10-inch layer of Sand and Gravel Fill base course layer is recommended below heavy-duty concrete pavement areas as well.

TABLE VII. RECOMMENDED GENERAL DUTY PAVEMENT SECTION	
Layer	*Minimum Thickness*
Bituminous Concrete Top Course	1.5"
Bituminous Concrete Binder Course	1.5"
Sand and Gravel Base Course	10"

The Dense Graded Aggregate and Sand and Gravel Fill layers should meet the recommended gradation specifications shown in Tables III and IV in this report. Alternatively, the base course layers could consist entirely of Dense Graded Aggregate. These layers should be compacted to at least 95 percent of the materials maximum dry density as determined by ASTM D 1557 Method C.

We are available to review and discuss the anticipated site grading, pavement loading, and required pavement sections with the project team. We can further assess the recommended pavement sections based on the review and discussions.

5.80 Corrosion Considerations

Laboratory electric and thermal resistivity testing was performed on samples of the natural granular soils obtained from borings B-1, B-4, and B-5. The electrical resistivity values ranged from about 22,429 to 23,575 ohms-cm. The thermal resistivity values ranged from about 53 to 57 °Kelvin centimeter per watt (°K cm/W). The laboratory results are attached in Appendix C.

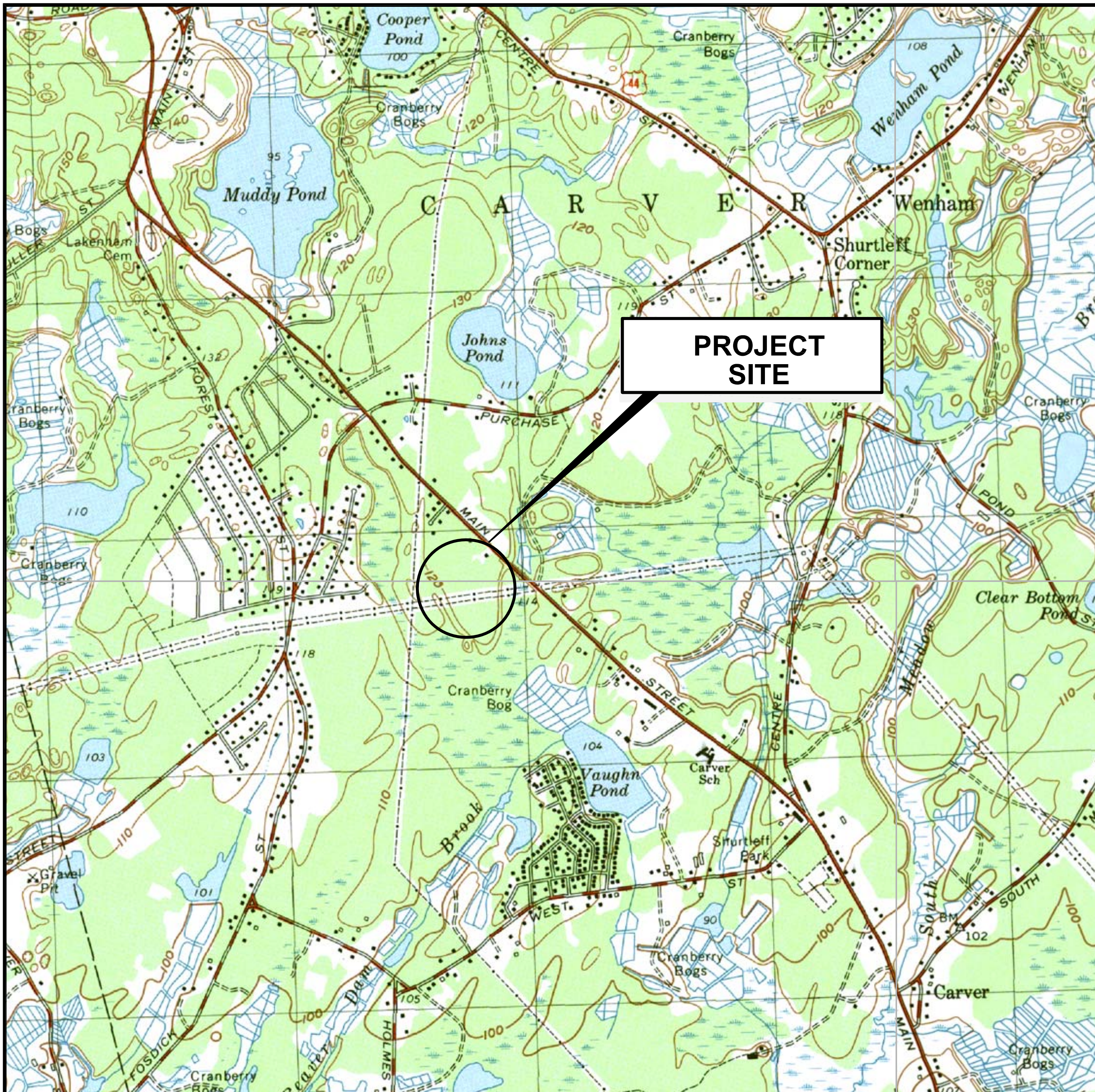
Based on criteria contained in the Unified Facilities Criteria (UFC) TM 5-811-7, the electrical resistivity values obtained for the samples tested are representative of an environment that is considered mildly corrosive for uncoated steel. The design engineer should determine if cathodic protection is required.

6.00 CONSTRUCTION OBSERVATION AND DOCUMENT REVIEW

It is recommended that MGA be retained to perform on-site construction observation and soil testing services during the earthwork phase of this project. The purpose of our services is to assess the contractor's compliance with the project plans and specifications and our recommendations. Our participation will allow us the to provide geotechnical engineering input on a timely basis to address earthwork conditions encountered during construction.

We respectfully request the opportunity to review final site and foundation plans and earthwork specifications for the project to see that our recommendations have been properly interpreted and included. We also recommend our participation during contractor interviews and meetings such as pre-bid, pre-construction and buyouts.

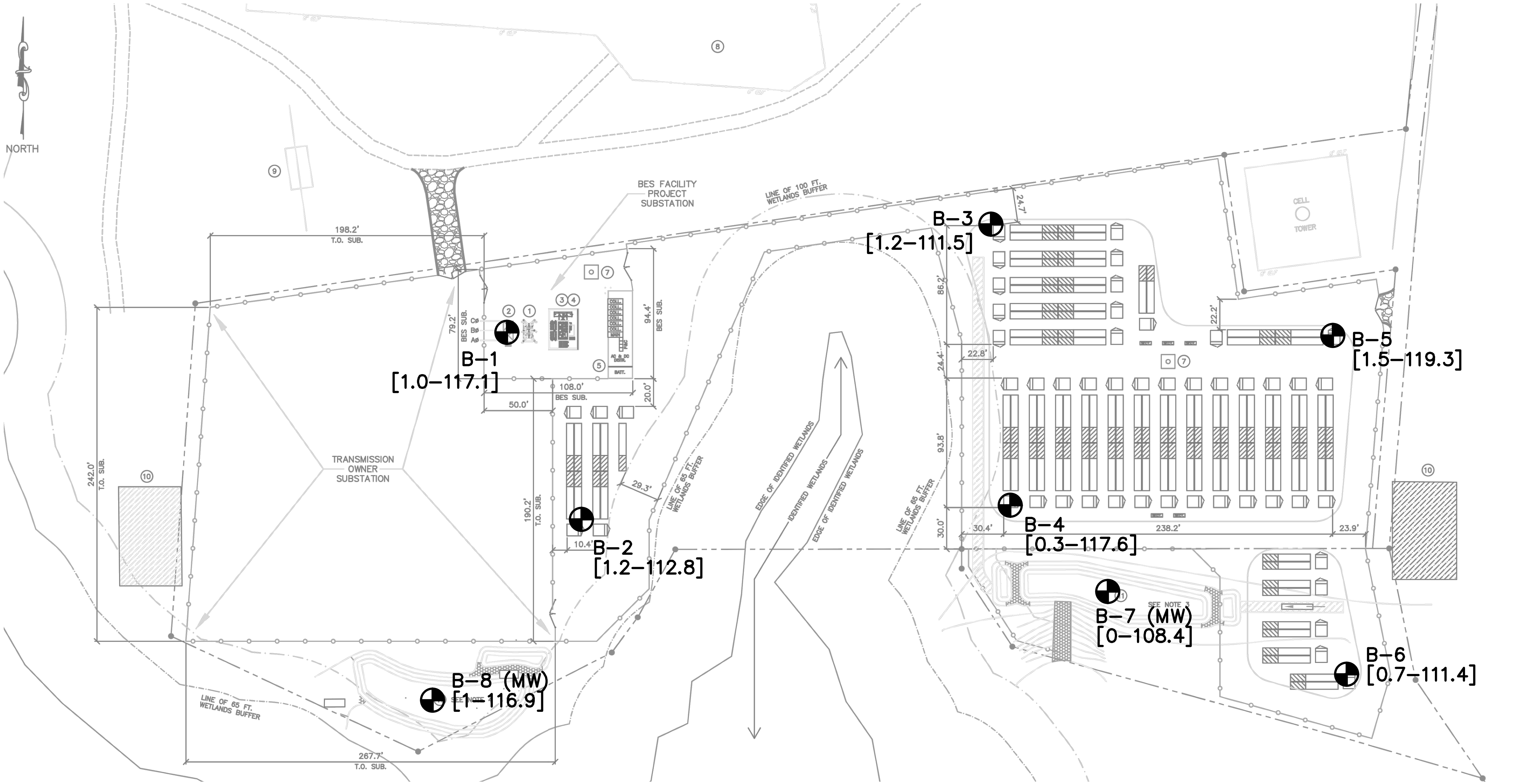
FIGURES



SCALE: 1"=2000'

0 1000 2000 4000 FEET

McArdle Gannon Associates, Inc. Engineers & Consultants 300 Oak Street, Suite 460 781.826.0040 phone Pembroke, MA 02359 781.735.0418 fax	LOCUS PLAN PROPOSED CRANBERRY POINT ENERGY STORAGE FACILITY MAIN STREET, CARVER, MASSACHUSETTS PROJECT: G0841 DATE: 06/2021 SCALE: AS NOTED	SKETCH NO.: FIG. No. 1 DRAWN: RED CHECKED: SLH



LEGEND:

BORINGS PERFORMED BY GEOSEARCH, INC. OF STERLING, MA ON JANUARY 4 THROUGH 6, 2021.

[1-117.1] INDICATES APPROXIMATE DEPTH-ELEVATION TO BOTTOM OF EXISTING FILL OR SUBSOIL ENCOUNTERED AT EXPLORATION LOCATION.

(MW) INDICATES MONITORING WELL INSTALLED AT COMPLETED EXPLORATION LOCATION.

NOTES:

1. BASE PLAN DEVELOPED FROM PLAN ENTITLED "GENERAL ARRANGEMENT PLAN," DRAWING NO. GA01, DATED NOVEMBER 13, 2020, BY ASSET ENGINEERING.
2. BEALS AND THOMAS, INC. SURVEY LOCATED THE BORING LOCATIONS SHOWN. EXPLORATION LOCATIONS SHOWN ARE APPROXIMATE.
3. MGA OBSERVED AND LOGGED THE EXPLORATIONS SHOWN.

SCALE: 1"=80'

0 40 80 160

EXPLORATION LOCATION PLAN

PROPOSED CRANBERRY POINT ENERGY STORAGE FACILITY
MAIN STREET, CARVER, MASSACHUSETTS

PROJECT: G0841 | DATE: 6/2021 | SCALE: AS NOTED

SKETCH NO.: FIG. No. 2

DRAWN: RED
CHECKED: SLH

McArdle Gannon Associates, Inc.
Engineers & Consultants
300 Oak Street, Suite 460
Pembroke, MA 02359
781.826.0040 phone
781.735.0418 fax

APPENDIX A: STATEMENT OF LIMITATIONS

STATEMENT OF LIMITATIONS

Explorations

The analysis and recommendations submitted in this report are based in part upon the data obtained from subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

The stratification lines on the logs represent the approximate boundary between soil types and the transition may be gradual.

Water level readings have been made in the explorations at the time and under the conditions stated on the logs. This data has been reviewed and interpretations made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors that are different from the time the measurements were made.

Review

In the event that any change in the nature, design or location of the proposed structures are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this preliminary report modified or verified in writing.

It is recommended that this firm be provided the opportunity for a general review of final design and specifications in order that earthwork recommendations may be properly interpreted and implemented in the design and specifications.

Construction

It is recommended that this firm be retained to provide soil engineering services during the construction phase of the work. This is to observe compliance with design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

Use of Report

This report has been prepared for the exclusive use of Plus Power for specific application to the Proposed Cranberry Point Energy Storage Facility on Main Street in Carver, Massachusetts, in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

APPENDIX B: TEST BORING LOGS

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-1

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power
CONTRACTOR: Geosearch, Inc.

MGA NO. : G0841
SHEET NO. : 1 of 4
LOCATION N : See Plan
E :
ELEVATION : 118.1'
DATE START : 1/5/21
END : 1/6/21
DRILLER : Shawn Prescott
ENGINEER : John Gannon

GROUNDWATER		DEPTH (ft) OF:		
Date	Time	Water	Casing	Hole

EQUIPMENT	CASING	SAMPLER	CORE
Type	HW	Split Spoon	----
Size I.D.	4"	1-3/8"	----
Hammer Wt.	140#	140#	- - - -
Hammer Fall	30"	30"	- - - -

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
0			2 2 3 2	S-1	0.0 2.0	9	117.9 0.2	Black, fine to medium SAND and SILT, little Organic Matter. -FOREST MAT-
							117.1 1.0	Orange, fine to medium SAND, some(-) Silt. -SUBSOIL-
3								
			9 13 14 12	S-2	4.0 6.0	16		Medium Dense, Tan, fine to coarse SAND, little fine to coarse Gravel, trace Silt.
6								-SAND-
9			6 7 7 8	S-3	9.0 11.0	19		Medium Dense, Tan, fine to medium SAND, trace Silt.
12								
15			5 6 8 7	S-4	14.0 16.0	0		[No Recovery. Piece of gravel lodged in nose of split spoon.]

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
50 +	Very Dense	15 - 30	Very Stiff
		30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- B - Bulk/Grab Sample

SUMMARY
Station:
Rock:
Samples:

BORING B-1

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-1

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power

MGA NO. : G0841
SHEET NO. : 2 of 4

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recov-ery (in)	Elev-ation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
18								-SAND-
			3 3 3 6	S-5	19.0 21.0	6		Loose, Tan, fine to medium SAND, little fine to coarse Gravel, trace Silt.
21							97.1 21.0	
24			3 5 5 8	S-6	24.0 26.0	14		Loose to Medium Dense, Tan, SILT, little(-) fine to medium Sand.
27								-SILT-
30			16 12 10 11	S-7	29.0 31.0	12		Medium Dense, Tan, SILT.
33								
			4 2 2 3	S-8	34.0 36.0	18		Soft to Medium Stiff, Tan, CLAYEY SILT.
36								

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION
0 - 4	Very Loose	0 - 2	Very Soft	S - Split Spoon
4 - 10	Loose	2 - 4	Soft	T - Thin Wall Tube
10 - 30	Medium Dense	4 - 8	Medium Stiff	U - Undisturbed Piston
30 - 50	Dense	8 - 15	Stiff	C - Diamond Core
50 +	Very Dense	15 - 30	Very Stiff	B - Bulk/Grab Sample
		30+	Hard	

SUMMARY
Station:
Rock:
Samples:

BORING B-1

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-1

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power

MGA NO. : G0841
SHEET NO. : 3 of 4

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
39			2 1 1 2	S-9	39.0 41.0	19		Very Loose, Tan, SILT.
42								
45			1 2 2 3	S-10	44.0 46.0	20		Very Loose to Loose, Tan, SILT, little fine Sand.
								-SILT-
48								
			1 2 2 2	S-11	49.0 51.0	14		Very Loose to Loose, Tan, SILT, little(-) fine Sand.
51								
54			3 2 2 1	S-12	54.0 56.0	20		Very Loose to Loose, Tan, SILT, little fine Sand.
57								

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION
0 - 4	Very Loose	0 - 2	Very Soft	- S - Split Spoon
4 - 10	Loose	2 - 4	Soft	- T - Thin Wall Tube
10 - 30	Medium Dense	4 - 8	Medium Stiff	- U - Undisturbed Piston
30 - 50	Dense	8 - 15	Stiff	- C - Diamond Core
50 +	Very Dense	15 - 30	Very Stiff	- B - Bulk/Grab Sample
		30+	Hard	

SUMMARY

Station:
Rock:
Samples:

BORING B-1

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-1

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power

MGA NO. : G0841
SHEET NO. : 4 of 4

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
60			2 2 2 2	S-13	59.0 61.0	21		Very Loose to Loose, Tan, SILT, some(-) fine Sand.
63								-SILT-
66			5 5 6 7	S-14	64.0 66.0	12		Medium Dense, Tan, SILT, little fine Sand.
69			4 36 41 26	S-15	69.0 71.0	12	48.1 / 70.0	Very Dense, Tan, fine to coarse SAND and fine to coarse GRAVEL, some Silt. -GLACIAL TILL-
							47.1 / 71.0	Bottom of Boring at 71 Feet.
72								
75								
78								

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION
0 - 4	Very Loose	0 - 2	Very Soft	- S - Split Spoon
4 - 10	Loose	2 - 4	Soft	- T - Thin Wall Tube
10 - 30	Medium Dense	4 - 8	Medium Stiff	- U - Undisturbed Piston
30 - 50	Dense	8 - 15	Stiff	- C - Diamond Core
50 +	Very Dense	15 - 30	Very Stiff	- B - Bulk/Grab Sample
		30+	Hard	

SUMMARY
Station:
Rock:
Samples:

BORING B-1

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-2

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power
CONTRACTOR: Geosearch, Inc.

MGA NO. : G0841
SHEET NO. : 1 of 2
LOCATION N : See Plan
E :
ELEVATION : 114'
DATE START : 1/5/21
END : 1/5/21
DRILLER : Shawn Prescott
ENGINEER : John Gannon

GROUNDWATER		DEPTH (ft) OF:		
Date	Time	Water	Casing	Hole

EQUIPMENT	CASING	SAMPLER	CORE
Type	HW	Split Spoon	----
Size I.D.	4"	1-3/8"	----
Hammer Wt.	140#	140#	- - - -
Hammer Fall	30"	30"	- - - -

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
0			2 1 2 1	S-1	0.0 2.0	17	113.8 0.2	Black, fine to medium SAND, some Silt, little Organic Matter. -FOREST MAT-
							112.8 1.2	Orange, fine to medium SAND, little Silt. -SUBSOIL-
3								
			3 4 7 9	S-2	4.0 6.0	18		Medium Dense, Tan, fine to medium SAND, trace Silt.
6								-SAND-
9			4 5 6 6	S-3	9.0 11.0	15		Medium Dense, Brown, fine to medium SAND, trace(+) fine Gravel, trace Silt.
12							102.0 12.0	-SILT-
15			3 5 4 4	S-4	14.0 16.0	6		Loose, Tan, SILT, trace fine Sand.

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
50 +	Very Dense	15 - 30	Very Stiff
		30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- B - Bulk/Grab Sample

SUMMARY
Station:
Rock:
Samples:

BORING B-2

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG | **BORING B-2**

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA | **MGA NO. :** G0841
CLIENT: Plus Power | **SHEET NO. :** 2 of 2

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
18								
			3 3 3 6	S-5	19.0 21.0	9		Loose, Tan, SILT, trace fine Sand.
21								
								-SILT-
24			9 13 11 9	S-6	24.0 26.0	18		Medium Dense, Tan, SILT, trace(-) fine Sand.
							88.0 26.0	Bottom of Boring at 26 Feet.
27								
30								
33								
36								

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION
0 - 4	Very Loose	0 - 2	Very Soft	- S - Split Spoon
4 - 10	Loose	2 - 4	Soft	- T - Thin Wall Tube
10 - 30	Medium Dense	4 - 8	Medium Stiff	- U - Undisturbed Piston
30 - 50	Dense	8 - 15	Stiff	- C - Diamond Core
50 +	Very Dense	15 - 30	Very Stiff	- B - Bulk/Grab Sample
		30+	Hard	

SUMMARY
Station:
Rock:
Samples:

BORING B-2

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-3

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power
CONTRACTOR: Geosearch, Inc.

MGA NO. : G0841
SHEET NO. : 1 of 2
LOCATION N : See Plan
E :
ELEVATION : 112.7'
DATE START : 1/5/21
END : 1/5/21
DRILLER : Shawn Prescott
ENGINEER : John Gannon

GROUNDWATER		DEPTH (ft) OF:		
Date	Time	Water	Casing	Hole

EQUIPMENT	CASING	SAMPLER	CORE
Type	HW	Split Spoon	----
Size I.D.	4"	1-3/8"	----
Hammer Wt.	140#	140#	- - - -
Hammer Fall	30"	30"	- - - -

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
0			1 2 2 3	S-1	0.0 2.0	12	112.4 0.3 111.5 1.2	Black, fine to medium SAND, some Silt, little Organic Matter. -FOREST MAT- Orange, fine to medium SAND, little(+) Silt. -SUBSOIL-
3								
			3 4 3 6	S-2	4.0 6.0	19		Loose, Tan, fine to coarse SAND, trace fine Gravel, trace Silt.
6								-SAND-
9			3 4 4 4	S-3	9.0 11.0	8		Loose, Brown, fine to coarse SAND, trace Silt.
12								
			5 5 5 8	S-4	14.0 16.0	12		Loose to Medium Dense, Tan, fine to coarse SAND, trace fine Gravel, trace(-) Silt.
15							97.2 15.5	-SILT-

BLOWS/FT.	DENSITY
0 - 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

BLOWS/FT.	CONSISTENCY
0 - 2	Very Soft
2 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- B - Bulk/Grab Sample

SUMMARY
Station:
Rock:
Samples:

BORING B-3

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-3

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power

MGA NO. : G0841
SHEET NO. : 2 of 2

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recov-ery (in)	Elev-ation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
18								
			8 7 8 11	S-5	19.0 21.0	14		Medium Dense, Tan, SILT, trace fine Sand.
21								
								-SILT-
24			6 9 11 15	S-6	24.0 26.0	12		Medium Dense, Tan, SILT, trace fine Sand.
							86.7 26.0	Bottom of Boring at 26 Feet.
27								
30								
33								
36								

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	SUMMARY
0 - 4	Very Loose	0 - 2	Very Soft	- S - Split Spoon	Station:
4 - 10	Loose	2 - 4	Soft	- T - Thin Wall Tube	Rock:
10 - 30	Medium Dense	4 - 8	Medium Stiff	- U - Undisturbed Piston	Samples:
30 - 50	Dense	8 - 15	Stiff	- C - Diamond Core	**BORING B-3**
50 +	Very Dense	15 - 30	Very Stiff	- B - Bulk/Grab Sample	
		30+	Hard		

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-4

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power
CONTRACTOR: Geosearch, Inc.

MGA NO. : G0841
SHEET NO. : 1 of 2
LOCATION N : See Plan
E :
ELEVATION : 117.9'
DATE START : 1/5/21
END : 1/5/21
DRILLER : Shawn Prescott
ENGINEER : John Gannon

GROUNDWATER		DEPTH (ft) OF:		
Date	Time	Water	Casing	Hole

EQUIPMENT	CASING	SAMPLER	CORE
Type	HW	Split Spoon	----
Size I.D.	4"	1-3/8"	----
Hammer Wt.	140#	140#	- - - -
Hammer Fall	30"	30"	- - - -

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
0			3 4 5 5	S-1	0.0 2.0	18	117.6 0.3	Orange/Brown, fine to medium SAND, little Silt, little Organic Matter. -SUBSOIL- Tan, fine to coarse SAND, trace Silt, trace fine Gravel.
3			6 7 11 13	S-2	2.0 4.0	16		Medium Dense, Tan, fine to coarse SAND, trace Silt, trace fine Gravel.
			7 9 7 8	S-3	4.0 6.0	10		Medium Dense, Tan, fine to coarse SAND, trace Silt, trace(-) fine Gravel
6								-SAND-
9			5 7 7 8	S-4	9.0 11.0	11		Medium Dense, Tan, fine to medium SAND, trace(+) Silt, trace fine Gravel.
12								
15			3 4 4 4	S-5	14.0 16.0	5		Loose, Tan, fine to medium SAND, trace Silt.

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION
0 - 4	Very Loose	0 - 2	Very Soft	- S - Split Spoon
4 - 10	Loose	2 - 4	Soft	- T - Thin Wall Tube
10 - 30	Medium Dense	4 - 8	Medium Stiff	- U - Undisturbed Piston
30 - 50	Dense	8 - 15	Stiff	- C - Diamond Core
50 +	Very Dense	15 - 30	Very Stiff	- B - Bulk/Grab Sample
		30+	Hard	

SUMMARY
Station:
Rock:
Samples:

BORING B-4

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG | **BORING B-4**

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power
MGA NO. : G0841
SHEET NO. : 2 of 2

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recov-ery (in)	Elev-ation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
18								-SAND-
			4 4 3 5	S-6	19.0 21.0	3	98.9 19.0	Loose, Brown, fine SAND and SILT, trace fine Gravel.
21								-SAND & SILT-
24			3 3 5 6	S-7	24.0 26.0	12	93.9 24.0	Loose, Brown, SILT, little fine SAND. -SILT-
							91.9 26.0	Bottom of Boring at 26 Feet.
27								
30								
33								
36								

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION
0 - 4	Very Loose	0 - 2	Very Soft	- S - Split Spoon
4 - 10	Loose	2 - 4	Soft	- T - Thin Wall Tube
10 - 30	Medium Dense	4 - 8	Medium Stiff	- U - Undisturbed Piston
30 - 50	Dense	8 - 15	Stiff	- C - Diamond Core
50 +	Very Dense	15 - 30	Very Stiff	- B - Bulk/Grab Sample
		30+	Hard	

SUMMARY
Station:
Rock:
Samples:

BORING B-4

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-5

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power
CONTRACTOR: Geosearch, Inc.

MGA NO.: G0841
SHEET NO.: 1 of 2
LOCATION N: See Plan
E:
ELEVATION: 120.8'
DATE START: 1/5/21
END: 1/5/21
DRILLER: Shawn Prescott
ENGINEER: John Gannon

GROUNDWATER		DEPTH (ft) OF:		
Date	Time	Water	Casing	Hole
1/4/21	9:00	15'	15'	17'

EQUIPMENT	CASING	SAMPLER	CORE
Type	HSA	Split Spoon	----
Size I.D.	4.25"	1-3/8"	----
Hammer Wt.	----	140#	- - - -
Hammer Fall	----	30"	- - - -

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
0			3 7 7 5	S-1	0.0 2.0	18	119.8 1.0	Dark Brown, fine to medium SAND, little Silt, little Organic Matter. -FILL-
							119.3 1.5	Orange, fine to medium SAND, little(+) Silt. -SUBSOIL-
3			6 8 9 7	S-2	2.0 4.0	15		Medium Dense, Brown, fine to medium SAND, trace Silt, trace(-) fine Gravel.
6								-SAND-
9			3 3 3 5	S-3	10.0 12.0	14		Loose, Tan, fine to medium SAND, trace(-) Silt, trace(-) fine Gravel.
12								
15			1 1 1 1	S-4	15.0 17.0	14		Very Loose, Wet, Tan, fine SAND, little Silt, trace fine Gravel.

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
50 +	Very Dense	15 - 30	Very Stiff
		30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- B - Bulk/Grab Sample

SUMMARY
Station:
Rock:
Samples:

BORING B-5

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-5

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power

MGA NO. : G0841
SHEET NO. : 2 of 2

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
18								
21			1 2 4 5	S-5	20.0 22.0	15		Loose, wet, fine to medium SAND, trace(+) Silt. -SAND-
24							95.8 25.0	
			1 4 4 3	S-6	25.0 27.0	20		Loose, wet, Tan, SILT, litte fine Sand. -SILT-
27								
30			1 4 5 4	S-7	30.0 32.0	17	90.8 30.0	Loose, wet, fine SAND, some(-) Silt. -SILTY SAND-
							88.8 32.0	Bottom of Boring at 32 Feet.
33								
36								

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
50 +	Very Dense	15 - 30	Very Stiff
		30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- B - Bulk/Grab Sample

SUMMARY
Station:
Rock:
Samples:

BORING B-5

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-6

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power
CONTRACTOR: Geosearch, Inc.

MGA NO. : G0841
SHEET NO. : 1 of 2
LOCATION N : See Plan
E :
ELEVATION : 112.1'
DATE START : 1/5/21
END : 1/5/21
DRILLER : Shawn Prescott
ENGINEER : John Gannon

GROUNDWATER		DEPTH (ft) OF:		
Date	Time	Water	Casing	Hole
1/4/21	9:00	15'	15'	17'

EQUIPMENT	CASING	SAMPLER	CORE
Type	HW	Split Spoon	----
Size I.D.	4"	1-3/8"	----
Hammer Wt.	140#	140#	- - - -
Hammer Fall	30"	30"	- - - -

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
0			6 7 9 9	S-1	0.0 2.0	15	111.4 0.7	Orange/Brown, fine to medium SAND, little Silt. -FILL- Tan, fine to coarse SAND, trace Silt, trace(-) fine Gravel.
3								
			4 6 5 6	S-2	4.0 6.0	9		Medium Dense, Tan, fine to medium SAND, trace(-) Silt, trace (-) fine Gravel.
6								-SAND-
9			3 3 3 3	S-3	9.0 11.0	4		Loose, Tan, fine to medium SAND, trace Silt.
12								
15			5 6 8 8	S-4	14.0 16.0	9		Medium Dense, Tan, fine to medium SAND, trace(+) Silt, trace fine Gravel.

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
50 +	Very Dense	15 - 30	Very Stiff
		30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- B - Bulk/Grab Sample

SUMMARY
Station:
Rock:
Samples:

BORING B-6

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-6

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power

MGA NO. : G0841
SHEET NO. : 2 of 2

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
18							93.1 19.0	-SAND-
			4 2 4 4	S-5	19.0 21.0	15		Loose, Tan, SILT, trace fine Sand.
21								-SILT-
24			4 3 3 3	S-6	24.0 26.0	18	86.1 26.0	Loose, Tan, SILT, trace fine Sand.
27								Bottom of Boring at 26 Feet.
30								
33								
36								

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION
0 - 4	Very Loose	0 - 2	Very Soft	- S - Split Spoon
4 - 10	Loose	2 - 4	Soft	- T - Thin Wall Tube
10 - 30	Medium Dense	4 - 8	Medium Stiff	- U - Undisturbed Piston
30 - 50	Dense	8 - 15	Stiff	- C - Diamond Core
50 +	Very Dense	15 - 30	Very Stiff	- B - Bulk/Grab Sample
		30+	Hard	

SUMMARY
Station:
Rock:
Samples:

BORING B-6

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-7 (MW)

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power
CONTRACTOR: Geosearch, Inc.

MGA NO. : G0841
SHEET NO. : 1 of 2
LOCATION N : See Plan
E :
ELEVATION : 108.4'
DATE START : 01/04/21
END : 01/04/21
DRILLER : Shawn Prescott
ENGINEER : John Gannon

GROUNDWATER		DEPTH (ft) OF:		
Date	Time	Water	Casing	Hole
01/04/21	2:00	4'	5'	7'
01/06/21	9:30	4.3'	well	15'
01/08/21	10:40	4.4	well	15'

EQUIPMENT	CASING	SAMPLER	CORE
Type	HSA	Split Spoon	----
Size I.D.	4.25"	1.75"	----
Hammer Wt.	----	140#	- - - -
Hammer Fall	----	30"	- - - -

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
0			2 2 3 5	S-1	0.0 2.0	12		Loose, Tan, fine to medium SAND, trace Silt, trace(-) fine Gravel.
3								-SAND-
6			1 2 2 2	S-2	5.0 7.0	11		Very Loose to Loose, Wet, Tan, fine to medium SAND, trace Silt.
9			2 3 4 7	S-3	10.0 12.0	13	96.4 12.0	Loose, Wet, Tan, fine to coarse SAND, trace Silt.
12								-SILT-
15			5 5 3 8	S-4	15.0 17.0	11	91.4	Loose, Wet, Tan, SILT, trace fine Sand.

Well Schematic

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
50 +	Very Dense	15 - 30	Very Stiff
		30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample

SUMMARY
Overburden:
Rock:
Samples:

BORING B-7 (MW)

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-7 (MW)

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power

MGA NO. : G0841
SHEET NO. : 2 of 2

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS	Well Schematic
							17.0	Bottom of Boring at 17 Feet.	
18									
21									
24									
27									
30									
33									
36									

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION
0 - 4	Very Loose	0 - 2	Very Soft	S - Split Spoon
4 - 10	Loose	2 - 4	Soft	T - Thin Wall Tube
10 - 30	Medium Dense	4 - 8	Medium Stiff	U - Undisturbed Piston
30 - 50	Dense	8 - 15	Stiff	C - Diamond Core
50 +	Very Dense	15 - 30	Very Stiff	W - Wash Sample
		30+	Hard	

SUMMARY
Overburden:
Rock:
Samples:

BORING B-7 (MW)

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-8 (MW)

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power
CONTRACTOR: Geosearch, Inc.

MGA NO. : G0841
SHEET NO. : 1 of 2
LOCATION N : See Plan
E :
ELEVATION : 117.9'
DATE START : 01/04/21
END : 01/04/21
DRILLER : Shawn Prescott
ENGINEER : John Gannon

GROUNDWATER		DEPTH (ft) OF:		
Date	Time	Water	Casing	Hole
01/06/21	12:55	13'	15'	17'
01/08/21	10:30	13'	well	20'

EQUIPMENT	CASING	SAMPLER	CORE
Type	HSA	Split Spoon	----
Size I.D.	4.25"	1.75"	----
Hammer Wt.	----	140#	- - - -
Hammer Fall	----	30"	- - - -

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS	Well Schematic
0			2 2 2 4	S-1	0.0 2.0	20	117.7 0.2 116.9 1.0	Black/Brown, fine SAND and SILT, little Organic Matter. -FOREST MAT- Orange, fine to medium SAND, some(-) Silt. -SUBSOIL-	
3									
6			6 6 5 7	S-2	5.0 7.0	21		Medium Dense, Tan, fine to medium SAND trace Silt. -SAND-	
9									
			2 3 3 3	S-3	10.0 12.0	20		Loose, Tan, fine to medium SAND, trace Silt, trace(-) fine Gravel.	
12									
15			3 2 3 2	S-4	15.0 17.0	18		Loose, Wet, Tan, fine to medium SAND, trace Silt.	

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
50 +	Very Dense	15 - 30	Very Stiff
		30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample

SUMMARY
Overburden:
Rock:
Samples:

BORING B-8 (MW)

McArdle Gannon Associates, Inc.
Engineers & Consultants

TEST BORING LOG

BORING B-8 (MW)

PROJECT: Cranberry Point Energy Storage Facility, Carver, MA
CLIENT: Plus Power

MGA NO. : G0841
SHEET NO. : 2 of 2

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
18								-SAND-
21			1 3 5 7	S-5	20.0 22.0	15		Loose, Wet, Brown, fine to medium SAND, trace Silt.
							95.9 22.0	Bottom of Boring at 22 Feet.
24								
27								
30								
33								
36								

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
50 +	Very Dense	15 - 30	Very Stiff
		30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample

SUMMARY
Overburden:
Rock:
Samples:

BORING B-8 (MW)

KEY TO SYMBOLS

Symbol	Description

Strata symbols

- Forest Mat
- Subsoil
- Sand
- Silt
- Glacial Till
- Sand & Silt
- Fill
- Silty sand

Soil Samplers

- Split Spoon

Monitor Well Details

- assorted cuttings
- bentonite slurry
- slotted pipe w/ sand
- no pipe, filler material

Notes:

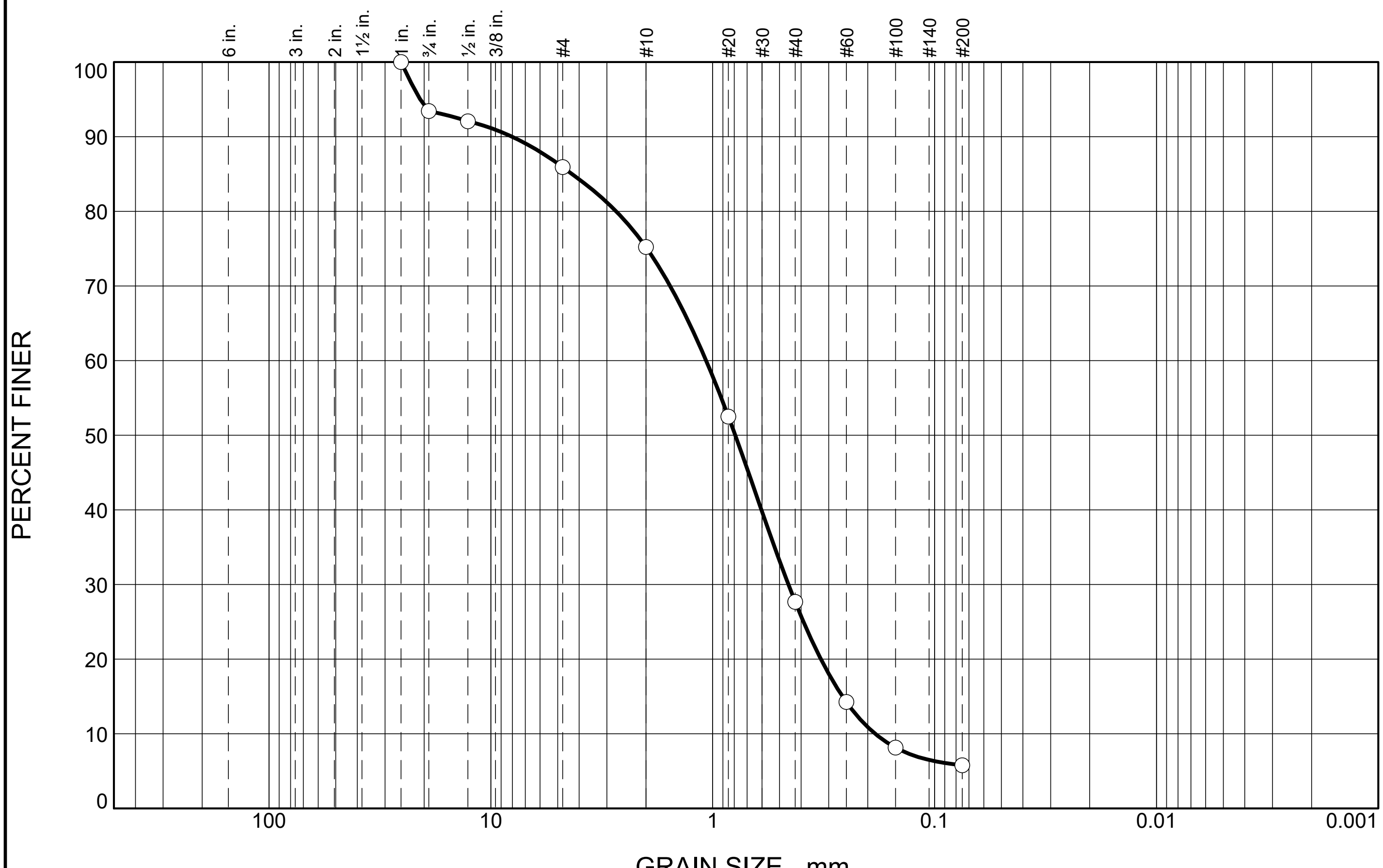
1. Geosearch, Inc. performed the test borings with an ATV mounted drill rig equipped with a automatic safety hammer on January 4 through 6, 2021.

2. Beals and Thomas, Inc. survey located the test borings and provided the ground surface elevations indicated on the logs. Elevations are approximate.

3. MGA observed and logged the borings.

APPENDIX C: GEOTECHNICAL LABORATORY TEST RESULTS

PARTICLE SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.6	7.5	10.7	47.5	21.9	5.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
3/4	93.4		
1/2	92.1		
#4	85.9		
#10	75.2		
#20	52.5		
#40	27.7		
#60	14.3		
#100	8.2		
#200	5.8		

* (no specification provided)

Material Description

Tan, fine to coarse SAND, little fine to coarse Gravel, trace Silt.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 8.0200 D_{85}= 4.3052 D_{60}= 1.0715
D_{50}= 0.7918 D_{30}= 0.4559 D_{15}= 0.2601
D_{10}= 0.1853 C_u= 5.78 C_c= 1.05

Classification

USCS= AASHTO=

Remarks

Natural Sand
As Rec'd M% = 5.0%

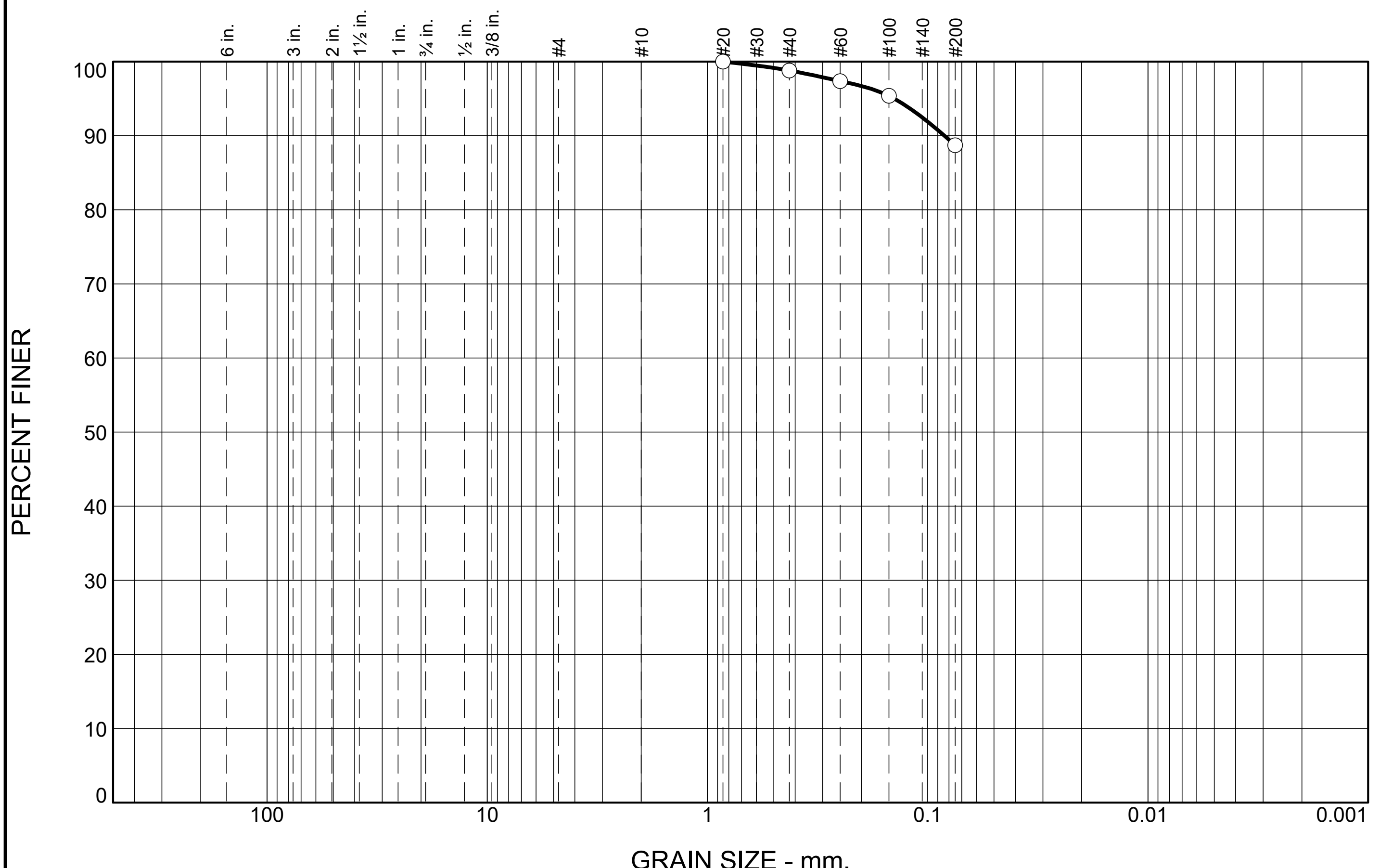
Source of Sample: B-1 **Depth:** 4-6'
Sample Number: S-2

Date: 1/14/21

McArdle Gannon Associates, Inc.
Engineers & Consultants

Client: Plus Power
Project: Cranberry Point Energy Storage
Carver, MA
Project No: G0841 **Figure**

PARTICLE SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.2	10.1	88.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#20	100.0		
#40	98.8		
#60	97.4		
#100	95.4		
#200	88.7		

* (no specification provided)

Material Description

Tan, SILT, little (-) fine to medium Sand.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0840 D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Natural Silt
As Rec'd M% = 25.9%

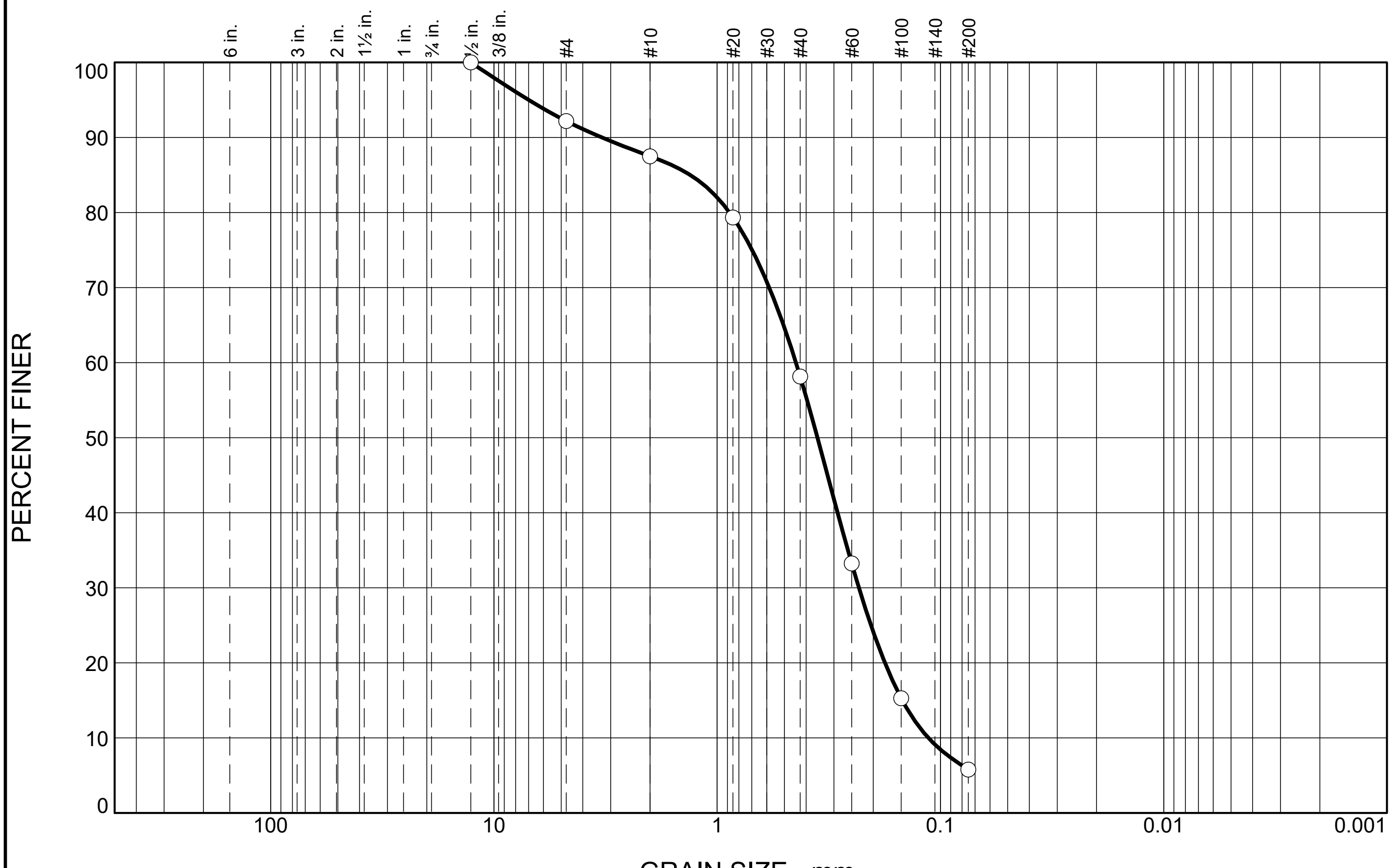
Source of Sample: B-1 **Depth:** 24-26'
Sample Number: S-6

Date: 1/14/21

MGA McArdle Gannon Associates, Inc.
Engineers & Consultants

Client: Plus Power
Project: Cranberry Point Energy Storage
Carver, MA
Project No: G0841 **Figure**

PARTICLE SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.8	4.7	29.3	52.4	5.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2	100.0		
#4	92.2		
#10	87.5		
#20	79.3		
#40	58.2		
#60	33.2		
#100	15.3		
#200	5.8		

* (no specification provided)

Material Description

Brown, fine to medium SAND, trace (+) fine Gravel, trace Silt.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 3.2827 D_{85}= 1.3191 D_{60}= 0.4439
D_{50}= 0.3556 D_{30}= 0.2320 D_{15}= 0.1482
D_{10}= 0.1132 C_u= 3.92 C_c= 1.07

Classification

USCS= AASHTO=

Remarks

Natural Sand
As Rec'd M% = 20.5%

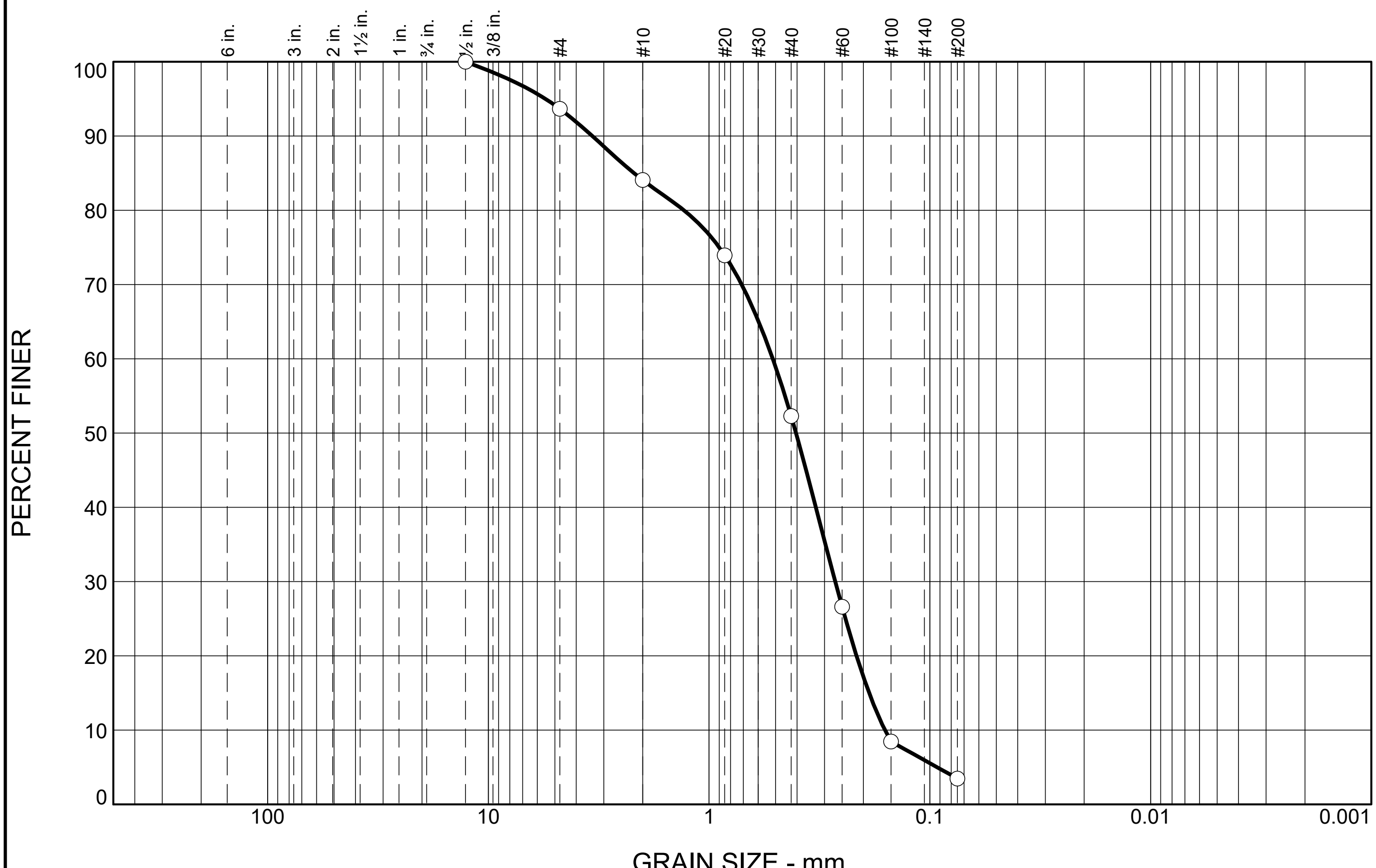
Source of Sample: B-2 **Depth:** 9-11'
Sample Number: S-3

Date: 1/14/21

McArdle Gannon Associates, Inc.
Engineers & Consultants

Client: Plus Power
Project: Cranberry Point Energy Storage
Carver, MA
Project No: G0841 **Figure**

PARTICLE SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	6.3	9.6	31.8	48.8	3.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2	100.0		
#4	93.7		
#10	84.1		
#20	73.9		
#40	52.3		
#60	26.6		
#100	8.5		
#200	3.5		

* (no specification provided)

Material Description

Tan, fine to coarse SAND, trace fine Gravel, trace Silt.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 3.3829 D_{85}= 2.1880 D_{60}= 0.5146
D_{50}= 0.4039 D_{30}= 0.2685 D_{15}= 0.1883
D_{10}= 0.1599 C_u= 3.22 C_c= 0.88

Classification

USCS= SP AASHTO=

Remarks

Natural Sand
As Rec'd M% = 6.7%

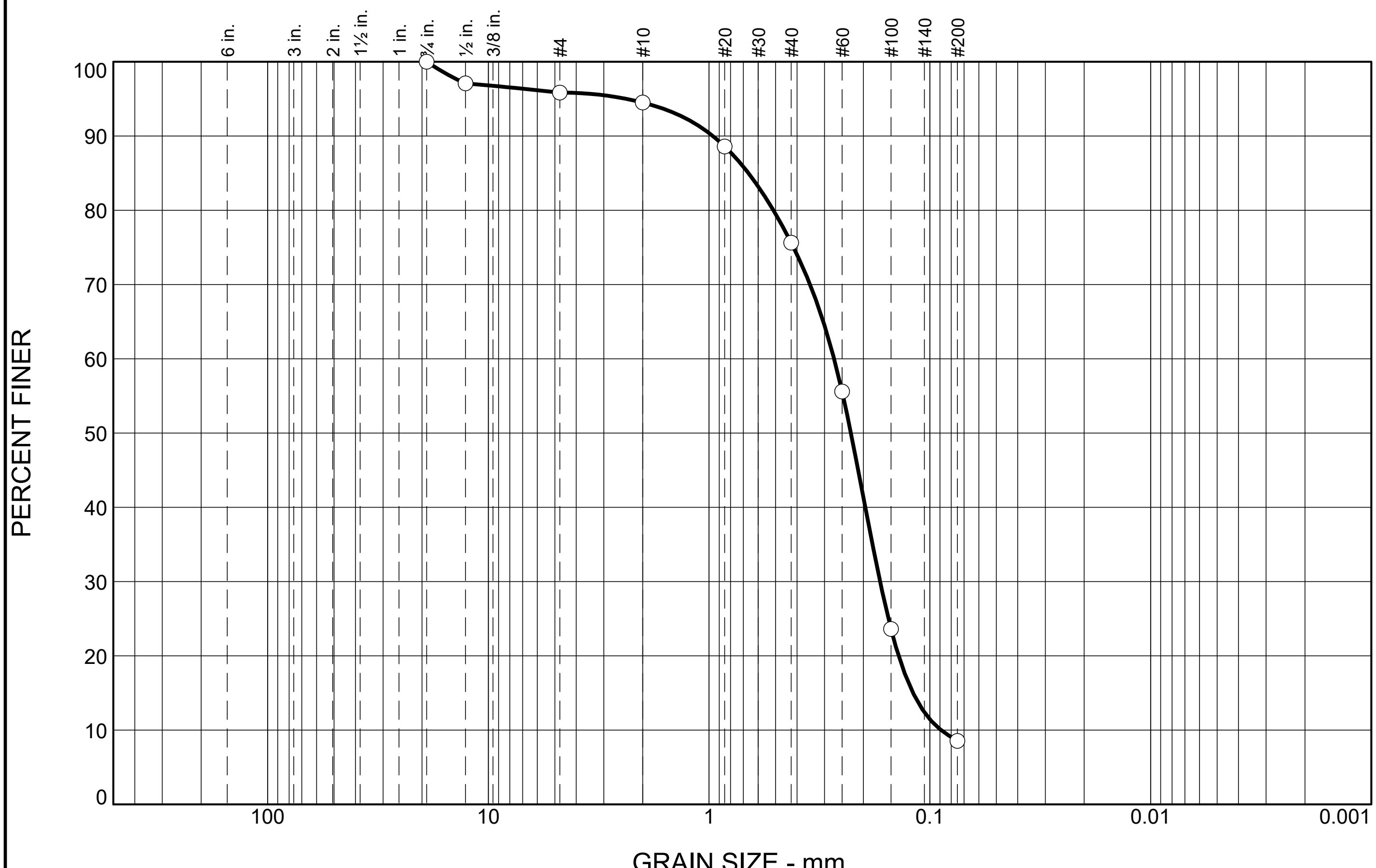
Source of Sample: B-3 **Depth:** 4-6'
Sample Number: S-2

Date: 1/14/21

McArdle Gannon Associates, Inc.
Engineers & Consultants

Client: Plus Power
Project: Cranberry Point Energy Storage
Carver, MA
Project No: G0841 **Figure**

PARTICLE SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.1	1.4	18.9	67.1	8.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
1/2	97.1		
#4	95.9		
#10	94.5		
#20	88.6		
#40	75.6		
#60	55.6		
#100	23.6		
#200	8.5		

* (no specification provided)

Material Description

Tan, fine to medium SAND, trace (+) Silt, trace fine Gravel.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.9624 D_{85}= 0.6634 D_{60}= 0.2718
D_{50}= 0.2279 D_{30}= 0.1681 D_{15}= 0.1192
D_{10}= 0.0890 C_u= 3.05 C_c= 1.17

Classification

USCS= AASHTO=

Remarks

Natural Sand
As Rec'd M% = 19.9%

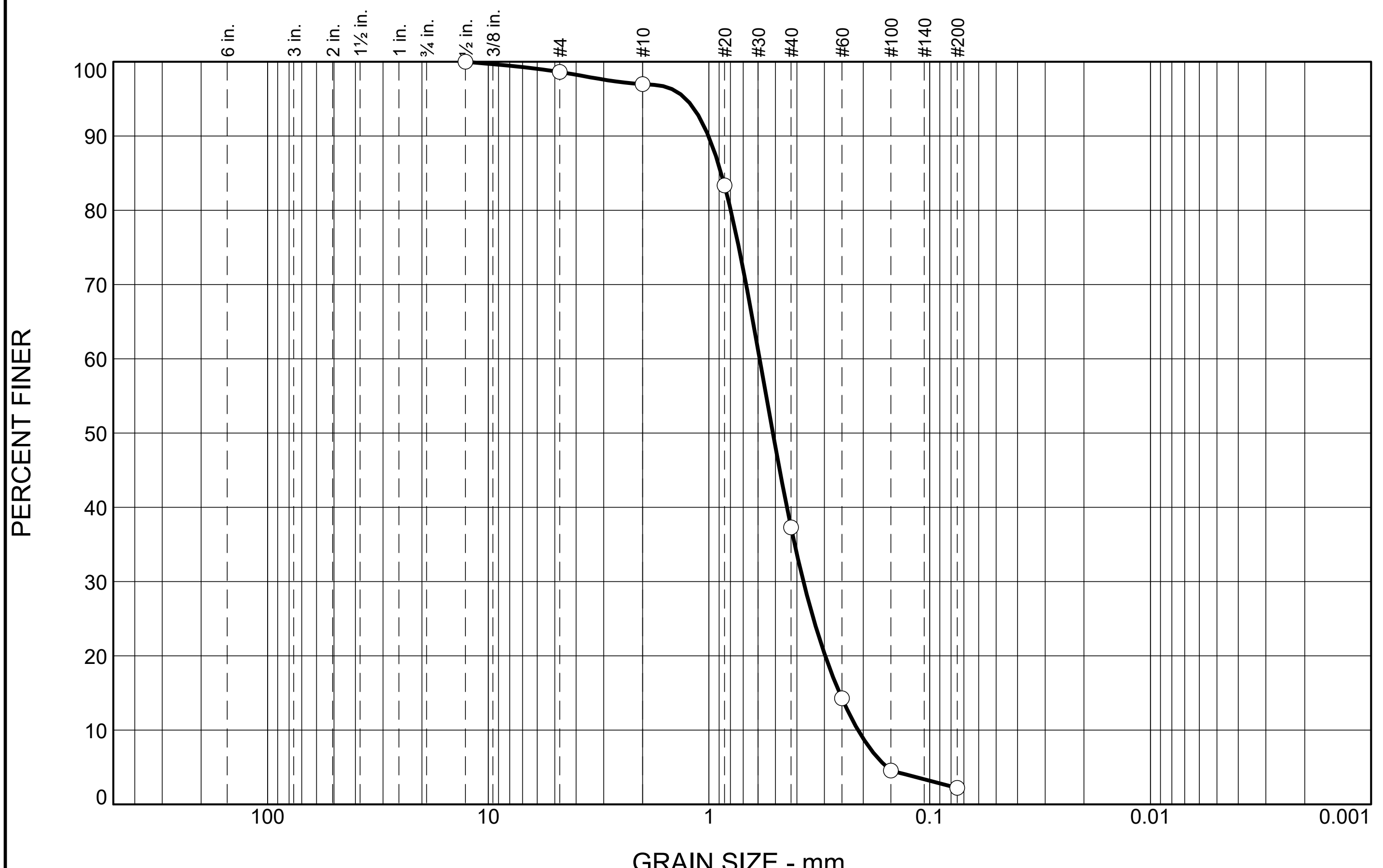
Source of Sample: B-4 **Depth:** 9-11'
Sample Number: S-4

Date: 1/14/21

McArdle Gannon Associates, Inc.
Engineers & Consultants

Client: Plus Power
Project: Cranberry Point Energy Storage
Carver, MA
Project No: G0841 **Figure**

PARTICLE SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.4	1.6	59.7	35.1	2.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2	100.0		
#4	98.6		
#10	97.0		
#20	83.4		
#40	37.3		
#60	14.3		
#100	4.6		
#200	2.2		

* (no specification provided)

Material Description

Tan, fine to medium SAND, trace (-) Silt, trace (-) fine Gravel.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.0061 D_{85}= 0.8806 D_{60}= 0.5893
D_{50}= 0.5133 D_{30}= 0.3734 D_{15}= 0.2562
D_{10}= 0.2112 C_u= 2.79 C_c= 1.12

Classification

USCS= SP AASHTO=

Remarks

Natural Sand
As Rec'd M% = 4.9%

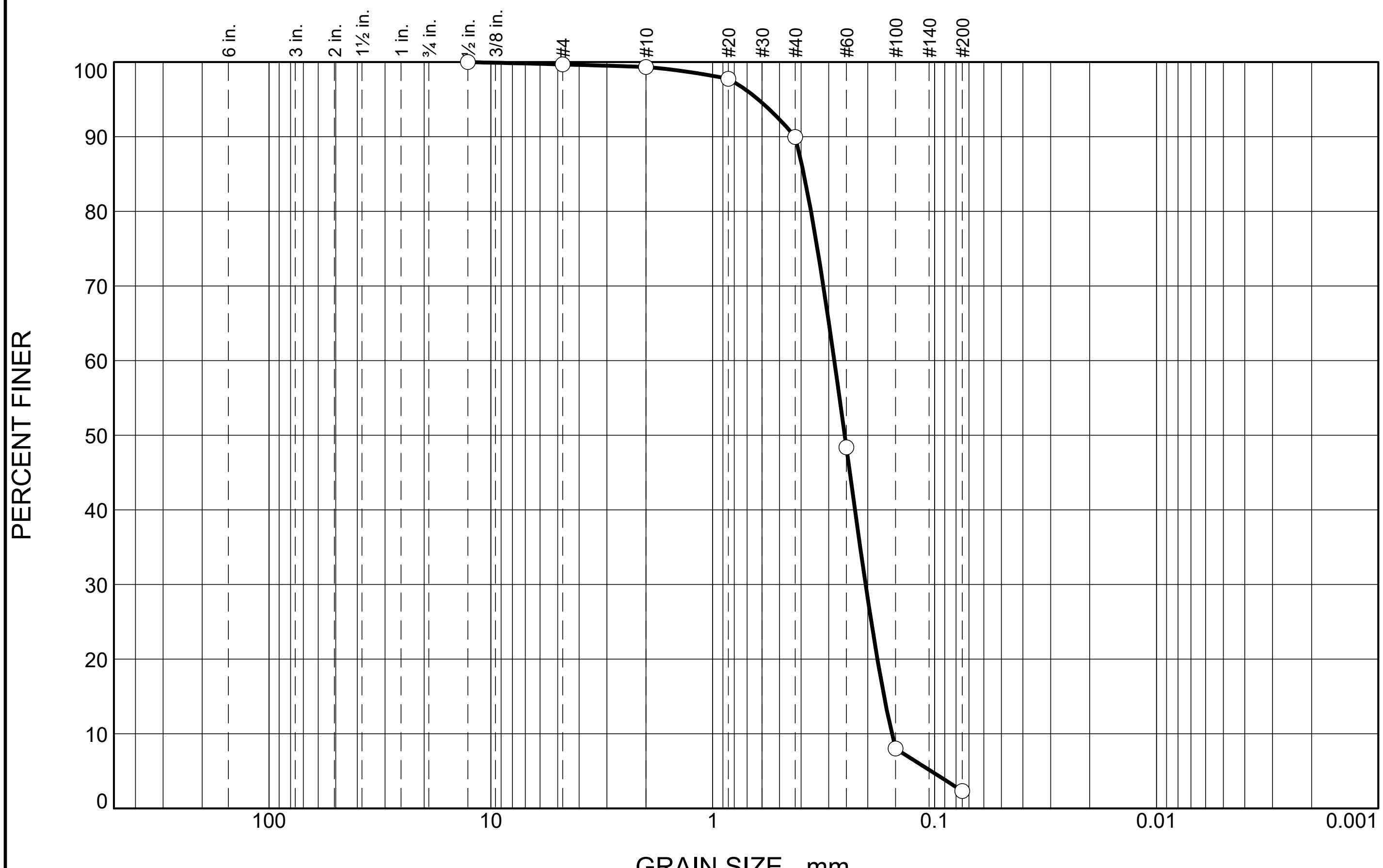
Source of Sample: B-5 **Depth:** 10-12'
Sample Number: S-3

Date: 1/14/21

McArdle Gannon Associates, Inc.
Engineers & Consultants

Client: Plus Power
Project: Cranberry Point Energy Storage
Carver, MA
Project No: G0841 **Figure**

PARTICLE SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	0.3	9.4	87.7	2.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2	100.0		
#4	99.7		
#10	99.4		
#20	97.8		
#40	90.0		
#60	48.4		
#100	8.0		
#200	2.3		

* (no specification provided)

Material Description

Tan, fine to medium SAND, trace (-) Silt, trace (-) fine Gravel.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4258 D_{85}= 0.3885 D_{60}= 0.2833
D_{50}= 0.2543 D_{30}= 0.2045 D_{15}= 0.1689
D_{10}= 0.1558 C_u= 1.82 C_c= 0.95

Classification

USCS= SP AASHTO=

Remarks

Natural Sand
As Rec'd M% = 24.6%

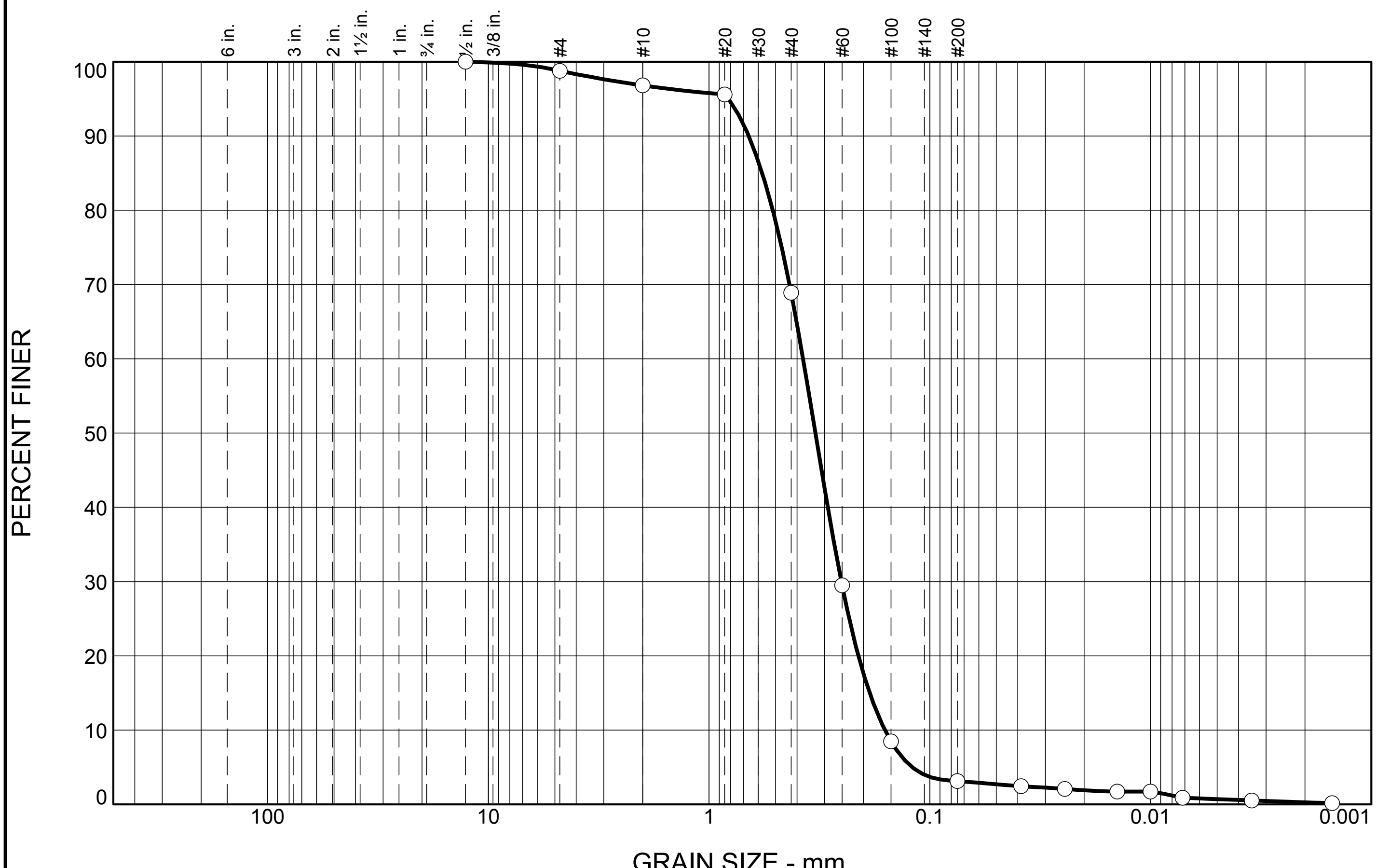
Source of Sample: B-6 **Depth:** 4-6'
Sample Number: S-2

Date: 1/14/21

MGA McArdle Gannon Associates, Inc.
Engineers & Consultants

Client: Plus Power
Project: Cranberry Point Energy Storage
Carver, MA
Project No: G0841 **Figure**

PARTICLE SIZE DISTRIBUTION REPORT



% Stones	% +3"	% Gravel			% Sand					% Silt		% Clay
		Coarse	Medium	Fine	V. Crs.	Crs.	Med.	Fine	V. Fine	Crs.	Fine	
0.0	0.0	0.0	1.2	2.0	1.0	17.3	49.0	25.8	1.0	0.8	1.6	0.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2	100.0		
#4	98.8		
#10	96.8		
#20	95.6		
#40	68.9		
#60	29.5		
#100	8.5		
#200	3.1		
0.0386 mm.	2.5		
0.0245 mm.	2.1		
0.0142 mm.	1.7		
0.0100 mm.	1.7		
0.0072 mm.	0.9		
0.0035 mm.	0.5		
0.0015 mm.	0.2		

* (no specification provided)

Soil Description

Burmister - Tan, fine to medium SAND, trace Silt, trace (-) fine Gravel.
USDA - SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6615 D_{85}= 0.5746 D_{60}= 0.3753
D_{50}= 0.3300 D_{30}= 0.2519 D_{15}= 0.1873
D_{10}= 0.1598 C_u= 2.35 C_c= 1.06

Classification

USCS= SP AASHTO=

Remarks

Natural Sand

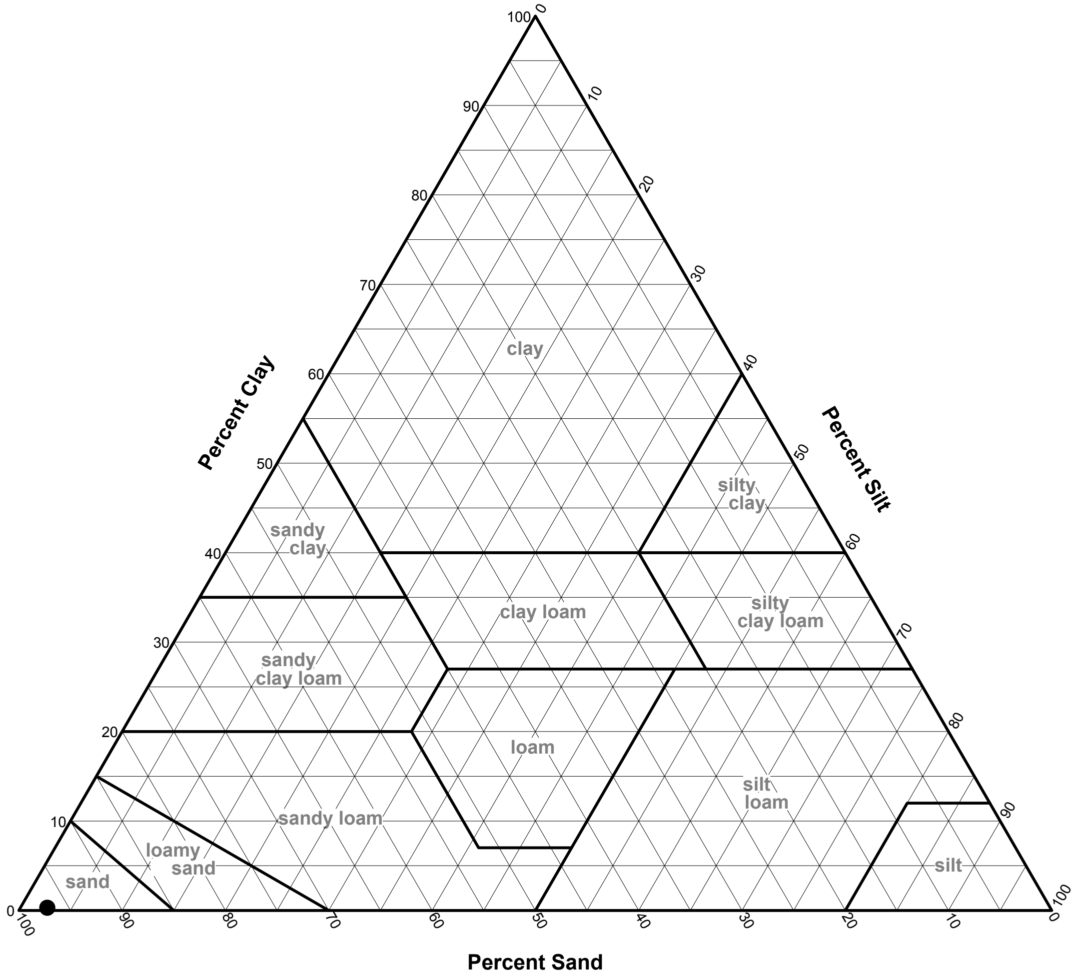
Source of Sample: B-7 **Depth:** 0-2'
Sample Number: S-1

Date: 01/18/2021

McArdle Gannon Associates, Inc.
Engineers & Consultants

Client: Plus Power
Project: Cranberry Point Energy Storage
Carver, MA
Project No: G0841 **Figure**

USDA Soil Classification



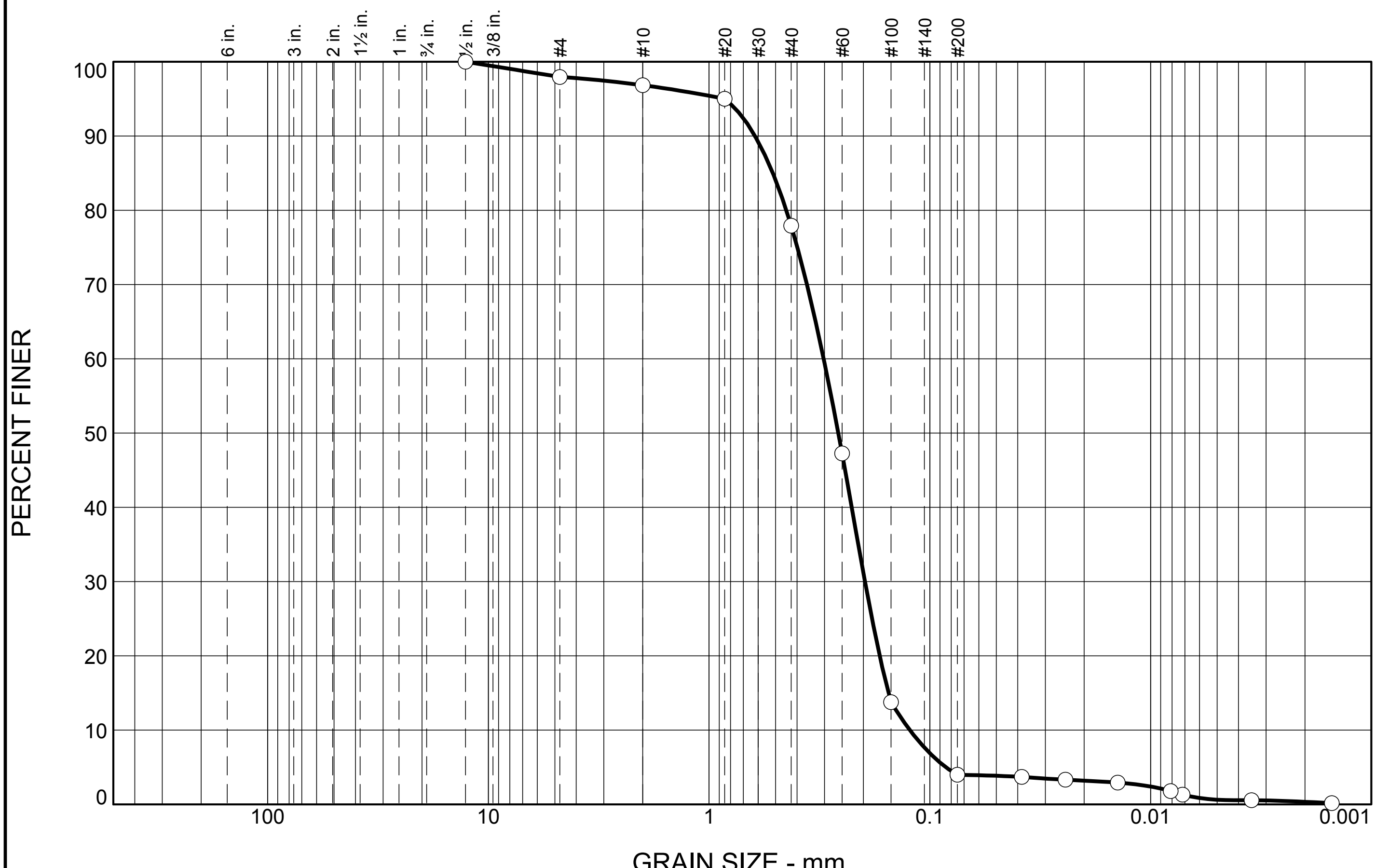
SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	B-7	S-1	0-2'	97.1	2.6	0.3	Sand

McArdle Gannon Associates, Inc.
Engineers & Consultants

Client: Plus Power
Project: Cranberry Point Energy Storage
Carver, MA
Project No.: G0841
Figure

PARTICLE SIZE DISTRIBUTION REPORT



% Stones	% +3"	% Gravel			% Sand					% Silt		% Clay
		Coarse	Medium	Fine	V. Crs.	Crs.	Med.	Fine	V. Fine	Crs.	Fine	
0.0	0.0	0.0	2.0	1.2	1.4	11.3	36.8	40.4	3.0	0.7	2.9	0.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2	100.0		
#4	98.0		
#10	96.8		
#20	95.0		
#40	77.9		
#60	47.3		
#100	13.8		
#200	4.0		
0.0384 mm.	3.7		
0.0243 mm.	3.3		
0.0141 mm.	2.9		
0.0081 mm.	1.8		
0.0072 mm.	1.3		
0.0035 mm.	0.6		
0.0015 mm.	0.2		

* (no specification provided)

Soil Description

Burmister - Tan, fine to medium SAND, trace Silt, trace (-) fine Gravel.
USDA - SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6193 D_{85}= 0.5142 D_{60}= 0.3029
D_{50}= 0.2601 D_{30}= 0.1967 D_{15}= 0.1540
D_{10}= 0.1231 C_u= 2.46 C_c= 1.04

Classification

USCS= SP AASHTO=

Remarks

Natural Sand

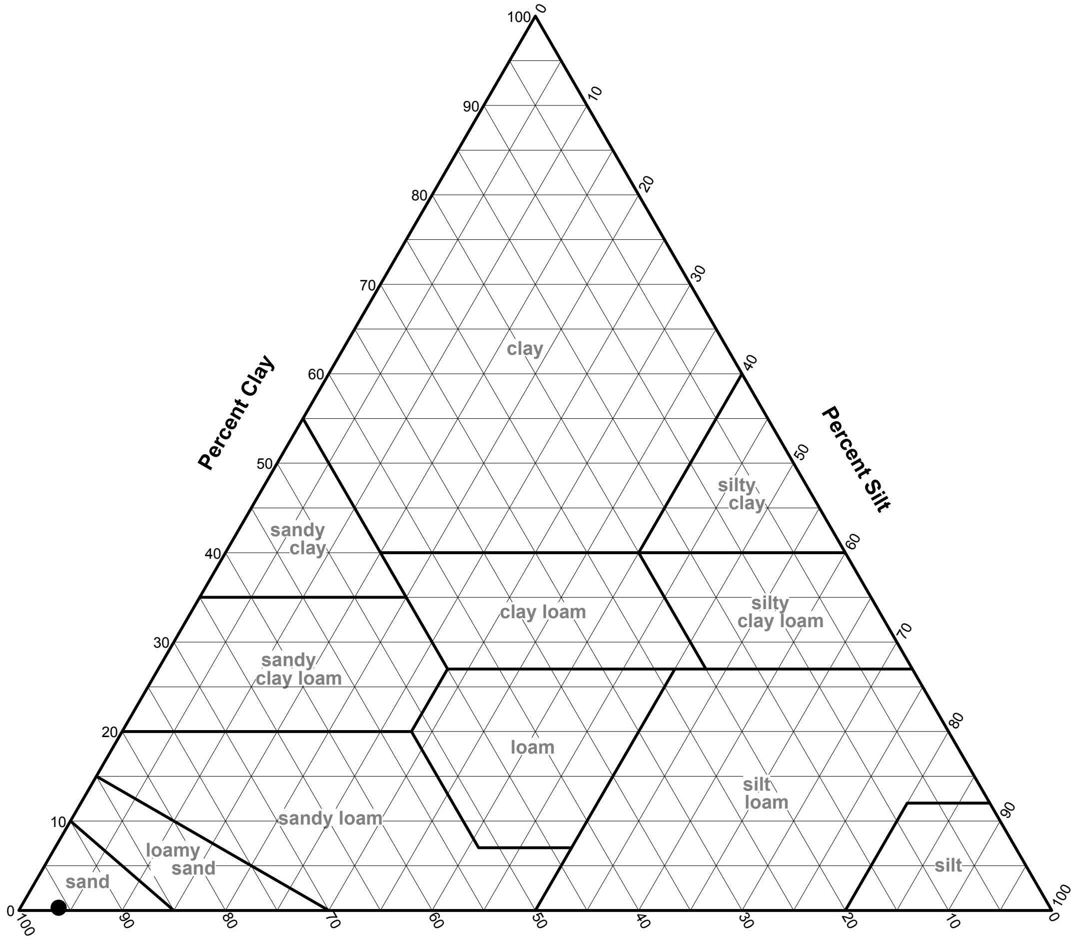
Source of Sample: B-8 **Depth:** 10-12'
Sample Number: S-3

Date: 01/18/2021

McArdle Gannon Associates, Inc.
Engineers & Consultants

Client: Plus Power
Project: Cranberry Point Energy Storage
Carver, MA
Project No: G0841 **Figure**

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	B-8	S-3	10-12'	96.0	3.7	0.3	Sand

McArdle Gannon Associates, Inc.
Engineers & Consultants

Client: Plus Power
Project: Cranberry Point Energy Storage
Carver, MA
Project No.: G0841

Figure

McArdle Gannon Associates, Inc.
Engineers & Consultants

Soil Resistivity Laboratory Testing Results

PROJECT:	Cranberry Point Energy Storage	**LAB JOB NO:**	SL-1474		
LOCATION:	Main Street, Carver, MA	**TEST BY:**	SAD/RED	**DATE:**	02/03/2021
CLIENT:	Plus Power	**CHECK BY:**	JJG	**DATE:**	02/03/2021
MGA FILE NO:	G0841				

INDENTIFICATION				**Soil Resistivity**	**OTHER TESTS AND REMARKS**
Exploration Number	Sample Number	Sample Depth (feet)	Soil Description	(ohms-cm)	
B-1	R-1	1-5	Natural Sand	22,429	61.3 ºF
B-4	R-1	0.3-5	Natural Sand	23,575	61.7 ºF
B-5	R-1	1.5-5	Natural Sand	23,097	60.2 ºF

ASTM G 187-18 – Standard Test Method for Measurement of Soil Resistivity Using the Two-Electrode Method Soil Box Method

300 Oak Street, Suite 460, Pembroke, MA 02359 Telephone: 781.826.0040 Fax: 781.735.0418 mcardlegannon.com

GeoTesting EXPRESS

Client:	McArdle Gannon Associates, Inc
Project Name:	Cranberry Point Energy Storage
Project Location:	Carver, MA
GTX #:	313073
Start Date:	01/22/21
End Date:	01/25/21
Tested By:	est
Checked By:	bfs
Preparation:	Test specimen compacted with moderate effort at 6% moisture content. Material >3/8-inch removed from sample prior to testing (4.53% of sample). Needle was pushed into specimen.

Thermal Conductivity of Soil by ASTM D5334

Boring	Sample	Depth, ft	Sample Description	Moisture Content, %	Wet Density, pcf	Dry Density, pcf	Thermal Conductivity, $^{W}/_{m°K}$	Thermal Resistivity, $^{°K\ cm}/_{W}$
B-1	R-1	1-5	Moist, dark yellowish brown sand	5.94	107.6	101.5	1.28	78

Notes: $^{W}/_{m°K}$ = Watts per Meter °Kelvin
$^{°K\ cm}/_{W}$ = °Kelvin Centimeter per Watt

GeoTesting EXPRESS

Client:	McArdle Gannon Associates, Inc
Project Name:	Cranberry Point Energy Storage
Project Location:	Carver, MA
GTX #:	313073
Start Date:	01/22/21
End Date:	01/25/21
Tested By:	est
Checked By:	bfs
Preparation:	Test specimen compacted with moderate effort at 6% moisture content. Material >3/8-inch removed from sample prior to testing (<1% of sample). Needle was pushed into specimen.

Thermal Conductivity of Soil by ASTM D5334

Boring	Sample	Depth, ft	Sample Description	Moisture Content, %	Wet Density, pcf	Dry Density, pcf	Thermal Conductivity, $^{W}/_{m°K}$	Thermal Resistivity, $^{°K\ cm}/_{W}$
B-4	R-1	0.3-5	Moist, dark yellowish brown sand	5.95	102.9	97.1	1.90	53

Notes: $^{W}/_{m°K}$ = Watts per Meter °Kelvin
$^{°K\ cm}/_{W}$ = °Kelvin Centimeter per Watt

GeoTesting EXPRESS

Client:	McArdle Gannon Associates, Inc
Project Name:	Cranberry Point Energy Storage
Project Location:	Carver, MA
GTX #:	313073
Start Date:	01/22/21
End Date:	01/25/21
Tested By:	est
Checked By:	bfs
Preparation:	Test specimen compacted with moderate effort at 6% moisture content. Material >3/8-inch removed from sample prior to testing (2.07% of sample). Needle was pushed into specimen.

Thermal Conductivity of Soil by ASTM D5334

Boring	Sample	Depth, ft	Sample Description	Moisture Content, %	Wet Density, pcf	Dry Density, pcf	Thermal Conductivity, W/m°K	Thermal Resistivity, °K cm/W
B-5	R-1	1.5-5	Moist, dark yellowish brown sand	6.04	105.0	99.1	1.76	57

Notes: W/m°K = Watts per Meter °Kelvin
°K cm/W = °Kelvin Centimeter per Watt

6.0 References

Town of Carver, Massachusetts. Carver Conservation Commission Bylaws, Chapter 9.

Federal Emergency Management Agency. National Flood Hazard Layer FIRMette Panel No. 25023C0343J. July 17, 2012.

Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services. Land Use (2005). June 2009.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey.

United States Department of Agriculture, Natural Resources Conservation Service, Conservation Engineering Division, Technical Release 55, June 1986.

Northeast Regional Climate Center & National Resources Conservation Service. “Extreme Precipitation in New York & New England.”

Commonwealth of Massachusetts, Stormwater Handbook. Volume 2, Chapter 2: “Structural BMP Specifications for the Massachusetts Stormwater Handbook.”