Figure B-I81-3.13
B-I81-3 Box 7 Runs 25-28 Dry

Figure B-I81-3.14
B-I81-3 Box 7 Runs 25-28 Wet

MOTT MACDONALD	PennEast Pipeline Project Rock Core Photographs	BORING NO.: B-I81-3

Figure B-I81-3.15
B-I81-3 Box 8 Runs 29-30 Dry

Figure B-I81-3.16
B-I81-3 Box 8 Runs 29-30 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-I81-3

MOTT MACDONALD M M

SOIL BORING LOG

BORING NO.: **B-7A**
Page **1** of **2**

Project:	PennEast Pipeline Project	**Project No.:**	353754
Location:	Interstate - 81 Crossing, Wilkes - Barre, PA	**Project Mgr:**	Vatsal Shah
Client:	PennEast Pipeline	**Field Eng. Staff:**	Dafydd Chandler
Drilling Co.:	Craig Test Boring Co., Inc.	**Date/Time Started:**	August 2, 2016 at 8:47 am
Driller/Helper:	Paul Mullins /Nick Beehler	**Date/Time Finished:**	August 4, 2016 at 1:45 pm

Elevation: 812 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** Southwest corner of construction site. **Coord.:** **N:** 14991208.71 **E:** 1419193.09 **Horizontal Datum:** UTM Zone 18 T

Item	Casing	Sampler	Core Barrel
Type	HW	SS	NQ2
Length (ft)	5	2	5
Inside Dia. (in.)	4	1.375	2.0
Hammer Wt. (lb.)	140	140	-
Hammer Fall (in.)	30	30	-

Rig Make & Model: CME-750X

☐ Truck ☐ Tripod ☐ Cat-Head
☑ ATV ☐ Geoprobe ☑ Winch
☐ Track ☐ Air Track ☑ Roller Bit
☐ Skid ☐ _____ ☐ Cutting Head

Hammer Type: ☐ Safety ☐ Doughnut ☑ Automatic ☐ _____

Drilling Fluid: ☐ Bentonite ☐ Polymer ☑ Water ☐ None

Drill Rod Size: A Rod

Casing Advance: Mud Rotary

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Group Symbol	Visual - Manual Identification & Description (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Field Tests: Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
	S-1 0.0'- 2.0'	23	10 11 12 10		FILL	Very stiff, Dark gray Lean CLAY with Gravel and cobbles, moist (FILL)	N	-	L	L	Gravel is coarse to fine Coal and Sandstone.
810											
5	S-2 5.0'- 7.0'	20	21 15 18 22		FILL	Very stiff, Dark gray Sandy Lean CLAY with Gravel and Silt, moist (FILL)	N	-	L	L	Gravel is coarse to fine Coal and Sandstone.
10	S-3 10.0'- 12.0'	4	19 20 16 18		FILL	Very stiff, Dark gray Gravelly Lean CLAY with Sand, moist (FILL)	N	-	L	L	Poor recovery due to Gravel in tip of spoon. Gravel is Sandstone.
800											
15	S-4 15.0'- 17.0'	12	13 13 15 30		FILL	Very stiff, Dark gray Gravelly Lean CLAY with Sand, moist (FILL)	N	-	L	L	Gravel is Sandstone, Coal, and Quartzite.

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet to: Bot. of Casing	Bottom of Hole	Water
8/4/16	6:15	-	5.0	160.0	129.6

Sample Type

O Open End Rod
T Thin-Wall Tube
U Undisturbed Sample
S Split Spoon Sample
G Grab Sample

Notes:

Strip mining backfill
PP = Pocket Penetrometer
TV = Torvane

Boring No.: **B-7A**

Field Test Legend: Dilatancy: N - None S - Slow R - Rapid; Toughness: L - Low M - Medium H - High; Plasticity: NP - Non-Plastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High VH - Very High

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

MOTT MACDONALD M M

SOIL BORING LOG
(continued)

BORING NO.: **B-7A**
Page **2** of **2**

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	Visual - Manual Identification & Description (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Field Tests: Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
	S-5 20.0'-22.0'	12	9 10 14 18		FILL	Very stiff, Dark gray Gravelly Lean CLAY with Sand and Silt, moist (FILL)	N	-	L	L	Gravel is coarse to fine Sandstone, Coal, and Quartzite.
790											
25	S-6 25.0'-27.0'	10	10 12 50/2"		FILL	Hard, Dark gray Gravelly Lean CLAY with Sand and Silt, moist (FILL)	N	-	L	L	Gravel is coarse to fine Sandstone, Coal, and Quartzite.
30	S-7 30.0'-32.0'	11	9 27 21 19		FILL	Hard, Dark gray Gravelly Lean CLAY with Sand and Silt, moist (FILL)	N	-	L	L	Gravel is coarse to fine Sandstone, Coal, and Quartzite.
780											
35	S-8 35.0'-37.0'	9	12 30 25 40		FILL	Hard, Dark gray Gravelly Lean CLAY with Sand and Silt, moist (FILL)	N	-	L	L	Gravel is Sandstone, Quartzite, and Gneiss.
						38.5					
40	S-9 40.0'-42.0'	0.5	50/1"			SANDSTONE fragments	-	-	-	-	Slow drilling from 40 to 45 feet BGS.
770											
						45.0					
45	S-10 45.0'-47.1'	0.5	50/0.5"			Top of Rock at 45 feet BGS. See Rock Coring Log.	-	-	-	-	Top of weathered rock 40ft

NOTES: Strip mining backfill
PP = Pocket Penetrometer
TV = Torvane

PROJECT NO.: **353754**

BORING NO.: **B-7A**

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

MOTT MACDONALD M M

CORE BORING LOG

BORING NO.: **B-7A**

Project:	PennEast Pipeline Project	**Project No.:**	353754
Location:	Interstate - 81 Crossing, Wilkes - Barre, PA	**Project Mgr:**	Vatsal Shah
Client:	PennEast Pipeline	**Field Eng. Staff:**	Dafydd Chandler
Drilling Co.:	Craig Test Boring Co., Inc.	**Date/Time Started:**	August 2, 2016 at 8:47 am
Driller/Helper:	Paul Mullins /Nick Beehler	**Date/Time Finished:**	August 4, 2016 at 1:45 pm

Elevation: 812 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** Southwest corner of construction site. **Coord.: N:** 14991208.71 **E:** 1419193.09

Item	Casing	Core Barrel	Core Bit
Type	HW	NQ2	Imp. Diamond
Length (ft)	5	5	3.25
Inside Dia. (in.)	4	2.0	2.0

Horizontal Datum: UTM Zone 18 T **Rig Make & Model:** CME-750X **Drilling Method:** Wireline

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec (in. / %)	RQD (in / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
									SEE TEST BORING LOG FOR OVERBURDEN DETAILS								
	3.00	45.0							QUARTZITE, Gray, medium to coarse grained, moderately weathered, medium strong, close to moderately spaced discontinuities Mica present. (Quartzite is MetaSandstone) 46' - 47.4' Highly Fractured zone	45.70	J	10	P,R	FR	T	N	
	2.00																
	1.50		R-1	60 100%	38 63%	R3	M			48.00	J	0	P,R	DG	O	CL	
	1.50									49.00	J	5	P,R	FR	T	N	
	1.50	50.0															
50	2.00	50.0							QUARTZITE, Gray, medium to coarse grained, slightly weathered, medium strong, close spaced discontinuities Mica present	50.70	J	20	P,R	FR	T	N	
	1.50									51.10	J	0	P,R	FR	W	N	Sudden loss of water at 51 feet BGS.
760										51.50	J	0	P,R	FR	T	N	
	1.50		R-2	57 95%	40 67%	R3	SL			52.10	J	10	P,R	FR	T	N	
	1.50								53' - 55' Highly Fractured zone including vertical fractures								
	1.50	55.0															
55	1.00	55.0							QUARTZITE, Gray, fine to coarse grained, fresh, strong, moderately spaced discontinuities Mica present								
	1.50									56.70	J	20	P,R	DS	T	N	
	1.50		R-3	60 100%	55 92%	R4	FR			57.40	J	30	P,Sm	DG	PO	SD	
	1.00								58.7' - 59.4' Highly Fractured zone								
	1.00	60.0															
60	1.00	60.0							QUARTZITE, Gray, fine to coarse grained, fresh, strong, moderate to wide spaced discontinuities								Used up to 270 Gallons for R-3.
	1.00									60.70	J	70	P,R	FR	PO	N	
750										61.50	J	10	P,R	FR	T	N	
	1.50		R-4	60 100%	52 87%	R4	FR			62.10	J	15	P,R	FR	T	N	
	1.50																
	1.50	65.0								64.20	J	0	U,R	FR	PO	N	
										64.50	J	0	U,R	FR	PO	N	

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet to: Bot. of Casing	Bottom of Hole	Water
8/4/16	6:15	-	5.0	160.0	129.6

Notes:

Coal seam encountered.

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities (See Legend for Rock Description System) Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	2.00	65.0							QUARTZITE, Light gray, fine to coarse grained, fresh, very strong, wide spaced discontinuities								Hole is very dry, all drilling water loosed rapidly when drilling stops.
	2.00									66.10	J	20	P,R	FR	PO	N	
	1.50		R-5	60 100%	60 100%	R5	FR			66.90	J	45	P,R	FR	T	N	
	3.00									68.60	J	10	U,R	FR	T	N	
	3.00	70.0								69.60	J	20	U,R	FR	T	N	
70	2.00	70.0							QUARTZITE, Light gray, fine to coarse grained, fresh, very strong, wide spaced discontinuities								
	2.00									70.70	J	15	P,R	FR	T	N	
	2.00									71.20	J	10	U,R	FR	O	N	
740	2.00		R-6	58 97%	46 77%	R5	FR			72.20	J	5	P,R	FR	T	N	
										72.50	J	15	P,R	FR	T	N	
									73.0								
	2.00								73' - 75' Sandy SHALE, Dark gray, very fine to fine grained, fresh, strong, wide spaced discontinuities	73.00	J	25	P,R	DS	T	Fe	
	2.00	75.0								74.40	J	20	P,R	DS	T	Fe	
75		75.0							75.0 QUARTZITE, Light gray, fine to coarse grained, fresh, very strong, close to wide spaced discontinuities								
	2.00																
	3.00									76.40	J	45	P,R	FR	T	N	
	3.00		R-7	59 98%	52 87%	R5	FR										
	4.00								78' - 80' Highly Fractured zone								
	4.00	80.0															
80		80.0							QUARTZITE, Light gray, fine to coarse grained, fresh, very strong, close to wide spaced discontinuities								
	2.00																
	2.50																
730	2.50		R-8	57 95%	57 95%	R5	FR										
	3.00																
	3.00	85.0								84.60	J	15	P,R	FR	T	N	
85		85.0							QUARTZITE, Light gray, fine to coarse grained, fresh, very strong, wide spaced discontinuities								
	2.00									85.50	J	40	P,R	FR	T	N	
	2.00								86.3' - 86.7' Highly Fractured zone								
	2.00		R-9	59 98%	54 90%	R5	FR			87.50	J	35	P,R	FR	T	N	
	2.00																
	2.00	90.0								89.00	J	10	U,R	DS	PO	N	

NOTES: Coal seam encountered.

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	2.00	90.0							QUARTZITE, Gray, fine to coarse grained, fresh, very strong, close to wide spaced discontinuities	90.50	J	30	U,R	DS	PO	N	
	2.00									91.20	J	45	P,R	FR	T	N	
										91.60	J	30	U,R	DS	W	Fe	
720	2.00		R-10	58 97%	54 90%	R5	FR			92.30	J	30	P,R	FR	T	N	
	2.00									93.30	J	15	P,R	FR	T	N	
										93.80	J	5	U,R	DS	PO	N	
	2.00	95.0							95.0	94.20	J	40	U,R	DS	T	N	
95		95.0							CONGLOMERATE, Gray and white, coarse grained, fresh, very strong, wide spaced discontinuities Conglomerate is of coarse angular grains predominantly quartz.								
	1.50								96.3 95' - 96.3' Highly Fractured zone								
	1.50								Sandy SHALE, Gray, very fine to medium grained, fresh, very strong, close to moderately spaced discontinuities 0.2-inch thick Anthracite COAL seam at 96.5'								
	1.50		R-11	60 100%	40 67%	R5	FR			97.30	J	20	U,R	FR	T	N	
										97.80	J	20	U,R	FR	T	N	
	1.50																
	1.50	100.0								98.80	J	15	U,R	DS	PO	N	
100		100.0							Sandy SHALE, Gray, very fine to medium grained, fresh, very strong, very close to moderately spaced discontinuities Occasional very think Coal seam 100' - 101.9' Highly Fractured zone								3 inch rod drop at 103 feet BGS.
	1.50																
	2.00																
710																	
	2.00		R-12	54 90%	42 70%	R5	FR										
	2.00									103.30	J	10	U,R	FR	T	N	
										103.90	J	10	S,R	FR	T	N	
	2.00	105.0							104.3' - 105' Highly fractured zone 105.0								
105		105.0							QUARTZITE, Gray, fine to medium grained, slightly weathered, very strong, very close to close spaced discontinuities 105' - 110' Highly Fractured zone								
	2.00								106.4								
	2.00								106.4' - 106.9' Video confirmed Open Features [V-13] 106.9								
	2.00		R-13	55 92%	0 0%	R5	SL										
	3.00																
	3.00	110.0															
110		110.0							QUARTZITE, Gray, fine to medium grained, slightly weathered, strong, very close to close spaced discontinuities 110' - 115' Highly Fractured zone								Rod dropped 4 inches from 114 to 114.3 feet BGS.
	3.00																
	3.00																
700																	
	2.00		R-14	11 18%	6 10%	R4	SL										
	2.00								113.9								
									114.3 113.9' - 114.3' Video confirmed VOID [V-14]								
	2.00	115.0															

NOTES: Coal seam encountered.

PROJECT NO.: **353754**

Boring No.: **B-7A**

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	1.50	115.0							QUARTZITE, Gray, fine to coarse grained, fresh, very strong, extremely close to close spaced discontinuities 115' - 120' Highly Fractured zone								Rod dropped 18 inches from 116 to 117.5 feet BGS.
	1.50								116.3 116.3'-117.2' Video confirmed VOID [V-15]								
	0.00		R-15	44 73%	22 37%	R5	FR		117.2								
	0.50																
	1.50	120.0															
120	0.50	120.0							120.2 SHALE, Dark gray, very fine grained, slightly weathered, medium strong, extremely close to moderately spaced discontinuities 120' - 125' Highly Fractured zone								Rod dropped 12 inches from 122 to 123 feet and 124 to 125 feet BGS.
	1.00								121.2 120.2' - 121.2' Video confirmed VOID [V-16]								
690	0.00		R-16	34 57%	16 27%				122.5 122.5' - 124' Video confirmed VOID [V-17] - (Field logged as 124' - 128.5' VOID)								
	2.00								124.0								
	0.00	125.0							125.0								
125	0.00	125.0							125' - 128.5' Small Athracite Coal fragments								Drill rods dropped at 125 feet BGS.
	0.00																
	0.00		R-17	18 30%	7 12%	R3	SL										
	0.20								128.5 128.5' - 130' SHALE, Dark gray, very fine to fine grained, slightly weathered, medium strong, extremely close to close spaced discontinuities								
▽	0.50	130.0															
130	1.00	130.0							SHALE, Gray, very fine grained, fresh, strong, close to moderately spaced discontinuities 130' - 130.5' Highly Fractured zone								
	1.50									131.60	J	70	U,R	FR	T	N	
680										131.90	B	10	P,R	FR	T	N	
	2.00		R-18	60 100%	37 62%	R4	FR			132.10	B	5	P,R	FR	T	N	
										132.40	B	5	P,Sm	FR	T	N	
	2.00									133.50	J	10	P,R	FR	T	N	
	3.00	135.0															
135	1.50	135.0							SHALE, Dark gray, very fine grained, fresh, strong, very close to wide spaced discontinuities 136' - 137.2' Highly Fractured zone								
	2.00																
	2.00		R-19	58 97%	44 73%	R4	FR										
	2.50																
	2.50	140.0															

NOTES: Coal seam encountered.

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities (See Legend for Rock Description System) Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	2.50	140.0							SHALE, Dark gray, very fine grained, fresh, strong, wide to very wide spaced discontinuities	140.40	B	5	U,R	DS	PO	N	No water return.
	2.00																
670	2.00		R-20	60 100%	60 100%	R4	FR										
	2.50									143.40	B	0	P,K	FR	PO	N	
	2.50																
	2.50	145.0															
145	2.00	145.0							SHALE with interbedded QUARTZITE, Light to dark gray, very fine to coarse grained, fresh, very strong, close to moderately spaced discontinuities Laminated interbedding								
	2.00									146.60	J	20	P,R	FR	T	N	
	2.50		R-21	60 100%	53 88%	R5	FR			147.60	J	15	U,R	FR	PO	N	
	2.50																
	2.50	150.0															
150	2.00	150.0							QUARTZITE, Light gray, coarse grained, fresh, very strong, wide spaced discontinuities	150.40	B	5	U,Sm	DS	PO	Py	
	1.50																
660	1.50		R-22	60 100%	60 100%	R5	FR										
	2.00																
	3.00	155.0															
155	2.50	155.0							CONGLOMERATE, Gray and white, coarse grained, fresh, very strong, wide spaced discontinuities Conglomerate is of coarse angular grains predominantly quartz								
	3.00																
	3.00		R-23	60 100%	60 100%	R5	FR										
	3.50																
	5.00	160.0															
160	3.00	160.0							QUARTZITE, Light gray, medium to coarse grained, fresh, very strong, close to wide spaced discontinuities								Used up to 8,000 Gallons from 105 to 160 feet BGS.
	3.00																
650	3.00		R-24	60 100%	50 83%	R5	FR										
	3.00																
	3.00	165.0															

NOTES: Coal seam encountered.

PROJECT NO.: **353754**

Boring No.: **B-7A**

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath.	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	2.00	165.0							QUARTZITE, Dark gray, fine to medium grained, fresh, extremely strong, wide spaced discontinuities Mica crystals present								
	2.00									166.50	J	15	U,R	FR	VT	N	
	2.50		R-25	60 100%	60 100%	R6	FR										
	2.50																
	2.50	170.0															
170	2.50	170.0							QUARTZITE, Dark gray, fine to medium grained, fresh, extremely strong, wide spaced discontinuities								
	3.00																
640	3.00		R-26	60 100%	54 90%	R6	FR			171.80	J	30	P,R	FR	VT	N	
	3.00									173.70	J	10	U,R	FR	VT	N	
	3.00	175.0								174.60	J	40	P,R	DS	T	Fe	
175	1.50	175.0							QUARTZITE, Dark gray, fine to medium grained, fresh, extremely strong, wide spaced discontinuities								
	1.50								176.3' - 177.3' Highly Fractured zone	176.30	J	20	P,R	DS	T	Fe	
	2.00		R-27	60 100%	42 70%	R5	FR										
	2.50								178.6 178.7 178.6' Anthracite Coal encountered								
	2.50	180.0							179.6 179.5' - 181' Highly Fractured zone								
180		180.0							179.6' - 180.4' SHALE with Anthracite Coal 180.4 encountered								
	2.00								QUARTZITE, Light gray, coarse grained, fresh, very strong, moderately spaced discontinuities								
	2.00									181.60 181.70	J J	15 15	P,R P,R	FR FR	T T	N N	
630	2.00		R-28	60 100%	46 77%	R5	FR										
	2.00									183.20	J	20	U,R	FR	T	N	
	3.00	185.0								184.00	J	15	P,R	DS	T	N	
185	2.50	185.0							QUARTZITE, Light gray, medium grained, fresh, very strong, moderately spaced discontinuities								
	2.50									185.80	J	10	P,R	FR	T	N	
	2.50		R-29	58 97%	51 85%	R5	FR			186.70	J	20	U,R	FR	T	N	
	3.00								188.2' - 188.6' Highly Fractured zone	187.50	J	25	U,R	FR	T	N	
	2.50	190.0								189.20 189.60	J J	10 5	U,R U,R	FR FR	T T	N N	

NOTES: Coal seam encountered.

PROJECT NO.: **353754**

Boring No.: **B-7A**

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities (See Legend for Rock Description System) Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	2.50	190.0							QUARTZITE, Gray, fine to coarse grained, slightly weathered, strong, very close spaced discontinuities Occassional fine Shale bedding at fractures Occasional Coal encountered 190' - 195' Highly Fractured zone								
	2.50																
620	3.00		R-30	59 98%	20 33%	R4	SL										
	2.50																
	2.50	195.0															
195	2.00	195.0							QUARTZITE, Gray, medium grained, fresh, strong, very close to moderately spaced discontinuities Occasional fine Shale bedding	195.70	J	30	P,R	FR	T	N	
										195.90	J	30	U,R	FR	T	N	
	2.00									196.10	J	30	U,R	FR	T	N	
										196.70	J	30	U,R	FR	T	N	
	2.00		R-31	60 100%	38 63%	R4	FR			196.90	J	5	U,R	FR	T	N	
										197.00	J	5	U,R	FR	T	N	
	2.00									197.40	J	5	P,R	FR	T	N	
	3.00									198.40	J	10	P,R	FR	T	N	
	4.00								199.2' - 200' Highly Fractured zone								
200		200.0							200.0 End of Boring at 200 feet BGS. Borehole grouted with cement and bentonite hole plug.								
610																	
205																	
210																	
600																	

NOTES: Coal seam encountered.

PROJECT NO.: **353754**

Boring No.: **B-7A**

Figure B-7A.1
B-7A Box 1 Runs 1-4 Dry

Figure B-7A.2
B-7A Box 1 Runs 1-4 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-7A

Figure B-7A.3
B-7A Box 2 Runs 5-8 Dry

Figure B-7A.4
B-7A Box 2 Runs 5-8 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-7A

Figure B-7A.5
B-7A Box 3 Runs 9-12 Dry

Figure B-7A.6
B-7A Box 3 Runs 9-12 Wet

MOTT MACDONALD	PennEast Pipeline Project Rock Core Photographs	BORING NO.: B-7A

Figure B-7A.7
B-7A Box 4 Runs 13-16 Dry

Figure B-7A.8
B-7A Box 4 Runs 13-16 Wet

MOTT MACDONALD	PennEast Pipeline Project Rock Core Photographs	BORING NO.: B-7A

Figure B-7A.9
B-7A Box 5 Runs 17-20 Dry

Figure B-7A.10
B-7A Box 5 Runs 17-20 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-7A

Figure B-7A.11
B-7A Box 6 Runs 21-24 Dry

Figure B-7A.12
B-7A Box 6 Runs 21-24 Wet

Figure B-7A.13
B-7A Box 7 Runs 25-28 Dry

Figure B-7A.14
B-7A Box 7 Runs 25-28 Wet

MOTT MACDONALD M M	PennEast Pipeline Project Rock Core Photographs	BORING NO.: B-7A

Figure B-7A.15
B-7A Box 8 Runs 29-31 Dry

Figure B-7A.16
B-7A Box 8 Runs 29-31 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-7A

MOTT MACDONALD M M

SOIL BORING LOG

BORING NO.: **B-7**

Project:	PennEast Pipeline Project	**Project No.:**	353754
Location:	Interstate - 81 Crossing, Wilkes - Barre, PA	**Project Mgr:**	Vatsal Shah
Client:	PennEast Pipeline	**Field Eng. Staff:**	Bernard Cortes
Drilling Co.:	Craig Test Boring Co., Inc.	**Date/Time Started:**	February 11, 2016 at 7:00 am
Driller/Helper:	Paul Mullins /Nick Beehler	**Date/Time Finished:**	February 12, 2016 at 1:30 pm

Elevation: 815 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** Off Hwy 315. **Coord.:** **N:** 14991241.03 **E:** 1419204.376

Horizontal Datum: UTM Zone 18 T

Item	Casing	Sampler	Core Barrel
Type	HW	SS	NQ2
Length (ft)	5	2	5
Inside Dia. (in.)	4	1.375	2.0
Hammer Wt. (lb.)	140	140	-
Hammer Fall (in.)	30	30	-

Rig Make & Model: CME-750X

☐ Truck ☐ Tripod ☐ Cat-Head
☑ ATV ☐ Geoprobe ☑ Winch
☐ Track ☐ Air Track ☑ Roller Bit
☐ Skid ☐ _____ ☐ Cutting Head

Hammer Type: ☐ Safety ☐ Doughnut ☑ Automatic ☐ _____

Drilling Fluid: ☐ Bentonite ☐ Polymer ☑ Water ☐ None

Drill Rod Size:

Casing Advance: Mud Rotary

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Group Symbol	Visual - Manual Identification & Description (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Field Tests: Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
	S-1 0.0'- 2.0'	17	7 3 6 5		ML	Medium stiff, Yellowish red SILT with Decomposed Rock fragments, moist (FILL)	N	-	NP	N	
						3.5					
5 810	S-2 5.0'- 7.0'	16	5 7 7 5		CL	Very stiff, Dark gray Sandy Lean CLAY with Gravel and Silt, moist (FILL)	N	L	M	N	
10	S-3 10.0'- 12.0'	16	6 7 7 6		CL	Very stiff, Dark gray Sandy Lean CLAY with Gravel and Silt, moist (FILL)	N	H	H	N	
15 800	S-4 15.0'- 17.0'	12	12 14 50/3"		CL	Very stiff, Dark gray Sandy Lean CLAY with Gravel and Silt, moist (FILL)	N	H	M	N	
						18.5					

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet to: Bot. of Casing	Bottom of Hole	Water
2/12/16	8:00	-	45.0	67.0	28

Sample Type

- **O** Open End Rod
- **T** Thin-Wall Tube
- **U** Undisturbed Sample
- **S** Split Spoon Sample
- **G** Grab Sample

Notes:

PP = Pocket Penetrometer
TV = Torvane

Boring No.: **B-7**

Field Test Legend: Dilatancy: N - None S - Slow R - Rapid; Toughness: L - Low M - Medium H - High; Plasticity: NP - Non-Plastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High VH - Very High

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	Visual - Manual Identification & Description (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Field Tests: Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
	S-5 20.0'-22.0'	7	12 17 38 14		GP	Very dense, gray GRAVEL with Silty Clay, wet (FILL)	N	H	M	L	
25 790	S-6 25.0'-27.0'	8	9 11 12 13		GP	Medium dense, gray GRAVEL with Sandy Clay, wet (FILL)	N	H	M	N	
▽											
30	S-7 30.0'-32.0'	12	10 16 14 11		GP	Medium dense, gray GRAVEL with Clayey Sand, wet (FILL)	N	L	M	N	
35 780	S-8 35.0'-37.0'	10	16 17 35 12		GP	Very dense, gray GRAVEL with Silty Sand, wet (FILL)	N	L	M	N	
40	S-9 40.0'-42.0'	8	13 12 14 12		GP	Medium dense, gray GRAVEL with Clayey Sand, wet (FILL)	N	M	M	N	
45 770	S-10 45.0'-47.0'	16	19 24 33 31		GP	Very dense, gray GRAVEL with Silty Sand, moist (FILL)	N	M	L	N	Installed Casing to 45 feet.

NOTES: PP = Pocket Penetrometer
TV = Torvane

PROJECT NO.: 353754

BORING NO.: B-7

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

SOIL BORING LOG
(continued)

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	Visual - Manual Identification & Description (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Field Tests: Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
						48.5					
50	S-11 50.0'-52.0'	15	22 33 26 34		SM	Very dense, Brown Silty SAND with Gravel, moist (SM)	N	L	L	N	
						53.5					
55 760	S-12 55.0'-57.0'	1	50/1"		SC	Very dense, Brown Clayey SAND with Decomposed Rock fragments (SC)	N	L	M	N	
60	S-13 60.0'-62.0'		50/0"			No Recovery in SPT. Borehole advanced using roller bit. Possible boulder or top of rock	-	-	-	-	
65 750	S-14 65.0'-67.0'		50/0"			No Recovery in SPT. Borehole advanced using roller bit. Possible boulder or top of rock	-	-	-	-	
70						70.0 Rock coring from 70 feet BGS. See Rock Coring Log.					

NOTES: PP = Pocket Penetrometer
TV = Torvane

PROJECT NO.: **353754**

BORING NO.: **B-7**

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

MOTT MACDONALD M M

CORE BORING LOG

BORING NO.: **B-7**

Project:	PennEast Pipeline Project	**Project No.:**	353754
Location:	Interstate - 81 Crossing, Wilkes - Barre, PA	**Project Mgr:**	Vatsal Shah
Client:	PennEast Pipeline	**Field Eng. Staff:**	Bernard Cortes
Drilling Co.:	Craig Test Boring Co., Inc.	**Date/Time Started:**	February 11, 2016 at 7:00 am
Driller/Helper:	Paul Mullins /Nick Beehler	**Date/Time Finished:**	February 12, 2016 at 1:30 pm

Elevation: 815 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** Off Hwy 315. **Coord.: N:** 14991241.03 **E:** 1419204.376

Item	Casing	Core Barrel	Core Bit
Type	HW	NQ2	Imp. Diamond
Length (ft)	5	5	3.25
Inside Dia. (in.)	4	2.0	2.0

Horizontal Datum: UTM Zone 18 T **Rig Make & Model:** CME-750X **Drilling Method:** Wireline

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec (in. / %)	RQD (in / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities (See Legend for Rock Description System) Type	Dip	Rgh	Wea	Aper	Infill	Remarks
									SEE TEST BORING LOG FOR OVERBURDEN DETAILS								
	2.50	70.0							QUARTZITE, Light gray, medium grained, fresh, extremely strong, extremely close to close spaced discontinuities. (Quartzite is MetaSandstone)	70.10	J	10	X,R	DE	O	N	Losing Water.
										70.30	J	10	P,R	DE	O	N	
										70.80	J	10	P,R	DE	PO	N	
	2.50									71.00	J	0	P,Sm	FR	PO	N	
										71.20	J	5	P,R	FR	PO	N	
	2.50		R-1	60 100%	26 43%	R6	FR		72' - 72.9' Highly Fractured Zone								Core barrel moving side to side.
	2.50																
	2.50	75.0							74' - 75' Highly Fractured Zone								
75 740	4.00	75.0							QUARTZITE with Silica cement, Light gray, medium to coarse grained, slightly weathered, medium strong, close spaced discontinuities.	75.20	J		X,R	FR	O	N	
	4.00									76.40	J	10	P,R	DG	O	CL	
										76.90	V	30	P,R	FR	O	X	
	3.50		R-2	60 100%	47 78%	R3	M			77.60	J	5	P,Sm	FR	T	N	
	3.50									78.20	MB						
										78.70	J	10	P,R	FR	PO	N	
	4.00									79.00	V	30	P,R	FR	PO	X	
		80.0								79.30	V	30	P,R	FR	T	X	
80	5.00	80.0							QUARTZITE, Light gray, fine to medium grained, fresh, strong, close to moderately spaced discontinuities	80.30	J	5	P,R	FR	PO	N	Used up to 275 Gallons for R1/R2/R3.
										80.90	J	10	P,R	DS	O	ML	
	3.00									81.20	J	10	S,K	DG	O	Sa	
										81.90	J	0	P,Sm	FR	T	N	
	2.30		R-3	60 100%	55 92%	R4	FR			82.60	J	0	P,R	FR	PO	N	
	2.50																
	3.00	85.0								84.50	J	5	P,R	FR	PO	N	
85 730	6.00	85.0							QUARTZITE with Silica cement, Light gray, medium to coarse grained, fresh, very strong, extremely close to moderately spaced discontinuities								
	5.00									86.20	J	5	P,R	FR	PO	N	
										86.30	J	60	P,R	DG	T	N	
										86.60	J	0	P,R	DG	O	N	
	3.00		R-4	60 100%	53 88%	R5	FR			86.80	J		X,R	DG	W	N	
	3.00									88.30	J	40	P,R	DG	T	X	
										88.70	J	30	P,R	FR	PO	N	
	3.00	90.0								89.60	J	0	P,Sm	FR	PO	N	

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet to: Bot. of Casing	Bottom of Hole	Water
2/12/16	8:00	-	45.0	67.0	28.0

Notes:

MOTT MACDONALD M M

CORE BORING LOG
(continued)

BORING NO.: **B-7**

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities (See Legend for Rock Description System) Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	2.00	90.0							QUARTZITE, Light gray, fine to medium grained, fresh, extremely strong, coarse to wide spaced discontinuities								
										90.70	J	20	P,R	FR	T	N	
	2.00									91.50	J	20	P,R	FR	T	N	
										91.60	J	30	P,R	DG	T	X	
	3.50		R-5	60 100%	60 100%	R6	FR			92.20	J	5	P,R	FR	T	N	
	3.50																
	3.00	95.0															
95 720		95.0							QUARTZITE, Light gray, medium grained, fresh, extremely strong, extremely close to moderately spaced discontinuities								
	4.00									95.20	J	20	P,R	FR	MW	N	
										95.80	J	30	P,R	FR	PO	N	
										96.10	J	10	X,R	DG	W	N	
	6.00									96.20	J		P,R	DG	PO	X	
										96.60	J	40	P,R	FR	PO	N	
	6.00		R-6	60 100%	50 83%	R6	FR			97.30	J	10	P,R	DS	PO	X	
										97.70	J		X,R	DS	MW	X	
										98.10	J	10	P,R	DS	PO	X	
	6.50									98.30	J	10	P,R	DS	PO	X	
										98.80	J	10	P,Sm	DG	PO	X	
	7.00	100.0							100.0								
100									End of Boring at 100 feet BGS. Borehole grouted with cement and bentonite hole plug.	99.80	MB						
105 710																	
110																	

NOTES:

PROJECT NO.: **353754**

Boring No.: **B-7**

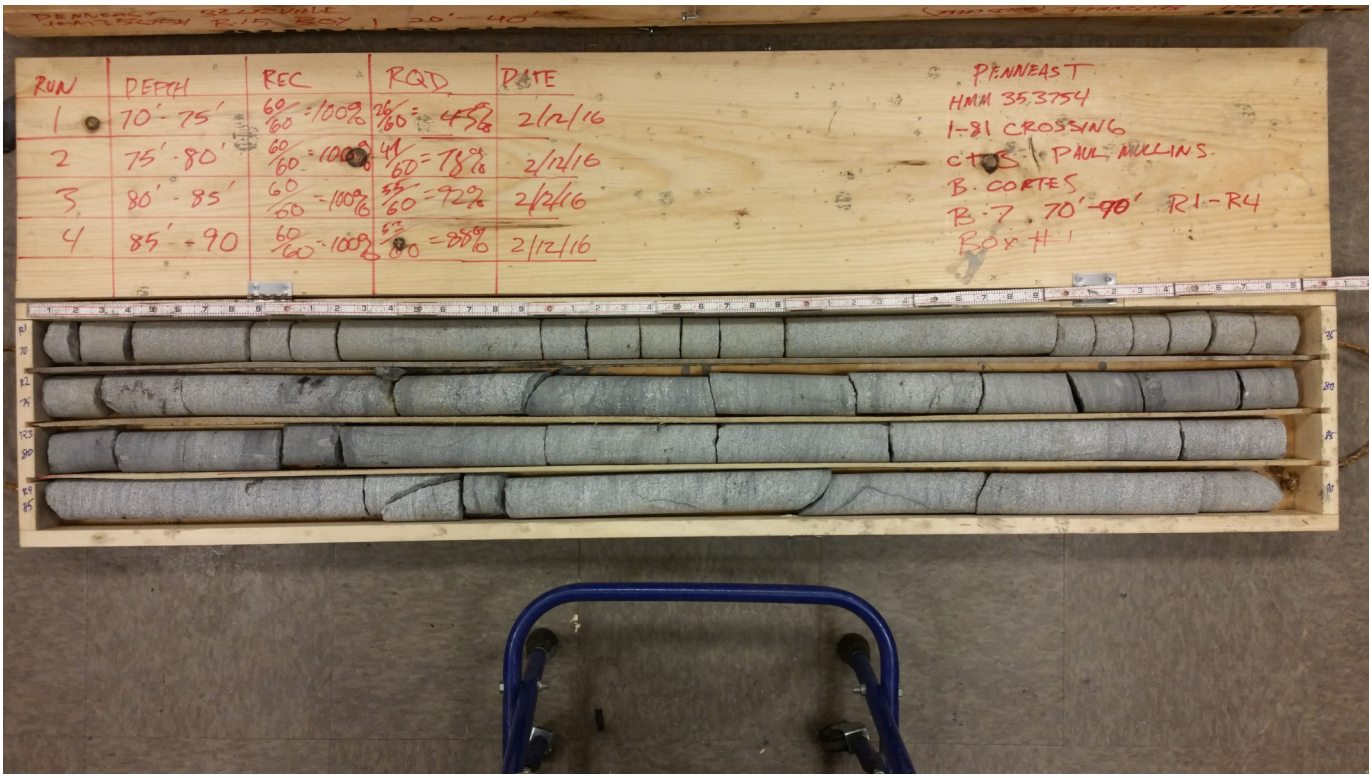


Figure B-7.1
B-7 Box 1 Runs 1-4 Dry

Figure B-7.2
B-7 Box 1 Runs 1-4 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-7

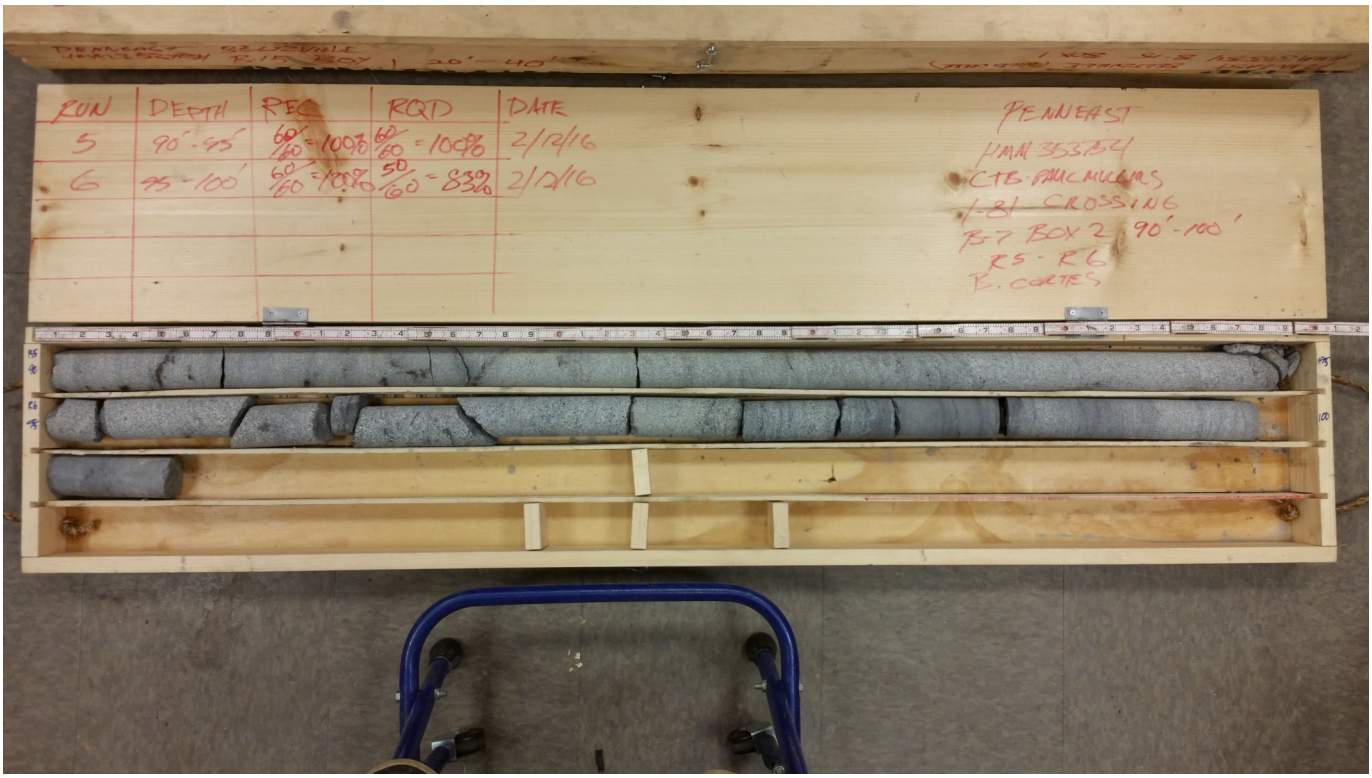


Figure B-7.3
B-7 Box 2 Runs 5-6 Dry

Figure B-7.4
B-7 Box 2 Runs 5-6 Wet

MOTT MACDONALD M M	PennEast Pipeline Project Rock Core Photographs	BORING NO.: B-7

MOTT MACDONALD M M

SOIL BORING LOG

BORING NO.: **B-8**

Project:	PennEast Pipeline Project	**Project No.:**	353754
Location:	Interstate - 81 Crossing, Wilkes - Barre, PA	**Project Mgr:**	Vatsal Shah
Client:	PennEast Pipeline	**Field Eng. Staff:**	Dafydd Chandler
Drilling Co.:	Craig Test Boring Co., Inc.	**Date/Time Started:**	August 12, 2016 at 11:39 am
Driller/Helper:	Paul Mullins /Nick Beehler	**Date/Time Finished:**	August 16, 2016 at 3:15 pm

Elevation: 883 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** Off PP&L ROW **Coord.:** **N:** 14990651.3 **E:** 1419754.868

Horizontal Datum: UTM Zone 18 T

Item	Casing	Sampler	Core Barrel
Type	HW	SS	NQ2
Length (ft)	17	2	5
Inside Dia. (in.)	4	1.375	2.0
Hammer Wt. (lb.)	140	140	-
Hammer Fall (in.)	30	30	-

Rig Make & Model: CME-750X

- ☐ Truck ☐ Tripod ☐ Cat-Head
- ☑ ATV ☐ Geoprobe ☑ Winch
- ☐ Track ☐ Air Track ☑ Roller Bit
- ☐ Skid ☐ _____ ☐ Cutting Head

Hammer Type

- ☐ Safety
- ☐ Doughnut
- ☑ Automatic
- ☐ _____

Drilling Fluid

- ☐ Bentonite
- ☐ Polymer
- ☑ Water
- ☐ None

Drill Rod Size:

Casing Advance

Mud Rotary

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Group Symbol	Visual - Manual Identification & Description (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Field Tests: Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
	S-1 0.0'- 2.0'	24	2 2 3 6		CL	Medium stiff, Light brown Gravelly Lean CLAY, moist. (CL)	N	L	M	M	Installed 4-inch casing to 5 feet BGS.
880						3.5					
5	S-2 5.0'- 7.0'	4	17 17 20 19		GW	Dense, Brownish gray Clayey GRAVEL, moist. (GW)	-	-	-	-	Gravel consists of fine to coarse sandstone.
						8.5					
10	S-3 10.0'- 12.0'	16	10 10 50 60		CL	Hard, Blackish Brown Gravelly Lean CLAY with Cobbles, moist. (CL)	N	L	L	L	Installed 4-inch casing to 10 feet BGS.
870											
15	S-4 15.0'- 17.0'	6.5	9 70/0.5"		CL	Hard, Blackish Brown Gravelly Lean CLAY with Cobbles, moist. (CL)	-	-	-	-	Installed 4-inch casing to 15 feet BGS.
						20.0					

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet to: Bot. of Casing	Bottom of Hole	Water
8/15/16	6:45	-	17.0	20.0	1.5
8/16/16	6:00	-	17.0	120.0	110

Sample Type

- **O** Open End Rod
- **T** Thin-Wall Tube
- **U** Undisturbed Sample
- **S** Split Spoon Sample
- **G** Grab Sample

Notes:

PP = Pocket Penetrometer
TV = Torvane

Boring No.: **B-8**

Field Test Legend: Dilatancy: N - None S - Slow R - Rapid; Toughness: L - Low M - Medium H - High; Plasticity: NP - Non-Plastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High VH - Very High

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

MOTT MACDONALD M M

SOIL BORING LOG
(continued)

BORING NO.: **B-8**
Page **2** of **2**

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	Visual - Manual Identification & Description (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Field Tests: Dilatancy	Field Tests: Toughness	Field Tests: Plasticity	Field Tests: Dry Strength	Remarks
	S-5 20.0'- 20.0'	0	70/0.5"			Top of Rock at 20 feet BGS. See Rock Coring Log.	-	-	-	-	Installed 4-inch casing to 17 feet BGS. No Rec. Start coring from 20ft
860											
25											
30											
850											
35											
40											
840											
45											

NOTES: PP = Pocket Penetrometer
TV = Torvane

PROJECT NO.: **353754**

BORING NO.: **B-8**

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

MOTT MACDONALD M M

CORE BORING LOG

BORING NO.: **B-8**

Project:	PennEast Pipeline Project	**Project No.:**	353754
Location:	Interstate - 81 Crossing, Wilkes - Barre, PA	**Project Mgr:**	Vatsal Shah
Client:	PennEast Pipeline	**Field Eng. Staff:**	Dafydd Chandler
Drilling Co.:	Craig Test Boring Co., Inc.	**Date/Time Started:**	August 12, 2016 at 11:39 am
Driller/Helper:	Paul Mullins /Nick Beehler	**Date/Time Finished:**	August 16, 2016 at 3:15 pm

Elevation: 883 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** Off PP&L ROW **Coord.: N:** 14990651.3 **E:** 1419754.868

Item	Casing	Core Barrel	Core Bit
Type	HW	NQ2	Imp. Diamond
Length (ft)	17	5	3.25
Inside Dia. (in.)	4	2.0	2.0

Horizontal Datum: UTM Zone 18 T
Rig Make & Model: CME-750X
Drilling Method: Wireline

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec (in. / %)	RQD (in / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
									SEE TEST BORING LOG FOR OVERBURDEN DETAILS								
	2.00	20.0							QUARTZITE, Gray, medium grained, slightly weathered, strong, close spaced discontinuities. (Quartzite is MetaSandstone)								Good drilling water return from 20 to 25 feet BGS.
	2.00									21.70	B	0	U,R	DS	PO	N	
	1.50		R-1	58 97%	53 88%	R4	SL			22.90	B	15	U,R	DS	PO	N	
860	1.50									23.90	B	10	U,R	DS	PO	N	
	1.50	25.0								24.70	B	10	U,R	DS	PO	N	
25	1.50	25.0							QUARTZITE, Gray, medium grained, slightly weathered, strong, close spaced discontinuities								
	1.00									26.20	B	0	S,R	FR	T	N	
	1.00		R-2	60 100%	58 97%	R4	SL			27.20	J	25	S,R	FR	VT	N	
	1.00									27.90	J	10	S,R	FR	T	N	
	1.00	30.0								28.50	B	10	P,R	DS	PO	N	
30	1.50	30.0							QUARTZITE, Gray, medium grained, fresh, strong, very close to moderately spaced discontinuities								
	1.50									31.00	B	0	P,R	DG	W	N	
	1.50									31.60	B	15	U,R	FR	PO	N	
	1.50		R-3	60 100%	45 75%	R4	FR		32.4								
850									32.8 32.4' - 32.8' CONGLOMERATE								No drilling water return below 31 feet BGS.
	1.50									33.10	B	10	S,R	DS	PO	N	
	1.50									33.40	J	50	P,R	FR	T	N	
	1.50	35.0															
35	1.50	35.0							QUARTZITE, Gray, medium grained, fresh, strong, very close to moderately spaced discontinuities	35.40	J	60	P,R	FR	VT	N	
	1.50																
	1.50		R-4	60 100%	45 75%	R4	FR		36.8' - 37.2' Highly Fractured zone								
	1.50																
	1.50	40.0								39.50	B	0	S,R	DS	PO	N	

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet to: Bot. of Casing	Bottom of Hole	Water
8/15/16	6:45	-	17.0	20.0	1.5
8/16/16	6:00	-	17.0	120.0	110.0

Notes:

Coal seam encountered

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	2.00	40.0							40.5 QUARTZITE, Gray, medium grained, slightly weathered, strong, close spaced discontinuities								
	2.00								CONGLOMERATE, Gray, coarse grained, fresh, very strong, modeate to wide spaced discontinuities								Rod dropped 4 inches at 44 feet BGS.
	2.00		R-5	60 100%	60 100%	R5	FR			41.90	J	15	P,R	DS	PO	N	
840	2.00									44.00	J	0	S,R	FR	VT	N	
	2.00	45.0								44.20	J	0	P,R	DG	W	SD	
45	1.50	45.0							46.3								
	1.50								QUARTZITE, Gray, coarse to medium grained, fresh, very strong, moderately spaced discontinuities	46.20	B	10	P,R	DS	T	N	
	1.50		R-6	60 100%	58 97%	R5	FR			47.30	B	10	U,R	FR	VT	N	
	1.50									48.10	B	0	P,R	FR	T	N	
	1.50	50.0								49.10	B	5	U,R	FR	T	N	
50	1.50	50.0							QUARTZITE, Gray, fine to medium grained, fresh, very strong, very close to close spaced discontinuities 50' - 51.4' Highly Fractured zone								
	1.50																
	1.50		R-7	60 100%	43 72%	R5	FR			52.50	J	0	U,R	DG	W	SD	
830	1.50									52.90	B	15	P,R	FR	VT	N	
	1.50	55.0															
55	1.50	55.0							QUARZITE, Gray, fine to medium grained, slightly weathered, strong, extremely close to moderately spaced discontinuities 55' - 56' Highly Fractured zone with high angle fractures.								
	1.50									56.50	J	40	P,R	FR	T	N	
	1.50		R-8	60 100%	32 53%	R4	SL			56.80	J	40	P,R	FR	T	N	
	1.50									57.80	J	25	S,R	FR	PO	N	
	1.50	60.0								59.30	B	30	S,R	DG	PO	N	
60	1.00	60.0							60' - 61' Highly Fractured zone								
	1.50								61.8 61.5' - 62.5' Highly Fractured zone								Coal infilling
	1.00		R-9	60 100%	44 73%	R4	SL		SHALE, Black, fine grained, slightly weathered, strong, very close spaced discontinuities 61.8' - 63' Highly Fractured zone	62.40	J	40	P,Sm	DS	T	Fe	
820									63.0								
	1.50								QUARTZITE, Gray, fresh, medium grained, very strong, moderately spaced discontinuities	63.20	J	20	U,R	FR	VT	N	
										63.70	J	20	U,R	FR	VT	N	
	1.50	65.0															

NOTES: Coal seam encountered

PROJECT NO.: **353754**

Boring No.: **B-8**

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath.	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	1.20	65.0							QUARTZITE, Gray, medium to coarse grained, fresh, strong, close spaced discontinuities	65.40	B	20	P,Sm	FR	VT		Coal infilling
	1.20									66.40	J	10	U,R	FR	T	N	
										66.50	J	10	U,R	FR	T	N	
	1.30		R-10	60 100%	48 80%	R4	FR			67.20	B	10	P,Sm	FR	VT		Coal infilling
									68.0								
	1.40								68.3 68' - 68.3' Coal								
										68.70	B	15	P,Sm	FR	VT	Fe	
	1.40	70.0								69.60	J	10	P,Sm	FR	T		
70		70.0							QUARTZITE, Gray, medium to coarse grained, fresh, very strong, extremely close to wide spaced discontinuities								3-inch Rod drop at 74.5' (See V-11.1)
	1.50																
	1.50																
										71.70	B	10	U,R	FR	T		
	1.50		R-11	57 95%	46 77%	R5	FR			72.30	J	80	U,R	DS	T	Fe	
										72.40	B	10	P,Sm	FR	VT	N	
810									73.1								
	1.50								73.4 73.1' - 73.4' Video confirmed VOID [V-11.1]								
	1.50																
	1.50	75.0							74.9								
75		75.0							74.9' - 77.6' Video confirmed VOID [V-11.2]								
			R-12	19 32%	15 25%	R4	FR		77.6								Rod drop 77' - 79' (See V-12)
									QUARTZITE, Gray, medium to coarse grained, fresh, very strong, extremely close to wide spaced discontinuities								
									78.4								
									78.4' - 81' Video confirmed VOID [V-12] - field logged as: (76.6' - 79' VOID) (79' - 79.5' COAL) (79.5' - 81' VOID) voids contain rubble of shale and anthracite coal								
		80.0							81.0								
80		80.0							81' - 82.4' COAL								
									82.4								
			R-13	20 33%	0 0%	R1	FR		82.4' - 83.1' Video confirmed VOID [V-13.1] - (field logged as 81.5' - 83.4' VOID)								
800									83.1								
									83.1' - 84' COAL								
									84.0								
									84' - 85.7' Video confirmed VOID [V-13.2] - (field logged as 85.5' - 87.5' VOID)								
		85.0							85.7								
85		85.0							85.7' - 86.2' SHALE, Dark gray, very fine grained,								
									86.2 weak, slightly weathered, iron staining								
									86.6 86.2' - 86.6' Video confirmed VOID [V-14.1]								
									88' - 91.2' VOID								
			R-14	25 42%	4 7%	R2	SL		86.6' - 88' SHALE, Gray, very fine grainedm, slightly weathered, strong, iron staining (field logged as 91.2' - 92.5')								
									88.0								
									88' - 91.9' Video confirmed VOID [14.2]								
		90.0															

NOTES: Coal seam encountered

PROJECT NO.: **353754**

Boring No.: **B-8**

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
		90.0															
			R-15	23 38%	13 22%	R4	SL		91.9								
790																	
		95.0															
95		95.0							SHALE, Black, very fine grained, fresh, strong, wide spaced discontinuities								
	1.00																
	1.50																
	1.50		R-16	58 97%	55 92%	R4	FR			97.00	J	15	U,R	DG	PO	N	
										97.70	J	0	P,R	DG	T	N	
	1.00																
	1.00	100.0								99.50	J	10	P,R	FR	T	N	
100		100.0							SHALE, Black, very fine grained, slightly weathered, medium strong, extremely close spaced discontinuities 100' - 102.5' Highly Fractured zone								
	1.50																
	1.50									101.10	J	45	P,R		PO	QZ	
	1.50		R-17	57 95%	17 28%	R4	FR		102.5								
780									QUARTZITE, Gray, medium grained, fresh, strong, very close to close spaced discontinuities								
	1.50									103.50	J	0	U,R	DS	O	N	
	1.50																
		105.0															
105		105.0							QUARTZITE, Dark gray, fine to medium grained, fresh, strong, moderately spaced discontinuities								
	1.00																
	1.00									106.20	J	0	S,R	DG	W	N	
	1.00		R-18	60 100%	28 47%	R4	FR			107.30	J	30	P,R	FR	VT	N	
	1.50																
	1.50																
▽110		110.0							110.0								
		110.0							SHALE, Dark gray, fine grained, slightly weathered, medium strong, extremely close to moderately spaced discontinuities 110' - 110.5' Highly Fractured zone								
	1.00																
	1.00									111.30	J	50	P,Sm	FR	PO	N	
	1.00		R-19	57 95%	33 55%	R3	SL			112.00	J	25	S,R	DS	PO	Fe	
770									113' - 115' Highly Fractured zone								
	1.00																
	1.00	115.0							115.0								

NOTES: Coal seam encountered

PROJECT NO.: **353754**

Boring No.: **B-8**

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	1.00	115.0							QUARTZITE, Gray, fine to medium grained, fresh, strong, close to moderately spaced discontinuities								
	1.00								116.6	116.20	J	40	S,R	FR	VT	N	
	1.00		R-20	57 95%	33 55%	R4	FR		116.6' -118.2' Video confirmed VOID [V-20] - (field logged as 117.9' -119.7' Highly Fractured zone)								
	1.00								118.2								
	1.00								SHALE, Gray, very fine grained, extremely weathered, extremely weak 118' - 120' Highly Weathered to CLAY								
	1.00	120.0							120.0								
120	1.00	120.0							QUARTZITE, Dark gray, fine to medium grained, medium strong, extremely close to close spaced discontinuities 120' - 122.2' Highly Fractured zone								
	1.50																
	1.00		R-21	60 100%	34 57%	R3	SL										
760										123.00	J	30	P,Sm	FR	T	N	
	1.50									123.60	J	45	U,R	FR	PO	CL	
	1.50	125.0															
125		125.0							QUARTZITE, Dark gray, fine to medium grained, fresh, strong, close to moderately spaced discontinuities	125.00	J	50	S,R	FR	T	QZ	
	1.00									125.50	J	40	U,R	FR	T	N	
	1.50																
	1.50		R-22	60 100%	41 68%	R4	FR			127.00	J	30	S,R	FR	T	N	
										127.30	J	0	S,R	FR	VT	N	
	1.50																
	1.50									129.00	J	60	S,R	FR	T	N	
	1.50	130.0															
130	1.50	130.0							QUARTZITE, Light gray, medium grained, fresh, very strong, wide spaced discontinuities								
	2.00																
	2.00		R-23	60 100%	60 100%	R5	FR										
750										133.20	B	20	S,R	FR	VT	N	
	2.00																
	2.00	135.0															
135	1.50	135.0							QUARTZITE, Light gray, medium grained, fresh, very strong, wide spaced discontinuities								
	1.50																
	1.50		R-24	60 100%	60 100%	R5	FR										
	1.50									138.50	J	10	P,Sm	FR	O	QZ	
	1.50	140.0								139.10	J	55	U,R	FR	O	N	

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities (See Legend for Rock Description System) Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	2.00	140.0							QUARTZITE, Light gray, fresh, strong, medium grained, moderately spaced discontinuities	140.30	J	80	S,R	DS	T	Fe	
	2.00																
	2.00									142.00	B	10	P,R	DS	T	N	
	2.00		R-25	60 100%	45 75%	R5	FR			142.40	J	80	S,R	DS	T	Fe	
740										143.00	B	10	P,Sm	FR	VT	QZ	
	2.00																
	2.00	145.0															
145																	
	1.50	145.0							QUARTZITE, Light to dark gray, fine to coarse grained, fresh, strong, close to moderately spaced discontinuities	145.30	B	0	S,R	FR	T	N	
	1.50																
	1.50		R-26	60 100%	44 73%	R4	FR			147.00	J	0	S,R	DG	W	Fe	
	1.50								148' - 150' Highly Fractured zone								
	1.50	150.0															
150																	
	1.00	150.0							QUARTZITE, Light to dark gray, medium to coarse grained, slightly weathered, medium strong, very close to close spaced discontinuities								
	1.00								151' Subvertical fracture encountered	151.20	J	0	S,R	FR	T	N	
											J	90	P,R	DS	O	Fe	
	1.00									152.00	J	30	U,R	DG	W	Fe	
	1.00		R-27	60 100%	37 62%	R3	SL										
730									153.0								
	1.00								153' - 155' CONGLOMERATE	153.30	J	0	S,R	FR	VT	N	
	1.00									154.00	B	0	S,R	FR	VT	N	
		155.0							155.0								
155																	
	1.00	155.0							155' - 160' QUARTZITE and CONGLOMERATE encountered, poor recovery, highly disturbed								Inner barrel not engaged from 155 to 160 feet BGS. Run highly disturbed. RQD cannot be determined.
	1.50																
	2.00		R-28	37 62%	-- --	-	-										
	1.50																
	1.50	160.0															
160																	
	2.00	160.0							QUARTZITE, Light gray, coarse to medium grained, fresh, very strong, very close to moderately spaced discontinuities Fine grained laminations								
	2.00																
	2.00		R-29	60 100%	51 85%	R5	FR			162.10	B	0	P,R	FR	T	N	
720																	
	2.00									163.40	J	10	P,R	FR	T	N	
										163.90	J	20	S,R	FR	T	N	
	2.00	165.0							165.0								

NOTES: Coal seam encountered

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities (See Legend for Rock Description System) Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	2.00	165.0							CONGLOMERATE, Light gray to gray, coarse grained, fresh, very strong, moderately spaced discontinuities	165.60	J	0	P,R	DS	PO	N	
	2.00									166.60	J	20	P,R	FR	T	N	
	2.00		R-30	60 100%	60 100%	R5	FR			167.30	J	5	P,Sm	FR	T		Mica infilling
	2.00																
	2.00	170.0								169.40	J	20	P,Sm	FR	VT		Mica infilling
170	2.00	170.0							CONGLOMERATE, Light gray, coarse grained, fresh, extremely strong, wide to extremely close spaced discontinuities	170.40	J	5	P,R	FR	T	N	
	3.00																
	3.00		R-31	60 100%	54 90%	R6	FR			172.30	J	45	S,R	DS	PO	SD	
710	3.00									173.70	J	30	P,R	FR	T		Mica infilling
	2.00	175.0								174.50	J	45	S,R	FR	T	N	
175	2.00	175.0							CONGLOMERATE, Light gray, coarse grained, fresh, extremely strong, wide spaced discontinuities Clasts of angular Quartz encountered								
	2.00																
	2.00		R-32	60 100%	60 100%	R6	FR			177.80	J	50	P,Sm	FR	T		Mica infilling
	2.00																
	2.00	180.0								179.00	J	40	U,R	DS	PO	Fe	
180	1.50	180.0							CONGLOMERATE, Light gray, coarse grained, fresh, extremely strong, wide to close spaced discontinuities								
	1.50																
	1.50		R-33	60 100%	55 92%	R6	FR										
700	1.50																
	1.50	185.0								184.30	B	40	P,R	FR	VT	Sh	
185	1.50	185.0							0.08-inch thick layer of Graphite at 184.8' CONGLOMERATE, Light gray, coarse grained, fresh, extremely strong, wide to close spaced discontinuities	184.80	B	40	S,R	FR	VT	N	
									186.0								
	1.50								QUARTZITE, Dark gray, fine to medium grained, fresh, very strong, very close to close spaced discontinuities	186.10	B	30	U,R	FR	T	N	
	1.50									186.40	B	15	U,R	FR	T	N	
	1.50		R-34	60 100%	45 75%	R5	FR		187.5 187.1' - 187.6' Highly Fractured zone								
	1.50								SHALE, Black, fine grained, fresh, very strong, moderately spaced discontinuities Occassional Iron staining Occassional 0.12-inch thick Coal layer								
	1.50									188.90	B	20	P,R	DS	PO	Fe	
	1.50	190.0							190.0								

NOTES: Coal seam encountered

PROJECT NO.: **353754**

Boring No.: **B-8**

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	1.50	190.0							QUARTZITE, Dark gray, fine to medium grained, fresh, very strong, wide spaced discontinuities Fine Sandstone encountered	190.40	J	0	S,R	FR	T	N	
										190.70	J	20	S,R	FR	T	N	
	1.50																
	1.00		R-35	60 100%	56 93%	R5	FR										
690	1.00																
	1.00	195.0															
195		195.0							QUARTZITE, Dark gray, fine to medium grained, fresh, very strong, wide spaced discontinuities Fine Sandstone encountered								
	1.50																
	1.50																
	1.50		R-36	60 100%	60 100%	R5	FR										
	1.50																
	1.50									198.70	J	5	U,R	FR	T	N	
		200.0							200.0								
200									End of Boring at 200 feet BGS. Borehole grouted with cement and bentonite hole plug.								
680																	
205																	
210																	
670																	

NOTES: Coal seam encountered

PROJECT NO.: **353754**

Boring No.: **B-8**

Figure B-8.1
B-8 Box 1 Runs 1-4 Dry

Figure B-8.2
B-8 Box 1 Runs 1-4 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-8

Figure B-8.3
B-8 Box 2 Runs 5-8 Dry

Figure B-8.4
B-8 Box 2 Runs 5-8 Wet

MOTT MACDONALD	PennEast Pipeline Project Rock Core Photographs	BORING NO.: B-8

Figure B-8.5
B-8 Box 3 Runs 9-12 Dry

Figure B-8.6
B-8 Box 3 Runs 9-12 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-8

Figure B-8.7
B-8 Box 4 Runs 13-16 Dry

Figure B-8.8
B-8 Box 4 Runs 13-16 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-8

Figure B-8.9
B-8 Box 5 Runs 17-20 Dry

Figure B-8.10
B-8 Box 5 Runs 17-20 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-8

Figure B-8.11
B-8 Box 6 Runs 21-24 Dry

Figure B-8.12
B-8 Box 6 Runs 21-24 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-8

Figure B-8.13
B-8 Box 7 Runs 25-28 Dry

Figure B-8.14
B-8 Box 7 Runs 25-28 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-8

Figure B-8.15
B-8 Box 8 Runs 29-32 Dry

Figure B-8.16
B-8 Box 8 Runs 29-32 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-8

Figure B-8.17
B-8 Box 9 Runs 33-36 Dry

Figure B-8.18
B-8 Box 9 Runs 33-36 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-8

MOTT MACDONALD M M

SOIL BORING LOG

BORING NO.: **B-9**

Project:	PennEast Pipeline Project	**Project No.:**	353754
Location:	Interstate - 81 Crossing, Wilkes - Barre, PA	**Project Mgr:**	Vatsal Shah
Client:	PennEast Pipeline	**Field Eng. Staff:**	Dafydd Chandler
Drilling Co.:	Craig Test Boring Co., Inc.	**Date/Time Started:**	August 9, 2016 at 11:48 am
Driller/Helper:	Paul Mullins /Nick Beehler	**Date/Time Finished:**	August 12, 2016 at 9:00 am

Elevation: 900 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** Off PP&L ROW **Coord.:** **N:** 14990338.7 **E:** 1419918.221 **Horizontal Datum:** UTM Zone 18 T

Item	Casing	Sampler	Core Barrel
Type	HW	SS	NQ2
Length (ft)	17	2	5
Inside Dia. (in.)	4	1.375	2.0
Hammer Wt. (lb.)	140	140	-
Hammer Fall (in.)	30	30	-

Rig Make & Model: CME-750X

☐ Truck ☐ Tripod ☐ Cat-Head
☑ ATV ☐ Geoprobe ☑ Winch
☐ Track ☐ Air Track ☑ Roller Bit
☐ Skid ☐ _____ ☐ Cutting Head

Hammer Type: ☐ Safety ☐ Doughnut ☑ Automatic ☐ _____

Drilling Fluid: ☐ Bentonite ☐ Polymer ☑ Water ☐ None

Drill Rod Size:

Casing Advance: Mud Rotary

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Group Symbol	Visual - Manual Identification & Description (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Field Tests: Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
900	S-1 0.0'- 2.0'	13	3 4 10 11		ML	Stiff, Brownish yellow SILT with Gravel, dry (ML)	-	M	L	M	Installed 4-inch casing to 10 feet BGS.
						3.5					
5	S-2 5.0'- 7.0'	11	9 10 17 15		CL	Very stiff, Gray Gravelly Lean CLAY, moist (CL)	-	M	L	M	Gravel is Coal and Sandstone.
10 890	S-3 10.0'- 12.0'	18	9 9 13 11		CL	Very stiff, Dark gray Gravelly Lean CLAY, moist (CL)	-	M	L	M	Gravel is Coal and Sandstone.
15	S-4 15.0'- 17.0'	16	14 14 8 27		CL	Very stiff, Dark gray Gravelly Lean CLAY, moist (CL)	-	M	L	M	Gravel is Coal and Sandstone. Installed 4-inch casing to 17 feet BGS. Hit casing refusal at 17 feet BGS.
						17.0					
						DECOMPOSED ROCK FRAGMENTS. Sandstone					
						20.0					

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet to: Bot. of Casing	Bottom of Hole	Water
8/11/16	6:20	-		125.0	84

Sample Type

O Open End Rod
T Thin-Wall Tube
U Undisturbed Sample
S Split Spoon Sample
G Grab Sample

Notes:

PP = Pocket Penetrometer
TV = Torvane

Boring No.: **B-9**

Field Test Legend: Dilatancy: N - None S - Slow R - Rapid; Toughness: L - Low M - Medium H - High; Plasticity: NP - Non-Plastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High VH - Very High

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

MOTT MACDONALD M M

SOIL BORING LOG
(continued)

BORING NO.: **B-9**
Page **2** of **2**

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	**Visual - Manual Identification & Description** (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Field Tests: Dilatancy	Field Tests: Toughness	Field Tests: Plasticity	Field Tests: Dry Strength	Remarks
880						Top of Rock at 20 feet BGS. See Rock Coring Log.					
25											
30 870											
35											
40 860											
45											

NOTES: PP = Pocket Penetrometer
TV = Torvane

PROJECT NO.: **353754**

BORING NO.: **B-9**

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

MOTT MACDONALD M M

CORE BORING LOG

BORING NO.: **B-9**

Project:	PennEast Pipeline Project	**Project No.:**	353754
Location:	Interstate - 81 Crossing, Wilkes - Barre, PA	**Project Mgr:**	Vatsal Shah
Client:	PennEast Pipeline	**Field Eng. Staff:**	Dafydd Chandler
Drilling Co.:	Craig Test Boring Co., Inc.	**Date/Time Started:**	August 9, 2016 at 11:48 am
Driller/Helper:	Paul Mullins /Nick Beehler	**Date/Time Finished:**	August 12, 2016 at 9:00 am

Elevation: 900 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** Off PP&L ROW **Coord.: N:** 14990338.7 **E:** 1419918.221

Item	Casing	Core Barrel	Core Bit
Type	HW	NQ2	Imp. Diamond
Length (ft)	17	5	3.25
Inside Dia. (in.)	4	2.0	2.0

Horizontal Datum: UTM Zone 18 T
Rig Make & Model: CME-750X
Drilling Method: Wireline

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec (in. / %)	RQD (in / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
									SEE TEST BORING LOG FOR OVERBURDEN DETAILS		(See Legend for Rock Description System)						
880	1.00	20.0							QUARTZITE, Light gray, medium grained, slightly weathered, strong, close spaced discontinuities. (Quartzite is MetaSandstone)	20.30	J	30	U,R	DG	PO	CL	
	1.50									21.10	J	0	P,R	DS	PO	N	
	1.50		R-1	60 100%	55 92%	R4	FR			22.70	J	10	U,R	DS	T	N	
	1.50									22.90	J	10	U,R	DS	PO	CL	
	1.50									23.70	J	5	U,R	FR	T	N	
	1.50	25.0								24.60	J	10	S,R	DS	PO	N	
25	1.50	25.0							QUARTZITE, Light gray, medium grained, fresh, strong, close to moderately spaced discontinuities 25' - 26.5' Highly Fractured zone								
	1.50																No water return from 26 feet to base of hole.
	1.50		R-2	59 98%	43 72%	R5	FR			27.50	J	15	U,R	FR	PO	N	
	1.50									28.40	J	20	U,R	FR	PO	N	
	1.50	30.0								28.90	J	5	U,R	FR	T	N	
30 870	2.00	30.0							QUARTZITE, Light gray, medium grained, fresh, strong, close to moderately spaced discontinuities								
	2.00									31.00	J	30	P,R	DG	O	N	
	2.00		R-3	60 100%	54 90%	R5	FR			32.70	J	30	U,R	DS	PO	N	
	1.50																
	1.50	35.0															
35	1.50	35.0							QUARTZITE, Light gray, medium grained, fresh, strong, close to moderately spaced discontinuities 35' - 36.5' Highly Fractured zone								
	1.50																
	1.50		R-4	60 100%	41 68%	R4	FR			37.50	J	60	P,R	FR	PO	N	
	1.50																
	1.50	40.0															

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet to: Bot. of Casing	Bottom of Hole	Water
8/11/16	6:20	-		125.0	84.0

Notes:

Coal seam encountered

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities (See Legend for Rock Description System) Type	Dip	Rgh	Wea	Aper	Infill	Remarks
860	1.50	40.0							QUARTZITE, Gray, fine to coarse grained, fresh, strong, moderate to wide spaced discontinuities 43.2' - 44' Highly fractured zone	40.70	J	10	U,R	FR	T	N	
	2.00									41.70	J	25	P,R	FR	T	N	
	2.00		R-5	60 100%	36 60%	R4	FR			42.50	J	30	U,R	FR	T	N	
	2.00																
	2.00	45.0															
45	1.50	45.0							QUARTZITE, Gray, medium grained, fresh, very strong, wide spaced discontinuities								
	1.50									46.70	J	15	S,R	FR	T	N	
	2.00		R-6	60 100%	60 100%	R5	FR										
	2.00									48.20	J	15	U,R	FR	VT	N	
	3.00	50.0															
50 850	2.50	50.0							QUARTZITE, Gray, medium to coarse grained, fresh, very strong, extremely close to wide spaced discontinuities 51' - 52' Highly Fractured zone 53.9' - 55' Highly Fractured zone								
	2.50																
	2.50		R-7	57 95%	34 57%	R5	FR										
	2.50																
	2.50	55.0															
55	2.50	55.0							QUARTZITE, Gray, coarse grained, fresh, very strong, extremely close to wide spaced discontinuities 55' - 55.4' Highly Fractured zone								
	2.50																
	2.50		R-8	60 100%	48 80%	R5	FR			57.30	J	40	U,R	FR	T	N	
	2.50									58.30	J	0	P,R	DG	VT	N	
	2.50	60.0															
60 840	2.00	60.0							60.3 SHALE, Black, fine grained, fresh, moderately strong, very close discontinuities. 60.9 Highly Fractured zone 60.9' - 68.5' Video confirmed VOID [V-10] - (field logged as 62' - 69' VOID)								
	2.00																
	0.00		R-9	16 27%	0 0%												
	0.00																
	0.00	65.0															

NOTES: Coal seam encountered

PROJECT NO.: **353754**

Boring No.: **B-9**

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities (See Legend for Rock Description System) Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	0.00	65.0							VOID								
	0.00																
	0.00		R-10	7 12%	0 0%												
	0.00								68.5								
	1.00	70.0							CLAY								No clay recovery but drilling indicated soft base.
70 830		70.0							69.5 SHALE, Black, fine grained 70.0								
	2.00								QUARTZITE, Dark gray, fine grained, slightly weathered, strong Iron stains on fractures Highly Fractured zone								Used 4200 gallons of water from 45 to 85 feet BGS.
	2.00																
	2.00		R-11	50 83%	24 40%	R3	SL										
	2.00								73.0 Anthracite COAL. Brittle.								
	1.00	75.0							75.0								
75		75.0							SLATE, Dark gray, very fine grained, fresh, strong, close spaced discontinuities Some Iron stains on fractures 79' - 80' Highly Fractured zone	75.70	J	35	P,R	FR	T	N	
	1.50									76.40	J	0	P,R	FR	PO	N	
	1.50									76.70	J	0	P,Sm	FR	PO	N	
	1.50		R-12	60 100%	35 58%	R4	FR			77.30	J	0	U,R	DS	W	Fe	
	1.50									77.70	J	0	P,R	DS	T	N	
	1.50									78.50	J	10	S,R	DS	PO	N	
	1.50	80.0															
80 820	1.50	80.0							SLATE, Black, very fine grained, slightly weathered, medium strong, extremely close to moderately spaced discontinuities 80' - 82' Occasional thin COAL bed 80' - 82' Highly Fractured zone								
	1.50																
	1.50		R-13	60 100%	36 60%	R3	SL			82.30	J	0	S,R	FR	VT	N	
	1.50																
▽	1.50	85.0															
85		85.0							SLATE, Black, very fine grained, fresh, strong, moderately spaced discontinuities								
	1.50									85.90	J	25	P,Sm	FR	VT	N	
	1.50									86.50	J	5	P,Sm	FR	VT	N	
	1.50		R-14	51 85%	44 73%	R4	FR										
	0.50																
	1.50	90.0							89' - 89.7' CLAY Soft. (R1)								

NOTES: Coal seam encountered

PROJECT NO.: **353754**

Boring No.: **B-9**

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities (See Legend for Rock Description System) Type	Dip	Rgh	Wea	Aper	Infill	Remarks
810	1.50	90.0							SLATE, Black, very fine grained, fresh, strong, moderately spaced discontinuities								
									91.0								
	1.50								QUARTZITE, Dark gray, fine grained, fresh, strong, extremely close to wide spaced discontinuities 92.7' - 93.6' Highly Fractured zone with vertical joints	91.70	J	0	P,R	FR	VT	N	
										92.00	J	0	P,R	FR	VT	N	
	1.50		R-15	56 93%	33 55%	R4	FR			92.30	J	15	P,R	FR	PO	N	
	1.50																
	1.50	95.0															
95	2.00	95.0							QUARTZITE, Gray, fine to coarse grained, fresh, very strong, wide spaced discontinuities								
	2.00																
	2.00		R-16	60 100%	60 100%	R5	FR			97.10	J	0	P,R	DS	VT	N	
	2.00																
	2.00	100.0															
100 800	3.00	100.0							QUARTZITE, Gray, fine to coarse grained, fresh, extremely strong, wide spaced discontinuities								
	3.00																
	2.00		R-17	60 100%	60 100%	R6	FR										
	2.00									103.50	J	10	U,R	FR	VT	N	
	2.00	105.0															
105	2.50	105.0							QUARTZITE, Gray, fine to coarse grained, fresh, extremely strong, wide spaced discontinuities								
	2.50																
	2.50		R-18	60 100%	60 100%	R6	FR										
	2.50																
	2.50	110.0															
110 790	3.00	110.0							QUARTZITE, Gray, fine to coarse grained, fresh, extremely strong, wide spaced discontinuities Graphite on some broken surfaces								
	3.00									111.80	J	0	S,R	FR	T	N	
	3.00		R-19	60 100%	60 100%	R6	FR			112.50	J	5	S,R	DG	PO	N	
	4.00																
	5.00	115.0								114.60	J	10	U,R	FR	VT		Graphite Infilling

NOTES: Coal seam encountered

PROJECT NO.: **353754**

Boring No.: **B-9**

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	4.00	115.0							QUARTZITE, Gray, fine to coarse grained, fresh, extremely strong, wide spaced discontinuities Laminated by grain size	115.60	J	0	S,R	FR	W	N	
	4.00									116.20	J	10	U,R	FR	T	N	
	4.00		R-20	60 100%	58 97%	R6	FR										
	4.00									118.60	J	10	U,R	FR	PO	N	
	4.00	120.0															
120 780	4.00	120.0							QUARTZITE, Dark gray, fine to medium grained, fresh, extremely strong, wide spaced discontinuities								
	4.00									121.50	J	15	P,R	FR	T	N	
	4.00		R-21	60 100%	60 100%	R6	FR										
	4.00									123.20	J	20	P,R	FR	VT	Coal	
	4.00	125.0															
125	3.00	125.0							QUARTZITE, Dark gray, fine to medium grained, fresh, extremely strong, wide spaced discontinuities Occasional fine Shale interbedding								
	3.00																
	3.00		R-22	60 100%	60 100%	R6	FR										
	3.00																
	3.00	130.0															
130 770	2.50	130.0							QUARTZITE, Dark gray, fine to medium grained, fresh, extremely strong, wide spaced discontinuities Occasional fine Shale interbedding								
	2.50																
	2.50		R-23	60 100%	47 78%	R6	FR										
	3.00								133.7								
	3.00	135.0							SHALE, Black, very fine to fine grained, fresh, medium strong, extremely close spaced discontinuities 133.9' - 135' Highly Fractured zone								
135	3.00	135.0							135.4 QUARTZITE, Dark gray, fine grained, fresh, very strong, wide spaced discontinuities	135.20	J	5	P,R	DS	PO	N	
	3.00																
	3.00		R-24	60 100%	52 87%	R5	FR			137.40	J	70	U,R	DG	O	N	
	3.00									138.00	J	10	P,R	FR	T	N	
	3.00	140.0															

NOTES: Coal seam encountered

PROJECT NO.: **353754**

Boring No.: **B-9**

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities (See Legend for Rock Description System) Type	Dip	Rgh	Wea	Aper	Infill	Remarks
760	1.50	140.0							QUARTZITE, Dark gray, fine to coarse grained, fresh, extremely strong, moderate spaced discontinuities Occasional Shale interbedding								
	1.50									141.50	B	15	P,Sm	FR	VT	N	
	1.50		R-25	60 100%	60 100%	R6	FR			142.40	J	30	P,R	FR	T	N	
	1.50									143.10	J	10	U,R	FR	VT	N	
	1.50	145.0															
145	1.50	145.0							QUARTZITE, Dark gray, fine to coarse grained, fresh, extremely strong, moderate to wide spaced discontinuities Occasional Shale interbedding	145.60	J	5	P,R	FR	T	N	
	1.50									145.90	J	5	P,R	FR	T	N	
	1.50		R-26	60 100%	60 100%	R6	FR			147.10	J	5	P,R	FR	T	N	
	2.00																
750	2.00	150.0							QUARTZITE, Dark gray, medium grained, fresh, extremely strong, wide spaced discontinuities								
	2.00																
	2.00		R-27	60 100%	60 100%	R6	FR										
	2.00																
	2.00	155.0															
155	3.00	155.0							QUARTZITE, Dark gray, medium grained, fresh, extremely strong, moderate to wide spaced discontinuities								
	3.50									156.50	J	10	P,R	FR	T	N	
	3.50		R-28	60 100%	56 93%	R5	FR			157.30	J	50	U,R	FR	VT	N	
										157.50	J	0	P,R	FR	T	N	
	3.50								2" thick Shale bed with very rich in Pyrite at 158'	158.00	J	0	P,R	FR	T	Py	
										159.00	J	30	U,R	FR	T	N	
	4.00	160.0							159.6	159.40	J	5	U,R	FR	T	N	
740	3.00	160.0							SHALE, Black, very fine to fine grained, fresh, medium strong 162.6' - 165' Highly Fractured zone	160.70	J	10	S,R	FR	VT	N	
	3.00									161.50	J	15	S,R	FR	VT	N	
	3.00		R-29	56 93%	33 55%	R3	FR			162.00	J	0	P,R	FR	VT	N	
	3.00								163.5								
	2.00	165.0							Anthracite COAL, Black, very fine grained, medium strong, brittle								

NOTES: Coal seam encountered

PROJECT NO.: **353754**

Boring No.: **B-9**

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	2.50	165.0							SHALE, Dark gray, very fine grained, fresh, strong, close to wide spaced discontinuities								
	2.50									166.40	J	40	S,R	FR	VT	N	
	2.50		R-30	58 97%	54 90%	R4	FR			167.10	J	10	S,R	FR	PO	N	
	2.50																
	3.00	170.0															
170 730	2.50	170.0							SHALE, Dark gray, very fine grained, fresh, strong, wide spaced discontinuities								
	2.50																
	2.50		R-31	60 100%	60 100%	R4	FR			171.90	J	40	U,R	DS	O	N	
	2.50																
	2.50	175.0															
175	3.00	175.0							SHALE, Dark gray, very fine grained, fresh, strong, wide spaced discontinuities	174.80	J	0	S,R	DS	T	N	
	3.00																
	3.00		R-32	60 100%	25 42%	R4	FR		177.0 Anthracite COAL								
	3.00								178.8								
	3.00	180.0							SHALE, Dark gray, fine grained, fresh, strong 180.0								
180 720	2.50	180.0							QUARTZITE, Dark gray, fine to medium grained, fresh, extremely strong, wide to very wide spaced discontinuities								
	2.50																
	2.50		R-33	60 100%	60 100%	R6	FR										
	2.50																
	2.50	185.0															
185	3.00	185.0							QUARTZITE, Dark gray, fine to medium grained, fresh, very strong, wide to close spaced discontinuities 187.3' - 188' Highly Fractured zone with subvertical joins and Iron staining								
	3.00									186.60	J	10	S,R	DS	T	Fe	
	3.00		R-34	60 100%	51 85%	R5	FR										
	3.00																
	3.00	190.0															

NOTES: Coal seam encountered

PROJECT NO.: **353754**

Boring No.: **B-9**

CORE BORING LOG
(continued)

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
710	3.00	190.0							QUARTZITE, Gray, medium grained, fresh, extremely strong, wide spaced discontinuities								
	3.00																
	3.00		R-35	60 100%	60 100%	R6	FR										
	3.00																
	3.00	195.0															
195	3.00	195.0							QUARTZITE, Gray, medium to fine grained, fresh, extremely strong, wide to close spaced discontinuities								
	3.00																
	3.00		R-36	60 100%	47 78%	R6	FR			197.70	J	0	U,R	FR	T	N	
	3.00									198.40	B	5	U,R	FR	PO	N	
	3.00	200.0								199.10	J	80	U,R	FR	VT	N	
200 700									200.0 End of Boring at 200 feet BGS. Borehole grouted with cement and bentonite hole plug.								
205																	
210 690																	

NOTES: Coal seam encountered

PROJECT NO.: **353754**

Boring No.: **B-9**

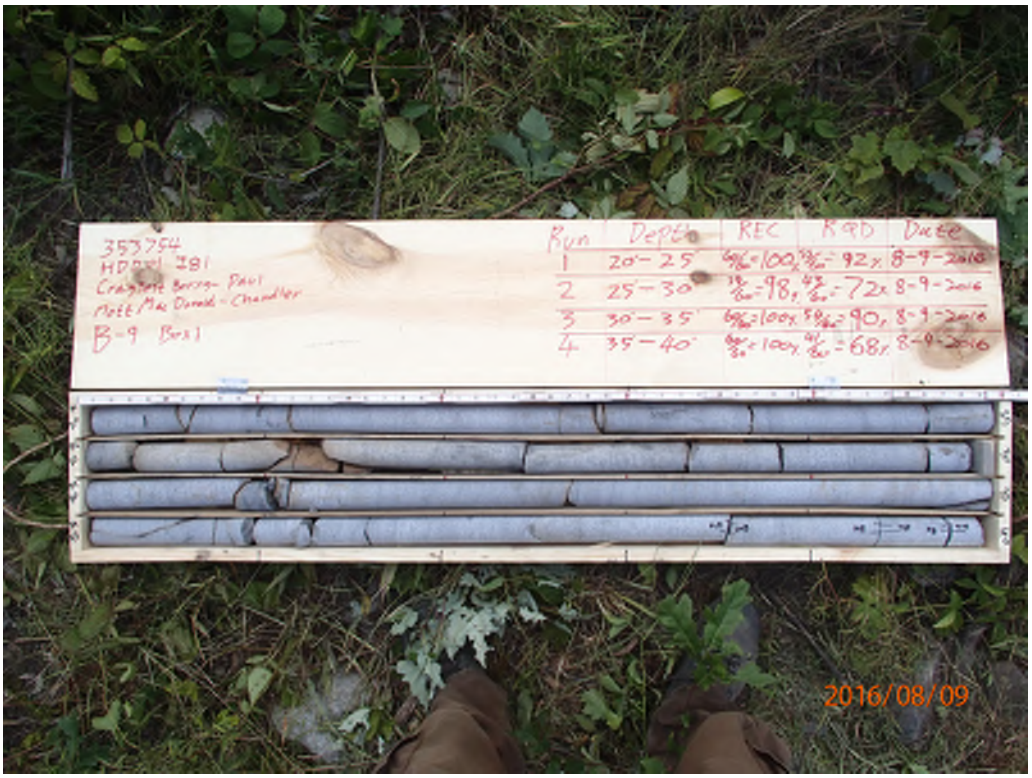


Figure B-9.1
B-9 Box 1 Runs 1-4 Dry

Figure B-9.2
B-9 Box 1 Runs 1-4 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-9

Figure B-9.3
B-9 Box 2 Runs 5-8 Dry

Figure B-9.4
B-9 Box 2 Runs 5-8 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-9

Figure B-9.5
B-9 Box 3 Runs 9-12 Dry

Figure B-9.6
B-9 Box 3 Runs 9-12 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-9

Figure B-9.7
B-9 Box 4 Runs 13-16 Dry

Figure B-9.8
B-9 Box 4 Runs 13-16 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-9

Figure B-9.9
B-9 Box 5 Runs 17-20 Dry

Figure B-9.10
B-9 Box 5 Runs 17-20 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-9

Figure B-9.11
B-9 Box 6 Runs 21-24 Dry

Figure B-9.12
B-9 Box 6 Runs 21-24 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-9

Figure B-9.13
B-9 Box 7 Runs 25-28 Dry

Figure B-9.14
B-9 Box 7 Runs 25-28 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-9

Figure B-9.15
B-9 Box 8 Runs 29-32 Dry

Figure B-9.16
B-9 Box 8 Runs 29-32 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-9

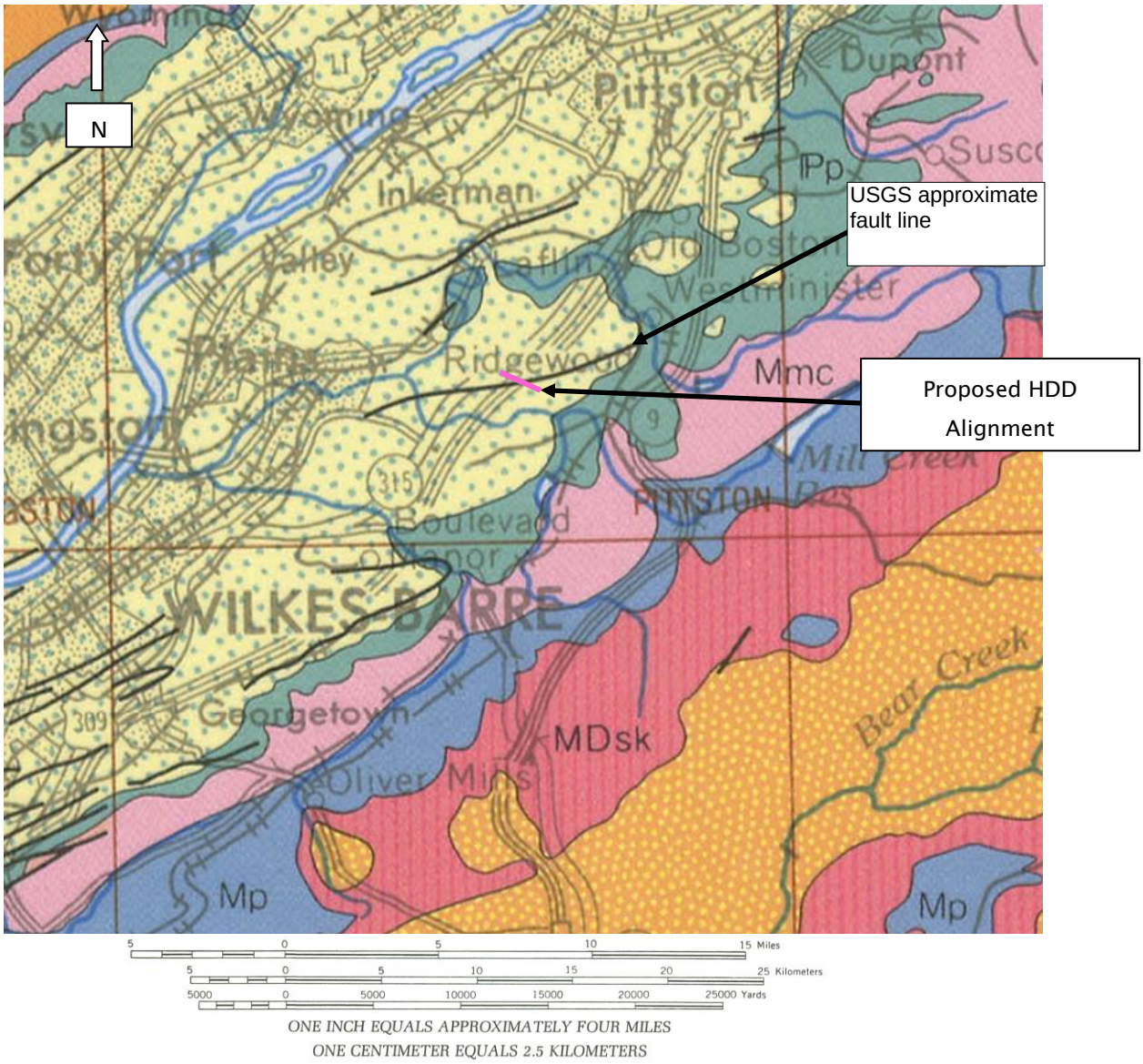
Figure B-9.17
B-9 Box 9 Runs 33-36 Dry

Figure B-9.18
B-9 Box 9 Runs 33-36 Wet

MOTT MACDONALD M M	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** B-9

D. Geologic Background References

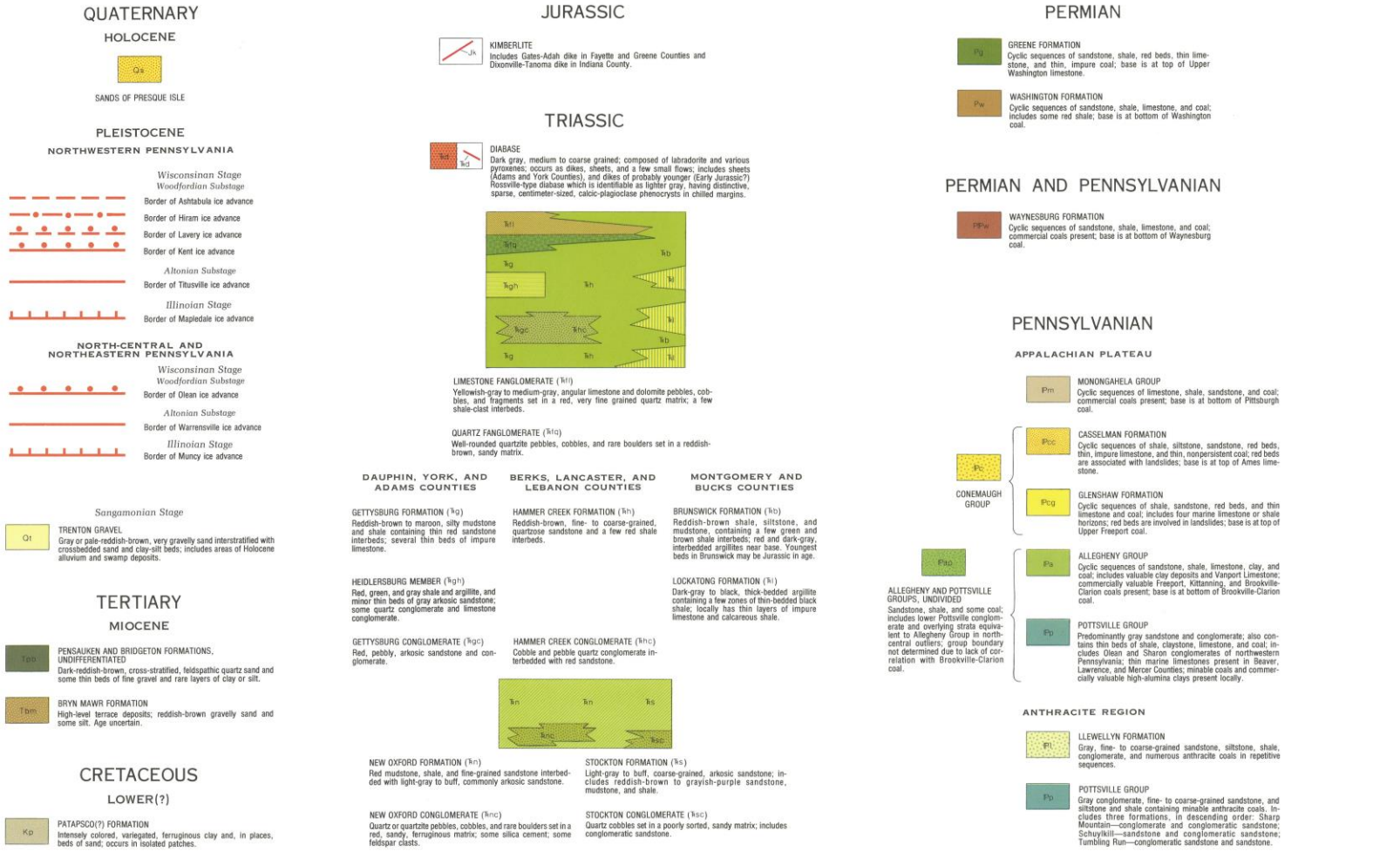
Figure 1: Bedrock Geology



Notes:

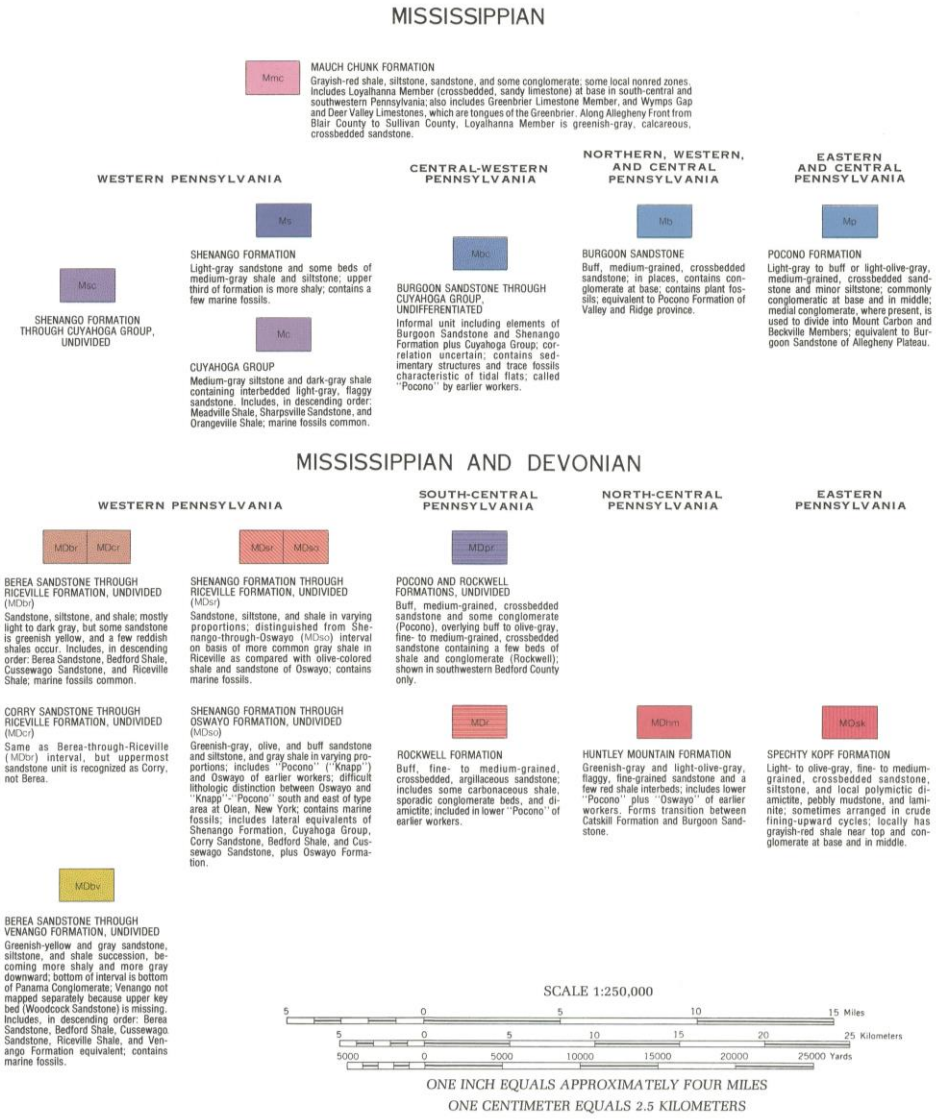
1. The proposed HDD alignment falls within the Llewellyn Formation (IPl).
2. Geologic Imaging taken from:
    a. Berg, T.M., Edmunds, W.E., Geyer, A.R., and others, compilers, 1980, Geologic map of Pennsylvania (2nd ed.): Pennsylvania Geological Survey, 4th ser., Map 1, 3 sheets, scale 1:250,000.

Geological Map of Pennsylvania: Bedrock Formation Legend



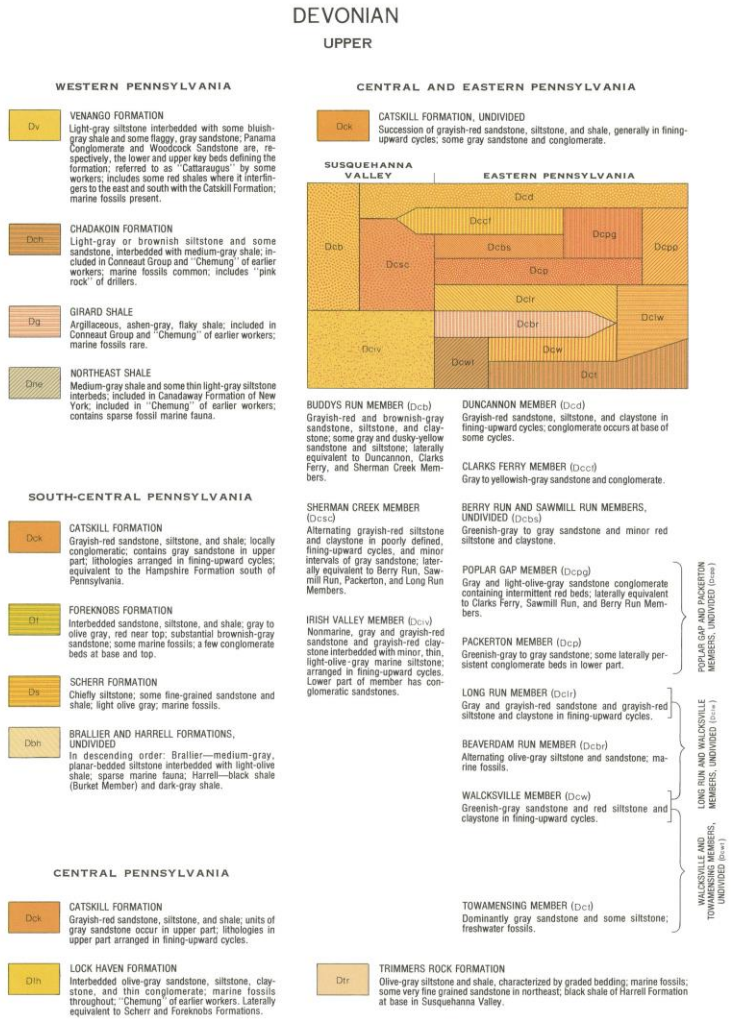
1. Note: Geologic Legend taken from:
   a. Berg, T.M., Edmunds, W.E., Geyer, A.R., and others, compilers, 1980, Geologic map of Pennsylvania (2nd ed.): Pennsylvania Geological Survey, 4th ser., Map 1, 3 sheets, scale 1:250,000.

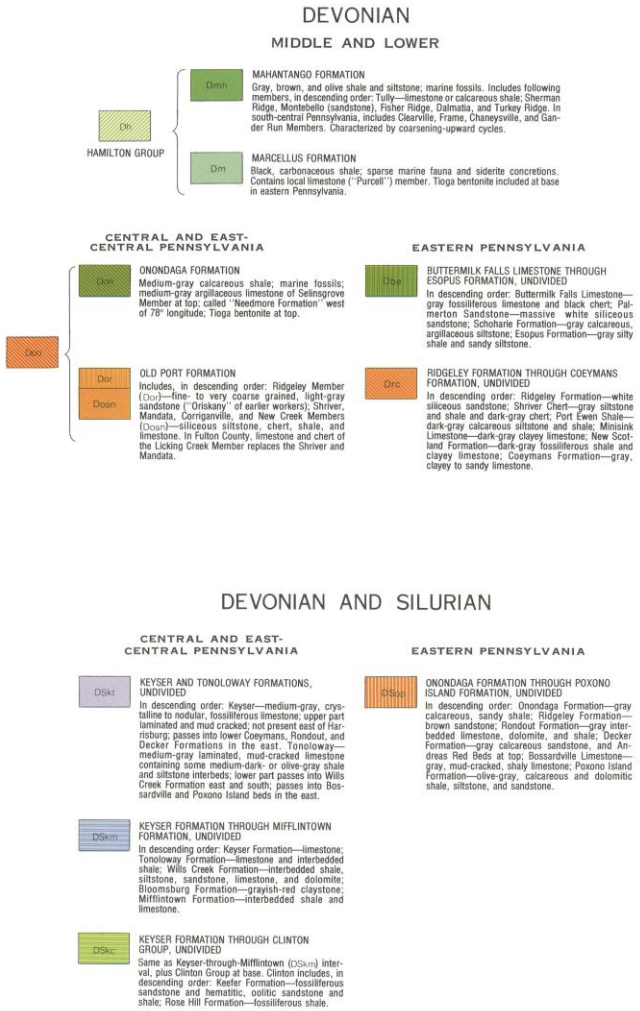
Geological Map of Pennsylvania: Bedrock Formation Legend



1. Note: Geologic Legend taken from:
   a. Berg, T.M., Edmunds, W.E., Geyer, A.R., and others, compilers, 1980, Geologic map of Pennsylvania (2nd ed.): Pennsylvania Geological Survey, 4th ser., Map 1, 3 sheets, scale 1:250,000.

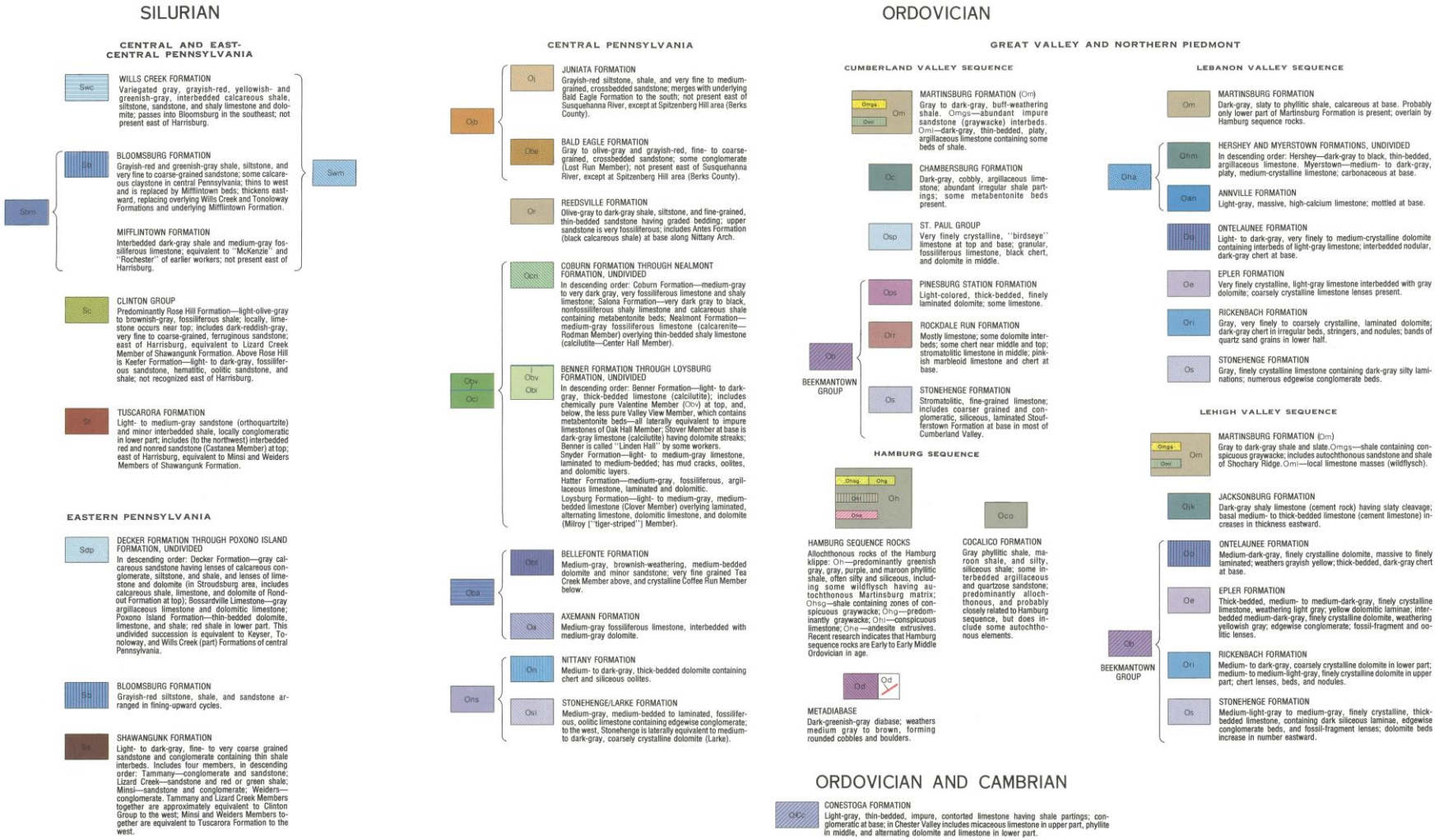
Geological Map of Pennsylvania: Bedrock Formation Legend





1. Note: Geologic Legend taken from:
   a. Berg, T.M., Edmunds, W.E., Geyer, A.R., and others, compilers, 1980, Geologic map of Pennsylvania (2nd ed.): Pennsylvania Geological Survey, 4th ser., Map 1, 3 sheets, scale 1:250,000.

Geological Map of Pennsylvania: Bedrock Formation Legend

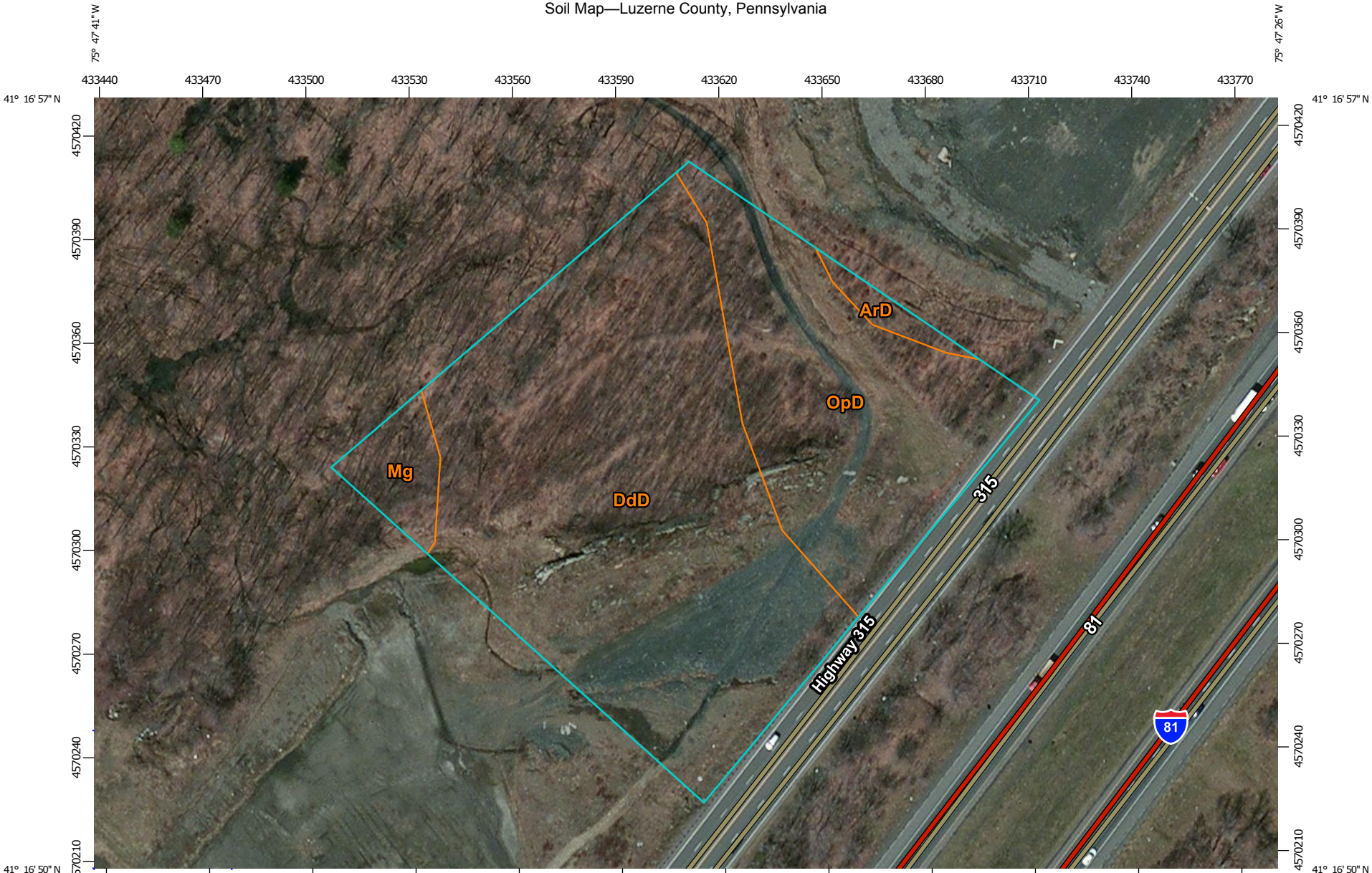


1. Note: Geologic Legend taken from:
   a. Berg, T.M., Edmunds, W.E., Geyer, A.R., and others, compilers, 1980, Geologic map of Pennsylvania (2nd ed.): Pennsylvania Geological Survey, 4th ser., Map 1, 3 sheets, scale 1:250,000.

Geological Map of Pennsylvania: Bedrock Formation Legend

1. Note: Geologic Legend taken from:
    a. Berg, T.M., Edmunds, W.E., Geyer, A.R., and others, compilers, 1980, Geologic map of Pennsylvania (2nd ed.): Pennsylvania Geological Survey, 4th ser., Map 1, 3 sheets, scale 1:250,000.

Soil Map—Luzerne County, Pennsylvania



Map Scale: 1:1,570 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Luzerne County, Pennsylvania
Survey Area Data: Version 6, Sep 19, 2014

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

Date(s) aerial images were photographed: Apr 14, 2011—May 10, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Luzerne County, Pennsylvania (PA079)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
ArD	Arnot-Rock outcrop complex, 8 to 25 percent slopes	0.1	1.6%
DdD	Dekalb extremely stony sandy loam, 8 to 25 percent slopes	3.1	64.4%
Mg	Mine dump	0.2	4.1%
OpD	Oquaga and Lordstown extremely stony silt loams, 8 to 25 percent slopes	1.4	29.9%
Totals for Area of Interest		**4.8**	**100.0%**

Soil Map—Luzerne County, Pennsylvania

Map Scale: 1:4,060 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Luzerne County, Pennsylvania
Survey Area Data: Version 6, Sep 19, 2014

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

Date(s) aerial images were photographed: Apr 14, 2011—May 10, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Luzerne County, Pennsylvania (PA079)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
ArB	Arnot-Rock outcrop complex, 0 to 8 percent slopes	0.6	2.4%
ArD	Arnot-Rock outcrop complex, 8 to 25 percent slopes	1.0	4.0%
CF	Cut and fill land	1.3	5.3%
ChB	Chenango gravelly loam, 3 to 8 percent slopes	1.1	4.7%
ChC	Chenango gravelly loam, 8 to 15 percent slopes	1.4	6.1%
LcB	Lackawanna very stony silt loam, 3 to 8 percent slopes	0.4	1.7%
OpD	Oquaga and Lordstown extremely stony silt loams, 8 to 25 percent slopes	0.8	3.4%
OXF	Oquaga and Lordstown extremely stony silt loams steep	14.3	60.1%
VoB	Volusia channery silt loam, 0 to 8 percent slopes	0.5	2.0%
WrB	Wurtsboro channery loam, 3 to 8 percent slopes	2.5	10.3%
Totals for Area of Interest		**23.9**	**100.0%**

Pennsylvania
Abandoned Mine Land Inventory

N
W E
S

Erie
Warren
McKean
Potter
Tioga
Bradford
Susquehanna
Wayne
Wyoming
Luzerne
Pike
Crawford
Forest
Elk
Cameron
Lycoming
Sullivan
Clinton
Columbia
Montour
Carbon
Monroe
Northampton
Venango
Mercer
Clarion
Jefferson
Clearfield
Centre
Union
Northumberland
Schuylkill
Lehigh
Snyder
Lawrence
Butler
Armstrong
Indiana
Mifflin
Juniata
Dauphin
Lebanon
Berks
Bucks
Montgomery
Perry
Blair
Huntingdon
Cambria
Beaver
Allegheny
Westmoreland
Cumberland
Lancaster
Chester
Philadelphia
Delaware
York
Adams
Franklin
Bedford
Fulton
Washington
Somerset
Fayette
Greene

Map Legend

- Counties
- AML Inventory Site (PA)

AML Features

- Unreclaimed
- Reclaimed

0 10 20 40 60 Miles

Please refer to one of the individual County maps
for the Disrtict Offices contact information

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Map Prepared By: Katelyn I. Smith
Date: 1/09/2014
Data Source: Bureau of Abandoned Mine Reclamation
Projection: North_America_Albers_Equal_Area_Conic

For Information only
Priority 1 (P1): An AML problem concerning the protection of public health, safety, and property from extreme danger of adverse effects of mining practices or adjacent land and water reclamation.
Priority 2 (P2): An AML problem concerning the protection of public health and safety from adverse effects of mining practices or adjacent land and water reclamation.
Priority 3 (P3): An AML problem concerning the restoration of land and water resources and the environment previously degraded by adverse effects of mining practices.

E. Laboratory Data

GEOTECHNICAL LABORATORY TESTING RESULTS

CLIENT: Mott MacDonald
111 Wood Ave South
Iselin, New Jersey 08830-4112

ATTN: Ms. Erica Vigliorolo

PROJECT: Penn East Pipeline
Wilkes-Barre,PA

CTL # 548000AL
CTB # 150167

DATE: August 29, 2016

CHECKED BY: Eduardo M. Freire, P.E.
Geotechnical Laboratory Manager

SAMPLES RECEIVED: August 18, 2016

SAMPLES TESTED: 8/18/16 - 8/26/16

LAB TECHNICIAN(S): J. Veach, J. Landy, A. Midgette

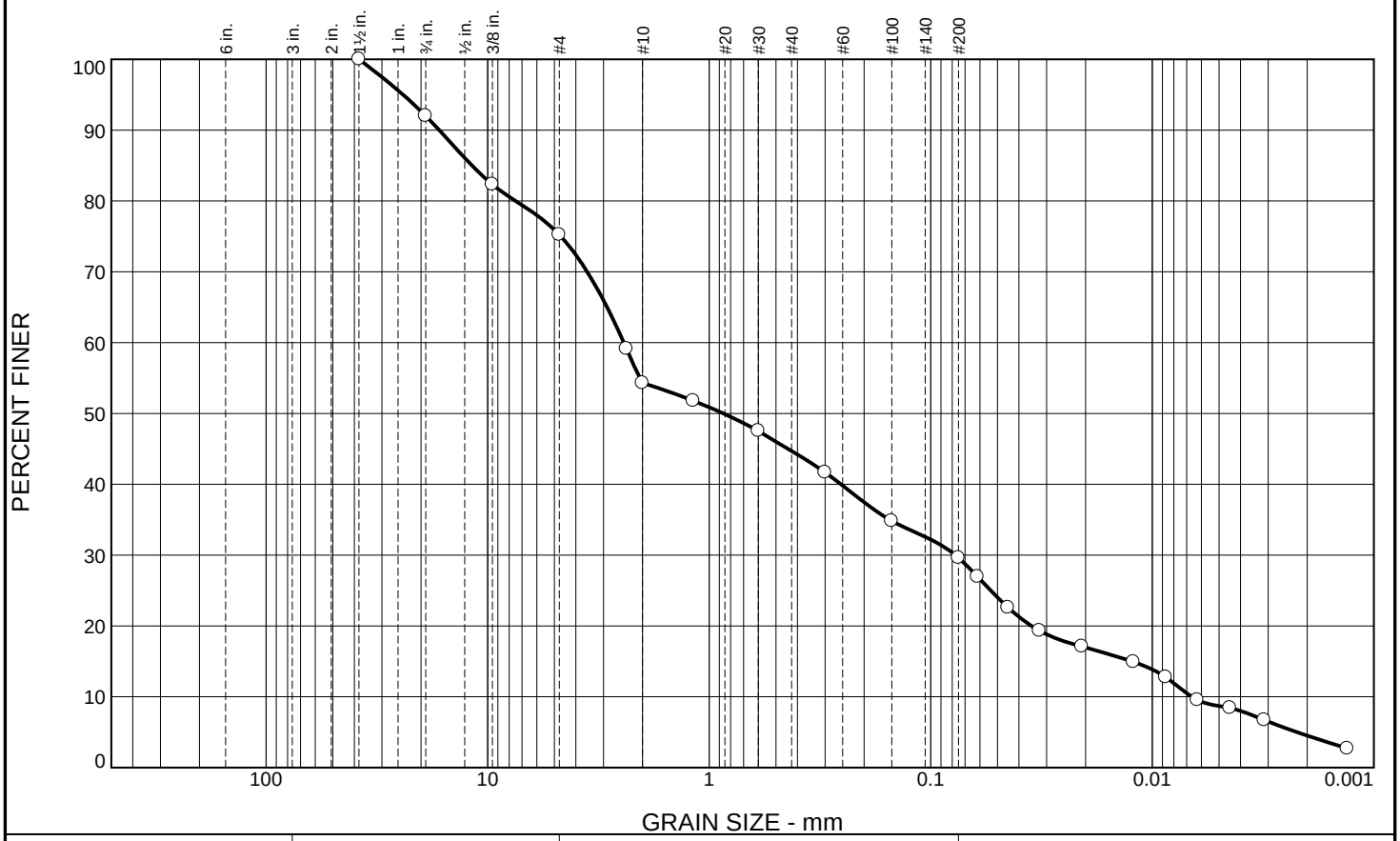
Test Boring No.	Sample No.	Depth (ft)	Water Content (%) (ASTM D2216)	Atterberg Limits (ASTM D4318)			Particle Size Analysis (Sieve Only)* (ASTM D422)	Particle Size Analysis with Hydrometer* (ASTM D422)	Total Unit Weight Determination (pcf)	Sulfate (mg/L) (ASTM D4327)	Chloride (mg/L) (ASTM D4327)	pH of Soil (ASTM G51)	Consolidation* (ASTM D2435)	UU Triaxial* (ASTM D2850)	CU Triaxial (ASTM D4767)	Soil Perm. Class Rating (NJAC 7:9A-6.3)					
				LL	PL	PI										A	B				
B-181-1	S-9	40-42	16.3	25	13	12		Plate 1													
	S-10	45-47	18.0	26	12	14			**												
	S-11	50-52	11.6	25	13	12		Plate 2													
	S-12	55-57	11.7	25	12	13			**												
Billing Total:			**0**	**4**				**2**	**0**												

Comments/Remarks: *See attached Plates

** Sample not Suitable for testing, Samples where disturbed in jar

CRAIG TESTING LABORATORIES, INC.
5439 Harding Highway, PO Box 427 - Mays Landing, NJ 08330
Lab: (609) 625-0386: Fax: (609) 625-9133

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	8.0	16.8	20.9	9.6	15.1	20.9	8.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
.75	92.0		
.375	82.3		
#4	75.2		
#8	59.1		
#10	54.3		
#16	51.8		
#30	47.5		
#50	41.7		
#100	34.8		
#200	29.6		

* (no specification provided)

Material Description

Gray

Atterberg Limits

LL= 25 PL= 13 PI= 12

Coefficients

D_{85}= 11.7667 D_{60}= 2.4278 D_{50}= 0.8631
D_{30}= 0.0774 D_{15}= 0.0124 D_{10}= 0.0066
C_u= 365.83 C_c= 0.37

Classification

USCS= SC

Remarks

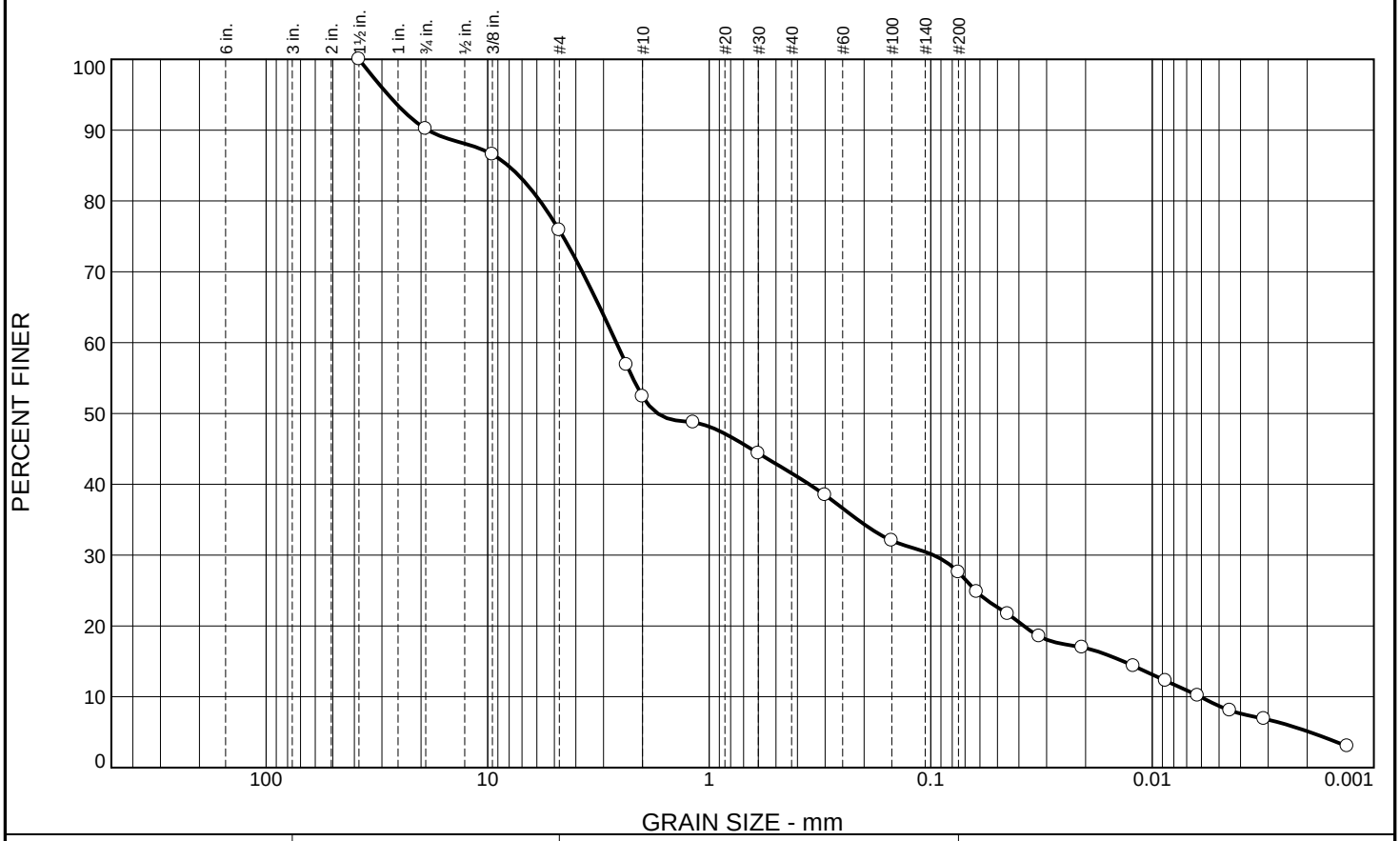
Water Content (WC):16.3%

Source of Sample: B-181-1 **Depth:** 40'-42'
Sample Number: S-9 **Date:** 8/26/16

CRAIG TESTING LABORATORIES, INC.
www.craigtestinglabs.com
Mays Landing, NJ 609-625-1700

Client: Mott MacDonald
Project: Penn East
Wilkes-Barre, PA
Project No: 548000AL **Plate** 1

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.8	14.3	23.5	10.8	14.0	18.9	8.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
.75	90.2		
.375	86.6		
#4	75.9		
#8	56.9		
#10	52.4		
#16	48.7		
#30	44.4		
#50	38.5		
#100	32.0		
#200	27.6		

* (no specification provided)

Material Description

Gray clayey SAND with gravel

Atterberg Limits

LL= 25 PL= 13 PI= 12

Coefficients

D_{85}= 8.0866 D_{60}= 2.6250 D_{50}= 1.7100
D_{30}= 0.0973 D_{15}= 0.0135 D_{10}= 0.0061
C_u= 431.40 C_c= 0.59

Classification

USCS= SC

Remarks

WC: 11.6%

Source of Sample: B-181-1 **Depth:** 50'-52'
Sample Number: S-11 **Date:** 8/26/16

CRAIG TESTING LABORATORIES, INC.
www.craigtestinglabs.com
Mays Landing, NJ 609-625-1700

Client: Mott MacDonald
Project: Penn East
Wilkes-Barre, PA
Project No: 548000AL **Plate** 2

GEOTECHNICAL LABORATORY TESTING RESULTS

CLIENT: Mott MacDonald
111 Wood Ave South
Iselin, NJ 08830-4112

ATTN: Mr. Garrett Keers-Flood

PROJECT: Penn East
Interstate 81 Crossing, Wilkes-Barre, PA

CTL # 548000BI
CTB # 150167

DATE: March 8, 2017

CHECKED BY: Eduardo M. Freire, P.E.
Geotechnical Laboratory Manager

SAMPLES RECEIVED: February 28, 2017

SAMPLES TESTED: 2/28/17 - 3/8/17

LAB TECHNICIAN(S): J. Veach

Test Boring No.	Sample No.	Depth (ft)	Water Content (%) (ASTM D2216)	Atterberg Limits (ASTM D4318)			Rock Unconfined Compression w/ Stress-Strain (ASTM D7012-D)*	Unit Weight of Oven Dried Rock (pcf)	Point Load Strength (ASTMD D5731)	Sulfate (mg/L) (ASTM D4327)	Chloride (mg/L) (ASTM D4327)	pH of Soil (ASTM G51)	Consolidation* (ASTM D2435)	UU Triaxial* (ASTM D2850)	CU Triaxial (ASTM D4767)	Soil Perm. Class Rating (NJAC 7:9A-6.3)					
				LL	PL	PI										A	B				
B-I81-2	R-1	26-26.64					RC-1														
	R-3	36.97-37.56					RC-2														
	R-5	47.1-47.6					**	164.9													
	R-7	56.55-57.34					RC-3														
	R-10	70.95-71.47					RC-4														
	R-12	80.3-80.9					RC-5														
	R-14	92.25-93.03					RC-6														
	R-16	103.27-104.07					RC-7														
	R-18	110.25-111.03					RC-8														
	R-20	123.57-124.38					RC-9														
	R-22	131.67-132.45					RC-10														
Billing Total:							**10**	**1**													

Comments/Remarks: *See attached Plates

** Sample was broken in shipment

CRAIG TESTING LABORATORIES, INC.
5439 Harding Highway, PO Box 427 - Mays Landing, NJ 08330
Lab: (609) 625-0386: Fax: (609) 625-9133

CRAIG TESTING LABORATORIES, INC.
5439 Harding Highway • P.O. Box 427 • Mays Landing, NJ 08330 • P:609.625.1700 • F:609.625.1798

ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

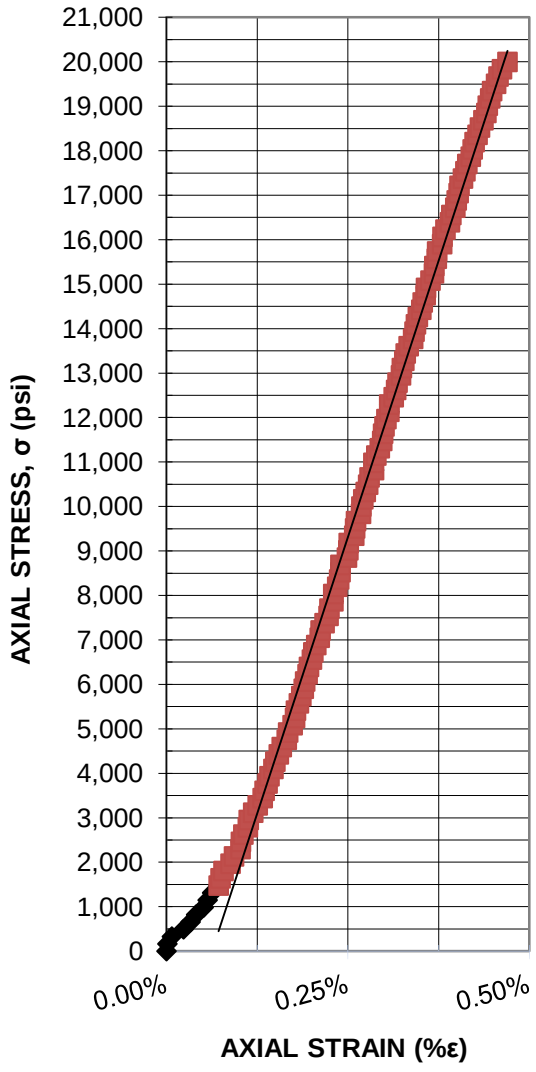
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	March 7, 2017	Plate :	RC-1
Project:	Penneast Pipeline - Interstate 81 Crossing - Wilkes-Barre, PA			CTL #:	548000BI
Boring No.:	B-I81-2	Core Run:	R-1	Depth (ft):	26-26.64
Description:	Light gray QUARTZITE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.711	Avg. Diameter (inch) =	1.971
L/D Ratio (2.0 to 2.5) =	2.39	Area (inch^2) =	3.050
Dry Unit Weight (pcf)	164.9	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 20,116 psi = 20.1 ksi

ESTIMATED YOUNG'S MODULUS, E: 4.65E+06 psi (Avg. Linear Portion of Curve, shown)

CRAIG TESTING LABORATORIES, INC.
5439 Harding Highway • P.O. Box 427 • Mays Landing, NJ 08330 • P:609.625.1700 • F:609.625.1798

ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

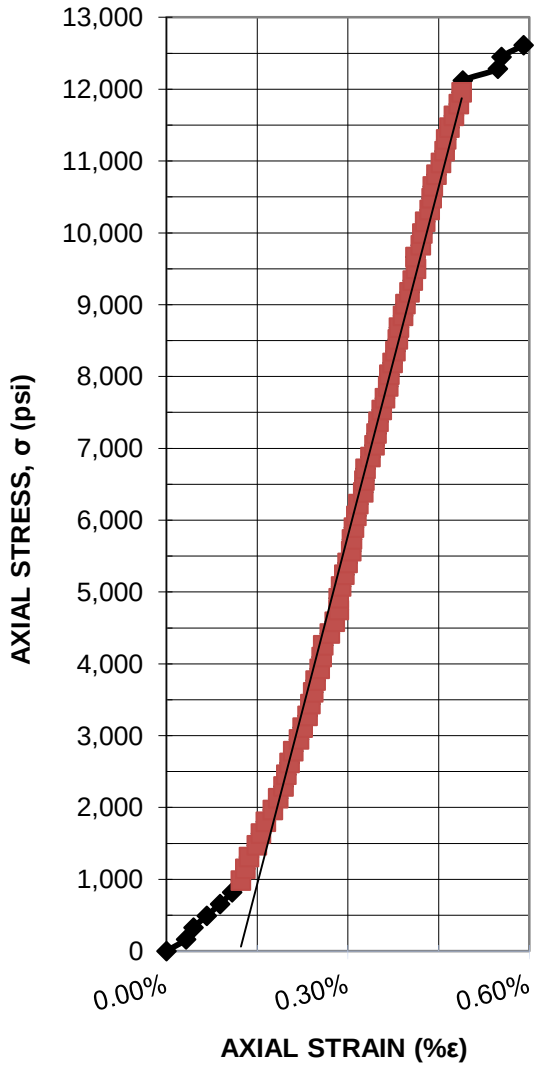
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	March 7, 2017	Plate :	RC-2
Project:	Penneast Pipeline - Interstate 81 Crossing - Wilkes-Barre, PA			CTL #:	548000BI
Boring No.:	B-I81-2	Core Run:	R-3	Depth (ft):	36.97-37.56
				Tested By:	J. Veach
Description:	Light gray QUARTZITE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.811	Avg. Diameter (inch) =	1.972
L/D Ratio (2.0 to 2.5) =	2.44	Area (inch^2) =	3.053
Dry Unit Weight (pcf)	163.7	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u:	**12,726**	**psi**	**=**	**12.7** **ksi**

ESTIMATED YOUNG'S MODULUS, E:	**3.01E+06**	**psi** (Avg. Linear Portion of Curve, shown)

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

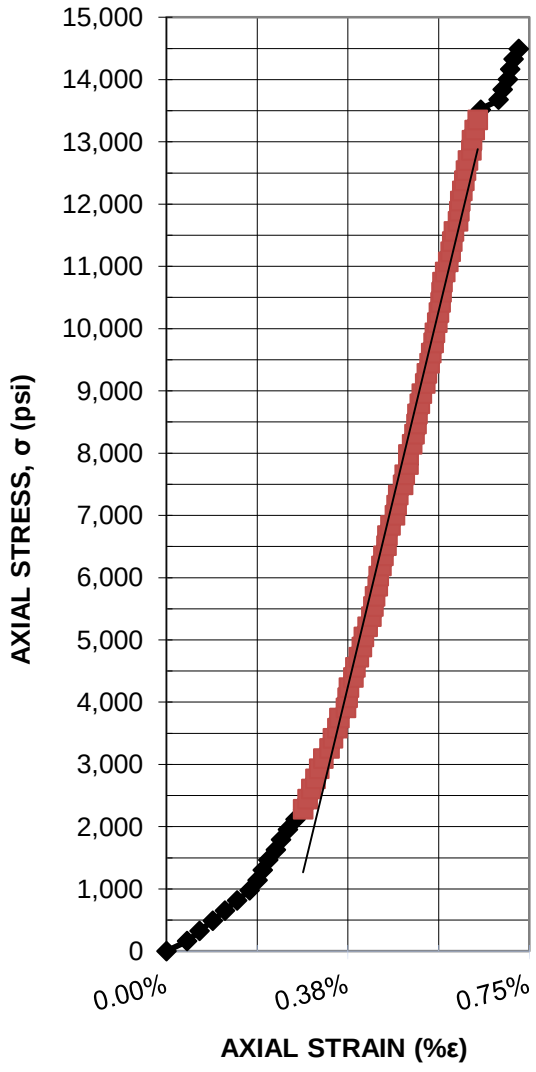
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	March 7, 2017	Plate :	RC-3
Project:	Penneast Pipeline - Interstate 81 Crossing - Wilkes-Barre, PA			CTL #:	548000BI
Boring No.:	B-I81-2	Core Run:	R-7	Depth (ft):	56.55-57.34
Description:	Light gray QUARTZITE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.606	Avg. Diameter (inch) =	1.977
L/D Ratio (2.0 to 2.5) =	2.33	Area (inch^2) =	3.071
Dry Unit Weight (pcf)	165.5	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 14,597 psi = 14.6 ksi

ESTIMATED YOUNG'S MODULUS, E: 3.07E+06 psi (Avg. Linear Portion of Curve, shown)

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

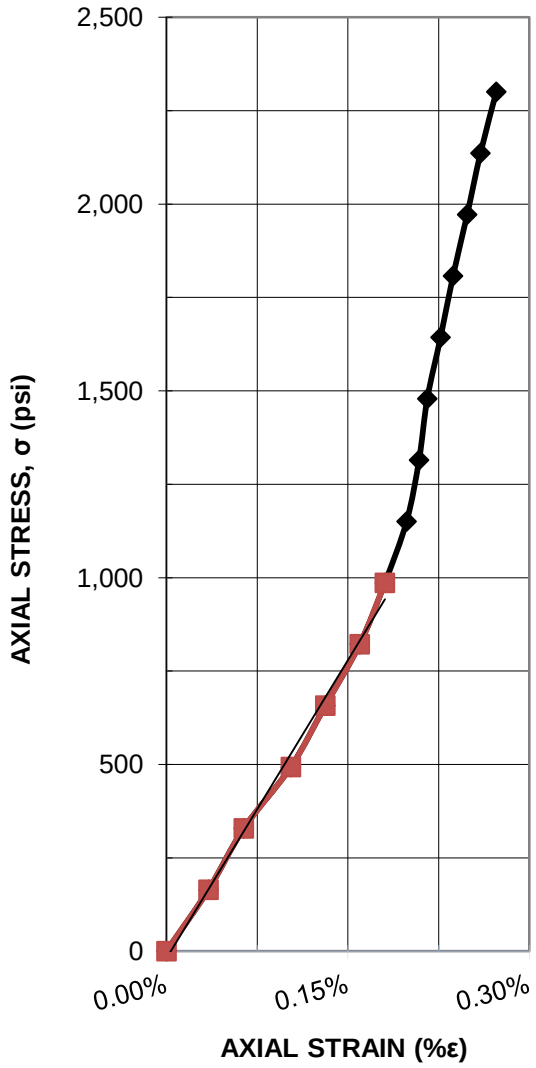
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	March 7, 2017	Plate :	RC-4
Project:	Penneast Pipeline - Interstate 81 Crossing - Wilkes-Barre, PA			CTL #:	548000BI
Boring No.:	B-I81-2	Core Run:	R-10	Depth (ft):	70.95-71.47
Description:	Light gray QUARTZITE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.771	Avg. Diameter (inch) =	1.968
L/D Ratio (2.0 to 2.5) =	2.42	Area (inch^2) =	3.043
Dry Unit Weight (pcf)	166.1	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 2,340 psi = 2.3 ksi

ESTIMATED YOUNG'S MODULUS, E: 5.46E+05 psi (Avg. Linear Portion of Curve, shown)

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

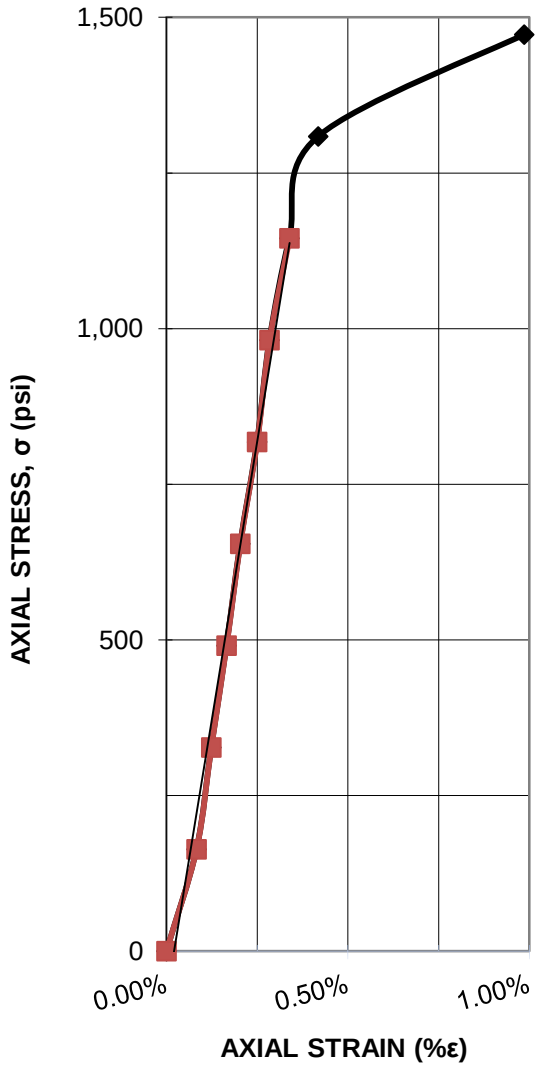
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	March 7, 2017	Plate :	RC-5
Project:	Penneast Pipeline - Interstate 81 Crossing - Wilkes-Barre, PA			CTL #:	548000BI
Boring No.:	B-I81-2	Core Run:	R-12	Depth (ft):	80.3-80.9
Description:	Dark gray MUDSTONE			Checked By:	E. Freire

Core Data:

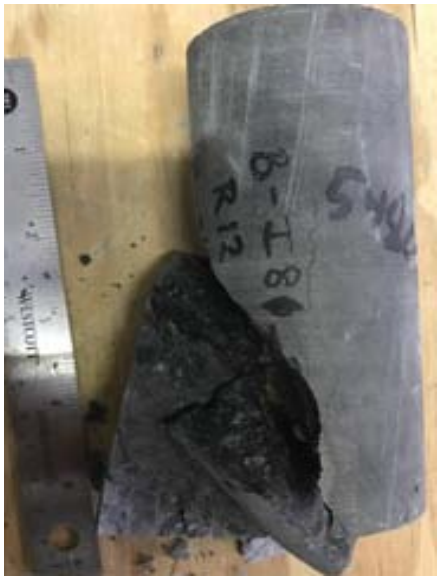
Avg. Length (inch) =	4.655	Avg. Diameter (inch) =	1.973
L/D Ratio (2.0 to 2.5) =	2.36	Area (inch^2) =	3.057
Dry Unit Weight (pcf)	166.3	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE



AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 1,590 psi = 1.6 ksi

ESTIMATED YOUNG'S MODULUS, E: 3.38E+05 psi (Avg. Linear Portion of Curve, shown)

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

(ASTM D 7012 - Method D)

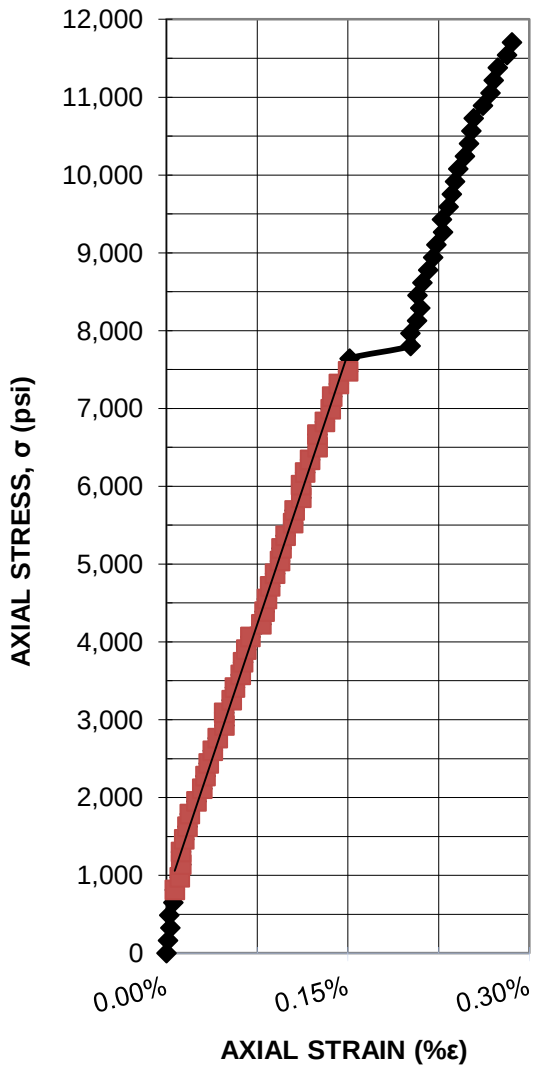
Client:	Mott MacDonald	Test Date:	March 7, 2017	Plate :	RC-6
Project:	Penneast Pipeline - Interstate 81 Crossing - Wilkes-Barre, PA			CTL #:	548000BI
Boring No.:	B-I81-2	Core Run:	R-19	Depth (ft):	92.25-93.03
				Tested By:	J. Veach
Description:	Gray QUARTZITE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.675	Avg. Diameter (inch) =	1.979
L/D Ratio (2.0 to 2.5) =	2.36	Area (inch^2) =	3.076
Dry Unit Weight (pcf)	166.2		

Note: Test specimen not prepared in accordance with D4543

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 11,759 psi = 11.8 ksi

ESTIMATED YOUNG'S MODULUS, E: 4.65E+06 psi (Avg. Linear Portion of Curve, shown)

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

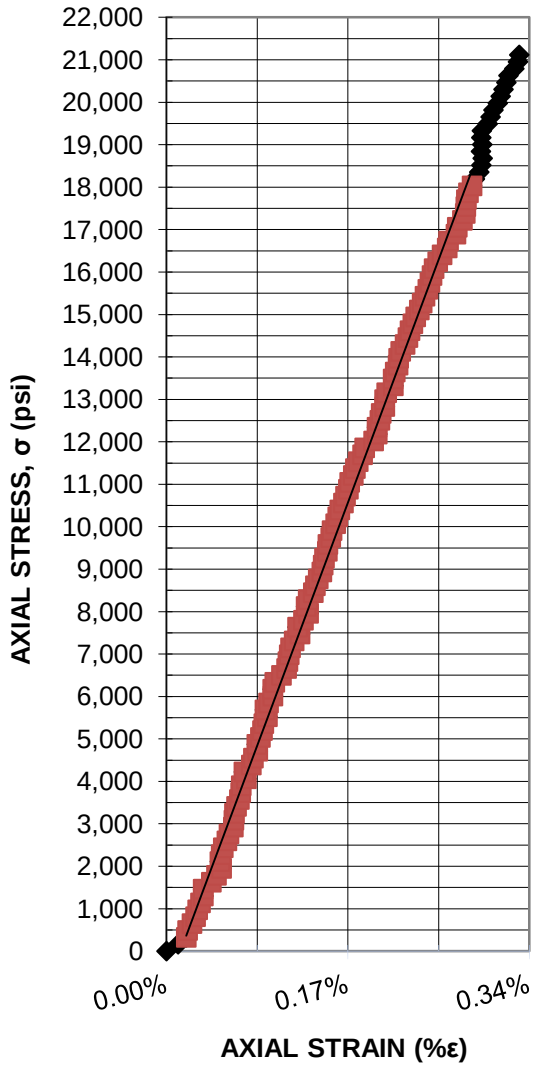
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	March 7, 2017	Plate :	RC-7
Project:	Penneast Pipeline - Interstate 81 Crossing - Wilkes-Barre, PA			CTL #:	548000BI
Boring No.:	B-I81-2	Core Run:	R-16	Depth (ft):	103.27-104.07
				Tested By:	J. Veach
Description:	Gray QUARTZITE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.663	Avg. Diameter (inch) =	1.980
L/D Ratio (2.0 to 2.5) =	2.36	Area (inch^2) =	3.078
Dry Unit Weight (pcf)	165.4	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 21,177 psi = 21.2 ksi

ESTIMATED YOUNG'S MODULUS, E: 6.61E+06 psi (Avg. Linear Portion of Curve, shown)

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

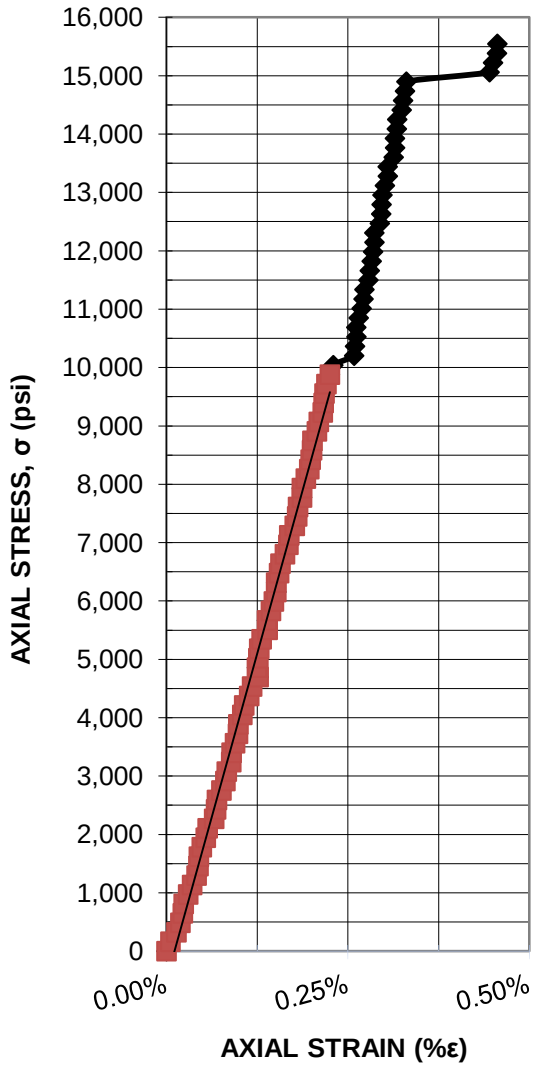
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	March 7, 2017	Plate :	RC-8
Project:	Penneast Pipeline - Interstate 81 Crossing - Wilkes-Barre, PA			CTL #:	548000BI
Boring No.:	B-I81-2	Core Run:	R-18	Depth (ft):	110.25-111.03
				Tested By:	J. Veach
Description:	Gray QUARTZITE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.731	Avg. Diameter (inch) =	1.983
L/D Ratio (2.0 to 2.5) =	2.39	Area (inch^2) =	3.088
Dry Unit Weight (pcf)	165.5	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u:	**15,682**	**psi**	**=**	**15.7** **ksi**

ESTIMATED YOUNG'S MODULUS, E:	**4.39E+06**	**psi** (Avg. Linear Portion of Curve, shown)

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

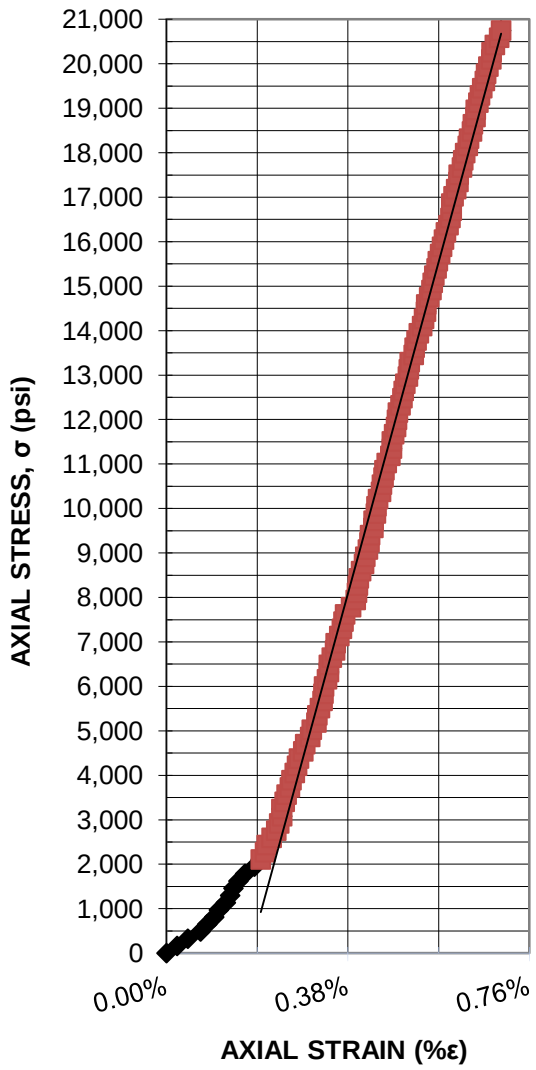
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	March 7, 2017	Plate :	RC-9
Project:	Penneast Pipeline - Interstate 81 Crossing - Wilkes-Barre, PA			CTL #:	548000BI
Boring No.:	B-I81-2	Core Run:	R-20	Depth (ft):	123.57-124.38
				Tested By:	J. Veach
Description:	Gray QUARTZITE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.715	Avg. Diameter (inch) =	1.982
L/D Ratio (2.0 to 2.5) =	2.38	Area (inch^2) =	3.085
Dry Unit Weight (pcf)	166.9	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 20,852 psi = 20.9 ksi

ESTIMATED YOUNG'S MODULUS, E: 3.70E+06 psi (Avg. Linear Portion of Curve, shown)

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

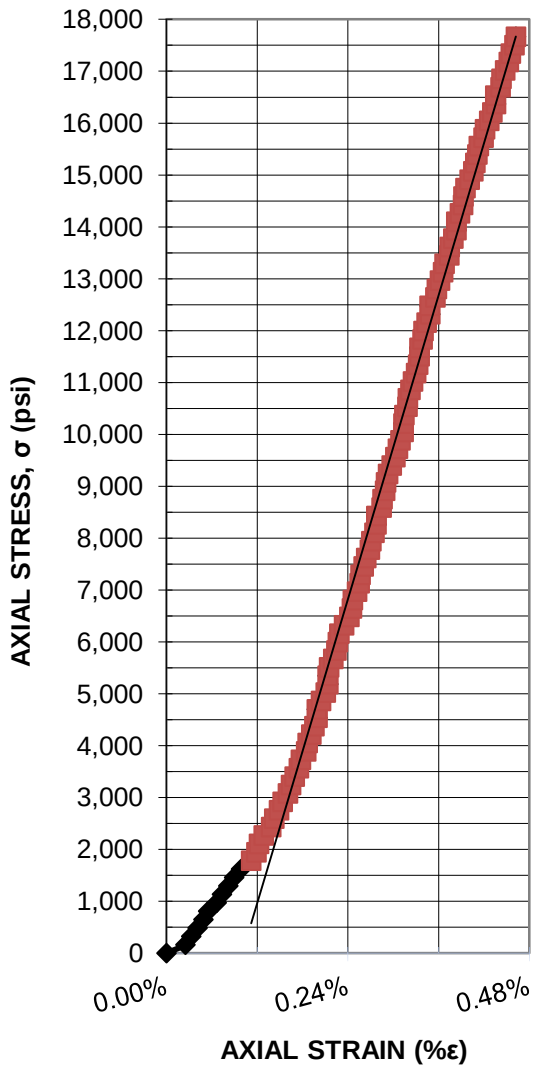
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	March 7, 2017	Plate :	RC-10
Project:	Penneast Pipeline - Interstate 81 Crossing - Wilkes-Barre, PA			CTL #:	548000BI
Boring No.:	B-I81-2	Core Run:	R-22	Depth (ft):	131.67-132.45
				Tested By:	J. Veach
Description:	Gray QUARTZITE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.649	Avg. Diameter (inch) =	1.982
L/D Ratio (2.0 to 2.5) =	2.35	Area (inch^2) =	3.085
Dry Unit Weight (pcf)	165.7	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 17,765 psi = 17.8 ksi

ESTIMATED YOUNG'S MODULUS, E: 4.53E+06 psi (Avg. Linear Portion of Curve, shown)

GEOTECHNICAL LABORATORY TESTING RESULTS

CLIENT: Mott MacDonald
111 Wood Ave South
Iselin, New Jersey 08830-4112

ATTN: Mr. Dafydd Chandler

PROJECT: Penn East Pipeline
I81 Crossing Median

CTL # 548000BY
CTB # 150167

DATE: May 9, 2017

CHECKED BY: Eduardo M. Freire, P.E.
Geotechnical Laboratory Manager

SAMPLES RECEIVED: April 25, 2017 **SAMPLES TESTED:** 4/25/17 - 5/9/17 **LAB TECHNICIAN(S):** J. Veach and D. Nhun

Test Boring No.	Sample No.	Depth (ft)	Water Content (%) (ASTM D2216)	Atterberg Limits (ASTM D4318)			Particle Size Analysis (Sieve Only)* (ASTM D422)	Particle Size Analysis with Hydrometer* (ASTM D422)	Rock Unconfined Compression w/ Stress-Strain (ASTM D7012-D)^/*	Unit Weight of Oven Dried Rock (pcf)	Chloride (mg/L) (ASTM D4327)	pH of Soil (ASTM G51)	Consolidation* (ASTM D2435)	UU Triaxial* (ASTM D2850)	CU Triaxial (ASTM D4767)	Soil Perm. Class Rating (NJAC 7:9A-6.3)					
				LL	PL	PI										A	B				
B-I81-3	R-1	25.78-27.35							RSS-1												
	R-2	32.83-33.5							RSS-2												
	R-2	33.52-34.14								165											
	R-4	43.05-43.7							RSS-3												
	R-4	44.38-44.8								167.1											
	R-8	63.3-65							RSS-4												
	R-18	114.42-114.6								165.1											
	R-18	113.78-114.4							RSS-5												
Billing Total:									**5**	**3**											

Comments/Remarks: *See attached Plates

5439 Harding Highway, PO Box 427 - Mays Landing, NJ 08330
Lab: (609) 625-0386: Fax: (609) 625-9133

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

(ASTM D 7012 - Method D)

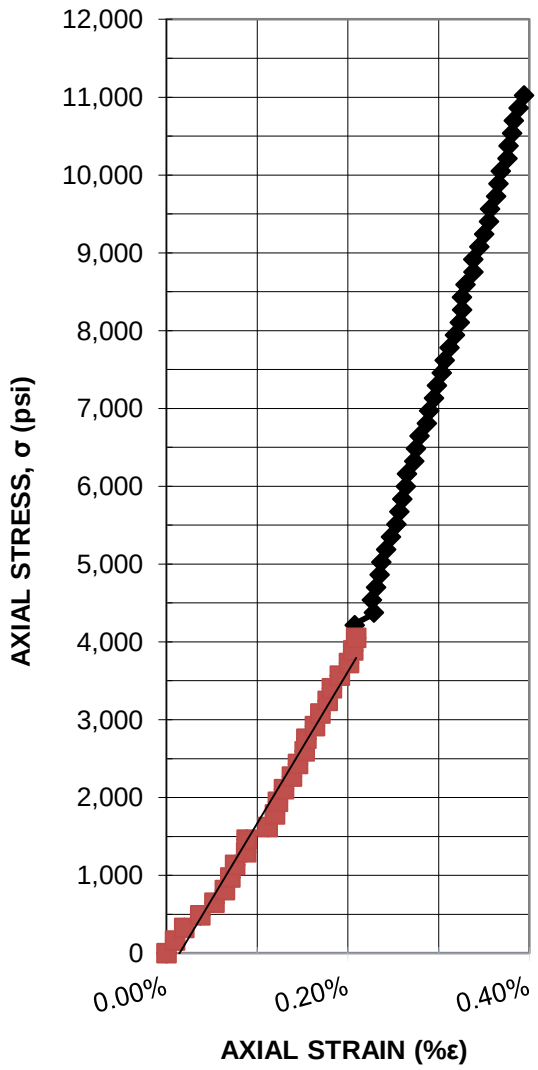
Client:	Mott MacDonald	Test Date:	May 8, 2017	Plate :	RSS-1
Project:	Penn East - I81 - Crossing Median			CTL #:	548000BY
Boring No.:	B-I-81-3	Core Run:	R-1	Depth (ft):	25.78-27.35
Description:	Gray SANDSTONE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.851	Avg. Diameter (inch) =	1.982
L/D Ratio (2.0 to 2.5) =	2.45	Area (inch^2) =	3.085
Dry Unit Weight (pcf)	167.8		

Note: Test specimen not prepared in accordance with D4543

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 11,143 psi = 11.1 ksi

ESTIMATED YOUNG'S MODULUS, E: 1.94E+06 psi (Avg. Linear Portion of Curve, shown)

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

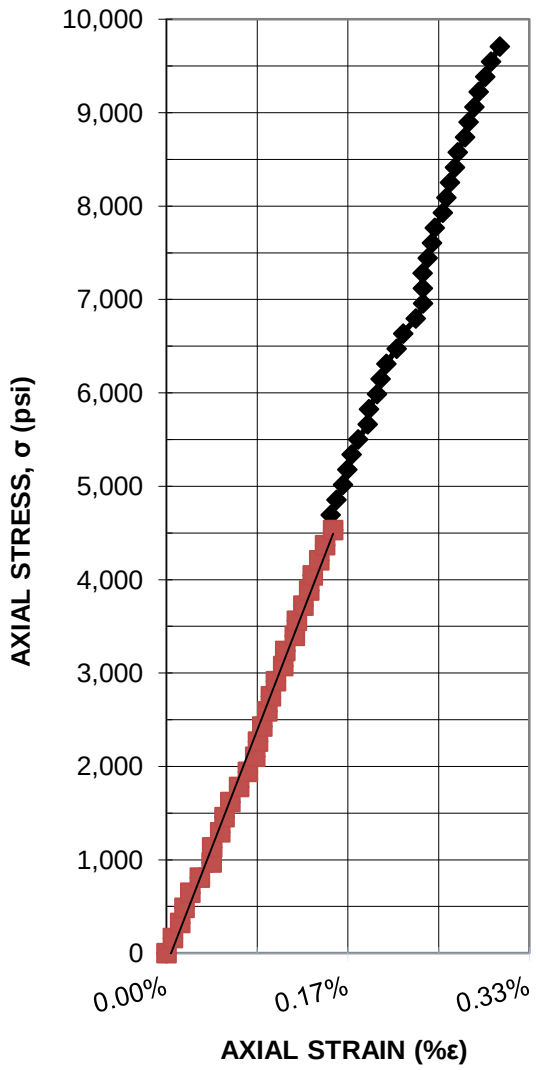
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	May 8, 2017	Plate :	RSS-2
Project:	Penn East - I81 - Crossing Median			CTL #:	548000BY
Boring No.:	B-I-81-3	Core Run:	R-2	Depth (ft):	32.83-33.5
Description:	Gray SANDSTONE			Checked By:	E. Freire

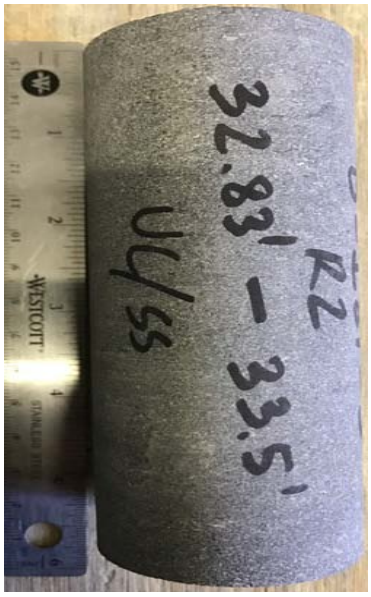
Core Data:

Avg. Length (inch) =	4.890	Avg. Diameter (inch) =	1.984
L/D Ratio (2.0 to 2.5) =	2.47	Area (inch^2) =	3.090
Dry Unit Weight (pcf)	166.7	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS



BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 9,819 psi = 9.8 ksi

ESTIMATED YOUNG'S MODULUS, E: 2.99E+06 psi (Avg. Linear Portion of Curve, shown)

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

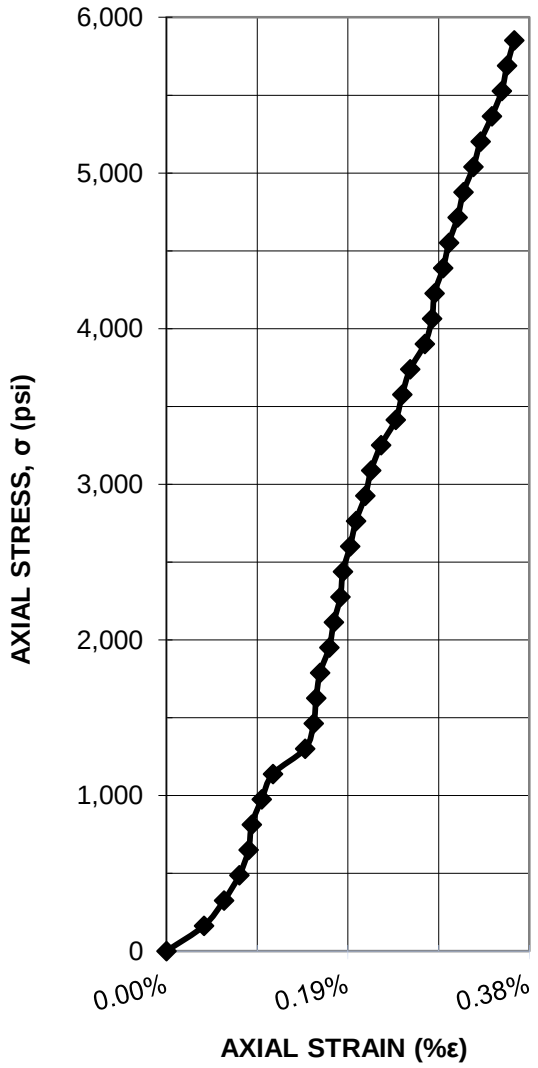
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	May 8, 2017	Plate :	RSS-3
Project:	Penn East - I81 - Crossing Median			CTL #:	548000BY
Boring No.:	B-I-81-3	Core Run:	R-4	Depth (ft):	43.05-43.7
Description:	Gray SILTSTONE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.725	Avg. Diameter (inch) =	1.979
L/D Ratio (2.0 to 2.5) =	2.39	Area (inch^2) =	3.076
Dry Unit Weight (pcf)	166.4	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u:	**5,979**	**psi**	**=**	**6.0 ksi**

ESTIMATED YOUNG'S MODULUS, E:	**-**	**psi**	**(No suitable linear portion to estimate)**

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

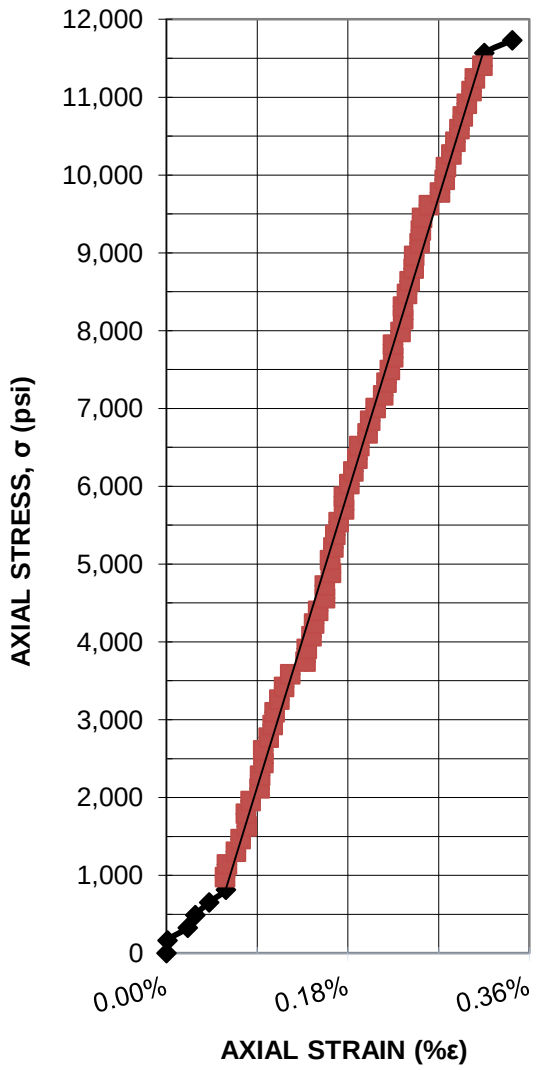
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	May 8, 2017	Plate :	RSS-4
Project:	Penn East - I81 - Crossing Median			CTL #:	548000BY
Boring No.:	B-I-81-3	Core Run:	R-8	Depth (ft):	63.3-65
Description:	Gray QUARTZITE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.774	Avg. Diameter (inch) =	1.977
L/D Ratio (2.0 to 2.5) =	2.41	Area (inch^2) =	3.069
Dry Unit Weight (pcf)	165.5	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u:	**11,903**	**psi**	**=**	**11.9** **ksi**

ESTIMATED YOUNG'S MODULUS, E:	**4.08E+06**	**psi** (Avg. Linear Portion of Curve, shown)

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

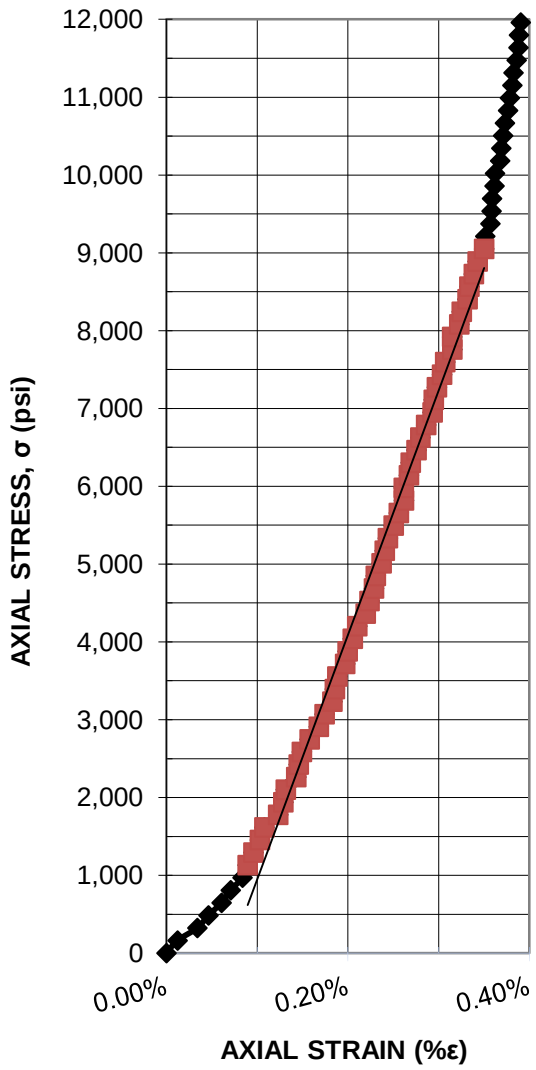
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	May 8, 2017	Plate :	RSS-5
Project:	Penn East - I81 - Crossing Median			CTL #:	548000BY
Boring No.:	B-I-81-3	Core Run:	R-18	Depth (ft):	113.78-114.4
				Tested By:	J. Veach
Description:	Gray SANDSTONE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.550	Avg. Diameter (inch) =	1.985
L/D Ratio (2.0 to 2.5) =	2.29	Area (inch^2) =	3.094
Dry Unit Weight (pcf)	166.7	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 12,001 psi = 12.0 ksi

ESTIMATED YOUNG'S MODULUS, E: 3.04E+06 psi (Avg. Linear Portion of Curve, shown)

AAP AASHTO R18

GEOTECHNICAL LABORATORY TESTING RESULTS

US Army Corps of Engineers

CLIENT: Mott MacDonald
111 Wood Ave South
Iselin, NJ 08830-4112

ATTN: Ms. Erica Viglirolo

PROJECT: Penn East
Interstae - 81
Wilkes-Barre, PA

CTL # 548000U
CTB # 150167

DATE: March 3, 2016

CHECKED BY: Eduardo M. Freire, P.E.
Geotechnical Laboratory Manager

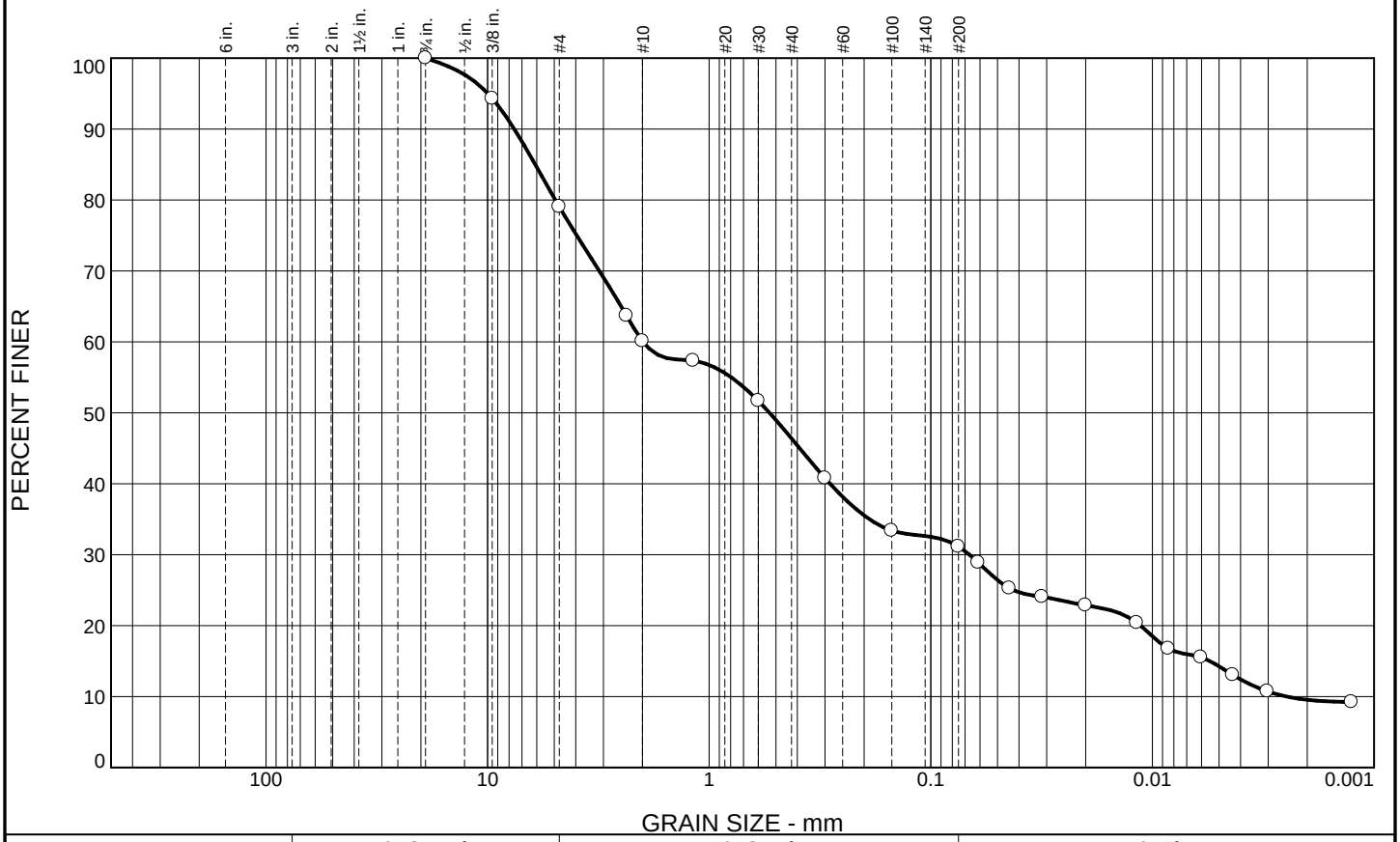
SAMPLES RECEIVED: February 22, 2016 **SAMPLES TESTED:** 2/22/16 - 3/3/16 **LAB TECHNICIAN(S):** J. Veach, J. Landy, A . Platt

Test Boring No.	Sample No.	Depth (ft)	Water Content (%) (ASTM D2216)	Atterberg Limits (ASTM D4318)			Particle Size Analysis (Sieve Only)* (ASTM D422)	Particle Size Analysis with Hydrometer* (ASTM D422)	Organic Content (%) (ASTM D2974)	Sulfate (mg/L) (ASTM D4327)	Chloride (mg/L) (ASTM D4327)	pH of Soil (ASTM G51)	Consolidation* (ASTM D2435)	UU Triaxial* (ASTM D2850)	CU Triaxial (ASTM D4767)	Soil Perm. Class Rating (NJAC 7:9A-6.3)					
				LL	PL	PI										A	B				
B-7	S-2	5-7	13.6	25	14	11		Plate 1													
	S-3	10-12	13.0	24	13	11		Plate 2													
	S-4	15-17	8.4	21	11	10		Plate 3													
	S-5	20-22						Plate 4													
	S-6	25-27						Plate 5													
	S-7	30-32	11.3	^	^	^		Plate 6													
	S-8	35-37	11.9	^	^	^		Plate 7													
	S-9	40-42	13.0	^	^	^		Plate 8													
	S-10	45-47						Plate 9													
	S-11	50-52	11.5	Non-Plastic				Plate 10													
	S-12	55-57	11.0	^	^	^	Plate 11	^													
Billing Total:			**4**	**4**			**1**	**10**													

Comments/Remarks: *See attached Plates ^Insufficent sample amount to run requested testing

CRAIG TESTING LABORATORIES, INC.
5439 Harding Highway, PO Box 427 - Mays Landing, NJ 08330
Lab: (609) 625-0386: Fax: (609) 625-9133

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	20.9	19.0	13.7	15.2	16.9	14.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	94.3		
#4	79.1		
#8	63.7		
#10	60.1		
#16	57.4		
#30	51.7		
#50	40.8		
#100	33.4		
#200	31.2		

* (no specification provided)

Material Description

Gray clayey SAND with gravel

Atterberg Limits

LL= 25 PL= 14 PI= 11

Coefficients

D_{85}= 6.0921 D_{60}= 1.9894 D_{50}= 0.5341
D_{30}= 0.0670 D_{15}= 0.0055 D_{10}= 0.0025
C_u= 800.68 C_c= 0.91

Classification

USCS= SC

Remarks

Water Content (WC): 13.6%

Source of Sample: B-7 **Depth:** 5'-7'
Sample Number: S-2

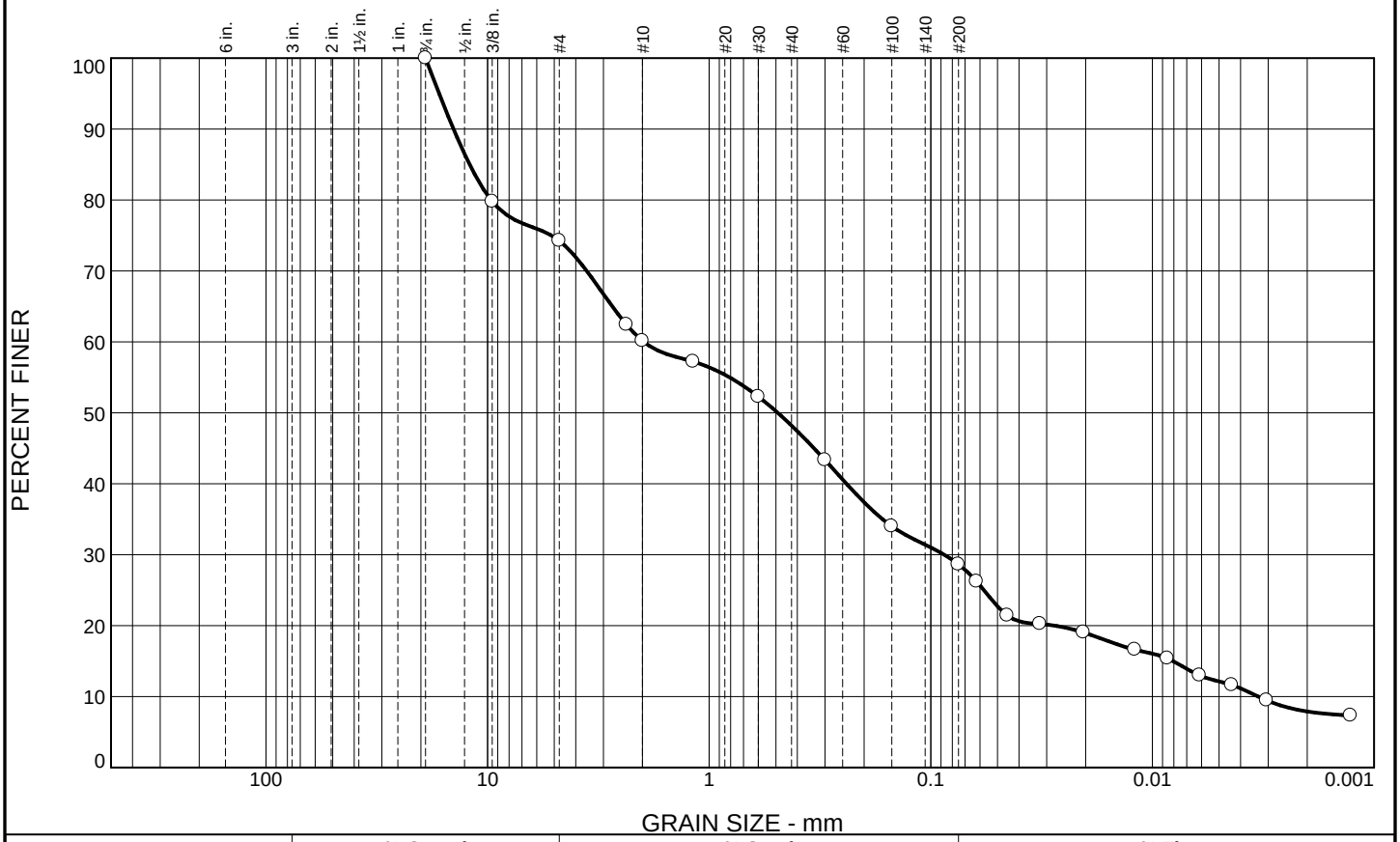
Date: 3/3/16

Craig Testing Laboratories, Inc.

Mays Landing, New Jersey

Client: Mott MacDonald
Project: Penn East
Interstae 81 - Wilkes-Barre, PA
Project No: 548000U **Plate** 1

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	25.7	14.2	11.9	19.6	16.5	12.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	79.8		
#4	74.3		
#8	62.4		
#10	60.1		
#16	57.2		
#30	52.3		
#50	43.3		
#100	34.0		
#200	28.6		

* (no specification provided)

Material Description

Gray clayey SAND with gravel

Atterberg Limits

LL= 24 PL= 13 PI= 11

Coefficients

D_{85}= 12.0539 D_{60}= 1.9732 D_{50}= 0.4902
D_{30}= 0.0870 D_{15}= 0.0081 D_{10}= 0.0033
C_u= 591.80 C_c= 1.15

Classification

USCS= SC

Remarks

WC:13.0%

Source of Sample: B-7 **Depth:** 10'-12'
Sample Number: S-3

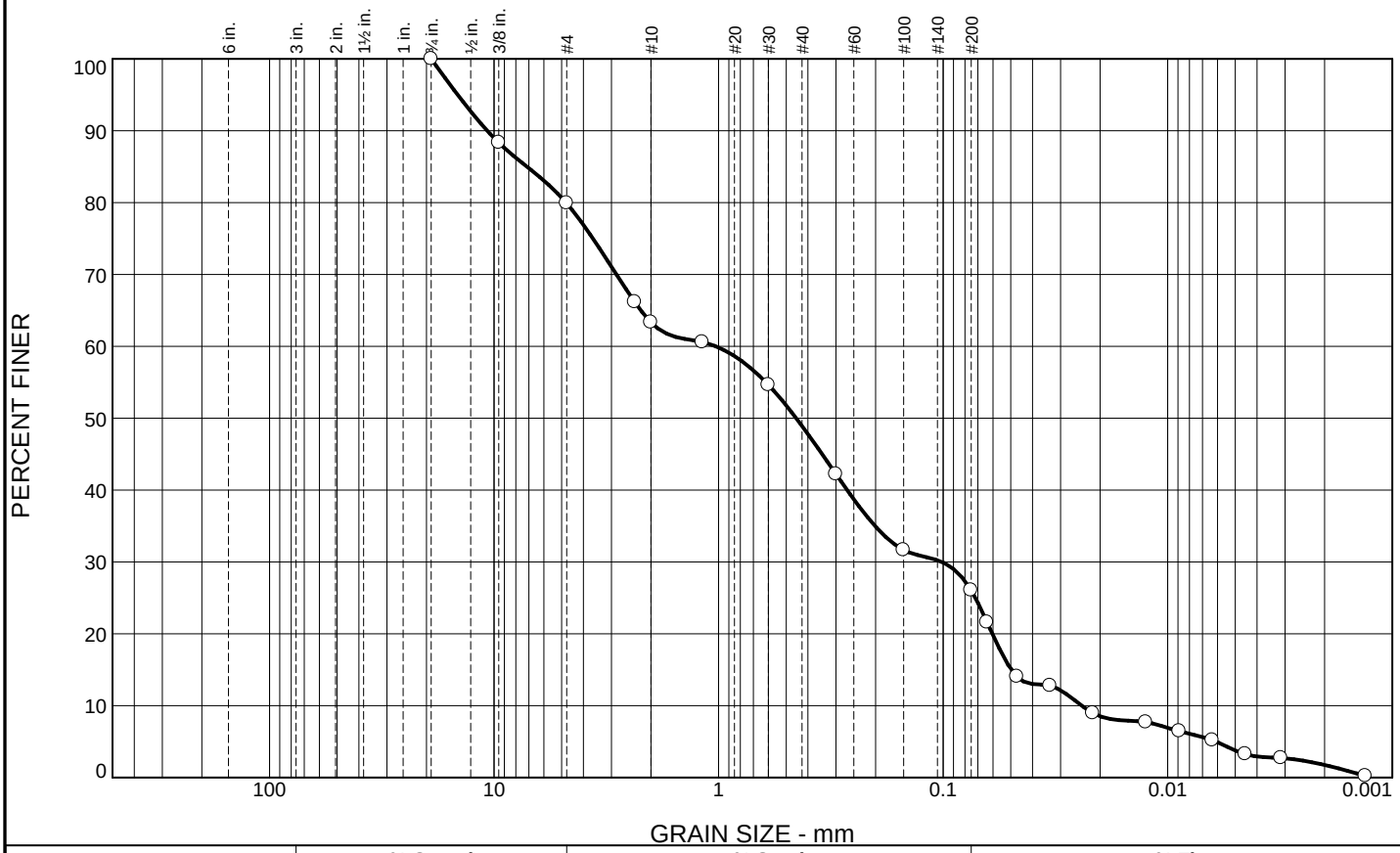
Date: 3/3/16

Craig Testing Laboratories, Inc.

Mays Landing, New Jersey

Client: Mott MacDonald
Project: Penn East
Interstae 81 - Wilkes-Barre, PA
Project No: 548000U **Plate** 2

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	20.1	16.6	14.4	22.8	22.3	3.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	88.3		
#4	79.9		
#8	66.2		
#10	63.3		
#16	60.6		
#30	54.6		
#50	42.2		
#100	31.7		
#200	26.1		

* (no specification provided)

Material Description

Black clayey SAND with gravel

Atterberg Limits

LL= 21 PL= 11 PI= 10

Coefficients

D_{85}= 7.1386 D_{60}= 1.0294 D_{50}= 0.4512
D_{30}= 0.1015 D_{15}= 0.0497 D_{10}= 0.0242
C_u= 42.62 C_c= 0.41

Classification

USCS= SC

Remarks

WC: 8.4%

Source of Sample: B-7 **Depth:** 15'-17'
Sample Number: S-4

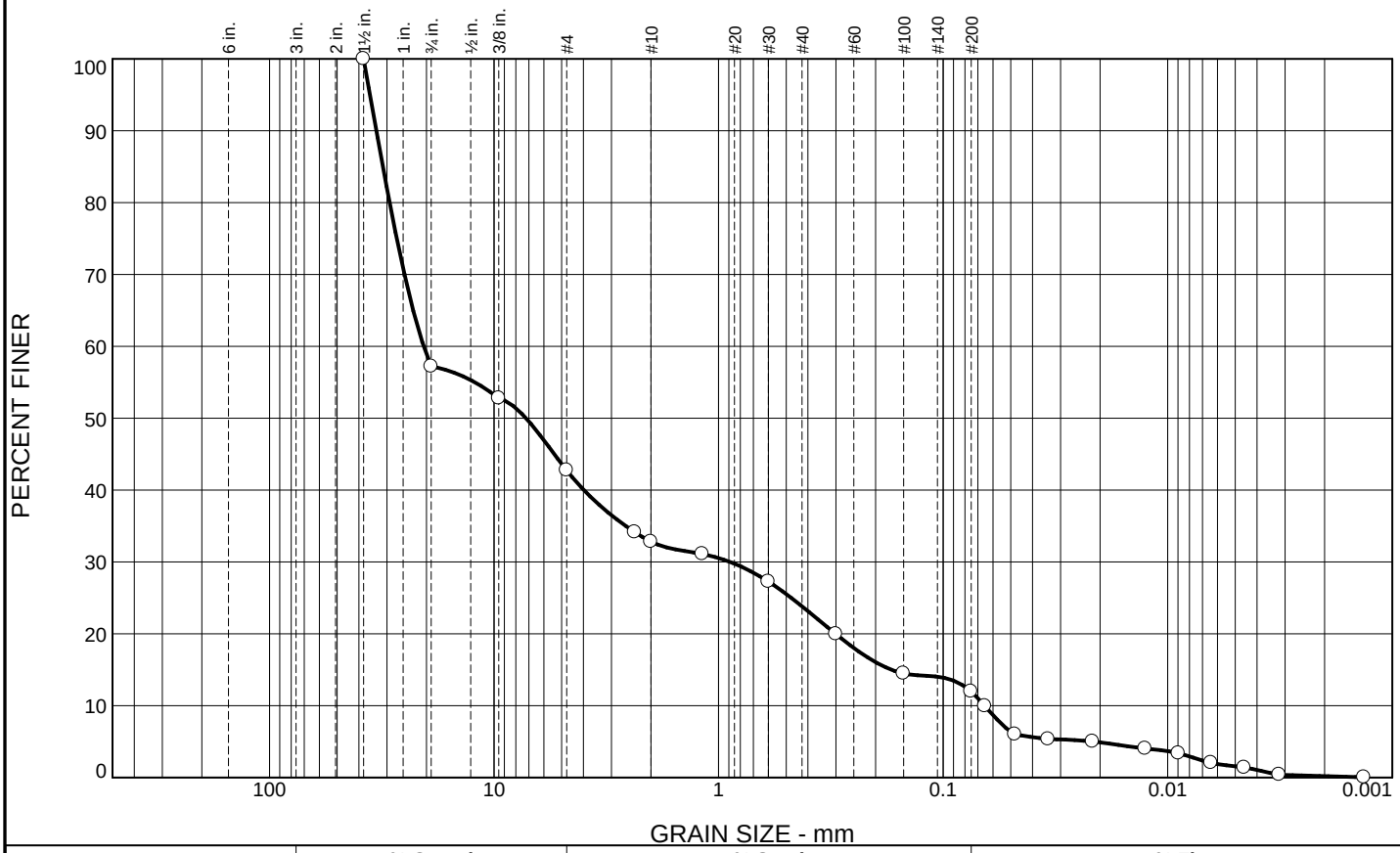
Date: 3/3/16

Craig Testing Laboratories, Inc.

Mays Landing, New Jersey

Client: Mott MacDonald
Project: Penn East
Interstae 81 - Wilkes-Barre, PA
Project No: 548000U **Plate** 3

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	42.8	14.5	9.9	9.0	11.8	10.4	1.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
.75	57.2		
.375	52.8		
#4	42.7		
#8	34.1		
#10	32.8		
#16	31.1		
#30	27.3		
#50	19.9		
#100	14.5		
#200	12.0		

* (no specification provided)

Material Description

Gray poorly graded GRAVEL with silt\clay and sand

Atterberg Limits

LL= PL= PI=

Coefficients

D_{85}= 31.2661 D_{60}= 20.5856 D_{50}= 7.2046
D_{30}= 0.8907 D_{15}= 0.1702 D_{10}= 0.0654
C_u= 314.71 C_c= 0.59

Classification

USCS= GP-GM\GC

Remarks

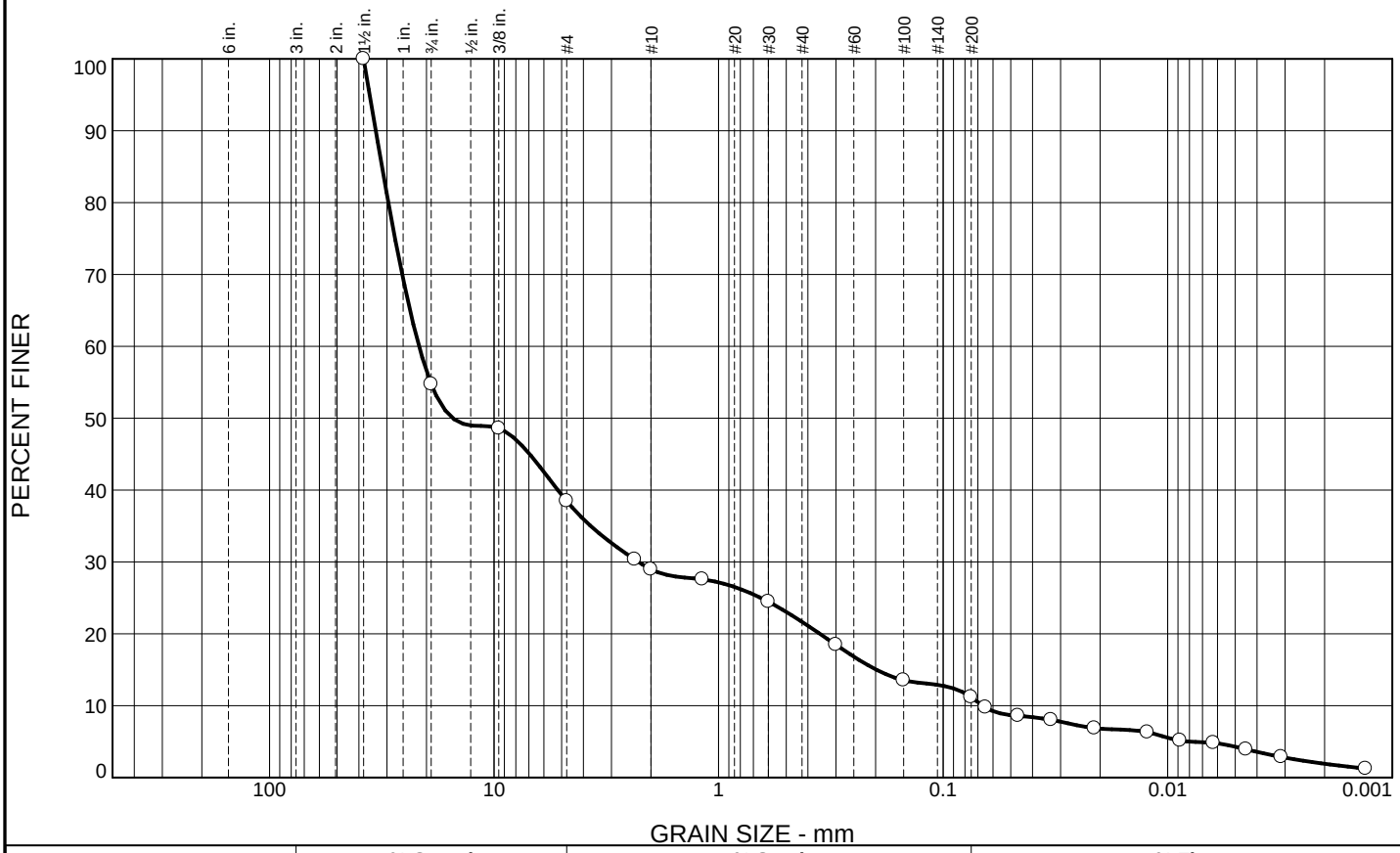
Source of Sample: B-7 **Depth:** 20'-22'
Sample Number: S-5 **Date:** 3/3/16

Craig Testing Laboratories, Inc.

Mays Landing, New Jersey

Client: Mott MacDonald
Project: Penn East
Interstae 81 - Wilkes-Barre, PA
Project No: 548000U **Plate** 4

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	45.3	16.2	9.5	7.3	10.5	6.9	4.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
.75	54.7		
.375	48.6		
#4	38.5		
#8	30.3		
#10	29.0		
#16	27.6		
#30	24.5		
#50	18.5		
#100	13.5		
#200	11.2		

* (no specification provided)

Material Description

Gray poorly graded GRAVEL with silt\clay and sand

Atterberg Limits

LL= PL= PI=

Coefficients

D_{85}= 31.5627 D_{60}= 21.5819 D_{50}= 15.2700
D_{30}= 2.2748 D_{15}= 0.1983 D_{10}= 0.0666
C_u= 324.11 C_c= 3.60

Classification

USCS= GP-GM\GC

Remarks

Source of Sample: B-7 **Depth:** 25'-27'
Sample Number: S-6

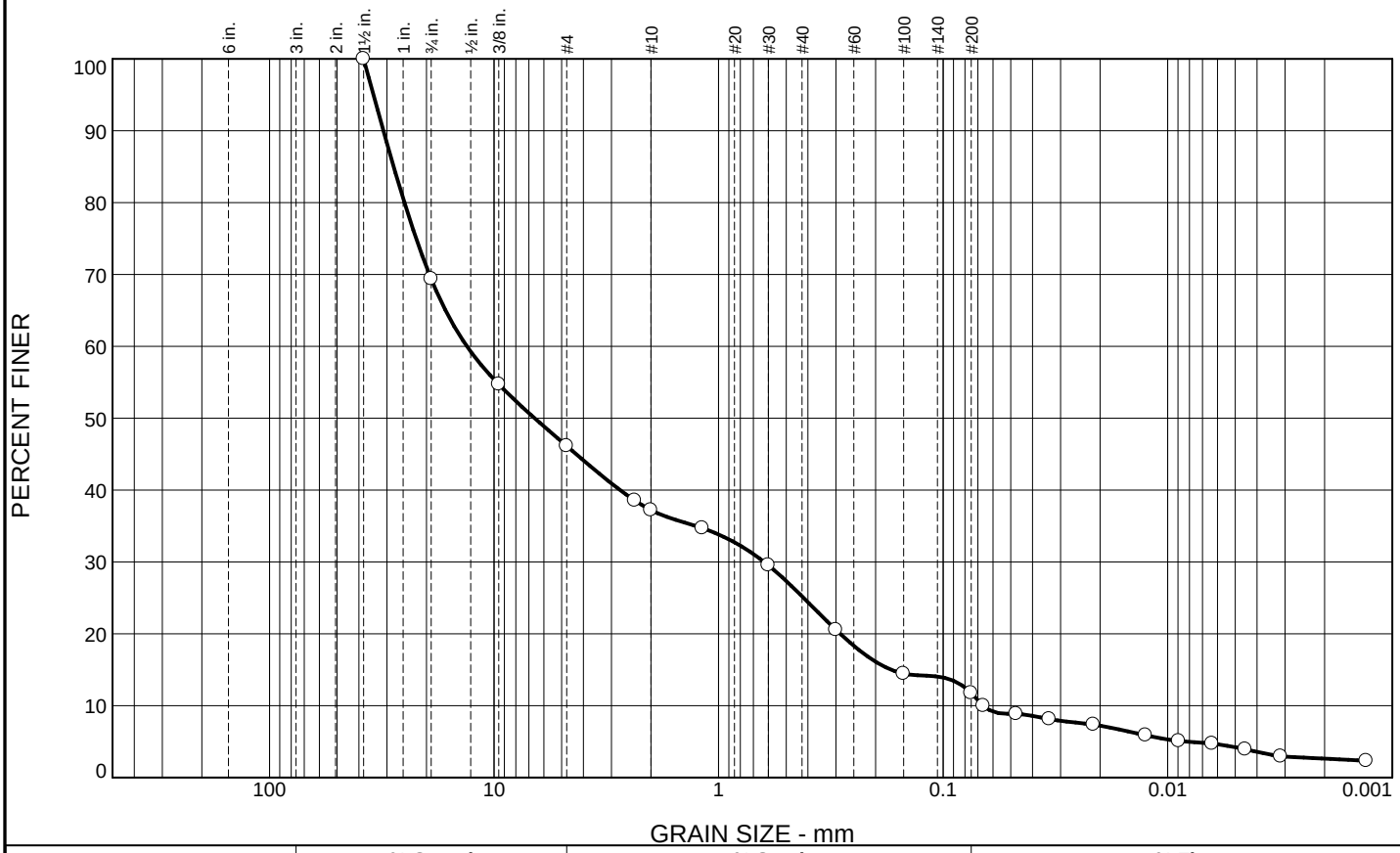
Date: 3/3/16

Craig Testing Laboratories, Inc.

Mays Landing, New Jersey

Client: Mott MacDonald
Project: Penn East
Interstae 81 - Wilkes-Barre, PA
Project No: 548000U **Plate** 5

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	30.6	23.3	8.9	12.0	13.4	7.6	4.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
.75	69.4		
.375	54.7		
#4	46.1		
#8	38.5		
#10	37.2		
#16	34.7		
#30	29.5		
#50	20.5		
#100	14.5		
#200	11.8		

* (no specification provided)

Material Description

Gray poorly graded GRAVEL with silt\clay and sand

Atterberg Limits

LL= PL= PI=

Coefficients

D_{85}= 27.9855 D_{60}= 13.2071 D_{50}= 6.5971
D_{30}= 0.6268 D_{15}= 0.1706 D_{10}= 0.0664
C_u= 199.01 C_c= 0.45

Classification

USCS= GP-GM\GC

Remarks

WC: 11.3%

Source of Sample: B-7 **Depth:** 30'-32'
Sample Number: S-7

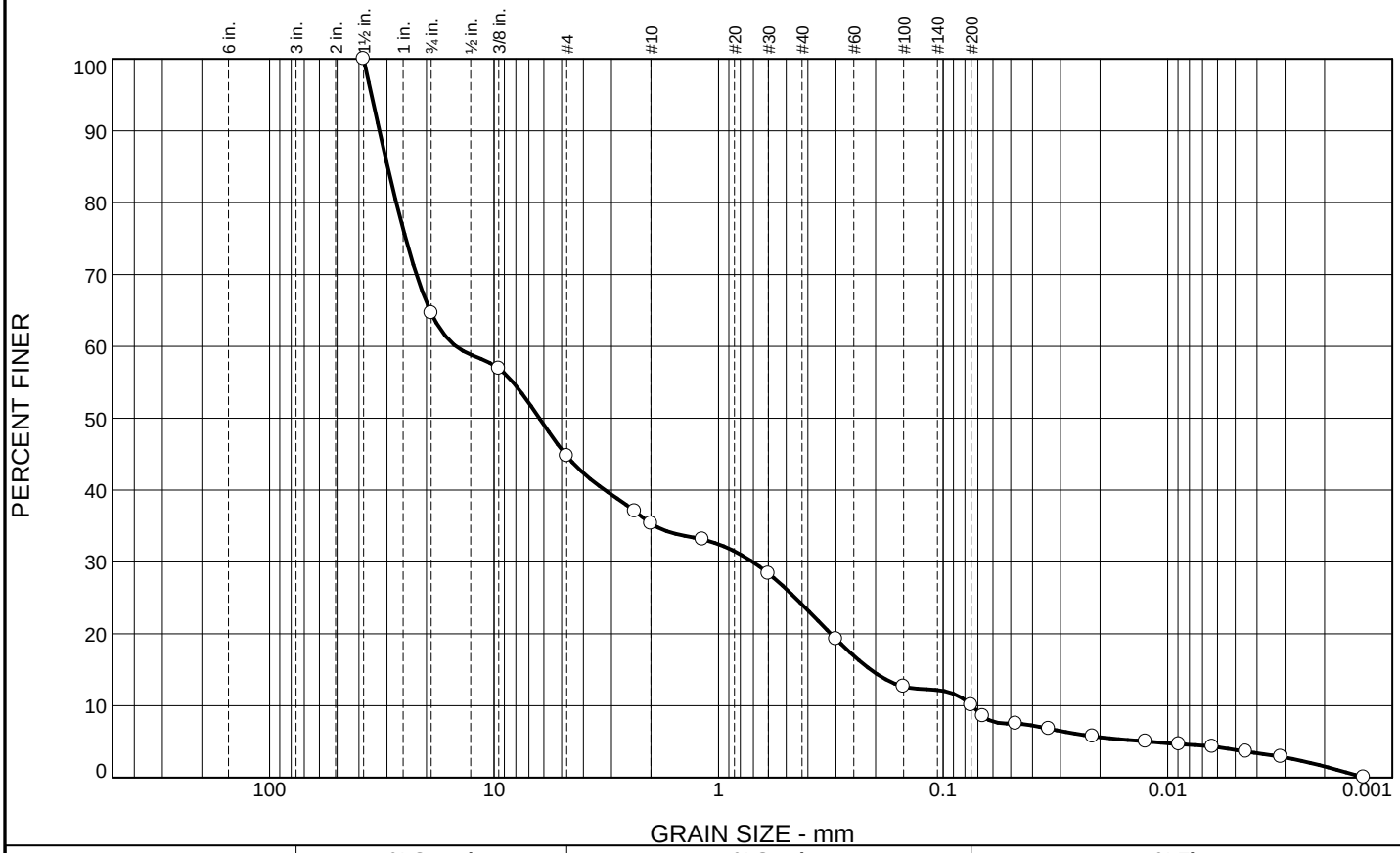
Date: 3/3/16

Craig Testing Laboratories, Inc.

Mays Landing, New Jersey

Client: Mott MacDonald
Project: Penn East
Interstae 81 - Wilkes-Barre, PA
Project No: 548000U **Plate** 6

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	35.3	19.9	9.5	11.2	14.0	6.3	3.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
.75	64.7		
.375	56.9		
#4	44.8		
#8	37.1		
#10	35.3		
#16	33.1		
#30	28.4		
#50	19.3		
#100	12.7		
#200	10.1		

* (no specification provided)

Material Description

Gray poorly graded GRAVEL with silt\clay and sand

Atterberg Limits

LL= PL= PI=

Coefficients

D_{85}= 29.7739 D_{60}= 14.7737 D_{50}= 6.2813
D_{30}= 0.7049 D_{15}= 0.2101 D_{10}= 0.0744
C_u= 198.54 C_c= 0.45

Classification

USCS= GP-GM\GC

Remarks

WC: 11.9%

Source of Sample: B-7 **Depth:** 35'-37'
Sample Number: S-8

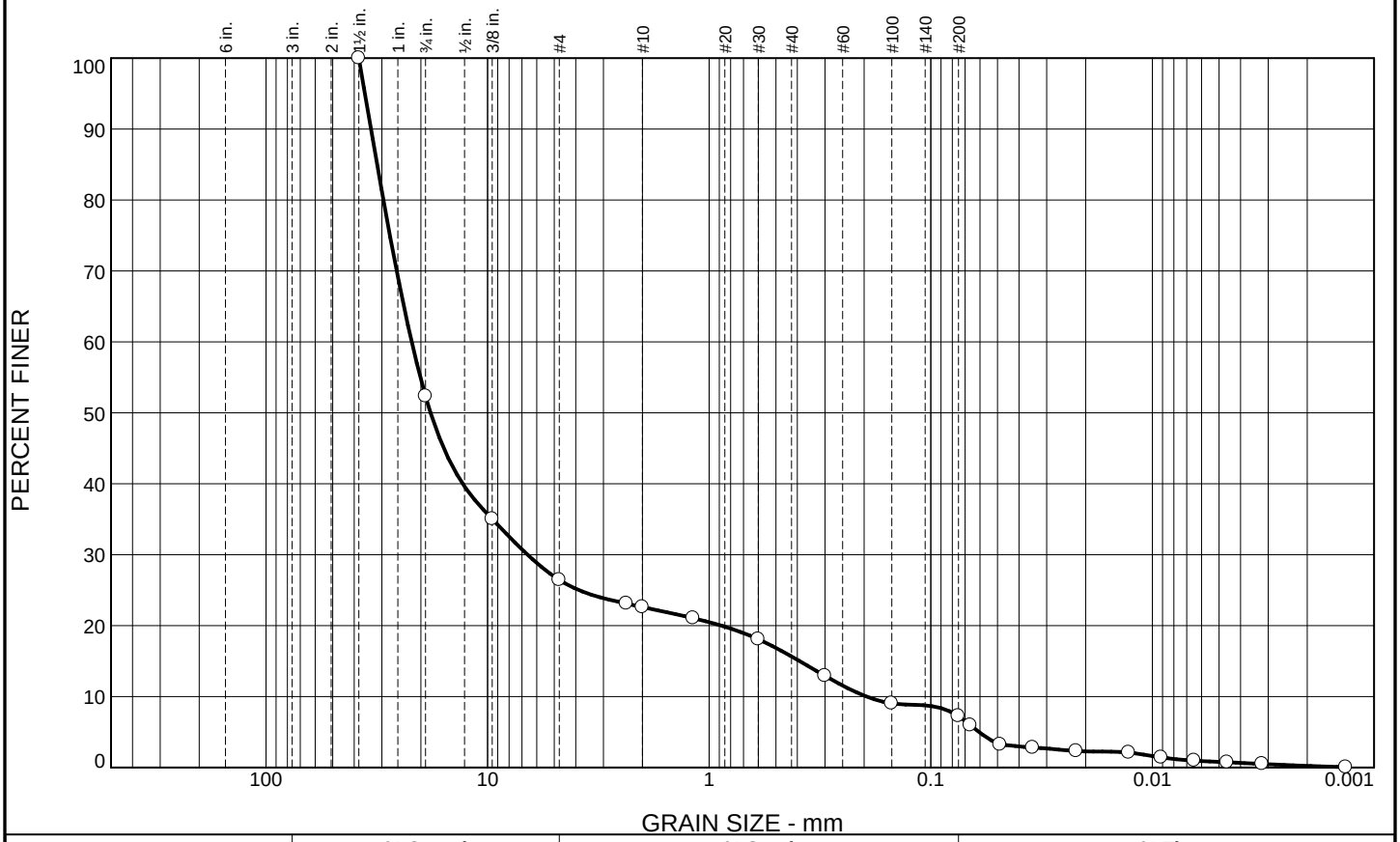
Date: 3/3/16

Craig Testing Laboratories, Inc.

Mays Landing, New Jersey

Client: Mott MacDonald
Project: Penn East
Interstae 81 - Wilkes-Barre, PA
Project No: 548000U **Plate** 7

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	47.7	25.9	3.8	6.9	8.5	6.4	0.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
.75	52.3		
.375	35.0		
#4	26.4		
#8	23.1		
#10	22.6		
#16	21.0		
#30	18.1		
#50	12.9		
#100	9.0		
#200	7.2		

* (no specification provided)

Material Description

Gray poorly graded GRAVEL with silt\clay and sand

Atterberg Limits

LL= PL= PI=

Coefficients

D_{85}= 31.5044 D_{60}= 22.0036 D_{50}= 18.0766
D_{30}= 6.6004 D_{15}= 0.3909 D_{10}= 0.1950
C_u= 112.81 C_c= 10.15

Classification

USCS= GP-GM\GC

Remarks

WC: 13.0%

Source of Sample: B-7 **Depth:** 40'-42'
Sample Number: S-9

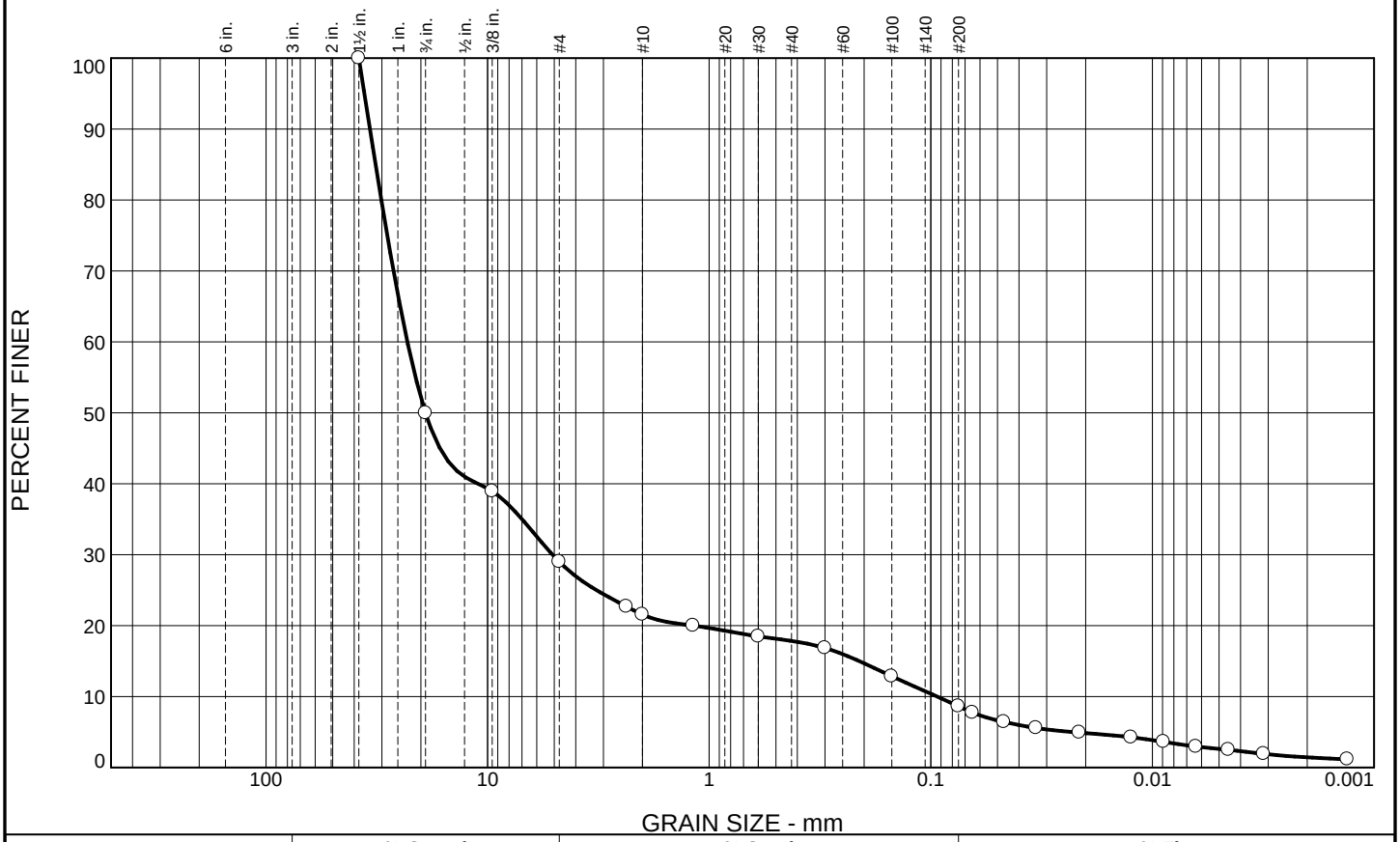
Date: 3/3/16

Craig Testing Laboratories, Inc.

Mays Landing, New Jersey

Client: Mott MacDonald
Project: Penn East
Interstae 81 - Wilkes-Barre, PA
Project No: 548000U **Plate** 8

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	50.0	21.0	7.5	3.7	9.2	6.0	2.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
.75	50.0		
.375	39.0		
#4	29.0		
#8	22.7		
#10	21.5		
#16	20.0		
#30	18.5		
#50	16.8		
#100	12.9		
#200	8.6		

* (no specification provided)

Material Description

Gray poorly graded GRAVEL with silt\clay and sand

Atterberg Limits

LL= PL= PI=

Coefficients

D_{85}= 32.0221 D_{60}= 23.0032 D_{50}= 19.0675
D_{30}= 5.0954 D_{15}= 0.2107 D_{10}= 0.0936
C_u= 245.74 C_c= 12.06

Classification

USCS= GP-GM\GC

Remarks

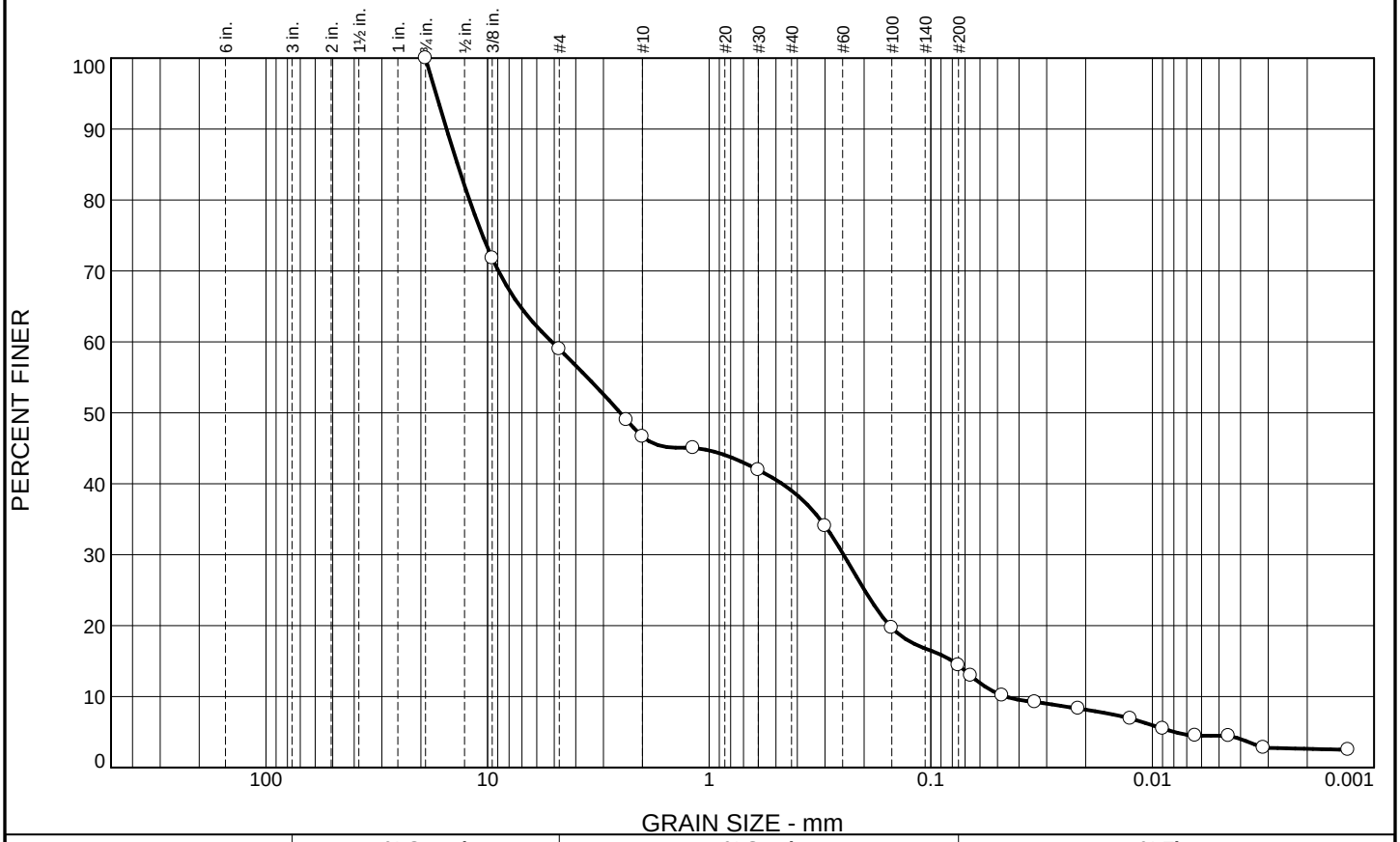
Source of Sample: B-7 **Depth:** 45'-47'
Sample Number: S-10 **Date:** 3/3/16

Craig Testing Laboratories, Inc.

Mays Landing, New Jersey

Client: Mott MacDonald
Project: Penn East
Interstae 81 - Wilkes-Barre, PA
Project No: 548000U **Plate** 9

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	41.0	12.3	7.7	24.6	9.9	4.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	71.8		
#4	59.0		
#8	49.0		
#10	46.7		
#16	45.0		
#30	41.9		
#50	34.1		
#100	19.7		
#200	14.4		

* (no specification provided)

Material Description

Brown silty SAND with gravel

Atterberg Limits

LL= NV PL= NP PI= NP

Coefficients

D_{85}= 13.6511 D_{60}= 5.1308 D_{50}= 2.5182
D_{30}= 0.2476 D_{15}= 0.0796 D_{10}= 0.0461
C_u= 111.24 C_c= 0.26

Classification

USCS= SM

Remarks

WC:11.5%
NP: Non-Plastic
NV: No-Value

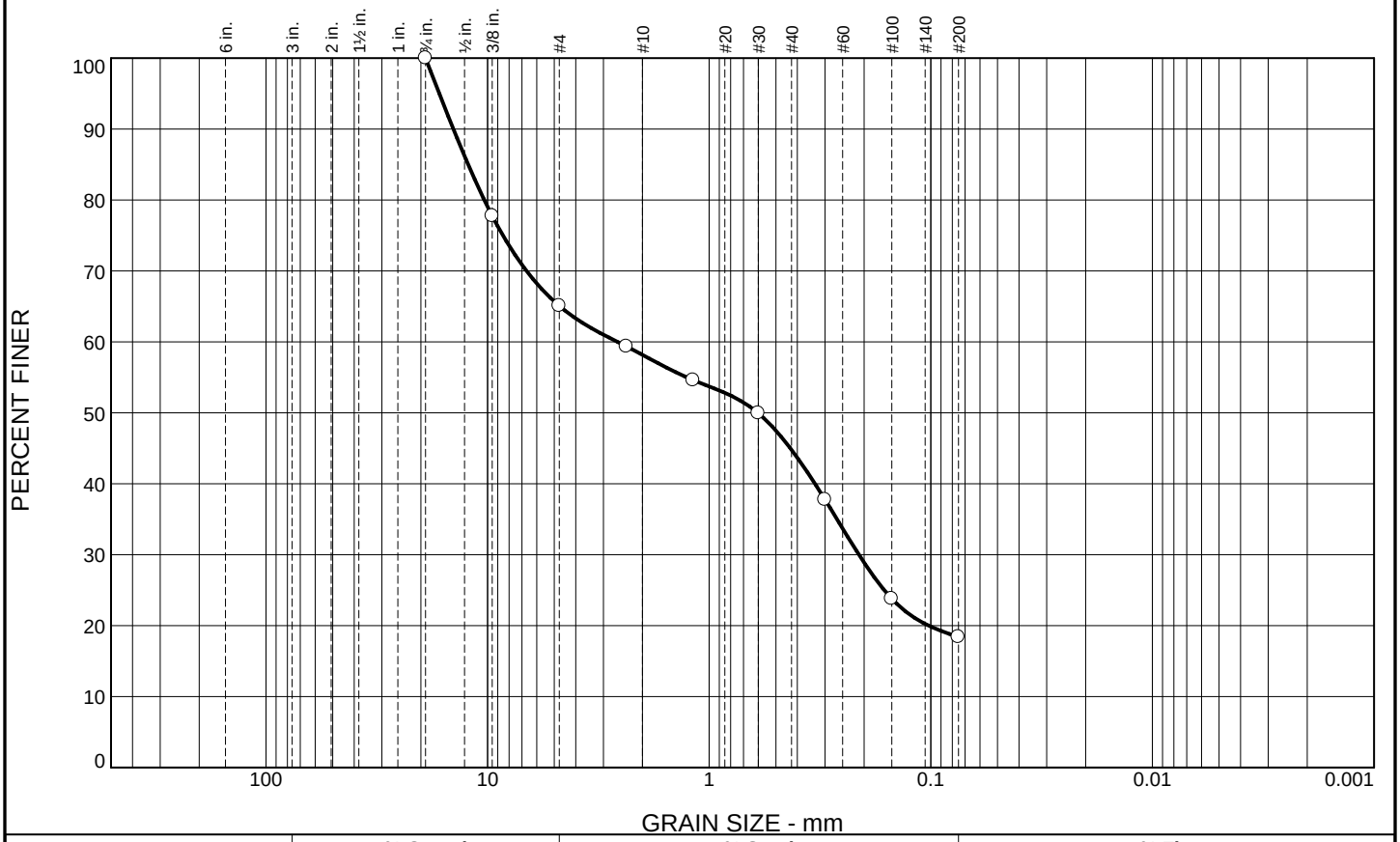
Source of Sample: B-7 **Depth:** 50'-52'
Sample Number: S-11 **Date:** 3/3/16

Craig Testing Laboratories, Inc.

Mays Landing, New Jersey

Client: Mott MacDonald
Project: Penn East
Interstae 81 - Wilkes-Barre, PA
Project No: 548000U **Plate** 10

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	34.9	6.9	13.4	26.4	18.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	77.7		
#4	65.1		
#8	59.4		
#16	54.6		
#30	49.9		
#50	37.7		
#100	23.8		
#200	18.4		

* (no specification provided)

Material Description

Brown silty\clayey SAND with gravel

Atterberg Limits

LL= PL= PI=

Coefficients

D_{85}= 12.2359 D_{60}= 2.5934 D_{50}= 0.6029
D_{30}= 0.2110 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM\SC

Remarks

WC: 11.0%

Source of Sample: B-7 **Depth:** 55'-57'
Sample Number: S-12

Date: 3/3/16

Craig Testing Laboratories, Inc.

Mays Landing, New Jersey

Client: Mott MacDonald
Project: Penn East
Interstae 81 - Wilkes-Barre, PA
Project No: 548000U **Plate** 11

GEOTECHNICAL LABORATORY TESTING RESULTS

CLIENT: Mott MacDonald
111 Wood Ave South
Iselin, NJ 08830-4112

ATTN: Ms. Erica Viglirolo

PROJECT: Penn East
Interstae-81
Wilkes-Barre, PA

CTL # 548000T
CTB # 150167

DATE: March 3, 2016

CHECKED BY: Eduardo M. Freire, P.E.
Geotechnical Laboratory Manager

SAMPLES RECEIVED: February 22, 2016

SAMPLES TESTED: 2/22/16 - 3/3/16

LAB TECHNICIAN(S): J. Veach

Test Boring No.	Sample No.	Depth (ft)	Water Content (%) (ASTM D2216)	Atterberg Limits (ASTM D4318)			Rock Unconfined Compression* (ASTM D7012-C)^	Unit Weight of Oven Dried Rock (pcf)	Point Load Strength (ASTMD D5731)	Sulfate (mg/L) (ASTM D4327)	Chloride (mg/L) (ASTM D4327)	pH of Soil (ASTM G51)	Consolidation* (ASTM D2435)	UU Triaxial* (ASTM D2850)	CU Triaxial (ASTM D4767)	Soil Perm. Class Rating (NJAC 7:9A-6.3)					
				LL	PL	PI										A	B				
B-7	R-1	71.2-71.9							PR-1												
		72.9-74					RUC-1														
	R-2	75.6-75.3					RUC-2														
		76.9-77.6							PR-2												
		77.6-76.2						164.5													
Billing Total:							**2**	**1**	**2**												

Comments/Remarks: *See attached Plates

CRAIG TESTING LABORATORIES, INC.
5439 Harding Highway, PO Box 427 - Mays Landing, NJ 08330
Lab: (609) 625-0386: Fax: (609) 625-9133

CRAIG TESTING LABORATORIES, INC.
5439 Harding Highway • P.O. Box 427 • Mays Landing, NJ 08330 • P:609.625.1700 • F:609.625.1798

ROCK UNCONFINED COMPRESSIVE STRENGTH TEST REPORT

(ASTM D 7012 - Method C)

Client: Mott MacDonald Test Date: March 1, 2016 Plate : RC-1

Project: Penn East Intersate 81 - Wilkes-Barre PA CTL #: 548000T

Tested By: J. Veach Checked By: E. Freire

Boring No.: B-7 Core Run: R-1 Depth (ft): 72.9-74

Core Data:
Avg. Length (inch) = 4.772 Avg. Diameter (inch) = 1.979
L/D Ratio (2.0 to 2.5) = 2.41 Area (inch^2) = 3.077
Dry Unit Weight (pcf) 162.6

Note: Test specimen not prepared in accordance with D4543

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 16,547 psi = 16.5 ksi

Boring No.: B-7 Core Run: R-2 Depth (ft): 75.6-76.3

Core Data:
Avg. Length (inch) = 4.934 Avg. Diameter (inch) = 1.983
L/D Ratio (2.0 to 2.5) = 2.49 Area (inch^2) = 3.088
Dry Unit Weight (pcf) 164.5

Note: Test specimen not prepared in accordance with D4543

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 11,676 psi = 11.7 ksi

CRAIG TESTING LABORATORIES, INC.
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POINT LOAD STRENGTH INDEX OF ROCK REPORT

(ASTM D-5731)

Client:	Mott MacDonald	Test Date:	March 1, 2016	Plate :	PR-1
Project:	Penn East - Interstate 81 - Wilkes-Barre-PA			CTL #:	548000T
Boring No.:	B-7	Core Run:	R-1	Depth (ft):	71.2-71.9	Tested By:	J. Veach
As Received Water Content (%):	0.2%			Checked By:	E. Freire

DIAMETRAL TEST 1

Length, L (in):	2.08	SPECIMEN PHOTOGRAPH	Failure Load, P (lbs):	3,495
Diameter, D (in):	1.94		Uncorrected Point Load Index I_s (psi):	925
L/D Ratio (>1):	1.07		Size Correction Factor, F:	0.994
Length to Nearest Free End, L' (>0.5D (>1")) (in):	1.10		Corrected Point Load Index $I_{s(50)}$ (psi):	920
Equivalent Core Diameter, D_e = D (in):	1.94		Index to Strength Conversion Factor, K	22.8
Reduced Core Diameter, D' = D (in):	1.94		**Est. Uniaxial Compresive Strength, s_c (psi):**	**21,005**
Comments:				

DIAMETRAL TEST 2

Length, L (in):	2.08	SPECIMEN PHOTOGRAPH	Failure Load, P (lbs):	3,127
Diameter, D (in):	1.95		Uncorrected Point Load Index I_s (psi):	820
L/D Ratio (>1):	1.06		Size Correction Factor, F:	0.996
Length to Nearest Free End, L' (>0.5D (>1"))(in):	1.20		Corrected Point Load Index $I_{s(50)}$ (psi):	817
Equivalent Core Diameter, D_e = D (in):	1.95		Index to Strength Conversion Factor, K	22.9
Reduced Core Diameter, D' = D (in):	1.95		**Est. Uniaxial Compresive Strength, s_c (psi):**	**18,712**
Comments:				

AXIAL TEST

Distance, D = D_e (in): (0.3W<D<W (0.6 to 2"))	1.75	SPECIMEN PHOTOGRAPH	Failure Load, P (lbs):	4,145
Average Width, W (in):	1.95		Uncorrected Point Load Index I_s (psi):	955
Reduced Core Distance, D' = D (in):	1.75		Size Correction Factor, F:	0.948
Minimum Cross-Sectional Area, A (in^2)	3.41		Corrected Point Load Index $I_{s(50)}$ (psi):	905
Equivalent Core Area, D_e^2 (in^2):	4.34		Index to Strength Conversion Factor, K	21.5
			Est. Uniaxial Compresive Strength, s_c (psi):	**19,496**
Comments:				

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POINT LOAD STRENGTH INDEX OF ROCK REPORT

(ASTM D-5731)

Client:	Mott MacDonald	Test Date:	March 1, 2016	Plate :	PR-2
Project:	Penn East - Interstate 81 - Wilkes-Barre-PA			CTL #:	548000T
Boring No.:	B-7	Core Run:	R-2	Depth (ft):	76.9-77.6
As Received Water Content (%):	0.2%			Checked By:	E. Freire

DIAMETRAL TEST 1

Length, L (in):	3.05	SPECIMEN PHOTOGRAPH	Failure Load, P (lbs):	3,513
Diameter, D (in):	1.98		Uncorrected Point Load Index I_s (psi):	893
L/D Ratio (>1):	1.54		Size Correction Factor, F:	1.003
Length to Nearest Free End, L' (>0.5D (>1")) (in):	1.20		Corrected Point Load Index $I_{s(50)}$ (psi):	896
Equivalent Core Diameter, D_e = D (in):	1.98		Index to Strength Conversion Factor, K	23.1
Reduced Core Diameter, D' = D (in):	1.98		**Est. Uniaxial Compresive Strength, s_c (psi):**	**20,708**
Comments:				

DIAMETRAL TEST 2

Length, L (in):	3.29	SPECIMEN PHOTOGRAPH	Failure Load, P (lbs):	4,062
Diameter, D (in):	1.98		Uncorrected Point Load Index I_s (psi):	1,032
L/D Ratio (>1):	1.66		Size Correction Factor, F:	1.004
Length to Nearest Free End, L' (>0.5D (>1"))(in):	1.60		Corrected Point Load Index $I_{s(50)}$ (psi):	1,036
Equivalent Core Diameter, D_e = D (in):	1.98		Index to Strength Conversion Factor, K	23.1
Reduced Core Diameter, D' = D (in):	1.98		**Est. Uniaxial Compresive Strength, s_c (psi):**	**23,937**
Comments:				

AXIAL TEST

Distance, D = D_e (in): (0.3W<D<W (0.6 to 2"))	1.81	SPECIMEN PHOTOGRAPH	Failure Load, P (lbs):	4,238
Average Width, W (in):	1.98		Uncorrected Point Load Index I_s (psi):	927
Reduced Core Distance, D' = D (in):	1.81		Size Correction Factor, F:	0.963
Minimum Cross-Sectional Area, A (in^2)	3.59		Corrected Point Load Index $I_{s(50)}$ (psi):	893
Equivalent Core Area, D_e^2 (in^2):	4.57		Index to Strength Conversion Factor, K	21.9
			Est. Uniaxial Compresive Strength, s_c (psi):	**19,589**
Comments:				

GEOTECHNICAL LABORATORY TESTING RESULTS

CLIENT: Mott MacDonald
111 Wood Ave South
Iselin, New Jersey 08830-4112

ATTN: Mr. Dafydd Chandler

PROJECT: Penn East Pipeline
I81 Crossing Median

CTL # 548000BX
CTB # 150167

DATE: May 4, 2017

CHECKED BY: Eduardo M. Freire, P.E.
Geotechnical Laboratory Manager

SAMPLES RECEIVED: April 25, 2017

SAMPLES TESTED: 4/25/17 - 5/4/17

LAB TECHNICIAN(S): J. Veach and d. Nhun

Test Boring No.	Sample No.	Depth (ft)	Water Content (%) (ASTM D2216)	Atterberg Limits (ASTM D4318)			Particle Size Analysis (Sieve Only)* (ASTM D422)	Particle Size Analysis with Hydrometer* (ASTM D422)	Rock Unconfined Compression w/ Stress-Strain (ASTM D7012-D)^/*	Point Load Strength (ASTMD D5731)	Sulfate (ppm (mg/kg)) (ASTM D516)	Chloride (ppm (mg/kg)) (ASTM D512B)	Consolidation* (ASTM D2435)	UU Triaxial* (ASTM D2850)	CU Triaxial (ASTM D4767)	Soil Perm. Class Rating (NJAC 7:9A-6.3)					
				LL	PL	PI										A	B				
B-I81-3	S-2	5-7						PSA-1													
	S-4	15-17	10.7	21	9	12		PSA-2													
Billing Total:			**0**	**1**				**2**													

Comments/Remarks: *See attached Plates

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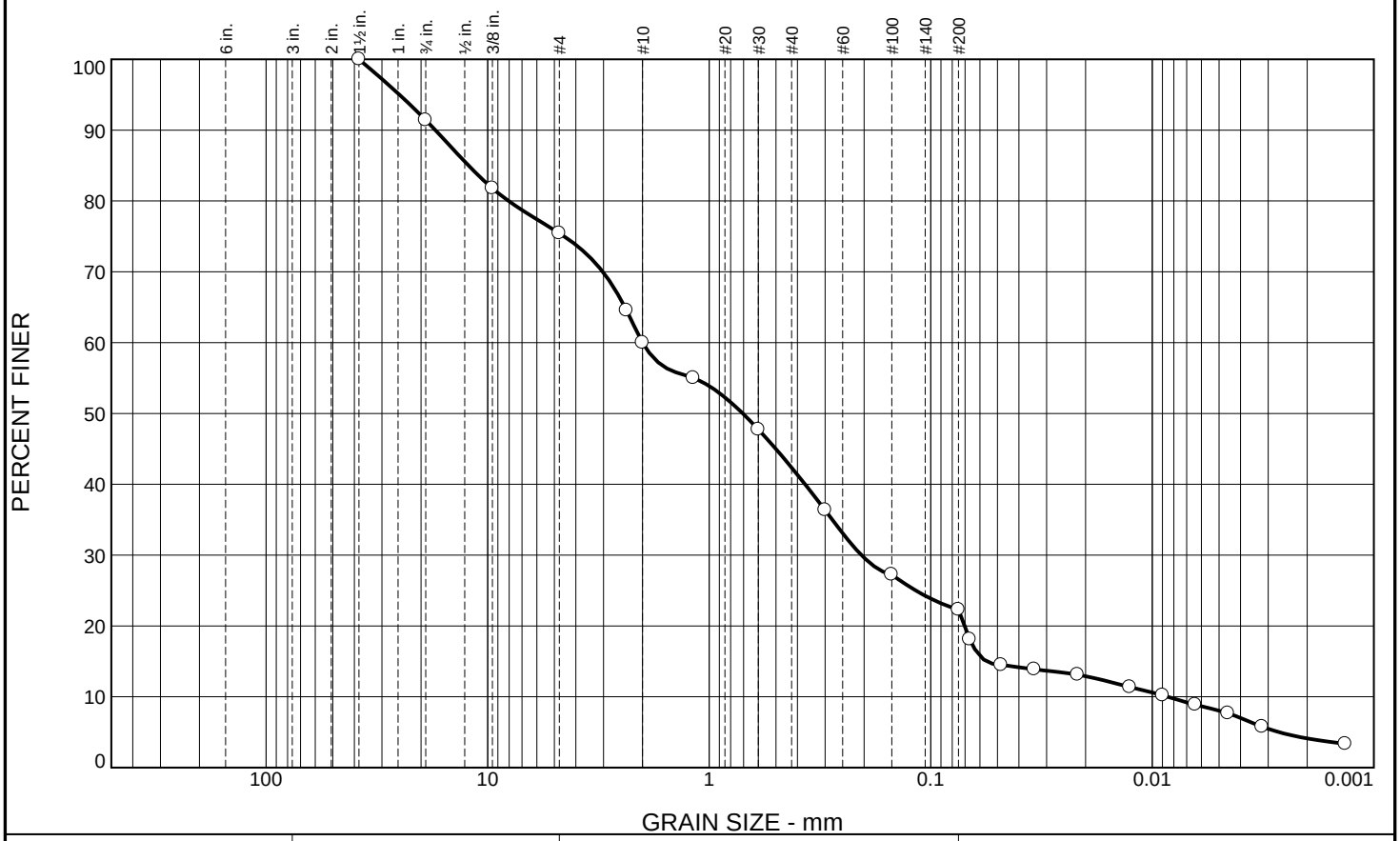
Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	8.6	16.0	15.4	17.6	20.1	14.3	8.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
.75	91.4		
.375	81.8		
#4	75.4		
#8	64.5		
#10	60.0		
#16	55.0		
#30	47.7		
#50	36.3		
#100	27.3		
#200	22.3		

* (no specification provided)

Material Description

Black silty\clayey SAND with gravel

Atterberg Limits

LL= PL= PI=

Coefficients

D_{85}= 12.2052 D_{60}= 1.9997 D_{50}= 0.7054
D_{30}= 0.2056 D_{15}= 0.0561 D_{10}= 0.0085
C_u= 234.80 C_c= 2.48

Classification

USCS= SM\SC

Remarks

Source of Sample: B-I81-3 **Depth:** 5'-7'
Sample Number: S-2 **Date:** 5/4/17

CRAIG TESTING LABORATORIES, INC.
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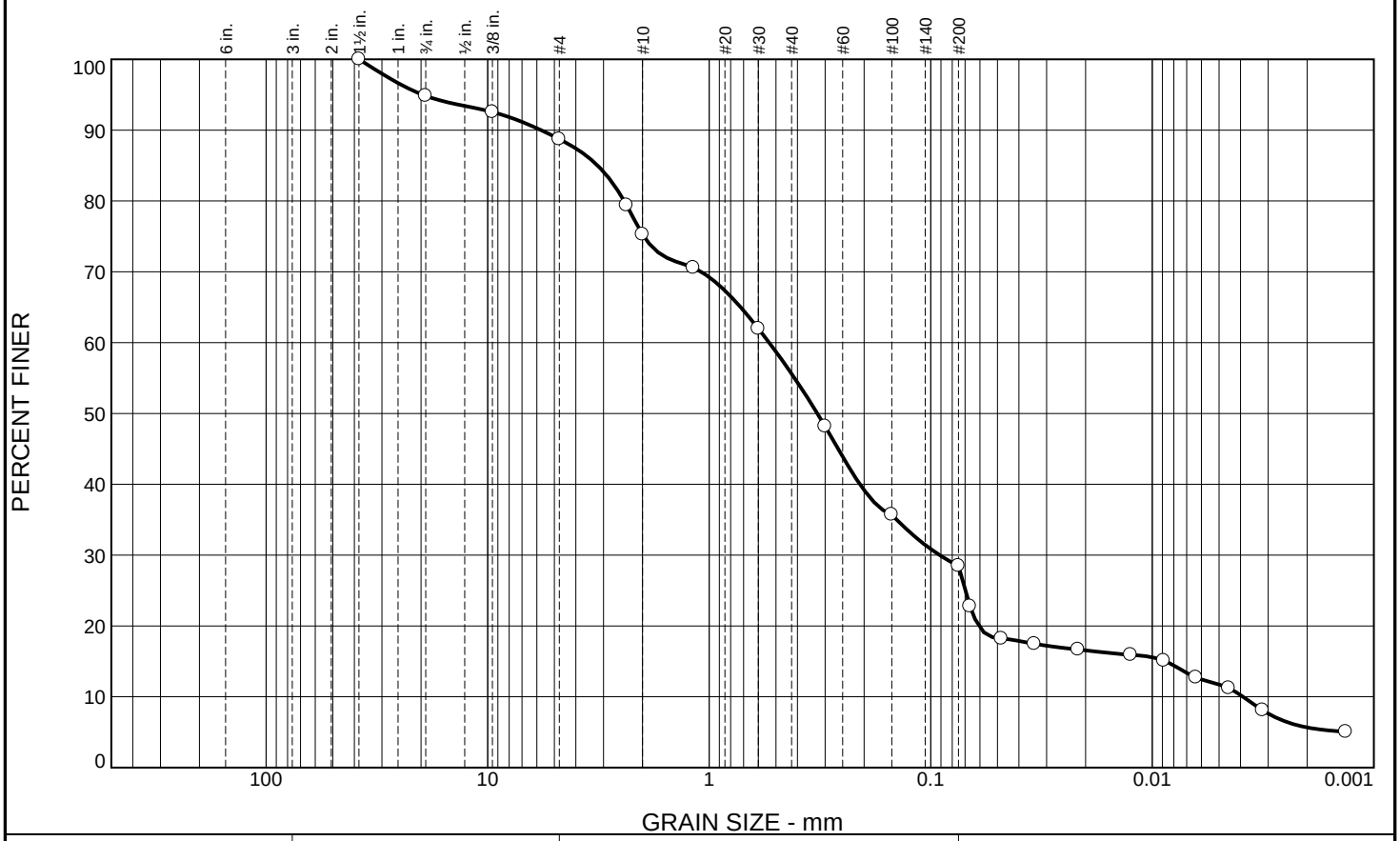
Mays Landing, NJ 609-625-1700

Client: Mott MacDonald
Project: Penn East - I81 crossing Median

Project No: 548000BX **Plate** PSA-1

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.2	6.1	13.4	19.7	27.1	16.8	11.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
.75	94.8		
.375	92.6		
#4	88.7		
#8	79.4		
#10	75.3		
#16	70.6		
#30	62.0		
#50	48.2		
#100	35.7		
#200	28.5		

* (no specification provided)

Material Description

Black clayey SAND

Atterberg Limits

LL= 21 PL= 9 PI= 12

Coefficients

D_{85}= 3.1899 D_{60}= 0.5364 D_{50}= 0.3251
D_{30}= 0.0912 D_{15}= 0.0087 D_{10}= 0.0039
C_u= 137.84 C_c= 3.98

Classification

USCS= SC

Remarks

Water Content (WC): 10.7%

Source of Sample: B-I81-3 **Depth:** 15'-17'
Sample Number: S-4 **Date:** 5/4/17

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Client: Mott MacDonald
Project: Penn East - I81 crossing Median

Project No: 548000BX **Plate** PSA-2

GEOTECHNICAL LABORATORY TESTING RESULTS

AASHTO R18

US Army Corps of Engineers

CLIENT: Mott MacDonald
111 Wood Ave South
Iselin, New Jersey 08830-4112

ATTN: Mr. Dafydd Chandler

PROJECT: Penn East Pipeline
I81 Crossing Median

CTL # 548000BY
CTB # 150167

DATE: May 9, 2017

CHECKED BY: Eduardo M. Freire, P.E.
Geotechnical Laboratory Manager

SAMPLES RECEIVED: April 25, 2017 **SAMPLES TESTED:** 4/25/17 - 5/9/17 **LAB TECHNICIAN(S):** J. Veach and D. Nhun

Test Boring No.	Sample No.	Depth (ft)	Water Content (%) (ASTM D2216)	Atterberg Limits (ASTM D4318) LL	PL	PI	Particle Size Analysis (Sieve Only)* (ASTM D422)	Particle Size Analysis with Hydrometer* (ASTM D422)	Rock Unconfined Compression w/ Stress-Strain (ASTM D7012-D)^*	Unit Weight of Oven Dried Rock (pcf)	Chloride (mg/L) (ASTM D4327)	pH of Soil (ASTM G51)	Consolidation* (ASTM D2435)	UU Triaxial* (ASTM D2850)	CU Triaxial (ASTM D4767)	Soil Perm. Class Rating (NJAC 7:9A-6.3) A	B
B-I81-3	R-1	25.78-27.35							RSS-1								
	R-2	32.83-33.5							RSS-2								
	R-2	33.52-34.14								165							
	R-4	43.05-43.7							RSS-3								
	R-4	44.38-44.8								167.1							
	R-8	63.3-65							RSS-4								
	R-18	114.42-114.6								165.1							
	R-18	113.78-114.4							RSS-5								
Billing Total:									**5**	**3**							

Comments/Remarks: *See attached Plates

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Lab: (609) 625-0386: Fax: (609) 625-9133

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

(ASTM D 7012 - Method D)

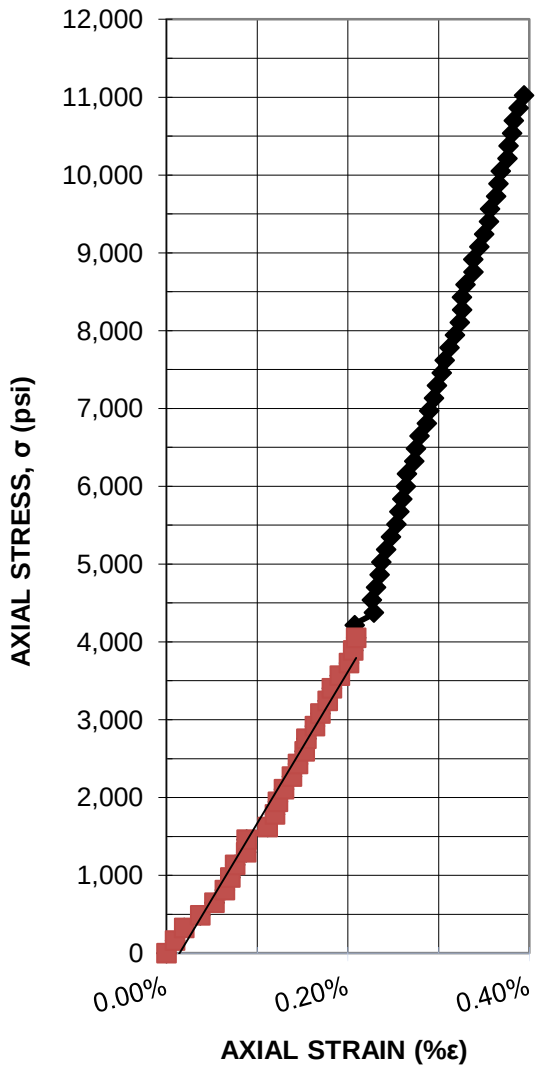
Client:	Mott MacDonald	Test Date:	May 8, 2017	Plate :	RSS-1
Project:	Penn East - I81 - Crossing Median			CTL #:	548000BY
Boring No.:	B-I-81-3	Core Run:	R-1	Depth (ft):	25.78-27.35
Description:	Gray SANDSTONE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.851	Avg. Diameter (inch) =	1.982
L/D Ratio (2.0 to 2.5) =	2.45	Area (inch^2) =	3.085
Dry Unit Weight (pcf)	167.8		

Note: Test specimen not prepared in accordance with D4543

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 11,143 psi = 11.1 ksi

ESTIMATED YOUNG'S MODULUS, E: 1.94E+06 psi (Avg. Linear Portion of Curve, shown)

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

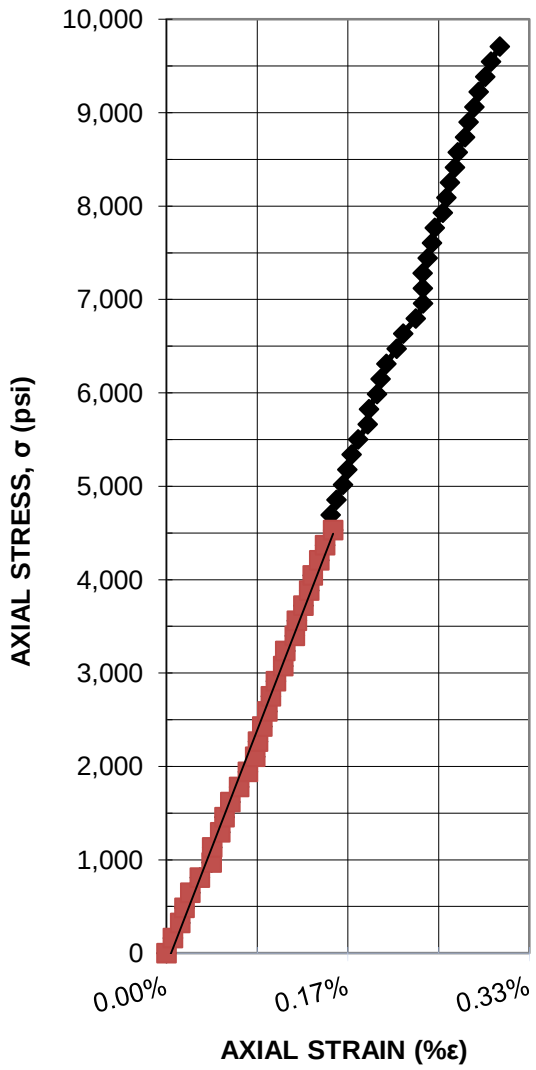
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	May 8, 2017	Plate :	RSS-2
Project:	Penn East - I81 - Crossing Median			CTL #:	548000BY
Boring No.:	B-I-81-3	Core Run:	R-2	Depth (ft):	32.83-33.5
Description:	Gray SANDSTONE			Checked By:	E. Freire

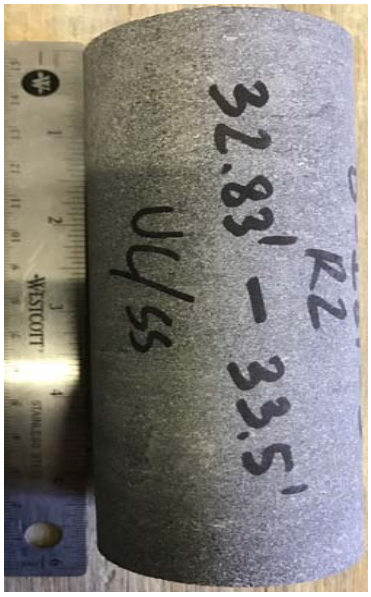
Core Data:

Avg. Length (inch) =	4.890	Avg. Diameter (inch) =	1.984
L/D Ratio (2.0 to 2.5) =	2.47	Area (inch^2) =	3.090
Dry Unit Weight (pcf)	166.7	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS



BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 9,819 psi = 9.8 ksi

ESTIMATED YOUNG'S MODULUS, E: 2.99E+06 psi (Avg. Linear Portion of Curve, shown)

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

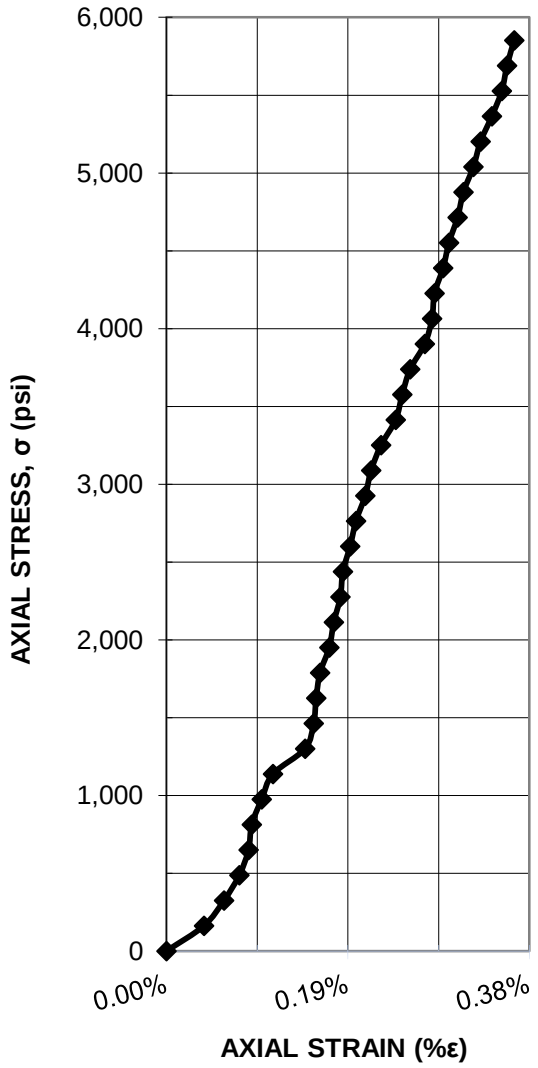
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	May 8, 2017	Plate :	RSS-3
Project:	Penn East - I81 - Crossing Median			CTL #:	548000BY
Boring No.:	B-I-81-3	Core Run:	R-4	Depth (ft):	43.05-43.7
Description:	Gray SILTSTONE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.725	Avg. Diameter (inch) =	1.979
L/D Ratio (2.0 to 2.5) =	2.39	Area (inch^2) =	3.076
Dry Unit Weight (pcf)	166.4	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE

AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u:	**5,979**	**psi**	**=**	**6.0 ksi**

ESTIMATED YOUNG'S MODULUS, E:	**-**	**psi**	**(No suitable linear portion to estimate)**

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

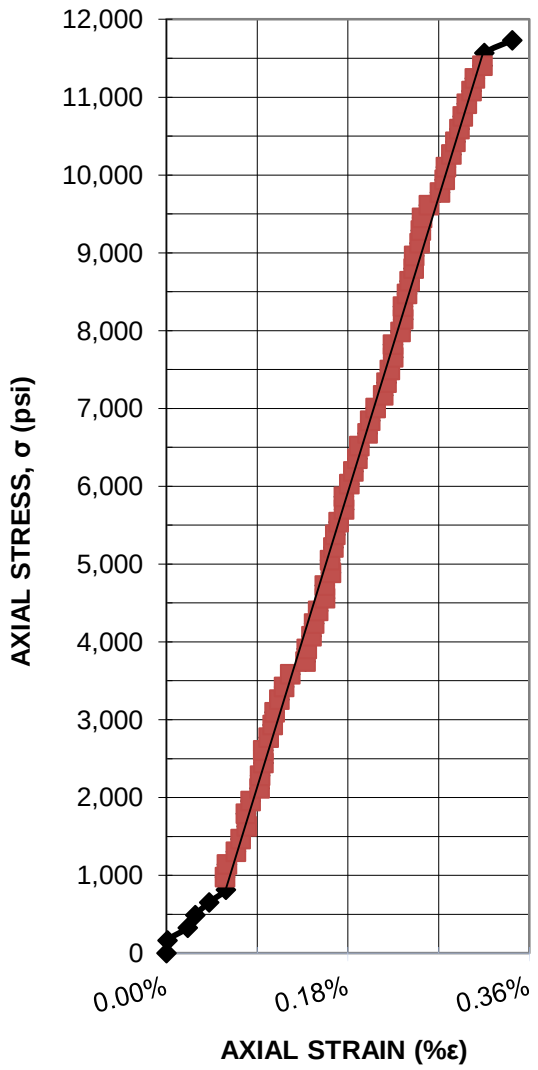
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	May 8, 2017	Plate :	RSS-4
Project:	Penn East - I81 - Crossing Median			CTL #:	548000BY
Boring No.:	B-I-81-3	Core Run:	R-8	Depth (ft):	63.3-65
Description:	Gray QUARTZITE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.774	Avg. Diameter (inch) =	1.977
L/D Ratio (2.0 to 2.5) =	2.41	Area (inch^2) =	3.069
Dry Unit Weight (pcf)	165.5	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

BEFORE AFTER

UNIAXIAL COMPRESSIVE STRENGTH, σ_u:	**11,903**	**psi**	**=**	**11.9** **ksi**

ESTIMATED YOUNG'S MODULUS, E:	**4.08E+06**	**psi** (Avg. Linear Portion of Curve, shown)

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ROCK UNCONFINED COMPRESSION TEST WITH STRESS-STRAIN CURVE REPORT

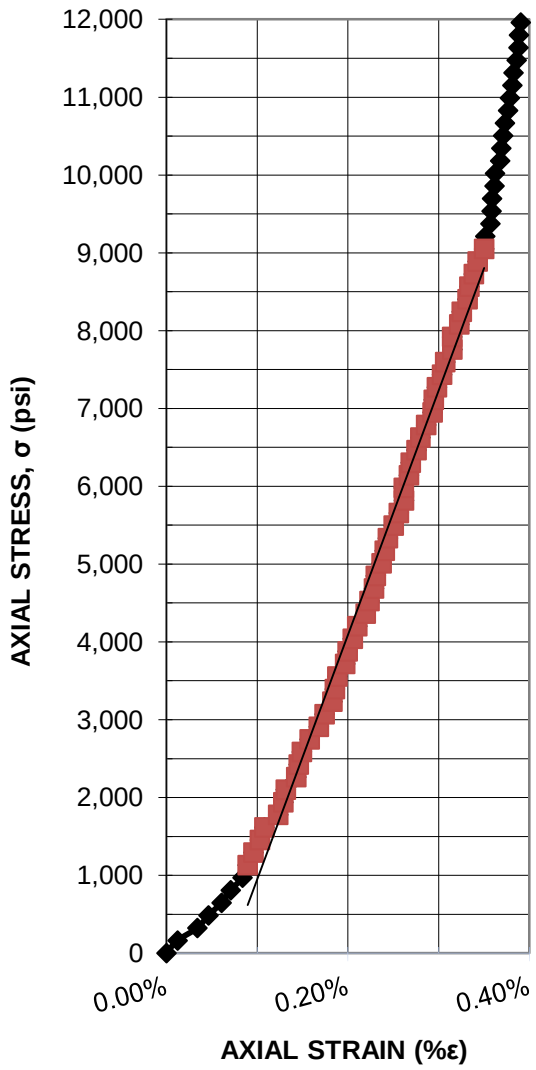
(ASTM D 7012 - Method D)

Client:	Mott MacDonald	Test Date:	May 8, 2017	Plate :	RSS-5
Project:	Penn East - I81 - Crossing Median			CTL #:	548000BY
Boring No.:	B-I-81-3	Core Run:	R-18	Depth (ft):	113.78-114.4
				Tested By:	J. Veach
Description:	Gray SANDSTONE			Checked By:	E. Freire

Core Data:

Avg. Length (inch) =	4.550	Avg. Diameter (inch) =	1.985
L/D Ratio (2.0 to 2.5) =	2.29	Area (inch^2) =	3.094
Dry Unit Weight (pcf)	166.7	Note: Test specimen not prepared in accordance with D4543	

AXIAL STRESS-STRAIN CURVE



ROCK SPECIMEN PHOTOGRAPHS

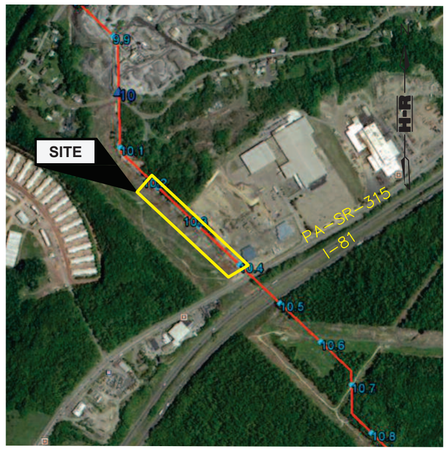
BEFORE

AFTER

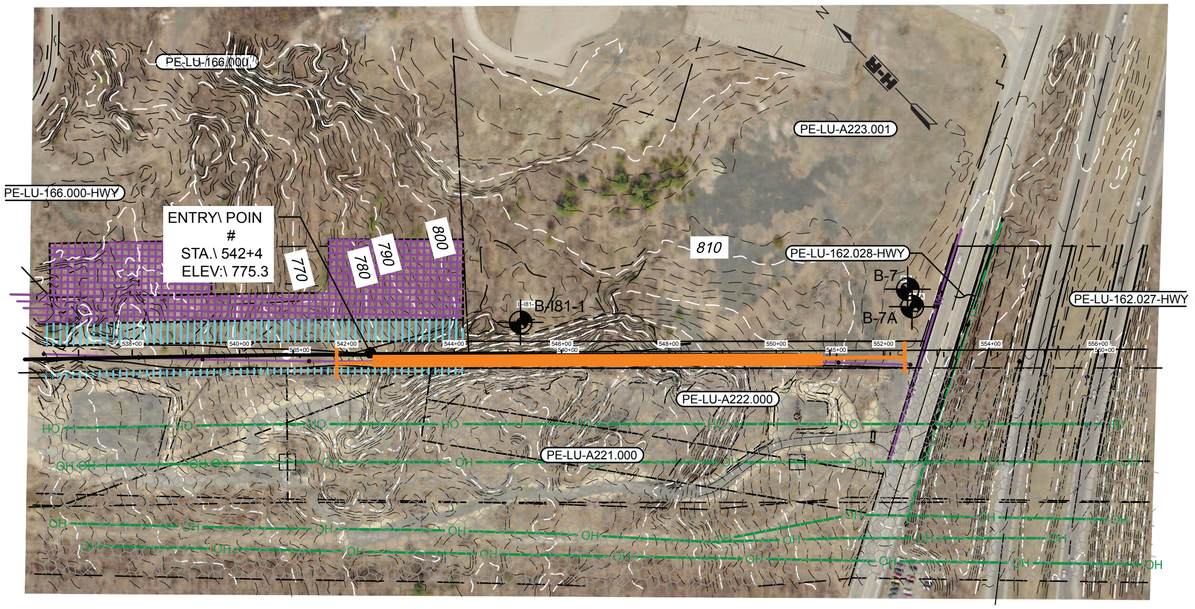
UNIAXIAL COMPRESSIVE STRENGTH, σ_u: 12,001 psi = 12.0 ksi

ESTIMATED YOUNG'S MODULUS, E: 3.04E+06 psi (Avg. Linear Portion of Curve, shown)

F. Geophysical Investigation Report



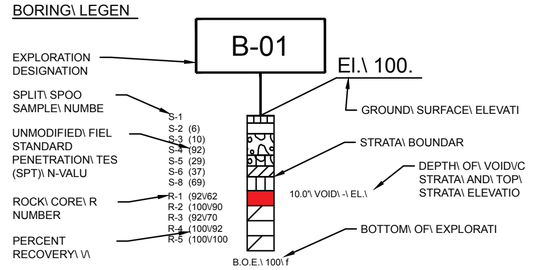
NOT TO SCALE



SOIL\ AND\ ROCK\ STRATAGRAPHIC\ LEG

ML	CL	GW	GP	FILL
SANDSTONE	SC	SM	SP	TOPSOIL
COAL	DECOMPOSED ROCK	VOID	MUDSTONE	CONGLOMERATE
SHALE	SLATE	QUARTZITE	GRAVEL-STONE	

BORING\ LEGEN

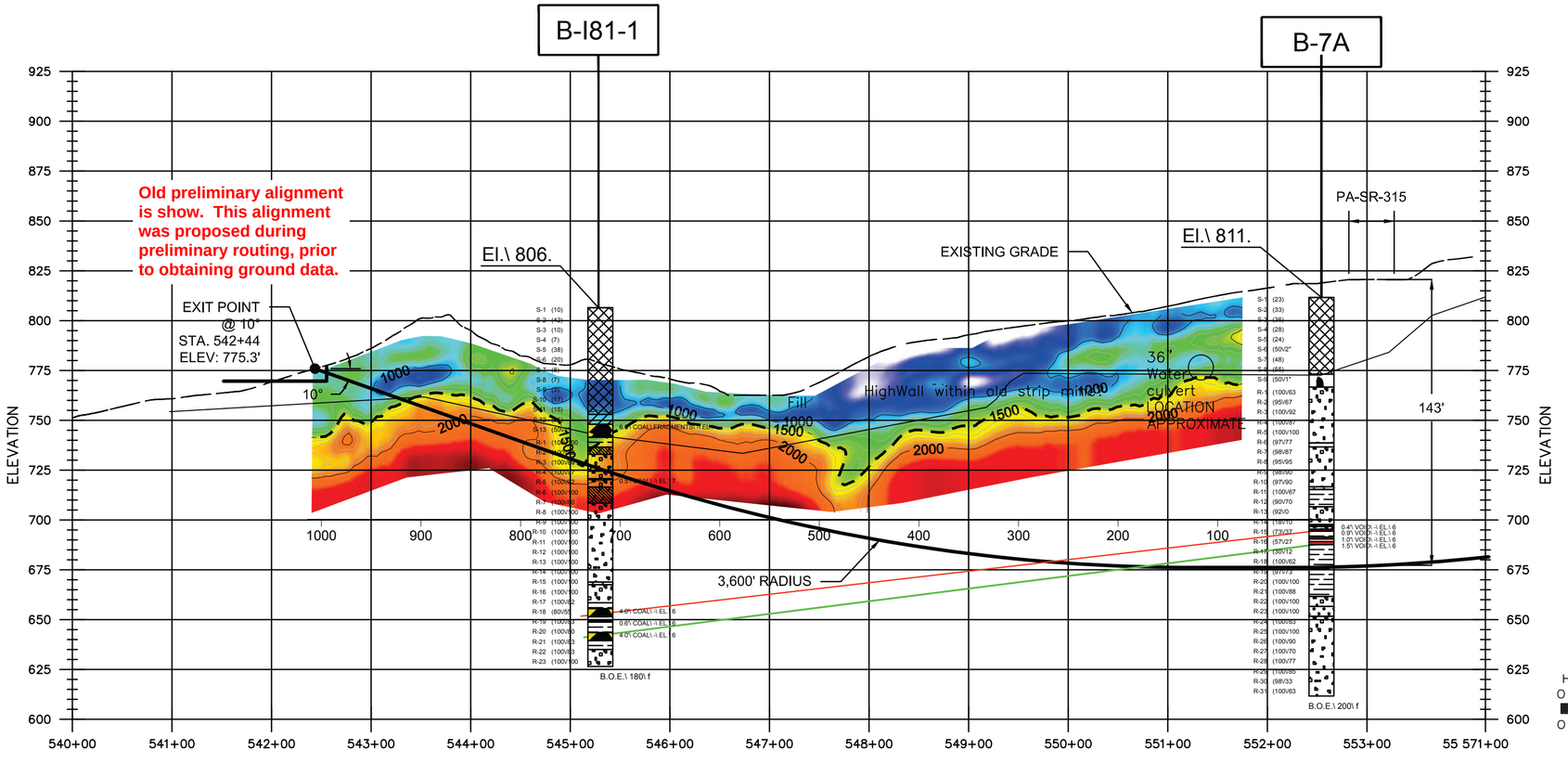


SCALE (feet)
0 200 400

LEGEND

MASW Seismic Line with indication of MASW effective data coverage in bold

Top of bedrock determined from MASW



Fill/Soil ◄► Bedrock

Vs (ft/s)

1000 1500 2000 2500 3000 3500 4000

NOTES:

1. Surface elevations determined from Site plan entitled A_Contours_Basefile_A-4_DEIS.dwg provided by Mott MacDonald
2. Estimated standard deviation of depth of bedrock is 15% or ± 5 feet, whichever is greater.
3. The depths along the MASW line determined for bedrock are depths of competent rock; weathered and/or fractured bedrock might occur at shallower depths.
4. MASW data acquired using a 48-channel digital seismograph (Geometrics Geode) coupled to 48 4.5-Hz geophones.
5. MASW data were analyzed using SurfSeis 4 software by Kansas Geological Survey.

HORIZONTAL SCALE (feet)
0 100 200

VERTICAL SCALE (feet)
0 50 100

Plate 1
MASW Results
PA-SR-315 & I-81 HDD
PennEast Pipeline Project
Hunterdon County Pennsylvania

File 15JCC19-7 | January 2017

HAGER-RICHTER
Salem, NH – Fords, NJ

mottmac.com