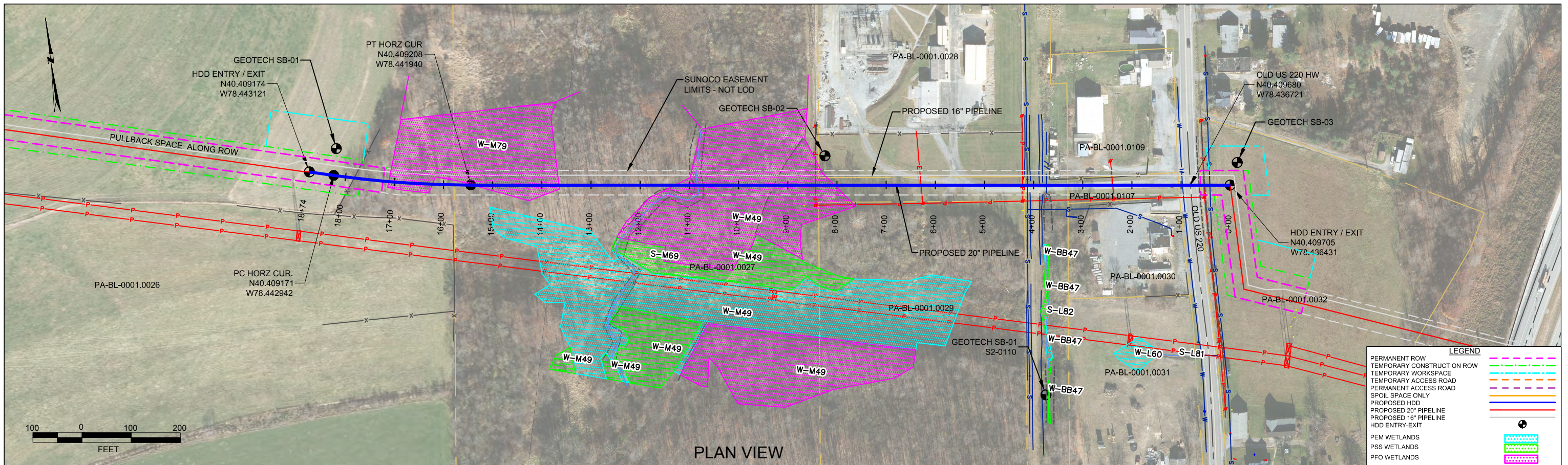


HDD PA-BL-0001.0027-RD (W-M79) (S-M69) (W-M49)

Given the design, the threat of inadvertent return has been reduced to the maximum extent practicable and in this case that threat is considered to be *low*. Implementing this design, along with adherence to the Pennsylvania Pipeline Project Inadvertent Return Contingency Plan will ensure inadvertent impacts, if they were to occur, are also minimized to the maximum extent.

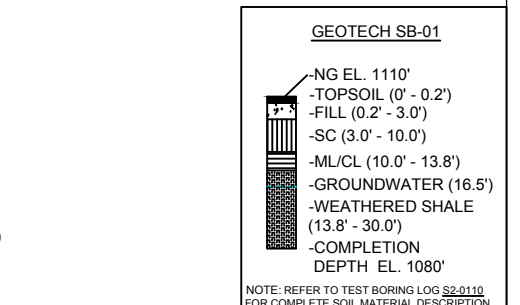
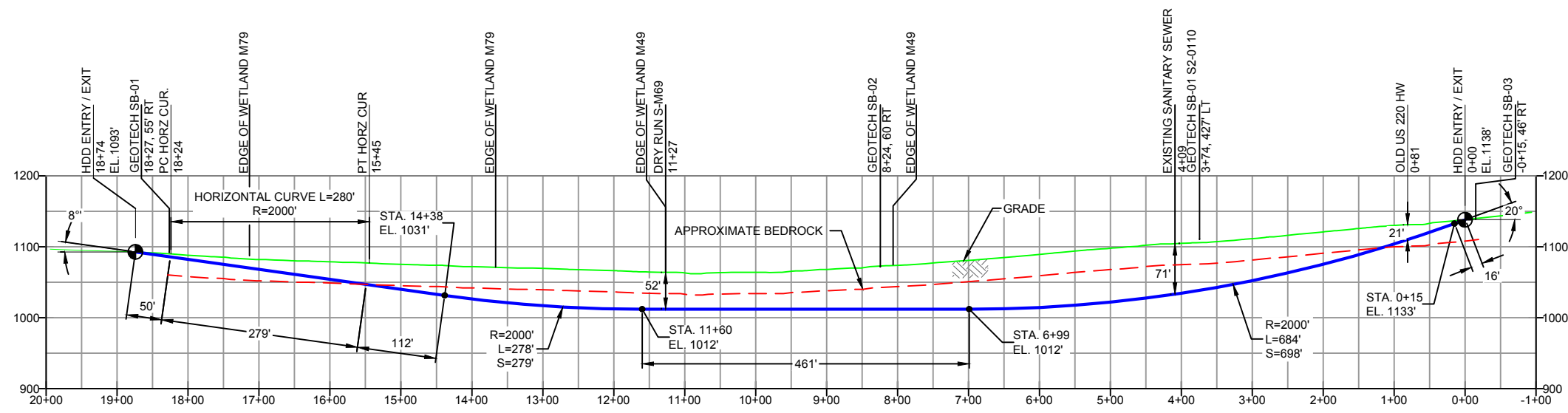
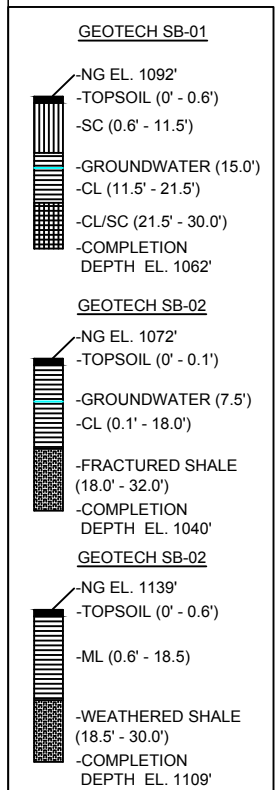
The drill will enter/exit 180 feet from the edge of the western most boundary of wetland W-M79. The drill will pass 350 feet under wetland W-M7. Using the results of the geotechnical investigation, as well as several other data points, the entry/exit, angles, and depths have been configured to pass through the best substrates while maintaining pipe integrity (e.g., no large bends). The majority of the substrate that will be passed through at this point is estimated to be fine to medium sand to clay at the western end of the wetland, soft silty clay at the central part of the wetland, and fine medium sand to clay at the eastern portion of the wetland. The drill will continue under the eastern most boundary of wetland W-M79 and will travel 230 feet to the western most edge of stream S-M69. The drill will pass beneath stream S-M69 for a total of 5 feet. The majority of the substrate that will be passed through is estimated to be soft silty clay. The drill will continue beneath stream S-M69 and will enter the western most edge of wetland W-M49. The drill will pass 320 feet under the wetland W-M49. The majority of the substrate that will be passed through is estimated to be shale. The drill will continue beneath wetland W-M49 and will enter/exit 900 feet from the eastern most edge of wetland W-M49.



PLAN VIEW

PROFILE VIEW

BLAIR COUNTY PENNSYLVANIA, BLAIR TOWNSHIP
S2-0109



NOTE: REFER TO TEST BORING LOG S2-0109 FOR COMPLETE SOIL MATERIAL DESCRIPTION

NOTE: REFER TO TEST BORING LOG S2-0110 FOR COMPLETE SOIL MATERIAL DESCRIPTION

- DESIGN AND CONSTRUCTION:
- CONTRACTOR SHALL FIELD VERIFY DEPTH OF ALL EXISTING UTILITIES SHOWN OR NOT SHOWN ON THIS DRAWING.
 - THE MINIMUM SEPARATION DISTANCE FROM EXISTING SUBSURFACE UTILITIES SHALL NOT BE LESS THAN 10 FEET AS MEASURED FROM THE OUTSIDE EDGE OF THE UTILITY TO OUTSIDE OF PROPOSED PIPELINE.
 - DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
 - CROSSING PIPE SPECIFICATION:
HDD HORZ. LENGTH (L=): 1874'
HDD PIPE LENGTH (S=): 1895'
20" x 0.456" W.T., X-65, API5L, PSL2, ERW, BFW
COATING: 14-16 MILS FBE WITH 30-35 MIL ARO (POWERCRETE R95)
 - INTERNAL DESIGN PRESSURE 1480 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50).
 - INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
 - PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS.
 - CARRIER PIPE NOT ENCASED.
 - PIPE / AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.
 - CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 1850 PSIG.
 - SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.
 - SUNOCO PIPELINE, L.P.'S HORIZONTAL DIRECTIONAL DRILL INADVERTENT RETURN CONTINGENCY PLAN WILL BE IMPLEMENTED AT ALL TIMES.
 - SUNOCO PIPELINE, L.P.'S EROSION AND SEDIMENTATION CONTROL PLAN WILL BE IMPLEMENTED AT ALL TIMES.

NOTES

- ALL COORDINATES SHOWN ARE IN LATITUDE AND LONGITUDE. ALL MSL ELEVATIONS ARE NAD83
- STATIONING IS BASED ON HORIZONTAL DISTANCES.
- ROONEY ENGINEERING, INC. AND SUNOCO PIPELINE, LP ARE NOT RESPONSIBLE FOR LOCATION OF FOREIGN UTILITIES SHOWN IN PLOT PLAN OR PROFILE. THE INFORMATION SHOWN HEREON IS FURNISHED WITHOUT LIABILITY ON THE PART OF ROONEY ENGINEERING, INC. AND SUNOCO PIPELINE, LP. FOR ANY DAMAGES RESULTING FROM ERRORS OR OMISSIONS THEREIN.
- CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UTILITIES. CONTACT ONE CALL AT 811 PRIOR TO DIGGING.
- SUNOCO EMERGENCY HOTLINE NUMBER IS #1-800-786-7440.

REF. DRAWING		REVISIONS		
ES-3.21	TO ES-3.22	EROSION & SEDIMENT PLAN	EP2 REVISED PER PADEP COMMENTS RECEIVED 09-06-16	
SHEET 13	TO SHEET 14	AERIAL SITE PLAN	EP1 REVISED PER PADEP COMMENTS	
			EP	
			C ADDED GEOTECH INFO	
			B ISSUED FOR BID	
			A ISSUED FOR REVIEW	
DWG NO	DWG NO	DESCRIPTION	NO.	DESCRIPTION

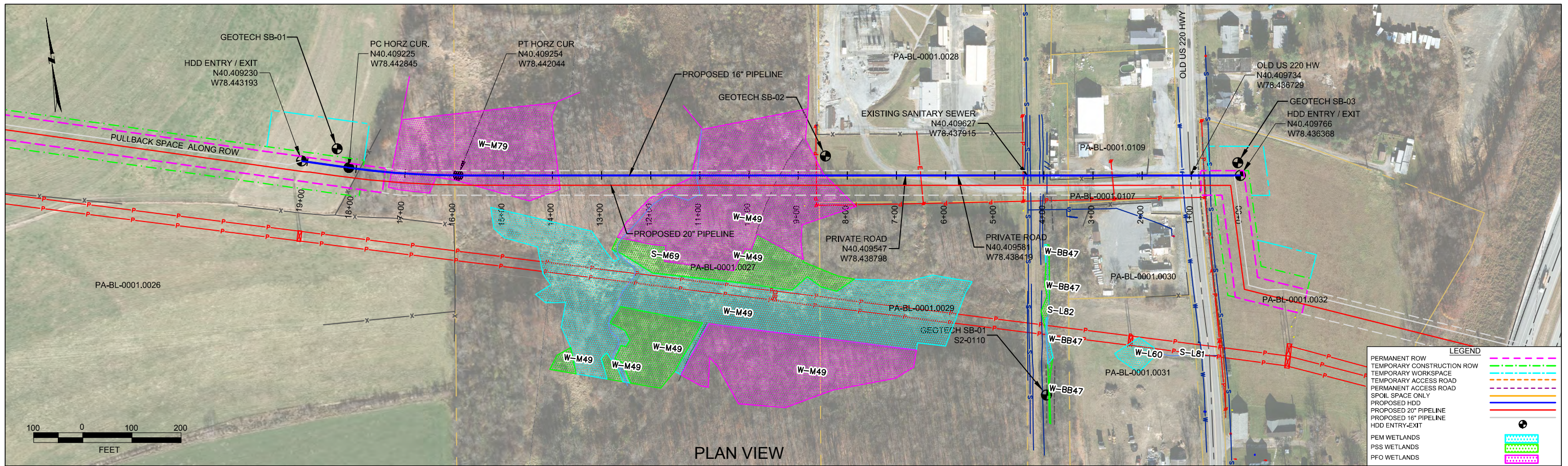
Sunoco Logistics Partners L.P.

TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

20-INCH HORIZONTAL DIRECTIONAL DRILL
OLD US 220 HWY
PENNSYLVANIA PIPELINE PROJECT

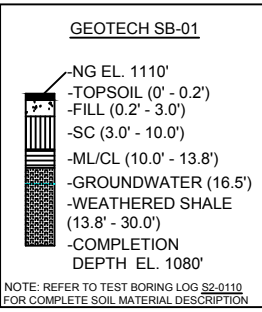
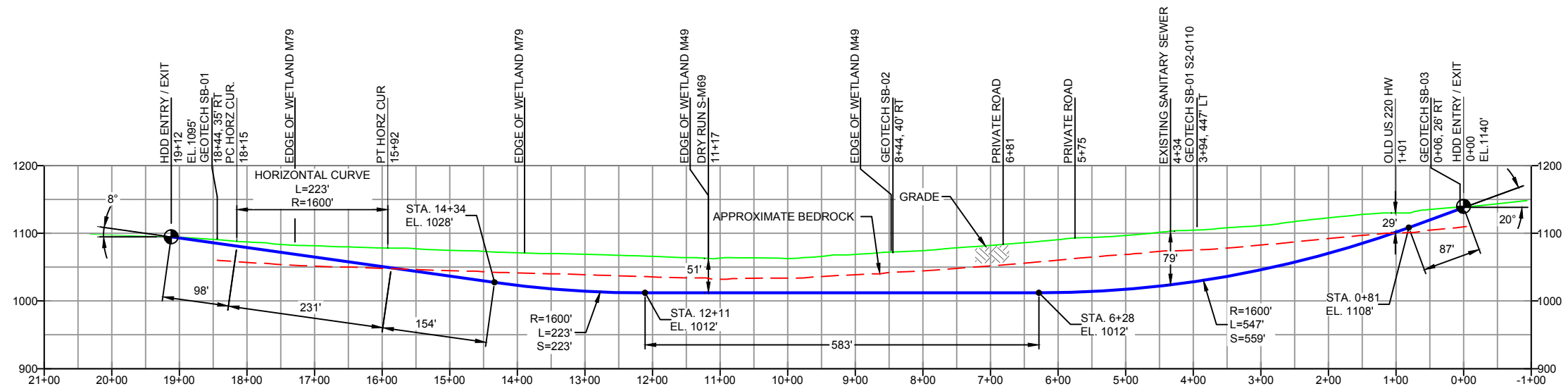
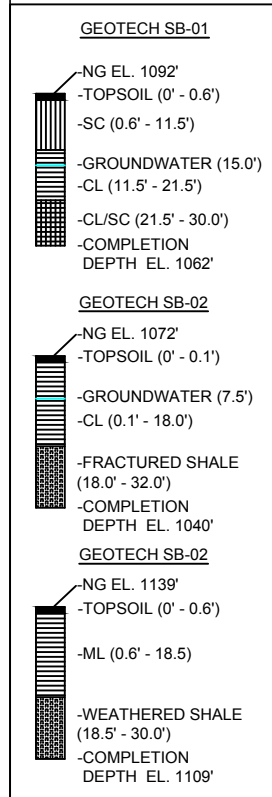
SCALE: 1"=200'
DWG. NO: PA-BL-0001.0027-RD



PLAN VIEW

BLAIR COUNTY PENNSYLVANIA, BLAIR TOWNSHIP
S2-0109-16

PROFILE VIEW



NOTE: REFER TO TEST BORING LOG S2-0109 FOR COMPLETE SOIL MATERIAL DESCRIPTION

NOTE: REFER TO TEST BORING LOG S2-0110 FOR COMPLETE SOIL MATERIAL DESCRIPTION

- DESIGN AND CONSTRUCTION:
- CONTRACTOR SHALL FIELD VERIFY DEPTH OF ALL EXISTING UTILITIES SHOWN OR NOT SHOWN ON THIS DRAWING.
 - THE MINIMUM SEPARATION DISTANCE FROM EXISTING SUBSURFACE UTILITIES SHALL NOT BE LESS THAN 10 FEET AS MEASURED FROM THE OUTSIDE EDGE OF THE UTILITY TO OUTSIDE OF PROPOSED PIPELINE.
 - DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
 - CROSSING PIPE SPECIFICATION:
HDD HORZ. LENGTH (L-): 1912'
HDD PIPE LENGTH (S-): 1935'
16" x 0.438" W.T., X-70, API5L, PSL2, ERW, BFW
COATING: 14-16 MILS FBE WITH 30-35 MIL ARO (POWERCRETE R95)
 - INTERNAL DESIGN PRESSURE 1480 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50).
 - INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
 - PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS.
 - CARRIER PIPE NOT ENCASED.
 - PIPE / AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.
 - CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 1850 PSIG.
 - SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.
 - SUNOCO PIPELINE, L.P.'S HORIZONTAL DIRECTIONAL DRILL INADVERTENT RETURN CONTINGENCY PLAN WILL BE IMPLEMENTED AT ALL TIMES.
 - SUNOCO PIPELINE, L.P.'S EROSION AND SEDIMENTATION CONTROL PLAN WILL BE IMPLEMENTED AT ALL TIMES.

NOTES

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- CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UTILITIES. CONTACT ONE CALL AT 811 PRIOR TO DIGGING.
- SUNOCO EMERGENCY HOTLINE NUMBER IS #1-800-786-7440.

REF. DRAWING	NO.	DESCRIPTION
ES-3.21	TO	ES-3.22
SHEET 13	TO	SHEET 14
		EROSION & SEDIMENT PLAN
		AERIAL SITE PLAN
		EP2
		EP1
		EP
		B
		ADDED GEOTECH INFO
		A
		ISSUED FOR BID
DWG NO	DWG NO	DESCRIPTION

REVISIONS

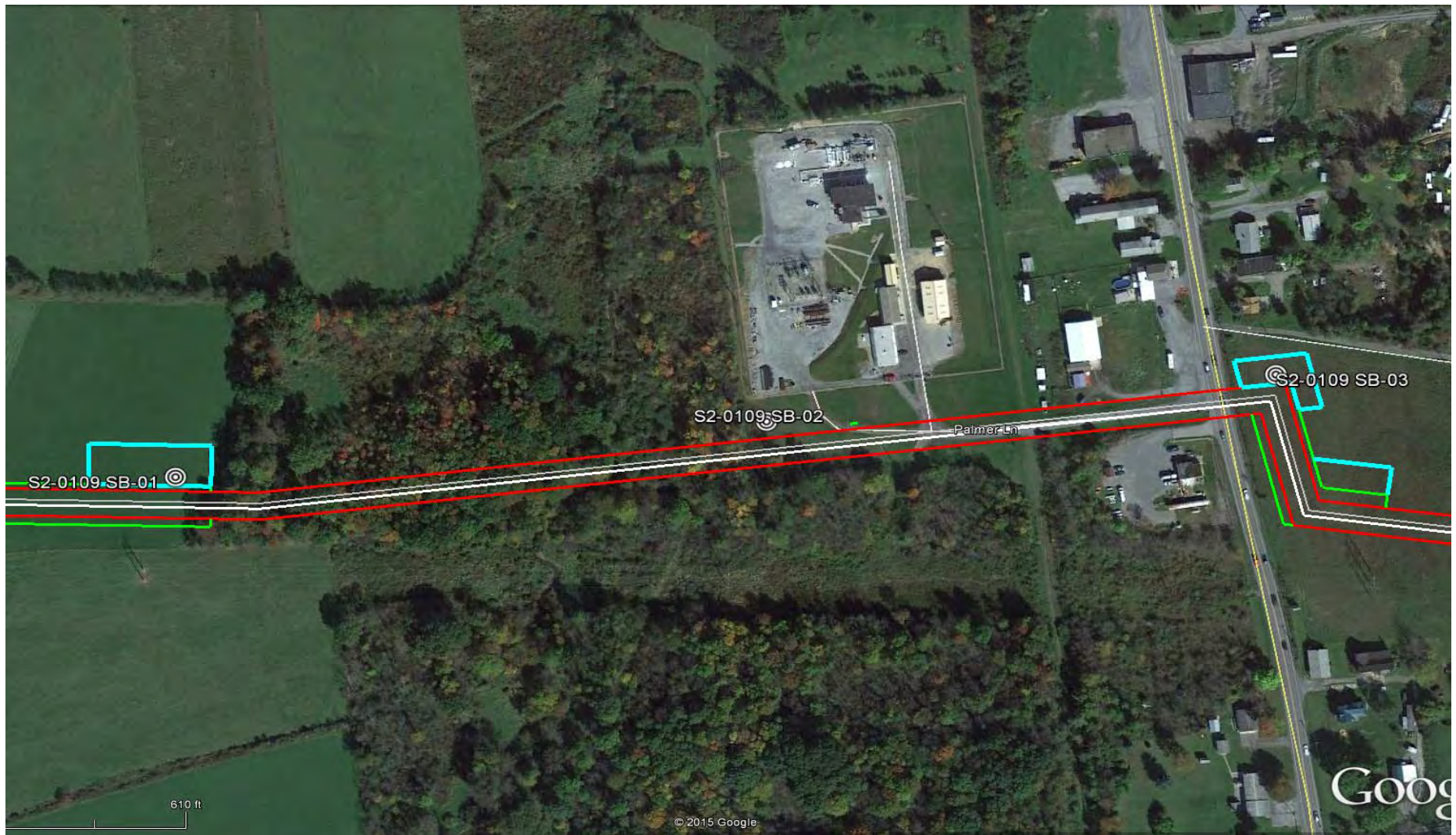
BY	DATE	CHK	DATE	APP	DATE
DLM	10/07/16	RMB	10/07/16	AAW	10/07/16
MRS	05/18/16	RMB	05/18/16	AAW	05/18/16
MRS	11/13/15	RMB	11/13/15	AAW	11/13/15
MRS	10/05/15	RMB	10/05/15	AAW	10/05/15
MRS	08/31/15	RMB	08/31/15	AAW	08/31/15



SUNOCO PIPELINE, L.P.

16-INCH HORIZONTAL DIRECTIONAL DRILL
OLD US 220 HWY
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=200' DWG. NO: PA-BL-0001.0027-RD-16



LEGEND:

⊙ Geotechnical Soil Boring (SB) Locations



GEOTECHNICAL BORING LOCATIONS
HDD S2-0109
BLAIR COUNTY, BLAIR TOWNSHIP, PA
SUNOCO PENNSYLVANIA PIPELINE PROJECT



TETRA TECH

240 Continental Drive, Suite 200
 Newark, Delaware 19713
 302.738.7551
 fax: 302.454.5988

TEST BORING LOG

Project Name: SUNOCO PENNSYLVANIA PIPELINE PROJECT			Project No.: 103IP3406		
Project Location: MILL ROAD, DUNCANSVILLE, PA			Page 1 of 1		
HDD No.: S2-0109		Dates(s) Drilled: 09-10-15		Inspector: E. WATT	
Boring No.: SB-01		Drilling Method: SPT - ASTM D1586		Driller: M. HYNES	
Drilling Contractor: HYNES		Groundwater Depth (ft): 15.0		Total Depth (ft): 30.0	
Boring Location Coordinates:			40° 24' 33.565" N		78° 26' 34.559" W

Sample No.	Sample Depth (ft)		Strata Depth (ft)		Recov. (ft)	Strata (USCS)	Description of Materials	6" Increment Blows *				N	
	From	To	From	To									
			0.0	0.6			TOPSOIL (7")						
1	3.0	5.0	0.6		14	SC	DR WEATHERED TO A BROWN AND GRAY FINE TO MEDIUM SAND AND CLAY, TRACE UNWEATHERED SHALE FRAGS.	5	5	7	7	12	
2	8.0	10.0		11.5	24		DR WEATHERED TO A BROWN AND GRAY FINE TO MEDIUM SAND, WITH SOME SILTY CLAY, TRACE UNWEATHERED SHALE FRAGS.	4	7	7	8	14	
3	13.0	15.0	11.5		20	CL	DR, MOTTLED GRAY, BROWN, ORANGE BRWN. SILTY CLAY, SOFT AT 15'. (USCS: CL)	4	5	6	6	11	
4	18.0	20.0		21.5	15		GRAY CLAY.	4	5	5	6	10	
5	23.0	25.0	21.5		14	CL/SC	DR, VARIEGATED (REDDISH BRWN, YELLOWISH BRWN, GRAY) SILTY CLAY & F-SAND, WITH UNWEATHERED SHALE FRAGS. (USCS: CL/SC)	9	22	36	50	58	
6	28.0	29.3		30.0	14		DR, VARIEGATED (REDDISH BROWN, YELLOWISH BROWN, GRAY)	25	15	50/3"		>50	
							AUGER STARTED GRINDING AT 25'.						
							WET ON SPOON AT 15'.						
							WATER LEVEL THROUGH AUGERS AT 15'						
							CAVED AT 14', WATER LEVEL ON CAVE AT 14'.						

Notes/Comments:
Pocket Pentrometer Testing
 S2: > 4 TSF
 S3: 1.75 TSF
 S4: 1.5 TSF
 DR: DECOMPOSED ROCK

Strata (USCS) Designations are approximated based on visual review, except where indicated in Description of Materials.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
 N: Number of blows to drive spoon from 6" to 18" interval.



TETRA TECH

240 Continental Drive, Suite 200
 Newark, Delaware 19713
 302.738.7551
 fax: 302.454.5988

TEST BORING LOG

Project Name: SUNOCO PENNSYLVANIA PIPELINE PROJECT			Project No.: 103IP3406		
Project Location: PALMER LAND, DUNCANSVILLE, PA			Page 1 of 1		
HDD No.: S2-0109		Dates(s) Drilled: 09-10/11-15		Inspector: E. WATT	
Boring No.: SB-02		Drilling Method: SPT - ASTM D1586		Driller: M. HYNES	
Drilling Contractor: HYNES		Groundwater Depth (ft): 7.5		Total Depth (ft): 32.0	
Boring Location Coordinates:			40° 24' 34.575" N		78° 26' 21.778" W

Sample No.	Sample Depth (ft)		Strata Depth (ft)		Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N	
	From	To	From	To									
			0.0	0.1			TOPSOIL (2")						
1	3.0	5.0	0.1		20	CL	MOTTLED (GRAY AND BROWN) SILTY CLAY AND FINE TO MEDIUM SAND, TRACR F-ROCK FRAGS.	3	3	4	6	7	
2	8.0	10.0			12		MOTTLED (BROWN AND ORANGE BROWN) SILTY CLAY AND FINE TO MEDIUM SAND, TRACT FINE SANDSTONE GRAVEL. (USCS: CL)	6	10	8	8	18	
3	13.0	15.0			23		GRAY AND DARK GRAY SILTY CLAY AND FINE TO MEDIUM SAND, TRACE FINE SANDSTONE GRAVEL.	1	1	1	1	2	
				18.0									
4	18.0	20.0	18.0	22.0	5		DARK GRAY PARTIALLY WEATHERED SHALE.	50/5"					>50
							AUGER REFUSAL AT 22'.						
							<u>ROCK CORING</u>						
RUN 1	22.0	24.5	22.0		22	SHALE	DARK GRAY INTENSELY FRACTURED DARK GRAY SHALE.	TCR: 73%, SCR: 28%, RQD: 0%					
RUN 2	24.5	29.5			44		DARK GRAY INTENSELY FRACTURED CALCEROUS SHALE.	TCR: 73%, SCR: 38%, RQD: 18%					
RUN 3	29.5	32.0		32.0	30		DARK GRAY MODERATELY FRACTURED CALCEROUS SHALE.	TCR: 100%, SCR: 83%, RQD: 63%					
							WET ON SPOON AT 8'.						
							WATER LEVEL THROUGH AUGERS AT 7.5'.						
							<u>CORE TESTING RESULTS (DEPTH 29-29.5'):</u>						
							COMPRESSIVE STRENGTH: 3,040 PSI						
							UNIT WEIGHT: 166.6 PCF						
							<u>CORE TESTING RESULTS (DEPTH 30-30.5'):</u>						
							COMPRESSIVE STRENGTH: 3,430 PSI						
							UNIT WEIGHT: 179.4 PCF						

Notes/Comments:
Pocket Pentrometer Testing
 4': 3.5 TSF DR: DECOMPOSED ROCK

Strata (USCS) Designations are approximated based on visual review, except where indicated in Description of Materials.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
 N: Number of blows to drive spoon from 6" to 18" interval.

**ROCK CORE DESCRIPTION SUMMARY
 SUNOCO PENNSYLVANIA PIPELINE PROJECT
 HDD S2-0109 PALMER LANE**

Location	Boring No.	Core Run	Core Depth (ft)		TCR (%)	SCR (%)	RQD (%)	Depth (ft)		Weathering	Classification	Bedding Thickness (ft)	Color	Discontinuity Data
			From	To				From	To					
S2-0109	SB-2	1	22	24.5	73	28	0	22	32	Moderate	Shale (Potential limestone)	Massive	Dark Gray	Fractures ranging from 0° to 20°, Avg. 12°
		2	24.5	29.5	73	38	17.5							
		3	29.5	32	100	83	63							

**GEOTECHNICAL LABORATORY TESTING SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S2-0109 PALMER LAND**

HDD No.	Test Boring No.	Sample No.	Depth of Sample (ft.)		Water Content, %	Percent Silts/Clays, %	Atterburg Limits (ASTM D4318)			USCS Classif.
			From	To	(ASTM D2216)	(ASTM D1140)	Liquid Limit, %	Plastic Limit, %	Plasticity Index, %	(ASTM D2487)
S2-0109	SB-01	1	3.0	5.0	10.2	41.5	-	-	-	-
		2	8.0	10.0	11.9	34.3	-	-	-	-
		3	13.0	15.0	24.9	98.7	36	23	13	CL
		5	23.0	25.0	16.0	51.2	33	21	12	CL/SC
		6	28.0	29.3	17.2	51.0	-	-	-	-
	SB-02	1	3.0	5.0	20.5	69.2	-	-	-	-
		2	8.0	10.0	26.5	75.2	43	25	18	CL
		3	13.0	15.0	29.4	57.5	-	-	-	-
		4	18.0	20.0	12.8	13.6	-	-	-	-
	SB-03	1	3.0	5.0	14.2	67.0	-	-	-	-
		2	8.0	10.0	14.8	63.3	33	25	18	ML
		3	13.0	15.0	13.6	79.6	35	26	9	ML
		4	18.0	20.0	13.2	60.0	-	-	-	-

Rock Core Testing Results				
Boring No.	Core Run	Approximate Depth (ft)	Compressive Strength (psi)	Unit Weight (pcf)
SB-02	2	29 - 29.5	3,040	166.6
SB-02	3	30 - 30.5	3,430	179.4

Notes:

- 1) Sample depths based on feet below grade at time of exploration.

**REGIONAL GEOLOGY SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S2-0109 PALMER LANE**

HDD No.	NAME	BORING NO.	REGIONAL GEOLOGY DESCRIPTION	GENERAL TOPOGRAPHIC SETTING	BEDROCK FORMATION	GENERAL ROCK TYPE	APPROX MAX FM THICKNESS (FT)	DEPTH TO ROCK (Ft bgs) based on nearby well drilling logs	NOTES / COMMENTS
S2-109	Palmer Lane	SB-01	Hamilton Group - The Mahantango Formation and the underlying Marcellus Formation make up the Hamilton Group.	Gentle slope upwards to the east, mix of farmland and woods	Mahatango (aka Hamilton Group)	Shale-siltstone, laminated, fossiliferous			
		SB-02							
		SB-03	Onondaga and Old Port Formation (undivided) consists of two members - the upper Selinsgrove Limestone and the lower calcereous Needmore Shale.		Onadaga-Old Port	Limestone and calcareous shale with occasional chert	100-200	4-32	

Note : Source of well log data - <http://www.dcnr.state.pa.us/topogeo/groundwater/pagwis/records/index.htm>. All other sources as referenced in comments section.

FIELD DESCRIPTION AND LOGGING SYSTEM FOR SOIL EXPLORATION

GRANULAR SOILS

(Sand, Gravel & Combinations)

<u>Density</u>	<u>N (blows)*</u>
Very Loose	5 or less
Loose	6 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	51 or more

Particle Size Identification

Boulders	8 in. diameter or more
Cobbles	3 to 8 in. diameter
Gravel	Coarse (C) 3 in. to ¾ in. sieve
	Fine (F) ¾ in. to No. 4 sieve
Sand	Coarse (C) No. 4 to No. 10 sieve (4.75mm-2.00mm)
	Medium (M) No. 10 to No. 40 sieve (2.00mm – 0.425mm)
	Fine (F) No. 40 to No. 200 sieve (0.425 – 0.074mm)
Silt/Clay	Less Than a No. 200 sieve (<0.074mm)

Relative Proportions

<u>Description Term</u>	<u>Percent</u>
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

COHESIVE SOILS

(Silt, Clay & Combinations)

<u>Consistency</u>	<u>N (blows)*</u>
Very Soft	3 or less
Soft	4 to 5
Medium Stiff	6 to 10
Stiff	11 to 15
Very Stiff	16 to 30
Hard	31 or more

Plasticity

<u>Degree of Plasticity</u>	<u>Plasticity Index</u>
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to Very High	> 22

ROCK

(Rock Cores)

<u>Rock Quality Designation (RQD), %</u>	<u>Rock Quality Description</u>
0-25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

***N - Standard Penetration Resistance.** Driving a 2.0" O.D., 1-3/8" I.D. sampler a distance of 18 inches into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. The number of hammer blows to drive the sampler through each 6 inch interval is recorded; the number of blows required to drive the sampler through the final 12 inch interval is termed the Standard Penetration Resistance (SPR) N-value. For example, blow counts of 6/8/9 (through three 6-inch intervals) results in an SPR N-value of 17 (8+9).

Groundwater observations were made at the times indicated. Groundwater elevations fluctuate throughout a given year, depending on actual field porosity and variations in seasonal and annual precipitation.

UNIFIED SOIL CLASSIFICATION SYSTEM [Casagrande (1948)]

Major Divisions		Group Symbols	Typical Descriptions	Laboratory Classifications			
Coarse Grained Soils (More than half of material is larger than No. 200 sieve)	Gravels More than half of coarse fraction is larger than No. 4 sieve size	Clean gravel (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4: $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3 Not meeting C_u or C_c requirements for GW		
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines			
		Gravel with fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below A Line or I_p less than 4 Atterberg limits above A line with I_p greater than 7 Limits plotting in hatched zone with I_p between 4 and 7 are borderline cases requiring use of dual symbols		
			GC	Clayey gravels, gravel-sand-clay mixtures			
	Sands (More than half of coarse fraction is smaller than No. 4 Sieve)	Clean sands (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6: $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3 Not meeting C_u or C_c requirements for SW		
			SP	Poorly graded sands, gravelly sands, little or no fines			
		Sands with fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures	Atterberg limits below A Line or I_p less than 4 Atterberg limits above A line with I_p greater than 7 Limits Plotting in hatched zone with I_p between 4 and 7 are borderline cases requiring use of dual symbols		
			SC	Clayey sands, sand-clay mixtures			
		Determine Percentage of sand and gravel from grain size curve. Depending on Percentage of fines (fraction smaller than No. 200 sieve), coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP More than 12 percent GM, GC, SM, SC 5 to 12 percent Borderline cases requiring dual symbols ⁽¹⁾					
		Major Divisions		Group Symbols	Typical Descriptions	For soils plotting nearly on A line use dual symbols i.e., $I_p = 29.5$, $w_L = 60$ gives CH-MH. When w_L is near 50 use CL-CH or ML-MH. Take near as ± 2 percent.	
Fine-grained soils (More than half of material is smaller than No. 200 sieve)	Silt and clays (Liquid limit less than 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity				
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays				
		OL	Organic silts and organic silty clays of low plasticity				
	Silt and Clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts				
		CH	Inorganic clays of high plasticity, fat clays				
		OH	Organic clays of medium to high plasticity, organic silts				
	Highly organic soils	Pt	Peat and other highly organic soils				

(1) Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC. well-graded gravel-sand mixture with clay binder.