

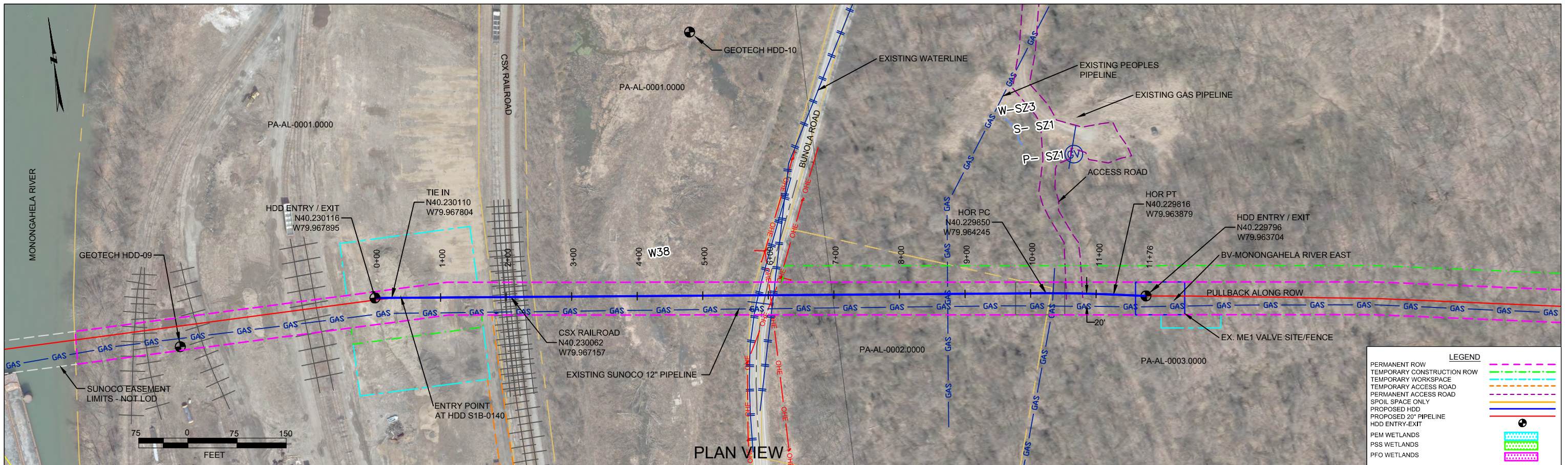
**Attachment A
HDD Table
Allegheny County**

Drawing Name	Drill Name	County	Township	Drill Location	Risk Assessment Level (Low / Medium / High)
PA-AL-0001.0000-RR.pdf	CSX Railroad	Allegheny	Forward	N: 40.230110 W: 79.967804	low
PA-AL-0033.0000-RD.pdf	Hayden Boulevard	Allegheny	Elizabeth & Forward	N: 40.220975 W: 79.848787	medium

HDD PA-AL-0001.0000-RR (W38)

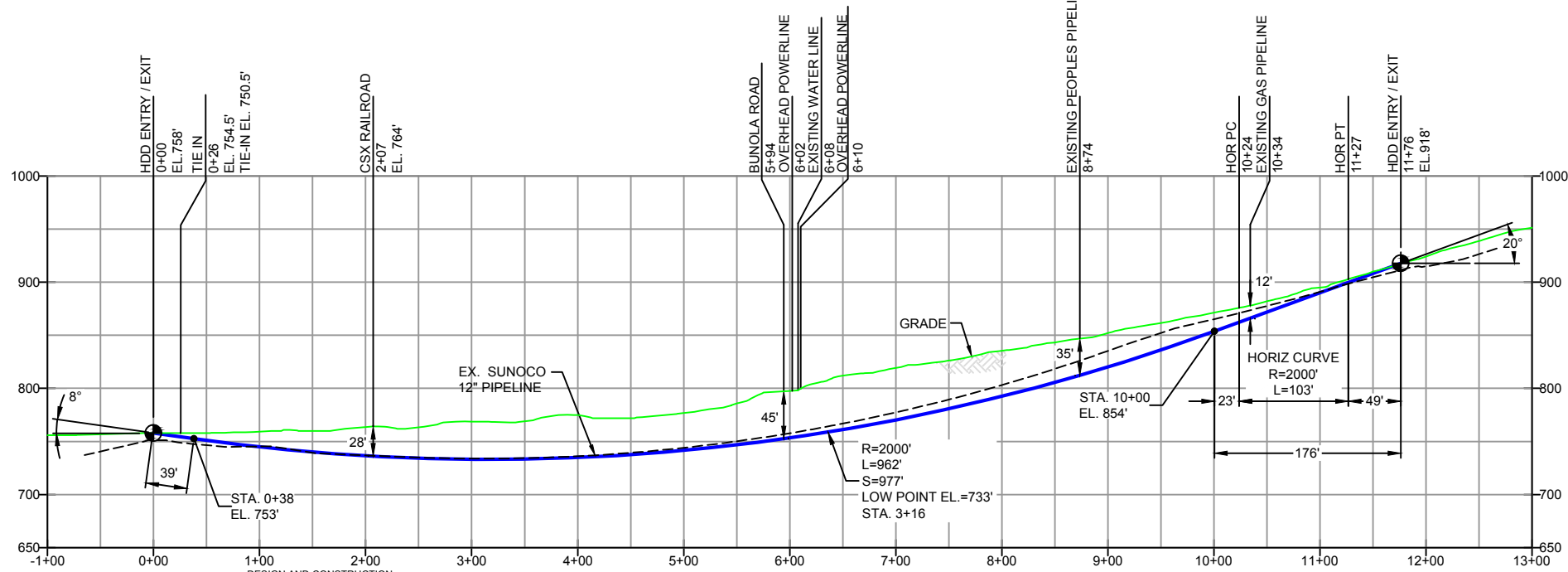
Given the design, the threat of inadvertent return has been reduced to the maximum extent practicable and in this case that threat is considered to be low. Implementing this design, along with adherence to the Pennsylvania Pipeline Project Inadvertent Return Contingency Plan will ensure inadvertent impacts,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

The drill will enter/exit 420 feet from the western edge of a potential grassy wetland (W38) and enter/exit 760 feet from the eastern edge. The horizontal directional drill will enter/exit 200 feet from the western edge of the CSX Railroad and enter/exit 950 feet from the eastern edge. The western edge Bunola Road is 580 feet from the anticipated entry/exit of the drill while the eastern edge of the road is 570 feet from the eastern entry/exit of the drill. The drill will cross below the CSX Railroad at 28 feet, the wetland W38 at 35 feet, and Bunola Road at 45 feet. The 20" drill will parallel the existing ME1 12" pipeline drill. The geotechnical results from the previous drill, as well as other data points, were used to determine the entry/exit angles, and depths to pass through the best substrates while maintaining the pipe integrity (e.g., no large bends). According to the geotechnical reports the primary substrate at all of the crossings is estimated to be silty sands and clay. Based on the geotechnical reports, the drill profile, and the previous drill data no inadvertent returns are expected.



ALLEGHENY COUNTY, PENNSYLVANIA - FORWARD TOWNSHIP
S1B-0150

PROFILE VIEW



GEOTECH HDD-09	
-NG EL. 754'	-SM (0.0' - 12.0')
-CL (12.0' - 27.0')	-GROUNDWATER (24.5')
-SM (27.0' - 62.0')	-SC (62.0' - 68.6')
-SILTSTONE (68.5' - 78.5')	-COMPLETION DEPTH EL. 709.5'
NOTE: REFER TO TEST BORING LOG HDD-09 FOR COMPLETE SOIL MATERIAL DESCRIPTION	
GEOTECH HDD-10	
-NG EL. 765'	-SM (0.0' - 4.5')
-CL (4.5' - 7.0')	-SM (7.0' - 32.0')
-CL (32.0' - 55.5')	-GROUNDWATER (49.5')
-SILTSTONE (55.5')	-COMPLETION DEPTH EL. 709.5'
NOTE: REFER TO TEST BORING LOG HDD-10 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)= 1176'
HDD PIPE LENGTH (S)= 1202'
20" x 0.458" W.T., X-65, AP5L, PSL2, ERW, BFW
COATING: 14-16 MILS FBE WITH 40 MILS MIN. ARO (POWERCRETE R95)
 - INTERNAL DESIGN PRESSURE 1480 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50 (HOOP STRESS)).
 - 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.
 - PIPELINE AND CROSSING TO BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH LAST APPROVED AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION SPECIFICATIONS FOR PIPELINES CONVEYING FLAMMABLE AND NON-FLAMMABLE SUBSTANCES.
 - BLASTING NOT PERMITTED.
 - SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.

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-1.60	TO ES-1.02	EROSION & SEDIMENT PLAN	
SHEET 2	TO SHEET 2	AERIAL SITE PLAN	
		EP2	REVISED PER PADEP COMMENTS RECEIVED 09-06-16
		EP1	REVISED PER PADEP COMMENTS
		EP	
DWG NO	DWG NO	DESCRIPTION	NO.
		DESCRIPTION	
		BY	DATE
		CHK	DATE
		APP	DATE

**Sunoco Logistics
Partners L.P.**

TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

20-INCH HORIZONTAL DIRECTIONAL DRILL
CSX RAILROAD
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=150' DWG. NO: PA-AL-0001.000-RR



Source: Topo data from USGS DLG; Roads from DelDOT

S:\05-Projects\14\complan\111 - Rooney (WB)\GIS\Boring Map HDD-09.mxd

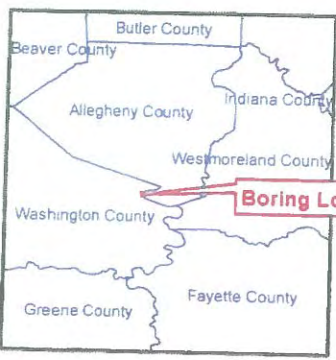


Figure
Boring Location HDD-09
Sunoco Mariner East Project
Allegheny County, PA



1 inch = 500 feet

Tetra Tech, Inc.
 Phone: (302) 738-7551
 Toll Free: (800) 462-0910
www.tetrattech.com

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Source: Topo data from USGS D1.G. Roads from DelDOT

S:\03-Projects\in\com\p\011 - Rooney (RE)\GIS\Boring Map HDD-10.mxd



Figure
Boring Location HDD-10
Sunoco Mariner East Project
Allegheny County, PA



1 inch = 500 feet

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TETRA TECH
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 Newark, Delaware 19713
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 fax: 302.454.5908

TEST BORING LOG

Project Name: SUNOCO MARINER EAST			Project No.: 103IP2762		
Project Location: ALLEGHANY COUNTY, PA			Page 1 of 1		
Test Boring No.: HDD-09	Dates(s) Drilled: 09/09/13		Inspector: E. WATT		
Drilling Contractor: CONNELLY	Drilling Method: SPT - ASTM D1586		Driller: K. KERCH		
Surface Elevation (ft):	Groundwater Depth (ft): 24.5		Total Depth (ft): 78.5		

Sample No.	Sample Depth (ft)		Strata Depth (ft)		Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *			N	
	From	To	From	To								
1	3.5	5.0	0.0		6	SM	LIGHT BROWN FINE TO MEDIUM SAND WITH A TRACE OF SANDSTONE GRAVEL, AND A LITTLE SILT (HISTORIC FILL).	3	4	5	9	
2	8.5	10.0		12.0	2		LIGHT BROWN FINE TO MEDIUM SAND WITH A TRACE OF SANDSTONE GRAVEL, AND A LITTLE SILT (HISTORIC FILL).	3	3	5	8	
3	13.5	15.0	12.0		10	CL	MOTTLED BROWN AND GRAY SILTY CLAY, TRACE MICA, TRACE TO LITTLE SILT. USCS: CL	2	3	3	6	
4	18.5	20.0			18		BROWN SILTY CLAY WITH SOME FINE SAND, TRACE MICA.	3	3	3	6	
5	23.5	25.0		27.0	18	SM	BROWN SANDY CLAY, TRACE MICA.	1	1	2	3	
6	28.5	30.0	27.0		1		BROWN FINE TO MEDIUM SAND WITH A LITTLE SILT.	2	3	3	6	
7	33.5	35.0			18		BROWN FINE TO MEDIUM SAND WITH A LITTLE SILT.	3	3	6	9	
8	38.5	40.0			18		BROWN FINE TO MEDIUM SAND WITH A LITTLE SILT. 2" BLACK SEAM PRESENT (LIGNITE?)	1	3	4	7	
9	43.5	45.0			18		BROWN FINE TO MEDIUM SAND WITH A LITTLE SILT.	3	4	7	11	
10	48.5	50.0			18		BROWN FINE TO MEDIUM SAND WITH A LITTLE SILT. 2" BLACK SEAM PRESENT (LIGNITE?).	3	6	7	13	
11	53.5	55.0			18		BROWN FINE TO MEDIUM SAND WITH A LITTLE SILT, WITH A LITTLE FINE GRAVEL, INTERLAYERED WITH "LIGNITE?".	3	17	30	47	
12	58.5	60.0			17		BROWN FINE TO COARSE SAND WITH A LITTLE SILT, WITH A LITTLE FINE GRAVEL.	8	16	17	33	
13	63.5	65.0	62.0		18		SC	DECOMPOSED ROCK WEATHERED TO A MULT-COLORED FINE TO MEDIUM SAND, WITH SOME CLAY.	19	32	50	82
14	68.5	68.6		68.6	<1			LIGHT GRAY PARTIALLY WEATHERED SILTSTONE.	50/1"			
							AUGER REFUSAL AT 68.5'.					
							ROCK CORING					
RUN 1	68.5	73.5	68.5			ROCK*	ROCK CORING: 88% RECOVERY, 37% RQD					
RUN 2	73.5	78.5		78.5			ROCK CORING: 95% RECOVERY, 58% RQD					
							*PREDOMINATELY GRAY AND GREENISH GRAY SILTSTONE, WITH A THIN SEAM OF CALCEROUS CLAYSTONE, AND A THIN SEAM OF GRAY LIMESTONE.					

Notes/Comments:
Pocket Penetrometer Testing
 S3: 0.75 TSF
 S4: 0.75 TSF
 S13: > 4 TSF

WET ON SPOON AT 28.0'.
 WATER LEVEL THROUGH AUGERS AT 24.5'.

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
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TEST BORING LOG

Project Name: SUNOCO MARINER EAST			Project No.: 103IP2762		
Project Location: ALLEGHANY COUNTY, PA			Page 1 of 1		
Test Boring No.:	HDD-10	Dates(s) Drilled:	06/11/13	Inspector:	E. WATT
Drilling Contractor:	CONNELLY	Drilling Method:	SPT - ASTM D1586	Driller:	T. REDMAN
Surface Elevation (ft):		Groundwater Depth (ft):	49.5'	Total Depth (ft):	55.5

Sample No.	Sample Depth (ft)		Strata Depth (ft)		Recov. (ft)	Strata (USCS)	Description of Materials	6" Increment Blows *			N
	From	To	From	To							
1	3.5	5.0	0.0		18	SM	BROWN FINE TO MEDIUM SAND, TRACE FINE GRAVEL, APPEARS TO BE POTENTIAL FILL MATERIAL.	4	7	8	15
			4.5								
			4.5								
2	8.5	10.0	7.0		16	SM	MOTTLED BROWN AND GRAY SILTY CLAY WITH A LITTLE FINE SAND.				14
3	13.5	15.0			13	SM	MEDIUM BROWN FINE SAND WITH A LITTLE SILT.	5	8	8	16
4	18.5	20.0			14	SM	MEDIUM BROWN FINE SAND WITH A LITTLE SILT.	7	8	8	16
5	23.5	25.0			14	SM	MEDIUM BROWN FINE SAND WITH A LITTLE SILT.	5	6	8	14
6	28.5	30.0			10	SM	MEDIUM BROWN CLAYEY FINE TO MEDIUM SAND.	WH	1	2	3
7	33.5	35.0	32.0		18	CL	GRAY TO BROWN SILTY CLAY WITH A LITTLE FINE SAND.	3	5	7	12
8	38.5	40.0			18	CL	GRAY SILTY CLAY WITH A LITTLE FINE SAND; USCS: CL	3	6	5	11
9	43.5	45.0			9	CL	GRAY SILTY CLAY WITH A LITTLE FINE SAND, TRACE COARSE GRAVEL.	6	8	10	18
10	48.5	50.0			6	CL	GRAYGRAVELLY AND SANDY CLAY.	8	10	12	22
11	53.5	55.0			16	CL	REDDISH BROWN SILTY CLAY, WITH VARYING AMOUNTS OF FINE SAND.	31	30	27	57
12	55.5	55.5	55.5		<1	SM	AUGER REFUSAL AT 55.0'. PIECES OF LIGHT GRAY TO REDDISH BROWN PARTIALLY WEATHERED SILTSTONE OR CLAYSTONE.	50/0"			
							MOIST IN SPOON AT 29'; HOWEVER, NO WATER WITHIN AUGERS.				
							WATER LEVEL THROUGH AUGERS AT 49.5'.				

Notes/Comments:
Pocket Penetrometer Testing
 S1: 2.5 TSF
 S7: 2.25 TSF
 S8: 1.25 TSF

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.

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	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⁾	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4: $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3			
		GP Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting C_u or C_c requirements for GW					
		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	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		Atterberg limits above A line with I_p greater than 7			
	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			
			SP Poorly graded sands, gravelly sands, little or no fines		Not meeting C_u or C_c requirements for SW			
		Sands with fines (Appreciable amount of fines)	SM Silty sands, sand-silt mixtures		Atterberg limits below A Line or I_p less than 4	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		Atterberg limits above A line with I_p greater than 7			
						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							

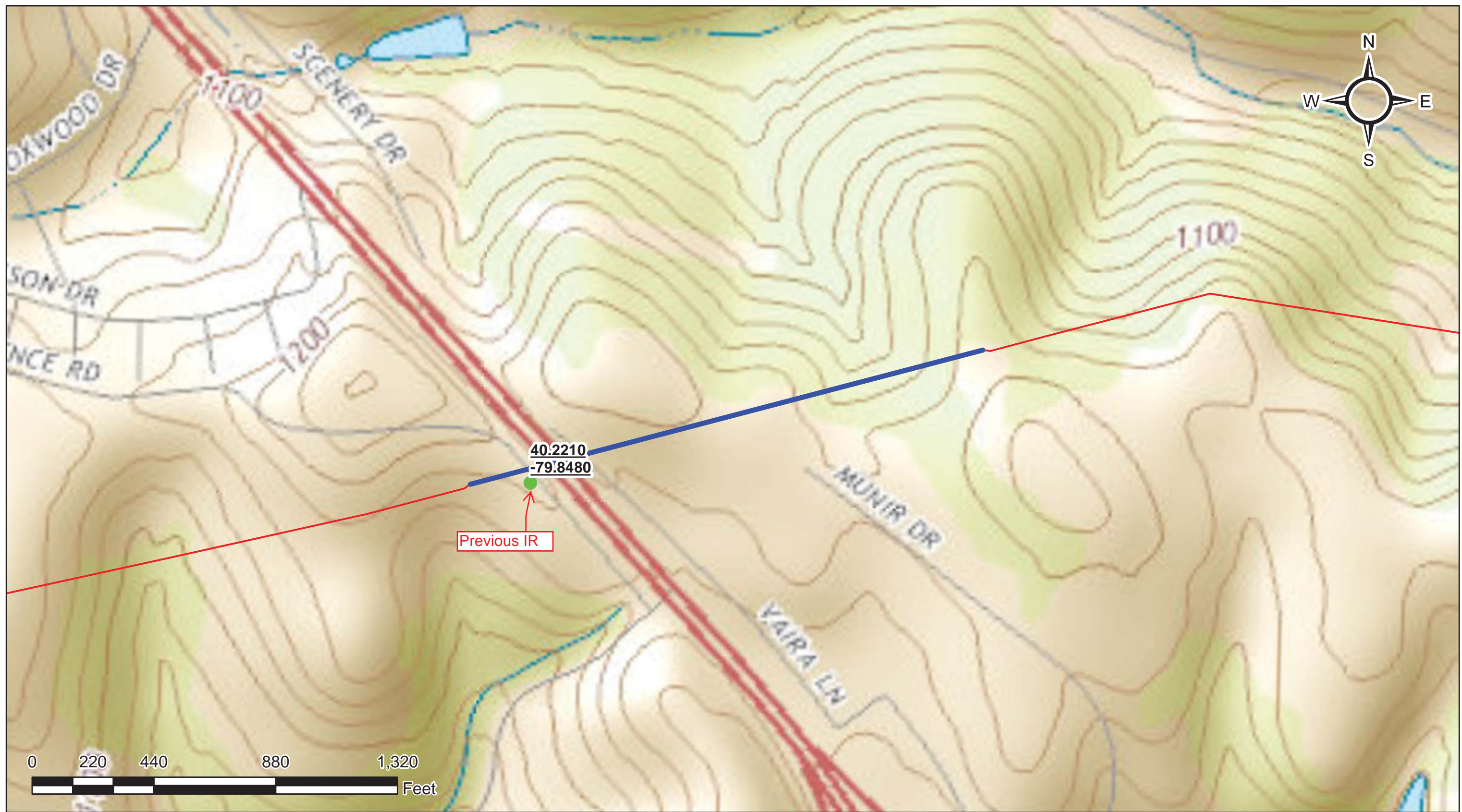
(1) Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC. well-graded gravel-sand mixture with clay binder.

HDD PA-AL-0033.0000-RD (S163)

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 medium. 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 190 feet from the western edge of Torrence Road and enter/exit 1700 feet from the eastern edge. The horizontal drill will enter/exit 280 feet from the western edge of Hayden Boulevard and will enter/exit 1,550 feet from the eastern edge of Hayden Boulevard. Stream 163 (S-163) is 1,700 feet from the western entrance/exit of the drill and 210 feet from the eastern entrance/exit. The drill crosses 53 feet below the two roads and about 10 feet below the stream. The 20" drill will parallel the existing ME1 12" pipeline drill, which resulted in an inadvertent return. The geotechnical results from the previous drill, as well as other data points, were used to determine the entry/exit angles, and depths to pass through the best substrates while maintaining the pipe integrity (e.g., no large bends). According to the geotechnical report the primary substrate at all crossings is estimated to be bedrock with clay above the rock.

Given the design, the threat of inadvertent return has been reduced to the maximum extent practicable and based on geotechnical data, the threat will otherwise be considered to be low. However, due to inadvertent return on a previous HDD in this area, the threat in this area is considered to be medium. The previous IR was 900 gallons that got into S-163. Silt fence was used for containment and a vac truck removed as much of the fluid as possible. There were no lasting impacts from this spill. For this reason, we recommend additional inspection while the drill is being performed. 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.



Legend

- HDD Path
- Proposed Centerline

DRAWN	CHECKED	APPROVED	DATE	REV NO.	DESCRIPTION
AW	RB	RB	11/21/16	A	ISSUED FOR REVIEW

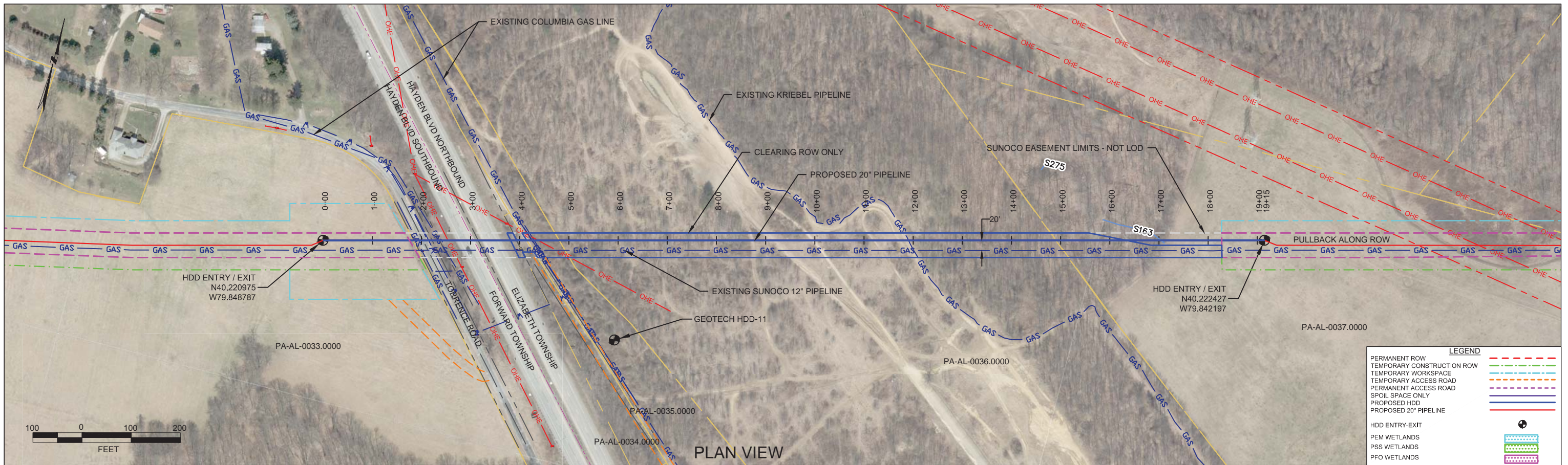
PREPARED BY:

 (303) 79

Sunoco Pipeline L.P.
 PENNSYLVANIA PIPELINE PROJECT
 INADVERTENT RETURN ASSESSMENTS

DRAWN: AW	CHECKED: RB
DATE: 11/21/16	SCALE: AS SHOWN

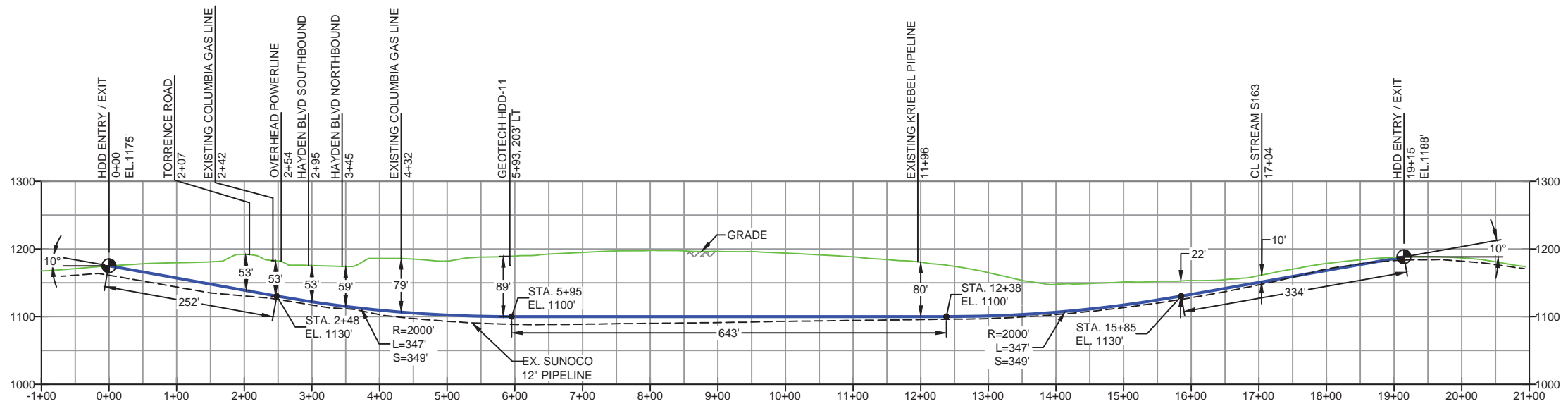
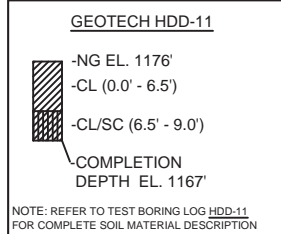
PA-AL-0033-RD-HDD



PLAN VIEW

ALLEGHENY COUNTY, PENNSYLVANIA - FORWARD/ELIZABETH TOWNSHIPS
S1B-0160

PROFILE VIEW



- 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=): 1915'
HDD PIPE LENGTH (S=): 1927'
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 811-900-786-7440.

REF. DRAWING	
ES-1.22	EROSION & SEDIMENT PLAN
SHEET 15	AERIAL SITE PLAN

REVISIONS						
NO.	DESCRIPTION	BY	DATE	CHK	DATE	APP
EP2	REVISED PER PADEP COMMENTS RECEIVED 09-06-16	MRS	09/30/16	RMB	09/30/16	AAW
EP1	REVISED PER PADEP COMMENTS	MRS	05/17/16	RMB	05/17/16	AAW
EP		DLM	03/15/16	RMB	03/15/16	AAW

Sunoco Logistics Partners L.P.

TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

20-INCH PIPE HORIZONTAL DIRECTIONAL DRILL
HAYDEN BOULEVARD
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=200' DWG. NO: PA-AL-0033.000-RD



Source: Topo data from USGS DLG. Roads from DelDOT

S:\03-Projects\116company\11 - Rooney (RED)\GIS\Boring Map HDD-11.mxd



Figure
Boring Location HDD-11
Sunoco Mariner East Project
Allegheny County, PA



1 inch = 500 feet

Tt Tetra Tech, Inc.
 Phone: (302) 738-7551
 Toll Free: (800) 462-0910
 www.tetrattech.com

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 Newark, Delaware 19713
 302.738.7551
 fax: 302.454.5988

TEST BORING LOG

Project Name: SUNOCO MARINER EAST			Project No.: 103IP2762		
Project Location: ALLEGHANY COUNTY, PA			Page 1 of 1		
Test Boring No.: HDD-11	Dates(s) Drilled: 06/13/13		Inspector: E. WATT		
Drilling Contractor: CONNELLY	Drilling Method: SPT - ASTM D1586		Driller: T. REDMAN		
Surface Elevation (ft):	Groundwater Depth (ft): Not Encountered		Total Depth (ft): VARIOUS, SEE BELOW.		

Sample No.	Sample Depth (ft)		Strata Depth (ft)		Recov. (ft)	Strata (USCS)	Description of Materials	6" Increment Blows *			N	
	From	To	From	To								
1	3.5	5.0	0.0		18	CL	HIGHLY DECOMPOSED SHALE WEATHERED TO A MULTI-COLOR (GRAY, BROWN, TAN, BLACK NODULES) SILTY CLAY WITH A LITTLE FINE SAND. USCS: CL	5	7	11	18	
				6.5								
2	8.5	9.0	6.5		6	CL/SC	DECOMPOSED ROCK WEATHERED TO A LIGHT GRAY AND BROWN SILTY CLAY AND F-M, TRACE SILTSTONE FRAGS. IN TIP.	45	50/0"		>50	
				9.0								
							AUGER REFUSAL AT 9.0'. OFF-SET 4' TO THE WEST AND CONTINUOUSLY DRILLED TO REFUSAL AT 9.5'.					

Notes/Comments:
Pocket Penetrometer Testing
 S1: 1.25 TSF

DUE TO ACCESS CONSTRAINTS (E.G., UTILITIES, TREE-LINES, ETC.), BORING PERFORMED 264' SOUTH AND 40' EAST OF ORIGINA PROPOSED LOCATION.

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.

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	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	Atterberg limits above A line with I_p greater than 7		
	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	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	Atterberg limits above A line with I_p greater than 7		
		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.