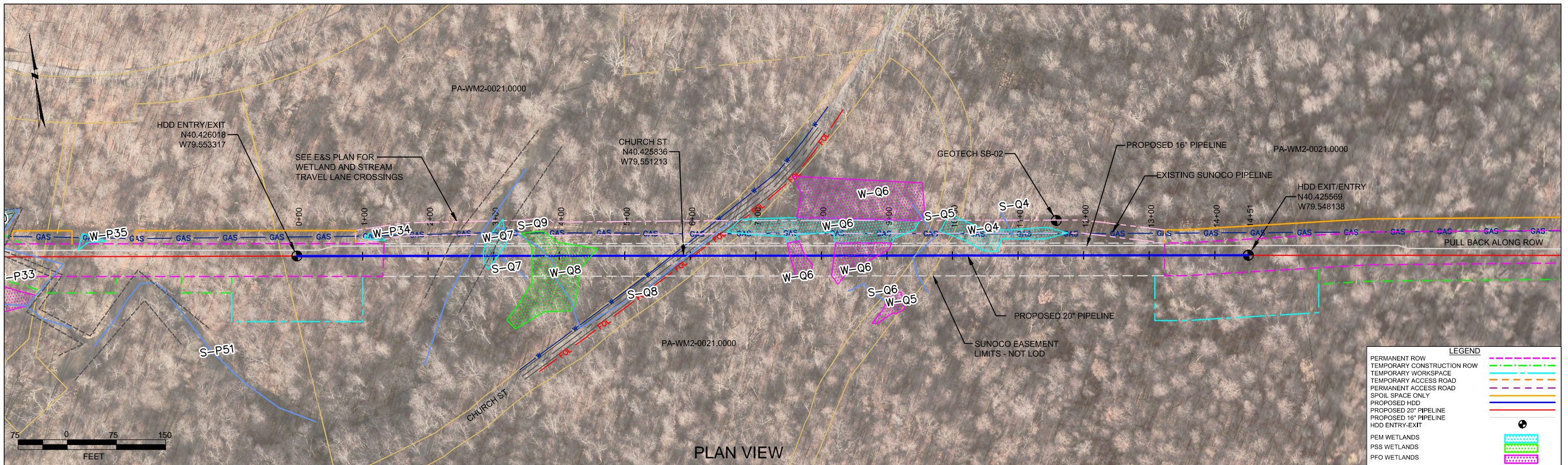


HDD PA-WM2-0021.0000-RD (S-Q7, S-Q8, and S-Q5)

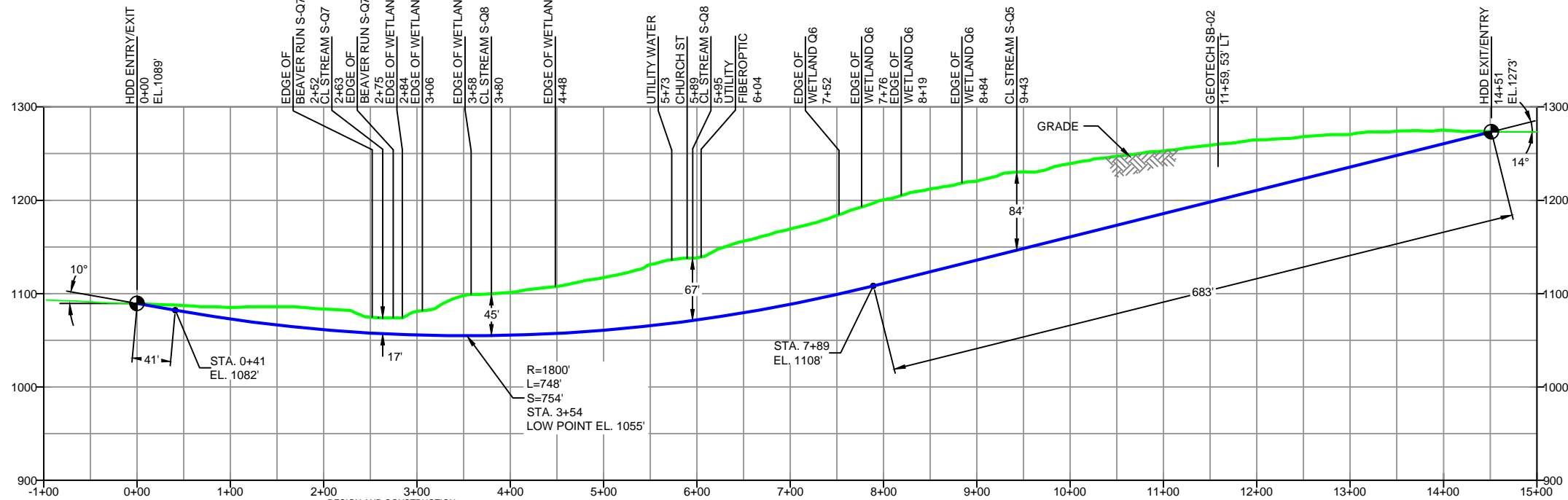
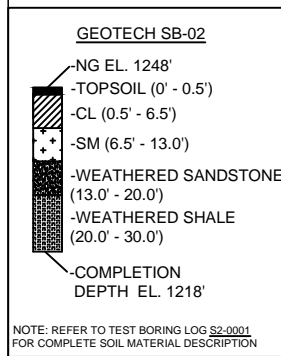
Given the design, the threat of inadvertent return has been reduced to the maximum extent practicable and in this case that threat is considered to be low. Implementing this design, along with adherence to the Pennsylvania Pipeline Project Inadvertent Return Contingency Plan will ensure inadvertent impacts,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

The drill will enter/exit 260 feet west of stream Q7. The drill will pass 17 feet under this stream. It will pass 45 feet under stream Q8, 379 feet from the entry/exit, and cross it again, passing 67 feet below it, 595 feet from the entry/exit. It will also pass under stream Q5 at depth of 75 feet, 943 feet from the entry/exit. This point is also 508 feet from the east entry/exit point. 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 is estimated to be silty clay, sand, sandstone and shale east of the streams. Geotechnical data was only available for the area near the eastern side of the drill.



WEST MORE LAND COUNTY, PENNSYLVANIA - SALEM TOWNSHIP
S2-0001

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=): 1625'
HDD PIPE LENGTH (S=): 1655'
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

ES-2.04	TO	ES-2.05	EROSION & SEDIMENT PLAN	EP2	REVISED PER PADEP COMMENTS RECEIVED 09-06-16
SHEET 55	TO	SHEET 55	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

REVISIONS

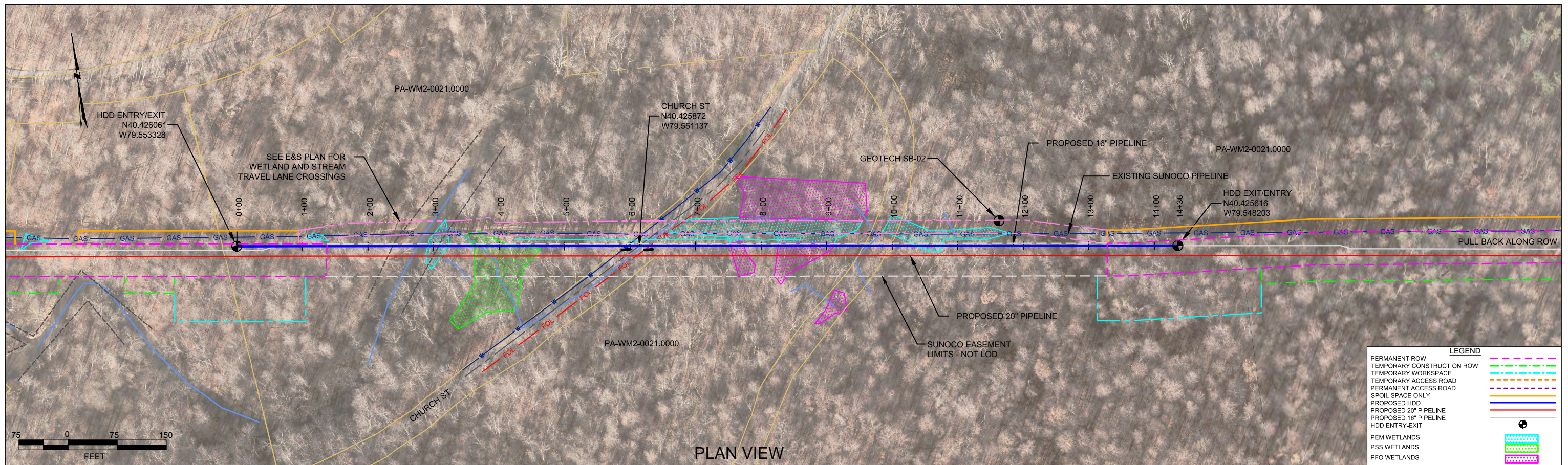
BY	DATE	CHK	DATE	APP	DATE
MRS	09/30/16	RMB	09/30/16	AAW	09/30/16
MRS	05/20/16	RMB	05/20/16	AAW	05/20/16
DLM	03/15/16	RMB	03/15/16	AAW	03/15/16
MRS	10/08/15	RMB	10/08/15	AAW	10/08/15
MRS	07/31/15	RMB	07/31/15	AAW	07/31/15
RTT	03/25/15	RMB	03/25/15	AAW	03/25/15

(303) 792-5911

SUNOCO PIPELINE, L.P.

20-INCH HORIZONTAL DIRECTIONAL DRILL
CHURCH STREET
PENNSYLVANIA PIPELINE PROJECT

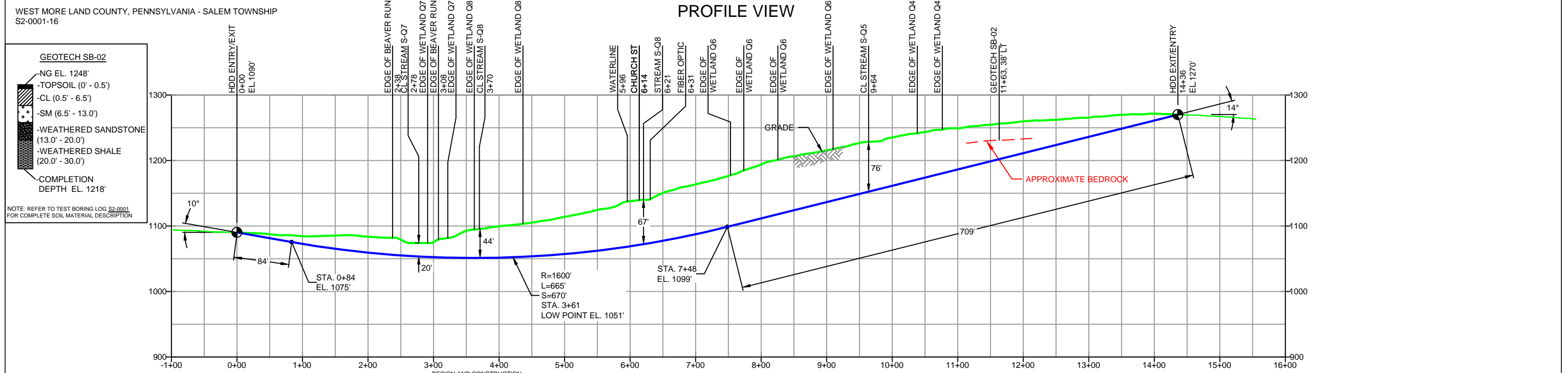
SCALE: 1"=150' DWG. NO: PA-WM2-0021.0000-RD



LEGEND

PERMANENT ROW	
TEMPORARY CONSTRUCTION ROW	
TEMPORARY WORKSPACE	
TEMPORARY ACCESS ROAD	
PERMANENT ACCESS ROAD	
SPOIL SPACE ONLY	
PROPOSED HDD	
PROPOSED 20" PIPELINE	
PROPOSED 16" PIPELINE	
HDD ENTRY-EXIT	
PEM WETLANDS	
PSS WETLANDS	
PFO WETLANDS	

PLAN VIEW



PROFILE VIEW

GEOTECH SB-02

	-NG EL. 1248'
	-TOPSOIL (0' - 0.5')
	-CL (0.5' - 6.5')
	-SM (6.5' - 13.0')
	-WEATHERED SANDSTONE (13.0' - 20.0')
	-WEATHERED SHALE (20.0' - 30.0')
	-COMPLETION DEPTH EL. 1218'

NOTE: REFER TO TEST BORING LOG S2-0001 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-): 1625'
 HDD PIPE LENGTH (S-): 1657'
 16" x 0.438" W.T., X-70, APISL, 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.
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 - SUNOCO PIPELINE, L.P.'S HORIZONTAL DIRECTIONAL DRILL INADVERTENT RETURN CONTINGENCY PLAN WILL BE IMPLEMENTED AT ALL TIMES.
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- SUNOCO EMERGENCY HOTLINE NUMBER IS #1-800-786-7440.

REF. DRAWING	NO.	DESCRIPTION	NO.	DESCRIPTION
ES-2.04	TO	ES-2.05	EROSION & SEDIMENT PLAN	
SHEET 55	TO	SHEET 55	AERIAL SITE PLAN	EP2 REVISED PER PADEP COMMENTS RECEIVED 09-06-16
				EP1 REVISED PER PADEP COMMENTS
				EP
				B ADDED GEOTECH INFO
				A ISSUED FOR BID

REVISIONS

BY	DATE	CHK	DATE	APP	DATE
DLM	10/07/16	RMB	10/07/16	AAW	10/07/16
MRS	05/20/16	RMB	05/20/16	AAW	05/20/16
DLM	03/15/16	RMB	03/15/16	AAW	03/15/16
MRS	10/08/15	RMB	10/08/15	AAW	10/08/15
MRS	08/31/15	RMB	08/31/15	AAW	08/31/15



SUNOCO PIPELINE, L.P.	
16-INCH HORIZONTAL DIRECTIONAL DRILL CHURCH STREET PENNSYLVANIA PIPELINE PROJECT	
SCALE: 1"=150'	DWG. NO: PA-WM2-0021.0000-RD-16



LEGEND:

⊙ Geotechnical Soil Boring (SB) Locations



TETRA TECH

GEOTECHNICAL BORING LOCATIONS
 HDD S2-0001 CHURCH STREET
 WESTMORELAND COUNTY, SALEM 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: CHURCH STREET/DONNA LANE, DELMONT, PA		Page 1 of 1
HDD No.: S2-0001	Dates(s) Drilled:	Inspector:
Boring No.: SB-01	Drilling Method: SPT - ASTM D1586	Driller:
Drilling Contractor:	Groundwater Depth (ft):	Total Depth (ft):
Boring Location Coordinates:		

Sample No.	Sample Depth (ft)		Strata Depth (ft)		Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N
	From	To	From	To								
							BORING NOT ADVANCED. COULD NOT ACCESS LOCATION OR NEARBY LOCATIONS DUE TO FORREST. ALSO, ADJACENT LANDOWNERS WOULD NOT ALLOW ACCESS FOR ALTERNATIVE LOCATIONS. REFER TO REGIONAL GEOLOGY FOR POTENTIAL BEDROCK ENCOUNTER AND DEPTHS TO ENCOUNTER.					

Notes/Comments:
Pocket Pentrometer Testing

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: CHURCH STREET/DONNA LANE, DELMONT, PA			Page 1 of 1		
HDD No.: S2-0001		Dates(s) Drilled: 09-24-15		Inspector: E. WATT	
Boring No.: SB-02		Drilling Method: SPT - ASTM D1586		Driller: K. KERSH	
Drilling Contractor: CONNELLY		Groundwater Depth (ft): NOT ENCOUNTERED		Total Depth (ft): 30.0	
Boring Location Coordinates:			40° 25' 32.896" N		79° 32' 56.979" 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	0.5			TOPSOIL (6")						
1	3.0	5.0	0.5		14	CL	MOTTLED BROWN AND GRAY SILTY CLAY AND FINE SAND. (USCS: CL).	6	7	7	9	14	
2	8.0	10.0	6.5		24	SM	DR, VARIOUS SHADES OF BROWN, FINE TO MEDIUM SAND WITH SOME SILT, TRACE UNWEATHERED SANDSTONE.	9	28	46	49	74	
3	13.0	14.0	13.5		12	PARTIALLY WEATHERED SANDSTONE	BROWN FINE TO MEDIUM SAND WITH A LITTLE SILT, INTER-LAYERED WITH PARTIALLY WEATHERED SANDSTONE.	24	50/6"			>50	
4	18.0	18.3			4		BROWN FINE TO MEDIUM SAND WITH A LITTLE SILT, INTER-LAYERED WITH PARTIALLY WEATHERED SANDSTONE.	50/4"				>50	
5	23.0	23.3	20.0		4	PARTIALLY WEATHERED SHALE	BROWN PARTIALLY WEATHERED SHALE.	50/4"				>50	
6	28.0	28.3			3		BROWN AND GRAY PARTIALLY WEATHERED SHALE.	50/3"				>50	
				30.0									
							AUGERED TO 30'.						

Notes/Comments:
 Pocket Pentrometer Testing
 S1: 2.75 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.

**GEOTECHNICAL LABORATORY TESTING SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S2-0001 CHURCH STREET**

HDD No.	Boring No.	Sample No.	Depth of Sample (ft.)		Water	Percent	Atterburg Limits (ASTM D4318)			USCS
			From	To	Content, % (ASTM D2216)	Silts/Clays, % (ASTM D1140)	Liquid Limit, %	Plastic Limit, %	Plasticity Index, %	Classif. (ASTM D2487)
S2-0001	SB-01	BORING NOT ADVANCED. NO ACCESS TO LOCATION OR NEARBY								
	SB-02	1	3.0	5.0	17.6	66.0	41	23	18	CL
		2	8.0	10.0	8.7	24.8	-	-	-	-
		3	13.0	14.0	4.8	18.0	-	-	-	-
		5	23.0	23.3	7.0	37.6	-	-	-	-
		6	28.0	28.3	7.5	61.8	-	-	-	-

Notes:

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

**REGIONAL GEOLOGY SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S2-0001 CHURCH STREET**

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
S2-0001	Church Street	SB-01	Casselman Formation - Cyclic sequences of shale, siltstone, sandstone, red beds, thin, impure limestone, and thin, nonpersistent coal; red beds are associated with landslides; base is at top of Ames limestone.	Rolling hills, moderate relief	Casselman	Shale-sandstone with limestone-clastic-coal	236-525	16-28	Yields range from 3-15 gpm
		SB-02							

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	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.