

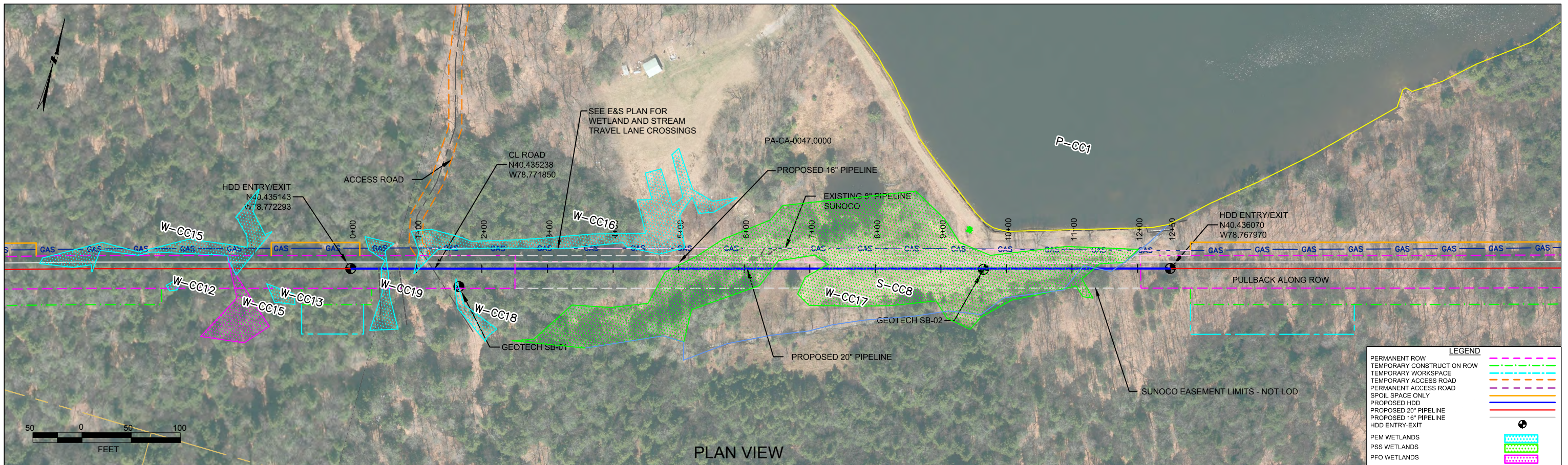
***HDD PA-CA-0047.0000-SR (W-CC19, W-CC16, W-CC17, and S-CC8)***

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 50 feet from the edge of the western most boundary of the wetland CC19, the wetland is 10 feet wide in this area. The drill will pass 8 feet under the western most boundary of the wetland. 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.

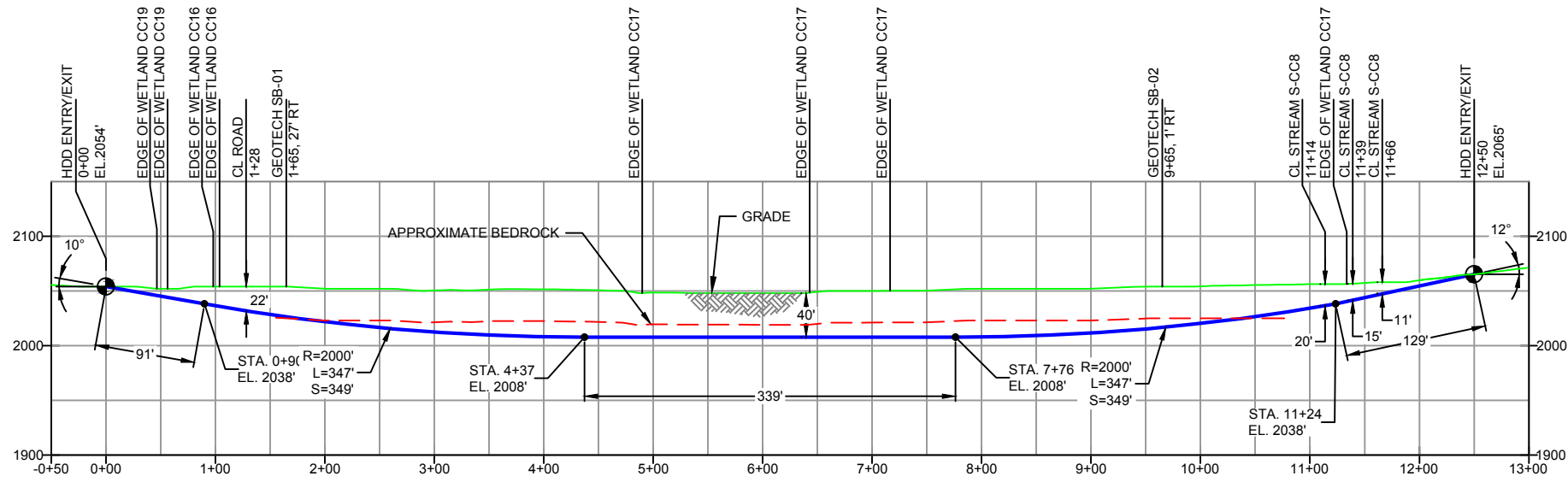
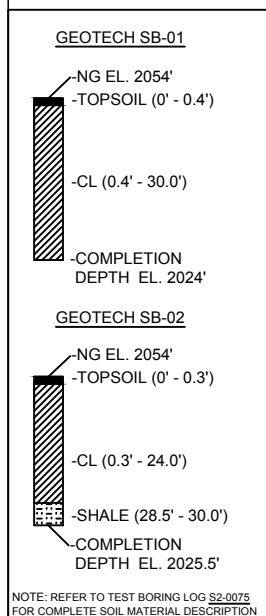
The drill will enter/exit 100 feet from the edge of the western most boundary of the wetland CC16, the wetland is 10 feet wide in this area. The drill will pass 15 feet under the western most boundary of the wetland. Using the results of the geotechnical investigation, as well as several other data points, 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.

The drill will enter/exit 480 feet west of wetland CC17. The drill will pass 40 feet under the western most boundary of the wetland and 15 feet under the eastern most boundary of the wetland. Stream CC8 runs along the eastern end of this wetland which is 1130 feet east of the west entry/exit point and 230 feet west of the east entry/exit point. The drill will pass 10 feet under this stream. 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.



PLAN VIEW  
PROFILE VIEW

CAMBRIA COUNTY PENNSYLVANIA, CAMBRIA TOWNSHIP  
S2-0075



DESIGN AND CONSTRUCTION:

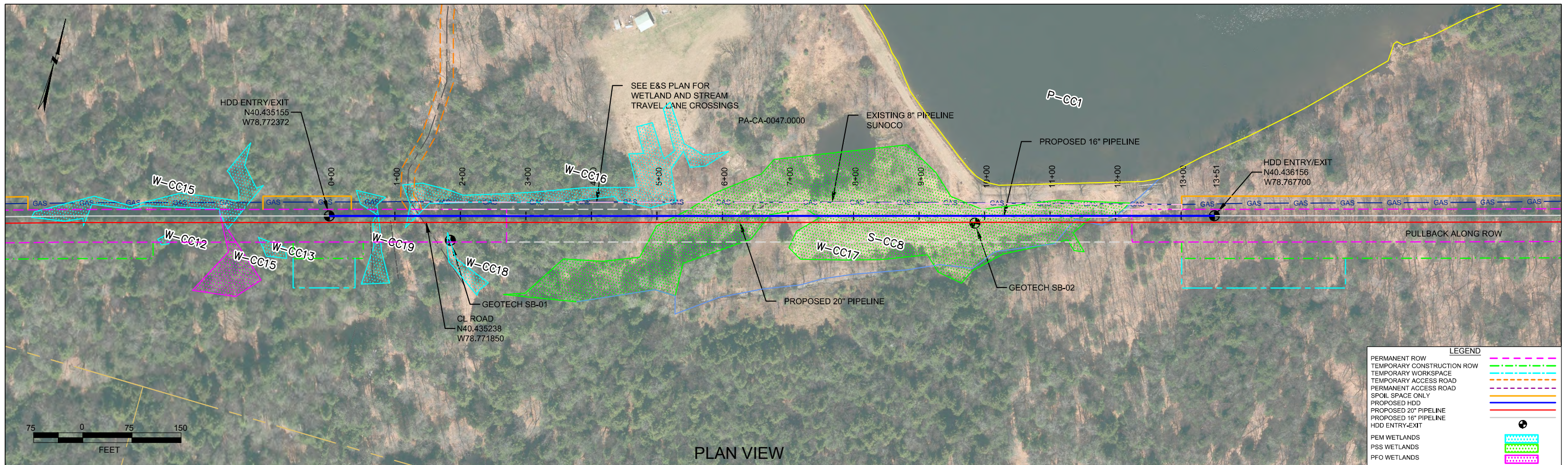
- CONTRACTOR SHALL FIELD VERIFY DEPTH OF ALL EXISTING UTILITIES SHOWN OR NOT SHOWN ON THIS DRAWING.
- THE MINIMUM SEPARATION DISTANCE FROM EXISTING SUBSURFACE UTILITIES SHALL NOT BE LESS THAN 10 FEET AS MEASURED FROM THE OUTSIDE EDGE OF THE UTILITY TO OUTSIDE OF PROPOSED PIPELINE.
- DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
- CROSSING PIPE SPECIFICATION:  
HDD HORZ. LENGTH (L)=1250'  
HDD PIPE LENGTH (S)=1257'  
20" x 0.456" W.T., X-65, API5L, PSL2, ERW, BFW  
COATING: 14-16 MILS FBE WITH 30-35 MIL ARO (POWERCRETE OR ENGINEER APPROVED EQUAL)
- 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

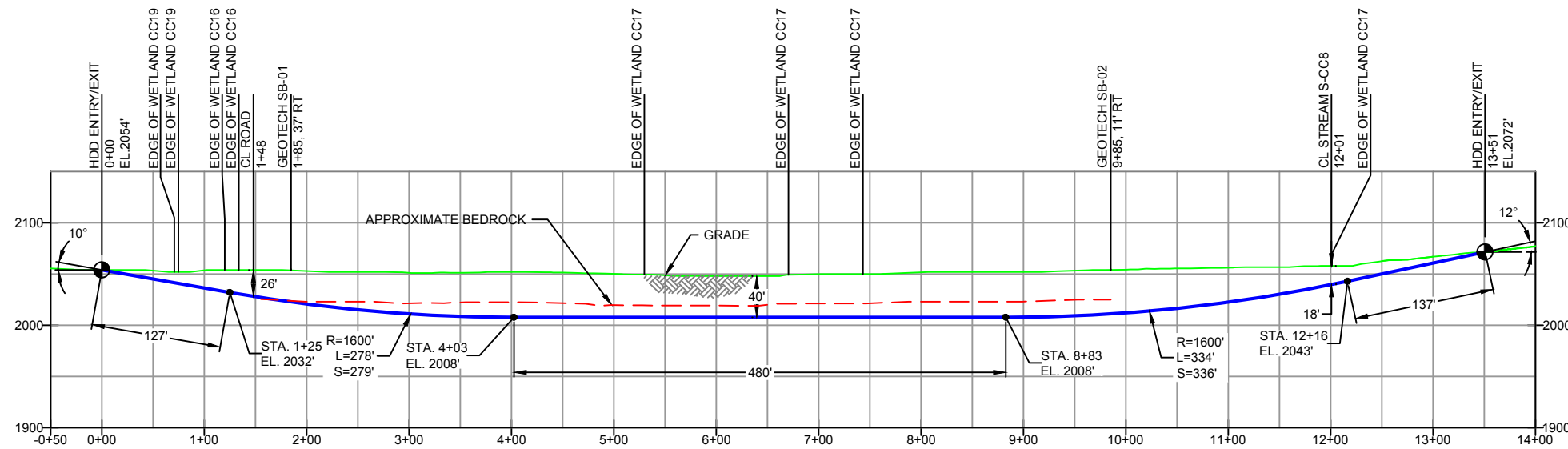
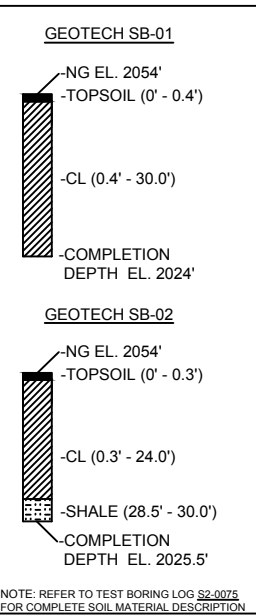
- ALL COORDINATES SHOWN ARE IN LATITUDE AND LONGITUDE. ALL MSL ELEVATIONS ARE NAD83
- STATIONING IS BASED ON HORIZONTAL DISTANCES.
- ROONEY ENGINEERING, INC. AND SUNOCO PIPELINE, LP ARE NOT RESPONSIBLE FOR LOCATION OF FOREIGN UTILITIES SHOWN IN PLOT PLAN OR PROFILE. THE INFORMATION SHOWN HEREON IS FURNISHED 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-2.33	TO ES-2.33	EROSION & SEDIMENT PLAN	EP2 REVISED PER PADEP COMMENTS RECEIVED 09-06-16	
SHEET 21	TO SHEET 21	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

			<b>SUNOCO PIPELINE, L.P.</b>	
	20-INCH HORIZONTAL DIRECTIONAL DRILL WETLAND CC17 PENNSYLVANIA PIPELINE PROJECT		SCALE: 1"=100'    DWG. NO: PA-CA-0047.0000-SR	



CAMBRIA COUNTY PENNSYLVANIA, CAMBRIA TOWNSHIP  
S2-0075-16



- 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-): 1351'  
HDD PIPE LENGTH (S-): 1361'  
16" x 0.438" W.T., X-70, API5L, PSL2, ERW, BFW  
COATING: 14-16 MILS FBE WITH 30-35 MIL ARO (POWERCRETE OR ENGINEER APPROVED EQUAL)
  - 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
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REF. DRAWING	NO.	DESCRIPTION	NO.	DESCRIPTION
ES-2.33 TO ES-2.33		EROSION & SEDIMENT PLAN		
SHEET 21 TO SHEET 21		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	05/18/16	RMB	05/18/16	AAW	05/18/16
JTW	03/15/16	RMB	03/15/16	AAW	03/15/16
MRS	09/06/15	RMB	09/06/15	AAW	09/06/15
MRS	08/31/15	RMB	08/31/15	AAW	08/31/15

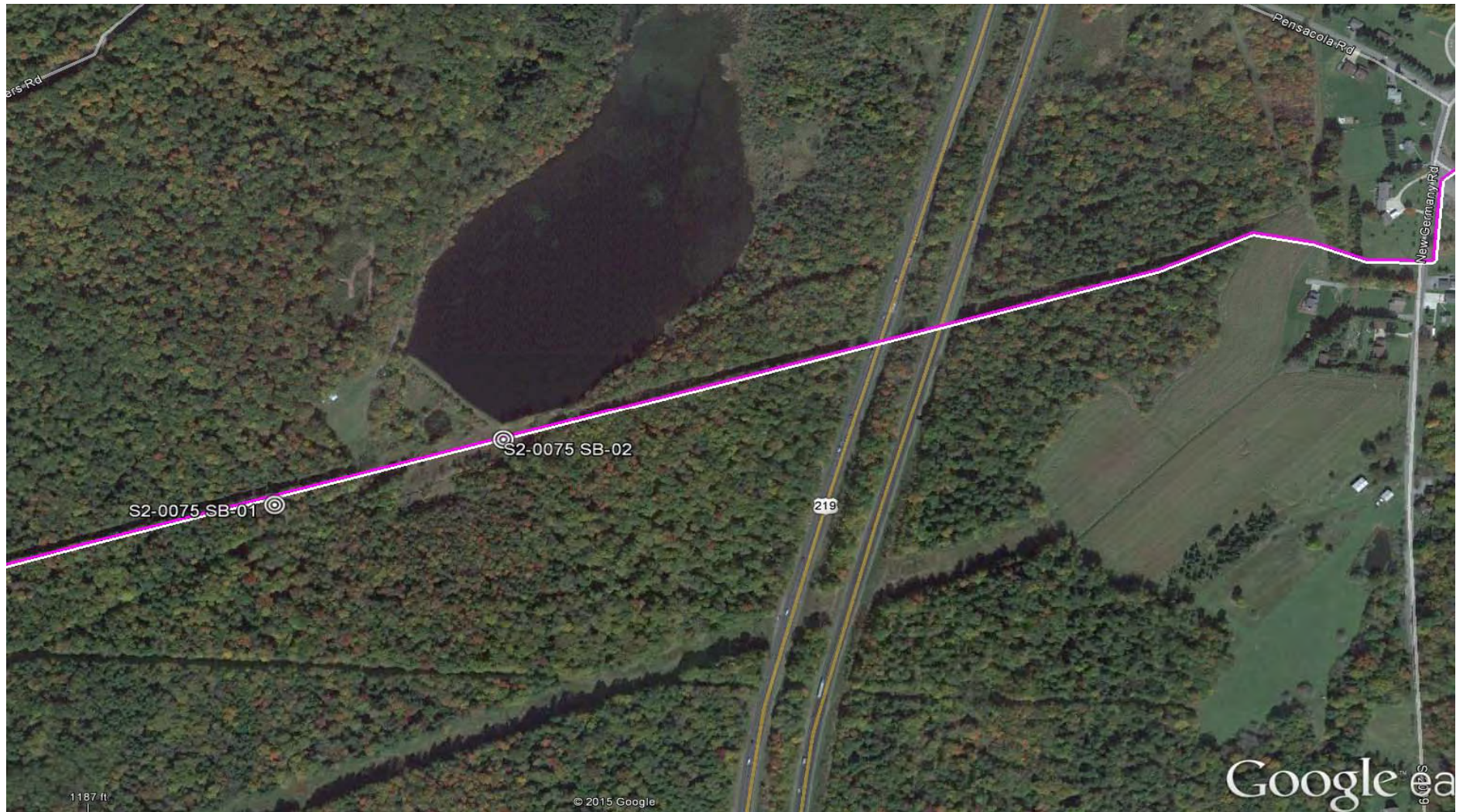
**Sunoco Logistics Partners L.P.**

**TETRA TECH ROONEY**  
(303) 792-5911

**SUNOCO PIPELINE, L.P.**

16-INCH HORIZONTAL DIRECTIONAL DRILL  
WETLAND CC17  
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=150' DWG. NO: PA-CA-0047.0000-SR-16



**LEGEND:**

⊙ Geotechnical Soil Boring (SB) Locations



GEOTECHNICAL BORING LOCATIONS  
HDD S2-0075  
CAMBRIA COUNTY, CAMBRIA 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: STAGER ROAD, EBENSBURG, PA			Page 1 of 1		
HDD No.: S2-0075		Dates(s) Drilled: 04-20-15		Inspector: E. WATT	
Boring No.: SB-01		Drilling Method: SPT - ASTM D1586		Driller: S. HOFFER	
Drilling Contractor: HAD DRILLING		Groundwater Depth (ft): NOT ENCOUNTERED		Total Depth (ft): 30.0	
Boring Location Coordinates:			40° 26' 6.703" N		78° 46' 18.065" 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	0.4			TOPSOIL (5")						
1	3.0	5.0	0.4		20	CL	MOTTLED BROWN AND GRAY SILTY CLAY WITH A LITTLE FINE SAND.	2	6	12	11	18	
2	8.0	10.0			24		MOTTLED BROWN AND GRAY SILTY CLAY WITH SOME FINE SAND, TRACE FINE GRAVEL. (USCS: CL)	4	8	10	15	18	
3	13.0	15.0			24		MOTTLED BROWN AND GRAY SILTY CLAY WITH SOME FINE SAND, TRACE FINE GRAVEL.	2	7	15	15	22	
4	18.0	20.0			24		MOTTLED BROWN AND GRAY SILTY CLAY WITH SOME FINE SAND, TRACE FINE GRAVEL. (USCS: CL)	1	3	6	8	9	
5	23.0	25.0			24		REDDISH BROWN, BROWN AND TAN SILTY CLAY AND FINE SAND, TRACE FINE TO COARSE GRAVEL.	1	4	13	12	17	
6	28.0	30.0			24		REDDISH BROWN, BROWN AND TAN SILTY CLAY WITH SOME FINE SAND, TRACE FINE TO COARSE GRAVEL.	2	6	8	15	14	
				30.0									
								DRY AND CAVED AT 27'.					

Notes/Comments:  
Pocket Pentrometer Testing  
 S1 THROUGH S3: > 4TSF  
 S4: 2.25 TSF  
 S5: > 4TSF  
 S6: > 4TSF

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  
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**TEST BORING LOG**

Project Name: SUNOCO PENNSYLVANIA PIPELINE PROJECT			Project No.: 103IP3406		
Project Location: STAGER ROAD, EBENSBURG, PA			Page 1 of 1		
HDD No.: S2-0075		Dates(s) Drilled: 04-21-15		Inspector: E. WATT	
Boring No.: SB-02		Drilling Method: SPT - ASTM D1586		Driller: S. HOFFER	
Drilling Contractor: HAD DRILLING		Groundwater Depth (ft): NOT ENCOUNTERED		Total Depth (ft): 28.5	
Boring Location Coordinates:			40° 26' 9.088" N		78° 46' 8.190" 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	0.3			TOPSOIL (3")						
1	3.0	5.0	0.3		8	CL	MOTTLED BROWN AND GRAY SILTY CLAY WITH SOME FINE SAND.	2	3	5	7	8	
2	8.0	10.0			24		MOTTLED BROWN AND GRAY SILTY CLAY WITH TRACE FINE SAND, TRACE FINE GRAVEL.	4	7	6	7	13	
3	13.0	15.0			24		MOTTLED BROWN AND GRAY SILTY CLAY WITH A LITTLE FINE SAND, TRACE FINE GRAVEL (USCS: CL)	1	1	4	5	5	
4	18.0	20.0			24		GRAY SITLY CLAY WITH A LITTLE FINE SAND, TRACE FINE GRAVEL.	1	8	16	26	24	
				19.5									
5	23.0	24.3	19.5		10		CL	GRAY DECOMPOSED SHALE, WEATHERED TO A SILTY CLAY, LITTLE FINE SAND, WITH A LITTLE SHALE GRAVEL. (USCS: CL)	38	37	50/3"		>50
6	28.0	28.3	24.0	28.5	3	PARTIALLY WEATHERED GRAY SHALE.		50/4"				>50	
							AUGER REFUSAL AT 28.5'.						
							DRY AND CAVED AT 26'.						

Notes/Comments:  
Pocket Pentrometer Testing BORING IN WETLANDS.  
 S2: 2.75 TSF  
 S3: 0.5 TSF  
 S4: > 4 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.

**GEOTECHNICAL LABORATORY TESTING SUMMARY  
SUNOCO PENNSYLVANIA PIPELINE PROJECT  
HDD S2-0075**

HDD No.	Test Boring No.	Sample No.	Depth of Sample (ft.)		Water Content, % (ASTM D2216)	Percent Silts/Clays, % (ASTM D1140)	Atterburg Limits (ASTM D4318)			USCS Classif. (ASTM D2487)
			From	To			Liquid Limit, %	Plastic Limit, %	Plasticity Index, %	
S2-0075	SB-01	2	8.0	10.0	14.2	74.4	36	21	15	CL
		3	13.0	15.0	14.3	65.5	-	-	-	-
		4	18.0	20.0	14.9	72.7	38	22	16	CL
		5	23.0	25.0	14.4	59.7	-	-	-	-
		6	28.0	30.0	16.1	76.4	-	-	-	-
	SB-02	1	3.0	5.0	29.0	71.9	-	-	-	-
		2	8.0	10.0	19.8	94.4	-	-	-	-
		3	13.0	15.0	23.2	81.4	35	17	18	CL
		4	18.0	20.0	16.5	84.2	-	-	-	-
		5	23.0	24.3	11.2	89.1	32	17	15	CL

**Notes:**

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

**REGIONAL GEOLOGY SUMMARY  
SUNOCO PENNSYLVANIA PIPELINE PROJECT  
HDD S2-0075**

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
S2-0075	Stager	SB-01	<b>Glenshaw Formation</b> - Cyclic sequences of shale, sandstone, red beds, and thin limestone and coal; includes four marine limestone or shale horizons; red beds are involved in landslides; base is at top of Upper Freeport coal.	Upland to mid-ridge	Glenshaw	Shale-sandstone with limestone-clastic-coal	280-375	7-39	Yields range from 5 to 30 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	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 <sup>(1)</sup>	$C_u = \frac{D_{60}}{D_{10}}$ 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 $\pm 2$ 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.