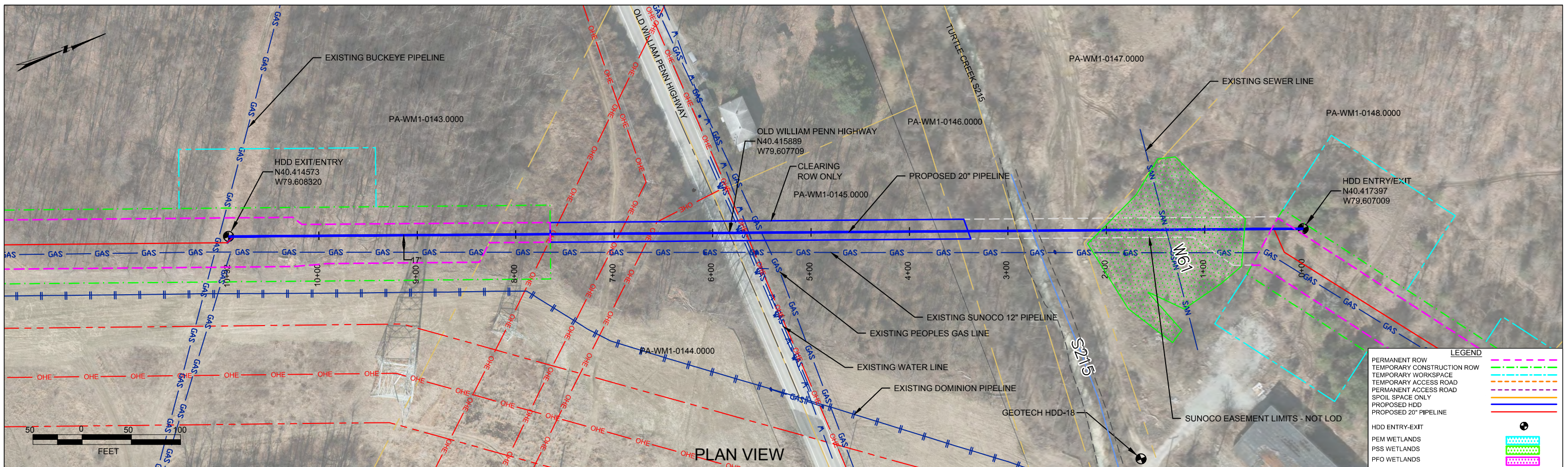


HDD PA-WM1-0144.0000-RD (S215, W61)

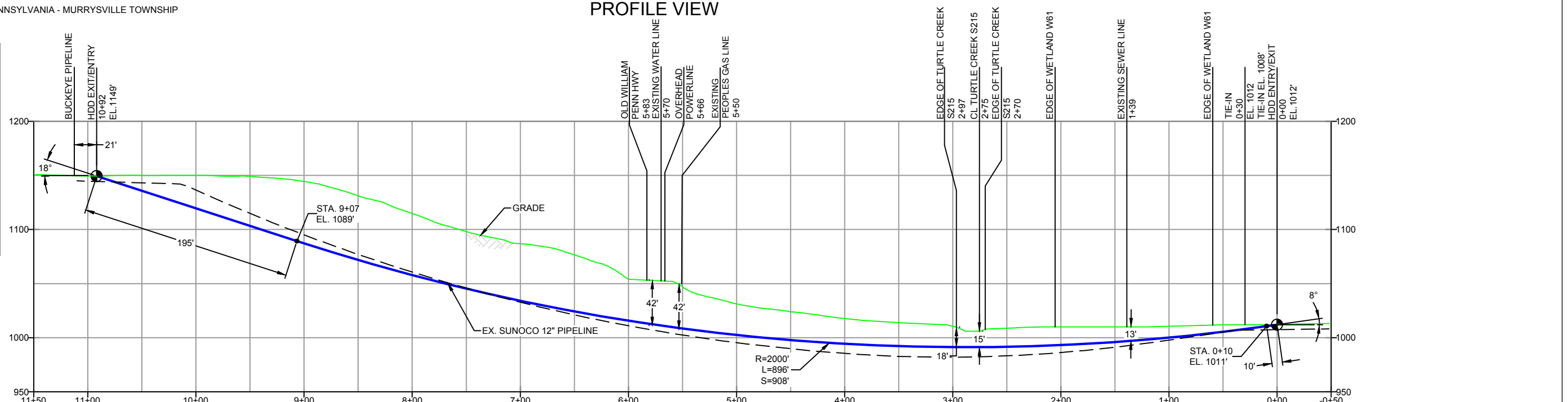
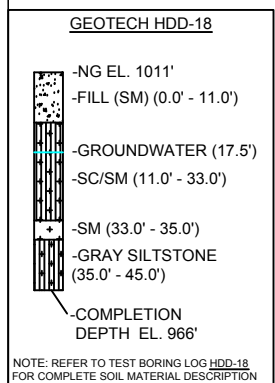
Given the design, the threat of inadvertent return has been reduced to the maximum extent practicable and in this case that threat is considered to be medium. Implementing this design, along with adherence to the Pennsylvania Pipeline Project Inadvertent Return Contingency Plan will ensure inadvertent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

The drill will enter/exit 500 feet from the western edge of Old William Penn Highway and enter/exit 540 feet from the eastern edge. The horizontal directional drill will enter/exit 820 feet from the western edge of Turtle Creek (S215) and enter/exit 250 feet from the eastern edge. The drill will also enter/exit 890 feet from the western edge of a scrub shrub wetland (W61) and enter/exit 28 feet from the eastern edge. The drill will cross below the highway at 42 feet, Turtle Creek at 15 feet, and the wetland between 8 feet and 15 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 report the primary substrate at the crossings is estimated to be a silty sand. Based on the geotechnical report, the drill profile, and the previous drill data minimal inadvertent returns are expected. With the low crossing below the wetland it is recommended (8 to 15 feet) additional inspection is recommended to observe for inadvertent returns during the drill.



WESTMORELAND COUNTY, PENNSYLVANIA - MURRYSVILLE TOWNSHIP
S1B-0270

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 HORIZ. LENGTH (L=): 1092'
HDD PIPE LENGTH (S=): 1113'
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		EROSION & SEDIMENT PLAN	
ES-1.64	TO	ES-1.65	EROSION & SEDIMENT PLAN
SHEET 48	TO	SHEET 48	AERIAL SITE PLAN
		EP2	REVISED PER PADEP COMMENTS RECEIVED 09-06-16
		EP1	REVISED PER PADEP COMMENTS
		EP	
DWG NO	DWG NO	DESCRIPTION	NO.

REVISIONS					
BY	DATE	CHK	DATE	APP	DATE

(303) 792-5911

SUNOCO PIPELINE, L.P.

20-INCH HORIZONTAL DIRECTIONAL DRILL
OLD WILLIAM PENN HIGHWAY
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=100'
DWG. NO: PA-WM1-0144.0000-RD



S:\GIS\Projects\GIS\Boring Map HDD-18.mxd

Source: Topo data from USGS DLG; Roads from De/DO*



Figure
Boring Location HDD-18
Sunoco Mariner East Project
Westmoreland 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
 302.733.7551
 fax: 302.454.5088

TEST BORING LOG

Project Name: SUNOCO MARINER EAST			Project No.: 103IP2762		
Project Location: WESTMORELAND COUNTY, PA			Page 1 of 1		
Test Boring No.: HDD-18	Dates(s) Drilled: 09/12/13		Inspector: E. WATT		
Drilling Contractor: CONNELLY	Drilling Method: SPT - ASTM D1586		Driller: K. KERSH		
Surface Elevation (ft):	Groundwater Depth (ft): 17.5'		Total Depth (ft): 45.0		

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		10	FILL (SM)	MULTI-COLORED FINE TO MEDIUM SAND, GRAVEL, SOME SILT (SUSPECTED HISTORICAL FILL).	3	9	15	24
2	8.5	10.0		11.0	2		MULTI-COLORED FINE TO MEDIUM SAND, GRAVEL, SOME SILT (SUSPECTED HISTORICAL FILL).	3	3	3	6
3	13.5	15.0	11.0		12	SC/S M	BROWN AND GRAY FINE SAND WITH SOME CLAY AND TRACES OF FINE GRAVEL.	1	2	2	4
4	18.5	20.0			9		BROWN FINE SAND AND CLAY. USCS: SC	1	1	2	3
5	23.5	25.0			12		DARK GRAY FINE TO MEDIUM SAND, WITH A LITTLE SILTY CLAY, TRACE FINE GRAVEL.	2	2	2	4
6	28.5	30.0		33.0	16		BROWN TO GRAY FINE TO COARSE SAND WITH SOME SILT, AND A LITTLE FINE GRAVEL.	4	3	3	6
7	33.5	34.4	33.0		10	SM	DECOMPOSED SILTSTONE ROCK WEATHERED TO A GRAY FINE SAND, WITH A LITTLE UNWEATHERED SILTSTONE GRAVEL.	41	50/5"		>50
				35.0			AUGER REFUSAL AT 35.0'.				
							ROCK CORING				
RUN 1	35.0	40.0	35.0			ROCK	GRAY SILTSTONE, 98% RECOVERY, 62.5% RQD				
RUN 2	40.0	45.0		45.0			DARK GRAY SILTSTONE, 100% RECOVERY, 83% RQD				

Notes/Comments:
Pocket Penetrometer Testing
 S3: 2.0 TSF
 S4: 1.5 TSF
 S7: >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.

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.