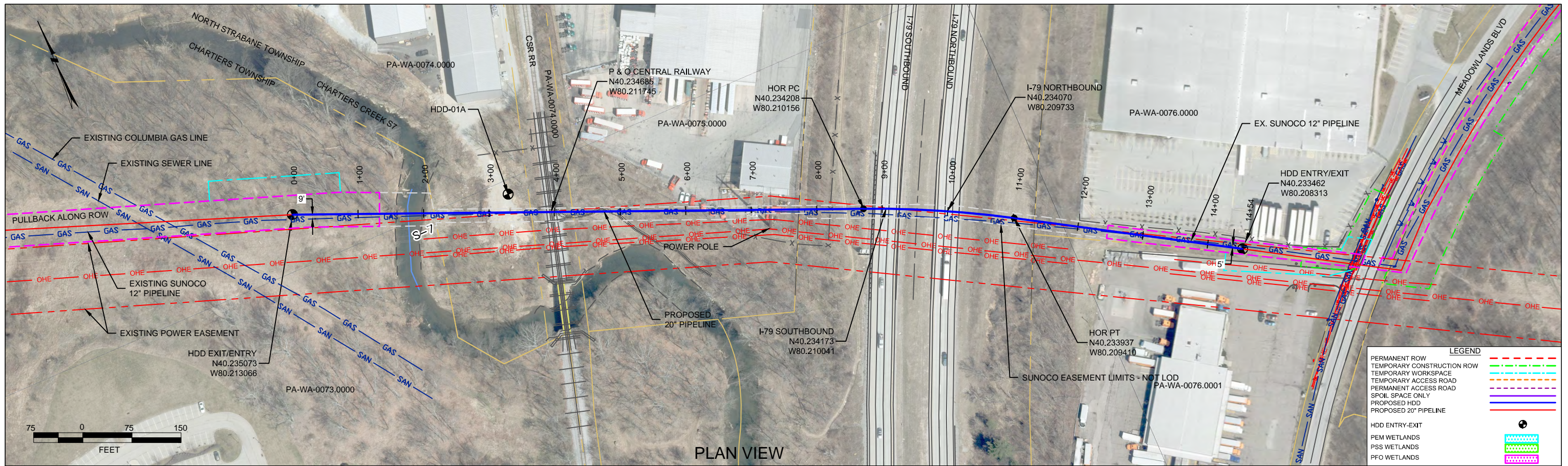


HDD PA-WA-0074.0000-RR (S7)

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.

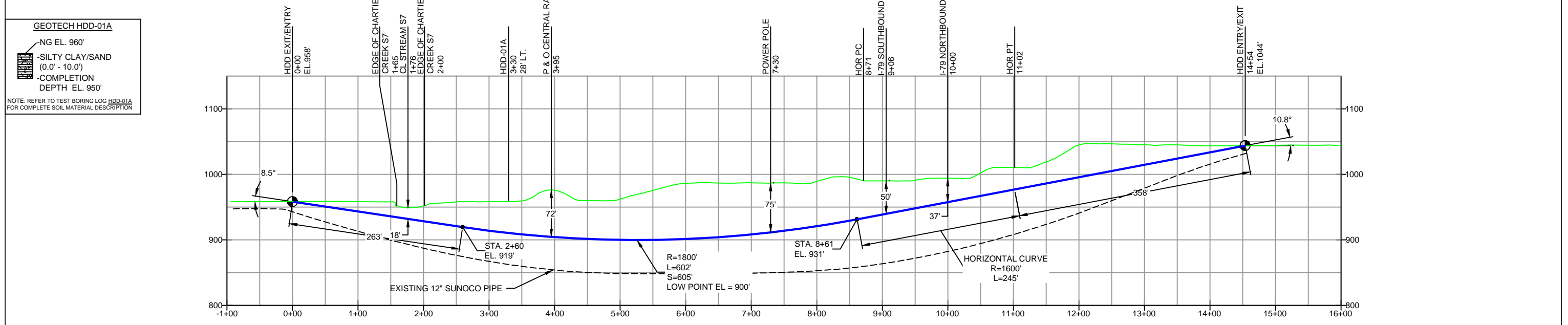
The drill will enter/exit 150 feet from the edge of the western most boundary of Chartiers Creek (S7) and enter/exit 1,200 feet from the eastern most boundary after crossing under Interstate 79. The drill will pass 15 feet under the western most boundary of the creek and 25 feet under the eastern most boundary. 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 that will be passed through below 12 feet is estimated to be rock. Based on the geotechnical report, the drill profile, and the previous drill data minimal inadvertent returns are expected.



PLAN VIEW

WASHINGTON COUNTY, PENNSYLVANIA - CHARTIERS/NORTH STRABANE TOWNSHIPS S1B-0020

PROFILE VIEW



GEOTECH HDD-01A
 -NG EL. 960'
 -SILTY CLAY/SAND (0.0' - 10.0')
 -COMPLETION DEPTH EL. 950'
 NOTE: REFER TO TEST BORING LOG HDD-01A 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): 1454'
 HDD PIPE LENGTH (S): 1471'
 20" x 0.456" W.T., X-65, API5L, 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

ES-1.14	TO	ES-1.15	EROSION & SEDIMENT PLAN
SHEET 8	TO	SHEET 9	AERIAL SITE PLAN

REVISIONS

EP2	REVISED PER PADEP COMMENTS RECEIVED 09-06-16	MRS	09/30/16	RMB	09/30/16	AAW	09/30/16			
EP1	REVISED PER PADEP COMMENTS	MRS	05/17/16	RMB	05/17/16	AAW	05/17/16			
EP		DLM	03/15/16	RMB	03/15/16	AAW	03/15/16			
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
 PITTSBURGH & OHIO CENTRAL RAILWAY, I-79
 PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=150' DWG. NO: PA-WA-0074.0000-RR



Source: Topo data from USGS D.L.G. Roads from DelDOT

S:\US-Projects\intra\community\RT - Rooney (RE)\GIS\Boring Map HDD-01A_01A2_01B.mxd



Figure
Boring Locations HDD-01A/01A2/01B
Sunoco Mariner East Project
Washington 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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TEST BORING LOG

Project Name: SUNOCO MARINER EAST			Project No.: 103IP2762		
Project Location: WASHINGTON COUNTY, PA			Page 1 of 1		
Test Boring No.: HDD-01A	Dates(s) Drilled: 06/10/13		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			6		GRAY AND BROWN FINE TO MEDIUM SAND WITH SOME SILTY CLAY, TRACE FINE GRAVEL, TRACES OF WOOD (FILL)	5	4	4	8
2	8.5	8.2			<1"		NO RECOVERY, GRAVEL IN SPOON TIP.	50/2"			
							AUGER REFUSAL AT 9.0'. OFFSET BORING 8' TO THE NORTH.				
3	12.0	12.1			0		CONTINUOUS DRILLING, AUGER REFUSAL AT 12'. NO RECOVERY. OFFSET BORING 13' TO THE WEST.	50/1"			
4	13.5	15.0			8		CONTINUOUS DRILLING, AUGER REFUSAL AT 13.5'. GRAY GRAVEL AND SAND WITH SOME SILT AND CLAY (FILL). OFFSET BORING 53' TO THE NORTH.	14	14	7	21
							CONTINUOUS DRILLING, AUGER REFUSAL AT 10'.				
							ABOVE BORINGS PERFORMED IN MOUNDED HISTORIC FILL				
							FILL AREA; INDICATED BY STEEP SIDE SLOPES CONTAINING MISCELLANEOUS SOIL FILL, CONCRETE RUBBLE, AND MISC. DEBRIS.				
							WILL PERFORM AN ADDITIONAL BORING TO THE NORTH, AT LOCATION BEYOND HISTORIC FILL AREA.				

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.



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TEST BORING LOG

Project Name: SUNOCO MARINER EAST			Project No.: 103IP2762		
Project Location: WASHINGTON COUNTY, PA			Page 1 of 1		
Test Boring No.:	HDD-01B	Dates(s) Drilled:	09/10/13	Inspector:	E. WATT
Drilling Contractor:	CONNELLY	Drilling Method:	SPT - ASTM D1586	Driller:	K. KERSH
Surface Elevation (ft):		Groundwater Depth (ft):		Total Depth (ft):	57.0

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		18	SUSPECTED FILL (SM)	BROWN FINE TO MEDIUM SAND, SILT, AND GRAVEL.	7	13	20	33
							SUSPECTED HISTORICAL FILL)				
2	8.5	10.0			17		SIMILAR TO ABOVE.	8	11	16	27
3	12.0	12.0		12.0	0	SUSPECTED FILL??	NO RECOVERY	50/0"			
							AUGER REFUSAL AT 12'. MADE SEVERAL FAILED ATTEMPTS TO				
							PENETRATE DEEPER THAN 12'.				
							ROCK CORING				
RUN 1	12.0	17.0	12.0			SUSPECTED FILL??	78% RECOVERY, 58% RQD. SUSPECTED HISTORICAL FILL:				
							GRAY SANDSTONE, MICA, BROWN SILT, GRAVEL.				
RUN 2	17.0	22.0					40% RECOVERY, 0% RQD. SUSPECTED HISTORICAL FILL:				
							SANDSTONE, BROWN AND GRAY SILT, GRAVEL/ROCK.				
RUN 3	22.0	27.0				SUSPECTED FILL??	33% RECOVERY, 0% RQD. SUSPECTED HISTORICAL FILL:				
							SOIL, GRAVEL, ROCK.				
RUN 4	27.0	32.0		32.0		SUSPECTED FILL??	60% RECOVERY, 0% RQD. SUSPECTED HISTORICAL FILL:				
							SANDSTONE GRAVEL WITH MICA.				
RUN 5	32.0	37.0	32.0			VIRGIN SOILS??	50% RECOVERY, 0% RQD. SUSPECTED HISTORICAL FILL:				
							BROWN AND GRAY SILT, SAND, GRAVEL, ROCK.				
RUN 6	37.0	42.0		43.0		VIRGIN SOILS??	22% RECOVERY, 0% RQD. SUSPECTED HISTORICAL FILL:				
							BROWN AND GRAY SILT, SAND, GRAVEL, ROCK.				
RUN 7	42.0	47.0	43.0			ROCK	78% RECOVERY, 43% RQD. GRAY TO DARK GRAY				
							SILTSTONE.				
RUN 8	47.0	52.0					100% RECOVERY, 34% RQD. GRAY TO DARK GRAY SILTSTONE.				
RUN 9	52.0	57.0		57.0		ROCK	87% RECOVERY, 45% RQD. GRAY TO DARK GRAY SILTSTONE.				

Notes/Comments:

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					
	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.