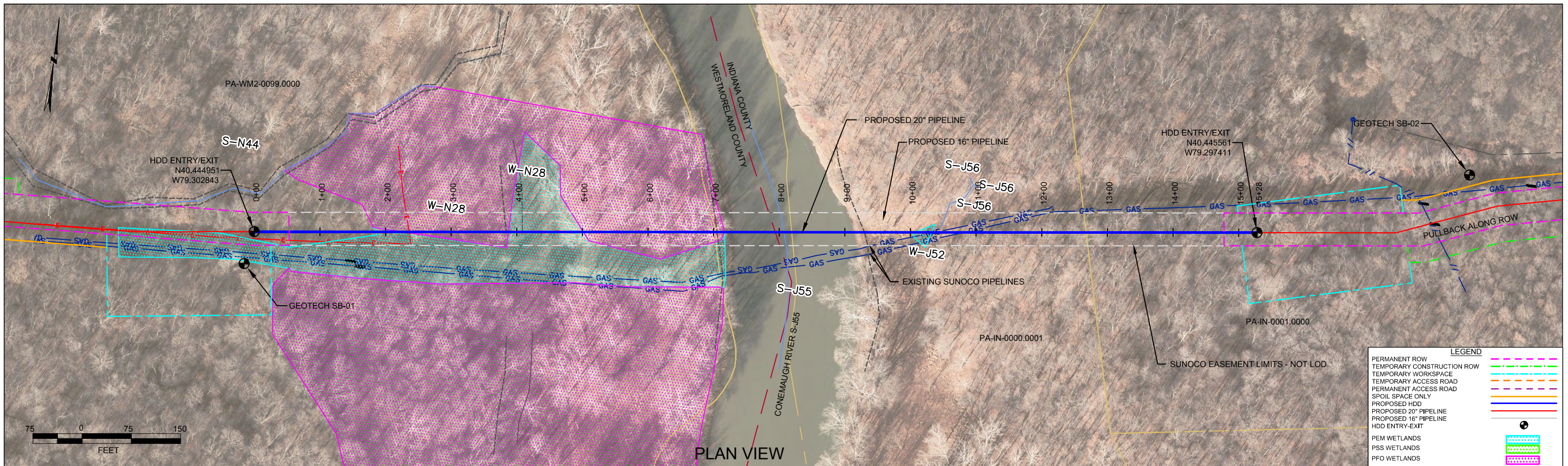


HDD PA-IN-0000.0001-WX (W-N28 and Conemaugh River)

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.

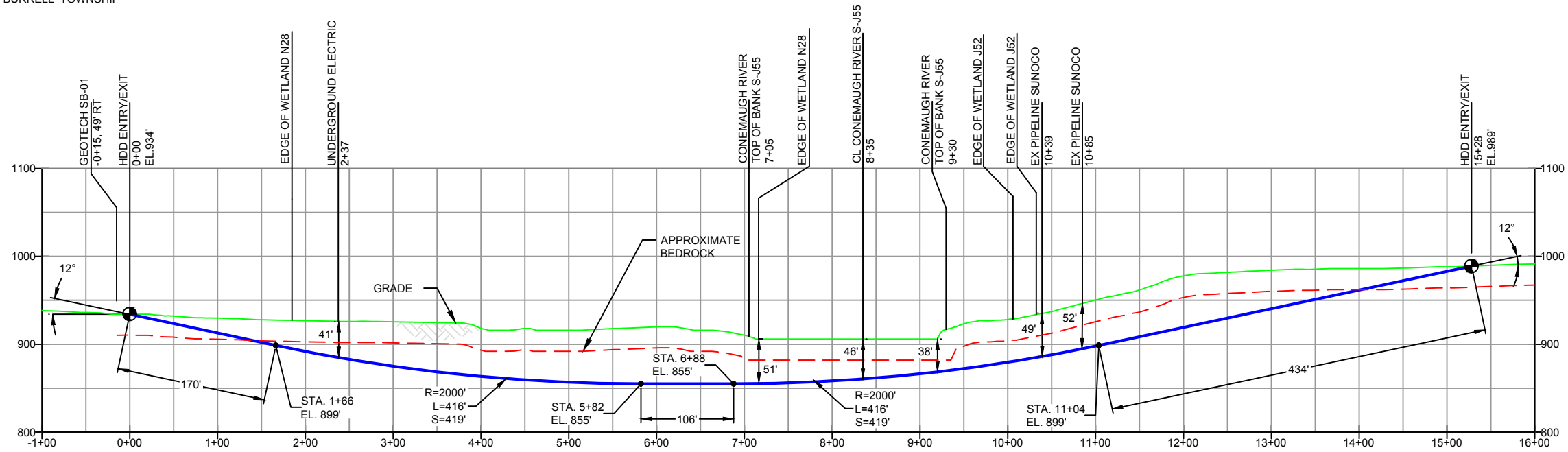
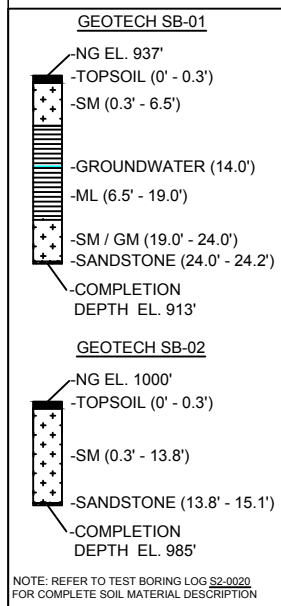
The drill will enter/exit 185 feet west of wetland W-N28. The drill will pass 30 feet under the westernmost boundary of this wetland. The east entry/exit point is 815 feet east of the easternmost boundary of this wetland. The drill will pass 51 feet under the easternmost boundary of this wetland. Using 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 sand, silt, sandstone gravel and sandstone.

The drill will enter/exit 705 feet west of the Conemaugh River. The drill will pass 51 feet under the west bank and 38 feet under the east bank. The east entry/exit point is 598 feet east of this river. 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 sand, silt, sandstone gravel and sandstone west of the river, silty sand and sandstone east of the river, and sandstone beneath the river.



WESTMORELAND COUNTY, PENNSYLVANIA - DERRY TOWNSHIP
 INDIANA COUNTY, PENNSYLVANIA - BURRELL TOWNSHIP
 S2-0020

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=): 1528'
 HDD PIPE LENGTH (S=): 1548'
 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		REVISIONS		
ES-2.47.01	TO ES-2.01	EROSION & SEDIMENT PLAN	EP2 REVISED PER PADEP COMMENTS RECEIVED 09-06-16	
SHEET 82	TO SHEET 1	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

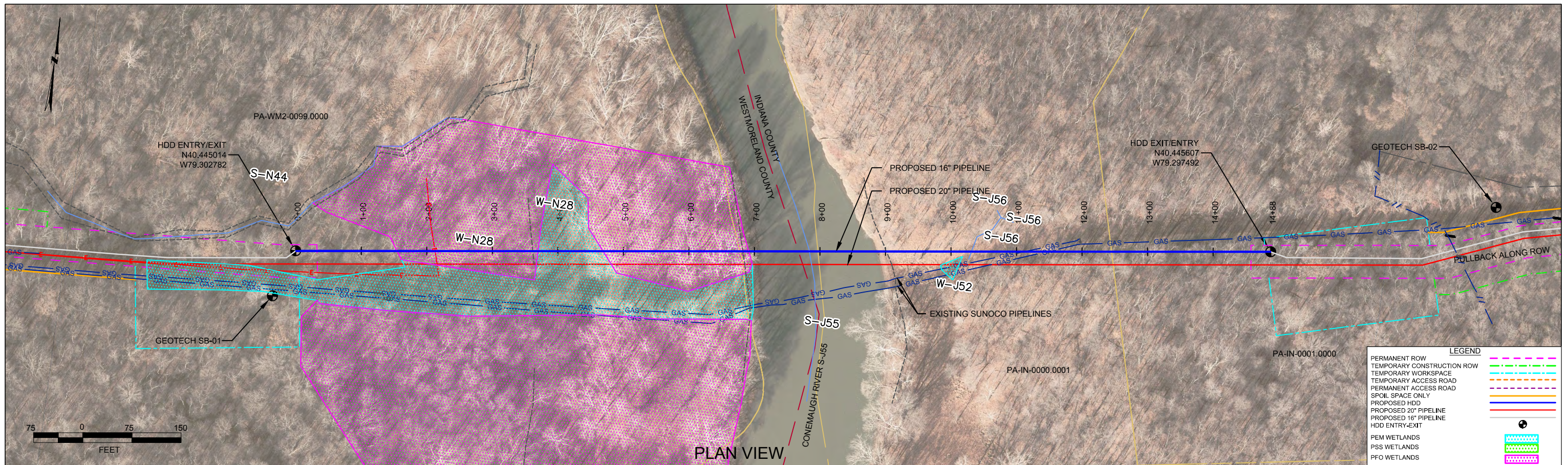
**Sunoco Logistics
Partners L.P.**

TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

20-INCH HORIZONTAL DIRECTIONAL DRILL
CONEMAUGH RIVER
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=150' DWG. NO: PA-IN-0000.0001-WX



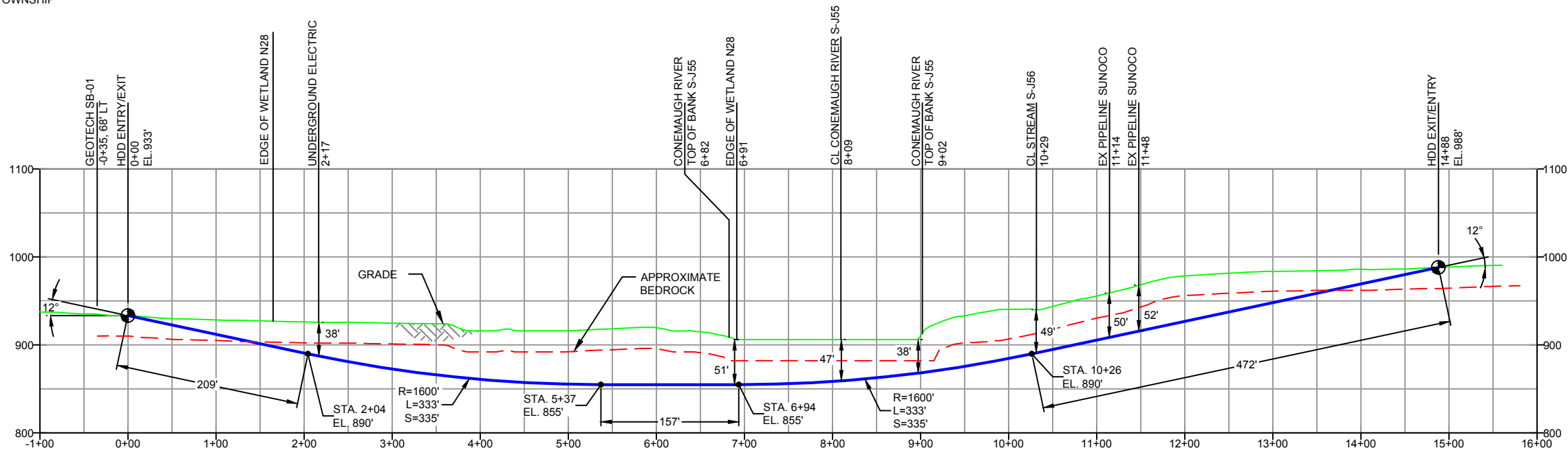
LEGEND	
PERMANENT ROW	
TEMPORARY CONSTRUCTION ROW	
TEMPORARY WORKSPACE	
TEMPORARY ACCESS ROAD	
PERMANENT ACCESS ROAD	
SPOIL SPACE ONLY	
PROPOSED HDD	
PROPOSED 20" PIPELINE	
PROPOSED 16" PIPELINE	
HDD ENTRY-EXIT	
PEM WETLANDS	
PSS WETLANDS	
PFO WETLANDS	

WESTMORELAND COUNTY, PENNSYLVANIA - DERRY TOWNSHIP
 INDIANA COUNTY, PENNSYLVANIA - BURRELL TOWNSHIP
 S2-0020-16

PROFILE VIEW

GEOTECH SB-01	
-NG EL. 937'	
-TOPSOIL (0' - 0.3')	
-SM (0.3' - 6.5')	
-GROUNDWATER (14.0')	
-ML (6.5' - 19.0')	
-SM / GM (19.0' - 24.0')	
-SANDSTONE (24.0' - 24.2')	
-COMPLETION DEPTH EL. 913'	
GEOTECH SB-02	
-NG EL. 1000'	
-TOPSOIL (0' - 0.3')	
-SM (0.3' - 13.8')	
-SANDSTONE (13.8' - 15.1')	
-COMPLETION DEPTH EL. 985'	

NOTE: REFER TO TEST BORING LOG S2-0020 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-): 1488'
 HDD PIPE LENGTH (S-): 1508'
 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.
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NOTES	
1.	ALL COORDINATES SHOWN ARE IN LATITUDE AND LONGITUDE. ALL MSL ELEVATIONS ARE NAD83
2.	STATIONING IS BASED ON HORIZONTAL DISTANCES
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4.	CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UTILITIES. CONTACT ONE CALL AT 811 PRIOR TO DIGGING.
5.	SUNOCO EMERGENCY HOTLINE NUMBER IS #1-800-786-7440.

REF. DRAWING		REVISIONS	
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SHEET 82	TO SHEET 1	AERIAL SITE PLAN	
		EP2	REVISED PER PADEP COMMENTS RECEIVED 09-06-16
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		B	ADDED GEOTECH INFO
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DWG NO	DWG NO	DESCRIPTION	DESCRIPTION

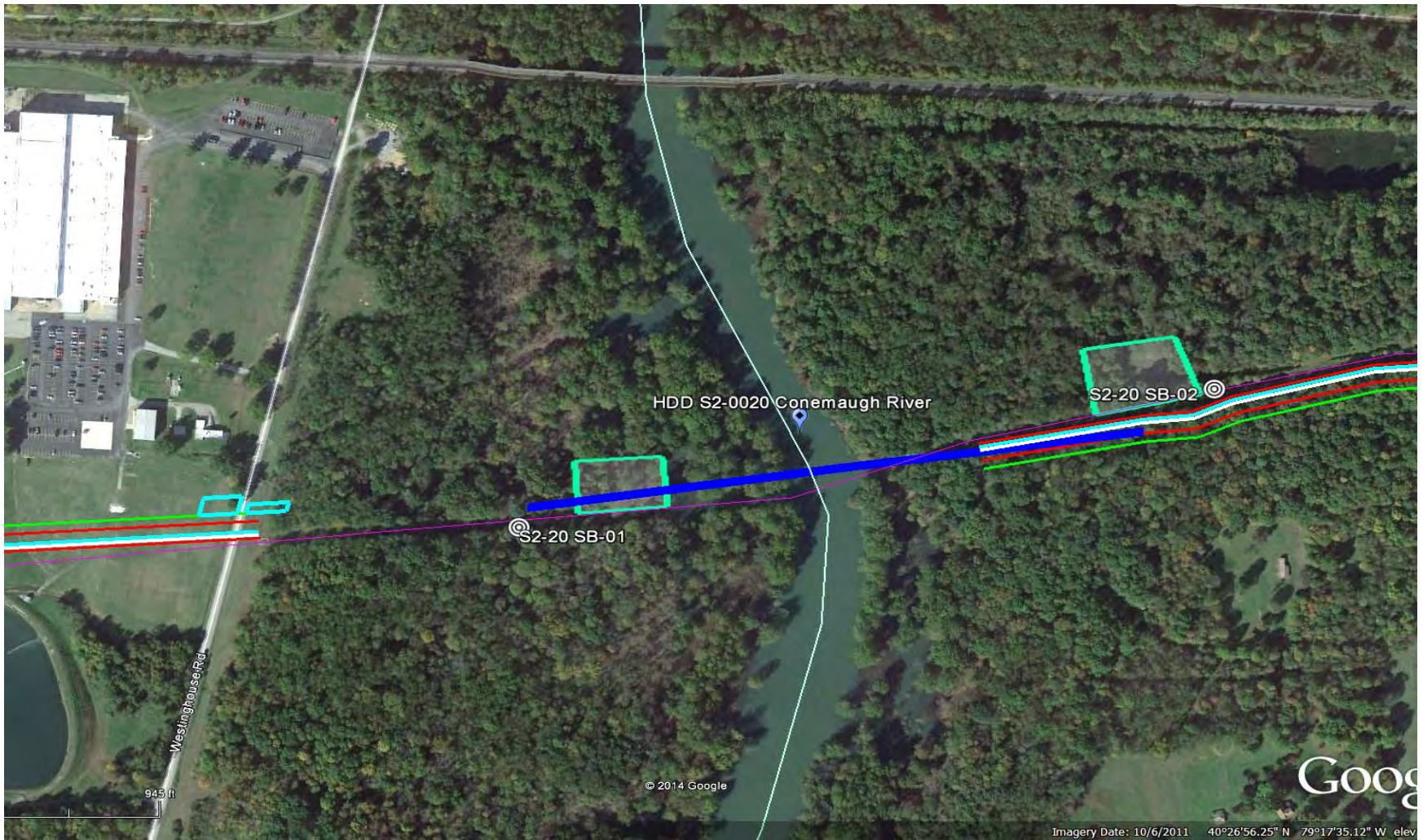
Sunoco Logistics Partners L.P.

TETRA TECH ROONEY
 (303) 792-5911

SUNOCO PIPELINE, L.P.

16-INCH HORIZONTAL DIRECTIONAL DRILL
 CONEMAUGH RIVER
 PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=150'
 DWG. NO: PA-IN-0000.0001-WX-16



LEGEND:

⊙ Geotechnical Soil Boring (SB) Locations



GEOTECHNICAL BORING LOCATIONS
 HDD S2-0020
 WESTMORELAND COUNTY, DERRY TOWNSHIP, PA &
 INDIANA COUNTY, BURRELL 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:	WEST SIDE OF CONEMAUGH RIVER, WESTINGHOUSE ROAD, BLAIRSVILLE, PA	Page 1 of 1	
HDD No.:	S2-0020	Dates(s) Drilled:	10-09-14
Boring No.:	SB-01	Inspector:	E. WATT
Drilling Contractor:	HAD DRILLING	Drilling Method:	SPT - ASTM D1586
		Driller:	S. HOFFER
		Groundwater Depth (ft):	14.0
		Total Depth (ft):	24.2

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		12	SM	BROWN TO ORANGE BROWN FINE TO MEDIUM SAND WITH A LITTLE FINE TO COARSE SANDSTONE GRAVEL.	7	22	20	18	42	
2	8.0	10.0	6.5		12	ML	MOTTLED (BROWN AND LIGHT GRAY) CLAYEY SILT WITH A TRACE FINE GRAVEL (USCS: ML).	3	6	8	12	14	
3	13.0	14.9			14		DR WEATHERED TO A MOTTLED (REDDISH BROWN, LIGHT GRAY, YELLOW BROWN) SILT.	2	15	48	50/5"	63	
4	18.0	18.6			5	ML	DR WEATHERED T A LIGHT BROWN AND LIGHT GRAY SILT AND F-M SAND, TRACE SANDSTONE GRAVEL.	2	50/2"			>50	
				19.0									
5	23.0	23.7	19.0		8	SM/GM	DR WEATHERED TO A FINE TO MEDIUM SAND AND FINE TO COARSE SANDSTONE GRAVEL.	19	50/3"			>50	
6	24.0	24.2			2		PARTIALLY WEATHERED GRAY SANDSTONE	50/2"				>50	

Notes/Comments:
Pocket Pentrometer Testing DR: DECOMPOSED ROCK
 S2: >4 TSF 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.

**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:	EAST SIDE OF CONEMAUGH RIVER, BLAIRSVILLE, PA	Page 1 of 1	
HDD No.:	S2-0020	Dates(s) Drilled:	10-08-14
Boring No.:	SB-02	Inspector:	E. WATT
Drilling Contractor:	HAD DRILLING	Drilling Method:	SPT - ASTM D1586
		Driller:	S. HOFFER
		Groundwater Depth (ft):	NOT ENCOUNTERED
		Total Depth (ft):	15.1

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	0.3			TOPSOIL (3")						
1	3.0	5.0	0.3		18	SM	DR WEATHERED TO A BROWN FINE SAND, WITH A TRACE FINE SANDSTONE GRAVEL, SOME SILT.	7	24	38	50/0"	62	
2	8.0	8.9			10		LIGHT BROWN TO ORANGE BROWN FINE SAND WITH SOMESILT, AND A LITTLE FINE TO COARSE SANDSTONE GRAVEL.	10	50/5"			>50	
3	13.0	13.8			8		LIGHT BROWN TO ORANGE BROWN FINE SAND WITH A LITTLE SILT, AND A LITTLE FINE TO COARSE SANDSTONE GRAVEL.	42	50/3"			>50	
4	15.0	15.1	13.8	15.1	<1		PARTIALLY WEATHERED BROWN SANDSTONE.	50/1"				>50	
							AUGER REFUSAL AT 15.0'. SUBSEQUENTLY, OFF-SET BOREHOLE AND CONTINUOUSLY AUGERED TO AUGER REFUSAL AT 14.9'.						
							STARTED GRINDING AT 7'. CAVED AND DRY AT 14'.						

Notes/Comments:
Pocket Pentrometer Testing 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.

**LABORATORY TESTING SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S2-0020 CONEMAUGH RIVER SOIL BORINGS**

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, %	
S2-0020	SB-01	1	3.0	5.0	16.6	30.2	-	-	-	-
		2	8.0	10.0	17.6	99.4	35	29	6	ML
		3	13.0	15.0	8.2	96.4	-	-	-	-
		4	18.0	20.0	8.2	58.3	-	-	-	-
		5	23.0	25.0	2.8	16.8	-	-	-	-
	SB-02	1	3.0	5.0	7.1	36.4	-	-	-	-
		2	8.0	10.0	6.3	29.9	-	-	-	-
		3	13.0	15.0	6.3	19.9	-	-	-	-
		4	18.0	20.0	8.4	38.9	-	-	-	-

Sunoco Pennsylvania Pipeline Project
Regional Geological Description
HDD S2-0020 Conemaugh River

HDD NO.	NAME	BORING NO.	GEOLOGY DESCRIPTION	GENERAL TOPO. SETTING	BEDROCK FM	GENERAL ROCK TYPE	APPROX. FM THICK. (FT)	DEPTH TO ROCK (Ft bgs)
S2-0020	Conemaugh River	SB-01	Glenshaw Formation - 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 ridge sloping down to river	Glenshaw	Shale-sandstone with limestone-clastic-coal	280-375	12-22
		SB-02						

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.