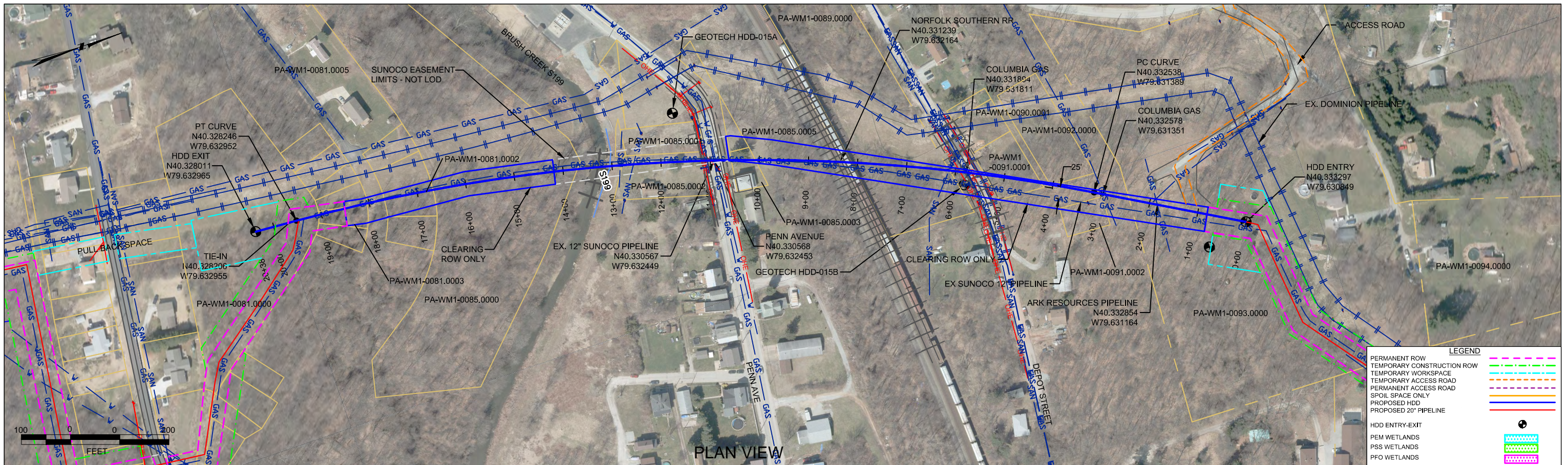


HDD PA-WM1-0088.0000-RR (S199)

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 600 feet from the western edge of Brush Creek (S199) and enter/exit 1,300 feet from the eastern edge. The horizontal directional drill will enter/exit 1,100 feet from the western edge of the Norfolk Southern Rail Road (NSRR) and enter/exit 810 feet from the eastern edge. The drill will cross below S199 at 35 feet and NSRR at 93 feet. The 20" drill will follow 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 both crossings is estimated to be claystone with silty clay layers above the drill. Based on the geotechnical report, the drill profile, and the previous drill data minimal inadvertent returns are expected.



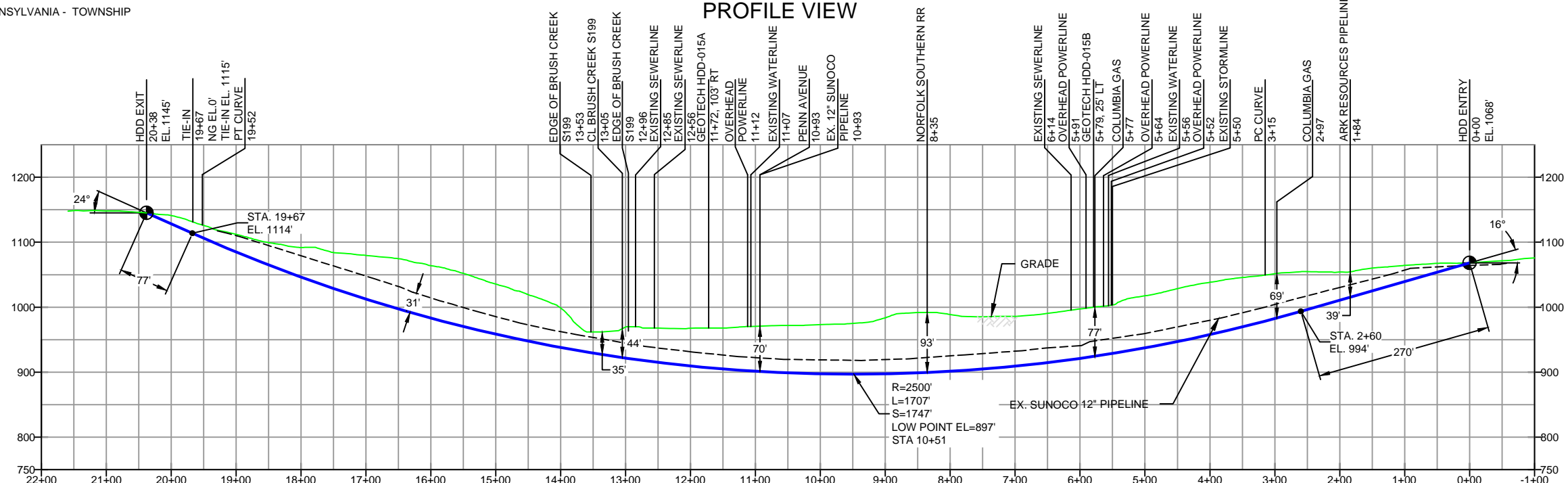
WESTMORELAND COUNTY, PENNSYLVANIA - TOWNSHIP
S1B-0250

PROFILE VIEW

GEOTECH HDD-15A

- NG EL. 968'
- CL (0.0' - 7.0')
- SM (7.0' - 12.0')
- GROUNDWATER (11.0')
- CL (12.0' - 15.0')
- WEATHERED CLAYSTONE (15.0' - 23.5')
- GRAY/RED CLAYSTONE (23.5' - 33.5')
- COMPLETION DEPTH EL. 935'

NOTE: REFER TO TEST BORING LOG HDD-15A 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_H): 2038'
HDD PIPE LENGTH (S_H): 2039'
20" x 0.456" W.T., X-65, APISL, 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 | | REVISIONS | |
|--------------|-------------|-------------------------|--|
| ES-1.43 | TO ES-1.44 | EROSION & SEDIMENT PLAN | |
| SHEET 32 | TO SHEET 33 | AERIAL SITE PLAN | |
| | | EP2 | REVISED PER PADEP COMMENTS RECEIVED 09-06-16 |
| | | EP1 | REVISED PER PADEP COMMENTS |
| | | EP | |
| DWG NO | DWG NO | DESCRIPTION | NO. |
| | | | |
| BY | DATE | CHK | DATE |
| MRS | 09/30/16 | RMB | 09/30/16 |
| MRS | 05/20/16 | RMB | 05/20/16 |
| JTW | 03/15/16 | RMB | 03/15/16 |
| APP | DATE | APP | DATE |
| AAW | 09/30/16 | AAW | 09/30/16 |
| AAW | 05/20/16 | AAW | 05/20/16 |
| AAW | 03/15/16 | AAW | 03/15/16 |

Sunoco Logistics Partners L.P.

TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

20-INCH HORIZONTAL DIRECTIONAL DRILL
NORFOLK SOUTHERN RAILWAY
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=200'
DWG. NO: PA-WM1-0088.0000-RR



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

S:\03-Project\Info\company\11 - Rooney (R)\GIS\Boring Map HDD-15A\B.mxd



Figure
 Boring Locations HDD-15A/15B
 Sunoco Mariner East Project
 Westmoreland County, PA



1 inch = 500 feet


Tetra Tech, Inc.
 Phone: (302) 738-7551
 Toll Free: (800) 462-0910
www.tetrattech.com

This map is provided by Tetra Tech solely for display and reference purposes and is subject to change without notice. No claims, either real or assumed, as to the absolute accuracy or precision of any data contained herein are made by Tetra Tech, nor will Tetra Tech be held responsible for any use of this document for purposes other than which it was intended.



TETRA TECH
 240 Continental Drive, Suite 200
 Newark, Delaware 19713
 302.738.7551
 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-15A** Dates(s) Drilled: 06/14/13 Inspector: E. WATT
 Drilling Contractor: **CONNELLY** Drilling Method: SPT - ASTM D1586 Driller: T. REDMAN
 Surface Elevation (ft): _____ Groundwater Depth (ft): 11 Total Depth (ft): 17.7

| 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 | CL | BROWN SILTY CLAY, FRAGMENTS OF GRAVEL IN TIP. | 4 | 4 | 5 | 9 |
| | | | | 7.0 | | | | | | | |
| 2 | 8.5 | 10.0 | 7.0 | | 15 | SM | MOTTLED DARK GRAY AND BROWN FINE TO MEDIUM SAND WITH SOME SILT. POSSIBLE COAL LENS AT 9.7. | 4 | 8 | 11 | 19 |
| | | | | 12.0 | | | | | | | |
| 3 | 13.5 | 13.9 | 12.0 | | 18 | CL | GRAY TO DARK GRAY SILTY CLAY, TRACE FINE SAND. USCS: CL | 17 | 22 | 27 | 49 |
| | | | | 15.0 | | | | | | | |
| 4 | 17.5 | 17.7 | 15.0 | 17.7 | 1 | | LIGHT GRAY PARTIALLY WEATHERED CLAYSTONE. | 50/2" | | | |
| | | | | | | | AUGER REFUSAL AT 17.5'. | | | | |
| | | | | | | | WET ON SPOON AT 20'. | | | | |
| | | | | | | | WATER LEVEL THROUGH AUGERS AT 11'. | | | | |

Notes/Comments:
Pocket Penetrometer Testing
 S3: >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.



TETRA TECH
 240 Continental Drive, Suite 200
 Newark, Delaware 19713
 302.738.7551
 fax: 302.454.5988

TEST BORING LOG

| | | | | | |
|---|--|-----------------------------------|-------------------------|--------------------|------------------------|
| Project Name: SUNOCO MARINER EAST | | | Project No.: 103IP2762 | | |
| Project Location: WESTMORELAND COUNTY, PA | | | Page 1 of 1 | | |
| Test Boring No.: HDD-15A CORING | | Dates(s) Drilled: 09/11/13 | | Inspector: E. WATT | |
| Drilling Contractor: CONNELLY | | Drilling Method: SPT - ASTM D1586 | | Driller: K. KERSH | |
| Surface Elevation (ft): | | | Groundwater Depth (ft): | | Total Depth (ft): 33.5 |

| 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 | 18.5 | | | CONTINUOUS AUGERING. SEE BORING LOG HDD-15A. | | | | | |
| 1 | 18.5 | 19.0 | 18.5 | 23.5 | | | GRAY PARTIALLY WEATHERED CLAYSTONE. | 50/6" | | | | |
| | | | | | | | AUGER REFUSAL AT 23.5'. | | | | | |
| | | | | | | | ROCK CORING | | | | | |
| RUN 1 | 23.5 | 28.5 | 23.5 | | | ROCK | 100% RECOVERY, 21% RQD: GREENISH GRAY AND RED CLAYSTONE. | | | | | |
| RUN 2 | 28.5 | 33.5 | | | | | 100% RECOVERY, 68% RQD: GRAY TO GREENISH GRAY AND RED CLAYSTONE. | | | | | |
| | | | | 33.5 | | | | | | | | |
| | | | | | | | | | | | | |

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.



TETRA TECH
 240 Continental Drive, Suite 200
 Newark, Delaware 19713
 302.738.7551
 Fax: 302.454.5008

TEST BORING LOG

| | | | |
|--|--|--|------------------------------|
| Project Name: SUNOCO MARINER EAST | | | Project No.: 103IP2762 |
| Project Location: WESTMORELAND COUNTY, PA | | | Page 1 of 1 |
| Test Boring No.: HDD-15B | Dates(s) Drilled: 06/13/13 | 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): 5.7 |

| 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 | 2.0 | | CL | BROWN SILTY CLAY (AUGER CUTTINGS) | | | | |
| 1 | 3.5 | 3.9 | 2.0 | | | | LIGHT GRAY TO BROWN PARTIALLY WEATHERED SILTSTONE. | 50/5" | | | |
| 2 | 5.5 | 5.7 | | 5.7 | | | LIGHT GRAY PARTIALLY WEATHERED SILTSTONE. | 50/2" | | | |
| | | | | | | | AUGER REFUSAL AT 5.5' | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Notes/Comments:
Pocket Penetrometer 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.

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.