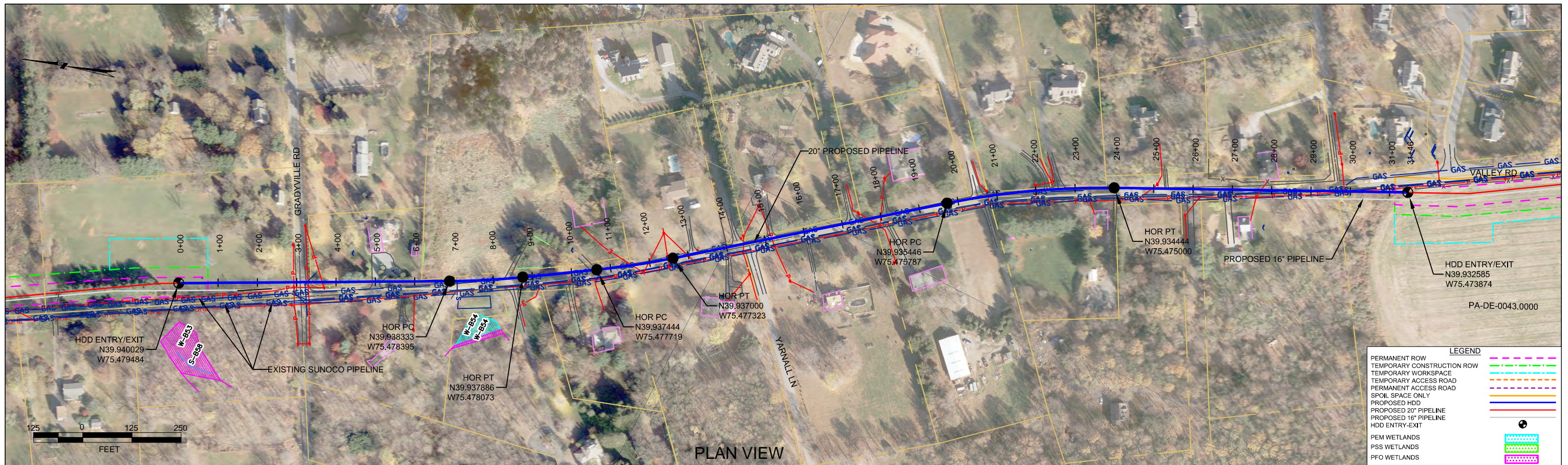


HDD PA-DE-0032.0000-RD (Valley Road)

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.

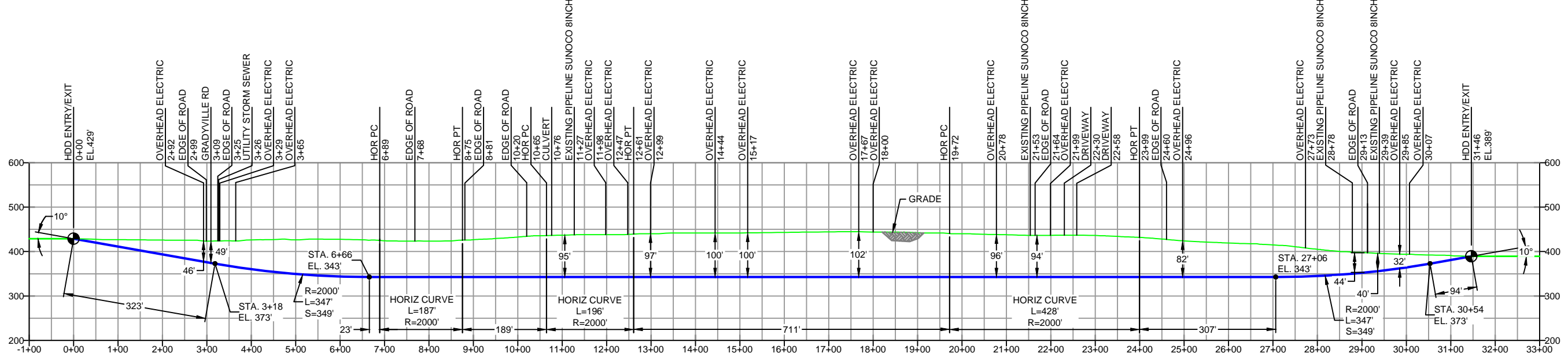
The drill will enter/exit 798 feet northwest of Valley Road. The drill will continue under Valley Road for approximately 2115 feet. This point is 233 feet northwest of the southeast entry/exit point. The drill will pass between 49 and 102 feet under this road. Using the results of the geotechnical investigation, 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 clayey sand, silty sand, schist, and gneiss.



PLAN VIEW

DELAWARE COUNTY PENNSYLVANIA, EDGMEONT TOWNSHIP
S3-580

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)-3146'
HDD PIPE LENGTH (S)-3156'
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 | |
|-------|--|
| 1. | ALL COORDINATES SHOWN ARE IN LATITUDE AND LONGITUDE. ALL MSL ELEVATIONS ARE NAD83 |
| 2. | STATIONING IS BASED ON HORIZONTAL DISTANCES |
| 3. | 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. |
| 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 | |
|--------------|------------|-------------------------|--------------------------------|
| ES-6.07 | TO ES-6.09 | EROSION & SEDIMENT PLAN | |
| SHEET 4 | TO SHEET 5 | AERIAL SITE PLAN | EP1 REVISED PER PADEP COMMENTS |
| | | | EP |
| | | | C ISSUED FOR BID |
| | | | B ISSUED FOR BID |
| | | | A ISSUED FOR REVIEW |
| DWG NO | DWG NO | DESCRIPTION | NO. |

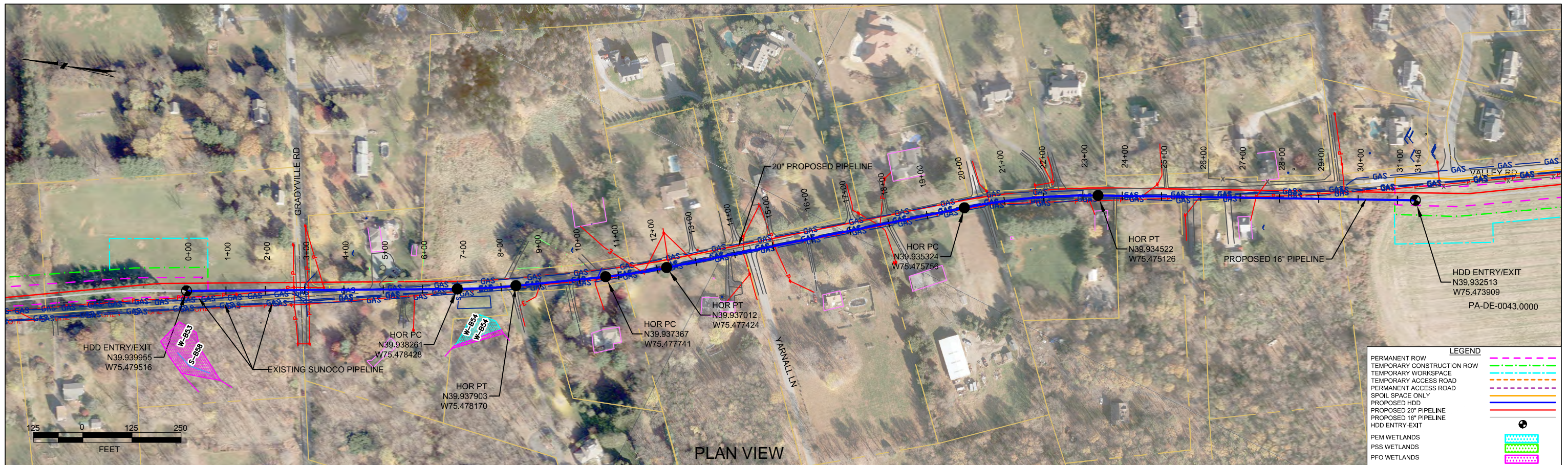
Sunoco Logistics Partners L.P.

TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

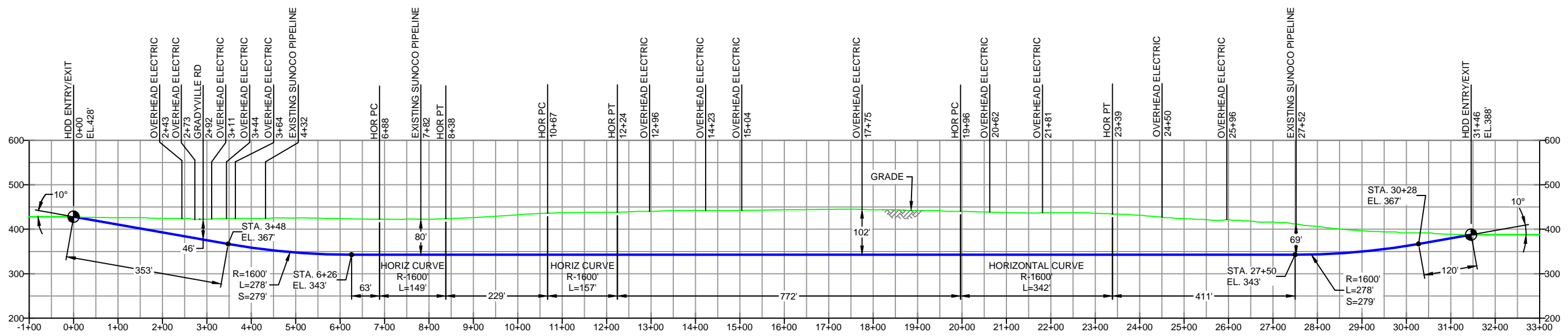
20-INCH HORIZONTAL DIRECTIONAL DRILL
GRADYVILLE RD
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=250' DWG. NO. PA-DE-0032.0000-RD



PLAN VIEW

DELAWARE COUNTY PENNSYLVANIA, EDGMEONT TOWNSHIP
S3-0580-16



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-): 3146'
HDD PIPE LENGTH (S-): 3154'
16" x 0.438" W.T., X-70, 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 | |
|-------|--|
| 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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| 5. | SUNOCO EMERGENCY HOTLINE NUMBER IS #1-800-786-7440. |

| REF. DRAWING | | REVISIONS | |
|--------------|------------|-------------------------|----------------------------|
| ES-6.07 | TO ES-6.09 | EROSION & SEDIMENT PLAN | |
| SHEET 4 | TO SHEET 5 | AERIAL SITE PLAN | |
| | | EP1 | REVISED PER PADEP COMMENTS |
| | | EP | |
| | | A | ISSUED FOR BID |
| DWG NO | DWG NO | DESCRIPTION | DESCRIPTION |

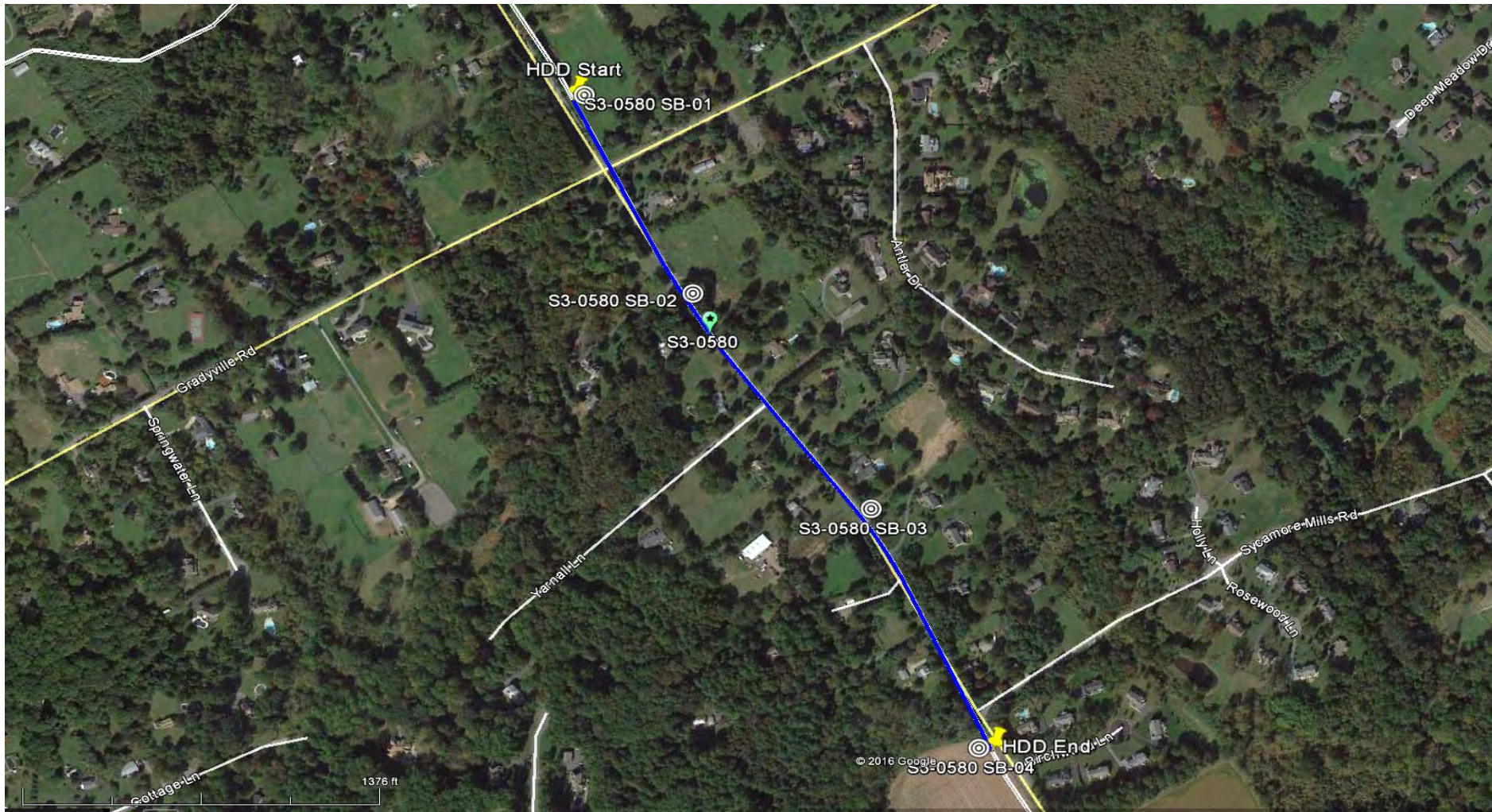
Sunoco Logistics Partners L.P.

TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

16-INCH HORIZONTAL DIRECTIONAL DRILL
GRADYVILLE RD
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=250' DWG. NO. PA-DE-0032.0000-RD-16



LEGEND:

⊙ Geotechnical Soil Boring (SB) Locations



GEOTECHNICAL BORING LOCATIONS
 HDD S3-0580
 DELAWARE COUNTY, EDMONT TWP, 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: 1320 VALLEY ROAD, GLEN MILLS, PA | | | Page 1 of 1 | | |
| HDD No.: S3-0580 | | Dates(s) Drilled: 11-01-15 | | Inspector: J. COSTELLO | |
| Boring No.: SB-02 | | Drilling Method: SPT - ASTM D1586 | | Driller: E. OGDEN | |
| Drilling Contractor: HAD DRILLING | | Groundwater Depth (ft): 8.0 | | Total Depth (ft): 31.0 | |
| Boring Location Coordinates: | | | 39°56'16.13"N | | 75°28'40.42"W |

| 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 | 0.2 | | | TOPSOIL (2") | | | | | | |
| 1 | 3.0 | 5.0 | 0.2 | | 18 | SM | DARK REDDISH BROWN FINE TO MEDIUM SAND WITH SOME SILT, TRACE MICA. | 2 | 2 | 4 | 6 | 6 | |
| 2 | 8.0 | 10.0 | | | 24 | | DR, BROWN TO GRAY FINE TO MEDIUM SAND, SOME F-C UNWEATHERED GRAVEL, A LITTLE SILT. | 15 | 21 | 31 | 38 | 52 | |
| 3 | 13.0 | 13.8 | | | 11 | | DR, BROWN TO GRAY FINE TO MEDIUM SAND, SOME F-C UNWEATHERED GRAVEL, A LITTLE SILT. (USCS: SM) | 22 | 50/4" | | | >50 | |
| | | | | 16.0 | | GM/SM - PARTIALLY WEATHERED ROCK | INTERLAYERS OF GRAY F-M SAND AND PARTIALLY WEATHERED GNEISS. | | | | | | |
| 4 | 18.0 | 19.4 | 16.0 | | 12 | | INTERLAYERS OF GRAY F-M SAND AND PARTIALLY WEATHERED GNEISS. | 23 | 38 | 50/5" | | >50 | |
| 5 | 23.0 | 24.2 | | | 14 | | INTERLAYERS OF GRAY, WHITE, BRWON F-M SAND AND PARTIALLY WEATHERED GNEISS. | 6 | 24 | 50/2" | | >50 | |
| | | | | 24.0 | | | AUGER REFUSAL AT 24'. | | | | | | |
| | | | | | | | <u>ROCK CORING</u> | | | | | | |
| RUN 1 | 24.0 | 26.0 | 24.0 | | 15 | ROCK | INTENSELY FRACTURED GRAY GNEISS, WITH DECOMPOSED ZONES. | TCR: 63%, SCR: 25%, RQD: 0% | | | | | |
| RUN 2 | 26.0 | 29.0 | | | 27 | | MODERATELY FRACTURED GRAY GNEISS | TCR: 75%, SCR: 44%, RQD: 42% | | | | | |
| RUN 2 | 29.0 | 31.0 | | 31.0 | 20.5 | | GRAY GNEISS | TCR: 85%, SCR: 73%, RQD: 73% | | | | | |
| | | | | | | | CAVED AT 24'. | | | | | | |
| | | | | | | | <u>CORE TESTING RESULTS (DEPTH 29-29.5')</u> : | | | | | | |
| | | | | | | | COMPRESSIVE STRENGTH: 11,076 PSI | | | | | | |
| | | | | | | | UNIT WEIGHT: 176.6 PCF | | | | | | |

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.

GEOTECHNICAL LABORATORY TESTING SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0580

| 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, % | |
| S3-0580 | SB-01 | 1 | 3.0 | 5.0 | 32.7 | 39.4 | 37 | 23 | 14 | SC |
| | | 2 | 8.0 | 10.0 | 59.2 | 29.1 | - | - | - | - |
| | | 3 | 13.0 | 13.8 | 48.5 | 26.8 | - | - | - | - |
| | SB-02 | 1 | 3.0 | 5.0 | 35.8 | 38.4 | - | - | - | - |
| | | 2 | 8.0 | 10.0 | 5.2 | 11.5 | - | - | - | - |
| | | 3 | 13.0 | 13.8 | 16.9 | 33.0 | NV | NP | NP | SM |
| | | 4 | 18.0 | 19.4 | 7.3 | 25.7 | - | - | - | - |
| | | 5 | 23.0 | 24.2 | 14.6 | 24.8 | - | - | - | - |
| | SB-03 | 1 | 3.0 | 5.0 | 37.4 | 39.9 | NV | NP | NP | SM |
| | SB-04 | 1 | 3.0 | 5.0 | 27.3 | 49.1 | - | - | - | - |
| | | 2 | 8.0 | 10.0 | 23.3 | 30.7 | - | - | - | - |
| | | 3 | 13.0 | 15.0 | 29.3 | 26.4 | - | - | - | - |
| | | 4 | 18.0 | 20.0 | 32.8 | 42.0 | 42 | 30 | 12 | SM |
| | | 5 | 23.0 | 25.0 | 21.9 | 27.7 | - | - | - | - |
| | | 6 | 28.0 | 30.0 | 9.5 | 24.6 | - | - | - | - |

| Rock Core Testing Results | | | | |
|---------------------------|----------|------------------------|----------------------------|-------------------|
| Boring No. | Core Run | Approximate Depth (ft) | Compressive Strength (psi) | Unit Weight (pcf) |
| SB-03 | 3 | 12.5-13.0 | 12,574 | 158.4 |
| SB-02 | 2 | 29.0-29.5 | 11,076 | 176.6 |
| | | | | |

Notes:

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

**ROCK CORE DESCRIPTION SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0580**

| Location | Boring No. | Core Run | Core Depth (ft) | | TCR (%) | SCR (%) | RQD (%) | Depth (ft) | | Weathering | Classification | Bedding Thickness (ft) | Color | Discontinuity Data |
|----------|------------|----------|-----------------|------|---------|---------|---------|------------|------|------------|----------------|--------------------------------|-------|--|
| | | | From | To | | | | From | To | | | | | |
| S3-0580 | SB-02 | 1 | 24 | 26 | 63 | 25 | 0 | 24 | 29 | Moderate | Gneiss | Massive (thin mica foliations) | Gray | Fractures ranging from 18° to 22°, Avg. 21°; fractures parallel to foliation, no bedding visible |
| | | 2 | 26 | 29 | 75 | 44 | 42 | | | | | | | |
| | | 3 | 29 | 31 | 85 | 73 | 73 | | | | | | | |
| | SB-03 | 1 | 5 | 8 | 58 | 0 | 0 | 5 | 17.5 | Heavily | Gneiss | Massive (thin mica foliations) | Gray | Rubble |
| | | 2 | 8 | 12 | 50 | 8 | 0 | | | | | | | One large piece, the rest of the core was rubble |
| | | 3 | 12 | 17.5 | 57 | 26 | 7 | | | | | | | Fractures ranging from 0° to 90°, Avg. 18° (based on larger, intact pieces) |

**REGIONAL GEOLOGY SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0580**

| HDD No. | 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 |
|---------|------------|---|---|---------------------------------|---------------------------------------|---|---|--|
| S3-0580 | SB-01 | Felsic gneiss - Light, medium grained; includes rocks of probable sedimentary origin. | Gently sloping to the south | Felsic gneiss (Precambrian age) | Felsic gneiss; Secondary - paragneiss | No information found during literature review | Ranges from 45 to 55 ft bgs, Avg. 46 ft bgs (.25 mile radius) | All part of Glenarm Supergroup a name given to provincial series of pre-Cambrian metamorphosed sedimentary rocks present in northern VA, MD, southeastern PA, western NJ, and possibly southeastern NY. Rocks from this assemblage consists of a thick sequence of metasedimentary rock and include the following formations; Setters metaquartzite, Cockeysville marble, Wissahickon Schist (along with subset of the Octoraro schist), Peters Creek metaquartzite and meta siltstones and the Peach Bottom Clate (Geology of Pennsylvania SP-1, 1999) . Drilling in these formations generally difficult to very difficult except where fractures and weathered exposed zones present. |
| | SB-02 | | Generally level, slightly sloping to the west | | | | | |
| | SB-03 | | Generally level | | | | | |
| | SB-04 | | Generally level | | | | | |

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 ⁽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.