GEOTECHNICAL ENGINEERING SERVICES

# SCHUYLKILL RIVER TRAIL EXTENSION FROM 58TH TO 61ST STREET

## PHILADELPHIA, PENNSYLVANIA

## Submitted To:

**Schuylkill River Development Corporation**
2401 Walnut Street, 6th Floor
Philadelphia, PA 19103

Daniel P. Marano Jr, PE
Pennsylvania License No. PE079972

SRDC 1601.GEO
January 20, 2020

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2041 Avenue C
Suite 100
Bethlehem, PA 18017
T: 610-231-0600
F: 610-231-2033

www.pennoni.com

January 20, 2020

SRDC 1601.GEO

Mr. Joseph Syrnick, President and CEO
Schuylkill River Development Corporation
2401 Walnut Street, 6th Floor
Philadelphia, PA 19103

RE: Geotechnical Engineering Services
Schuylkill River Trail Extension, 58th to 61st Street
Philadelphia, Pennsylvania

Dear Mr. Syrnick:

We are pleased to submit our geotechnical engineering report for the proposed trail extension along the Schuylkill River in the vicinity of 58th to 61st Street, Philadelphia, Pennsylvania. Work was initiated in general accordance with the scope of work presented in our proposal dated November 28, 2017, and your subsequent authorization to proceed.

We trust that the information presented in this report is what you require at this time and we thank you for the opportunity to assist you with this project. If you have any questions, or if you need any further assistance with this project, please contact this office at your earliest convenience.

Respectfully yours,

PENNONI ASSOCIATES INC.

Eli G. Brinker
Graduate Professional

Daniel P. Marano Jr., PE
Project Engineer

# 1. EXECUTIVE SUMMARY

Pennoni has completed our geotechnical study for the proposed trail extension along the Schuylkill River in the vicinity of South 58th Street to 61st Street, in Philadelphia, PA. The purpose of this study was to conduct a subsurface exploration, evaluate the subsurface conditions at the project site and provide engineering recommendations for foundation design, retaining walls, pavement design, and anticipated settlements.

The proposed construction consists of a walking trail that will extend between 58th and 61st Streets, a river overlook access point for pedestrians, and retaining walls that will run along to the proposed walking trail.

On October 4 and 7, 2019, eleven borings were drilled by SANO Drilling, Inc. Laboratory testing was completed on the samples from the borings.

Based on the results of our field exploration, laboratory testing, engineering analyses and our experience, we conclude that construction of the overlook access point, walking trail, and retaining walls are feasible. Due to softer soil conditions that were disclosed in the deeper borings, we recommend that the overlook access point should be constructed on a deep foundation system. Drilled Piers (Caissons), Open-Ended Steel Pipe Piles (Concrete Filled), and Timber Piles, were considered in our analyses. Encountering groundwater in excavations should be anticipated when constructing the proposed overlook access point. Due to the proximity to the Schuylkill River the groundwater elevation is expected to vary with the tides. Excessive settlements of the retaining wall and overlook access point are not expected if the recommendations presented herein are followed.

This report provides a more detailed summary of the field and laboratory testing program as well as a discussion of the conclusions and recommendations pertaining to design and construction.

# 2. INTRODUCTION

## 2.1. LOCATION & SURFACE FEATURES

The Phase II section of the proposed Schuylkill River Trail is to be located between the Phase I development that terminates at S 58th Street and extend east-southeast towards S 61st Street, in Philadelphia, Pennsylvania. The project site is bounded on the east by the Schuylkill River, to the south and west by a recycling plant, and to the north west by previously developed lots that are now razed and overgrown.

The trail entrance will originate from S 61st Street through a small strip of grass and vegetation that runs between the two developed industrial lots. The proposed trail location is densely vegetated with trees and brush. The proposed overlook area is heavily wooded. Part of the wooded area was cleared during our field investigation and revealed a stormwater outlet in the vicinity of Boring B-10. Evidence of overhead and underground utilities were observed at the proposed entrance location off of S 61st Street. Overhead electrical utilities traverse approximately the first 1/3 of the trail entrance.

The topography near the proposed overlook access point is sloping downward towards the river from the Delaware Valley Recycling Plant, with a change in elevation of approximately 30 ft over 200 ft. The topography over the length of the trail from S 61st towards the proposed overlook access point is generally flat gradually sloping downwards 4 ft over 700 ft, then slopes upwards to the northwest along the river approximately 4 ft over 500 ft.

## 2.2. PROPOSED CONSTRUCTION

The proposed construction consists of a walking trail that will extend between S 58th and S 61st Streets, a river overlook access point for pedestrians and a retaining wall that will run along to the proposed walking trail. The proposed walking trail will consist of a 12 ft wide bituminous concrete paved section that will vary in elevation from Elev. 4 to Elev. 24. The proposed retaining walls will most likely consist of modular blocks (Redi-Rock, or similar) with heights that will range from 5 to 9 ft based off of the most recent Conceptual Grading Plan provided to us dated November 22, 2019.

The proposed overlook will extend from on-grade to a raised platform with an elevation on the order of Elev. 12.65. It will consist of steel framing and a wood deck. The loading provided to us from Pennoni's Structural Technology indicates that the vertical axial compression loads will range from 3 kips to 107 kips, uplift loads on the order of 8 kips, and have shear loads on the order of 1 to 3 kips.

## 2.3. OBJECTIVES

The objectives of this geotechnical study were to determine subsurface conditions at the project site, evaluate these conditions with respect to the proposed construction, and present our conclusions and recommendations regarding:

- foundation design, including a discussion of alternate solutions, if applicable, anticipated total and differential settlements;
- design frost depth;
- discussion of potential for consolidation and/or differential settlements of substrata encountered;
- "general procedure" Seismic Soil Site Classification in accordance with Section 1613.3 of the 2018 International Building Code;

- evaluation and determination of the earthwork requirements for use in preparation of the site area, including material selection and placement operations;
- suitability of on-site material for re-use as fill/backfill as part of the site work for the project;
- pavement design parameters;
- lateral earth design parameters;
- groundwater conditions and recommendations for management of groundwater;
- removal or treatment of objectional material, and;
- quality assurance and field observations during construction.

# 3. FIELD AND LABORATORY WORK

## 3.1. FIELD WORK

On October 4 and 7, 2019, eleven borings were drilled by SANO Drilling, Inc. at the approximate locations presented on the Boring Location Plan (Drawing No. LP-1). Boring locations were selected and established in the field by Pennoni personnel. Samples were obtained in general accordance with ASTM D 1586 and ASTM D 1587 methods. Appendix A includes Drawing No. LP-1 and the boring logs.

Our D. Marano, PE directed the field work; our E. Brinker conducted a site reconnaissance and provided full-time observation of the drilling operations.

## 3.2. LABORATORY WORK

The soil samples collected during our field study were delivered to our laboratory. Representative samples were selected and tested to determine moisture contents, organic contents, plasticity indices, unconfined compressive strengths, and gradation characteristics of the subsoils. A CBR was performed on a bulk sample for pavement design. Additionally, the Shelby tube sample was delivered to our laboratory and tested to determine the shear strength characteristics of the subsoils. Laboratory testing results and a list of testing procedures are presented in Appendix B.

# 4. SITE CHARACTERISTICS

## 4.1. GEOLOGY

The project site is located within the Lowland and Intermediate Upland section of the Atlantic Coastal Plain Province. The dominant topographic features of this section include very low local relief and a flat upper terrace surface cut by narrow, steep-sided to open valleys, shallow valleys; includes the Delaware River floodplain. The underlying subsurface material types consist of unconsolidated to poorly consolidated sand and gravel deposits, underlain by very complex, faulted and folded schist, gneiss, and other metamorphic rocks.

Available geological data indicates that the subject site is underlain by Trenton Gravel Formation, which is subsequently underlain by the Wissahickon Formation.

The Trenton Gravel Formation consists of gray to pale-reddish brown, very gravelly sand with interbedded and cross bedded sand and clay-silt layers.

The Wissahickon Formation consists of a coarsely crystalline, excessively micaceous schist. Fracturing results in a well-developed, platy pattern. This Formation is fissile to thinly bedded, moderately resistant to weathering, and often highly weathered to a moderate depth (10 to 15 ft).

## 4.2. SUBSOILS

The borings disclosed a topsoil layer at the surface in each of the borings that is approximately 4 to 6 in. thick. Underlying the topsoil layer is a fill layer that is approximately 20 ft thick consisting of fine to medium to coarse sand with varying amounts of coarse gravel, wood and brick (construction debris material). The subsoils encountered in the test borings, including the fill, have been grouped by us into five principal strata based on their engineering properties and our interpretation of their origin. Brief strata descriptions are presented below.

TABLE 1 – Soil Strata and Descriptions

| *Stratum* | *Description* |
|---|---|
| T | TOPSOIL |
| F | Fill: Fine to Medium to Coarse SAND, some Silt, trace Brick Concrete and Wood Fragments, trace Fine to Coarse gravel size Rock Fragments (Angular); loose |
| 1 | Fine SAND and CLAYEY SILT, some Coarse gravel size Rock Fragments (Angular); loose |
| 2 | CLAY and SILT, little Fine to Medium Sand; soft |
| 3 | Fine to Coarse gravel size Rock Fragments (Angular) and Fine to Medium to Coarse SAND, some Silt; medium dense |
| 4 | Decomposed Rock (Mica Schist); dense |

Refusal to further penetration of the drilling and soil sampling tools was encountered in Boring B-9 at a depth of 55 ft below existing grades. Auger refusal typically infers the top of rock surface. Rock was identified to be decomposed mica schist.

## 4.3. GROUNDWATER

Observations for groundwater were made in each boring during sampling and shortly after completion of drilling. Groundwater was encountered in borings B-9, B-10, and B-11. Table 2 below indicates the depth to water and the approximate elevation. These observations are for the times indicated and may not be indicative of tidal, seasonal, or daily variations in the ground water levels. Due to the close proximity of the Schuylkill River groundwater levels are expected to vary with the tidal changes.

TABLE 2 – Groundwater Data

| *Boring* | *Depth to Groundwater (ft)* | *Approximate Ground Water Elev. (ft)* |
|---|---|---|
| B-9 | 13.30 | -3.80 |
| B-10 | 13.00 | -4.00 |
| B-11 | 7.00 | -5.00 |

# 5. ANALYSES AND RECOMMENDATIONS

## 5.1. SEISMIC SITE CLASSIFICATION

The borings disclosed subsurface conditions generally described according to the Table 20.3-1 of ASCE 7 and referenced in Section 1613.3 of the 2018 International Building Code (IBC) as having a soil-profile corresponding to Site Class D – a stiff soil profile. Site Class determination is based on the properties in the upper 100 ft of the ground surface. Site Class determination is based on the properties in the upper 100 ft of the ground surface. Properties in soils below 55 ft were estimated based on our experience and knowledge of the geology.

## 5.2. EARTHWORK

Comparison of the proposed elevations of the walking path and the new retaining walls indicates that fills approximately 1 to 7 ft high will be required to reach the subgrade elevation. Additionally, cuts on the order of 1 to 4 ft deep are expected throughout the trail to reach subgrade elevation. These cuts and fills are based off of the conceptual grading plan dated November 24, 2019.

Prior to the any construction, the topsoil and associated vegetation and remnants of previous construction must be removed from within the proposed area of construction. The topsoil and vegetation can remain in proposed landscaped areas provided that future plans do not include building in those areas.

Our experience indicates that the fill (Stratum F) can be reused as a compacted fill for backfill, if necessary, as long as it is free of trash, environmental hazards, and other deleterious material. The laboratory tests indicate that the present moisture contents (7.0% to 8.3%) of the upper portion of Stratum F are slightly below the optimum moisture contents normally associated with soils to achieve a desired degree of compaction. Adjusting the moisture content prior to fill placement should be expected. Imported fill material should be selected from suitable borrow sources and be approved by Pennoni well in advance of fill construction. Granular fill should consist of well-graded material with not more than 20 percent passing the No. 200 sieve and have a plasticity index not greater than 8 percent. Maximum particle size should be limited to 3 in. for load bearing structural fills.

Fine grained and granular fills should be placed in layers not exceeding 8 to 10 in. and 10 to 12 in. loose measure, respectively. This criterion might be adjusted by the geotechnical engineer in the field depending on the conditions present at the time of construction, on the compaction equipment used, and on the fill materials selected. Fills for support of retaining walls and pavement should be compacted to at least 98 percent and 95 percent, respectively, of the laboratory determined maximum dry density, ASTM D 698, when small, hand-operated compaction equipment is used.

Specifications should indicate that the percentage of maximum dry density attained in the field is not the only criteria to be used for assessing fill compaction. Observation of the behavior of the fill under the loads of construction equipment should also be used. If the test results indicate that the percentage of compaction is being achieved, but the soil mass is moving under the equipment, placement of additional fill should not be continued until the movement is stabilized. Otherwise, settlement of the fill may occur.

## 5.3. FOUNDATIONS

Based on the results of the borings and our experience with similar project sites, it is our professional opinion that the proposed construction of the overlook access point is feasible. Because of the magnitude of the proposed loading and the presence of a soft compressible silt layer, standard spread footings cannot be considered due to anticipated excessive settlements. The vertical loads provided to us range from 3 kips to 107 kips, and 1 to 3 kips for shear loads, respectively. Uplift loads are on the order of 8 kips. Therefore, a deep foundation alternative is recommended for support. We recommend a Drilled Pier (Caisson) option to support the elevated pedestrian pier. Alternatively, Closed Ended Steel Pipe Piles (Concrete-Filled), and Timber Piles can also be considered.

Drilled Pier (Caisson)

Caissons will derive their capacity by a combination of skin friction and end bearing. The caissons can be designed using an end bearing capacity of 10 tsf and compressive and tensile skin friction resistances of 1.0 tsf and 0.5 tsf in the decomposed mica schist layer (Stratum 4) where the Standard Penetration N Values were greater than 50 blows per 6 inches. We analyzed the lateral capacity of 2 ft and 3 ft diameter caissons using LPILE software. Based on the varying load applications we estimated an average pile length on the order of 50 ft and assumed free head conditions, and determined lateral capacities on the order of 8 tons and 20 tons per pile for a 2 ft and 3 ft diameter pier, respectively.

Open Ended, Concrete-Filled, Steel Pipe Piles

Open end, concrete-filled pipe piles with nominal diameters of 10 and 12 in., and wall thickness of 3/8 in. to 1/2 in. can be considered for support of the new proposed deck. The estimated load carrying capacity is on the order of 50 tons/pile and 60 tons/pile for a 10 in. and 12 in. diameter pile, respectively. An allowable uplift capacity of 15 tons/pile can be used. The 10 in. and 12 in. diameter steel pipe piles have allowable lateral load carrying capacities of approximately 3 and 5 tons/pile, respectively. A minimum pile spacing of 3 times the pile diameter should be maintained between piles. Estimated pile lengths are on the order of 50 ft to 55 ft below existing grades.

Timber Piles

CCA treated timber piles may also be considered in this project. The timber piles should conform to ASTM 25-99 and AWPA C3-03 Specifications and should have minimum tip and butt diameters of 8 and 12 inches, respectively. The estimated length is about 50 to 55 ft below the existing grades with the pile tips bearing in the upper portions of the denser sand deposit. A preliminary estimate of the allowable pile capacity is on the order of 35 tons/pile. The minimum pile spacing should be at least three pile diameters (3D), center to center. Based on the assumptions stated earlier, at these estimated lengths, a typical timber pile can withstand lateral loads up to 3 tons per pile. Timber piles will require dynamic testing (PDA) during installation to confirm axial load carrying capacities.

General Driven Pile Recommendations

Predrilling of driven pile elements should be considered due to the variability of the constituents encountered within the fill. The piles should be “seated” into the bearing stratum using criterion developed based on an acceptable dynamic driving formula. The Wave Equation analysis is recommended to determine the suitability of the proposed driving equipment and pile system. The contractor should incorporate the results of the Wave Equation analysis within any submittals that are due prior to construction for approval.

We recommend performing dynamic monitoring using a Pile Driving Analyzer (PDA). The PDA will provide information on the actual driving stresses, verification of ultimate geotechnical resistance, energy transfer efficiency, pile damage assessments, and verify the refusal criteria during pile installation. A minimum factor of safety of 2.25 is recommended for pile design when using PDA testing alone to confirm the recommended installed pile capacity. The dynamic load test locations should be selected by the geotechnical engineer. Dynamic testing may be performed on production piles.

## 5.4. RETAINING WALL CONSTRUCTION

It is our understanding that modular block gravity retaining walls (i.e. Redi Rock, or similar) are being considered for adjacent the walking trail. We have estimated that the walls will vary in height from 5 to 9 ft. If it is determined that geogrid is required in the taller sections, then it should be noted that typical lengths are on the order of two-thirds to three quarters of the wall height. Table 3, below, presents the preferred reinforced soil gradation recommendations for MSE walls less than 20 ft tall. However, soils with a fines contents up to 60% can also be considered for the reinforced soil zone, but should be evaluated by the Geotechnical Engineer.

We have reviewed anticipated loads from retaining wall heights ranging from 5 to 9 ft, the results of our field exploration and our experience with similar projects it our professional opinion that the retaining walls can be supported without need for foundations. The retaining wall can be supported on densified existing fill and firm/dense native soils (Strata F, 1 and 2). The near surface soft/loose fill zone is unsuitable in its current state for foundation support based on the variable consistencies/densities that were disclosed by the borings. To minimize the magnitude of total and differential settlements the existing fill should be densified at the proposed bottom of wall subgrade elevations. Modular block walls with bearing capacity requirements on the order 3,000 psf to 4,000 psf can be supported on the densified subgrades.

TABLE 3 – MSE Wall Recommended Soil Gradation for Reinforced Zone

| *Sieve Size* | *Percent Passing* |
|---|---|
| 1 in. (24 mm) | 100 |
| No. 4 | 100-20 |
| No. 40 | 0-60 |
| No. 200 | 0-35 |

## 5.5. SETTLEMENT

Settlement of a soil mass is a function of the characteristics of the supporting soils (type of soil, void ratio, pre-consolidation, etc.), the thickness of the layer(s), and the stresses imposed on the soils by an applied load (fill, shallow foundations, floor slab, etc.). The stresses affecting subsoils generally decrease with increasing depth and are variable based on the magnitude and area of applied loading. The river overlook access point is recommended to be founded on deep foundations, therefore, settlements are not anticipated for this part of the project.

It should be noted that some differential settlement may occur for the proposed retaining wall but should be on the order of ½ inch. Surcharging the wall location with the new fill several months (3 to 4 months) prior to construction of the wall will eliminate most of the post construction differential settlement that may be encountered.

## 5.6. GROUNDWATER AND SURFACE WATER MANAGEMENT

Observations for ground water made in borings B-9 to B-11 indicate that water was encountered 7 to 13.3 ft below existing grades. It should be anticipated that water table fluctuations will correspond with the tidal action of Schuylkill River. The use of sumps and pumps should be expected when installing the Drilled Piers (Caissons); however, if casing is not watertight, a slurry method may be required. Surface runoff should be prevented from entering or ponding in excavations by creating soil berms or diversion swales along the perimeter, if the excavation will be left open for an extended period. Where ponding does occur, the water should be removed immediately by pumping. Grades should then be established to prevent further ponding.

## 5.7. PAVEMENTS

In the areas of proposed new pavements, a flexible (bituminous) type of pavement is recommended. The preparation of the pavement subgrades and placement of any required fill should be done as recommended under the “Earthwork” section of this report. A California Bearing Ratio (CBR) value of 8% can be used in the design of the pavement section.

We recommend that the pavement surface course (wearing and binder) be underlain by a crushed stone or coarse gravel base course at least 4 in. thick. The trail can be designed for a minimum asphalt thickness.

## 5.8. LATERAL EARTH PRESSURES

The soil parameters presented in Table 4, below, can be used to estimate lateral earth pressures to design below grade structures and retaining walls. If the top of the structure is restrained from movement, thereby preventing the mobilization of active soil pressures, the structure should be designed using the at-rest pressure coefficient.

The earth pressure coefficients are based on the assumption of vertical walls, horizontal backfill, no surcharges, no wall friction, and a safety factor of 1.0. A clear distance of 10 ft should be maintained during construction, between existing site features, stored materials, and construction surcharges or the wall must be designed to resist the driving force from the stored materials/construction surcharges. Where sufficient drainage cannot be provided to intercept and re-direct seepage, hydrostatic pressures must also be considered in the design.

TABLE 4 - Lateral Earth Pressure Design Parameters

| *Parameter* | Stratum | | | | | Processed Aggregate (PennDOT Type 2A) |
|---|---|---|---|---|---|---|
| | *F* | *1* | *2* | *3* | *4* | |
| Unit Weight (pcf) | 125 | 110 | 110 | 130 | 135 | 140 |
| Angle of Internal Friction (degrees) | 28 | 24 | -- | 36 | 38 | 38 |
| Cohesion (psf) | 0 | 0 | 300 | 0 | 0 | 0 |
| Friction Factor | 0.40 | 0.30 | -- | 0.50 | 0.50 | 0.50 |
| $k_a$ | 0.36 | 0.42 | -- | 0.26 | 0.24 | 0.24 |
| $k_o$ | 0.53 | 0.56 | -- | 0.41 | 0.38 | 0.38 |
| $k_p$ | 2.77 | 2.56 | -- | 3.85 | 4.20 | 4.20 |

### 5.9. CONSTRUCTION DIFFICULTIES

Experience has shown that remnant construction and obstructions are often encountered when building within similar, previously developed urban sites. Encountering remnants of previous foundations and shoring systems should be expected during site excavation. If remnant foundations are still present, they should be totally removed, to a depth of 18 in. below the bottom of the new ground floor slab. Existing structural elements encountered below new foundations should be evaluated individually.

## 6. RECOMMENDATIONS FOR FURTHER GEOTECHNICAL SERVICES

Our experience on numerous construction projects is that the interests of the project team are best served by retaining the Geotechnical Engineer of Record to provide construction observations and testing during earthwork and foundation construction operations. To determine if soils, other materials, and ground water conditions encountered during construction are similar to those encountered in the borings, and that they have comparable engineering properties or influences on the design of the trail, we recommend that Pennoni should provide field observation services during construction of compacted fill, preparation of foundation, floor slab subgrades; and construction of foundations and floor slabs.

## 7. LIMITATIONS

This work has been done in accordance with our authorized scope of work and in accordance with generally accepted professional practice in the fields of geotechnical and foundation engineering. This warranty is in lieu of all other warranties either express or implied. Our conclusions and recommendations are based on the data revealed by the data revealed by this exploration. We are not responsible for any conclusions or opinions drawn from the data included herein, other than those specifically stated, nor are the recommendations presented in this report intended for direct use as construction specifications. This report is intended for use with regard to the specific project described herein; any changes in loads, structures, or locations should be brought to our attention so that we may determine how they may affect our conclusions. An attempt has been made to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction. If this should occur, or if additional or contradictory data are revealed in the future, we should be notified so that modifications to this report can be made, if necessary. If we do not review relevant construction documents and witness the relevant construction operations, then we cannot be responsible for any problems that may result from misinterpretation or misunderstanding of this report or failure to comply with our recommendations.

# APPENDICES

# APPENDIX A – Field Data

# TEST BORING LOG

**TEST BORING B-1**


**CLIENT** Schuylkill River Development Corporation
**PROJECT NAME** Schuylkill River Trail Extension, 56th to 61th Street
**PROJECT NUMBER** SRDC 1601
**PROJECT LOCATION** 3107 S 61st ST Philadelphia, PA 19153
**DATE STARTED** 10/4/19 **COMPLETED** 10/4/19
**GROUND ELEVATION** 16.00'
**DRILLING CONTRACTOR** Sano Drilling Inc.
**WATER ENCOUNTERED:**
**DRILLING METHOD** Hollow Stem Auger
**DURING DRILLING** ---
**DRILLER / HELPER** Bob/ Tom
**AT END OF DRILLING** ---
**LOGGED BY** E. Brinker **CHECKED BY** D. Marano
**AFTER DRILLING** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (in.) | BLOW COUNTS | GRAPHIC LOG | STRATA | DESCRIPTION (Depth) | DESCRIPTION | DESCRIPTION (Elev.) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 13 | 2-2-4-5 | | T | 0.50 | Topsoil | 15.50 | |
| | 2 | 13 | 4-4-4-4 | | F | | FILL: Black Dark Brown F/M/C SAND, trace Silt | | |
| 5 | 3 | 10 | 4-3-4-5 | | | | | | |
| | 4 | 19 | 3-2-2-2 | | | | | | |
| 10 | 5 | 19 | 2-3-5-3 | | | 10.00 | | 6.00 | |

Borehole terminated at 10.00 feet.

*NOTES:*

# TEST BORING LOG

**TEST BORING B-2**


**CLIENT** Schuylkill River Development Corporation
**PROJECT NAME** Schuylkill River Trail Extension, 56th to 61th Street
**PROJECT NUMBER** SRDC 1601
**PROJECT LOCATION** 3107 S 61st ST Philadelphia, PA 19153
**DATE STARTED** 10/4/19 **COMPLETED** 10/4/19
**GROUND ELEVATION** 18.50'
**DRILLING CONTRACTOR** Sano Drilling Inc.
**WATER ENCOUNTERED:**
**DRILLING METHOD** Hollow Stem Auger
**DURING DRILLING** ---
**DRILLER / HELPER** Bob/ Tom
**AT END OF DRILLING** ---
**LOGGED BY** E. Brinker **CHECKED BY** D. Marano
**AFTER DRILLING** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (in.) | BLOW COUNTS | GRAPHIC LOG | STRATA | Depth | DESCRIPTION | Elev. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | T | 0.50 | Topsoil | 18.00 | |
| | | | | | | 4.00 | FILL: Black Brown F/M/C SAND, some Silt, some C gravel size Rock & Brick Fragments (Angular) | 14.50 | |
| 5 | | | | | F | 10.00 | Dark Brown F/M/C SAND, trace C gravel size Rock Fragments (Angular) | 8.50 | |
| 10 | | | | | | | | | |

Borehole terminated at 10.00 feet.

*NOTES:*

# TEST BORING LOG

**TEST BORING B-3**


**CLIENT** Schuylkill River Development Corporation
**PROJECT NAME** Schuylkill River Trail Extension, 56th to 61th Street
**PROJECT NUMBER** SRDC 1601
**PROJECT LOCATION** 3107 S 61st ST Philadelphia, PA 19153
**DATE STARTED** 10/4/19 **COMPLETED** 10/4/19
**GROUND ELEVATION** 19.00'
**DRILLING CONTRACTOR** Sano Drilling Inc.
**WATER ENCOUNTERED:**
**DRILLING METHOD** Hollow Stem Auger
**DURING DRILLING** ---
**DRILLER / HELPER** Bob/ Tom
**AT END OF DRILLING** ---
**LOGGED BY** E. Brinker **CHECKED BY** D. Marano
**AFTER DRILLING** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (in.) | BLOW COUNTS | GRAPHIC LOG | STRATA | Depth | DESCRIPTION | Elev. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | T | 0.50 | Topsoil | 18.50 | |
| | | | | | F | | Auger Down to 5' | | |
| 5 | | | | | F | 5.00 | | 14.00 | Bulk Sample 4'-5' |
| | 1 | 4 | 3-2-2-2 | | F | | FILL: Brown F/M/C SAND, little C gravel size Brick & Concrete Fragments, trace Silt | | |
| | 2 | 12 | 3-2-3-3 | | F | 8.00 | | 11.00 | |
| 10 | 3 | 19 | 3-5-6-4 | | F | | FILL: Dark Brown, F/M SAND AND CLAYEY SILT, trace C gravel size Brick & Concrete Fragments | | |
| | 4 | 12 | 3-2-6-7 | | F | | | | |
| 15 | 5 | 16 | 4-6-4-5 | | F | 15.00 | | 4.00 | |

Borehole terminated at 15.00 feet.

*NOTES:*
*10 Foot Horizontal Offset West, Auger Down to 5 Feet to Match Elevation Difference.*

# TEST BORING LOG

**TEST BORING B-4**


**CLIENT** Schuylkill River Development Corporation
**PROJECT NAME** Schuylkill River Trail Extension, 56th to 61th Street
**PROJECT NUMBER** SRDC 1601
**PROJECT LOCATION** 3107 S 61st ST Philadelphia, PA 19153
**DATE STARTED** 10/4/19 **COMPLETED** 10/4/19
**GROUND ELEVATION** 15.00'
**DRILLING CONTRACTOR** Sano Drilling Inc.
**WATER ENCOUNTERED:**
**DRILLING METHOD** Hollow Stem Auger
**DURING DRILLING** ---
**DRILLER / HELPER** Bob/ Tom
**AT END OF DRILLING** ---
**LOGGED BY** E. Brinker **CHECKED BY** D. Marano
**AFTER DRILLING** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (in.) | BLOW COUNTS | GRAPHIC LOG | STRATA | Depth | DESCRIPTION | Elev. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 11 | 1-2-1-1 | | T | 0.20 | Topsoil | 14.80 | |
| | 2 | 11 | 4-5-4-4 | | F | | FILL: Brown F/M/C SAND, trace Silt, trace C gravel sized Rock & Brick Fragments (Angular) | | |
| 5 | 3 | 7 | 3-3-11-11 | | | | | | |
| | 4 | 5 | 11-17-10-12 | | | | | | |
| 10 | 5 | 9 | 7-6-5-5 | | | 10.00 | | 5.00 | |

Borehole terminated at 10.00 feet.

*NOTES:*

# TEST BORING LOG

**TEST BORING B-5**
PAGE 1 OF 1

**CLIENT** Schuylkill River Development Corporation
**PROJECT NAME** Schuylkill River Trail Extension, 56th to 61th Street
**PROJECT NUMBER** SRDC 1601
**PROJECT LOCATION** 3107 S 61st ST Philadelphia, PA 19153
**DATE STARTED** 10/7/19 **COMPLETED** 10/7/19
**GROUND ELEVATION** 15.00'
**DRILLING CONTRACTOR** Sano Drilling Inc.
**WATER ENCOUNTERED:**
**DRILLING METHOD** Hollow Stem Auger
**DURING DRILLING** ---
**DRILLER / HELPER** Bob/ Drew
**AT END OF DRILLING** ---
**LOGGED BY** E. Brinker **CHECKED BY** D. Marano
**AFTER DRILLING** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (in.) | BLOW COUNTS | GRAPHIC LOG | STRATA | Depth | DESCRIPTION | Elev. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 5 | 1-1-5-9 | | T | 0.50 | Topsoil | 14.50 | |
| | 2 | 3 | 50/3" | | F | 4.00 | FILL: Brown F/C SAND & SILT, some gravel size Brick & Concrete Fragments | 11.00 | |
| 5 | 3 | 4 | 3-3-4-6 | | F | 5.00 | FILL: White F/M/C SAND, some C gravel size Rock Fragments (Angular) | 10.00 | Bulk Sample 4'-5' |
| | 4 | 3 | 3-4-4-6 | | F | | FILL: Redish Brown F/M/C SAND, some Silt, some gravel size Brick & Concrete Fragments | | |
| 10 | 5 | 4 | 4-2-2-2 | | F | 10.00 | | 5.00 | |

Borehole terminated at 10.00 feet.

*NOTES:*

# TEST BORING LOG

**TEST BORING B-6**


**CLIENT** Schuylkill River Development Corporation
**PROJECT NAME** Schuylkill River Trail Extension, 56th to 61th Street
**PROJECT NUMBER** SRDC 1601
**PROJECT LOCATION** 3107 S 61st ST Philadelphia, PA 19153
**DATE STARTED** 10/7/19 **COMPLETED** 10/7/19
**GROUND ELEVATION** 13.00'
**DRILLING CONTRACTOR** Sano Drilling Inc.
**WATER ENCOUNTERED:**
**DRILLING METHOD** Hollow Stem Auger
**DURING DRILLING** ---
**DRILLER / HELPER** Bob/ Drew
**AT END OF DRILLING** ---
**LOGGED BY** E. Brinker **CHECKED BY** D. Marano
**AFTER DRILLING** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (in.) | BLOW COUNTS | GRAPHIC LOG | STRATA | DESCRIPTION (Depth / Elev.) | REMARKS |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 1-2-1-2 | | T | 0.50 Topsoil 12.50 | |
| | 2 | 6 | 3-4-3-4 | | F | FILL: Brown and Orange F/C SAND, some Silt, trace gravel size Brick & Concrete Fragments | |
| 5 | 3 | 5 | 2-2-2-2 | | | | |
| | 4 | 10 | 1-4-4-2 | | | | |
| 10 | 5 | 10 | 3-2-3-3 | | | 10.00 3.00 | |

Borehole terminated at 10.00 feet.

*NOTES:*

Pennoni

# TEST BORING LOG

**TEST BORING B-7**


**CLIENT** Schuylkill River Development Corporation
**PROJECT NAME** Schuylkill River Trail Extension, 56th to 61th Street
**PROJECT NUMBER** SRDC 1601
**PROJECT LOCATION** 3107 S 61st ST Philadelphia, PA 19153
**DATE STARTED** 10/7/19 **COMPLETED** 10/7/19
**GROUND ELEVATION** 16.00'
**DRILLING CONTRACTOR** Sano Drilling Inc.
**WATER ENCOUNTERED:**
**DRILLING METHOD** Hollow Stem Auger
**DURING DRILLING** ---
**DRILLER / HELPER** Bob/ Drew
**AT END OF DRILLING** ---
**LOGGED BY** E. Brinker **CHECKED BY** D. Marano
**AFTER DRILLING** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (in.) | BLOW COUNTS | GRAPHIC LOG | STRATA | DESCRIPTION (Depth / Elev.) | REMARKS |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 10 | 2-6-11-18 | | T | 0.50 Topsoil 15.50 | |
| | 2 | 12 | 3-6-12-18 | | F | FILL: Brown F/M SAND, some C gravel size Rock Fragments (Angular) | |
| 5 | 3 | 9 | 42-6-12-17 | | | | Bulk Sample 4'-5' |
| | 4 | 13 | 32-16-17-12 | | | | |
| 10 | 5 | 8 | 18-16-8-5 | | | 10.00 6.00 | |

Borehole terminated at 10.00 feet.

*NOTES:*

# TEST BORING LOG

**TEST BORING B-8**



**CLIENT** Schuylkill River Development Corporation
**PROJECT NAME** Schuylkill River Trail Extension, 56th to 61th Street
**PROJECT NUMBER** SRDC 1601
**PROJECT LOCATION** 3107 S 61st ST Philadelphia, PA 19153
**DATE STARTED** 10/7/19 **COMPLETED** 10/7/19
**GROUND ELEVATION** 18.00'
**DRILLING CONTRACTOR** Sano Drilling Inc.
**WATER ENCOUNTERED:**
**DRILLING METHOD** Hollow Stem Auger
**DURING DRILLING** ---
**DRILLER / HELPER** Bob/ Drew
**AT END OF DRILLING** ---
**LOGGED BY** E. Brinker **CHECKED BY** D. Marano
**AFTER DRILLING** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (in.) | BLOW COUNTS | GRAPHIC LOG | STRATA | Depth | DESCRIPTION | Elev. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 1-1-2-3 | | T | 0.50 | Topsoil | 17.50 | |
| | 2 | 10 | 4-5-4-4 | | F | | FILL: Brown F/C SAND, some Silt, little C gravel size Rock, Brick & Concrete Fragments (Angular) | | |
| 5 | 3 | 11 | 4-3-8-11 | | | 6.00 | | 12.00 | Bulk sample 4'-5' |
| | 4 | 13 | 23-11-17-18 | | 1 | | Brown White and Black F/C SAND, trace Silt | | |
| 10 | 5 | 11 | 11-8-17-12 | | | 10.00 | | 8.00 | |

Borehole terminated at 10.00 feet.

*NOTES:*

Pennoni

# TEST BORING LOG

**TEST BORING B-9**


**CLIENT** Schuylkill River Development Corporation
**PROJECT NAME** Schuylkill River Trail Extension, 56th to 61th Street
**PROJECT NUMBER** SRDC 1601
**PROJECT LOCATION** 3107 S 61st ST Philadelphia, PA 19153
**DATE STARTED** 10/7/19 **COMPLETED** 10/7/19
**GROUND ELEVATION** 9.50'
**DRILLING CONTRACTOR** Sano Drilling Inc.
**WATER ENCOUNTERED:**
**DRILLING METHOD** Hollow Stem Auger
**DURING DRILLING** ---
**DRILLER / HELPER** Bob/ Drew
**AT END OF DRILLING** ---
**LOGGED BY** E. Brinker **CHECKED BY** D. Marano
**AFTER DRILLING** 13.30' / Elev -3.80'

| DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (in.) | BLOW COUNTS | STRATA | Depth | DESCRIPTION | Elev. | REMARKS |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 8 | 1-4-8-5 | T | 0.20 | Topsoil | 9.30 | |
| | 2 | 7 | 4-6-5-7 | F | | FILL: Brown F/C SAND, some Silt, some C gravel size Rock & Brick Fragments (Angular) | | |
| 5 | 3 | 3 | 4-5-3-1 | | 6.00 | | 3.50 | |
| | 4 | 4 | 2-2-2-2 | | | FILL: Brown F/C SAND AND SILT, with gray F/C gravel size Rock Fragments (Subrounded) | | |
| 10 | 5 | 8 | 2-3-3-1 | | | | | |
| 15 | 6 | 1 | 1-3-2-2 | 1 | 14.00 | | -4.50 | |
| | | | | | | Brown F/C SAND, some Silt, trace little F gravel size Rock Fragments (Subrounded) | | |
| 20 | 7 | 4 | 3-2-1-1 | | | | | |
| 25 | 8 | 20 | 1-1-1-2 | | 23.00 | | -13.50 | |
| | | | | | | Black F/C SAND AND SILT | | |
| | 1 | 24 | | | | | | |
| 30 | 9 | 24 | 1-1-2-1 | 2 | 30.00 | | -20.50 | |
| | | | | | | Gray SILT, trace F Sand | | |
| 35 | 10 | 12 | 1-1-2-3 | | | | | |
| 40 | 11 | 24 | 2-9-9-4 | 3 | 38.00 | | -28.50 | |
| | | | | | | Gray F/C GRAVEL (Subangular) AND F/M/C SAND, some Silt | | |

*NOTES:*

*(Continued Next Page)*

# TEST BORING LOG



**CLIENT** Schuylkill River Development Corporation
**PROJECT NAME** Schuylkill River Trail Extension, 56th to 61th Street
**PROJECT NUMBER** SRDC 1601
**PROJECT LOCATION** 3107 S 61st ST Philadelphia, PA 19153

| DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (in.) | BLOW COUNTS | GRAPHIC LOG | STRATA | Depth | DESCRIPTION | Elev. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 40 | | | | | 3 | | Gray F/C GRAVEL (Subangular) AND F/M/C SAND, some Silt *(continued)* | | |
| 45 | 12 | 24 | 5-9-13-19 | | | | | | |
| 50 | 13 | 24 | 9-13-17-15 | | | 50.00 | | -40.50 | |
| | | | | | 4 | | Brown C/M/F SAND, trace Silt (Decomposed Mica Schist) | | |
| 55 | 14 | 4 | 50/4" | | | 55.00 | | -45.50 | Spoon refusal at 55 ft |

Borehole terminated at 55.00 feet.

*NOTES:*

# TEST BORING LOG

**TEST BORING B-10**


**CLIENT** Schuylkill River Development Corporation
**PROJECT NAME** Schuylkill River Trail Extension, 56th to 61th Street
**PROJECT NUMBER** SRDC 1601
**PROJECT LOCATION** 3107 S 61st ST Philadelphia, PA 19153
**DATE STARTED** 10/4/19 **COMPLETED** 10/4/19
**GROUND ELEVATION** 9.00'
**DRILLING CONTRACTOR** Sano Drilling Inc.
**WATER ENCOUNTERED:**
**DRILLING METHOD** Hollow Stem Auger
**DURING DRILLING** ---
**DRILLER / HELPER** Bob/ Tom
**AT END OF DRILLING** ---
**LOGGED BY** E. Brinker **CHECKED BY** D. Marano
**AFTER DRILLING** 13.00' / Elev -4.00'

| DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (in.) | BLOW COUNTS | STRATA | Depth | DESCRIPTION | Elev. | REMARKS |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 3 | 3-2-5-7 | T | 0.50 | Topsoil | 8.50 | |
| | 2 | 8 | 4-5-5-4 | F | | FILL: Brown F/M/C SAND, trace Silt, trace C gravel size Brick & Rock Fragments (Angular) | | |
| 5 | 3 | 2 | 3-2-1/12" | | | | | |
| | 4 | 1 | 1/12"-1/12" | | | | | |
| 10 | 5 | 0 | 5-2-3-1 | | | | | |
| 15 | 6 | 6 | 1/12"-2-1 | | 15.00 | | -6.00 | Spoon Wet at 14 feet |
| | | | | | | FILL: Brown F/C SAND AND SILT | | |
| 20 | 7 | 0 | WOH | | 20.00 | | -11.00 | |
| | | | | 1 | | Brownish Black SILT, trace F Sand | | |
| 25 | 8 | 16 | 1/12"-24" | | | | | |
| | | | | | 28.00 | | -19.00 | |
| 30 | 9 | 6 | 3-3-4-5 | 2 | | Gray CLAYEY SILT, some F Sand | | Sample Wet |
| | | | | | 33.00 | | -24.00 | |
| 35 | 10 | 20 | 8-13-13-14 | 3 | | Purplish Gray C/F SAND, some Silt, meduim Gravel (Rounded) | | |
| 40 | 11 | 24 | 8-10-11-14 | | 40.00 | | -31.00 | |

Borehole terminated at 40.00 feet.

*NOTES:*

# TEST BORING LOG

**TEST BORING B-11**



**CLIENT** Schuylkill River Development Corporation
**PROJECT NAME** Schuylkill River Trail Extension, 56th to 61th Street
**PROJECT NUMBER** SRDC 1601
**PROJECT LOCATION** 3107 S 61st ST Philadelphia, PA 19153
**DATE STARTED** 10/4/19 **COMPLETED** 10/4/19
**GROUND ELEVATION** 2.00'
**DRILLING CONTRACTOR** Sano Drilling Inc.
**WATER ENCOUNTERED:**
**DRILLING METHOD** Hollow Stem Auger
**DURING DRILLING** 6.00' / Elev -4.00'
**DRILLER / HELPER** Bob/ Tom
**AT END OF DRILLING** ---
**LOGGED BY** E. Brinker **CHECKED BY** D. Marano
**AFTER DRILLING** 7.00' / Elev -5.00'

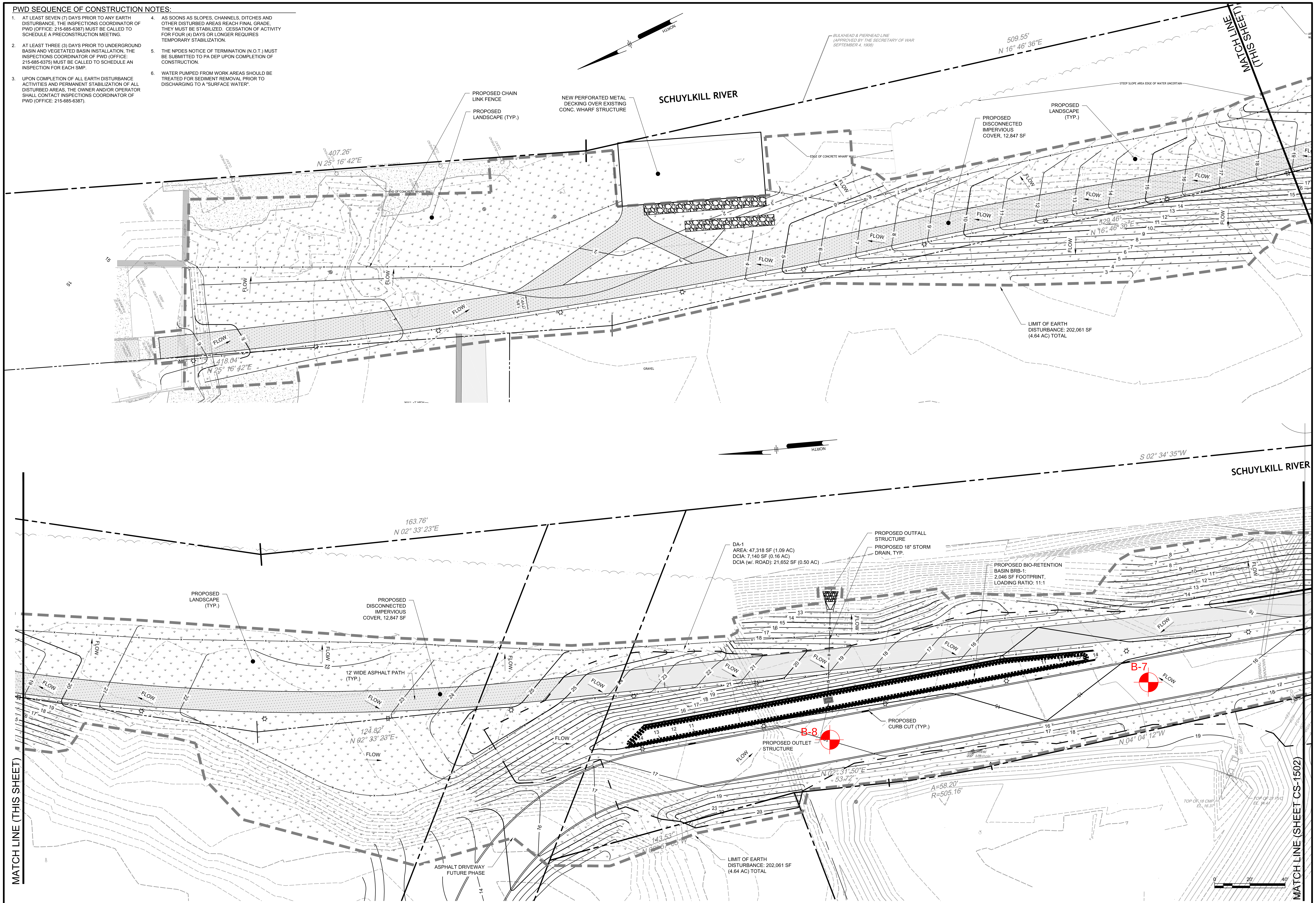
| DEPTH (ft) | SAMPLE TYPE NUMBER | RECOVERY (in.) | BLOW COUNTS | STRATA | Depth | DESCRIPTION | Elev. | REMARKS |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 6 | 3-8-6-3 | T | 0.20 | Topsoil | 1.80 | |
| | 2 | 1 | 4-1-1-1 | F | | FILL: Brown F/M/C SAND, some C gravel size Brick Fragments, trace Silt | | |
| 5 | 3 | 1 | 3-4-6-6 | F | 6.00 | | -4.00 | |
| | 4 | 1 | 3-1-1-1 | F | | FILL: Gray F/M/C SAND, trace Silt, trace Brick Fragments | | |
| 10 | 5 | 12 | 1/12"-1-1 | F | 10.00 | | -8.00 | |
| | | | | 2 | | Black SILT, little C/F gravel size Rock Fragments (Angular), trace F Sand | | strong petroleum odor |
| 15 | 6 | 19 | 1/12"-1/12" | 2 | | | | |
| 20 | 7 | 24 | 1/12"-1/12" | 2 | | | | |
| 25 | 8 | 24 | 1/12"-1/12" | 2 | 25.00 | | -23.00 | |
| | | | | 3 | | Black to Gray to Brown F SAND, some Silt, some M/C gravel size Rock Fragments (Angular) | | |
| 30 | 9 | 22 | 3-5-9-9 | 3 | | | | |
| 35 | 10 | 24 | 11-17-19-14 | 3 | | | | |
| 40 | 11 | 22 | 10-8-8-7 | 3 | 40.00 | | -38.00 | |

Borehole terminated at 40.00 feet.

*NOTES:*

## PWD SEQUENCE OF CONSTRUCTION NOTES:

1. AT LEAST SEVEN (7) DAYS PRIOR TO ANY EARTH DISTURBANCE, THE INSPECTIONS COORDINATOR OF PWD (OFFICE: 215-685-6387) MUST BE CALLED TO SCHEDULE A PRECONSTRUCTION MEETING.
2. AT LEAST THREE (3) DAYS PRIOR TO UNDERGROUND BASIN AND VEGETATED BASIN INSTALLATION, THE INSPECTIONS COORDINATOR OF PWD (OFFICE: 215-685-6375) MUST BE CALLED TO SCHEDULE AN INSPECTION FOR EACH SMP.
3. UPON COMPLETION OF ALL EARTH DISTURBANCE ACTIVITIES AND PERMANENT STABILIZATION OF ALL DISTURBED AREAS, THE OWNER AND/OR OPERATOR SHALL CONTACT INSPECTIONS COORDINATOR OF PWD (OFFICE: 215-685-6387).
4. AS SOONS AS SLOPES, CHANNELS, DITCHES AND OTHER DISTURBED AREAS REACH FINAL GRADE, THEY MUST BE STABILIZED. CESSATION OF ACTIVITY FOR FOUR (4) DAYS OR LONGER REQUIRES TEMPORARY STABILIZATION.
5. THE NPDES NOTICE OF TERMINATION (N.O.T.) MUST BE SUBMITTED TO PA DEP UPON COMPLETION OF CONSTRUCTION.
6. WATER PUMPED FROM WORK AREAS SHOULD BE TREATED FOR SEDIMENT REMOVAL PRIOR TO DISCHARGING TO A "SURFACE WATER".




## LEGEND

B-

Approximate Location of Drilled Boring

## LEGEND:

EXISTING SPILLWAY
RIGHT-OF-WAY / PROPERTY LINE
CURB
SIDEWALK
PAVEMENT
SIGN
UTILITY POLE AND LIGHT
HYDRANT
MAJOR CONTOUR
MINOR CONTOUR
WATER LINE
UNDERGROUND GAS LINE
UNDERGROUND STEAM LINE
COMBINED SEWER
UNDERGROUND ELECTRIC LINE
UNDERGROUND TELECOMM LINE
UNDERGROUND COMMUNICATIONS LINE
MANHOLES
VALVES
INLET
TREE
FRESH AIR INLET
EXISTING TREE LINE (APPROXIMATE)
PROPOSED INLET
PROPOSED MAJOR CONTOUR
PROPOSED MINOR CONTOUR
PROPOSED SPOT ELEVATION
PROPOSED SURFACE SLOPE
PROPOSED STORM SEWER PIPE
PROPOSED SANITARY/STORM MANHOLE
PROPOSED LANDSCAPE AREA
LIMIT OF EARTH DISTURBANCE
PROPOSED RUNOFF FLOW DIRECTION
PROPOSED DRAINAGE AREA
PROPOSED HEADWALL/RIPRAP

**NOT FOR CONSTRUCTION**


PENNONI ASSOCIATES INC.
One Drexel Plaza
3001 Market Street, Suite 200
Philadelphia, PA 19104
T 215.222.3000 F 215.222.3588


ALL DIMENSIONS MUST BE VERIFIED BY CONTRACTOR AND OWNER MUST BE NOTIFIED OF ANY DISCREPANCIES BEFORE PROCEEDING WITH WORK

# SCHUYLKILL RIVER TRAIL 58TH TO 61ST PIDC ACCESS DRIVEWAY 61ST STREET

56TH STREET TO 61ST STREET ALONG SCHUYLKILL RIVER
PHILADELPHIA, PA 19143

## BORING LOCATION PLAN

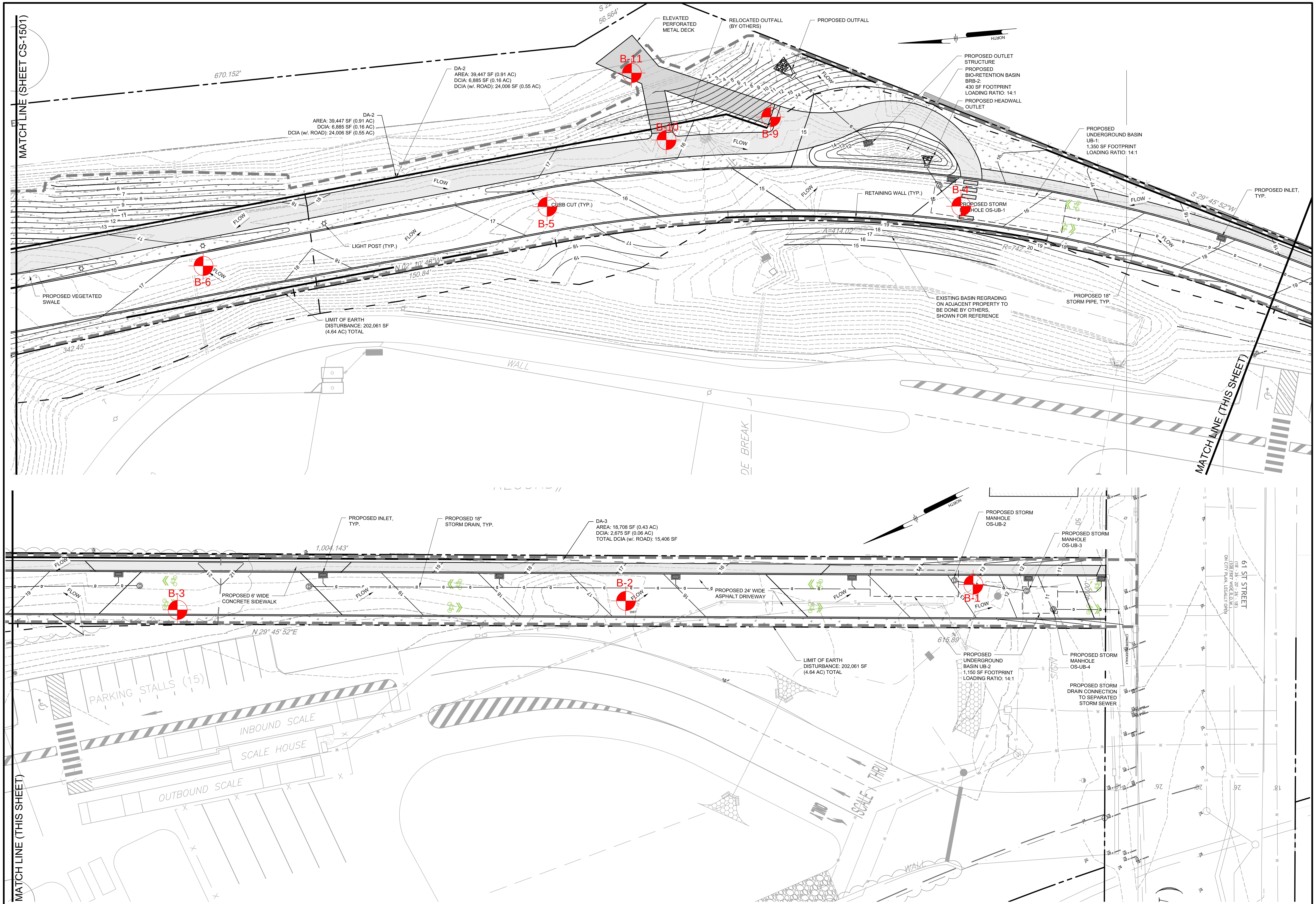
SCHUYLKILL RIVER DEVELOPMENT CORPORATION
2401 WALNUT STREET, 6TH FLOOR
PHILADELPHIA, PA 19103

| DATE | NO. | REVISIONS | BY |
|---|---|---|---|


ALL DOCUMENTS PREPARED BY PENNONI ASSOCIATES ARE INSTRUMENTS OF SERVICE IN RESPECT OF THE PROJECT. THEY ARE NOT INTENDED OR REPRESENTED TO BE SUITABLE FOR REUSE BY OWNER OR OTHERS ON THE EXTENSIONS OF THE PROJECT OR ON ANY OTHER PROJECT. ANY REUSE WITHOUT WRITTEN VERIFICATION OR ADAPTATION BY PENNONI ASSOCIATES FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT OWNERS SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO PENNONI ASSOCIATES; AND OWNER SHALL INDEMNIFY AND HOLD HARMLESS PENNONI ASSOCIATES FROM ALL CLAIMS, DAMAGES, LOSSES AND EXPENSES ARISING OUT OF OR RESULTING THEREFROM.


| | |
|---|---|
| PROJECT | SRDC1601 |
| DATE | 2019-10-24 |
| DRAWING SCALE | 1" = 20' |
| DRAWN BY | SS/TW |
| APPROVED BY | DPM |

LP-1A




## LEGEND

B-

Approximate Location of Drilled Boring

| | | | | | |
|---|---|---|---|---|---|
| UNDERGROUND STEAM LINE | PROPOSED INLET | PROPOSED DRAINAGE AREA | | | |
| COMBINED SEWER | PROPOSED MAJOR CONTOUR | PROPOSED HEADWALL/RIPRAP | | | |
| UNDERGROUND ELECTRIC LINE | PROPOSED MINOR CONTOUR | PROPOSED ASPHALT TRAIL | | | |
| UNDERGROUND TELECOMM LINE | PROPOSED SPOT ELEVATION | PROPOSED PWD DISCONNECTED IMPERVIOUS COVER | | | |
| UNDERGROUND COMMUNICATIONS LINE | PROPOSED SURFACE SLOPE | | | | |
| MANHOLES | PROPOSED STORM SEWER PIPE | | | | |
| VALVES | PROPOSED SANITARY/STORM MANHOLE | | | | |
| INLET | PROPOSED LANDSCAPE AREA | | | | |
| TREE | PROPOSED LIMIT OF EARTH DISTURBANCE | | | | |
| FRESH AIR INLET | PROPOSED RUNOFF FLOW DIRECTION | | | | |
| EXISTING TREE LINE (APPROXIMATE) | | | | | |

**NOT FOR CONSTRUCTION**

0 20' 40'

PENNONI ASSOCIATES INC.
One Drexel Plaza
3001 Market Street, Suite 200
Philadelphia, PA 19104
T 215.222.3000 F 215.222.3588

ALL DIMENSIONS MUST BE VERIFIED BY CONTRACTOR AND OWNER MUST BE NOTIFIED OF ANY DISCREPANCIES BEFORE PROCEEDING WITH WORK

# SCHUYLKILL RIVER TRAIL 58TH TO 61ST PIDC ACCESS DRIVEWAY 61ST STREET

58TH STREET TO 61ST STREET ALONG SCHUYLKILL RIVER
PHILADELPHIA, PA 19143

## BORING LOCATION PLAN

SCHUYLKILL RIVER DEVELOPMENT CORPORATION
2401 WALNUT STREET, 6TH FLOOR
PHILADELPHIA, PA 19103

| NO. | DATE | REVISIONS | BY |
|---|---|---|---|

ALL DOCUMENTS PREPARED BY PENNONI ASSOCIATES ARE INSTRUMENTS OF SERVICE IN RESPECT OF THE PROJECT. THEY ARE NOT INTENDED OR REPRESENTED TO BE SUITABLE FOR REUSE BY OWNER OR OTHERS ON EXTENSIONS OF THE PROJECT OR ON ANY OTHER PROJECT. ANY REUSE WITHOUT WRITTEN VERIFICATION OR ADAPTATION BY PENNONI ASSOCIATES FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT OWNER'S SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO PENNONI ASSOCIATES; AND OWNER SHALL INDEMNIFY AND HOLD HARMLESS PENNONI ASSOCIATES FROM ALL CLAIMS, DAMAGES, LOSSES AND EXPENSES ARISING OUT OF OR RESULTING THEREFROM.

| | |
|---|---|
| PROJECT | SRDC1601 |
| DATE | 2019-10-24 |
| DRAWING SCALE | 1"=20' |
| DRAWN BY | SS/TW |
| APPROVED BY | DPM |

# LP-1B

# TEST BORING/TEST PIT/AUGER PROBE LOG KEY SHEET

| COLUMN | DESCRIPTION |
|---|---|
| Depth | Depth in feet below ground surface |
| Description | Description of sample including color, texture, and classification of subsurface material as applicable. Estimated depths to bottom of strata as interpolated from the boring are also shown. |
| Stratum | Strata numbers as assigned by the geotechnical engineer |
| Sample No. | Split barrel sample and sample number (S-x)<br>Undisturbed Tube sample and sample number (U-x)<br>Rock core run and core number (R-x)<br>NR indicates no recovery |
| Blow Counts | For soils sample (ASTM D 1586): indicates number of blows obtained for each 6 inches penetration of the standard split-barrel sampler.<br><br>For rock coring (ASTM D 2113): indicates percent recovery (REC) per run and rock quality designation (RQD). RQD is the sum of rock pieces that are 4 inches or longer in length in one core run divided by the total core run. |
| Recovery | For soil samples indicates the length of recovery in the sample spoon |
| Remarks | Special conditions or test data as noted during drilling |

Ground Water: Free water level as shown ( )*; * Free water level as noted may not be indicative of daily, seasonal, or long term fluctuations.

## DESCRIPTIVE TERMS

### RELATIVE PROPORTIONS

| Descriptive Term | Symbol | Estimated Percentages |
|---|---|---|
| Trace | tr | 1 to 10 |
| Little | l | 10 to 20 |
| Some | sm | 20 to 35 |
| And | and | 35 to 50 |

### GRADATION OF COARSE GRAINED COMPONENTS

| Soil Component | Size Range | Particle Size Maximum | Particle Size Minimum |
|---|---|---|---|
| Boulders | | - | 12" |
| Cobbles | | 12" | 3" |
| Gravel | Coarse | 3" | ¾" |
| | Fine | ¾" | #4 Sieve |
| Sand | Coarse | #4 Sieve | #10 Sieve |
| | Medium | #10 Sieve | #40 Sieve |
| | Fine | #40 Sieve | #200 Sieve |
| Silt | | #200 Sieve | .005 mm |
| Clay | | .005 mm | - |

### COMPOSITION OF COARSE-GRAINED COMPONENTS

| Gradation Designation | Symbol | Defining Proportions |
|---|---|---|
| Coarse to Fine | CF | All fractions greater than 10% of the component |
| Coarse to Medium | CM | Less than 10% Fine |
| Medium to Fine | MF | Less than 10% Coarse |
| Coarse | C | Less than 10% Fine and Medium |
| Medium | M | Less than 10% Coarse and Fine |
| Fine | F | Less than 10% Coarse and Medium |

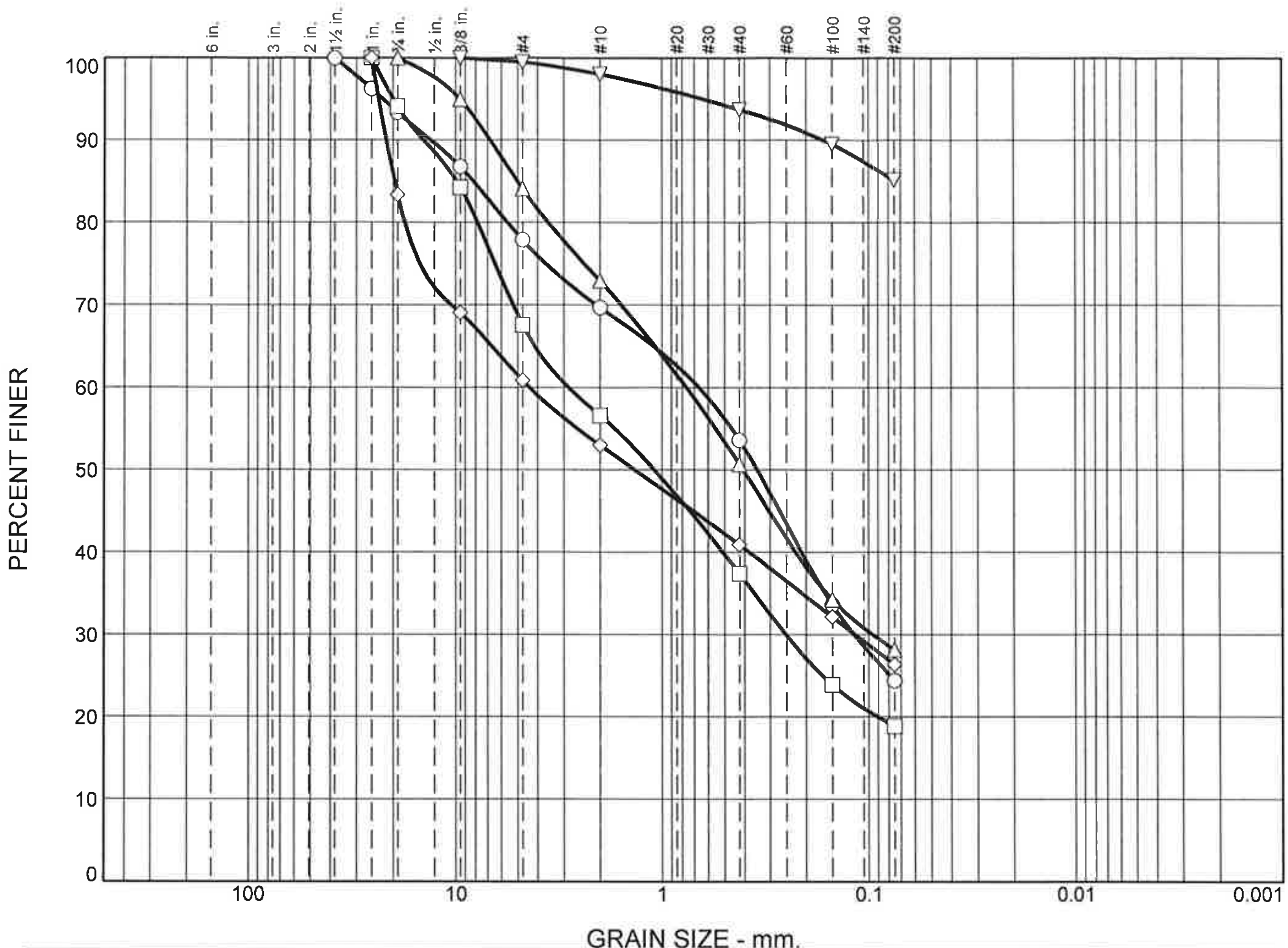
# APPENDIX B- Laboratory Data

# SUMMARY OF LABORATORY DATA

| BORING NUMBER | SAMPLE NUMBER | DEPTH (ft) | SOIL GROUP SYMBOL | GRAIN SIZE DISTRIBUTION: GRAVEL % | GRAIN SIZE DISTRIBUTION: SAND % | GRAIN SIZE DISTRIBUTION: SILT/CLAY % | PLASTICITY: LIQUID LIMIT $w_L$ | PLASTICITY: PLASTIC LIMIT wp | PLASTICITY: PLASTICITY INDEX $I_P$ | PLASTICITY: LIQUIDITY INDEX $I_L$ | MOISTURE CONTENT w % | VOLUMETRIC: SPECIFIC GRAVITY (G) (*) ASSUMED | VOLUMETRIC: DRY UNIT WEIGHT (pcf) | VOLUMETRIC: VOID RATIO (e) | VOLUMETRIC: DEGREE OF SATURATION % | COMPACTION DATA: MAXIMUM DRY DENSITY (pcf) | COMPACTION DATA: OPTIMUM MOISTURE CONTENT % | COMPACTION DATA: STANDARD/MODIFIED | CBR (%) @ 0.1 in. PENETRATION | CBR (%) @ 0.2 in. PENETRATION | ORGANIC (%) | SHEAR STRENGTH: UNCONFINED COMPRESSIVE STRENGTH (tsf) | SHEAR STRENGTH: COHESION (tsf) | SHEAR STRENGTH: AXIAL STRAIN (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-3 | BS-1 | 2-4 | SM | 22 | 53 | 25 | | | NP | | 7.0 | | | | | 111.6 | 13.0 | S | 8.6 | 9.3 | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| B-4 | S-2 | 2-4 | | | | | | | | | 8.2 | | | | | | | | | | | | | |
| B-4 | S-3 | 3-6 | | 32 | 49 | 19 | | | | | 8.3 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| B-9 | S-5 | 8-10 | | 16 | 46 | 28 | | | | | 20.7 | | | | | | | | | | | | | |
| B-9 | S-13 | 48-50 | | 39 | 35 | 26 | | | | | 12.9 | | | | | | | | | | | | | |
| B-9 | ST-1 | 25-27 | ML | | 15 | 85 | 48 | 36 | 12 | 1.4 | 53.0 | 2.60* | 67.3 | 1.41 | 98 | | | | | | 5.6 | 0.59 | 0.30 | 9.6 |

| | | | | |
|---|---|---|---|---|
| **PENNONI ASSOCIATES INC.** | DRAWN BY: BL<br>CHECKED BY: DPM | DATE: 11/4/2019<br>DATE: 11/5/2019 | PROJECT: **SCHUYLKILL RIVER TRAIL 56TH - 61ST**<br>LOCATION: **PHILADELPHIA, PA** | JOB No.: **SRDC 1601**<br>TABLE No.: **L-2** |

# Particle Size Distribution Report




| | % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|---|
| | | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| ○ | 0.0 | 6.7 | 15.4 | 8.2 | 16.1 | 29.2 | 24.4 | |
| □ | 0.0 | 5.9 | 26.5 | 11.0 | 19.2 | 18.6 | 18.8 | |
| △ | 0.0 | 0.0 | 15.9 | 11.2 | 22.2 | 22.6 | 28.1 | |
| ◇ | 0.0 | 16.7 | 22.4 | 7.9 | 12.1 | 14.6 | 26.3 | |
| ▽ | 0.0 | 0.0 | 0.5 | 1.5 | 4.3 | 8.6 | 85.1 | |

## SOIL DATA

| SYMBOL | SOURCE | SAMPLE NO. | DEPTH (ft.) | Material Description | USCS |
|---|---|---|---|---|---|
| ○ | B-3 | BS-1 | 2-4 | F/M/C SAND, SOME SILT, SOME F/C GRAVEL | SM |
| □ | B-4 | S-3 | 3-6 | M/F/C SAND, SOME F/C GRAVEL, LITTLE SILT | |
| △ | B-9 | S-5 | 8-10 | F/M/C SAND, SOME SILT, LITLE FINE GRAVEL | |
| ◇ | B-9 | S-13 | 48-50 | F/C GRAVEL & F/M/C SAND, SOME SILT | |
| ▽ | B-9 | ST-1 | 25-27 | CLAY & SILT, LITTLE F/M SAND | ML |

**PENNONI ASSOCIATES INC.**

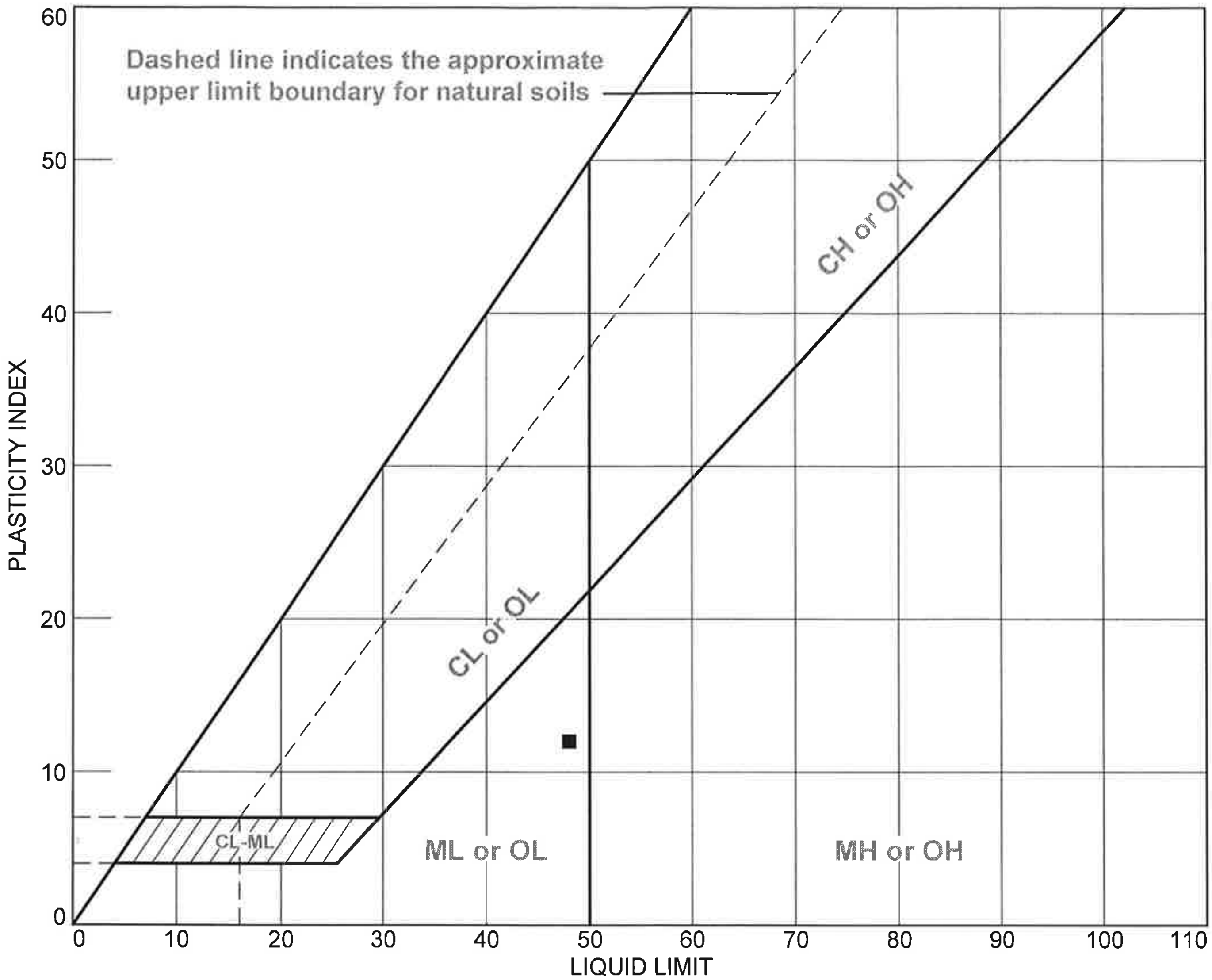
**Bethlehem, PA**

**Client:** SCHUYLKILL RIVER DEVELOPMENT CORPORATION

**Project:** SCHUYLKILL RIVER TRAIL - 58TH TO 61ST

**Project No.:** SRDC1601 **Figure** S-1

# LIQUID AND PLASTIC LIMITS TEST REPORT




| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-3 | BS-1 | 2-4 | 7.0 | NP | NV | NP | SM |
| ■ | B-9 | ST-1 | 25-27 | 53.0 | 36 | 48 | 12 | ML |

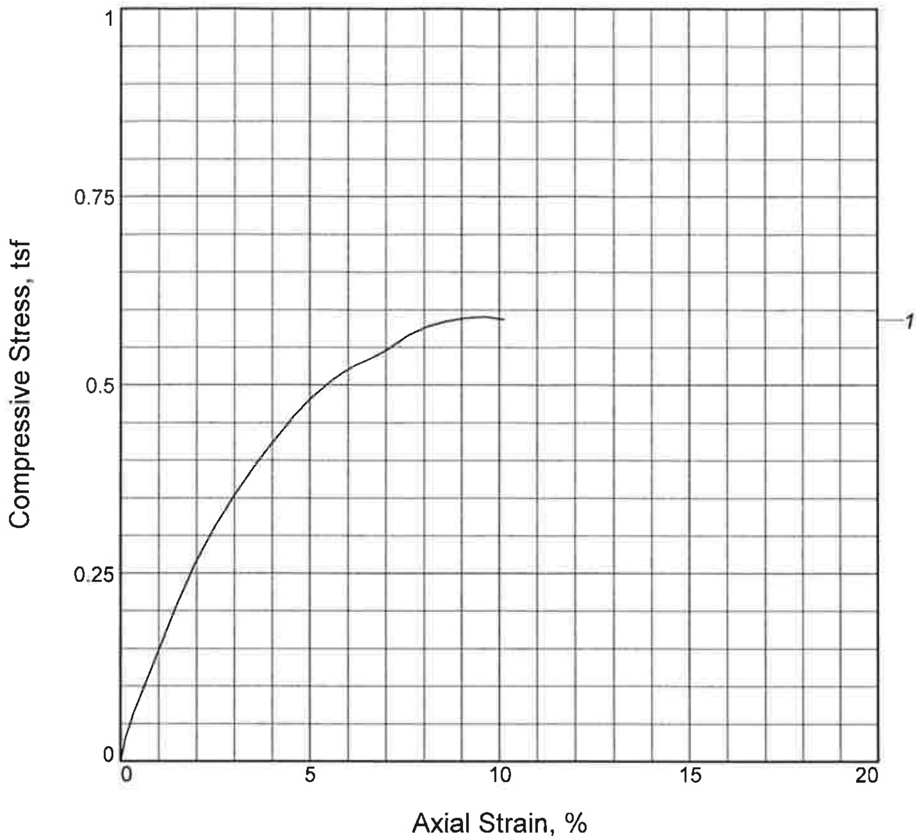
**PENNONI ASSOCIATES INC.**

**Bethlehem, PA**

**Client:** SCHUYLKILL RIVER DEVELOPMENT CORPORATION
**Project:** SCHUYLKILL RIVER TRAIL - 58TH TO 61ST

**Project No.:** SRDC1601 **Figure** A-1

# UNCONFINED COMPRESSION TEST




| Sample No. | 1 | | | |
|---|---|---|---|---|
| Unconfined strength, tsf | 0.590 | | | |
| Undrained shear strength, tsf | 0.295 | | | |
| Failure strain, % | 9.6 | | | |
| Strain rate, in./min. | 0.057 | | | |
| Water content, % | 53.0 | | | |
| Wet density, pcf | 103.0 | | | |
| Dry density, pcf | 67.3 | | | |
| Saturation, % | 97.7 | | | |
| Void ratio | 1.4113 | | | |
| Specimen diameter, in. | 2.83 | | | |
| Specimen height, in. | 5.71 | | | |
| Height/diameter ratio | 2.02 | | | |

**Description:** CLAY & SILT, LITTLE F/M SAND

| LL = 48 | PL = 36 | PI = 12 | Assumed GS= 2.60 | Type: SHELBY TUBE |
|---|---|---|---|---|

**Project No.:** SRDC1601
**Date Sampled:**
**Remarks:**

**Figure** U-1

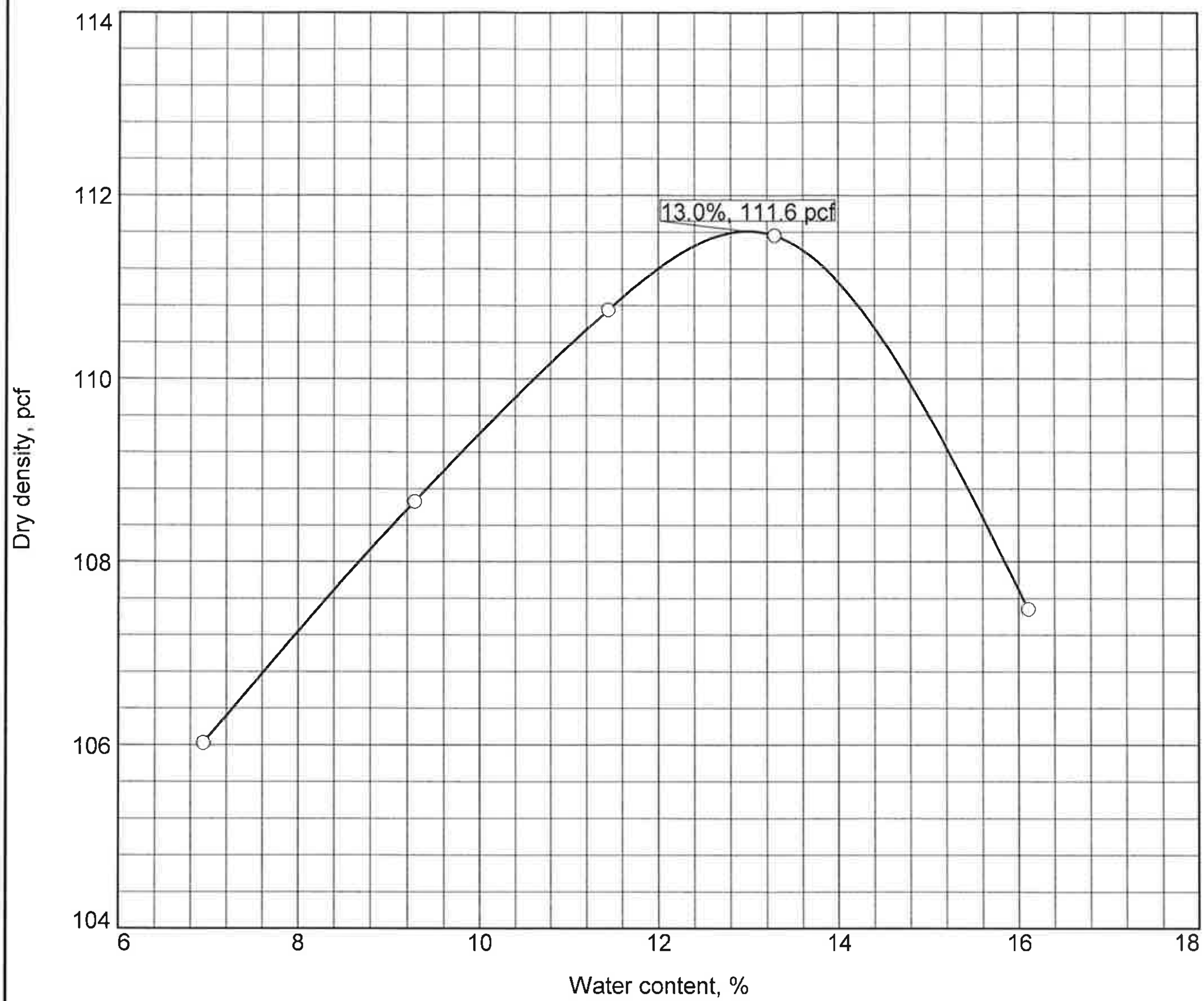
**Client:** SCHUYLKILL RIVER DEVELOPMENT CORPORATION

**Project:** SCHUYLKILL RIVER TRAIL - 58TH TO 61ST

**Source of Sample:** B-9 **Depth:** 25-27
**Sample Number:** ST-1

UNCONFINED COMPRESSION TEST
PENNONI ASSOCIATES INC.
Bethlehem, PA

**Tested By:** BL




Test specification: ASTM D 698-12 Method C Standard
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

| Elev/ Depth | Classification | | Nat. Moist. | Sp.G. | LL | PI | % > 3/4 in. | % < No.200 |
|---|---|---|---|---|---|---|---|---|
| | USCS | AASHTO | | | | | | |
| 2-4 | SM | A-2-4(0) | 7.0 | | NV | NP | 6.7 | 24.4 |

| ROCK CORRECTED TEST RESULTS | UNCORRECTED | MATERIAL DESCRIPTION |
|---|---|---|
| Maximum dry density = 111.6 pcf | 109.8 pcf | F/M/C SAND, SOME SILT, SOME F/C GRAVEL |
| Optimum moisture = 13.0 % | 13.6 % | |

**Project No.** SRDC1601 **Client:** SCHUYLKILL RIVER DEVELOPMENT
**Project:** SCHUYLKILL RIVER TRAIL - 58TH TO 61ST
**Date:**
○ **Source of Sample:** B-3 **Sample Number:** BS-1

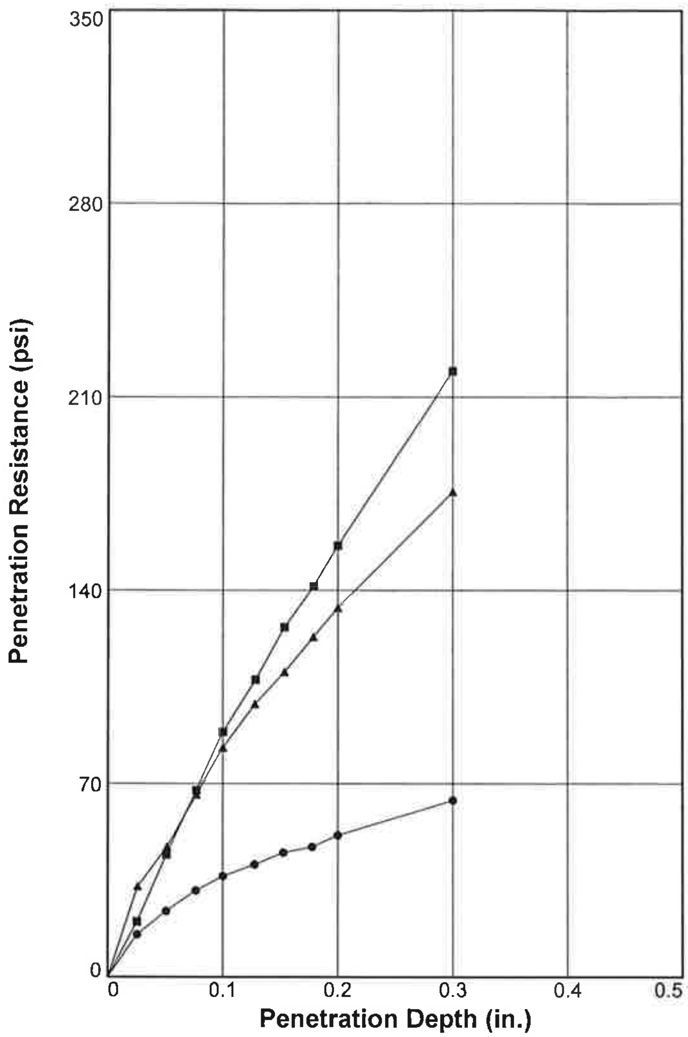
**Remarks:**
MANUAL RAMMER

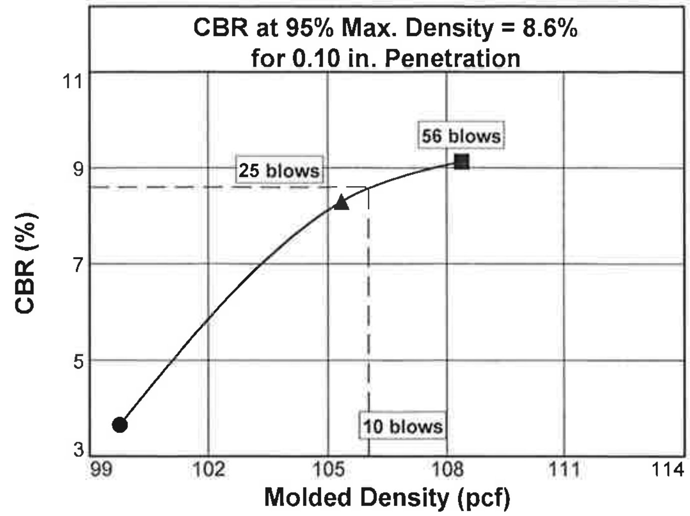
**PENNONI ASSOCIATES INC.**

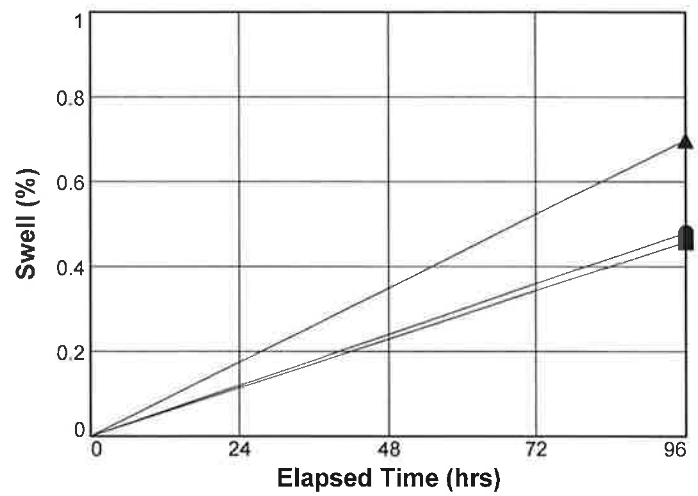
**Bethlehem, PA**

**Figure** P-1

# BEARING RATIO TEST REPORT
## ASTM D 1883-07




| | Molded | | | Soaked | | | CBR (%) | | Linearity Correction (in.) | Surcharge (lbs.) | Max. Swell (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Density (pcf) | Percent of Max. Dens. | Moisture (%) | Density (pcf) | Percent of Max. Dens. | Moisture (%) | 0.10 in. | 0.20 in. | | | |
| 1 ○ | 99.8 | 89.4 | 13.6 | 99.3 | 89 | 20.6 | 3.6 | 3.4 | 0.000 | 10 | 0.5 |
| 2 △ | 105.3 | 94.4 | 13.6 | 104.6 | 93.7 | 18.6 | 8.3 | 8.9 | 0.000 | 10 | 0.7 |
| 3 □ | 108.4 | 97.1 | 13.6 | 107.9 | 96.7 | 19.3 | 9.1 | 10.6 | 0.004 | 10 | 0.5 |

| Material Description | USCS | Max. Dens. (pcf) | Optimum Moisture (%) | LL | PI |
|---|---|---|---|---|---|
| F/M/C SAND, SOME SILT, SOME F/C GRAVEL | SM | 111.6 | 13.0 | NV | NP |

**Project No:** SRDC1601

**Project:** SCHUYLKILL RIVER TRAIL - 58TH TO 61ST

**Source of Sample:** B-3 **Depth:** 2-4

**Sample Number:** BS-1

**Date:**

**Test Description/Remarks:**

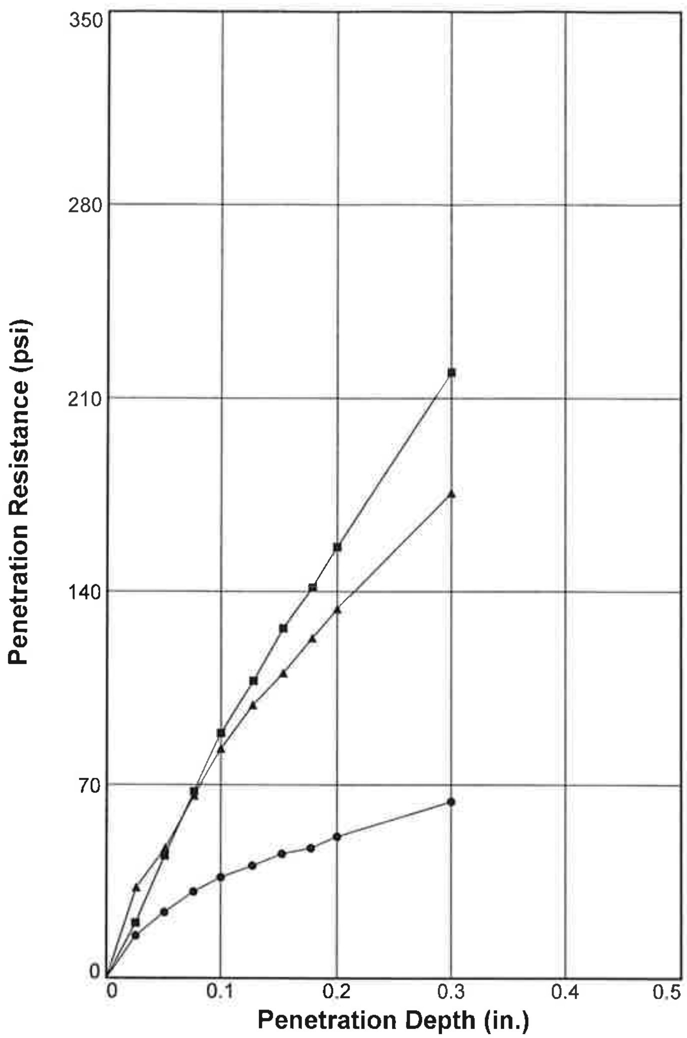
MANUAL RAMMER

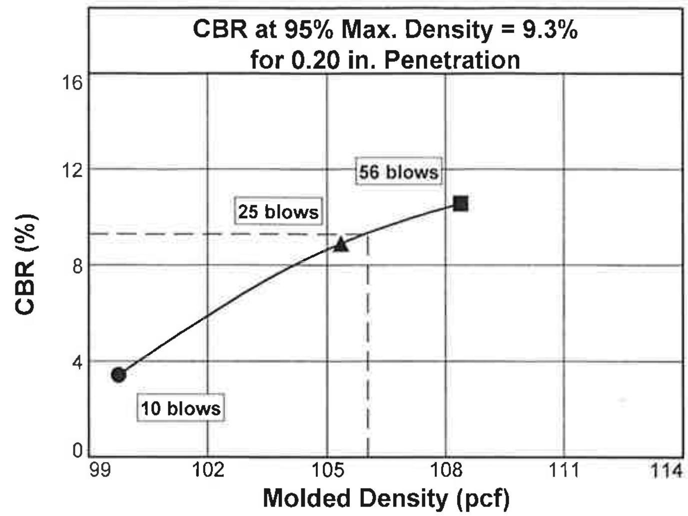
BEARING RATIO TEST REPORT

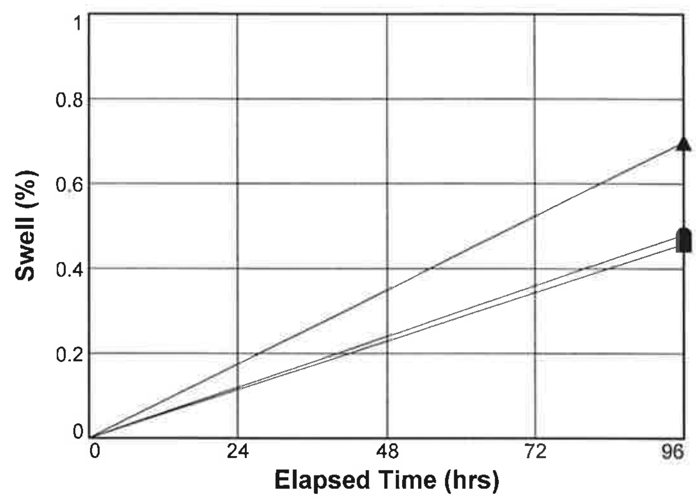
PENNONI ASSOCIATES INC.

**Figure** CBR-1

# BEARING RATIO TEST REPORT
## ASTM D 1883-07




| | Molded | | | Soaked | | | CBR (%) | | Linearity Correction (in.) | Surcharge (lbs.) | Max. Swell (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Density (pcf) | Percent of Max. Dens. | Moisture (%) | Density (pcf) | Percent of Max. Dens. | Moisture (%) | 0.10 in. | 0.20 in. | | | |
| 1 ● | 99.8 | 89.4 | 13.6 | 99.3 | 89 | 20.6 | 3.6 | 3.4 | 0.000 | 10 | 0.5 |
| 2 ▲ | 105.3 | 94.4 | 13.6 | 104.6 | 93.7 | 18.6 | 8.3 | 8.9 | 0.000 | 10 | 0.7 |
| 3 ■ | 108.4 | 97.1 | 13.6 | 107.9 | 96.7 | 19.3 | 9.1 | 10.6 | 0.004 | 10 | 0.5 |

| Material Description | USCS | Max. Dens. (pcf) | Optimum Moisture (%) | LL | PI |
|---|---|---|---|---|---|
| F/M/C SAND, SOME SILT, SOME F/C GRAVEL | SM | 111.6 | 13.0 | NV | NP |

**Project No:** SRDC1601

**Project:** SCHUYLKILL RIVER TRAIL - 58TH TO 61ST

**Source of Sample:** B-3 **Depth:** 2-4

**Sample Number:** BS-1

**Date:**

**Test Description/Remarks:**

MANUAL RAMMER

BEARING RATIO TEST REPORT

PENNONI ASSOCIATES INC.

**Figure** CBR-1

## LABORATORY TESTING PROCEDURES

All testing is either done in accordance with the indicated ASTM Designation-latest edition, or with other standard or generally accepted engineering practice as described:

1. Consolidation Test of Soils
   Preparation of samples and testing procedures generally follow the methods described in Lambe, op. Cit. In addition, the time of loading may be selected on the basis of:

   a. Controlled rate of percent of consolidation
   b. Controlled pore pressure gradient
   c. Controlled strain

   The method of test is selected to suit the soil type in question and the test is conducted in accordance with generally accepted engineering practice.

2. Atterberg Limits – Plasticity Indices
   a. Liquid limit of soils, ASTM D 4318
   b. Plastic limit and plasticity index of soils, ASTM D 4318
   c. Shrinkage factors of soils, ASTM D 427

   (Moisture content is also determined with the Atterberg Limit test, and liquidity index is also computed)

3. Moisture Content of Soil
   ASTM D 2216

4. Particle Size Analysis of Soils
   ASTM D 421, Dry preparation of soil samples; ASTM D 422, Sieve and/or hydrometer analysis.

5. Triaxial Compression Test of Soils
   Sample preparation, apparatus, and testing generally follow the procedures outlined in Soil Testing for Engineers, T.W. Lambe, John Wiley & Sons, Inc., New York, 1951 and in The Measurement of Soil Properties in the Triaxial Test, Alan W. Bishop & D.J. Henkel, 2nd Edition, St. Martin's Press, New York, 1962

6. Unconfined Compression Strength of Cohesive Soil
   ASTM D 2166

7. Specific Gravity of Soils
   ASTM D 854

8. Unit Weight Determination of Soils
   See ASTM D 2166 for preparation of specimen except that sample size may differ. For moisture content see ASTM D 2216.

9. Visual Identification of Soil Samples
   All soil samples are visually identified and/or classified. The classification system used is shown in Table L-1.

10. Identification of Rock
    Rock core samples are identified by the character and appearance of newly fractured surfaces of unweathered pieces, by core conditions and characteristics, and by the determination of simple physical and chemical properties.

11. Compaction Test of Soils
    a. Moisture-density relations of soils using 5.5 lb. hammer and 12 in. drop, ASTM D 698
    b. Moisture-density relations of soils using 10 lb. hammer and 18 in. drop, ASTM D 1557

12. Maximum and Minimum Densities of Granular Soils
    Testing procedures follow D.M. Burmeister, "Suggested Method of Test for Maximum and Minimum Densities of Granular Soils" cited in Proceedings for Testing Soils, Fourth Edition, ASTM, Philadelphia. 1964, pp 175-177.

13. Bearing Ratio of Laboratory Compacted Soils
    ASTM D 1883 (Sometimes called California Bearing Ratio or CBR)

14. Organic Content
    A modified dichromate oxidation method using ferrous ammonium sulfate is employed in determining the percent of organic matter in soil.

## APPENDIX C – Standard Symbols

## STANDARD SYMBOLS

| | |
|---|---|
| B | Width of footing |
| c | cohesion |
| $c_v$ | coefficient of consolidation |
| $C_c$ | compression index |
| C | coefficient of secondary compression |
| $C_3$ | swelling index |
| $C_u$ | uniformity coefficient ($D_{60}/D_{10)}$ |
| CBR | California Bearing Ratio |
| $D_f$ | depth of foundation |
| $D_p$ | diameter of grain corresponding to percentage p on grain size curve |
| $D_{10}$ | effective grain size |
| E | modulus of linear deformation |
| $E_s$ | Young's Modulus |
| e | void ratio |
| $F_s$ | factor of safety |
| G | specific gravity |
| h | hydraulic head |
| H | stratum thickness |
| i | hydraulic gradient |
| $I_L$ | liquidity index |
| $I_P$ | plasticity index |
| k | coefficient of permeability |
| $k_h$ | coefficient of horizontal subgrade reaction |
| $k_v$ | coefficient of vertical subgrade reaction |
| l | length of footing |
| n | porosity |
| P | deviator stress |
| $P_c$ | estimated probable preconsolidation pressure |
| $P_o$ | existing overburden pressure |
| $q_a$ | allowable soil bearing pressure |
| Q | triaxial compression test unconsolidated and undrained |
| $Q_c$ | triaxial compression test consolidated and undrained |
| S | triaxial compression test consolidated and drained |
| $S_r$ | degree of saturation |
| $\upsilon$ | pore-water pressure |
| U | degree of consolidation |
| $U_c$ | unconfined compression test |
| $w_f$ | moisture content at end of test |
| $w_l$ | liquid limit |
| $w_n$ | natural moisture content |
| $w_p$ | plastic limit |
| $\gamma$ | unit weight |
| $\gamma_d$ | dry unit weight |
| $\gamma_b$ | submerged unit weight |
| $\varepsilon$ | unit linear strain |
| $\varepsilon_f$ | unit linear strain at failure |
| $\sigma$ | normal stress |
| $\sigma_1$ | major principal stress |
| $\sigma_3$ | minor principal stress |
| $\tau$ | shear stress |
| $\phi$ | angle of internal friction |
| $k_a$ | coefficient of active pressure |
| $k_p$ | coefficient of passive pressure |
| $\delta$ | friction angle |
| $\tan \delta$ | friction factor |

**APPENDIX D – Important Information about this Geotechnical Engineering Report (published by GBA)**

# Important Information about This

# Geotechnical-Engineering Report

**Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.**

**While you cannot eliminate all such risks, you can manage them. The following information is provided to help.**

## Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

## Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

## Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

## Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

## Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

## A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

## A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

### Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

### Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

### Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

### Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

### Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

### Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GBC GEOTECHNICAL BUSINESS COUNCIL *of the Geoprofessional Business Association*

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org

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