GEOTECHNICAL ENGINEERING SERVICES

SCHUYLKILL RIVER TRAIL PLATFORM REVITALIZATION AT 56TH STREET

PHILADELPHIA, PENNSYLVANIA

Submitted To:

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

COMMONWEALTH OF PENNSYLVANIA
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SRDC 1601.GEO
July 19, 2017
Revised October 16, 2017

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July 19,2017
Revised October 16, 2017

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 – Platform Revitalization at 56th Street
Philadelphia, Pennsylvania

Dear Mr. Syrnick:

We are pleased to submit our geotechnical engineering report for the proposed section of the existing relieving platform along the Schuylkill River in the vicinity of 56th Street, Philadelphia, Pennsylvania. Work was initiated in general accordance with the scope of work presented in our proposal dated March 15, 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.

David A. Copeland, EIT
Graduate Professional

Daniel P. Marano Jr., PE
Project Engineer

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1. EXECUTIVE SUMMARY

Pennoni has completed our geotechnical study for the proposed revitalization of a section of the existing relieving platform along the Schuylkill River in the vicinity of South 56th 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.

The ultimate project goal is to extend the Schuylkill River Trail between 56th and 61st Streets and provide amenities along the trail such as pedestrian platforms lookouts and a fishing pier. The proposed construction for this phase of the project consists of rehabilitating a 60 ft long portion of the existing relieving platform, and constructing a pedestrian fishing pier. The existing platform is to remain in place and a new bulkhead constructed over the existing.

On May 10 and 11, 2017, seven test borings labeled B-1 through B-6A were drilled. 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 new fishing pier over the existing platform is feasible. Our original report provided pile alternatives, but due to the estimated lateral load from a failure of the existing timber cribbing alternative approaches needed to be considered. Therefore, we recommend that the new fishing pier/platform should be constructed by driving sheet piles in front of the existing timber cribbing. Do to the anticipated heights of exposed sheet pile tieback anchors are anticipated. We recommend a deadman be used to anchor the sheet pile wall. Surcharging the deadman anchor locations will be required. Encountering ground water in shallow excavations should be anticipated. Due to the proximity to the Schuylkill River the groundwater elevation is expected to vary with the tidal action.

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 relieving platform associated with the proposed Schuylkill River Trail section is located in the vicinity of South 56th Street, in Philadelphia, Pennsylvania. The project site is bounded on the north by an approximate 250 ft long section of the platform that has been redeveloped, followed by South 56th Street, on the east by the Schuylkill River, and on the south and west by a densely overgrown/wooded former commercial/industrial use lots.

The buildings that once occupied the site have been razed, and the ground cover is a mixture of clean gravel fill, concrete, or densely overgrown and covered by topsoil. A 2 ft tall concrete retaining wall parallels the Schuylkill River (offset approximately 14 ft from the edge of the pier) approximately 120 ft to the southern limit of the project site. A 20 ft long concrete covered area spans the southern limit of the site. Control panel metal enclosure boxes and relic warning sign were observed in several locations along the southern limit of the site. West of the platform, the groundcover consists of gravel (similar to AASHTO #3 stone). A dense line of trees/bushes divides the gravel covered area from the pier along the retaining wall traversing in the northerly/southerly direction.

Overhead and underground utilities were not observed within the areas of the proposed development. The overall topography of the site is gently sloping downward from west to the east with an approximate change in elevation of 1.5 ft over a distance of 100 ft.

2.2. PROPOSED CONSTRUCTION

The proposed construction consists of a 12 ft wide walking trail that will extend between 56th and 61st Streets, and will be located approximately 30 ft from the face of the relieving platform and established at Elevation 7.0. Also proposed is a 60 ft long water access point and pedestrian platform at the face of the relieving platform. The current schematic design drawings indicate that the redevelopment of the existing platform will consist of driving sheet piles in front of the existing platform to stabilize the existing timber cribbing. Due to the exposed height of the sheet pile wall tieback/anchors are expected to be required. A concrete deadman anchor will be used to tieback the sheet pile wall. A bituminous concrete covered pedestrian platform will then be constructed on top of the existing platform.

2.3. HISTORICAL DOCUMENT REVIEW

Historical documents dating back to 1866 indicate that existing platform was once part of Gibson's Point Oil Works and Yard. Gibson's Point Oil Works and Yard consisted of Phoenix Petroleum Works, Franklin Oil Works, Harkness Oil Refinery, and M. Lloyd Oil Storage & Filling Shed. Multiple buildings and tanks were once located west of the existing platform. By 2002 the tanks that were located on the west side of the site were demolished, and sometime between 2006 and 2007 the buildings that occupied the north half of the site were demolished.

A previous geotechnical report completed by others for the revitalization of the platform north of our exploration was provided for our review. The subsurface conditions, platform construction methods and report recommendations were reviewed. Sections of the platform starting from 56th Street to the south were categorized based on the foundation systems observed during their field review.

- Type A – consists of a timber cribbing substructure with two types of water construction methods.
- Type B – consists of 4 to 5 ft diameter steel cellular cofferdams, filled with concrete; and
- Type C – consists of timber pile bents.

The substructure observed in Boring B-1 through the cored slab could be consistent with the Type A or B foundation systems described in the previous report. A upper concrete deck with timber low deck was encountered; however, soils were not encountered until the mudline, which was identified at a depth of 20 ft below existing grade. The previous geotechnical report concluded that it was not possible to evaluate the competency of the platform and it was their professional opinion that structure should be removed from active use.

2.4. 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:

- impacts of subsurface conditions on site development;
- foundation recommendations;
- discussion of potential for consolidation and/or differential settlements of substrata encountered;
- “general procedure” soil Site Class based on applicable IBC requirements;
- ground water conditions and influence of design and construction;
- removal or treatment of objectionable material;
- lateral earth design parameters;
- use of in-situ materials for controlled fill, including compaction requirements; and
- quality assurance and field observations during construction.

3. FIELD AND LABORATORY WORK

3.1. FIELD WORK

On May 10 and 11, 2017, seven borings were drilled by CGC Geoservices, LLC 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. Boring B-6 encountered refusal prior to reaching the prescribed depth, so the boring was offset (B-6A) and advanced. 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 D. Copeland, EIT and C. Bugher, EIT 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. Additionally, the Shelby tube sample was delivered to TRC Laboratories and tested to determine the tri-axial 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 crossbedded 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

Borings B-1 through B-3 were performed 10 ft from the face of pier. The top of the pier was only encountered in B-1, the top slab was observed to be 8 in. thick; however, remnants from the low deck (timber) was encountered in Borings B-1 through B-3 at depths varying from 8 to 13 ft below existing grades. The zone below the top deck and low deck were void of any soils in Boring B-1. The mud line was encountered at depths of 20.0 ft, 8.0 ft, and 15.0 ft below existing grades in Borings B-1, B-2 and B-3, respectively.

Topsoil was observed at the surface, approximately 3 to 4 in. thick, in Borings B-2, B-3 and B-6, and Fill was observed at the surface in Borings B-4 and B-5. A Fill layer was encountered in all the borings, except B-1, with thicknesses varying from 4 to 13 ft thick. The subsoils encountered in the test borings 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.

Fill – Stratum F

The fill layer encountered in the borings predominantly consisted of poorly graded SAND with gravel and cobble size rock fragments. Constituents such as wood, concrete, brick, etc. were encountered in the fill. Standard Penetration Test (SPT) N-values (blows/ft) vary from 5 to >50 indicating densities that vary from loose to very dense, respectively. The thickness of the fill layer varies from approximately 4 to 13 ft.

Poorly graded SAND – Stratum 1

Underlying the Fill are alluvial soils that we suspect comprise the former mud line. This transition zone consists of fine Sand to Silt. Stratum 1 soils are alluvial poorly graded SANDs with varying amounts of silt and gravel. SPT N-values vary from Weight of Hammer (WOH) to 10 indicating a density of very loose to medium dense, respectively. The thickness of the sand layer varies from approximately 15 to 16 ft. The soils were observed to be wet. These soils are susceptible to differential settlements based on their densities.

Elastic Silt – Stratum 2

Underlying the fill layer was an alluvial Elastic SILT. SPT N-values vary from WOH to 6 indicating a stiffness that varies from very soft to firm, respectively. The thickness of the silt layer varies from approximately 8 to 13 ft. Laboratory results indicate the tested soils have moisture contents that vary from 15.5% to 44.1%; the cohesion of the silt was determined to vary between 200 to 360 psf. These soils are susceptible to differential settlements based on their consistencies.

Poorly to well graded GRAVEL – Stratum 3

Underlying Strata 1 and 2 are the alluvial deposited poorly to well graded GRAVEL with varying amounts of sand, typically associated with the Trenton Gravel Formation. SPT N-values vary from 10 to >50 indicating densities that vary from medium dense to very dense. The thickness of the gravel layer varies from approximately 6 to 16 ft. Moisture contents of 9.0 and 12.7% were determined through laboratory testing; the soils were observed to be wet during sampling.

Decomposed Rock – Stratum 4

The borings encountered decomposed rock at depths varying from 28 ft to 34 ft below existing grades. The decomposed rock is completely weathered Mica Schist. The Stratum resembles a medium to fine to coarse micaceous SAND, with varying amounts of Silt and Gravel. SPT N-values are generally >50 indicating very dense conditions.

Refusal to further penetration of the drilling and soil sampling tools was not encountered in the borings.

4.3. GROUNDWATER

Observations for groundwater were made in each boring during sampling and shortly after completion of drilling. Groundwater was encountered in all of the test borings. The table 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 proximity of the Schuylkill Rive the water elevations are expected to vary with the change in the tidal elevation.

Boring	*Depth to Groundwater (ft)*	*Approximate Water Table Elev.**	*Boring*	*Depth to Groundwater (ft)*	*Approximate Water Table Elev.**
B-1	6.0	-5.2	B-4	5.0	-3.2
B-2	3.0	-1.5	B-5	6.0	-3.8
B-3	6.0	-4.0	B-6	6.0	-2.7

*Groundwater elevations were referenced from City datum.

5. ANALYSES AND RECOMMENDATIONS

5.1. SEISMIC SITE CLASSIFICATION

The borings disclosed subsurface conditions generally described according to the 2009 International Building Code (IBC) as having a soil-profile corresponding to Site Class D – a stiff soil profile.

5.2. EARTHWORK

The design of the deadman is intended to ensure it constructed within the upper fill zone. Cuts on the order of 7 ft deep will be required to construct the concrete deadman. In order to provide a sufficient anchor capacity a surcharge load of 500 psf must be applied to the top of the deadman. This equates to 4.5 ft of new fill must be placed on top of the concrete deadman.

Due to the new surcharge settlement of deadman is expected. We recommend surcharging the deadman location plus 5 ft in either direction with 4.5 ft of fill, prior to construction of the sheet pile wall. Our calculations indicate settlement from fill placement will be on the order of 4.0 inches. Fill placement should be done as early as possible in the construction schedule to allow for any settlements to occur prior to constructing the bulkhead. Movements of the subsoils should be monitored with settlement plates which are discussed later in this report.

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. Adjusting the moisture content prior to fill placement should be expected. Similarly, if the existing pier is demolished, the concrete can be broken up and reused for fill, provided it is free of the limitations described above. 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 foundations/floor slab 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. RETAINING STRUCTURES

The construction of a new fishing pier will require stabilization of the existing timber cribbing. Our previous report provided pile options that could have been considered, but after our analyses was complete, the piles could not develop enough lateral resistance if a catastrophic failure were to occur. Therefore, we recommend that the existing timber cribbing is stabilized by constructing a sheet pile wall with the piles driven adjacent to the timber cribbing. The anticipated exposed height of the sheet pile wall and anticipated lateral loading from the timber cribbing require that the wall is anchored/tied back.

An adequately designed steel sheet pile wall can be considered to support the new bulkhead. We recommend that a concrete deadman anchor with the dimensions of 7 ft high by 8.5 ft wide by 60 ft long is constructed to provide adequate lateral resistance for anchors spaced at a distance of 8 ft apart. The steel sheet pile wall will be approximately 25 ft in exposed height with a minimum embedment depth below the river bed of 11 ft. Preliminary analysis indicates that PZ27 grade 50 steel sheet piles will be required.

5.4. SETTLEMENT

Settlement of a soil mass is a function of the characteristics of the supporting materials and the stresses imposed on the soils by a structure/foundation. The proposed new site fills and deadman anchors will impose high stresses on the subgrade soils; our calculations indicate settlements will be on the order of 4.0 inches. It is our professional opinion that in order to expedite the calculated settlement, the subsoils should be preloaded (surcharged). Based on our experience with these soil types we anticipate that settlement should stabilize within approximately 3 months or less. We recommend a minimum surcharge height of 4 ft. The rate of consolidation can be adjusted by adjusting the surcharge height. We recommend that the surcharge be extended a minimum of 5 ft beyond deadman anchor locations.

Movements of the subsoils should be monitored with settlement plates during and after fill placement to assess the magnitude and rate of settlement. A minimum of two settlement plates should be installed within the proposed building footprint. Settlement plates should be installed prior to any fill being constructed and a "zero" reading obtained. Settlement plate readings and adjacent ground surface elevations should be obtained by the contractor on a daily basis during construction and twice weekly thereafter. A qualified Geotechnical Engineer should evaluate the settlement data.

Provided that our recommendations are followed and the new bulkhead is supported in accordance with Section 5.3, detrimental long-term post-construction settlements are not expected.

5.5. GROUND WATER AND SURFACE WATER MANAGEMENT

Observations for ground water made in each boring indicate that water was encountered 3 to 6 ft. below existing grades. It should be anticipated that water table fluctuations correspond with the tidal action of Schuylkill River. Static water levels could affect utility installation if they are proposed at depths greater than the Mean High Water Line (MHWL). The use of sumps and pumps should be expected; well points and/or a sheeting/shoring system comprised of steel interlocking sheeting and high capacity pumps may be required to control ground water during utility installation in deeper excavations (>5 ft. deep).

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.

5.6. LATERAL EARTH PRESSURES

The soil parameters presented below can be used to estimate lateral earth pressures to design below grade structures and temporary shoring. 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.

Parameter	*Strata*				
	F	*1/2*	*3/Granular Fill*	*4*	***Processed Aggregate*** *(PennDOT Type 2A)*
Unit Weight (pcf)	125	120	135	145	140
Angle of Internal Friction (degrees)	28	24	36	40	38
Cohesion (psf)	0	200	0	0	0
Friction Factor	0.30	0.29	0.45	0.67	0.47
k_a	0.36	0.42	0.26	0.17	0.24
k_o	0.53	0.59	0.41	0.29	0.38
k_p	2.77	2.37	3.85	5.83	4.20

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 perimeter walls and stored materials and construction surcharges or the wall must be design to resist the driving force from the stored materials/construction surcharges. Where sufficient drainage cannot be provided to intercept and re-direct seepage and perched water from structures, hydrostatic pressures must also be considered in the design.

Retaining walls for the proposed water access are can be designed as either as cantilevered cast-in-place retaining walls or segmental retaining walls. The walls are not expected to exceed 4 ft in height. The retaining walls can be supported on spread footings, and localized soil exchanges may be required. The walls should be designed using "Granular Fill" design values reported above, and minimum factors of safety for Sliding and Overturning of 1.5.

5.7. CONSTRUCTION DIFFICULTIES

The field review program in the report done by others directly north of the currently proposed platform reconstruction included below water tactile and visual review by divers. The report noted the timber pile bents in the Type C construction portion of the pier appeared to be deteriorated with many piles missing and numerous damaged or with missing connections. Our Boring B-1 encountered voids to a depth of 20 ft below existing grade. Visual observations of the timber load relieving platform, in the area of Boring B-1, disclosed extreme deterioration below the pier. The structural stability of the existing platform is unknown. The effects of introducing loads or vibrations from the construction phase on the existing platform are unknown. Provided that the existing platform is left in place and a new pile supported platform constructed over the existing, a collapse of the existing platform would impose additional lateral loads on the piles.

Demolition of the existing platform is anticipated; however, proposed construction is directly adjacent to the recently revitalized section of the pier. A construction joint, and/or shoring of the existing pier may be required to protect that section of the platform from this scope of work. Alternatively, it may be more cost beneficial to relocate the area of proposed construction closer to our Borings B-2 and B-3 to minimize disturbance to the recently revitalized section of the platform.

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. If encountered, these obstructions will most likely impair the construction process. Existing foundations or other structural components disclosed should be removed, or the new deep foundations installed in alternate locations.

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

CLIENT Schuylkill River Development Corporation
PROJECT NAME Schuylkill River Trail - 58th to 61st
PROJECT NUMBER SRDC1601
PROJECT LOCATION Philadelphia, PA
DATE STARTED 5/11/17 **COMPLETED** 5/11/17
GROUND ELEVATION 0.8
DRILLING CONTRACTOR CGC Geoservices, LLC
WATER ENCOUNTERED:
DRILLING METHOD Hollow Stem Auger
▽ **DURING DRILLING** 7.90 / Elev -7.10
DRILLER / HELPER E. Blemings/A. Martinez
▼ **AT END OF DRILLING** 6.00 / Elev -5.20
LOGGED BY D. Copeland **CHECKED BY** D. Marano
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0				CON	0.7	8" CONCRETE	0.1	Wire mesh reinforcement 7" below top of concrete
5						VOID		
					7.9	WOOD (timber)	-7.1	Highly decomposed timber mat
10				WAT	10.0	WATER	-9.2	
15								
20					20.0		-19.2	
	S-1	12	WOH/4'	1		Dark brown SILT, trace F Sand, trace Organics (Possible Fill)		
25	S-2	0	WOH/24"		26.0		-25.2	
						WOOD (timber)		Hard augering 26'-28'
					28.0		-27.2	
30	S-3	0	WOH/4'	2		Dark brown SILT, trace F Sand, trace Organics		
	S-4	24	2-2-35-50/6"		33.0		-32.2	Hard augering 33'-43'
35				4		Brown Micaceous SILT AND F SAND (decomposed MICA SCHIST)		

NOTES:
--- = Not Measured

(Continued Next Page)

TEST BORING LOG

CLIENT Schuylkill River Development Corporation
PROJECT NAME Schuylkill River Trail - 58th to 61st
PROJECT NUMBER SRDC1601
PROJECT LOCATION Philadelphia, PA

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION (Depth / Elev.)	REMARKS
35						Brown Micaceous SILT AND F SAND (decomposed MICA SCHIST) *(continued)*	
	S-5	3	50/3		4		
40							
						43.0 / -42.2	Auger refusal at 43 ft

Boring terminated at 43.0 feet.

NOTES:
--- = Not Measured

TEST BORING LOG

BORING B-2

CLIENT Schuylkill River Development Corporation
PROJECT NAME Schuylkill River Trail - 58th to 61st
PROJECT NUMBER SRDC1601
PROJECT LOCATION Philadelphia, PA
DATE STARTED 5/10/17 **COMPLETED** 5/10/17
GROUND ELEVATION 1.5
DRILLING CONTRACTOR CGC Geoservices, LLC
WATER ENCOUNTERED:
DRILLING METHOD Casing with Roller Bit
▽ **DURING DRILLING** 3.00 / Elev -1.50
DRILLER / HELPER D. Bolze/C. Kleine
▼ **AT END OF DRILLING** 3.00 / Elev -1.50
LOGGED BY D. Copeland **CHECKED BY** D. Marano
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0					T	0.3	4" TOPSOIL	1.2	8" diameter thin wall core bit advanced to 2'
	S-1	22	4-4-4-4		F	4.0	FILL: Brown SILT AND F SAND, trace F/C gravel-size Brick, Coal and Schist Rock Fragments	-2.5	
5	S-2	14	3-3-3-10			6.0	FILL: Brown F SAND, some Silt	-4.5	Strong petroleum odor 4'-6'
	S-3	8	10-3-4-3			8.0	WOOD (possibly solid timber)	-6.5	Possible timber pile or wooden foundation element
10, 15	S-4	4	WOH/10'		1		Dark gray to brown F SAND, trace Silt		Strong petroleum odor 8'-20'
20	S-5	6	5-5-WOH/12"			23.0		-21.5	
25	S-6	20	12-14-10-42			25.0	WOOD (solid timber)	-23.5	Hard drilling 23'-25'. Possible timber foundation element.
30	S-7	18	23-24-25-35		3	31.0	Brown F SAND AND F/C GRAVEL (rounded), some Silt, trace Mica	-29.5	Strong petroleum odor 28'-30'
35	S-8	0	50/1"		4		Brown Micaceous SILT AND F SAND, some F/C gravel-size Rock Fragments (decomposed MICA SCHIST)		Hard drilling 31'-38'

NOTES:
--- = Not Measured

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TEST BORING LOG

CLIENT Schuylkill River Development Corporation
PROJECT NAME Schuylkill River Trail - 58th to 61st
PROJECT NUMBER SRDC1601
PROJECT LOCATION Philadelphia, PA

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
35					4		Brown Micaceous SILT AND F SAND, some F/C gravel-size Rock Fragments (decomposed MICA SCHIST) *(continued)*		
	S-9	0	50/1"			38.1		-36.6	Spoon refusal at 38.1 ft
							Boring terminated at 38.1 feet.		

NOTES:
--- = Not Measured

TEST BORING LOG

CLIENT Schuylkill River Development Corporation
PROJECT NAME Schuylkill River Trail - 58th to 61st
PROJECT NUMBER SRDC1601
PROJECT LOCATION Philadelphia, PA
DATE STARTED 5/10/17 **COMPLETED** 5/10/17
GROUND ELEVATION 2
DRILLING CONTRACTOR CGC Geoservices, LLC
WATER ENCOUNTERED:
DRILLING METHOD Casing with Roller Bit
DURING DRILLING 6.00 / Elev -4.00
DRILLER / HELPER D. Bolze/C. Kleine
AT END OF DRILLING 6.00 / Elev -4.00
LOGGED BY D. Copeland **CHECKED BY** D. Marano
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0	S-1	24	3-8-9-13	T	0.3	4" TOPSOIL	1.7	Dry
				F		FILL: Dark brown F/M/C SAND, some Silt, little F gravel-size Coal, Brick and Rock Fragments		
	S-2	18	12-6-4-3					Dry
5	S-3	18	4-4-4-6					Damp
	S-4	12	5-7-46-5					Strong petroleum odor 6-8' Wet
10	S-5	3	3-3-4-5					
					13.0	WOOD (solid timber)	-11.0	
15	S-6	24	18-11-8-8					Possible foundation element
				2	15.0	Brown SILT, some F Sand	-13.0	
20	S-7	24	WOH/24"					
	U-1	24	-					Undisturbed Tube sample
				3	23.0	Brown F SAND AND F/C GRAVEL (rounded), some Silt, trace Mica	-21.0	
25	S-8	16	5-30-13-11					Strong petroleum odor 23-30'
30	S-9	16	28-38-35-35					
				4	31.0	Brown Micaceous F/M SAND, some Silt (decomposed MICA SCHIST)	-29.0	Hard drilling 31-38'
	S10	10	35-50/4"					
35								

NOTES:
--- = Not Measured

(Continued Next Page)

TEST BORING LOG

BORING B-3

CLIENT Schuylkill River Development Corporation
PROJECT NAME Schuylkill River Trail - 58th to 61st
PROJECT NUMBER SRDC1601
PROJECT LOCATION Philadelphia, PA

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION (Depth / Elev.)	REMARKS
35					4	Brown Micaceous F/M SAND, some Silt (decomposed MICA SCHIST) *(continued)*	
	S-11	1	50/1"			38.1 / -36.1	Spoon refusal at 38.1 ft
						Boring terminated at 38.1 feet.	

NOTES:
--- = Not Measured

TEST BORING LOG

BORING B-4

CLIENT Schuylkill River Development Corporation
PROJECT NAME Schuylkill River Trail - 58th to 61st
PROJECT NUMBER SRDC1601
PROJECT LOCATION Philadelphia, PA
DATE STARTED 5/11/17 **COMPLETED** 5/11/17
GROUND ELEVATION 1.8
DRILLING CONTRACTOR CGC Geoservices, LLC
WATER ENCOUNTERED:
DRILLING METHOD Hollow Stem Auger
DURING DRILLING 5.00 / Elev -3.20
DRILLER / HELPER E. Blemings/A. Martinez
AT END OF DRILLING 5.00 / Elev -3.20
LOGGED BY C. Bugher **CHECKED BY** D. Marano
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	STRATA	DESCRIPTION	REMARKS
0	S-1	6	16-50/5	F	FILL: Brown M/F SAND, some Silt, Gravel, Brick and Wood Fragments	
	S-2	6	10-9-5-6		Depth 4.0, Elev. -2.2	
5	S-3	18	1-1-1-1	1	Gray F SAND, some Silt (Possible Fill)	Wet
	S-4	12	1-1-1-1			
10	S-5	18	WOH/24"		Depth 13.0, Elev. -11.2	
15	S-6	12	12-20-13-10	3	Brown M/F SAND AND GRAVEL, some Silt	
					Depth 18.0, Elev. -16.2	
20	S-7	12	4-5-5-6		Brown C/M/F SAND AND GRAVEL, trace Silt	
					Depth 23.0, Elev. -21.2	
25	S-8	12	8-17-24-20		Brown F/M/C SAND, little Silt, little F Gravel	
	S-9	10	31-50/4"		Depth 29.0, Elev. -27.2	
30				4	Brown Micaceous SILT AND F SAND (decomposed MICA SCHIST)	
35	S10	5	50/5"			

NOTES:
--- = Not Measured

(Continued Next Page)

TEST BORING LOG

CLIENT Schuylkill River Development Corporation
PROJECT NAME Schuylkill River Trail - 58th to 61st
PROJECT NUMBER SRDC1601
PROJECT LOCATION Philadelphia, PA

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION (Depth / Elev.)	REMARKS
35					4	Brown Micaceous SILT AND F SAND (decomposed MICA SCHIST) *(continued)*	
	S-11	3	50/3"			38.3 / -36.5	Spoon refusal at 38.3 ft
						Boring terminated at 38.3 feet.	

NOTES:
--- = Not Measured

BORING B-5

Pennoni

TEST BORING LOG

CLIENT	Schuylkill River Development Corporation	**PROJECT NAME**	Schuylkill River Trail - 58th to 61st
PROJECT NUMBER	SRDC1601	**PROJECT LOCATION**	Philadelphia, PA
DATE STARTED	5/11/17 **COMPLETED** 5/11/17	**GROUND ELEVATION**	2.2
DRILLING CONTRACTOR	CGC Geoservices, LLC	**WATER ENCOUNTERED:**	
DRILLING METHOD	Hollow Stem Auger	**DURING DRILLING**	6.00 / Elev -3.80
DRILLER / HELPER	D. Bolze/C. Kleine	**AT END OF DRILLING**	6.00 / Elev -3.80
LOGGED BY	C. Bugher **CHECKED BY** D. Marano	**AFTER DRILLING**	---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0	S-1	13	3-5-5-8	F	1.3	FILL: Black F/M SAND, some Silt, little F/C Gravel (Rock Fragments), Wood Fragments	0.9	
	S-2	13	5-10-6-5	F		FILL: Brown to black to red F SAND AND SILT, trace F/C Gravel (Rock Fragments)		Strong petroleum odor and sheen 2-10'
5	S-3	15	2-2-3-4	F				
	S-4	7	5-8-5-2	F	8.0		-5.8	Wet
10	S-5A S-5B	24	1-1-1-2	2		Red to brown to dark gray SILT, little F Sand		Wet Damp
15	S-6	0	1-3-3-3	2	18.0		-15.8	
20	S-7	22	11-24-27-28	3	23.0	Multi-colored F/C GRAVEL AND M/F/C SAND, little Silt	-20.8	
				3	24.0	Brown C/M/F SAND, trace Silt, trace Mica	-21.8	
25	S-8A S-8B	24	18-37-40-49	3	28.0	C/F GRAVEL (ROCK FRAGMENTS), some C/M/F Sand, trace Silt	-25.8	
30	S-9	10	29-50/4"	4		Yellow to brown to black Micaceous F SAND, trace Silt (decomposed MICA SCHIST)		
35	S-10	1	50/2"	4				

NOTES:
--- = Not Measured

(Continued Next Page)

TEST BORING LOG

CLIENT Schuylkill River Development Corporation
PROJECT NAME Schuylkill River Trail - 58th to 61st
PROJECT NUMBER SRDC1601
PROJECT LOCATION Philadelphia, PA

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION (Depth)	DESCRIPTION	DESCRIPTION (Elev.)	REMARKS
35					4		Yellow to brown to black Micaceous F SAND, trace Silt (decomposed MICA SCHIST) *(continued)*		
	S-11	1	50/2"			38.2		-36.0	Spoon refusal at 38.2 ft
							Boring terminated at 38.2 feet.		

NOTES:
--- = Not Measured

TEST BORING LOG

BORING B-6
PAGE 1 OF 1

Pennoni

CLIENT Schuylkill River Development Corporation
PROJECT NAME Schuylkill River Trail - 58th to 61st
PROJECT NUMBER SRDC1601
PROJECT LOCATION Philadelphia, PA
DATE STARTED 5/11/17 **COMPLETED** 5/11/17
GROUND ELEVATION 3.3
DRILLING CONTRACTOR CGC Geoservices, LLC
WATER ENCOUNTERED:
DRILLING METHOD Casing with Roller Bit
DURING DRILLING 6.00 / Elev -2.70
DRILLER / HELPER D. Bolze/C. Kleine
AT END OF DRILLING 6.00 / Elev -2.70
LOGGED BY C. Bugher **CHECKED BY** D. Marano
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	REMARKS
0–2	S-1	13	3-7-5-50/4"	Spoon bouncing
2–4	S-2	13	13-3-2-2	Damp
4–6	S-3A S-3B	12	4-3-2-5	Petroleum odor and sheen
6–8	S-4	6	1-2-1-1	Wet
8–10	S-5	24	1-1-1-1	
13–15	S-6	5	1-2-3-4	Wet
18–20	S-7	11	8-17-21-29	Wet
23–25	S-8	20	8-20-30-33	Auger refusal at 25 ft

STRATA	Depth	DESCRIPTION	Elev.
T	0.3	3" TOPSOIL	3.0
F	2.0	FILL: Black to brown F/M SAND, some Silt, trace to little C Sand to F/C Gravel, trace Roots, trace Mica, trace Brick Fragments, (1" F/C GRAVEL at 2')	1.3
F	4.0	FILL: Brown to black SILT, some F Sand, trace Mica	-0.7
F	5.0	FILL: Black to brown F/M/C SAND, some Silt, little F/C Gravel	-1.7
F	6.0	FILL: Gray decomposed MICA SCHIST	-2.7
1	10.0	Light gray F/M SAND, some Silt (Trace round nodules of silty clay)	-6.7
2	18.0	Dark brown SILT, trace F Gravel, trace F/M/C Sand	-14.7
3	23.0	Red to brown F/C GRAVEL, little C Sand, trace Silt	-19.7
3	23.7	Brown F/M SAND, little Silt, trace Mica	-20.4
3	24.0	Brown Silty CLAY, trace Mica, trace F/M/C Sand	-20.7
3	25.0	Brown F/C GRAVEL, some F/M/C Sand	-21.7

Boring terminated at 25.0 feet.

NOTES:
Auger/bit refusal at 25'. Casing damaged - worn into tapered end. Offset ~10' W and continued with hollow stem auger. See boring "B-6A."
--- = Not Measured

TEST BORING LOG

BORING B-6a

CLIENT Schuylkill River Development Corporation
PROJECT NAME Schuylkill River Trail - 58th to 61st
PROJECT NUMBER SRDC1601
PROJECT LOCATION Philadelphia, PA
DATE STARTED 5/11/17 **COMPLETED** 5/11/17
GROUND ELEVATION 3
DRILLING CONTRACTOR CGC Geoservices, LLC
WATER ENCOUNTERED:
DRILLING METHOD Hollow Stem Auger
DURING DRILLING 6.00 / Elev -3.00
DRILLER / HELPER D. Bolze/C. Kleine
AT END OF DRILLING 4.00 / Elev -1.00 ft after augers pulled
LOGGED BY C. Bugher **CHECKED BY** D. Marano
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0–28							Auger to 28'		Hard/slow drilling through apparent timber 7.5'-8.3'
						28.0		-25.0	
28.8–29.0	S-1	20	13-17-26-45			28.8	Brown Micaceous M/C/F SAND, little Silt (decomposed MICA SCHIST)	-25.8	
						29.0	C SAND to F GRAVEL seam (decomposed MICA SCHIST)	-26.0	
					4		Red to brown Micaceous F SAND, some Silt, trace F/C Gravel (decomposed MICA SCHIST)		
33.0	S-2	1	50/2"			33.0		-30.0	

NOTES:
Offet ~10' W of boring "B-6."
--- = Not Measured

(Continued Next Page)

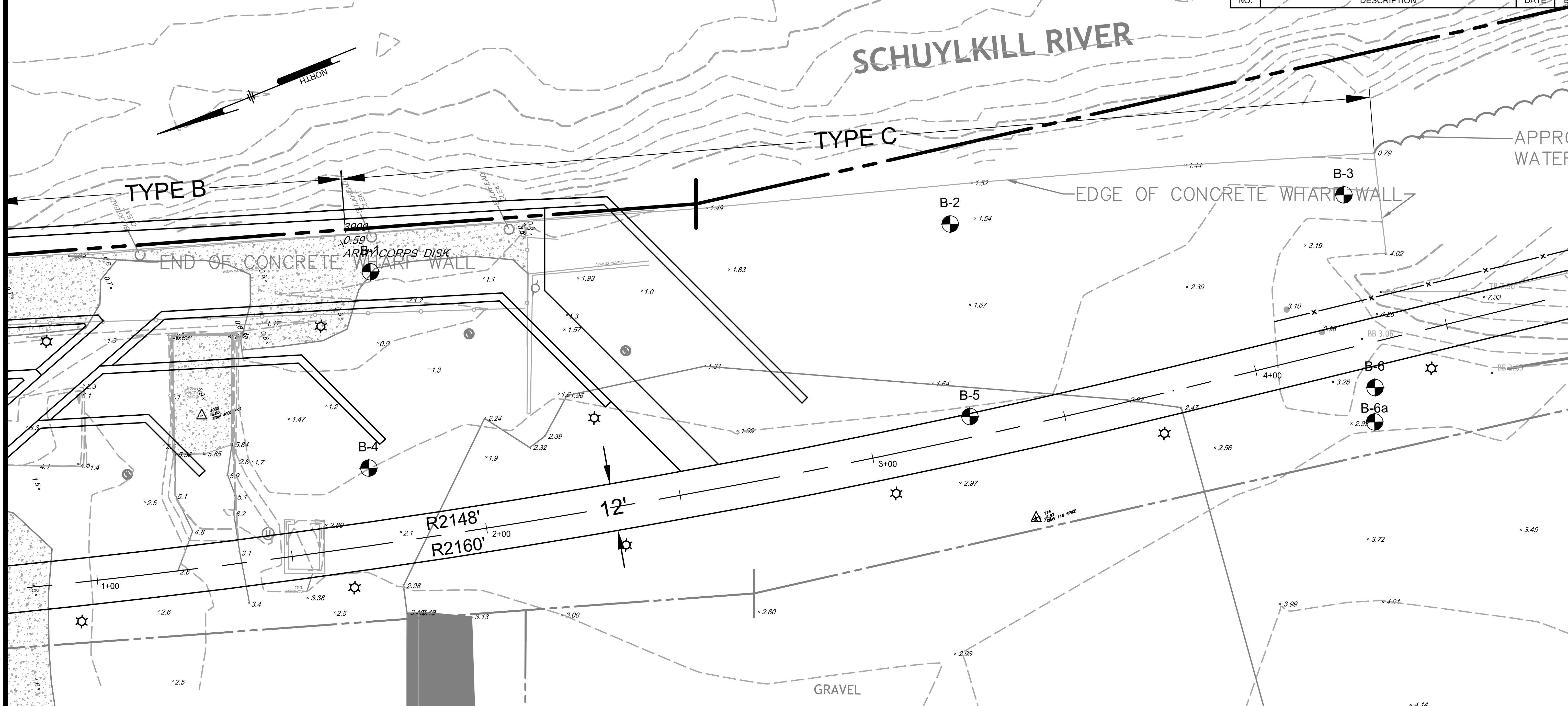
TEST BORING LOG

CLIENT Schuylkill River Development Corporation
PROJECT NAME Schuylkill River Trail - 58th to 61st
PROJECT NUMBER SRDC1601
PROJECT LOCATION Philadelphia, PA

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION (Depth / Elev.)	REMARKS
35					4	Black and white Micaceous F SAND, some Silt (decomposed MICA SCHIST) *(continued)*	
	S-3	1	50/1"			38.1 / -35.1	Spoon refusal at 38.1 ft
						Boring terminated at 38.1 feet.	

NOTES:
Offet ~10' W of boring "B-6."
--- = Not Measured

REVISIONS			
NO.	DESCRIPTION	DATE	BY



0 25' 50'

LEGEND

B-1 INDICATES APPROXIMATE TEST BORING LOCATION AND IDENTIFYING NUMBER.

NOTES

WATER LEVELS, WHERE SHOWN, ARE THOSE OBSERVED AT THE TIME NOTED AND MAY NOT REFLECT DAILY OR SEASONAL VARIATIONS IN THE GROUND WATER LEVEL.

THE SUBSURFACE CONDITIONS REVEALED BY THIS STUDY REPRESENT CURRENT CONDITIONS AT THE SPECIFIED TEST LOCATIONS ONLY AND MAY NOT BE INDICATIVE OF CONDITIONS AT OTHER LOCATIONS.

Pennoni

PENNONI ASSOCIATES INC.
2041 Avenue C, Suite 100
Bethlehem, PA 18017
T 610.231.0600 F 610.231.2033

SCHUYLKILL RIVER TRAIL
58TH TO 61ST STREET
PHILADELPHIA, PENNSYLVANIA

BORING LOCATION PLAN

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

PROJECT	SRDC 1601
DATE	2017-06-27
DRAWING SCALE	1"=25'
DRAWN BY	DAC
APPROVED BY	DPM
DRAWING NO.	LP-1
SHEET 1 OF 1	

P:\PROJECTS\SRDC\SRDC1601 - SCHUYLKILL RIVER TRAIL 58TH TO 61ST\DESIGN\B\CS-1001.DWG
PLOTTED: 6/30/2017 3:16:58 PM, BY: DAVID A. COPELAND PLOTSTYLE: PENNONI NCS.STB, PROJECT STATUS: ----

Test Pit Log Key Sheet

Notes in "Remarks" Column

Difficulty of Excavation	In-Place density /consistency of excavated soil
Difficult	Very dense/very hard
Moderate	Dense/hard
Easy	Medium dense/firm
Very easy	Loose to medium dense/soft to firm

Stability of Sidewalls during Test Pit Excavation

"Stable"	No cave –in, spalling or tension cracks during or after excavation
"Caving"	Portions of the sidewall(s) separate and fall into the test pit
"Voids"	Openings in the test pit walls where bricks, concrete pieces, boulders are encountered
"Jagged"	While backhoe is unearthing rock fragments, the sidewall becomes irregular. Potential for cave-ins

S- JAR SAMPLE
B- BAG SAMPLE
U- UNDISTURBED SAMPLE
P- PENETROMETER TEST (TSF)
▼- GROUNDWATER

Remarks: Special conditions or test data as noted during excavation

* 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		-	9"
Cobbles		9"	3"
Gravel	Coarse	3"	¾"
	Fine	¾"	#4
Sand	Coarse	#4	#10
	Medium	#10	#40
	Fine	#40	#200
Silt/Clay		#200	-

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

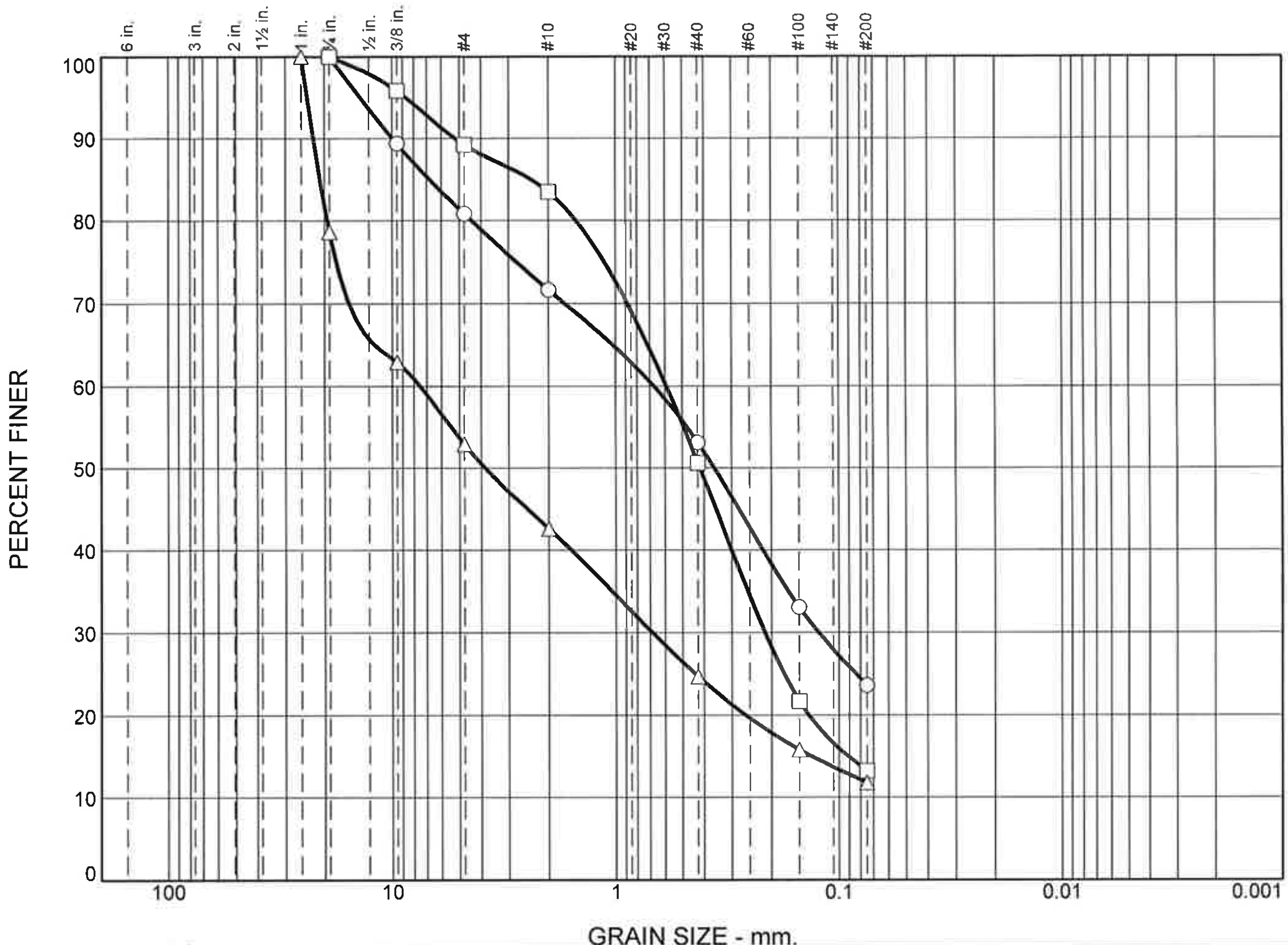
APPENDIX B- Laboratory Data

SUMMARY OF LABORATORY DATA

BORING NUMBER	SAMPLE NUMBER	DEPTH (ft)	SOIL GROUP SYMBOL	GRAIN SIZE DISTRIBUTION			PLASTICITY				MOISTURE CONTENT w %	VOLUMETRIC				COMPACTION DATA			NORMAL STRESS (PSI)		EFFECTIVE INTERNAL ANGLE OF FRICTION (DEGREES)	SHEAR STRENGTH		
				GRAVEL %	SAND %	SILT/CLAY %	LIQUID LIMIT w_l	PLASTIC LIMIT wp	PLASTICITY INDEX I_P	LIQUIDITY INDEX I_L		SPECIFIC GRAVITY (G) (*) ASSUMED	DRY UNIT WEIGHT (pcf)	VOID RATIO (e)	DEGREE OF SATURATION %	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT %	STANDARD/MODIFIED				UNCONFINED COMPRESSIVE STRENGTH (tsf)	COHESION (tsf)	AXIAL STRAIN (%)
B-1	S-1	20-24							NP		32.9													
B-3	S-4	6-8	SM	19	57	24			NP		17.2													
	S-7	18-20									44.1	2.70 *	78.1	1.15	100							0.20	0.10	9.2
	ST-1	20-22	CL-ML	16	26	58	24	18	6	-0.4	15.5		115.2	0.44	100				7.1		31.5	0.36	0.10	6.3
											17.0		110.5	0.50	100				27.9		31.5	0.36	0.10	10.9
B-4	S-9	28-30		11	76	13					12.7													
B-5	S-7	18-20	GP-GM	47	41	12			NP		9.0													

PENNONI ASSOCIATES INC.	DRAWN BY: RJE	DATE: 6/12/2017	PROJECT: **SCHUYKILL RIVER TRAIL - 58TH TO 61ST**	JOB No.: **SRDC 1601**
	CHECKED BY: DAC	DATE: 6/22/2017	LOCATION:	TABLE No.: **L-1**

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	19.2	9.2	18.5	29.5	23.6	
□	0.0	0.0	10.8	5.7	32.9	37.4	13.2	
△	0.0	21.4	25.7	10.3	17.9	12.9	11.8	

SOIL DATA

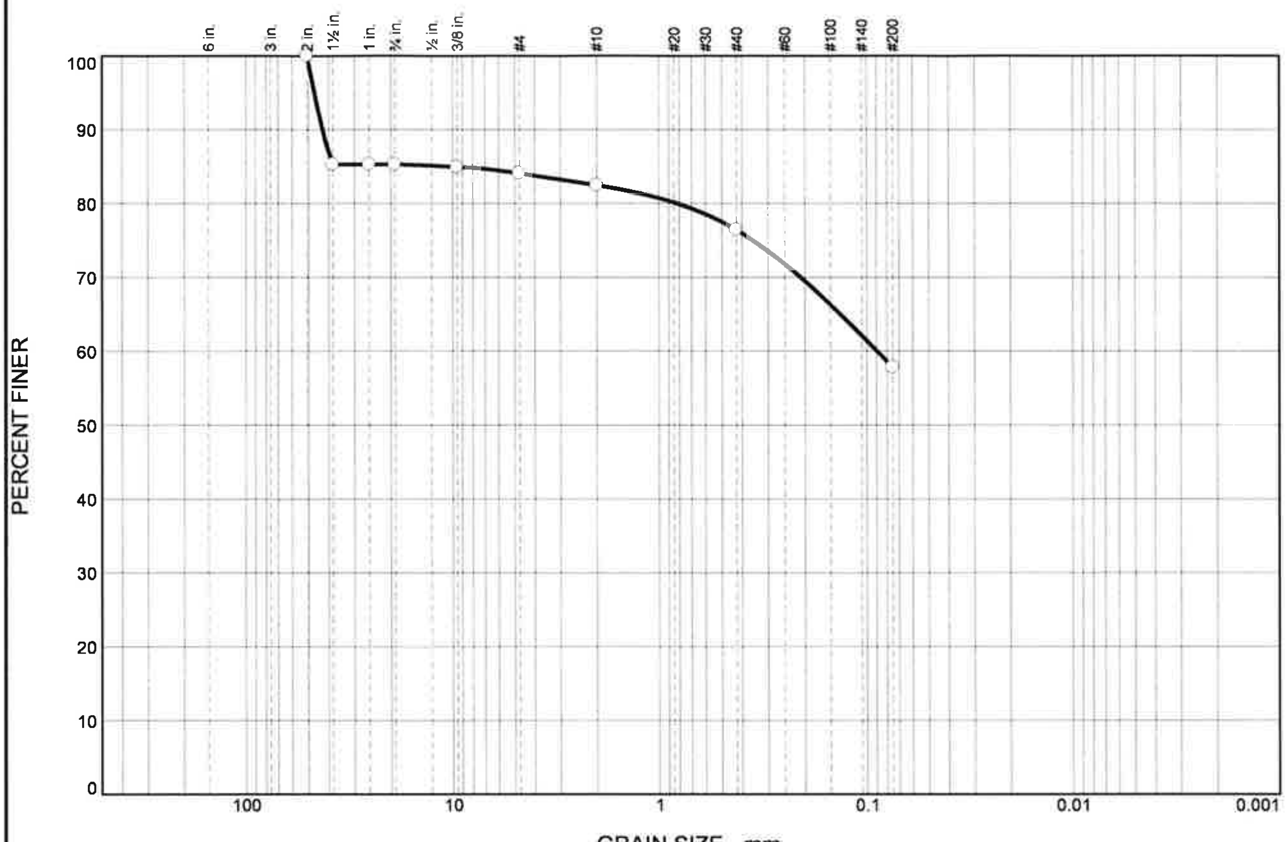
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-3	S-4	6-8	F/M/C SAND, SOME SILT, LITTLE F GRAVEL	SM
□	B-4	S-9	28-30	F/M/C SAND, LITTLE SILT, LITTLE F GRAVEL	
△	B-5	S-7	20-21	F/C GRAVEL AND M/F/C SAND, LITTLE SILT	GP-GM

PENNONI ASSOCIATES INC.

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

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

Particle Size Distribution Report



% +3"	% Gravel Coarse	% Gravel Fine	% Sand Coarse	% Sand Medium	% Sand Fine	% Fines Silt	% Fines Clay
0.0	14.7	1.2	1.6	6.1	18.6	57.8	

LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
24	18	10.4432	0.0894						

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SANDY SILTY CLAY WITH GRAVEL	06/02/17	CL-ML	15.5

Project No. 280372 **Client:** PENNONI ASSOCIATES, INC.

Project: SCHUYLKILL RIVER TRAIL

S. 56TH ST. TO 61ST ST.

○ **Source of Sample:** B-3 **Depth:** 20.0-22.0 FT **Sample Number:** U-1

Remarks:

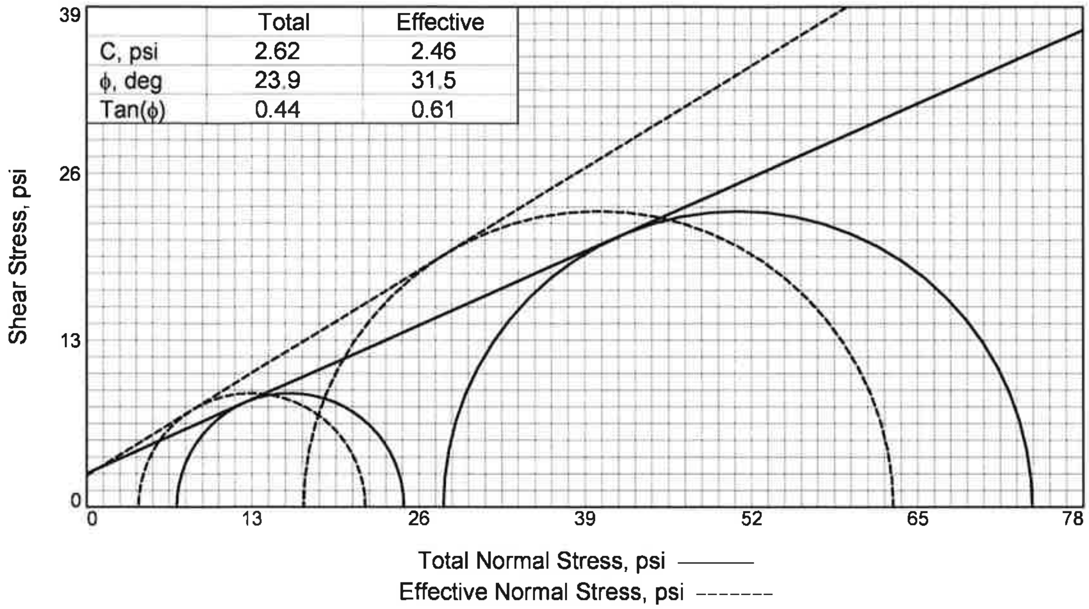
○SAMPLE DESCRIPTION BASED ON USCS

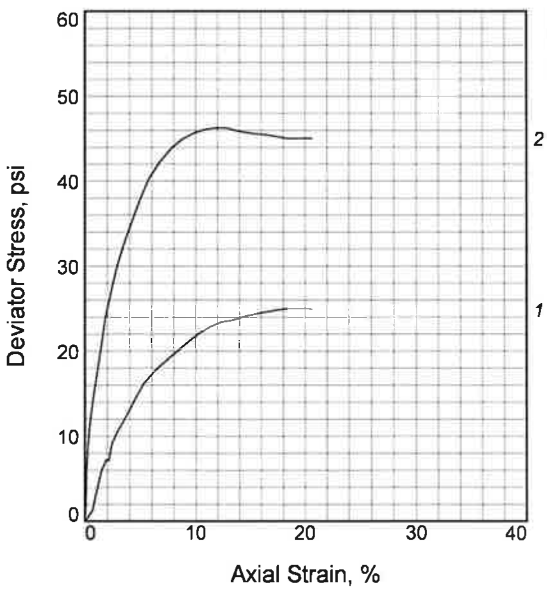
TRC Engineers, Inc.

Mt. Laurel, NJ

Figure 2

Tested By: TBT 06/02/17 **Checked By:** CJH 06/02/17





Sample No.		1	2
Initial	Water Content, %	16.8	21.0
	Dry Density, pcf	115.2	110.5
	Saturation, %	101.9	112.0
	Void Ratio	0.4362	0.4967
	Diameter, in.	2.85	2.84
	Height, in.	5.50	5.42
At Test	Water Content, %	15.5	17.0
	Dry Density, pcf	116.4	111.7
	Saturation, %	97.8	93.4
	Void Ratio	0.4210	0.4815
	Diameter, in.	2.84	2.87
	Height, in.	5.48	5.28
Strain rate, in./min.		0.08	0.08
Eff. Cell Pressure, psi		7.1	27.9
Fail. Stress, psi		17.7	46.1
Excess Pore Pr., psi		3.0	10.9
Strain, %		6.3	10.9
Ult. Stress, psi			
Excess Pore Pr., psi			
Strain, %			
$\bar{\sigma}_1$ Failure, psi		21.8	63.1
$\bar{\sigma}_3$ Failure, psi		4.1	17.0

Type of Test:
CU with Pore Pressures
Sample Type: SHELBY TUBE
Description: BROWN SANDY SILTY CLAY WITH GRAVEL
LL= 24 **PL=** 18 **PI=** 6
Assumed Specific Gravity= 2.65
Remarks: SAMPLE DESCRIPTION BASED ON USCS

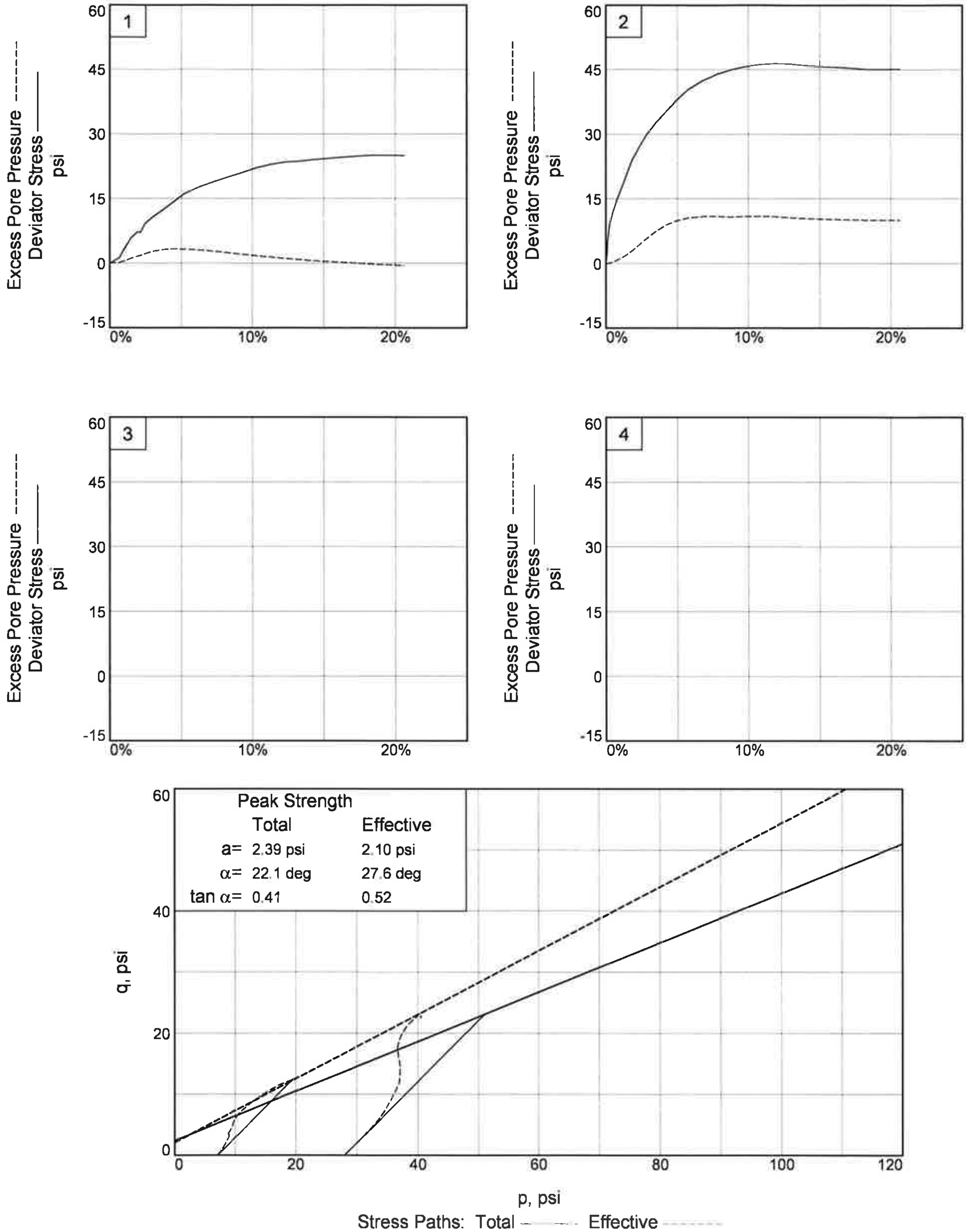
Figure 3

Client: PENNONI ASSOCIATES, INC.

Project: SCHUYLKILL RIVER TRAIL
S. 56TH ST. TO 61ST ST.
Source of Sample: B-3 **Depth:** 20.0-22.0 FT
Sample Number: U-1
Proj. No.: 280372 **Date Sampled:** 05/10/17

TRIAXIAL SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

Tested By: TBT 05/29/17 **Checked By:** CJH 06/02/17



Client: PENNONI ASSOCIATES, INC.

Project: SCHUYLKILL RIVER TRAIL

Source of Sample: B-3 **Depth:** 20.0-22.0 FT **Sample Number:** U-1

Project No.: 280372

Figure 4

TRC Engineers, Inc.

Tested By: TBT 05/29/17 **Checked By:** CJH 06/02/17

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
υ	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
γ	unit weight
γ_d	dry unit weight
γ_b	submerged unit weight
ε	unit linear strain
ε_f	unit linear strain at failure
σ	normal stress
σ_1	major principal stress
σ_3	minor principal stress
τ	shear stress
ϕ	angle of internal friction
k_a	coefficient of active pressure
k_p	coefficient of passive pressure
δ	friction angle
$\tan\delta$	friction factor

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

Pennoni

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

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