

June 25, 2019

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Attention: Mr. J. Douglas Wenger, RLA, LEED AP, DBIA

Re: Geotechnical Engineering Study  
**PSU Harrisburg Campus**  
**Proposed Soccer Competition and Practice Field Improvement Project**  
Harrisburg, Pennsylvania  
HCEA Project No. R19044

Mr. Wenger:

Hillis-Carnes Engineering Associates, Inc. (HCEA) is pleased to submit this report concerning the subsurface exploration and subsequent geotechnical evaluations for the proposed Soccer Competition and Practice Field Improvement Project on the PSU Harrisburg Campus in Middletown, Pennsylvania. The subsurface exploration program was performed in the area of the proposed expansion of existing SWM Basin 1A and at four (4) proposed light pole locations surrounding the proposed soccer facility. This report summarizes the subsurface soil conditions at the site and provides recommendations for the design and construction of the proposed foundations associated with the proposed construction. These services were provided in general accordance with our proposal dated May 24, 2019.

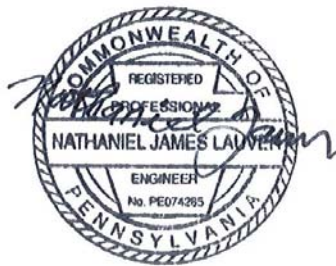
We wish to advise you that the boring samples will be stored at our Harrisburg, Pennsylvania office for a period of 30 days from the date of this letter. Should you wish the samples to be stored for a longer period of time or to be delivered to you or another party, please advise us in writing prior to the end of the 30-day period. Otherwise, the samples will be discarded at the end of the 30-day storage period.

HCEA appreciates having had the opportunity to provide the geotechnical consultation for this project, and we will remain available for further consultation during the various design stages. Should you have any questions concerning the contents of this report, or require additional consultation, design, inspection, or testing services, please contact our Office.

Very truly yours,  
**HILLIS-CARNES ENGINEERING ASSOCIATES, INC.**



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# **HILLIS-CARNES**

## **ENGINEERING ASSOCIATES, INC.**

Geotechnical Engineering Study  
**PSU Harrisburg Campus**  
**Proposed Soccer Competition and Practice Field Improvement Project**  
Harrisburg, Pennsylvania  
HCEA Project No. R19044

Prepared For:

Pennsylvania State University  
The 328 Building, Suite 325  
University Park, PA 16802

Prepared By:

Hillis-Carnes Engineering Associates, Inc.  
3110 Pike Street  
Harrisburg, PA 17111

Date:

June 25, 2019

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## 1.0 PURPOSE AND SCOPE

The purpose of this study was to determine the general subsurface conditions at the boring locations and to evaluate those conditions with respect to the proposed construction.

The evaluations and recommendations presented in this study were developed from a review of the project information provided and an interpretation of the general subsurface conditions at the site based on the results of the site exploration. An evaluation of the site with respect to potential construction problems and recommendations dealing with the earthwork and inspection during construction is also included. The inspection is considered necessary to confirm that the subsurface conditions are consistent with those identified during the geotechnical study and to document that the soils-related construction activities are performed properly.

## 2.0 PROJECT CHARACTERISTICS

The project site is located on the Pennsylvania State University Harrisburg Campus in Middletown, Pennsylvania. The proposed project is located to the west of College Avenue just north of the College Avenue/Olmstead Drive intersection and south of the existing Educational Activities Building South as shown on Figure 1 - Project Location Map and Figure 2 – Aerial Location Map in the Appendix.

Based on available site plans, it is understood that the proposed project will include expansion of the existing Stormwater Basin (SWM) 1A to the north, construction of a lighted soccer competition and practice field, and construction of a future parking lot between the proposed soccer field and the existing Educational Activities Building South. As requested, an exploration program was performed in the area of the proposed expansion of existing SWM Basin 1A and at four (4) proposed light pole locations surrounding the proposed soccer facility as shown on Figure 3 – Boring Location Plan.

Available plans indicate a bottom of pond elevation of El. 330 feet for the expansion of SWM Basin 1A. Based on existing ground elevations at the boring locations, cut ranging from 20 to 25 feet will be required to establish the bottom of the facility. It is anticipated that minimal cuts and fills (on the order of 3 feet or less) will be required to establish the proposed finished grade elevations at the proposed light pole bases adjacent to the soccer facility.

Should any of the project characteristics, construction type, or structural loading conditions differ from those outlined above, then this office should be contacted so revisions of these recommendations can be made.

## 3.0 FIELD EXPLORATION AND LABORATORY TESTING

### 3.1 Standard Penetration Test Borings

To determine the general subsurface conditions at the site, a subsurface exploration program was performed consisting of a total of seven (7) Standard Penetration Test (SPT) soil borings designated as Boring B-1 through Boring B-7. Borings B-1 through B-3 were drilled in the area of the proposed expansion of SWM Basin 1A to evaluate the subsurface conditions in regard to the excavation required to establish the bottom of the expanded facility. Borings B-4 through B-7 were drilled at the proposed location of four (4) of four light pole bases surrounding the proposed soccer facility. Boring B-4 was drilled at the base of proposed Light Pole S1, while Boring B-5 was drilled at the base of

proposed Light Pole S2. Similarly, Boring B-6 was drilled at the base of proposed Light Pole S3, while Boring B-7 was drilled at the base of proposed Light Pole S4. Boring locations are shown on Figure 3 – Boring Location Plan included in the Appendix.

The test borings were extended to depths ranging from 13.0 feet to 25.0 feet. All borings were advanced using hollow stem augers to their desired depths or to the apparent top of bedrock which is indicated at depths at which auger refusal was obtained. Ten feet of rock coring was conducted with Boring B-3 in order to advance the boring to the planned bottom of basin elevation. Depths to the top of bedrock ranged from 13.0 in Boring B-6 feet to 21.5 feet in Boring B-2 below existing grade as indicated below. A brief overall summary of the boring results is presented in tabular form below.

Summary of Boring Data				
Boring Designation	Drilled Depth (Feet)	Depth to Bedrock (Feet)	Groundwater Levels	
			Depth Upon Completion (Feet)	Depth After 24 Hours (Feet)
SWM Basin 1A Expansion – Proposed Bottom of Basin El. 330 feet				
B-1	20.0 (El. 328.7)	Auger Refusal Obtained at 20.0 feet (El. 328.7)	Dry	Borehole Backfilled Upon Completion
B-2	21.5 (El. 329.6)	Auger Refusal Obtained at 21.5 feet (El. 329.6)	Dry	Borehole Backfilled Upon Completion
B-3	25.0 (El. 328.7)	Bedrock Cored at 15.0 feet (El. 338.7)	Dry	Borehole Backfilled Upon Completion
Proposed Light Pole Borings – Light Poles S1, S2, S3, and S4				
B-4	19.5 (El. 339.4)	Spoon Refusal Encountered at 19.5 feet (El. 339.4)	Dry	Borehole Backfilled Upon Completion
B-5	20.0 (El. 340.0)	Bedrock Not Encountered	17.5	Borehole Backfilled Upon Completion
B-6	13.0 (El. 346.7)	Auger Refusal Obtained at 13.0 feet (El. 346.7)	Dry	Borehole Backfilled Upon Completion
B-7	18.0 (El. 338.4)	Auger Refusal Obtained at 18.0 feet (El. 338.4)	Dry	Borehole Backfilled Upon Completion

Negley's Drilling performed the test borings on June 4, 2019, with an Acker XLS track-mounted drill rig equipped with an automatic hammer. HCEA provided full-time boring inspection during drilling operations. The borings were advanced with hollow-stem augers and the subsurface soils were sampled continuously to a depth of 10 feet and at 5-foot sample intervals thereafter until the depths at which the boreholes encountered bedrock or were terminated. Samples were taken by driving a 1-3/8 inch I.D. (2-inch O.D.) split-spoon sampler in accordance with ASTM D1586 specifications. The sampler was first seated 6 inches to penetrate any loose cuttings and then was driven an additional foot with blows of a 140 pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the middle 12 inches of the 2-foot spoon is designated as the "Penetration Resistance" or "N" value. The penetration resistance is an index to the soil strength and compression characteristics.

Bedrock was obtained by diamond core drilling in general accordance with the procedures in ASTM D2113 "Standard Method for Diamond Core Drilling for Site Investigation. In-situ quality of bedrock was determined by physical observation of the core retrieved (hardness, degree of weathering, fracture spacing, etc.) as well as calculation of the Rock Quality Designation (RQD) of the recovered core. RQD is a qualitative index used to identify the relative quality of the rock mass. It is a

percentage calculated by summing the lengths of intact pieces of rock core which exceed 4 inches in length and dividing that length by the total length of the core run.

At completion of the drilling, the boreholes were backfilled with the auger cuttings. Upon backfilling of the boreholes, no additional compaction effort or site restoration was performed. Additional settlement and/or softening of the soil replaced in the boreholes may occur, resulting in a depression or hole in the ground surface. Consequently, future maintenance or restoration of the site may be required by others.

During drilling operations, HCEA performed boring inspection and prepared field logs for each of the borings. Portions of each SPT soil sample were placed in air-tight glass jars and rock cores were placed in wooden core storage boxes. After completion of the drilling, the samples were transported to HCEA's laboratory for future examination. In the laboratory, the samples were visually reviewed by the Geotechnical Engineer to review the inspector's field classifications. The samples were classified in accordance with the Unified Soil Classification System (USCS) and the field classifications were revised where necessary. The USCS classifications appear on the typed Records of Exploration.

The Records of Exploration, included in the Appendix, show subsurface sample depths and recoveries, SPT results, RQD values, and water level measurement data. The logs also show the approximate thickness, location, and visual classification of each material encountered. The stratigraphic lines separating each material type represent the approximate location of the boundary between them. The transition between materials may be far more or less gradual than indicated on the logs.

### 3.2 Laboratory Testing

Laboratory testing was performed in HCEA's laboratory on representative samples obtained from the field exploration for basic engineering properties. Laboratory testing consisted of Particle Size Analysis (ASTM D442), Atterberg Limits (ASTM D4318), and Natural Moisture Content (ASTM D2216). The Unified Soil Classification System (USCS) was used to assign group symbols and group names to the soils tested. The results of the laboratory testing are summarized below. The Particle Size Distribution Reports from the laboratory testing are also included in the Appendix of this study.

Summary of Laboratory Testing Results									
Boring and Sample Numbers	Depth (Feet)	USCS Classification	USCS Symbols <sup>1</sup>	As-Received Moisture Content (%)	Atterberg Limits		Grain Size		
					Liquid Limit	Plasticity Index	%Gravel	%Sand	%Fines
B-1 S-5	8.0 – 10.0	Silty SAND	sm	13.6	--	--	--	--	--
B-1 S-6	13.0 – 14.5	Silty SAND	sm	13.1	--	--	--	--	--
B-2 S-5	8.0 – 10.0	Clayey SAND with Gravel	sc	18.7	--	--	--	--	--
B-2 S-6	13.0 – 13.9	Clayey SAND with Gravel	sc	17.8	--	--	--	--	--
B-2 S-7	18.0 – 20.0	Silty SAND	sm	10.5	--	--	--	--	--
B-3 S-3	4.0 - 6.0	Silty CLAY with Sand	cl-ml	10.7	--	--	--	--	--
B-3 S-6	13.0 – 14.3	Silty SAND	sm	10.3	--	--	--	--	--
B-4 S-4	6.0 – 8.0	Silty SAND	sm	20.0	--	--	--	--	--
B-4 S-6	13.0 – 15.0	Silty SAND	sm	15.3	--	--	--	--	--
B-5 S-6	13.0 – 15.0	Silty GRAVEL with Sand	GM <sup>1</sup>	10.1	Non-plastic		44.9	41.5	13.6
B-5 S-7	18.0 – 20.0	Silty SAND	sm	15.3	--	--	--	--	--
B-6 S-4	6.0 – 8.0	Well-graded GRAVEL with Sand	gw	10.4	--	--	--	--	--
B-6 S-5	8.0 – 10.0	Well-graded GRAVEL with Sand	gw	8.5	--	--	--	--	--
B-7 S-5	8.0 – 10.0	Silty SAND	SM <sup>1</sup>	15.3	Non-plastic		0.2	52.4	47.4
B-7 S-6	13.0 – 15.0	Silty SAND	sm	13.3	--	--	--	--	--

NOTE <sup>1</sup>: Lower case USCS symbol denotes that the sample was visually classified while an upper case classification denotes that the sample was laboratory classified.

#### 4.0 SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered at the site are shown on the Records of Soil Exploration and included in the Appendix. A summary of the test boring results and brief description of the subsurface conditions and pertinent engineering characteristics of the soils are given below.

Strata divisions shown on the Records of Soil Exploration have been estimated based on visual examinations of the recovered boring samples. In the field, strata changes could occur gradually and/or at slightly different levels than indicated. Groundwater conditions indicated on the Records of Soil Exploration are those observed during the period of the subsurface exploration. Fluctuations in groundwater levels could occur seasonally and might also be influenced by changes in grading, runoff and infiltration rates, and other influencing factors.



Generalized subsurface conditions based on the results of the test borings are discussed below.

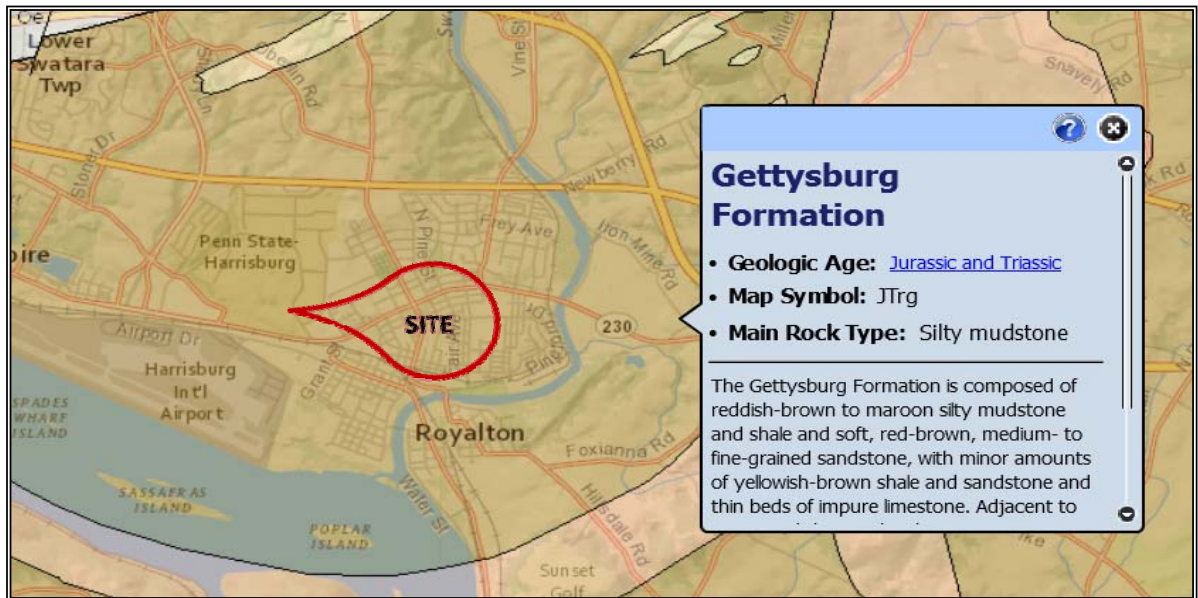
#### 4.1 General Site Geology

Available geologic maps indicate that the project site is located within the Jurassic and Triassic-aged Gettysburg Formation (JTrg). The bedrock of the Gettysburg Formation is described as reddish-brown to maroon silty mudstone and shale and soft, reddish-brown medium to fine-grained sandstone. Minor amounts of yellowish-brown shale and sandstone and thin beds of impure limestone are common.

The rock is generally described as well bedded and most bedding is described as thin to flaggy. Most joints have a blocky pattern. Fractures are moderately developed, moderately abundant with an uneven regularity. The fractures are generally closely spaced, steeply dipping, and open and often filled with quartz and calcite. The rock is generally moderately resistant to weathering and moderately weathered to a moderate depth. Weathered fragments range in size from elongated and pencil-like to medium sized, irregularly shaped blocks. Smaller fragments result from rapid hydration of minerals in exposed outcrops or rock cuts.

Excavation is moderately easy in weathered zones but may be difficult in unweathered zone of less weathered rock. Foundation stability is good but foundations should be excavated to sound material.

**Figure 1 - "Pennsylvania Geologic Data Exploration (PaGEODE)" Web Mapping – Bedrock Geology**



#### 4.2 Topsoil

Topsoil was encountered at all the boring locations. The topsoil generally consisted of dark brown organic silt and ranged from approximately 7 to 9 inches in thickness.



#### 4.3 Apparent Fill

Apparent fill material was encountered in Borings B-3, B-4, and B-5 to depths ranging from 4.0 to 8.0 feet in depth below the existing ground surface. The apparent fill material consisted of similar composition to that of the natural soils but was encountered above a strata containing trace organics indicating that its origin was not native and may have been placed during past reworking of the site. No man-made debris such as brick, concrete, cinders, etc. was observed. The apparent fill material was typically described as light brown, brown, and black in color and generally classified as non-plastic, well-graded GRAVEL with sand based on gradation. "N" values from the Standard Penetration Test (SPT) borings typically indicated relative densities of medium dense.

Since the size of the samples obtained is relatively small in comparison to the areal extent of the site and since the fill materials could be of similar composition to the natural soils encountered at the site, it is often difficult to determine the presence and composition of fill materials from the SPT samples. It should be anticipated that man-placed fill materials may be encountered at other locations and to different depths across the site due to the previous construction that has occurred on and around the project site.

#### 4.4 Natural Soils

Residual soils, derived from the weathering of the parent bedrock, were encountered in the borings below the apparent fill material noted in Borings B-3, B-4, and B-4 and below the topsoil in all other borings. The residual soils continued to the depth at which auger refusal was obtained or bedrock was cored. In general, the residual soils decomposed to a reddish-brown to dark maroon silty SAND mimicking the grain-size and color of the parent bedrock material encountered and coring in Boring B-3. Based on SPT N-values, the residual soils were generally medium dense near the top of the stratum and became more dense and more competent with depth, gradually transitioning to sandstone bedrock. As common with residual soils, more rock fabric was visible with depth and spoon refusals were obtained as the degree of weathering of the parent bedrock decreased with depth.

#### 4.5 Bedrock

Fine-grained sandstone bedrock was encountered cored in Boring B-3 at a depth of 15.0 feet below the existing ground surface. Coring operations continued within this boring until a depth of 25.0 feet at which depth the boring was terminated. All other borings encountered completely weathered sandstone at various depths above the depth at which auger refusal was obtained but due to the weathered nature of the material augers could be advanced and spoon samples could be obtained. Auger refusal, indicating the apparent top of bedrock, was obtained in these borings at depths ranging from 13.0 feet to 21.5 feet below existing site grades.

The sandstone bedrock encountered and cored was generally described as dark maroon, soft to medium hard, completely to highly weathered, thinly bedded, and very broken to very closely fractured. Fracturing and bedding planes were observed to be at shallow dipping. The rock core conditions obtained are summarized as follows:

Test Boring No.	Depth to Bedrock (feet)	Rock Quality Designation (RQD)	Recovery (%)
B-3	15.0	Rock Core 15.0 to 20.0 feet (RQD = 0%) Rock Core 20.0 to 25.0 feet (RQD = 0%)	50% 40%

The rock core samples obtained were observed to have no RQD and low core recoveries indicative of the highly weathered nature of the rock cored. Consequently, rock quality encountered at the site for the depths cored is characterized as very poor as shown on the table below.

Rock Quality Designation (RQD)	Description
0 – 25%	Very Poor
26 – 50%	Poor
51 – 75%	Fair
76 – 90%	Good
91 – 100%	Excellent

#### 4.6 Groundwater

With the exception of Boring B-5, groundwater level readings performed after completion indicate that the boreholes were “dry”. A groundwater depth of 17.5 feet was recorded with Boring B-5 immediately after completion of the borehole. Based on the groundwater depth measured in Boring B-5 and the absence of groundwater in the other borings, it is believed that the groundwater table is relatively deep in the area of the project and therefore should be below any construction related activities.

A more accurate determination of the hydrostatic water table would require the installation of perforated pipes or piezometers which could be monitored over an extended period of time. The actual level of the hydrostatic water table and the amount and level of perched water should be anticipated to fluctuate throughout the year, depending on variations in precipitation, surface run-off, infiltration, site topography, and drainage. The Contractor should determine the actual groundwater levels at the time of construction to evaluate groundwater impact on the proposed construction procedures.

#### 5.0 CONCLUSIONS

The following conclusions have been developed on the basis of the previously described project characteristics and subsurface conditions. If there are any changes to the project characteristics or if different subsurface conditions are encountered during construction, HCEA should be consulted so that the recommendations of this report can be reviewed and revised accordingly.

##### 5.1 Expansion of SWM Basin 1A

As requested, an exploration program was performed in the area of the proposed expansion of existing SWM Basin 1A. Available plans indicate a bottom of pond elevation of El. 330 feet for the expansion of SWM Basin 1A. Based on existing ground elevations at the boring locations, cut ranging from 20 to 25 feet will be required to establish the bottom of the facility. Based on the results of the borings, it is anticipated that completely weathered, dark maroon residual soil derived from the weathering process of the

underlying sandstone bedrock will be encountered at depths in the order of 10 to 15 feet below existing grades. Due to the advanced weathered state of the underlying sandstone bedrock, spoon sampling and advancement with hollow stem augers could be performed to the bottom of the pond depths in Borings B-1 and B-2. Less weathered sandstone was encountered at a depth of 15.0 feet in Boring B-3 and auger refusal was obtained. Therefore, coring operations were performed to the proposed bottom of the pond depth. Based on conditions of the core recovered, the sandstone bedrock is completely to highly weathered, soft, and very broken and very closely fractured. Due to the highly weathered condition of the sandstone bedrock encountered, it is anticipated that excavation can be performed using mechanical means.

## 5.2 Light Pole Foundations

Exploration borings were performed at four (4) proposed light pole locations surrounding the proposed soccer facility. Based on existing ground elevations at the boring locations, it is anticipated that minimal cuts and fills (on the order of 3 feet or less) will be required to establish the proposed finished grade elevations at the proposed light pole bases adjacent to the soccer facility. It is understood that design of the light pole foundations will be performed by others. It is anticipated that drilled shafts will be used to support the loading associated with the light poles and lighting units.

It should be noted that auger refusal, indicating the apparent top of bedrock, was encountered in Boring B-6 (Light Pole S3) at a depth of 13.0 feet below the existing ground surface. In the event the required length of the drilled shaft extends below this depth, it is anticipated that the excavation will require use of a rock auger and advancement rate will be somewhat slower to excavate this section of the shaft.

## 6.0 REMARKS

This study has been prepared to aid in the evaluation of the site for the proposed construction. It is considered that adequate recommendations have been provided to serve as a basis for design and preparation of plans and specifications. Additional recommendations can be provided as needed.

These analyses and recommendations are, of necessity, based on the information made available to us at the time of the actual writing of the report and the on-site surface and subsurface conditions, that existed at the time the exploratory borings were drilled. Further assumptions have been made that the limited exploratory borings, in relation both to the areal extent of the site and to depth, are representative of conditions across the site.

If subsurface conditions are encountered which differ from those reported herein, this Office should be notified immediately so that the analyses and recommendations can be reviewed and/or revised as necessary. It is also recommended that:

1. We be given the opportunity to review any plans and specifications in order to comment on the interaction of the soil conditions as described herein and the design requirements.
2. The Geotechnical Engineer or an experienced Soils Technician be present at the site during the construction phase to document installation according to the approved plans and specifications. This is particularly important during excavation, placement, and compaction of fill materials.

Please note that successful completion of the project is dependent on your compliance with all of the recommendations provided in this report. While represented separately, the recommendations represent work that is intertwined.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties either implied or expressed. Hillis-Carnes Engineering Associates, Inc. assumes no responsibility for interpretations made by others based on work or recommendations made by HCEA.

APPENDIX

Figure 1 - Project Location Map

Figure 2 – Aerial Location Map

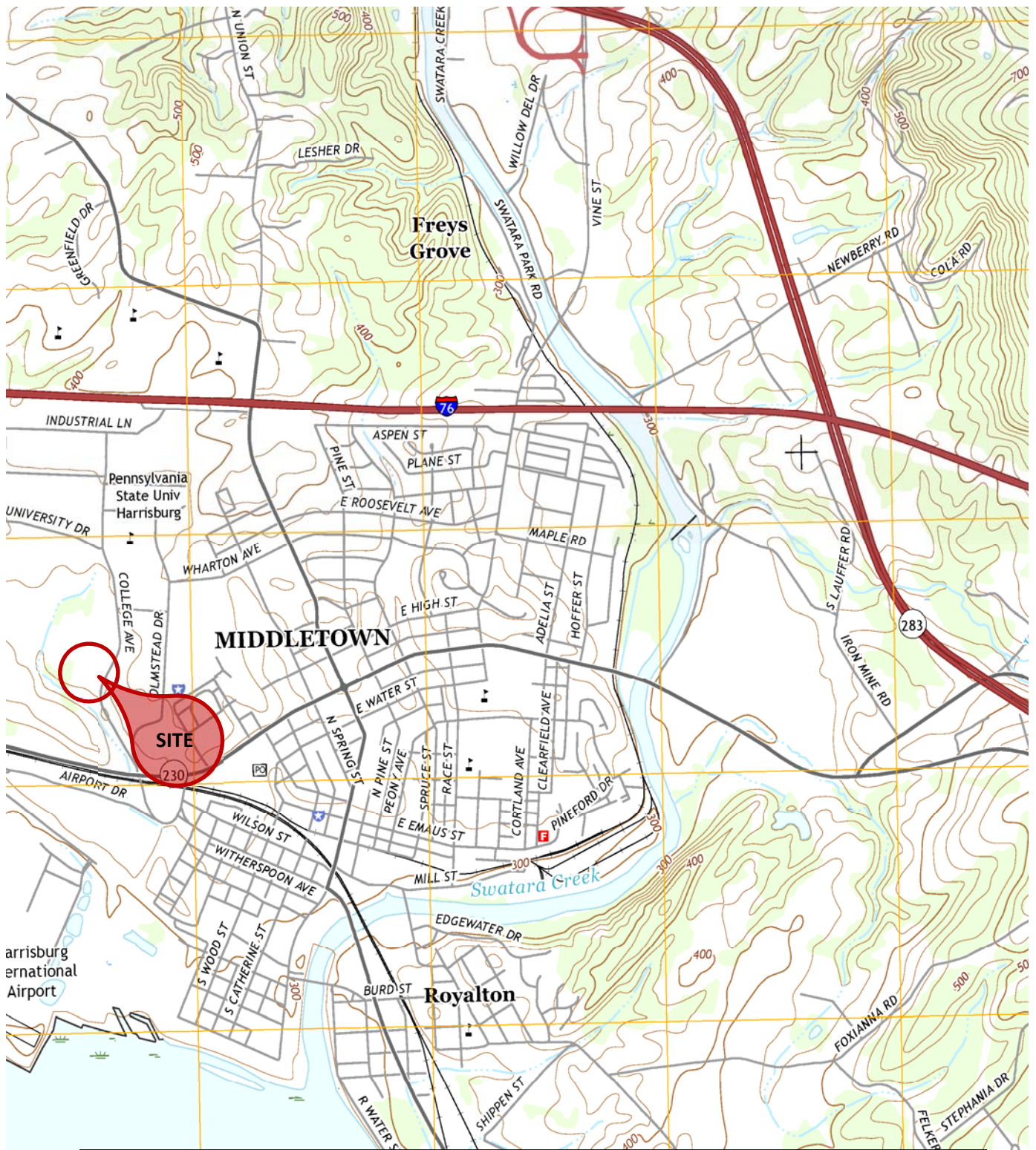
Figure 3 – Boring Location Plan

Record of Soil Exploration

Laboratory Testing Results

Field Classification Sheet





This map was adapted from the "Middletown Quadrangle, Pennsylvania, 7.5-Minute Series," as developed by the U.S. Department of the Interior, U.S. Geological Survey, dated 2016.

# **HILLIS-CARNES** **ENGINEERING ASSOCIATES**

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## **PROJECT LOCATION MAP**

### **FIGURE 1**

Penn State University - Harrisburg Campus  
Proposed Soccer Competition and Practice  
Field Improvement Project  
Middletown, PA

**JOB NO:** R19044

**DRAWN BY:** NJL

**DATE:** 6/20/19

**CHECKED BY:** JJH

**SCALE:** NTS

**PAGE:** 1





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## **AERIAL LOCATION MAP**

### **FIGURE 2**

Penn State University - Harrisburg Campus  
Proposed Soccer Competition and Practice  
Field Improvement Project  
Middletown, PA

**JOB NO:** R19044

**DRAWN BY:** NJL

**DATE:** 6/20/19

**CHECKED BY:** JJH

**SCALE:** NTS

**PAGE:** 1



This sketch was adapted from drawing titled "Boring Location Plan" prepared by K&W Engineers and dated May 31, 2019.

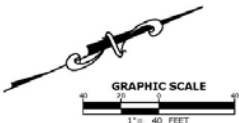
Legend

Approximate Test Boring Location

PRELIMINARY – NOT FOR CONSTRUCTION PURPOSES

LEGEND

- EXISTING AND DEMOLITION FEATURES
- EDGE OF PAVED BITUMINOUS SURFACE
  - EDGE OF GRAVEL OR CRUSHED STONE SURFACE
  - CENTER LINE
  - PROPERTY BOUNDARY LINE
  - IRON PIN OR PIPE
  - FENCE POST
  - ADJOINING PROPERTY BOUNDARY LINE
  - LEGAL RIGHT OF WAY LINE
  - MINIMUM BUILDING SETBACK LINE
  - INDEX CONTOUR LINE
  - INTERMEDIATE CONTOUR LINE
  - BUILDING
  - CONCRETE SURFACE
  - CURB
  - UNDERGROUND ELECTRIC LINES
  - MANHOLE
  - UTILITY POLE
  - GLY WIRE
  - LIGHT STANDARD OR LAMPPOST
  - BOLLARD
  - PARKING METER
  - DRAINAGE PIPE
  - DRAINAGE INLET
  - RIP-RAP
  - TREELINE
  - WALL
  - SANITARY SEWER GRAVITY LINE
  - SANITARY SEWER CLEANOUT
  - FIRE HYDRANT
  - WATER VALVE
  - FENCE
  - SIGN
  - SOIL TYPE BOUNDARY LINE



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BORING LOCATION PLAN

FIGURE 3

Penn State University – Harrisburg Campus  
Proposed Soccer and Competition and Practice Field Improvement Project  
Middletown, PA

JOB NO: R19044

DATE: 6/20/2019

SCALE: AS SHOWN

PAGE: 1

DRAWN BY: NJL

CHECKED BY: JJH

# HILLIS - CARNES

ENGINEERING ASSOCIATES, INC.

## RECORD OF SOIL EXPLORATION

Project Name PSU Harrisburg - Proposed Soccer Competition and Practice Field Boring No. B-1  
 Location Northern Expansion of Existing SWM Basin 1A Job # R19044

### SAMPLER

Datum \_\_\_\_\_ Hammer Wt. 140 lbs. Hole Diameter 3.25" ID Foreman G. Kerr / Negley's Drilling  
 Surf. Elev. 348.70 Ft. Hammer Drop 30 in. Rock Core Diameter N/A Classified By M. Birch / HCEA  
 Date Started 6/4/2019 Pipe Size N/A in. Boring Method HSA Date Completed 6/4/2019

Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM %	SPT Blows	SPT Blows/Foot Curve	
							N	
0		0.0' - 0.8': TOPSOIL	Soil classifications based on Visual-Manual procedure (ASTM D2488) unless laboratory classified.	1.1'		3-3-4-3	7	10 30 50
347.5		0.8' - 2.0': Sandy CLAY with gravel (cl), brown, moist						
2.5		2.0' - 4.0': Well-graded GRAVEL with sand (gw), brown, light brown, and gray, moist		1.9'		6-7-6-10	13	
345		- gravel is angular sandstone fragments		1.8'		4-10-10-12	20	
5		4.0' - 20.0': Silty SAND (sm), dark maroon, moist (Completely weathered SANDSTONE)		2.0'		10-11-12-11	23	
342.5				1.8'	13.6	4-6-10-11	16	
7.5								
340								
10								
337.5								
12.5				1.0'	13.1	19-19-50/5	69	69
335								
15								

### SAMPLER TYPE

DRIVEN SPLIT SPOON UNLESS OTHERWISE  
 PT - PRESSED SHELBY TUBE  
 CA - CONTINUOUS FLIGHT AUGER  
 RC - ROCK CORE

### SAMPLE CONDITIONS

D - DISINTEGRATED  
 I - INTACT  
 U - UNDISTURBED  
 L - LOST

### GROUND WATER

Dry

ft.

ft.

ft.

### CAVE IN DEPTH

N/A

ft.

ft.

ft.

### BORING METHOD

HSA - HOLLOW STEM AUGERS  
 CFA - CONTINUOUS FLIGHT AUGERS  
 DC - DRIVING CASING  
 MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

# HILLIS - CARNES

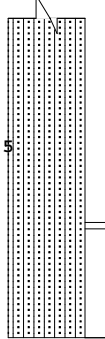
## ENGINEERING ASSOCIATES, INC.

### RECORD OF SOIL EXPLORATION

Project Name PSU Harrisburg - Proposed Soccer Competition and Practice Field Boring No. B-1  
 Location Northern Expansion of Existing SWM Basin 1A Job # R19044

#### SAMPLER

Datum \_\_\_\_\_ Hammer Wt. 140 lbs. Hole Diameter 3.25" ID Foreman G. Kerr / Negley's Drilling  
 Surf. Elev. 348.70 Ft. Hammer Drop 30 in. Rock Core Diameter N/A Classified By M. Birch / HCEA  
 Date Started 6/4/2019 Pipe Size N/A in. Boring Method HSA Date Completed 6/4/2019

Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM %	SPT Blows	SPT Blows/Foot				
							N	Curve			
								10	30	50	
332.5		Bottom of Boring at 20.0 feet	Auger refusal at 20.0'	0.0'		50/.1	100				
17.5											
330											
20											
327.5											
22.5											
325											
25											
322.5											
27.5											
320											
30											
317.5											

#### SAMPLER TYPE

DRIVEN SPLIT SPOON UNLESS OTHERWISE  
 PT - PRESSED SHELBY TUBE  
 CA - CONTINUOUS FLIGHT AUGER  
 RC - ROCK CORE

#### SAMPLE CONDITIONS

D - DISINTEGRATED  
 I - INTACT  
 U - UNDISTURBED  
 L - LOST

#### GROUND WATER

Dry

#### CAVE IN DEPTH

N/A

#### BORING METHOD

HSA - HOLLOW STEM AUGERS  
 CFA - CONTINUOUS FLIGHT AUGERS  
 DC - DRIVING CASING  
 MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

# HILLIS - CARNES



ENGINEERING ASSOCIATES, INC.

## RECORD OF SOIL EXPLORATION

Project Name PSU Harrisburg - Proposed Soccer Competition and Practice Field Boring No. B-2  
 Location Northern Expansion of Existing SWM Basin 1A Job # R19044

### SAMPLER

Datum \_\_\_\_\_ Hammer Wt. 140 lbs. Hole Diameter 3.25" ID Foreman G. Kerr / Negley's Drilling  
 Surf. Elev. 351.1 Ft. Hammer Drop 30 in. Rock Core Diameter N/A Classified By M. Birch / HCEA  
 Date Started 6/4/2019 Pipe Size N/A in. Boring Method HSA Date Completed 6/4/2019

Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM %	SPT Blows	SPT Blows/Foot			
							N	Curve		
								10	30	50
0		0.0' - 0.7': TOPSOIL	Soil classifications based on Visual-Manual procedure (ASTM D2488) unless laboratory classified.	1.5'		3-4-4-4	8			
350		0.7' - 18.0': Clayey SAND with gravel (sc), light brown, brown, and reddish-brown, moist		0.9'		2-1-2-1	3			
2.5		- gravel is angular sandstone fragments		0.7'		3-2-2-2	4			
347.5				0.0'		2-2-2-3	4			
5				1.5'	18.7	3-3-2-6	5			
345				0.6'	17.8	13-50/.3	100			
7.5										
342.5										
10										
340										
12.5										
337.5										
15										

### SAMPLER TYPE

DRIVEN SPLIT SPOON UNLESS OTHERWISE  
 PT - PRESSED SHELBY TUBE  
 CA - CONTINUOUS FLIGHT AUGER  
 RC - ROCK CORE

### SAMPLE CONDITIONS

D - DISINTEGRATED  
 I - INTACT  
 U - UNDISTURBED  
 L - LOST

### GROUND WATER

Dry

ft.

ft.

ft.

### CAVE IN DEPTH

N/A

ft.

ft.

ft.

### BORING METHOD

HSA - HOLLOW STEM AUGERS  
 CFA - CONTINUOUS FLIGHT AUGERS  
 DC - DRIVING CASING  
 MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

# HILLIS - CARNES

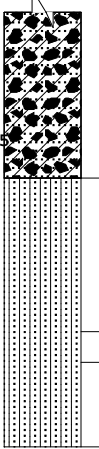
ENGINEERING ASSOCIATES, INC.

## RECORD OF SOIL EXPLORATION

Project Name PSU Harrisburg - Proposed Soccer Competition and Practice Field Boring No. B-2  
 Location Northern Expansion of Existing SWM Basin 1A Job # R19044

### SAMPLER

Datum \_\_\_\_\_ Hammer Wt. 140 lbs. Hole Diameter 3.25" ID Foreman G. Kerr / Negley's Drilling  
 Surf. Elev. 351.1 Ft. Hammer Drop 30 in. Rock Core Diameter N/A Classified By M. Birch / HCEA  
 Date Started 6/4/2019 Pipe Size N/A in. Boring Method HSA Date Completed 6/4/2019

Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM %	SPT Blows	SPT Blows/Foot			
							N	Curve		
								10	30	50
335										
17.5										
332.5		18.0' - 21.5': Silty SAND (sm), dark maroon, moist (Completely weathered SANDSTONE)		1.8'	10.5	8-18-22-38	40			
20				0.1'		50/4	100			
330		Bottom of Boring at 21.5 feet	Auger refusal at 21.5'							
22.5										
327.5										
25										
325										
27.5										
322.5										
30										
320										

### SAMPLER TYPE

DRIVEN SPLIT SPOON UNLESS OTHERWISE  
 PT - PRESSED SHELBY TUBE  
 CA - CONTINUOUS FLIGHT AUGER  
 RC - ROCK CORE

### SAMPLE CONDITIONS

D - DISINTEGRATED  
 I - INTACT  
 U - UNDISTURBED  
 L - LOST

### GROUND WATER

Dry

ft.

ft.

ft.

### CAVE IN DEPTH

N/A

ft.

ft.

ft.

### BORING METHOD

HSA - HOLLOW STEM AUGERS  
 CFA - CONTINUOUS FLIGHT AUGERS  
 DC - DRIVING CASING  
 MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.



# HILLIS - CARNES

ENGINEERING ASSOCIATES, INC.

## RECORD OF SOIL EXPLORATION

Project Name PSU Harrisburg - Proposed Soccer Competition and Practice Field Boring No. B-3  
 Location Northern Expansion of Existing SWM Basin 1A Job # R19044

### SAMPLER

Datum \_\_\_\_\_ Hammer Wt. 140 lbs. Hole Diameter 3.25" ID Foreman G. Kerr / Negley's Drilling  
 Surf. Elev. 353.7 Ft. Hammer Drop 30 in. Rock Core Diameter NQ2 - 2.0" Classified By M. Birch / HCEA  
 Date Started 6/4/2019 Pipe Size N/A in. Boring Method HSA Date Completed 6/4/2019

Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM %	SPT Blows	SPT Blows/Foot Curve	
							N	
0		0.0' - 0.6': TOPSOIL	Soil classifications based on Visual-Manual procedure (ASTM D2488) unless laboratory classified.	2.0'		3-5-6-6	11	10 30 50
352.5		0.6' - 4.0': Well-graded GRAVEL with sand (gw), light brown, brown, and black, moist (Apparent FILL)		1.5'		7-8-11-12	19	
2.5		- gravel is angular sandstone fragments						
350		4.0' - 6.0': Silty CLAY with sand (cl-m), brown and light brown, moist, with trace organics		1.4'	10.7	6-11-13-13	24	
5		- gravel is sandstone fragments		1.3'		12-15-12-14	27	
347.5		6.0' - 15.0': Silty SAND (sm), dark maroon, moist (Completely weathered SANDSTONE)	Auger refusal at 15.0'	2.0'		7-8-17-40	25	
7.5								
345								
10								
342.5				1.1	10.3	19-36-50/3	100	100
12.5								
340								
15		15.0' - 25.0': SANDSTONE, dark maroon, soft to medium hard,		2.5'				

### SAMPLER TYPE

DRIVEN SPLIT SPOON UNLESS OTHERWISE  
 PT - PRESSED SHELBY TUBE  
 CA - CONTINUOUS FLIGHT AUGER  
 RC - ROCK CORE

### SAMPLE CONDITIONS

D - DISINTEGRATED  
 I - INTACT  
 U - UNDISTURBED  
 L - LOST

### GROUND WATER

Dry ft.  
 \_\_\_\_\_ ft.  
 \_\_\_\_\_ ft.

### CAVE IN DEPTH

N/A ft.  
 \_\_\_\_\_ ft.  
 \_\_\_\_\_ ft.

### BORING METHOD

HSA - HOLLOW STEM AUGERS  
 CFA - CONTINUOUS FLIGHT AUGERS  
 DC - DRIVING CASING  
 MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

# HILLIS - CARNES

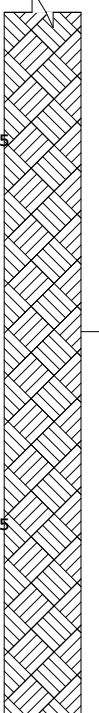
## ENGINEERING ASSOCIATES, INC.

### RECORD OF SOIL EXPLORATION

Project Name PSU Harrisburg - Proposed Soccer Competition and Practice Field Boring No. B-3  
 Location Northern Expansion of Existing SWM Basin 1A Job # R19044

#### SAMPLER

Datum \_\_\_\_\_ Hammer Wt. 140 lbs. Hole Diameter 3.25" ID Foreman G. Kerr / Negley's Drilling  
 Surf. Elev. 353.7 Ft. Hammer Drop 30 in. Rock Core Diameter NQ2 - 2.0" Classified By M. Birch / HCEA  
 Date Started 6/4/2019 Pipe Size N/A in. Boring Method HSA Date Completed 6/4/2019

Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM %	SPT Blows	SPT Blows/Foot			
							N	Curve		
								10	30	50
337.5		completely to highly weathered, thinly bedded, very broken to very closely fractured, shallow dip fractures	R-1: 15.0'-20.0' Rec=50%, RQD=0%							
17.5										
335										
20										
332.5										
22.5										
330										
25										
327.5										
27.5										
325	Bottom of Boring at 25.0 feet	R-2: 20.0'-25.0' Rec=40%. RQD=0%	2.0'							
30										
322.5										

#### SAMPLER TYPE

DRIVEN SPLIT SPOON UNLESS OTHERWISE  
 PT - PRESSED SHELBY TUBE  
 CA - CONTINUOUS FLIGHT AUGER  
 RC - ROCK CORE

#### SAMPLE CONDITIONS

D - DISINTEGRATED  
 I - INTACT  
 U - UNDISTURBED  
 L - LOST

#### GROUND WATER

Dry

ft.

ft.

ft.

#### CAVE IN DEPTH

N/A

ft.

ft.

ft.

#### BORING METHOD

HSA - HOLLOW STEM AUGERS  
 CFA - CONTINUOUS FLIGHT AUGERS  
 DC - DRIVING CASING  
 MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.



# HILLIS - CARNES

ENGINEERING ASSOCIATES, INC.

## RECORD OF SOIL EXPLORATION

Project Name PSU Harrisburg - Proposed Soccer Competition and Practice Field Boring No. B-4  
 Location Proposed Light Pole S1 Job # R19044

### SAMPLER

Datum \_\_\_\_\_ Hammer Wt. 140 lbs. Hole Diameter 3.25" ID Foreman G. Kerr / Negley's Drilling  
 Surf. Elev. 358.9 Ft. Hammer Drop 30 in. Rock Core Diameter N/A Classified By M. Birch / HCEA  
 Date Started 6/4/2019 Pipe Size N/A in. Boring Method HSA Date Completed 6/4/2019

Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM %	SPT Blows	SPT Blows/Foot			
							N	Curve		
								10	30	50
0		0.0' - 0.8': TOPSOIL	Soil classifications based on Visual- Manual procedure (ASTM D2488) unless laboratory classified.	1.3'		WOH-WOH-WOH- 1	1			
357.5		0.8' - 2.0': Silty CLAY (cl-ml), brown, moist (Apparent FILL)								
2.5		2.0' - 8.0': Silty SAND (sm), tan and grayish-tan, moist (Apparent FILL)		1.5'		3-5-8-10	13			
355				1.9'		6-6-8-11	14			
5				1.7'	20.0	13-15-11-11	26			
352.5										
7.5		8.0' - 14.0': Silty CLAY with sand (cl-ml), reddish-brown and brown, moist  S-5: with organics/roots	0.9'		6-13-11-10	24				
350										
10										
347.5										
12.5				1.5'	15.3	2-8-12-20	20			
345		14.0' - 19.5': Silty SAND (sm), maroon, moist (Completely weathered SANDSTONE)								
15										

### SAMPLER TYPE

DRIVEN SPLIT SPOON UNLESS OTHERWISE  
 PT - PRESSED SHELBY TUBE  
 CA - CONTINUOUS FLIGHT AUGER  
 RC - ROCK CORE

### SAMPLE CONDITIONS

D - DISINTEGRATED  
 I - INTACT  
 U - UNDISTURBED  
 L - LOST

AT COMPLETION  
 AFTER 24 HRS.  
 AFTER \_\_\_\_ HRS.

GROUND  
 WATER  
 Dry ft.

CAVE IN  
 DEPTH  
 N/A ft.

### BORING METHOD

HSA - HOLLOW STEM AUGERS  
 CFA - CONTINUOUS FLIGHT AUGERS  
 DC - DRIVING CASING  
 MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

**ENGINEERING ASSOCIATES, INC.**

## RECORD OF SOIL EXPLORATION

Project Name	<b>PSU Harrisburg - Proposed Soccer Competition and Practice Field</b>	Boring No.	B-4
Location	Proposed Light Pole S1	Job #	R19044

## SAMPLER

Datum	Hammer Wt.	140	lbs.	Hole Diameter	3.25" ID	Foreman	G. Kerr / Negley's Drilling
Surf. Elev.	358.9	Ft.	Hammer Drop	30	in.	Rock Core Diameter	N/A
						Classified By	M. Birch / HCEA
Date Started	6/4/2019		Pipe Size	N/A	in.	Boring Method	HSA
						Date Completed	6/4/2019

Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM %	SPT Blows	SPT Blows/Foot	
							N	Curve
								10 30 50
342.5								
17.5								
340				1.0'		11-21-50/.5	71	71
20		Bottom of Boring at 19.5 feet						
337.5								
22.5								
335								
25								
332.5								
27.5								
330								
30								
327.5								

**SAMPLER TYPE**

DRIVEN SPLIT SPOON UNLESS OTHERWISE

PT - PRESSED SHELBY TUBE

CA - CONTINUOUS FLIGHT AUGER

RC - ROCK CORE

### SAMPLE CONDITIONS

D - DISINTEGRATED

I - INTACT

U - UNDISTURBED

L - LOST

## GROUND WATER

Dry ft.

ft.

ft.

---

## CAVE IN DEPTH

N/A ft.

---

ft.

ft.

---

## BORING METHOD

HSA - HOLLOW STEM AUGERS

CFA - CONTINUOUS FLIGHT AUGERS

DC - DRIVING CASING

MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

# HILLIS - CARNES

ENGINEERING ASSOCIATES, INC.

## RECORD OF SOIL EXPLORATION

Project Name PSU Harrisburg - Proposed Soccer Competition and Practice Field Boring No. B-5  
 Location Proposed Light Pole S2 Job # R19044

### SAMPLER

Datum \_\_\_\_\_ Hammer Wt. 140 lbs. Hole Diameter 3.25" ID Foreman G. Kerr / Negley's Drilling  
 Surf. Elev. 360.0 Ft. Hammer Drop 30 in. Rock Core Diameter N/A Classified By M. Birch / HCEA  
 Date Started 6/4/2019 Pipe Size N/A in. Boring Method HSA Date Completed 6/4/2019

Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM %	SPT Blows	SPT Blows/Foot Curve	
							N	
360 0		0.0' - 0.7': TOPSOIL	Soil classifications based on Visual-Manual procedure (ASTM D2488) unless laboratory classified.	1.4'		WOH-3-4-4	7	10 30 50
357.5 2.5		0.7' - 5.0': Silty CLAY (cl-ml), brown, moist (Apparent FILL)  - with trace organics at 4.5'-5.0'		1.5'		4-5-5-8	10	
355 5		5.0' - 15.0': Silty GRAVEL with sand (GM), brown, reddish-brown, and black, moist		2.0'		3-8-13-11	21	
352.5 7.5					10.1			
350 10				1.5'		12-9-10-15	19	
347.5 12.5				1.3'		7-12-13-12	25	
345 15								
		15.0' - 20.0': Silty SAND (sm), brown and reddish-brown, moist	S-6 Lab Tested: USCS Class=GM, Non-plastic	1.0'		10-10-9-14	19	

### SAMPLER TYPE

DRIVEN SPLIT SPOON UNLESS OTHERWISE  
 PT - PRESSED SHELBY TUBE  
 CA - CONTINUOUS FLIGHT AUGER  
 RC - ROCK CORE

### SAMPLE CONDITIONS

D - DISINTEGRATED  
 I - INTACT  
 U - UNDISTURBED  
 L - LOST

### GROUND WATER

AT COMPLETION 17.5 ft.  
 AFTER 24 HRS. \_\_\_\_\_ ft.  
 AFTER \_\_\_\_ HRS. \_\_\_\_\_ ft.

### CAVE IN DEPTH

N/A ft.  
 \_\_\_\_\_ ft.  
 \_\_\_\_\_ ft.

### BORING METHOD

HSA - HOLLOW STEM AUGERS  
 CFA - CONTINUOUS FLIGHT AUGERS  
 DC - DRIVING CASING  
 MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

# HILLIS - CARNES

## ENGINEERING ASSOCIATES, INC.

### RECORD OF SOIL EXPLORATION

Project Name PSU Harrisburg - Proposed Soccer Competition and Practice Field Boring No. B-5  
 Location Proposed Light Pole S2 Job # R19044

#### SAMPLER

Datum \_\_\_\_\_ Hammer Wt. 140 lbs. Hole Diameter 3.25" ID Foreman G. Kerr / Negley's Drilling  
 Surf. Elev. 360.0 Ft. Hammer Drop 30 in. Rock Core Diameter N/A Classified By M. Birch / HCEA  
 Date Started 6/4/2019 Pipe Size N/A in. Boring Method HSA Date Completed 6/4/2019

Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM %	SPT Blows	SPT Blows/Foot Curve	
							N	
								10 30 50
342.5	17.5	(Completely weathered SANDSTONE)		1.3'	15.3	12-20-18-19	38	
340	20	Bottom of Boring at 20.0 feet						
337.5	22.5							
335	25							
332.5	27.5							
330	30							

#### SAMPLER TYPE

DRIVEN SPLIT SPOON UNLESS OTHERWISE  
 PT - PRESSED SHELBY TUBE  
 CA - CONTINUOUS FLIGHT AUGER  
 RC - ROCK CORE

#### SAMPLE CONDITIONS

D - DISINTEGRATED  
 I - INTACT  
 U - UNDISTURBED  
 L - LOST

#### GROUND WATER

AT COMPLETION 17.5 ft.

AFTER 24 HRS. \_\_\_\_\_ ft.

AFTER \_\_\_\_ HRS. \_\_\_\_\_ ft.

#### CAVE IN DEPTH

N/A ft.

\_\_\_\_\_ ft.

\_\_\_\_\_ ft.

#### BORING METHOD

HSA - HOLLOW STEM AUGERS  
 CFA - CONTINUOUS FLIGHT AUGERS  
 DC - DRIVING CASING  
 MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

# HILLIS - CARNES

ENGINEERING ASSOCIATES, INC.

## RECORD OF SOIL EXPLORATION

Project Name PSU Harrisburg - Proposed Soccer Competition and Practice Field Boring No. B-6  
 Location Proposed Light Pole S3 Job # R19044

### SAMPLER

Datum \_\_\_\_\_ Hammer Wt. 140 lbs. Hole Diameter 3.25" ID Foreman G. Kerr / Negley's Drilling  
 Surf. Elev. 359.7 Ft. Hammer Drop 30 in. Rock Core Diameter N/A Classified By M. Birch / HCEA  
 Date Started 6/4/2019 Pipe Size N/A in. Boring Method HSA Date Completed 6/4/2019

Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM %	SPT Blows	SPT Blows/Foot	
							N	Curve
								10 30 50
0		0.0' - 0.7': TOPSOIL	Soil classifications based on Visual-Manual procedure (ASTM D2488) unless laboratory classified.	1.9'		2-3-5-8	8	
357.5		0.7' - 4.0': Silty CLAY (cl-ml), brown, moist		2.0'		4-3-4-5	7	
355		4.0' - 10.5': Well-graded GRAVEL with sand (gw), brown, tan, and reddish-brown, moist		1.0'		4-10-13-11	23	
352.5				1.1'	10.4	12-11-5-7	16	
350				1.5'	8.5	5-9-10-12	19	
347.5		10.5' - 13.0': Silty SAND (sm), dark maroon, moist (Highly weathered SANDSTONE)						
345		Bottom of Boring at 13.0 feet	Auger refusal at 13.0'	0.0'		50/0	100	100

### SAMPLER TYPE

DRIVEN SPLIT SPOON UNLESS OTHERWISE  
 PT - PRESSED SHELBY TUBE  
 CA - CONTINUOUS FLIGHT AUGER  
 RC - ROCK CORE

### SAMPLE CONDITIONS

D - DISINTEGRATED  
 I - INTACT  
 U - UNDISTURBED  
 L - LOST

### GROUND WATER

Dry

ft.

ft.

ft.

### CAVE IN DEPTH

N/A

ft.

ft.

ft.

### BORING METHOD

HSA - HOLLOW STEM AUGERS  
 CFA - CONTINUOUS FLIGHT AUGERS  
 DC - DRIVING CASING  
 MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

# HILLIS - CARNES

## ENGINEERING ASSOCIATES, INC.

### RECORD OF SOIL EXPLORATION

Project Name PSU Harrisburg - Proposed Soccer Competition and Practice Field Boring No. B-7  
 Location Proposed Light Pole S4 Job # R19044

#### SAMPLER

Datum \_\_\_\_\_ Hammer Wt. 140 lbs. Hole Diameter 3.25" ID Foreman G. Kerr / Negley's Drilling  
 Surf. Elev. 356.4 Ft. Hammer Drop 30 in. Rock Core Diameter N/A Classified By M. Birch / HCEA  
 Date Started 6/4/2019 Pipe Size N/A in. Boring Method HSA Date Completed 6/4/2019

Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM %	SPT Blows	SPT Blows/Foot Curve	
							N	
0		0.0' - 0.8': TOPSOIL	Soil classifications based on Visual-Manual procedure (ASTM D2488) unless laboratory classified.	2.0'		2-2-1-2	3	10 30 50
355		0.8' - 2.0': Clayey SILT (ml-cl), brown, moist						
2.5		2.0' - 8.0': Well-graded GRAVEL with sand (gw), light brown, brown, and black, moist		1.5'		7-17-20-24	37	
352.5		- gravel is angular sandstone fragments		1.4'		6-17-21-20	38	
5				0.9'		14-18-20-18	38	
350								
7.5				1.5'	15.3	7-8-11-12	19	
347.5		8.0' - 18.0': Silty SAND (SM), reddish-brown to maroon, moist (Completely weathered SANDSTONE)	S-7 Lab Tested: USCS Class=SM, Non-plastic					
10				2.0'	13.3	9-12-26-25	38	
345								
12.5								
342.5								
15								

#### SAMPLER TYPE

DRIVEN SPLIT SPOON UNLESS OTHERWISE  
 PT - PRESSED SHELBY TUBE  
 CA - CONTINUOUS FLIGHT AUGER  
 RC - ROCK CORE

#### SAMPLE CONDITIONS

D - DISINTEGRATED  
 I - INTACT  
 U - UNDISTURBED  
 L - LOST

#### GROUND WATER

Dry

ft.

ft.

ft.

#### CAVE IN DEPTH

N/A

ft.

ft.

ft.

#### BORING METHOD

HSA - HOLLOW STEM AUGERS  
 CFA - CONTINUOUS FLIGHT AUGERS  
 DC - DRIVING CASING  
 MD - MUD DRILLING

STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.

# HILLIS - CARNES

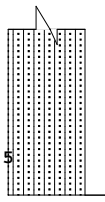
## ENGINEERING ASSOCIATES, INC.

### RECORD OF SOIL EXPLORATION

Project Name PSU Harrisburg - Proposed Soccer Competition and Practice Field Boring No. B-7  
 Location Proposed Light Pole S4 Job # R19044

#### SAMPLER

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Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	Rec.	NM %	SPT Blows	SPT Blows/Foot			
							N	Curve		
								10	30	50
340		Bottom of Boring at 18.0 feet	Auger refusal at 18.0'	0.0		50/0	100			
337.5										
335										
332.5										
330										
327.5										
325										

#### SAMPLER TYPE

DRIVEN SPLIT SPOON UNLESS OTHERWISE  
 PT - PRESSED SHELBY TUBE  
 CA - CONTINUOUS FLIGHT AUGER  
 RC - ROCK CORE

#### SAMPLE CONDITIONS

D - DISINTEGRATED  
 I - INTACT  
 U - UNDISTURBED  
 L - LOST

GROUND  
WATER  
Dry ft.

CAVE IN  
DEPTH  
N/A ft.

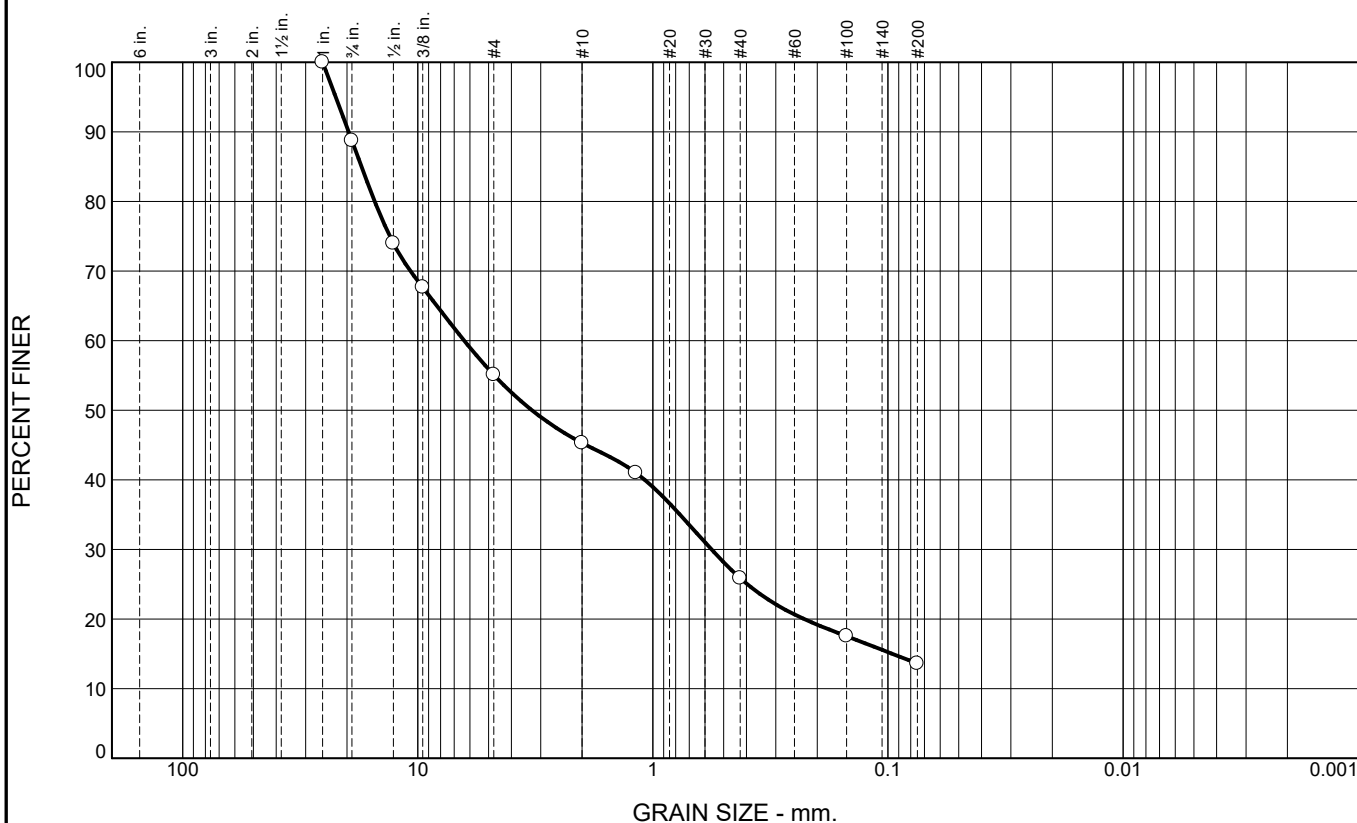
#### BORING METHOD

HSA - HOLLOW STEM AUGERS  
 CFA - CONTINUOUS FLIGHT AUGERS  
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STANDARD PENETRATION TEST-DRIVING 2" O.D. SAMPLER 1' WITH 140# HAMMER FALLING 30": COUNT MADE AT 6" INTERVALS.



# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.3	33.6	9.8	19.4	12.3	13.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	88.7		
.5	74.0		
.375	67.7		
#4	55.1		
#10	45.3		
#16	41.0		
#40	25.9		
#100	17.5		
#200	13.6		

\* (no specification provided)

<u><b>Material Description</b></u>		
Brown Silty Gravel with Sand		
<u><b>Atterberg Limits</b></u>		
PL= NP	LL= NV	PI= NP
<u><b>Coefficients</b></u>		
D <sub>90</sub> = 19.6673	D <sub>85</sub> = 17.3479	D <sub>60</sub> = 6.3437
D <sub>50</sub> = 3.2664	D <sub>30</sub> = 0.5627	D <sub>15</sub> = 0.0956
D <sub>10</sub> =	C <sub>u</sub> =	C <sub>c</sub> =
<u><b>Classification</b></u>		
USCS= GM	AASHTO= A-1-a	
<u><b>Remarks</b></u>		
Boring No. 5 Sample No. 6		
Depth: 13.0' - 15.0'		
NMC = 10.1%		

Location: Middletown, PA  
Sample Number: 1

Date: 6-11-19

HILLIS-CARNES ENGINEERING ASSOCIATES

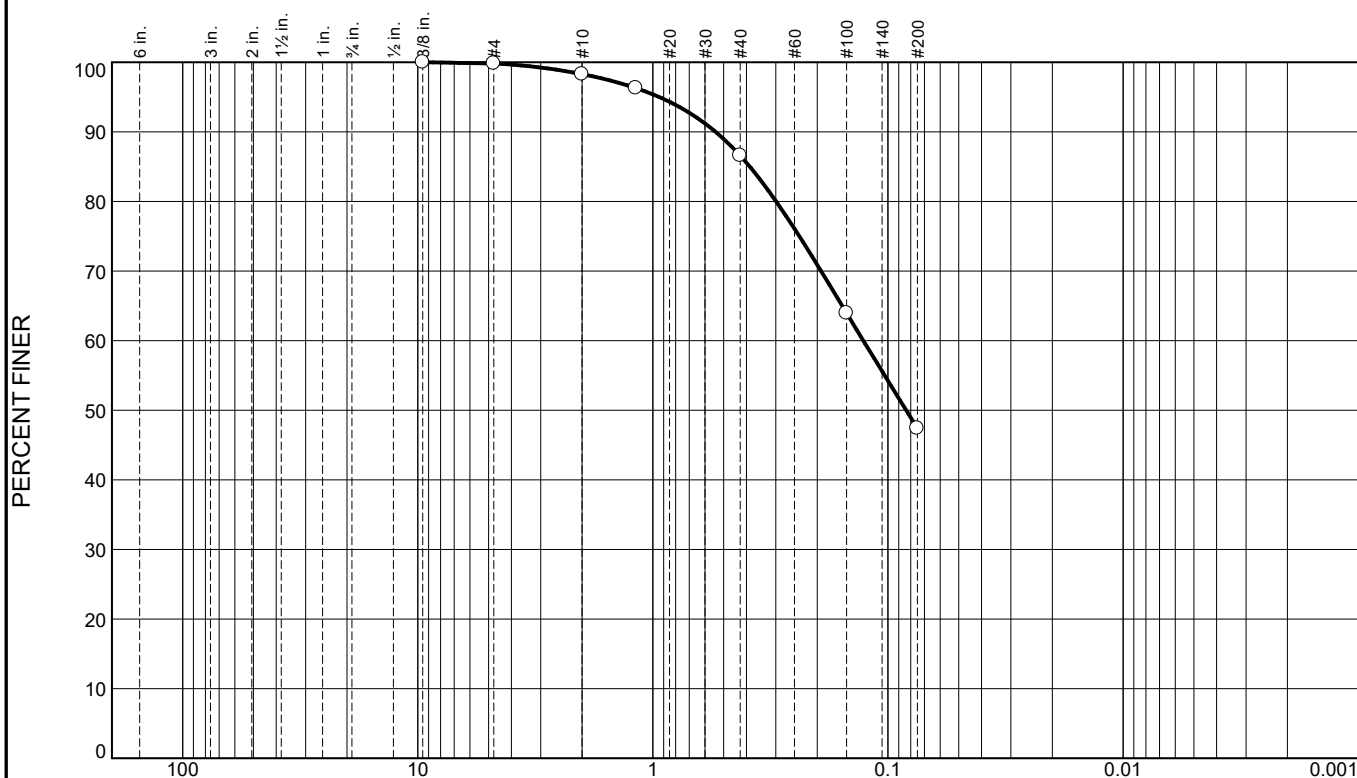
Harrisburg, Pennsylvania

Client: Penn State University  
Project: Soccer Field Improvements  
Penn State University Harrisburg Campus

Project No: R19044

Figure

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	1.5	11.7	39.2	47.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.8		
#10	98.3		
#16	96.3		
#40	86.6		
#100	64.0		
#200	47.4		

\* (no specification provided)

<u>Material Description</u>		
Reddish-Brown Silty Sand		
<u>Atterberg Limits</u>		
PL= NP	LL= NV	PI= NP
<u>Coefficients</u>		
D <sub>90</sub> = 0.5412	D <sub>85</sub> = 0.3870	D <sub>60</sub> = 0.1273
D <sub>50</sub> = 0.0837	D <sub>30</sub> =	D <sub>15</sub> =
D <sub>10</sub> =	C <sub>u</sub> =	C <sub>c</sub> =
<u>Classification</u>		
USCS= SM	AASHTO= A-4(0)	
<u>Remarks</u>		
Boring No. 7 Sample No. 5		
Depth: 8.0' - 10.0'		
NMC = 15.3%		

Location: Middletown, PA  
Sample Number: 2

Date: 6-11-19

HILLIS-CARNES ENGINEERING ASSOCIATES

Harrisburg, Pennsylvania

Client: Penn State University  
Project: Soccer Field Improvements  
Penn State University Harrisburg Campus

Project No: R19044

Figure

# HILLIS-CARNES ENGINEERING ASSOCIATES, INC.

3110 Pike Street • Harrisburg, PA 17111

PHONE: (717) 561-1623 • FAX: (717) 754-0084

Description of Soils – per ASTM D2487

Major Component	Component Type	Component Description	Symbol	Group Name
<b>Coarse-Grained Soils</b> , More than 50% is retained on the No. 200 sieve	<b>Gravels</b> – More than 50% of the coarse fraction is retained on the No. 4 sieve. Coarse = 1” to 3” Medium = ½” to 1” Fine = ¼” to ½”	Clean Gravels <5% Passing No. 200 sieve	<b>GW</b>	Well Graded Gravel
			<b>GP</b>	Poorly Graded Gravel
		Gravels with fines, >12% Passing the No. 200 sieve	<b>GM</b>	Silty Gravel
			<b>GC</b>	Clayey Gravel
	<b>Sands</b> – More than 50% of the coarse fraction passes the No. 4 sieve. Coarse = No.10 to No.4 Medium = No. 10 to No. 40 Fine = No. 40 to No. 200	Clean Sands <5% Passing No. 200 sieve	<b>SW</b>	Well Graded Sand
			<b>SP</b>	Poorly Graded Sand
		Sands with fines, >12% Passing the No. 200 sieve	<b>SM</b>	Silty Sand
			<b>SC</b>	Clayey Sand
<b>Fine Grained Soils</b> , More than 50% passes the No. 200 sieve	Silts and Clays Liquid Limit is less than 50 Low to medium plasticity	Inorganic	<b>ML</b>	Silt
			<b>CL</b>	Lean Clay
		Organic	<b>OL</b>	Organic silt Organic Clay
			Silts and Clays Liquid Limit of 50 or greater Medium to high plasticity	Inorganic
	<b>CH</b>	Fat Clay		
	Organic	<b>OH</b>		Organic Silt Organic Clay
		<b>Highly Organic Soils</b>		Primarily Organic matter, dark color, organic odor

Proportions of Soil Components

Component Form	Description	Approximate percent by weight
Noun	Sand, Gravel, Silt, Clay, etc.	50% or more
Adjective	Sandy, silty, clayey, etc.	35% to 49%
Some	Some sand, some silt, etc.	12% to 34%
Trace	Trace sand, trace mica, etc.	1% to 11%
With	With sand, with mica, etc.	Presence only

Particle Size Identification

Particle Size	Particle dimension
Boulder	12" diameter or more
Cobble	3" to 12" diameter
Gravel	¼" to 3" diameter
Sand	0.005" to ¼" diameter
Silt/Clay (fines)	Cannot see particle

Cohesive Soils

Field Description	No. of SPT Blows/ft	Consistency
Easily Molded in Hands	0 – 3	Very Soft
Easily penetrated several inches by thumb	4 – 5	Soft
Penetrated by thumb with moderate effort	6 – 10	Medium Stiff
Penetrated by thumb with great effort	11 – 30	Stiff
Indented by thumb only with great effort	Greater than 30	Hard

Granular Soils

No. of SPT Blows/ft	Relative Density
0 – 4	Very Loose
5 – 10	Loose
11 – 30	Medium Dense
31 – 50	Dense
Greater than 50	Very Dense

Other Definitions:

- **Fill:** Encountered soils that were placed by man. Fill soils may be controlled (engineered structural fill) or uncontrolled fills that may contain rubble and/or debris.
- **Saprolite:** Soil material derived from the in-place chemical and physical weathering of the parent rock material. May contain relic structure. Also called residual soils. Occurs in Piedmont soils, found west of the fall line.
- **Disintegrated Rock:** Residual soil material with rock-like properties, very dense, N = 60 to 51/0".
- **Karst:** Descriptive term which denotes the potential for solutioning of the limestone rock and the development of sinkholes.
- **Alluvium:** Recently deposited soils placed by water action, typically stream or river floodplain soils.
- **Groundwater Level:** Depth within borehole where water is encountered either during drilling, or after a set period of time to allow groundwater conditions to reach equilibrium.
- **Caved Depth:** Depth at which borehole collapsed after removal of augers/casing. Indicative of loose soils and/or groundwater conditions.