REPORT OF

SUBSURFACE EXPLORATION AND
GEOTECHNICAL ENGINEERING ANALYSIS
FOR STORMWATER MANAGEMENT

PROPOSED STADIUM CASINO
900 PACKER AVENUE
PHILADELPHIA, PA

FOR

McLAREN ENGINEERING GROUP
601 E PRATT STREET
SUITE 302
BALTIMORE, MD 21202

JUNE 23, 2015

June 23, 2015

Thomas J. Crawley, P.E.
McLaren Engineering Group
601 E Pratt Street
Suite 302
Baltimore, MD 21202

ECS Job No.: 18.3798

Reference: Report of Subsurface Exploration, Infiltration Testing, and Geotechnical Engineering Analysis for Stormwater Management
Stadium Casino
900 Packer Avenue
Philadelphia, PA

Dear Mr. Crawley:

As authorized by acceptance of our proposal No. 18.5001-GP REVII, ECS Mid-Atlantic, LLC. (ECS) has completed the subsurface exploration and geotechnical evaluation relative to stormwater management for the above-referenced project. The exploration consisted of 6 test pits and 2 borings within the parcel, with infiltration testing performed in the 6 test pits at varying depths.

The enclosed report discusses the subsurface exploration procedures and results, and presents the recommendations pertaining to the site relative to the stormwater management of the proposed lot.

We appreciate this opportunity to be of service to you on this project. If you have any questions regarding the information and recommendations contained in the accompanying report, or if we may be of further assistance to you in any way during planning or construction of this project, please contact us.

Respectfully,
ECS MID-ATLANTIC, LLC.

J. Matthew Carroll, P.E.
Geotechnical Manager

William D. Friedah, P.E.
Principal Engineer

Michael R. Paladino
Engineering Field Geologist

REPORT

PROJECT

Report of Subsurface Exploration and Infiltration Testing and
Geotechnical Engineering Analysis
Stadium Casino
900 Packer Avenue
Philadelphia, PA

CLIENT

Mr. Thomas J. Crawley
McLaren Engineering Group
601 E Pratt Street
Suite 302
Baltimore, MD 21202

PROJECT #18.3798

DATE June 23, 2015

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PROJECT OVERVIEW

Project Location and Proposed Construction

The project site is located at the existing Holiday Inn Philadelphia Stadium, a 10 story hotel located at the intersection of 10th and Packer in Philadelphia, Pennsylvania. The site borders Packer to the south and 10th to the east. It is our understanding that the proposed Stadium Casino will be constructed around and integrated into the existing hotel.

The site plans provided were limited to the depiction of the existing structures with the geotechnical boring and test pit locations indicated based on the estimated stormwater management locations and elevations. Infiltration testing was performed as requested on the plan provided by McLaren Engineering Group dated March 4, 2015.

Scope of Work

The scope of our subsurface exploration consisted of oversight of a test pit exploration program to explore the proposed stormwater management areas along with 2 borings to identify local groundwater levels and provide a preliminary understanding of the subsurface materials relative to the development of the geotechnical scope of work. A total of 6 test pits and 2 borings were excavated at the site with a backhoe under the supervision of ECS. The exploration was within the proposed location of proposed stormwater management facilities. The test pits were exploratory in nature to provide information on the general conditions at the site and to allow for infiltration testing at various locations around the site perimeter.

The number and general locations of the test pits performed for the subsurface exploration were determined by McLaren Engineering Group and located in the field by ECS. The results of the test pits were utilized to develop general recommendations for the development of stormwater management facilities.

The results of the subsurface exploration along with the Test Pit Location Diagram are included within the Appendix of this report.

EXPLORATION PROCEDURES

Purposes of Exploration

The purposes of this exploration were to explore the soil and groundwater conditions at the site and to develop engineering recommendations to guide design and construction procedures. We accomplished these purposes by:

1. Observation of excavation of test pits to explore the subsurface soil and groundwater conditions, with particular emphasis on the determination of the location of limiting layers and infiltration feasibility considerations.

2. Performing field infiltration testing in general accordance with the Philadelphia Stormwater Manual and the PA Best Management Practices Stormwater Manual at requested locations to further evaluate the infiltration characteristics of the site materials.

3. Drilling of test borings to depths of 35 feet to determine the groundwater elevation and the thickness of the existing fill materials.

4. Research of published soils and geologic information, as well as in-house files, to determine the geologic conditions at the site relative to the Pennsylvania Stormwater Best Management Practices Manual.

Subsurface Exploration Procedures

The test pits were excavated with a backhoe within the areas of the proposed infiltration basins with a Case CX50-B backhoe. The test pits were extended below the proposed test elevations by approximately two feet to detect any limiting zones/layers or ground water that could affect the infiltration of stormwater. Double Ring Infiltrometers were used in general accordance with the methodology presented in the Pennsylvania Best Management Practices (PA BMP) Manual for infiltration testing. Infiltration testing data can be found in Table 1 in the Infiltration Testing Results Section and the Appendix.

The soil borings were performed with an ATV-mounted auger drilling rig. The drilling rig utilized continuous flight, hollow stem augers to advance the boreholes. Drilling fluid was not used in this process. Following drilling operations, the boreholes were backfilled by grouting. Representative soil samples were obtained by means of the split-barrel sampling procedure in accordance with ASTM Specification D-1586. In this procedure, a 2-inch O.D., split-barrel sampler is driven into the soil a distance of 24 inches by a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler through a 12-inch interval is termed the Standard Penetration Test (SPT) value and is indicated for each sample on the boring logs. This value can be used as a qualitative indication of the in-place relative density of noncohesive soils. In a less reliable way, it also indicates the consistency of cohesive soils. This indication is qualitative, since many factors can significantly affect the standard penetration resistance value and prevent a direct correlation between drill crews, drill rigs, drilling procedures, and hammer-rod-sampler assemblies.

Refer to the Boring and Test Pit Location Diagram in the Appendix for a depiction of the boring locations. Refer to the Soil Conditions section of this report for a discussion of the subsurface conditions encountered.

Regional Geology

Based on the *Geologic Map of Pennsylvania* the project site is mapped as being underlain by the Trenton Gravel (Qt). According to *Engineering Characteristics of the Rocks of Pennsylvania*, Second Edition, 1982, by Alan Geyer and Peter Wilshusen, the Trenton Gravel is gray to reddish brown, very gravelly sand; interbedded cross bedded sand and clay layers. The bedrock is well bedded and cross bedded. The weathering is deeply weathered containing weathered gravel of granite, sandstone, gneiss, siltstone, and quartzite. The bedrock is easily excavated with poor cut slope and foundation stability.

USDA Soil Survey

We reviewed the soils mapping of the project site as provided by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) for Philadlphia County, Pennsylvania, as provided by the web soil survey (http://websoilsurvey.nrcs.usda.gov). The soil type mapped on the proposed project site was identified as being underlain by Urban Land (Uc).

The soils classification in this area is considered to be urban land which means the ground is covered with manmade features such as paved roads, sidewalks, and buildings. In areas such as this fill material is commonly found due to the earthwork processes to build and maintain the buildings and roads. It should be noted that the soil borings performed indicate that the fill at the site is present to depths of approximately 28 feet. A map depicting the mapped soils is included in the Appendix of this report.

FIELD EXPLORATION AND TESTING

Site Reconnaissance

The ECS representative visited the site on March 24, 2015 to coordinate the field exploration, observe the site conditions, and perform infiltration testing. A general reconnaissance of the site indicated that the site is currently developed with parking lots, landscape and lawn areas, and utilities associated with the existing 10 story hotel. No geologic features were visible at the ground surface. The site is generally relatively flat over much of the site, with an apparent slight slope downward to the east toward Darien Street. The site borders the large parking lot associated with Citizens Bank Park (Philadelphia Phillies Stadium), which is located to the south. It appears that the adjacent parking lot generally slopes downward toward this site.

Subsurface Exploration Results

The test pits were all excavated in lawn/landscape areas at the property. At the excavation locations, the surficial topsoil thicknesses ranged from 6 inches to 8 inches. Below the surficial materials (topsoil), the on-site soils generally consist of FILL that is comprised mostly of sandy silts with construction debris present thought depths. The observed debris included varying percentages of brick, concrete, asphalt, wood, rock fragments, plastic, and an apparent appliance was noted in DRI-6. Test pit DRI-1 encountered bucket refusal at 5 feet on a thick layer of asphalt, while the other 5 test pits were excavated to the proposed depths. Perched water was present in test pits DRI-3, DRI-4, and DRI-6 at a depth of roughly 3-4 feet. This perched water may be a result of recent snow melt from the neighboring parking lot. The test pits extended to depths of 5 feet to 10 feet below existing grades.

The test borings encountered similar FILL material, as noted in the test pits, to depths of up to 28 feet with brown SAND being present to the terminated depth. The localized ground water table was encountered at a depth of 13 feet in boring SW-1 and 20 feet in SW-2, which correspond to approximately EL -2. The test borings had variable Standard Penetration Test blow counts, varying between 1 blow/ft and 50 blows per 11 inches. The borings were terminated at a depth of 35 feet. It should be noted that due to the relative proximity of this site to the Delaware River, it is anticipated that the groundwater level will generally correspond to approximately sea level, (EL 0.0), which is generally 10-12 feet below the majority of the existing site grades, with the exception of the elevated area to the south of the existing hotel.

Representative soil samples recovered during the advancement and excavation of the test borings (SW-1 and SW-2) and test pits (DRI-1 through DRI-6) were screened for discolorations or other evidence of soil contamination (i.e., odors, stained soils, detectable PID readings). ECS observed evidence of petroleum odors and elevated PID readings ranging from 2.5 parts per million (ppm) to 25.1 ppm from 2 feet to 9 feet below ground surface (bgs) within the soil samples collected from test boring SW-1. No evidence of petroleum impact and/or elevated PID readings was observed in test boring SW-2 and/or test pits DRI-1 through DRI-6. Observations and PID readings are included on the attached boring logs.

Infiltration Testing Results

The test pits were tested with double ring infiltration testing in general accordance with the Pennsylvania Stormwater Best Management Practices (PA BMP) Manual. A one-hour presoak was utilized at each test location to determine the testing interval. Test readings were recorded at half-hour intervals in test pits DRI-2, DRI-3, and DRI-4. Test readings were record at 10 minute intervals in test pits DRI-1 and DRI-4. A minimum of four consecutive average stabilized readings were recorded. The soils tested were not frozen. The average infiltration rate is provided in the following table.

Test Pit Location	Test Elevation (ft)	Test Depth (ft)	Infiltration Rate (in/hr)	Elevation of Limiting Layer (ft)
DRI-1	9.0	3.0	3.56	7.0
DRI-2	7.0	6.0	0.06	Not Encountered
DRI-3	6.5	5.0	0.00	Not Encountered
DRI-4	8.0	4.0	0.13	Not Encountered
DRI-5	8.25	4.25	1.13	Not Encountered
DRI-6	13.5	2.0	*	Not Encountered

*Testing beyond the presoak not performed due to negligible infiltration rates combined with time constraints.

Refer to the Analysis and Recommendations Section of this report for specific recommendations pertaining to the management of the stormwater.

Engineering Laboratory Testing Program

Due to the prevalence of existing urban fill materials through the upper 28 feet at the site, laboratory testing for this project was limited to visual classifications. The encountered soils were classified on the basis of texture and plasticity in accordance with the Unified Soil Classification System (USCS). The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. A brief explanation of the Unified Soil Classification System is included with this report. The soil stratums were grouped into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs and profiles are approximate; in situ, the transitions may be gradual. The soil samples will be retained in our laboratory for a period of 60 days, after which, they may be discarded unless other instructions are received as to their disposal.

Environmental Laboratory Testing Program

ECS collected 19 sub soil samples from two test borings (SW-1 and SW-2) and five test pits (DRI-1 through DRI-5) to a maximum depth of the proposed stormwater excavation (anticipated to be 4 to 9 feet bgs). No soil samples were collected from test pit DRI-6. Soil sub samples were collected from the following locations:

- SW-1(A); 2 to 3 feet
- SW-1(B); 4 to 5 feet
- SW-1(C); 6 to 7 feet
- SW-1(D); 8 to 9 feet

- SW-2 (A); 2 to 3 feet
- SW-2(B); 4 to 5 feet
- SW-2(C); 6 to 7 feet
- SW-2(D); 8 to 9 feet
- DRI-1(A); 2 to 3 feet
- DRI-1(B); 3 to 4 feet
- DRI-2(A); 2 to 3 feet
- DRI-2(B); 4 to 5 feet
- DRI-2(C); 5 to 6 feet
- DRI-3(A); 2 to 3 feet
- DRI-3(B); 4 to 5 feet
- DRI-4(A); 2 to 3 feet
- DRI-4(B); 4 to 5 feet
- DRI-5(A); 2 to 3 feet
- DRI-5(B); 4 to 5 feet

Based on observations and/or highest PID readings, three (3) discrete soil samples were selected from soil samples SW-1(A) (2.5 ppm), SW-1(C) (17.1 ppm), and SW-1(D) (25.1 ppm) for analysis of TCL VOCs. For analysis of all compounds other than VOCs, three (3) composite soil samples were collected from six sub soil samples; including SW-2(A), SW-2(B), SW-2(C), SW-2(D), DRI-4(A) and DRI-4(B) (Comp-1), five sub soil samples; including DRI-2(A), DRI-2(B), DRI-2(C), DRI-3(A) and DRI-3(B) (Comp-2), and eight sub soil samples; including SW-1(A), SW-1(B), SW-1(C), SW-1(D), DRI-1(A), DRI-1(B), DRI-5(A) and DRI-5(B) (Comp-3). Soil samples were submitted to a Pennsylvania-certified laboratory for analysis of Volatile Organic Compounds (VOCs) via EPA Method 8260, Semi-Volatile Organic Compounds (SVOCs) via EPA Method 8270, Resource Conservation and Recovery Act (RCRA) 8 Metals via EPA Method 6010/7471, Organochlorinated Pesticides via EPA Method 8081, Herbicides via EPA Method 8151, and Polychlorinated Biphenyls (PCBs) via EPA Method 8082.

Three VOCs, including acetone, ethylbenzene, and methylene chloride, were detected in soil samples SW-1(A), SW-1(C) and Comp-1; however, these concentrations were below their respective PADEP Clean Fill Standards (**Table 1**).

Fifteen (15) SVOCs; including acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene; were detected in the composite soil samples Comp-1, Comp-2, and Comp-3. These SVOC concentrations were below the PADEP Clean Fill Standards; except for the benzo(a)pyrene concentrations detected in composite soil samples Comp-2 and Comp-3 at 3,470 micrograms per kilogram (ug/kg) and 3,580 ug/kg; respectively, which exceeded the PADEP Clean Fill Standard of 2,500 ug/kg but below the PADEP Regulated Fill Standard of 11,000 ug/kg (**Table 1**).

Various concentrations of RCRA metals were detected in soil samples Comp-1, Comp-2, and Comp-3; however, these concentrations were below their respective PADEP Clean Fill Standards; except for the arsenic concentration (18.5 milligrams per kilogram [mg/kg]) detected in composite soil sample Comp-2, which exceeded the PADEP Clean Fill Standard of 12 mg/kg but below the PADEP Regulated Fill Standard of 53 mg/kg (**Table 1**).

No pesticides, herbicides, or PCBs were detected in soil samples Comp-1, Comp-2, and Comp-3 (**Table 1**).

ANALYSIS AND RECOMMENDATIONS

Our recommendations presented in this report are based on our understanding of the project, the assumptions that we have stated in this report, the results of our subsurface exploration and laboratory testing and our experience in geotechnical engineering. If our assumptions or our understanding of the proposed project are not correct we should be notified so that we may alter our recommendations as required. The primary factors that will influence stormwater infiltration at this site are the variable fill soils and the limited infiltration potential of several of the test locations and elevations, and the potential for perched groundwater along the southern site boundary. In addition, some elevated levels of environmental contaminants, including benzo(a)pyrene and arsenic, were identified in composite soil samples Comp-2 and Comp-3 collected from test boring SW-1 and test pits DRI-1, DRI-2, DRI-3 and DRI-5 that should require additional delineation relative to the proposed excavation areas associated with stormwater management features for the project. The elevated level of contaminants should be further delineated as part of the next phase of the exploration program relative to its influence on stormwater infiltration location and elevations, as well as the general handling and disposal/export options for the excavation spoils.

Preliminary Exploration Implications on Design and Construction

Subgrade preparation for the infiltration locations is expected to be limited to stripping of topsoil and excavation to the design bottom of basin depths. It is anticipated that the excavated materials may be exported from the site and will therefore require proper analytical delineation to allow for proper disposal or reuse as Clean Fill. Based on the results of the soil sampling, concentrations of VOCs, SVOCs, Pesticides, Herbicides, PCBs and RCRA metals were either non-detect or below the PADEP Clean Fill Standards; except for benzo(a)pyrene and arsenic which were detected in the non-native fill materials in test boring SW-1 and test pits DRI-1, DRI-2, DRI-3 and DRI-5. Therefore, the impacted non-native fill materials in these sample locations cannot be transported offsite as clean fill in accordance with the PADEP Management of Fill Policy but must be transported offsite as regulated fill to an approved facility (i.e. landfill). Additional delineation is recommended to determine the extent of the PADEP Clean Fill exceedances.

The suitability of existing fill materials for the support of floor slabs will also require additional exploration and evaluation. The limited extent and locations of the exploratory borings and test pits appear to indicate that the fill is of variable material types and densities, likely indicating that the use of ground supported floor slabs would present a risk for settlement and cracking of floor slabs. The final design geotechnical report will likely recommend a structural slab that is supported by the deep foundations that are anticipated to be recommended for the support of the building. Presuming that a structural slab system is implemented, excavation of existing fill is anticipated to be limited to excavations associated with utilities, stormwater management, and structural foundation members.

Stormwater Management Recommendations

Based on the infiltration tests performed at the site, it appears that the proposed stormwater management basin areas have variable capabilities to perform as infiltration facilities. Stormwater management facilities can be design for area specific infiltration rates found on the Infiltration Testing Results Table. For areas where facilities will be constructed where negligible rates of infiltration were recorded, the construction of water quality BMP features may provide an alternate method of compliance with stormwater regulations.

Design infiltration rates for this site varied between negligible (0.00 in/hr) and moderately high (3.56 in/hr). The lowest rate was recorded in test pit TP-2, located south of the proposed building. Rates in excess of 1 inch per hour were recorded in DRI-1 (3.56 in/hr) and in DRI-5 (1.13 in/hr), both of which were located along the northern side of the site along Packer Avenue. Based on these test results, the areas of greater infiltration potential appear to be the northern side of the property and a focus on stormwater management facilities should be concentrated at this location of the parcel to maximize the infiltration potential. It should be noted, however, that there does appear to be the potential of elevated contaminant levels in the upper layers of the existing fill, based on the analytical testing performed on composite samples containing samples from these locations. Additional delineation of the extent(s) of environmental contaminants, both horizontally and vertically, is recommended in helping to understand the implications of these contaminants on the proposed stormwater management design. Infiltration of stormwater through layers with environmental contaminants could result in introduction of these contaminants into the groundwater system.

Stormwater facilities that may be constructed along the southern property boundary should be designed around the limiting features of the potential for perched water that was identified in the test pits. Water quality BMP features with ammended soils and underdrains to convey the water off-site will provide a level of management of the stormwater to assist in the approval process.

During excavation of the basin, the materials at the bottom of basin should be verified to be consistent with those encountered in the exploration. Care should be taken during construction to minimize trafficking of heavy equipment and construction vehicles in proposed infiltration areas. ECS recommends that construction equipment be prevented from operating within 2 feet vertically of any proposed infiltration layer in order to minimize the chance of compaction of underlying infiltration layers. If the soils at the infiltration elevation are subject to construction traffic and/or compacted, a tiller or disk harrow may be needed to loosen the soils to acceptable densities for the intended purpose of infiltration.

As mentioned in the **Subgrade Preparation** section, it is recommended that field verification of the subgrade conditions should be verified by the authorized ECS representative. ECS recommends that specific construction notes appear on the plans requiring full-time observation of the excavation of the basins by the authorized ECS representative to verify suitable conditions are present.

For infiltration basin areas that are used as sediment basins during construction, the basin should not be utilized for stormwater infiltration until stabilization of contributing areas has been completed. Any accumulated sediments in the basin area(s) should also be removed. If infiltration areas are not intended to serve for sediment control during construction, appropriate protection measures should be in-place during construction to prevent the accumulation of sediments which may affect the long-term performance of the basin's infiltration characteristics

Implications for Final Geotechnical Exploration

The limited exploration performed at this site with the combination of test pits and test borings provides some preliminary data that is helpful in starting to address the scope of the final geotechnical exploration. The site is underlain by approximately 28 feet of variable and generally loose urban fill that should not be considered suitable for support of foundations. Groundwater was also encountered at a depth of about 10-12 feet below the average ground surface elevation of the parcel. These factors indicate that the final geotechnical exploration should anticipated borings that are advanced between 50 and 100 feet in depth in order to identify suitable load bearing layers for likely deep foundations. Based on the limited exploration data, it is anticipated that deep foundations such as driven or auger cast piles may be appropriate for this site. Selection of foundation type may require consideration of the operation of the existing hotel, since noise and access limitations may apply. It should be noted that specific building layout or structural loading information has not been provided to ECS at this phase of the project, so the specific number, location, or depth of borings is not specifically addressed in this report. Based on our previous conversations, it is our understanding that a scope of work for the final geotechnical exploration for the structure is in-progress.

Additional Environmental Discussion

It should be noted that the concentrations of benzo(a)pyrene and arsenic in soil also exceeded the PADEP Act 2 Residential Statewide Health Standards (SHS); however, these concentrations are below the PADEP Act 2 Non-Residential SHS. Based on the exceedances, liability protection via the PADEP's Land Recycling Program (Act 2) would be an option. Liability protection may be obtained for multiple media including soils, water, vapor or a combination of the media. Ownership of the project site may transfer in the future. As a result, the current owner may wish to document the existing conditions and be afforded cleanup liability protection associated with the identified soil exceedances.

The process could include soil removal at the areas of soil exceedences including test boring SW-1 and test pits DRI-1, DRI-2, DRI-3 and DRI-5 and post removal soil sampling or reuse on-site and capped. The results of this soil removal and sampling and/or soil capping could be submitted to the PADEP ACT 2 program to obtain relief of liability for soils in these areas. Additionally, perched groundwater was encountered at a shallow depth immediately below the impacted fill material in the area of test boring SW-1; therefore, ECS recommends evaluating the concentrations of contaminants in the groundwater.

Site characterizations to further delineate the vertical and horizontal impact must be performed in accordance with Pennsylvania's Land Recycling Program ACT 2 in order to be approved as one of the initial steps toward achieving liability protection for the property.

Closing

This report has been prepared to aid in the evaluation of this site and to assist the design team with the design of the proposed stormwater management facilities. The report scope is limited to this specific project and the location described. The project description represents our current understanding of the significant aspects of the proposed improvements relevant to the geotechnical considerations.

We appreciate this opportunity to be of service to you on this project. If you have questions regarding the information and recommendations contained in this report, or if we may be of further assistance to you in during planning or construction of this project, please do not hesitate to contact the undersigned at your convenience.

APPENDIX

Site Location Diagram

Geology Diagram

Soils Mapping Diagram

Test Pit and Boring Location Diagram

Test Pit Logs

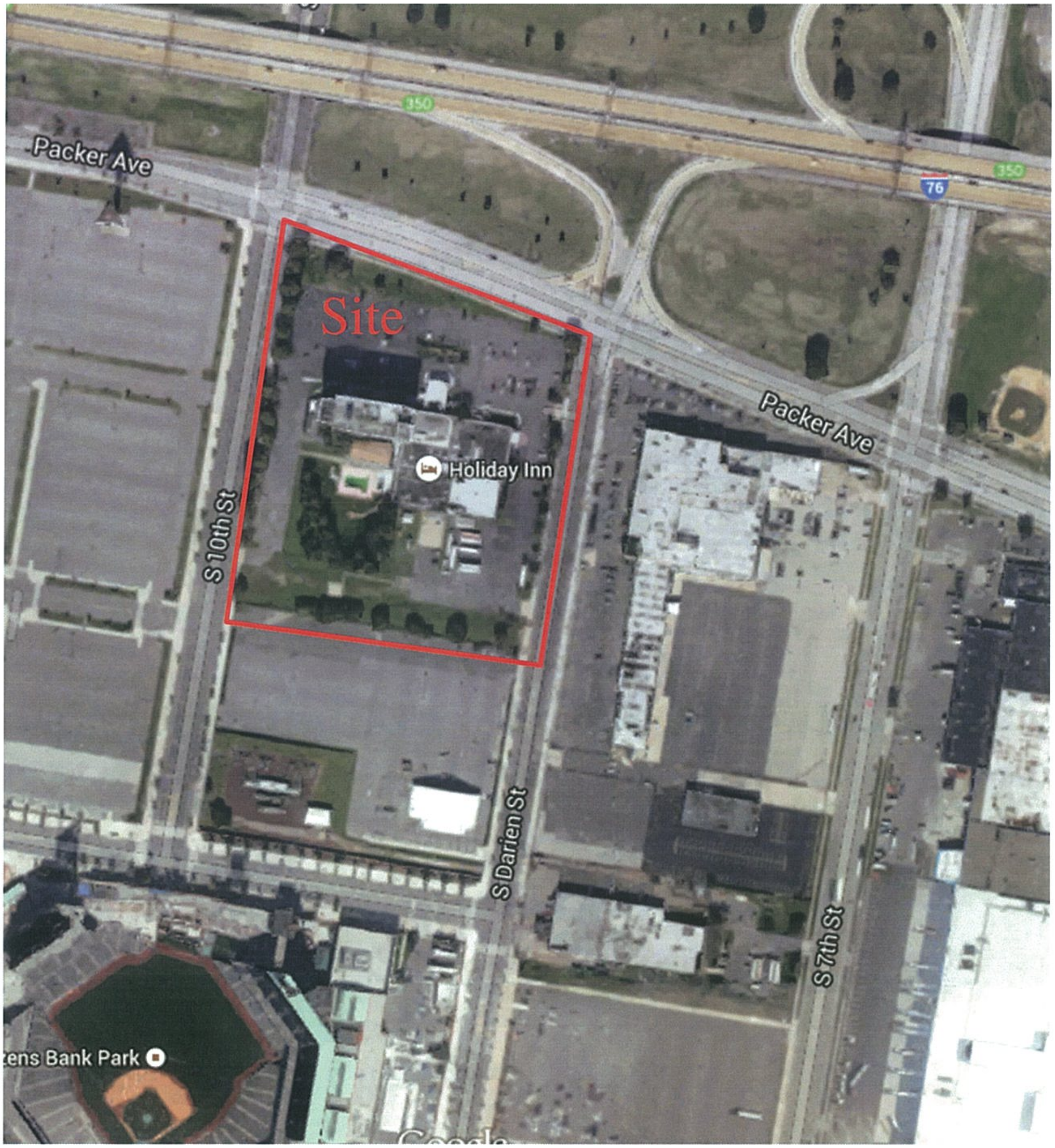
Boring Logs

Infiltration Test Results

Table 1 – Analytical Laboratory Testing Results

USCS Classification System

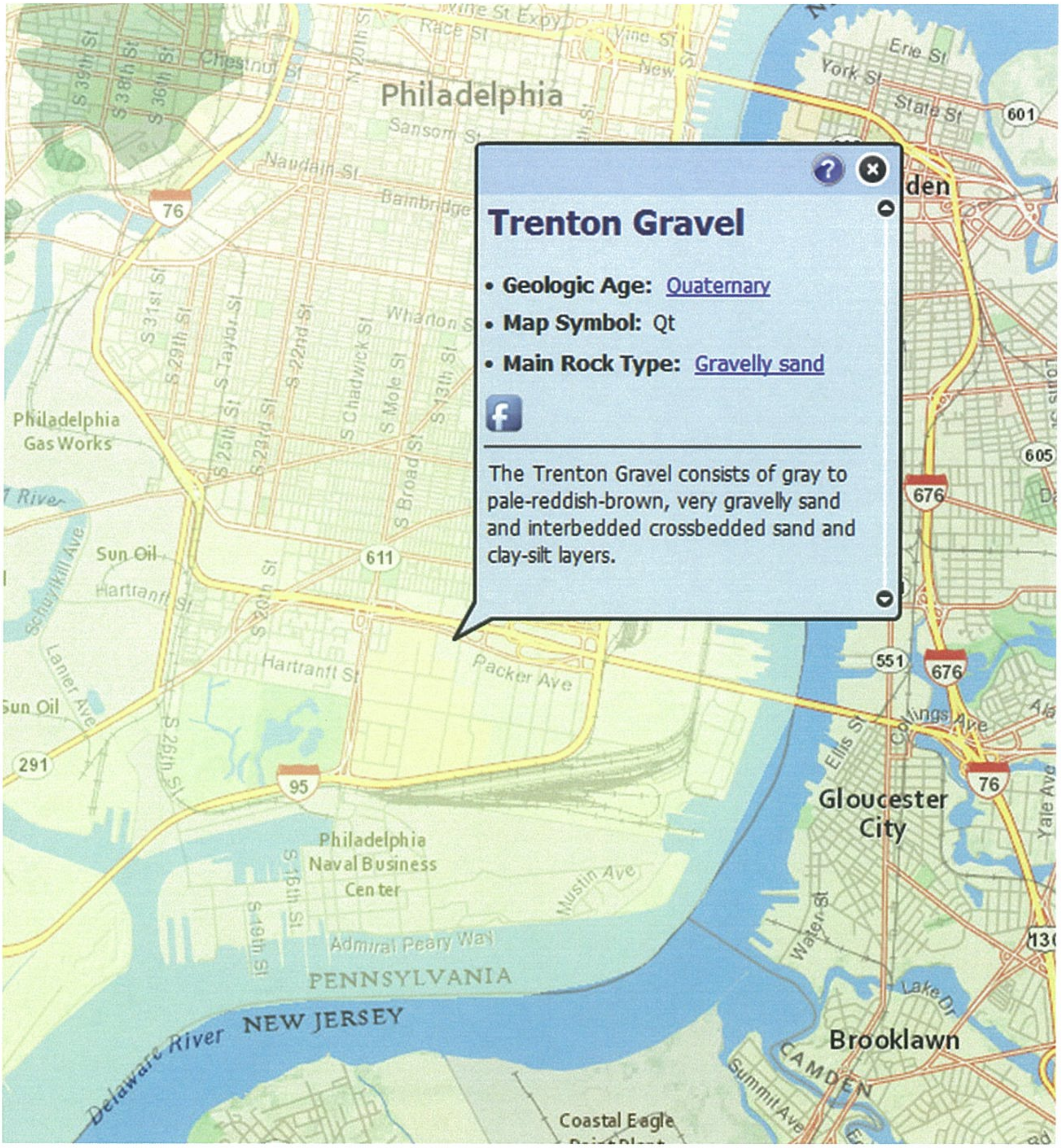
Reference Notes for Boring Logs



Source: GoogleMaps

NORTH

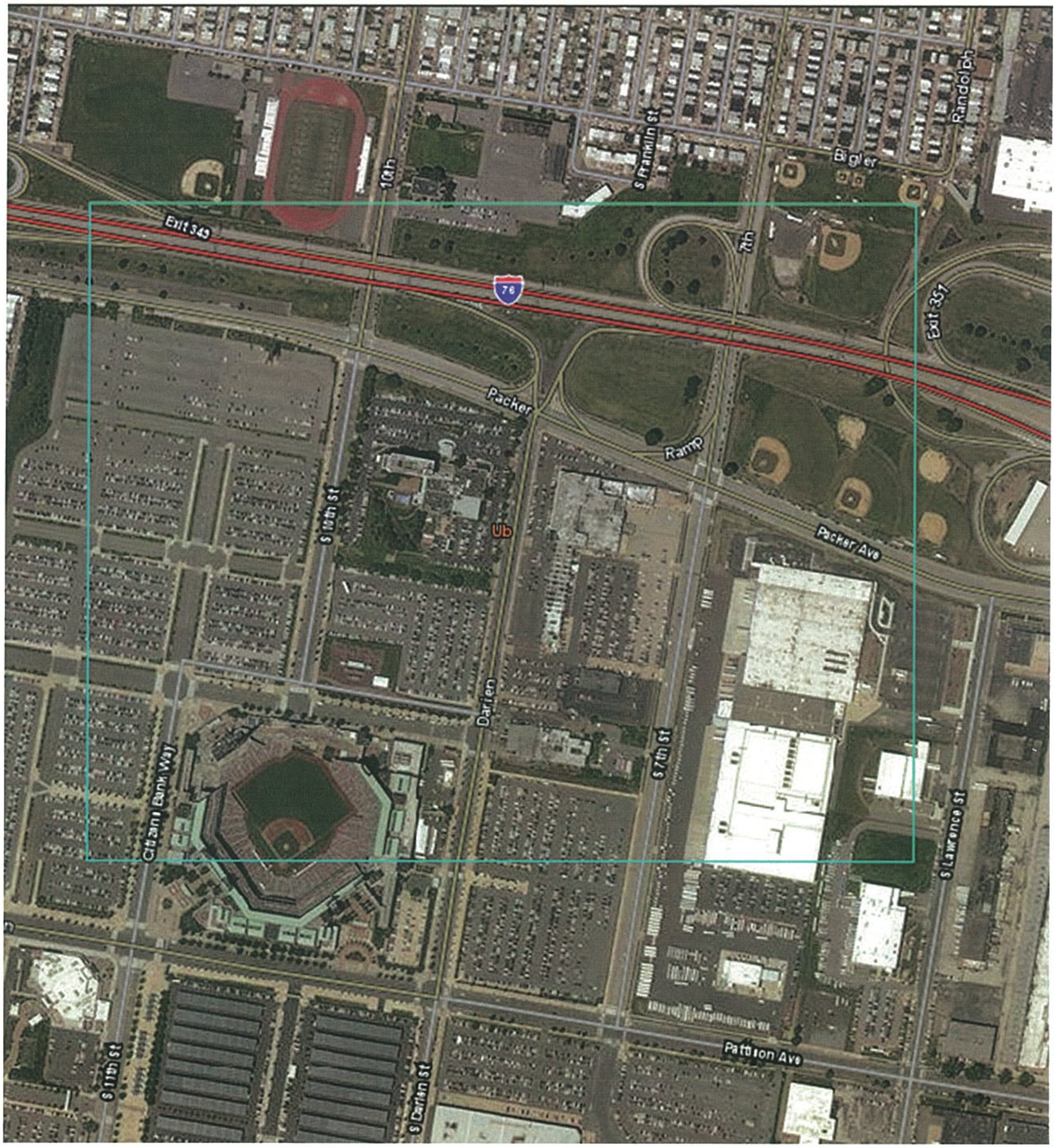
Proposed Stadium Casino 10th and Packer Ave. Philadelphia, PA	ECS	**Appendix** Site Location Diagram ECS Project 18-3798 April 2015



Source: PA D.E.R.

▲
NORTH

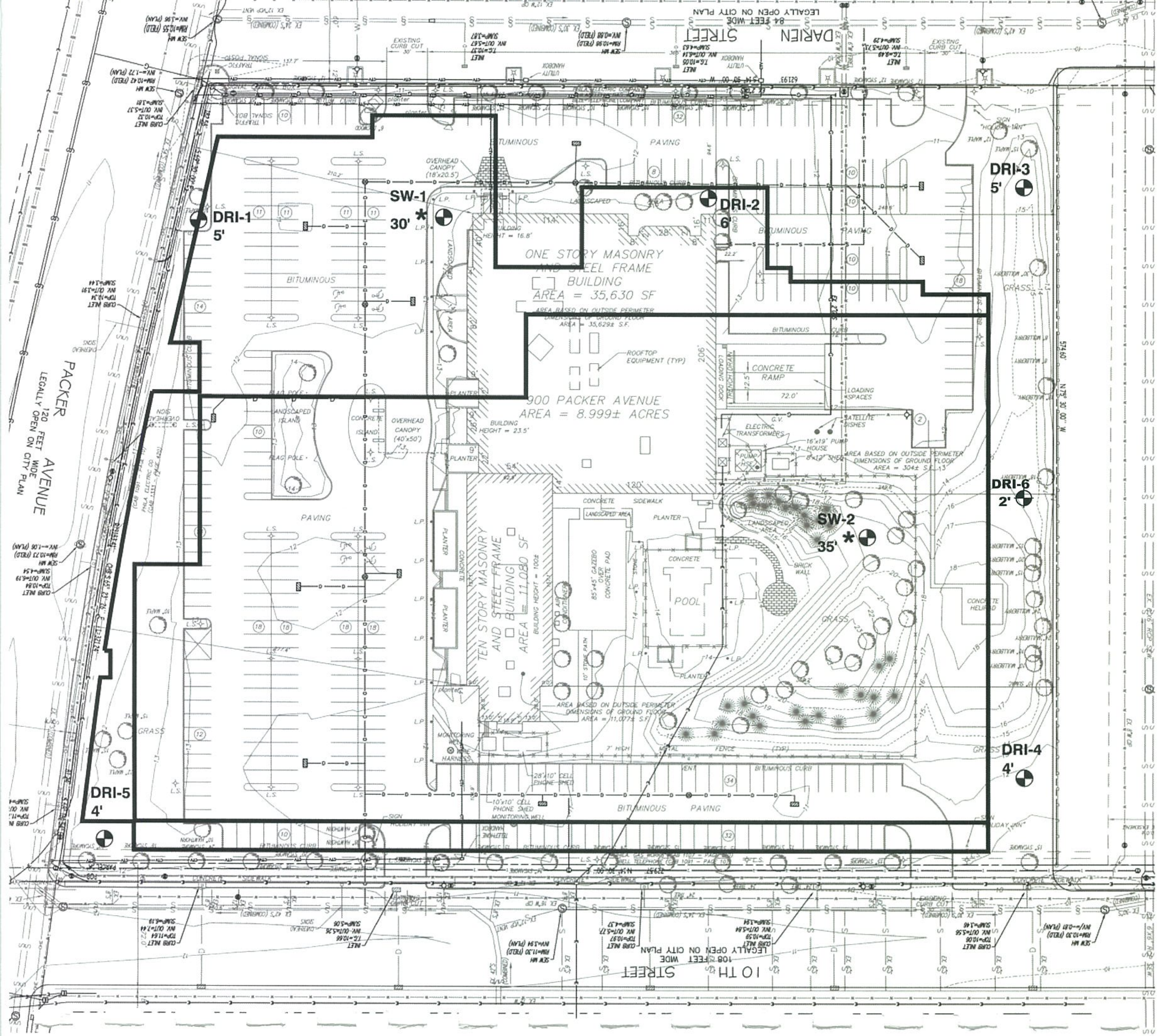
Proposed Stadium Casino 10th and Packer Avenue Philadelphia, PA	ECS	Appendix Geology Map ECS Project 18.3798 April 2015



Source: Web Soil Survey

▲
NORTH

Proposed Stadium Casino 10th and Packer Ave. Philadelphia, PA	ECS™	**Appendix** Soils Map ECS Project 18.3789 April 2015



LEGEND

SW-1 (DEPTH')	STORMWAT (DEPTH NO	
DRI-1 (DEPTH')	DOUBLE-RI INFILTROM (TEST DEPT	

*** BOREHOLE DRILLING NO**

1. THE ANTICIPATED DI GROUNDWATER IS APPROXIMATELY 15- BELOW THE EXISTIN
2. IF GROUNDWATER IS ENCOUNTERED BEFO NOTED DRILLING DE REACHED, DRILL AN ADDITIONAL 5 FEET THE GROUNDWATER AND END THE BORIN
3. IF GROUNDWATER IS ENCOUNTERED AT T SPECIFIED BORING D CONTINUE DRILLING GROUNDWATER IS ENCOUNTERED, PLU ADDITIONAL 5 FEET THE ENCOUNTERED GROUNDWATER DEP (TOTAL BORING DEP TO EXCEED 50 FEET)

GENERAL NOTES:

1. EXISTING UTILITIES AND OBSTRUCTIONS SHOWN HEREON ARE SHALL BE FIELD VERIFIED BY THE CONTRACTOR TO HIS OWN SA NEITHER THE OWNER NOR THE ENGINEER WARRANT OR GUARA CORRECTNESS OF THE INFORMATION SHOWN HEREIN.
2. ALL UTILITIES AND SERVICES, INCLUDING BUT NOT LIMITED TO STORM SEWER, TELEPHONE, CABLE, FIBER OPTIC, ETC. WITHIN VERTICALLY AND HORIZONTALLY LOCATED. THE CONTRACTOR REQUIREMENTS OF THE APPLICABLE UTILITY NOTIFICATION SYS UTILITIES. THE CONTRACTOR IS RESPONSIBLE FOR REPAIRS O DURING CONSTRUCTION, AT NO COST TO THE OWNER OR ENGI

CLIENT	JOB #	BORING #	SHEET
	1029	SW-2	1 OF 1

PROJECT NAME: 18 - Stadium Casino Project

ARCHITECT-ENGINEER:

SITE LOCATION: Darien Street, Philadelphia, Philadelphia County

NORTHING: | EASTING: | STATION:

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING / LOSS OF CIRCULATION

SURFACE ELEVATION 18.00

SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	BLOWS/6"
S-1	SS	18	12	3 2 3
S-2	SS	18	18	1 1 4
S-3	SS	18	18	9 9 10
S-4	SS	18	18	4 6 5
S-5	SS	18	18	11 9 8
S-6	SS	18	10	4 3 3
S-7	SS	18	0	2 3 3
S-8	SS	18	18	2 2 2
S-9	SS	18	18	6 11 36

Description of material:

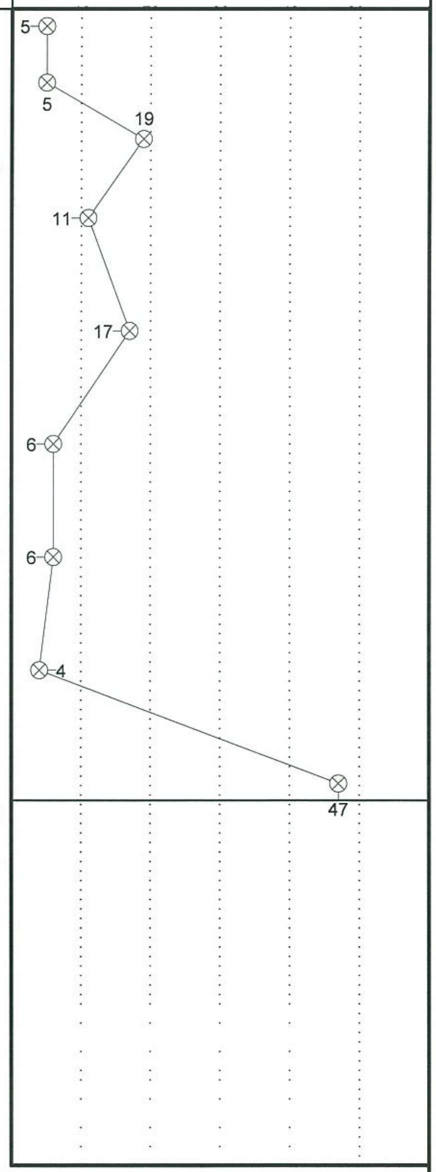
- Topsoil Depth [6"]
- (ML FILL) SILT WITH SAND, Contains Brick and Contains Slight Rock Fragments, Brown to Black, Moist, Loose Medium Dense
  - 2'-3' PID = 0.9 ppm
  - 4'-5' PID = 1.2 ppm
  - 6'-7' PID = 1.5 ppm
  - 8'-9' PID = 1.0 ppm
  - 10'-35' PID = <1 ppm
- (ML/CL FILL) CLAYEY SILT, Contains Slight Brick, Brown to Gray, Saturated, Soft
- (SP) SAND, Grayish Brown, Saturated, Medium Dense
- END OF BORING @ 35.00'

DEPTH (FT): 0, 10, 20, 30, 40, 50

ELEVATION (FT): 10, 0, -10, -20, -30

WATER LEVELS

Legend:
- CALIBRATED PENETROMETER TONS/FT^2
- ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — —, REC% ———
- PLASTIC LIMIT%, WATER CONTENT%, LIQUID LIMIT%
- STANDARD PENETRATION BLOWS/FT



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 20.0 WS☐ WD☐	BORING STARTED 03/24/15	
WL(BCR) WL(ACR)	BORING COMPLETED 03/24/15	CAVE IN DEPTH
WL	RIG ATV FOREMAN	DRILLING METHOD HSA

ECS Project # 44.1029

Infiltration Testing Field Measurements

Date Tested: 3/24/2015

Field Data	TP-1		TP-2		TP-3		TP-4		TP-5		TP-6	
Test Depth	3.00'		6.00'		5.00'		4.00'		4.25'		2.00'	
	Time	Reading	Time	Reading	Time	Reading	Time	Reading	Time	Reading	Time	Reading
Presoak Start/Water Depth	13:46	6.0	14:08	6.0	9:45	6.0	10:33	6.0	12:29	6.0	16:00	6.0
Presoak 30 Min	14:16	6.00	14:38	0.00	10:15	1.19	11:03	0.00	12:59	2.50	16:30	0.06
Presoak 60 Min	14:46	4.00	15:08	0.06	10:45	0.00	11:33	0.00	13:29	2.13	17:00	0.06
START TEST	14:46	6.0	15:08	6.0	10:45	6.0	11:33	6.0	13:29	6.0	17:00	6.0
Reading Interval	10 min		30 min		30 min		30 min		10 min		30 min	
Reading # 1 (in)	14:56	1.38	15:38	0.06	11:15	0.00	12:03	0.06	13:39	0.50		
Reading # 2 (in)	15:06	1.13	16:08	0.06	11:45	0.00	12:33	0.13	13:49	0.38		
Reading # 3 (in)	15:16	1.13	16:38	0.06	12:15	0.00	13:03	0.13	13:59	0.38		
Reading # 4 (in)	15:26	1.13	17:08	0.06	12:45	0.00	13:33	0.13	14:09	0.38		
Reading # 5 (in)							14:03	0.13	14:19	0.38		
Reading # 6 (in)												
Reading # 7 (in)												
Reading # 8 (in)												
O.D. of Double Ring Infiltrometer (in)	6.00		6.00		6.00		6.00		6.00			
Initial Water Depth (in)	6.00		6.00		6.00		6.00		6.00		6.00	
Final Water Level Drop (in)	1.13		0.06		0.00		0.13		0.38			
Average Reading (in)	1.19		0.06		0.00		0.13		0.38			
Infiltration Rate (in/hr)	7.13		0.13		0.00		0.25		2.25			
Safety Factor	2.00		2.00		2.00		2.00		2.00			
Corrected Infiltration Rate (in/hr)	**3.56**		**0.06**		**0.00**		**0.13**		**1.13**			
Observations:			black variable FILL		Perched water at 3'		Perched water at 3'				Perched water at 4'	

Notes:
1. Infiltrometer refilled to water depth of 6 inches (inner and outer ring) after each reading.

TABLE 1
PROPOSED CASINO STADIUM PHILADELPHIA
SOIL SAMPLE RESULTS
VOCS-PESTICIDES-HERBICIDES-PCBS

Client Sample ID:		PA Management of Fill Standards		SW-1 (A)	SW-1 (C)	SW-1 (D)	COMP-1	COMP-2	COMP-3
		Clean Fill (8/7/10)	Regulated Fill (8/7/10)						
Lab Sample ID:				30143814005	30143814006	30143814004	30143814001	30143814002	30143814003
Date Sampled:				3/24/2015	3/24/2015	3/24/2015	3/24/2015	3/24/2015	3/24/2015
Sample Location:				SW-1	SW-1	SW-1	SE Corner	NE Corner	West Side
Sample Depth:				2' - 3'	6' - 7'	8' - 9'	2' - 8'	2' - 6'	2' - 9'
Matrix:	Units			Soil	Soil	Soil	Soil	Soil	Soil
VOCs (SW846 8260)									
Acetone	ug/kg	41,000	110,000	**53.8**	**35.4**	ND (11.6)	ND (19.2)	ND (19.4)	ND (30)
Benzene	ug/kg	130	130	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Bromochloromethane	ug/kg	1,600	1,600	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Bromoform	ug/kg	4,400	4,400	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Bromomethane	ug/kg	540	540	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
2-Butanone (MEK)	ug/kg	54,000	110,000	ND (18)	ND (10.6)	ND (11.6)	ND (19.2)	ND (19.4)	ND (30)
Carbon disulfide	ug/kg	160,000	350,000	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Carbon tetrachloride	ug/kg	260	260	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Chlorobenzene	ug/kg	6,100	6,100	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Chloroethane	ug/kg	5,000	19,000	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Chloroform	ug/kg	2,500	2,500	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Chloromethane	ug/kg	38	38	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Dibromochloromethane	ug/kg	3,200	3,200	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
1,2-Dichlorobenzene	ug/kg	59,000	59,000	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
1,3-Dichlorobenzene	ug/kg	61,000	61,000	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
1,4-Dichlorobenzene	ug/kg	10,000	10,000	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
1,1-Dichloroethane	ug/kg	650	2,700	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
1,2-Dichloroethane	ug/kg	100	100	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
1,1-Dichloroethene	ug/kg	190	190	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
cis-1,2-Dichloroethene	ug/kg	1,600	1,600	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
trans-1,2-Dichloroethene	ug/kg	2,300	2,300	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
1,2-Dichloropropane	ug/kg	110	110	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
cis-1,3-Dichloropropene	ug/kg	NPS	NPS	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
trans-1,3-Dichloropropene	ug/kg	NPS	NPS	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Ethylbenzene	ug/kg	46,000	46,000	**15.9**	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
2-Hexanone	ug/kg	NPS	NPS	ND (18)	ND (10.6)	ND (11.6)	ND (19.2)	ND (19.4)	ND (30)
Methylene chloride	ug/kg	76	76	ND (9)	ND (5.3)	ND (5.8)	**21**	ND (9.7)	ND (15)
4-Methyl-2-pentanone(MIBK)	ug/kg	2,900	6,300	ND (18)	ND (10.6)	ND (11.6)	ND (19.2)	ND (19.4)	ND (30)
Methyl Tert Butyl Ether	ug/kg	280	280	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Styrene	ug/kg	24,000	24,000	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
1,1,2,2-Tetrachloroethane	ug/kg	9.3	9.3	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Tetrachloroethene	ug/kg	430	430	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Toluene	ug/kg	44,000	44,000	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
1,1,1-Trichloroethane	ug/kg	7,200	7,200	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
1,1,2-Trichloroethane	ug/kg	150	150	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Trichloroethene	ug/kg	170	170	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Vinyl chloride	ug/kg	30	27	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
m,p-Xylene	ug/kg	NPS	NPS	ND (18)	ND (10.6)	ND (11.6)	ND (19.2)	ND (19.4)	ND (30)
o-Xylene	ug/kg	NPS	NPS	ND (9)	ND (5.3)	ND (5.8)	ND (9.6)	ND (9.7)	ND (15)
Xylene (total)	ug/kg	990,000	990,000	ND (27)	ND (15.9)	ND (17.4)	ND (28.8)	ND (29.1)	ND (45)
Pesticides (SW846 8081A)									
Aldrin	ug/kg	100	440	NA	NA	NA	ND (40)	ND (39.5)	ND (39.4)
alpha-BHC	ug/kg	46	190	NA	NA	NA	ND (40)	ND (39.5)	ND (39.4)
beta-BHC	ug/kg	220	820	NA	NA	NA	ND (40)	ND (39.5)	ND (39.4)
delta-BHC	ug/kg	11,000	30,000	NA	NA	NA	ND (40)	ND (39.5)	ND (39.4)
gamma-BHC (Lindane)	ug/kg	72	72	NA	NA	NA	ND (40)	ND (39.5)	ND (39.4)
alpha-Chlordane	ug/kg	NPS	NPS	NA	NA	NA	ND (40)	ND (39.5)	ND (39.4)
gamma-Chlordane	ug/kg	NPS	NPS	NA	NA	NA	ND (40)	ND (39.5)	ND (39.4)
4,4'-DDD	ug/kg	6,800	30,000	NA	NA	NA	ND (80)	ND (79)	ND (78.7)
4,4'-DDE	ug/kg	41,000	170,000	NA	NA	NA	ND (80)	ND (79)	ND (78.7)
4,4'-DDT	ug/kg	53,000	230,000	NA	NA	NA	ND (80)	ND (79)	ND (78.7)
Dieldrin	ug/kg	110	440	NA	NA	NA	ND (80)	ND (79)	ND (78.7)
Endosulfan I	ug/kg	110,000	260,000	NA	NA	NA	ND (40)	ND (39.5)	ND (39.4)
Endosulfan II	ug/kg	130,000	260,000	NA	NA	NA	ND (80)	ND (79)	ND (78.7)
Endosulfan Sulfate	ug/kg	70,000	70,000	NA	NA	NA	ND (80)	ND (79)	ND (78.7)
Endrin	ug/kg	5,500	5,500	NA	NA	NA	ND (80)	ND (79)	ND (78.7)
Endrin Aldehyde	ug/kg	NPS	NPS	NA	NA	NA	ND (80)	ND (79)	ND (78.7)
Endrin Ketone	ug/kg	NPS	NPS	NA	NA	NA	ND (80)	ND (79)	ND (78.7)
Heptachlor	ug/kg	680	680	NA	NA	NA	ND (40)	ND (39.5)	ND (39.4)
Heptachlor Epoxide	ug/kg	1,100	1,100	NA	NA	NA	ND (40)	ND (39.5)	ND (39.4)
Methoxychlor	ug/kg	630,000	630,000	NA	NA	NA	ND (400)	ND (395)	ND (394)
Toxaphene	ug/kg	1,200	1,200	NA	NA	NA	ND (400)	ND (395)	ND (394)
Herbicides (SW846 8151)									
2,4-D	ug/kg	1,800	1,800	NA	NA	NA	ND (12)	ND (12)	ND (12)
2,4,5-T	ug/kg	1,500	1,500	NA	NA	NA	ND (6)	ND (6)	ND (5.8)
2,4,5-TP	ug/kg	22,000	22,000	NA	NA	NA	ND (6)	ND (6)	ND (5.8)
Dicamba	ug/kg	NPS	NPS	NA	NA	NA	ND (3.6)	ND (3.6)	ND (3.5)
PCBs (SW846 8082)									
Aroclor-1016	mg/kg	15,000	200,000	NA	NA	NA	ND (200)	ND (198)	ND (197)
Aroclor-1221	mg/kg	630	2,500	NA	NA	NA	ND (200)	ND (198)	ND (197)
Aroclor-1232	mg/kg	500	2,000	NA	NA	NA	ND (200)	ND (198)	ND (197)
Aroclor-1242	mg/kg	16,000	62,000	NA	NA	NA	ND (200)	ND (198)	ND (197)
Aroclor-1248	mg/kg	9,900	44,000	NA	NA	NA	ND (200)	ND (198)	ND (197)
Aroclor-1254	mg/kg	4,400	44,000	NA	NA	NA	ND (200)	ND (198)	ND (197)
Aroclor-1260	mg/kg	30,000	130,000	NA	NA	NA	ND (200)	ND (198)	ND (197)

Notes:
ug/kg - micrograms per kilogram
mg/kg - milligrams per kilogram
ND - Non Detect
NA - Not Analyzed
NPS - No Published Standard
( ) - Laboratory Reporting Limit
Bold values indicate parameter exceeds the laboratory reporting limit.

TABLE 1 (CONT.)
PROPOSED CASINO STADIUM PHILADELPHIA
SOIL SAMPLE RESULTS
SVOCS-RCRA METALS

Client Sample ID:		PA Management of Fill Standards		SW-1 (A)	SW-1 (C)	SW-1 (D)	COMP-1	COMP-2	COMP-3
		Clean Fill (8/7/10)	Regulated Fill (8/7/10)						
Lab Sample ID:				30143814005	30143814006	30143814004	30143814001	30143814002	30143814003
Date Sampled:				3/24/2015	3/24/2015	3/24/2015	3/24/2015	3/24/2015	3/24/2015
Sample Location:				SW-1	SW-1	SW-1	SE Corner	NE Corner	West Side
Sample Depth:				2' - 3'	6' - 7'	8' - 9'	2' - 8'	2' - 6'	2' - 9'
Matrix:	Units			Soil	Soil	Soil	Soil	Soil	Soil
SVOCs (SW846 8270C)									
Acenaphthene	ug/kg	2,700,000	4,700,000	NA	NA	NA	**417**	**453**	**691**
Acenaphthylene	ug/kg	2,500,000	6,900,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
Anthracene	ug/kg	350,000	350,000	NA	NA	NA	**1,260**	**1,260**	**1,580**
Benzo(a)anthracene	ug/kg	25,000	110,000	NA	NA	NA	**2,660**	**3,840**	**3,950**
Benzo(a)pyrene	ug/kg	2,500	11,000	NA	NA	NA	**2,290**	**3,470**	**3,580**
Benzo(b)fluoranthene	ug/kg	25,000	110,000	NA	NA	NA	**3,450**	**5,820**	**5,840**
Benzo(g,h,i)perylene	ug/kg	180,000	180,000	NA	NA	NA	**815**	**746**	**850**
Benzo(k)fluoranthene	ug/kg	250,000	610,000	NA	NA	NA	**1,540**	**2,580**	**2,300**
Benzyl Alcohol	ug/kg	400,000	1,100,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
4-Bromophenylphenyl ether	ug/kg	NPS	NPS	NA	NA	NA	ND (390)	ND (392)	ND (388)
Butylbenzylphthalate	ug/kg	10,000,000	10,000,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
4-Chloro-3-methylphenol	ug/kg	NPS	NPS	NA	NA	NA	ND (390)	ND (392)	ND (388)
4-Chloroaniline	ug/kg	19,000	52,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
bis(2-Chloroethoxy)methane	ug/kg	NPS	NPS	NA	NA	NA	ND (390)	ND (392)	ND (388)
bis(2-Chloroethyl)ether	ug/kg	3.9	17	NA	NA	NA	ND (390)	ND (392)	ND (388)
bis(2-Chloroisopropyl)ether	ug/kg	8,000	8,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
2-Chloronaphthalene	ug/kg	6,200,000	18,000,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
2-Chlorophenol	ug/kg	4,400	4,400	NA	NA	NA	ND (390)	ND (392)	ND (388)
4-Chlorophenylphenyl ether	ug/kg	NPS	NPS	NA	NA	NA	ND (390)	ND (392)	ND (388)
Chrysene	ug/kg	230,000	230,000	NA	NA	NA	**2,410**	**3,650**	**3,870**
Dibenzo(a,h)anthracene	ug/kg	2,500	11,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
Dibenzofuran	ug/kg	NPS	NPS	NA	NA	NA	**428**	ND (392)	**474**
1,2-Dichlorobenzene	ug/kg	59,000	59,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
1,3-Dichlorobenzene	ug/kg	61,000	61,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
1,4-Dichlorobenzene	ug/kg	10,000	10,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
3,3'-Dichlorobenzylphthalate	ug/kg	8,300	32,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
2,4-Dichlorophenol	ug/kg	1,000	1,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
Diethylphthalate	ug/kg	160,000	160,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
2,4-Dimethylphenol	ug/kg	32,000	87,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
Dimethylphthalate	ug/kg	NPS	NPS	NA	NA	NA	ND (390)	ND (392)	ND (388)
Di-n-butylphthalate	ug/kg	1,500,000	4,100,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
4,6-Dinitro-2-methylphenol	ug/kg	NPS	NPS	NA	NA	NA	ND (975)	ND (982)	ND (941)
2,4-Dinitrophenol	ug/kg	210	460	NA	NA	NA	ND (975)	ND (982)	ND (941)
2,4-Dinitrotoluene	ug/kg	50	200	NA	NA	NA	ND (390)	ND (392)	ND (388)
2,6-Dinitrotoluene	ug/kg	1,100	3000	NA	NA	NA	ND (390)	ND (392)	ND (388)
Di-n-octylphthalate	ug/kg	4,400,000	10,000,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
bis(2-Ethylhexyl)phthalate	ug/kg	130,000	130,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
Fluoranthene	ug/kg	3,200,000	3,200,000	NA	NA	NA	**5,720**	**7,910**	**7,910**
Fluorene	ug/kg	3,000,000	3,800,000	NA	NA	NA	**579**	**531**	**759**
Hexachloro-1,3-butadiene	ug/kg	1,200	1,200	NA	NA	NA	ND (390)	ND (392)	ND (388)
Hexachlorobenzene	ug/kg	960	960	NA	NA	NA	ND (390)	ND (392)	ND (388)
Hexachlorocyclopentadiene	ug/kg	91,000	91,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
Hexachloroethane	ug/kg	560	560	NA	NA	NA	ND (390)	ND (392)	ND (388)
Indeno(1,2,3-cd)pyrene	ug/kg	25,000	110,000	NA	NA	NA	**843**	**837**	**979**
Isophorone	ug/kg	1,900	1,900	NA	NA	NA	ND (390)	ND (392)	ND (388)
2-Methylnaphthalene	ug/kg	2,900,000	8,000,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
2-Methylphenol (0-Cresol)	ug/kg	64,000	180,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
3&4-Methylphenol (m&p Cresol)	ug/kg	4,200	12,000	NA	NA	NA	ND (780)	ND (785)	ND (752)
Naphthalene	ug/kg	25,000	25,000	NA	NA	NA	ND (390)	ND (392)	**671**
M-Nitroaniline	ug/kg	33	91	NA	NA	NA	ND (975)	ND (982)	ND (941)
O-Nitroaniline	ug/kg	38	100	NA	NA	NA	ND (975)	ND (982)	ND (941)
P-Nitroaniline	ug/kg	31	86	NA	NA	NA	ND (975)	ND (982)	ND (941)
Nitrobenzene	ug/kg	790	2,200	NA	NA	NA	ND (390)	ND (392)	ND (388)
2-Nitrophenol	ug/kg	5,900	17,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
4-Nitrophenol	ug/kg	4,100	4,100	NA	NA	NA	ND (390)	ND (392)	ND (388)
N-Nitroso-di-n-propylamine	ug/kg	1.3	5.1	NA	NA	NA	ND (390)	ND (392)	ND (388)
N-Nitrosodiphenylamine	ug/kg	20,000	83,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
Pentachlorophenol	ug/kg	5,000	5,000	NA	NA	NA	ND (975)	ND (982)	ND (941)
Phenanthrene	ug/kg	10,000,000	10,000,000	NA	NA	NA	**4,550**	**5,300**	**6,700**
Phenol	ug/kg	66,000	66,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
Pyrene	ug/kg	2,200,000	2,200,000	NA	NA	NA	**4,380**	**6,650**	**6,600**
1,2,4-Trichlorobenzene	ug/kg	27,000	27,000	NA	NA	NA	ND (390)	ND (392)	ND (388)
2,4,5-Trichlorophenol	ug/kg	2,300,000	6,100,000	NA	NA	NA	ND (975)	ND (982)	ND (941)
2,4,6-Trichlorophenol	ug/kg	3,100	8,900	NA	NA	NA	ND (390)	ND (392)	ND (388)
RCRA Metals (SW846 6010B/7471A)									
Arsenic	mg/kg	12	53	NA	NA	NA	**5.9**	**18.5**	**6.2**
Barium	mg/kg	8,200	8,200	NA	NA	NA	**134**	**494**	**207**
Cadmium	mg/kg	38	38	NA	NA	NA	**0.39**	**0.79**	**0.9**
Chromium	mg/kg	190,000	190,000	NA	NA	NA	**44.9**	**25.2**	**22.8**
Lead	mg/kg	450	450	NA	NA	NA	**317**	**440**	**436**
Mercury	mg/kg	10	10	NA	NA	NA	**1.1**	**0.89**	**1.4**
Selenium	mg/kg	26	26	NA	NA	NA	ND (0.56)	ND (0.61)	ND (0.64)
Silver	mg/kg	84	84	NA	NA	NA	ND (0.42)	**0.51**	ND (0.48)

Notes:

ug/kg - micrograms per kilogram

mg/kg - milligrams per kilogram

ND - Non Detect

NA - Not Analyzed

NPS - No Published Standard

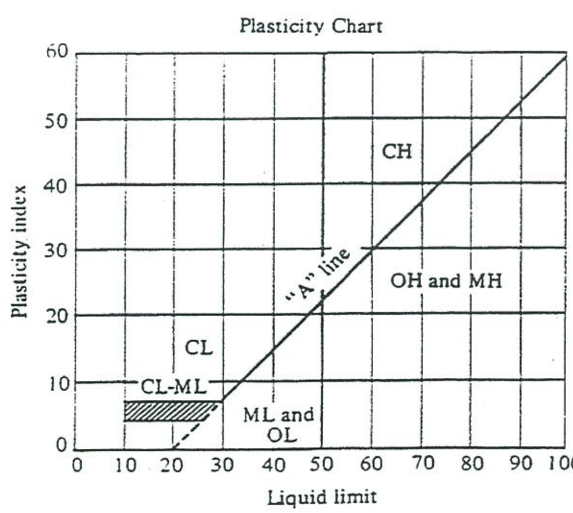
( ) - Laboratory Reporting Limit

Bold values indicate parameter exceeds the laboratory reporting limit.

Bold and shaded values indicate parameter exceeds the PADEP Clean Fill Standards.

Unified Soil Classification System (ASTM D-2487)

Major Divisions			*Group Symbols*	*Typical Names*	*Laboratory Classification Criteria*		
Coarse-grained soils (More than half of material is larger than No. 200 sive size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean Gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent: GW, GP, SW, SP; More than 12 percent: GM, GC, SM, SC; 5 to 12 percent: *Borderline* cases requiring dual symbols [b]	$C_u = D_{60}/D_{10}$ greater than 4; $C_c = (D_{30})^2/D_{10} \times D_{60}$ between 1 and 3	
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciablle Amount of fines)	GM[a] d / u	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring the use of dual symbols
			GC	Clayey Gravels, gravel-sand-clay mixtures		Atterberg Limits below "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines		$C_u = D_{60}/D_{10}$ greater than 6; $C_c = (D_{30})^2/D_{10} \times D_{60}$ between 1 and 3	
			SP	Poorly-graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM[a] d / u	Silty sands, sand-silt mixtures		Atterberg limits above "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring the use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine Grained Soils (More than half of material is smaller than No. 200 sieve size)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	Plasticity Chart (see below)		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL	Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		Pt	Peat and other highly organic soils			



[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L is 28 or less and the P.I. is 6 or less; the suffix u is used when L.L. is greater than 28.

[b] Borderline classifications, used for soils possessing the characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

From Winterkorn and Fang, 1975

REFERENCE NOTES FOR BORING LOGS

I. Drilling Sampling Symbols:

SS	Split Spoon Sampler	ST	Shelby Tube Sampler
RC	Rock Core, NX, BX, AX	PM	Pressuremeter
DC	Dutch Cone Penetrometer	RD	Rock Bit Drilling
BS	Bulk Sample of Cuttings	PA	Power Auger (no sample)
HAS	Hollow Stem Auger	WS	Wash Sample

II. Correlation of Penetration Resistances to Soil Properties:

Standard Penetration (Blows/Ft) refers to the blows per foot of a 140 lb. Hammer falling 30 inches on a 2-inch OD split spoon sampler, as specified in ASTM D-1586. The blow count is commonly referred to as the N value.

A. Non-Cohesive Soils (Silt, Sand, Gravel and Combinations)

Density		*Relative Properties*	
Under 3 blows/ft.	Very Loose	Adjective Form	36% to 49%
4 to 10 blows/ft.	Loose	With	21% to 35%
11 to 30 blows/ft.	Medium Dense	Some	11% to 20%
31 to 50 blows/ft.	Dense	Trace	1% to 10%
51 to 80 blows/ft.	Very Dense		
Over 80 blows/ft.	Extremely Dense		

Particle Size Identification

Boulders		8 inches or larger
Cobbles		3 to 8 inches
Gravel	Coarse	1 to 3 inches
	Medium	½ to 1 inch
	Fine	¼ to ½ inch
Sand	Coarse	2.00mm to ¼ inch (dia. of lead pencil)
	Medium	0.42 to 2.00mm (dia. of broom straw)
	Fine	0.074 to 0.42mm (dia. of human hair)
Silt and Clay		0 .0 to 0.074mm (particles cannot be seen)

B. Cohesive Soils (Clay, Silt, and Combinations)

Blows/Ft	*Consistency*	*Unconfined Comp. Strength Q_P(tsf)*	*Degree of Plasticity*	*Plasticity Index*
Under 4	Very Soft	Under 0.25	None to Slight	0 - 4
4 to 5	Soft	0.25-0.49	Slight	5 – 7
6 to 10	Medium Stiff	0.50-0.99	Medium	8- 22
11 to 15	Stiff	1.00-1.99	High to Very High	Over 22
16 to 30	Very Stiff	2.00-3.00		
31 to 50	Hard	4.00-8.00		
Over 51	Very Hard	Over 8.00		

III. Water Level Measurement Symbols

WL	Water Level	BCR	Before Casing Removal
WS	While Sampling	ACR	After Casing Removal
WD	While Drilling	WCI	Wet Cave-In
		DCI	Dry Cave-In

The water levels are those water levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in a granular soil. In clay and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally applied.