GEOTECHNICAL ENGINEERING REPORT
IN
PRELIMINARY DESIGN
I-579 URBAN OPEN SPACE CAP
CITY OF PITTSBURGH
ALLEGHENY COUNTY, PENNSYLVANIA

Prepared for
Sports & Exhibition Authority of Pittsburgh and Allegheny County

and

HDR, Inc.
Pittsburgh, Pennsylvania

Prepared by
American Geotechnical & Environmental Services, Inc.
Canonsburg, Pennsylvania

MAY 2015
A.G.E.S., Inc. Project No. 14083
March 27, 2015

Mr. Roger A. Eaton, P.E.
HDR, Inc.
11 Stanwix Street, Suite 800
Pittsburgh, Pennsylvania  15222

Re:  Geotechnical Engineering Report in Preliminary Design
I-579 Urban Open Space Cap
City of Pittsburgh
Allegheny County, Pennsylvania
A.G.E.S., Inc. Project No. 14083

Dear Mr. Eaton:

American Geotechnical & Environmental Services (A.G.E.S.), Inc. is pleased to present the results of the revised preliminary geotechnical engineering investigation for the above referenced structure. This report was prepared in general accordance with the requirements of the Pennsylvania Department of Transportation’s Design Manual Parts 1 and 4, and Publication 293, the Geotechnical Engineering Manual. Included in this report is our preliminary evaluation of the subsurface conditions that may impact the proposed construction, along with a draft subsurface exploration and laboratory soils testing program.

We wish to extend our appreciation to be of service to you. Should you have any questions or require additional information, please contact us.

Very truly yours,

American Geotechnical & Environmental Services, Inc.

Daniel Martt, P.G.
Project Geologic Specialist

Michael J. Lemansky, Jr., P.E.
Senior Geotechnical Engineer
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1.0 INTRODUCTION

1.1 Location

The project site is located along I-579 in the City of Pittsburgh, Allegheny County, Pennsylvania, between the Bigelow Boulevard/Webster Avenue Bridge on the north and the Centre Avenue Bridge on the south. The project consists of placing a concrete cap over I-579 between the bridges to create an open park space between Chatham Square on the west to Washington Place on the east. Currently, there is a triangular shaped park (Crosstown Park) on the west side between Chatham Street and I-579. The top of the retaining wall above I-579 is approximately 16 feet above the roadbed. There is an existing pedestrian tunnel from the park under Bigelow Boulevard to the north. On the east side there is an existing triangular shaped parking lot bordered by Washington Place on the east and Centre Avenue on the south, with a retaining wall approximately 25 feet above I-579 on the west. Starting on the west side of the I-579 corridor, next to the west retaining wall is the 7th Street outbound ramp (Ramp “E”). The southbound and northbound ramps are east of Ramp E, and the exit to 7th Street at Grant Street is between the southbound and northbound lanes (Ramp “D’’). The project location is presented on a General Highway Map and United States Geological Survey Topographic Map, Figures 1 and 2.

The proposed cap will bear on two (2) abutments located behind the existing retaining walls and pier located on I-579. The loads on the proposed foundations will be required to be transferred to the bedrock below the existing structure foundations. This is to ensure no additional loads or detrimental impacts to the existing foundations or structures.

1.2 Purpose and Scope

The purpose of this investigation was to establish the preliminary soils and geological conditions at the site and to provide recommendations for the subsurface exploration and laboratory testing program. The data obtained in these programs will be used to evaluate foundation alternatives and support development of the Foundation Report.
The following tasks were performed for the preparation of the report:

- Reviewed available geologic, soils, topographic, and mining literature for the structure location. These findings are presented in the District 11-0 Soils/Geological/Hydrological Setting Form (SGH) in Appendix B.

- Performed a geologic field reconnaissance to visually identify any surface features that may have an impact on the proposed structure. These findings are presented in the Field Visit Checklist in Appendix C. Photos are found in Appendix A.

- Prepared this report which documents the data that has been collected.
RECOMMENDATIONS
2.0 RECOMMENDATIONS

The recommendations presented within this report are preliminary and based on the conditions observed during the geologic field reconnaissance and information obtained from the review of available literature. In order to establish the subsurface conditions at the proposed structure, subsurface exploration and laboratory testing programs should be completed.

2.1 Subsurface Boring, Sampling, and Testing Program

A total of ten (10) structure borings are proposed with an estimated 1000 lineal feet of drilling. The borings are intended to characterize subsurface conditions at the proposed structure locations, secure soil and rock samples for laboratory testing, and provide information to develop recommendations for the Foundation Design Report. Four (4) borings are proposed behind the existing retaining wall adjacent to I-579 northbound, three (3) borings behind the existing retaining wall adjacent to I-579 southbound, and three (3) borings drilled on I-579. Due to the existence of the Pittsburgh Red Beds, a weak claystone member at the site, the borings will extend at least twenty (20) feet below the claystone, which is expected to be between elevation 750 and 740 feet. At least 5 feet will be added to cover any coal or weak rock layers. The borings will extend at least 20 feet below anticipated bottom of drilled shaft per PennDOT requirements. Therefore, each boring will be extended to elevation 700 feet. It is assumed a Highway Occupancy Permit will be obtained by HDR, Inc.

For laboratory testing, ten (10) soil classifications, ten (10) unconfined compression tests (bedrock), and three (3) corrosion tests on soil are proposed. The proposed drilling schedule and laboratory testing programs will be submitted upon Type, Size and Location Plan (TS&L) approval. Borings will be located at the anticipated locations of the drilled shafts.
3.0 SUMMARY AND CONCLUSIONS

Based on our site reconnaissance and review of available literature, the following preliminary conclusions were developed.

- The proposed project lies within the Pittsburgh Low Plateau Section of the Appalachian Plateaus Province. This section is characterized by smooth to irregular undulating surfaces, narrow and relatively shallow valleys, and strip mines and reclaimed land.

- According to the soils map, the surficial soils within the project area consist of the Urban Land, either of the Culleoka (UCD, Moderately Steep) or the Rainsboro (URB, Gently Sloping) which are both highly variable in composition and properties. Surface soils could not be observed at the site due to pavement, concrete retaining walls and grass and snow covering.

- Based on the existing borings, the depth to rock should be on the order of 5-15 feet.

- Bedrock underlying the project area belongs to the Pennsylvania aged, Casselman and Glenshaw Formations, Conemaugh Group. The anticipated bedrock interval at the site is most likely the Grafton sandstone, red beds above the Ames limestone, Pittsburgh Red Beds, and the Saltsburg Sandstone with the Upper Bakerstown coal below. Bedrock in the locality typically consists of sandstone, siltstone, claystone and shale with the Ames limestone, Harlem coal and Upper Bakerstown coal as minor members.

- According to the Mining Information Map and the geologic formations at the project site, the Pittsburgh coal is located at approximate elevation 1050 feet approximately 240-270 feet above the project site. The Upper Freeport coal seam is approximately 300 feet below the site and is not mined.

- No visually-obvious environmental concerns were identified during the site reconnaissance. The site was extensively urbanized up to the 1960s, when the Crosstown
Boulevard was constructed. Excavations in the area have encountered historic fill which is considered a potential environmental concern.

- Utility lines are all underground, with telephone and other communication lines under the existing bridges. There are various drainage inlets around the site, which are marked on the site reconnaissance plans.

- Maintenance and protection of traffic in accordance with Publication 213 will be required to drill on I-579. Most likely nighttime drilling will be required.
4.0 PHYSIOGRAPHIC SETTING

4.1 Topographic Features

The site is located in the Pittsburgh Low Plateau Section of the Appalachian Plateau Physiographic Province which consists typically of smooth undulating uplands, cut by numerous, narrow, relatively shallow valleys. The project is located just east of the Golden Triangle of Pittsburgh, between the Bigelow Boulevard and Centre Avenue Bridges over I-579 (and associated on and off ramps).

4.2 Soil Conditions

According to the USDA Soil Survey of Allegheny County, Pennsylvania (SGH Figure 3), the soil units mapped at the project location are Urban soils. Urban Soils are chiefly human transported soils hauled in and placed over natural soils. Due to the wide range of constituents, these soils exhibit highly variable engineering properties. It is anticipated that the soils of the Urban Land would consist of a mixture of different soil types as well as the rock overburden excavated during past roadway construction.

The majority of the site is mapped as Urban Lands-Culleoka, Modestly Steep (UCD). Culleoka soils are well drained. The southwestern corner of the site is mapped as Urban Lands-Rainsboro, Gently Dipping. Rainsboro soil are moderately well drained. No soil classification or properties are available for Urban Land soils.

Soil descriptions from the Crosstown Boulevard Construction (Appendix D, Previous Structure and Boring Information) and the nearby Lower Hill Redevelopment Project Borings (Appendix E) indicate silts, clays and clayey silts, presumably fill materials, underlain by red and gray clays of low plasticity (USCS, CL) with decomposed shale to refusal, generally between elevations 780-790. This would put top of bedrock on the west side of the site at or near surface elevation, and at least 20 feet below the ground surface on the east side.
4.3 Bedrock Geology

The bedrock at the site belongs to the Pennsylvanian aged Casselman and Glenshaw Formations, part of the Conemaugh Group (SGH Figures 5 and 6). Based on the literature review and available boring information, the near surface bedrock at the project location belongs to the lower portion of the Casselman Formation. The bedrock is anticipated to consist of Grafton sandstone and red beds above the Ames limestone. The red beds above the Ames are described as brown, red and gray or gray shale, sometimes limey. The top of the Ames limestone is defined as the top of the Glenshaw formation. The borings for the Crosstown Boulevard and the Lower Hill Redevelopment borings, describe the Ames member as either limey shale or limestone with fossils, the bottom elevation being 762.5 and 768 feet. Below this shale/limestone layer is the Pittsburgh Red Beds, described as red and gray shale, sometimes limey. At least one (1) boring (B-23, Appendix D) describes a thin, carbonaceous layer within the shale or claystone, which also may be the Harlem member. Around elevation 744-750, sandstone is found, which may be the Upper Saltsburg member. A dark “siltstone” is noted around elevation 726, which could be the Upper Bakerstown member.

4.4 Structural Geology

According to the Coal Outcrop Lines and Structure Contours Map of the Pittsburgh coal (SGH Figure 4), the site is located on the west flank of the McMurry syncline. Bedrock in the immediate vicinity is relatively flat (about 162 feet per mile to the southwest).

4.5 Mining Conditions

Based on the available literature, the Pittsburgh coal is located at approximately elevation 1050 feet, which is about 240-270 feet above the site and is missing due to erosion. The Upper Freeport coal seam is approximately 310 feet below the location and no mining has occurred.
4.6 Landslides

Based on the Landslide Map (SGH Figure 7) at the project site, no landslides are found near the site, and none are expected in the area. Concrete retaining walls are found on both sides of I-579, and appear in good condition.
5.0 ENVIRONMENTAL CONCERNS

According to mapping from the Pennsylvania Department of Environmental Protection (SGH Figure 14, eFACTS), there is one (1) eFACTS facility near the proposed cap location. The Doubletree by Hilton at 1 Bigelow Square has a waste permit which under normal conditions is exempt from regulation.

According to available historic aerial photos (SGH Figures 10, 11, 12, and 13), the site was extensively urbanized in the past. Crosstown Boulevard was built during the 1960s, and boring information noted cinders and silt layers. The soil behind the existing retaining walls is presumably fill and residual material, the fill likely being selected borrow for the site. No visually obvious potential hazardous waste concerns were observed during site reconnaissance. However, the possibility of encountering historic fill cannot be ruled out.
6.0 ECONOMIC CONSIDERATIONS

The economically valuable coals in Allegheny County include the Pittsburgh and Upper Freeport coals. The Pittsburgh coal is located at a higher elevation with respect to the bridge site and is not present. The Upper Freeport coal is located approximately 600 feet below the Pittsburgh coal. Based on the structure contours on Figure 4 the base of the Pittsburgh coal, the Upper Freeport coal is estimated to be at Elevation 455 or 310 feet below the site. According to the literature, the coal thickness is inferred to be less than three (3) feet and probably too thin for economical mining.
7.0 SITE INVESTIGATION

A Field Visit Checklist for the proposed structure location is included in Appendix C including map of the photos taken of the site. The following is a summary of the existing conditions that were observed during the site reconnaissance. Selected site photographs are included in Appendix A.

7.1 Site History

Previous structure and boring plans are presented in Appendix D. A review of the plans for the Crosstown Boulevard showed initial construction was in the 1960s, and rehabilitation of the Centre Avenue Bridge took place in the late 1990s. Both the Webster and Center Avenue Bridges were rehabilitated again in 2010.

7.2 Observations

A site reconnaissance was performed on January 8, 2015. The intent of this visit was to provide a preliminary evaluation of the soil and geologic conditions which may affect the design of the proposed replacement structure. Photographs depicting the general site conditions and specific features noted during the field reconnaissance are attached in Appendix A. The data collected from the literature review and site reconnaissance were used to develop the preliminary conclusions and recommendations presented in this report. Pertinent geological field observations are documented in the District 11-0 Field Visit Checklist form contained in Appendix C of this report.

Site reconnaissance of the structure location and the area around it revealed the following observations:

- The topography at the site is relatively flat, rising gently from west to east across the site, with I-579 located in the “bathtub” below.
The Doubletree by Hilton on the west side of Chatham Square is the closest building to the site (Photos 1 and 4).

A small park with a walkway and pedestrian tunnel under Bigelow Boulevard is located adjacent to the west retaining wall (Photos 2, 3, 28, 29, and 30).

There is a slope from the west retaining wall down to the walkway and tunnel in the park. Several trees are located in the park (Photos 5, 6, and 7).

The west retaining wall is in good condition with minor vertical cracking (Photos 8 and 9). There is an overhead sign over Ramp E from downtown to the south, along with light poles (Photo 14).

The northbound and southbound I-579 (right and left in the photos, respectively) are divided by Ramp D to downtown. The middle pier borings would most likely be in this vicinity (Photos 10 and 11). Some pavement cracks were observed in this area.

The east retaining wall is longer and higher than the west retaining wall. The wall is in good condition with minor vertical cracking (Photos 12, 13, 23, 24, and 25). The wall is topped by a tall chain link fence (Photo 15).

The triangular parking lot on the east side slopes gently toward the east retaining wall. There is an obvious break in slope about 20 feet east of the east retaining wall (Photo 17). Cracking and pitting in the parking lot is evident (Photos 16, 17, 18, 19, 20, and 21).

The Bigelow Boulevard Bridge and walkway appear in good condition. There is an existing overhead sign with one foundation on the bridge parapet in the park (Photos 22 and 28).

7.3 Slopes/Landslides

Based on the Landslide Susceptibility Map (SGH Figure 7), there are no slope stability problems at the site. The existing retaining walls appear to be in good condition with minor vertical cracking.
cracking. The foundations of the new Urban Cap will be constructed so to be below the foundations for the walls.

7.4 Site Utilities

Overhead light poles were observed around the site, which are evidently supplied by underground wires. The location of the wires should be determined prior to the drilling program. Telephone and other communication lines appear to be placed under the bridges on either side of the site. No other utility markers were noted during the reconnaissance. Telephone and other communication lines appear to be placed under the bridges on either side of the site on I-579. A utility locator service may be needed for the proposed exploration.

7.5 Adjacent Land and Residence

No existing buildings are located within the project limits. The project will impact Chatham Square and Crosstown Park on the west, as well as the triangular shaped parking lot on the east. These areas will most likely be used as staging areas for the proposed construction.

7.6 Wetlands

No apparent wetlands features were observed during the field view. Available literature does not show wetlands within the project site.
8.0 SOIL, GEOLOGIC AND HYDROLOGIC SETTING

8.1 Soil Conditions

According to the Soils Map (SGH Figure 3), the surficial soils at the project site are Urban Lands (URB and UCD). Urban land soils consist of fill materials placed over natural soils. The Urban Lands soils are very extensive and cover the entire project. The soils in this case would be a mixture of the pre-existing soils and the rock overburden excavated during the construction operations. No surface soils were observed during the site reconnaissance due to the existing pavement and concrete areas.

8.2 General Geology

The Geologic Map (SGH Figure 5) and Generalized Section (SGH Figure 6) indicate the bedrock at the site is located in the Casselman and Glenshaw Formations of the Pennsylvanian age Conemaugh Group. Bedrock in the lower Casselman Formation consists of the Grafton sandstone and Red Beds which is underlain by the Ames limestone. Bedrock in the Glenshaw Formation includes the Pittsburgh Red Beds, Harlem Coal, Saltsburg Sandstones and the Upper Bakerstown Coal. The existing retaining wall drawings (Appendix D) indicate the walls and piers are constructed on bedrock. Available core boring information at the concrete cap location (previous structure and boring information, Crosstown Boulevard and Wylie (Centre) Bridge, Borings 205, 209, 210, and 212 in Appendix D) shows a top of bedrock elevation between 780 to 786.2 feet. Red and gray shales are indicated at the top of bedrock. The base of a limy shale with fossils (believed to be the Ames limestone) is shown at elevations 762.5-765.5. Below the limy shale with fossils is found a gray and red limy shale (believed to be the Pittsburgh Red Beds). The gray and red shale extends to about elevation 745, to the top of a fine-grained sandstone (Boring 23, Lower Hill Redevelopment Project, in Appendix E). A dark gray siltstone is found at elevation 726.2 (believed to be the Upper Bakerstown coal member).
8.3 Structural Geology

The site is located on the west flank of the McMurry syncline (SGH Figure 4). The site is located in a relatively flat area structurally; the bedrock slopes/dips 162 ft/mile to the southwest.

8.4 Stratigraphy

Based on the geologic map of the area, the project site is located stratigraphically at the bottom of the Casselman Formation and top of the Glenshaw Formation between the Red Beds above and below the Ames limestone. The bedrock in this interval typically consists of sandstone, shale, claystone, and limestone.

8.5 Economic Geology

8.5.1 Coal Resources

Based on the Coal Resources of Allegheny County Map (SGH Figure 4), the Pittsburgh coal is located approximate elevation 1050, which is about 240-270 feet above the cap location and is not present near the site. The Upper Freeport coal seam is approximately 310 feet below the bridge location and is not mined.

8.5.2 Oil and Gas

According to available literature there are no oil or gas wells in the immediate vicinity of the structure location (SGH Figure 15).

8.6 Flooding

Based on the Flood Insurance Rate Map (FEMA) (SGH Figure 8), the site is outside any 100- or 500-year flood plain. Given the right conditions, flooding could occur along I-579, which should not affect the proposed cap, as all foundations are proposed to be deep.
8.7 Potential Hazardous Waste

No visual sign of hazardous waste were observed during the field reconnaissance. The Doubletree Hotel located adjacent to Crosstown Park is a permitted facility. The potential exists for encountering historic fill.
SUBSURFACE CONDITIONS
9.0 SUBSURFACE CONDITIONS

9.1 Structure

Previous plans and borings for the existing structure are presented in Appendix D. Based on the existing drawings, bedrock on the west side of the site is expected to be at or near the surface. Bedrock under I-579 is expected to be shallow, within 5-10 feet. Bedrock on the east side of the site is expected to be approximately 20-25 feet.

The bedrock anticipated at the site includes the red beds above the Ames limestone, the Ames limestone (approximately 2.5-3 feet), the Pittsburgh Red Beds (15-20 feet in thickness), and the Upper and Lower Saltsburg Sandstone with the Upper Bakerstown intervening. The sandstone is found at the site at approximately elevation 745 feet. The borings will be advanced 20 feet into competent bedrock, and 20 feet below anticipated bottom of drilled shaft as per PennDOT requirements. Approximately 5 feet will be added for possible weak layers, such a coal. It is estimated the borings will be advanced to elevation 700 feet unless the Pittsburgh Red Beds are deeper than anticipated, where additional drilling may be required.
10.0 ANALYSIS AND INTERPRETATION OF DATA

10.1 Deep Foundations

The proposed structure is a two-span and three-span concrete cap over I-579. It is to be constructed between Chatham Square and Washington Place and will bear on deep foundations drilled to a competent layer. Top of bedrock should be about elevation 785 on the west, and elevation 775 on the east side of the site. Competent bedrock (sandstone) is anticipated to be at elevations 745-750. According to PennDOT Design Manuals the borings will be advanced 20 feet into competent bedrock, and 20 feet below any anticipated drilled shaft elevation.
REFERENCES


8. Pennsylvania Ground Water Inventory System (PaGWIS), Commonwealth of Pennsylvania, Department of Environmental Services, Topographic and Geologic Survey.

10. Pennsylvania Spatial Data Access, Penn State University Compendium, “Oil and Gas Wells of PA, 2006, Web Site:


APPENDIX A
SELECTED SITE PHOTOGRAPHS
Photo 1: View SE of Crosstown Park along Chatham Square.

Photo 2: View NE of Crosstown Park walkway and tunnel under Bigelow Blvd.
Photo 3: View of entrance walkway to tunnel.

Photo 4: View NW along Chatham Square.
Photo 5: View north along west retaining wall.

Photo 6: View SW toward tunnel entrance under Bigelow Blvd.
Photo 7: View south along top of west retaining wall.

Photo 8: View of west retaining wall adjacent to Center Ave. Bridge and Ramp E.
Photo 9: Closeup of vertical cracks in west retaining wall (Photo 8).

Photo 10: View of Exit Ramp D to 7th Avenue (downtown).
Photo 11: Closeup of exit ramp to the 7th Ave. (Photo 10).

Photo 12: View of NB I-579 and east retaining wall adjacent to Centre Ave.
Photo 13: View of vertical cracks in east retaining wall adjacent to Centre Ave.

Photo 14: View of sign over SB I-579 lanes.
Photo 15: View north along top of east retaining wall.

Photo 16: View of pavement cracks, SW corner of parking lot.
Photo 17: View north, pavement cracks along break in slope, east parking lot.

Photo 18: View west pavement cracks in east parking lot.
Photo 19: View NW, pavement cracks and depression in east parking lot.

Photo 20: View NW, depression in east parking lot.
Photo 21: View west showing break in slope in east parking lot.

Photo 22: View SW, along Bigelow Blvd. walkway.
Photo 23: View south along east retaining wall, NB I-579 lanes.

Photo 24: View SE of east retaining wall.
Photo 25: Closeup of east retaining wall vertical cracks (Photo 24).

Photo 26: View south along west retaining wall.
Photo 27: View south of Crosstown Park and tunnel walkway.

Photo 28: View east along Bigelow Blvd. walkway.
Photo 29: View south of Crosstown Park from tunnel.

Photo 30: View SE of Crosstown Park from tunnel.
APPENDIX B
SOILS/GEOLOGICAL/HYDROLOGICAL SETTING FORM
SOILS/GEOLOGICAL/HYDROLOGICAL SETTING

Project Name: **SEA (Sports and Exhibition Authority) SR-0579 Urban Open Space Cap**

S.R. 0579 Section/Segment - -

General Location: See Figure 1

Specific Location: State Route 0576, between Bigelow Blvd./Webster Avenue and Centre Avenue Bridges

Project Description: Construct Cap/Urban Park over Roadway

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<th>Allegheny</th>
<th>Municipality(ies)</th>
<th>City of Pittsburgh</th>
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<td>Dan Martt</td>
<td>Date: 1-15-15</td>
<td>Checked By:</td>
<td>JJF</td>
<td>Date: 1/16/15</td>
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<tr>
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1.0 SURFACE ELEVATION

1.1 From U.S.G.S. Topographic Map* (Figure 2)

**U.S.G.S. 7.5 Minute Quadrangles (Terrain Navigator Spot Elevations)**

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<td>Project Ending</td>
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1.2 From Site Plans, (Sports & Exhibition Authority), (Figure 2A)

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<td>Intermediate Point(s)</td>
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<td>East Abutment</td>
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<tr>
<td>Project Ending</td>
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2.0 DESCRIPTION(S) OF SOIL(S)

2.1 From USDA Soil Survey of Allegheny County (References 11, 15), (Figure 3)
SOILS/GEOLOGICAL/HYDROLOGICAL SETTING

According to the soil survey mapping, the site is divided into two soil types, Urban Land- Culleoka Complex, Moderately Steep (UCD) and Urban Land-Rainsboro Complex, Gently Sloping (URB). Both soils have man-made fill as their parent material. Due to the mixture of soils, they are unrated for corrosion of concrete and steel, and for shallow excavations. Culleoka soils are derived from fine loamy residuum from weathered sandstone and siltstone, and are well drained. Rainsboro soils are derived from alluvium, and are moderately well drained.

A soil classification for Lower Hill Redevelopment site in 3-foot thick alluvial soil layer, 15-17’ deep, showed a USCS classification of CL, AASHTO A-4(3) (From Reference 15).

2.2 Erosion Characteristics (Reference 11), (Figure 3)

Urban soils are unrated for K factor (rock free or whole soil) or the T factor (annual rate of erosion without affecting crop productivity).

3.0 APPROXIMATE ELEVATION OF STRATIGRAPHIC UNIT AND BEDROCK INCLINATION
(From Structure Contour Map), (References), (Figure 4)

(Stratigraphic Unit, Pittsburgh Coal Structure Contour)

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<th>Surface Elevation</th>
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Approximate bedrock inclination: 162 ft./mile to S.W. As indicated by the structure contour lines around the project area

4.0 APPROXIMATE ELEVATION OF STRATIGRAPHIC UNIT (Reference 14)
(From Previous Boring Information)*

<table>
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<th>Previous Boring Information</th>
<th>Average elevation of Ames limestone (from borings)</th>
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<td>Outcrop Contour Elevation</td>
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<tr>
<td>I-579 Cap</td>
<td>762.5-768.0*</td>
</tr>
</tbody>
</table>

*Approximate bottom of limestone
SOILS/GEOLOGICAL/HYDROLOGICAL SETTING

5.0 GEOLOGIC DEFINITION OF PROJECT AREA (References 4, 13) (Figures 5, 6)

<table>
<thead>
<tr>
<th>Project Location</th>
<th>Stratigraphic Unit</th>
<th>Formation</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-579 Cap</td>
<td>Grafton Sandstone to Bakerstown Coal and Limestone</td>
<td>Glenshaw/Casselman</td>
<td>Conemaugh</td>
</tr>
</tbody>
</table>

6.0 LANDSLIDES AND RELATED FEATURES (Reference 9), (Figure 7)

According to the available literature the project area has no potential slope stability problems. Existing retaining walls are located on the sides of I-579 at the site. Site reconnaissance indicated no potential slope stability problems.

7.0 MINING, MINE SUBSIDENCE POTENTIAL AND MINE FIRES (References 4,12, 13)

Based on sections 3.0 and 4.0, the Pittsburgh coal is about 280 feet above the site and is absent. No other coal beds are mined or expected to be mined under the site, due to either mineable thickness or the presence of the urban nature of the site.

8.0 KARST FEATURES (References 7, 12, 13), (Figures 5,6)

Based on the geologic setting, no karst features are expected at the site.

9.0 FLOOD POTENTIAL (Reference 10), (Figure 8)

Based on FEMA Flood Maps, there are no flood hazards at the site.

10.0 STREAM AND/OR RIVER BANK STABILITY

There are no streams at or near the site.
SOILS/GEOLOGICAL/HYDROLOGICAL SETTING

11.0 GROUNDWATER CONDITIONS (References 12, 13, 14) (Figure 9)

Based on the Pennsylvania Groundwater Information System (PAGWIS), there are 98 groundwater wells within one (1) mile of the site. Most are drilled in the glacial-alluvial sediments along the rivers and in the triangle of Pittsburgh and do not reflect water levels at the site.

According to the available literature, the best sources of groundwater in the Conemaugh Group are the sandstones, Water can be found in the shales and limestones in bedding and joint planes, especially near fold axes.

A well was recently drilled by Duquesne University very near the site, at approximate elevation 813 (using Terrain Navigator software). This log shows red and light gray shale (Unit 3) at approximate elevation 774, sandstone at elevation 733 (Unit 6, Saltsburg), and coal at elevation 514 (Unit 25), which may be the Upper Freeport coal. The static water level for the well is shown as 51 feet (approximate elevation 749). The log for the well is shown in the Supplemental Information for the SGH report, and the well location is shown in Figure 9.

12.0 WETLAND IMPACT

12.1 From Hydric Soils Information (Reference 11)

There are no hydric soils occurring at the site.

12.2 From National Wetland Inventory Maps (Reference 5)

Freshwater wetlands were not identified in or around the project site.

13.0 OIL AND GAS WELLS (Reference 6) (Figure 15)

The Oil and Gas Fields of Pennsylvania Map shows that there are no oil or gas wells in the vicinity of the project area.

14.0 AERIAL PHOTOGRAPHY (Figures 10, 11, 12, 13)

Aerial photography shows that the area was all urban in 1939 and 1957. By 1967 the Crosstown Expressway (I-576) is in place and the Civic (Mellon) Arena built. The arena was demolished in 2012 to make way for the Lower Hill redevelopment project.
SOILS/GEOLOGICAL/HYDROLOGICAL SETTING

15.0 INDICATORS FOR POTENTIAL HAZARDOUS WASTE (Reference 14)

Based on a limited review of the available literature there are no indicators for the potential hazardous waste at the project site area. However, the area was extensively urbanized in the past. Excavations in the vicinity have encountered historic fill which is considered a potential environmental concern.

16.0 REMARKS/SUMMARY

- Available topographic information indicates the project site elevation is approximately 766 to 809 feet.

- The soil at the project site is Urban soils; properties of the soils are random, including corrosivity to steel and concrete, soil classifications and erodibility. Previous borings encountered various amounts of fills and residual soils in the overburden.

- Previously completed test borings show the top of rock elevations at the site range from elevations 780 to 790 feet.

- The bedrock at the site is at the contact of the Pennsylvanian aged Glenshaw and Casselman Formation. The specific bedrock anticipated interval includes Red Beds (claystone and shale) above and below the Ames limestone.

- The available mapping for the site shows the underlying Upper Freeport coal is nonexistent or nonmineable the site. There were no deep mining operations below the site and therefore there is no risk of mine subsidence.

- Johnson (Reference 13) indicates the interval between the Ames limestone and the Pittsburgh coal at the western edge of the Pittsburgh Quadrangle at 283 feet. Using this and the elevation of the Ames limestone in Boring GMI B-23 for the new arena, the Pittsburgh coal should outcrop at about elevation 1050 which is above the site elevation.

- The landslide susceptibility map for Allegheny County indicates that the project site area is not designated as area susceptible to landslides.

- There are no wetlands within the immediate vicinity of the project area.

- FEMA flood map indicates no base flood elevations are determined.

- Available aerial photograph shows that the area surrounding the site has historically (between 70-80 years ago to the present) been urbanized. Developments in the late 50’s and 60’s brought the Crosstown Expressway and the Civic Arena. Excavation in these urban areas have encountered historic fill which is considered a potential environmental concern.
## WATER WELL DETAILS

<table>
<thead>
<tr>
<th>Well Driller:</th>
<th>DILLAN WELL DRILLING INC</th>
<th>PA Well ID:</th>
<th>526261</th>
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</thead>
<tbody>
<tr>
<td>Driller License:</td>
<td>0375</td>
<td>Driller Well ID:</td>
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<tr>
<td>Type of Activity:</td>
<td>New Well</td>
<td>Local Permit #:</td>
<td></td>
</tr>
<tr>
<td>Original Well By:</td>
<td>CURRENT DRILLER</td>
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<td></td>
</tr>
<tr>
<td>Date Drilled:</td>
<td>8/15/2014</td>
<td>Drilling Method:</td>
<td>AIR PERCUSSION</td>
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</table>

Owner: Duquense University  
Address of Well: 1200 Forbes Ave.  
County: ALLEGHENY  
Municipality:  
Coordinate Method: Commercial Street Atlas Program  
Quadrangle:  
Latitude: 40.4379  
Longitude: -79.98875  
Zipcode: 15219  

<table>
<thead>
<tr>
<th>Well Depth (ft):</th>
<th>350</th>
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<th>OPEN HOLE</th>
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<tr>
<td>Depth to Bedrock (ft):</td>
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<td>Well Yield (gpm):</td>
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<td>Static Water Level:</td>
<td>51</td>
<td>Water level after yield test:</td>
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<td>(ft below land surface)</td>
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<td>(ft below land surface)</td>
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<td>Saltwater Zone (ft):</td>
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<td>(minutes)</td>
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<tr>
<td>Use of Well:</td>
<td>TEST</td>
<td>Use of Water:</td>
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## DRILLER'S LOG

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<th>UNIT BOTTOM</th>
<th>DESCRIPTION OF UNITS PENETRATED</th>
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</thead>
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<td>Unit Bottom 1: 22</td>
<td>Unit 1: sandy clay</td>
</tr>
<tr>
<td>Unit Top 2: 22</td>
<td>Unit Bottom 2: 32</td>
<td>Unit 2: gr. sandy shale</td>
</tr>
<tr>
<td>Unit Top 3: 32</td>
<td>Unit Bottom 3: 39</td>
<td>Unit 3: red &amp; lt. gr shale</td>
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</tbody>
</table>

http://www.iframerapps.dcnr.state.pa.us/topgeo/PaGWIS_Search/DisplayReportDetails.as... 1/12/2015
<table>
<thead>
<tr>
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<td>39</td>
<td>57</td>
<td>lt. gr. shale</td>
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<tr>
<td>57</td>
<td>71</td>
<td>red shale</td>
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<tr>
<td>71</td>
<td>80</td>
<td>green sandstone</td>
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<td>lt. gr. sandy shale</td>
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<tr>
<td>86</td>
<td>94</td>
<td>gr. shale</td>
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<tr>
<td>94</td>
<td>105</td>
<td>red &amp; lt. gr. shale</td>
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<tr>
<td>105</td>
<td>108</td>
<td>dk. gr. shale</td>
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<td>108</td>
<td>114</td>
<td>lt. gr. shale</td>
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<td>114</td>
<td>131</td>
<td>lt. gr. sandy shale</td>
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<td>131</td>
<td>134</td>
<td>lt. gr. sandstone</td>
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<tr>
<td>134</td>
<td>138</td>
<td>coarse lt. gr. sandstone</td>
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<td>138</td>
<td>141</td>
<td>gr. shale</td>
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<td>155</td>
<td>red &amp; lt. gr. shale</td>
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<td>155</td>
<td>186</td>
<td>lt. gr. sandy shale</td>
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<td>186</td>
<td>194</td>
<td>dk. gr. shale</td>
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<td>254</td>
<td>medium lt. gr. sandstone</td>
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<td>254</td>
<td>259</td>
<td>coarse lt. gr. sandstone</td>
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<td>259</td>
<td>284</td>
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<td>284</td>
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<tr>
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</tbody>
</table>

**BOREHOLE**

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<thead>
<tr>
<th>Section 1</th>
<th>Top: 0 Bottom: 43 Diameter: 12</th>
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</thead>
<tbody>
<tr>
<td>Section 2</td>
<td>Top: 43 Bottom: 350 Diameter: 8</td>
</tr>
</tbody>
</table>

http://www.iframeapps.dcnr.state.pa.us/topogeo/PaGWIS_Search/DisplayReportDetails.as... 1/12/2015
## CASING

**Casing 1:**
- Top: 0
- Bottom: 44
- Diameter: 8.63
- Material: STEEL

**Seal(Grout) 1:**
- Top: 0
- Bottom: 43
- Type: BENTONITE CHIPS OR PELLETS

## SCREEN/SLOT

## WELL LINER

## PACKER

## WATER BEARING ZONE

**Zone 1:**
- Top: 55
- Bottom: 60
- Yield: 4
17.0 SUPPLEMENTAL INFORMATION
18.0 REFERENCES

1. Pennsylvania Ground Water Inventory System (PaGWIS), Commonwealth of Pennsylvania, Department of Environmental Services, Topographic and Geologic Survey.
5. PA Spatial Data Access, Allegheny County, National Wetlands Inventory, Web Site: http://maps.psidee.psu.edu/preview/map.ashx?layer=1213
18.0 REFERENCES (Continued)


16. United States Environmental Protection Agency, Toxic Release Inventory (http://www2.epa.gov/toxics-release-inventory-tri-program)

17. Pennsylvania Department of Environmental Protection, eFACTS on the Web, www.ahs.dep.pa.gov/eFACTS.

FIGURES
MAP UNIT LEGEND

URB - Urban land - Rainsboro complex, gently sloping
UCD - Urban land - Culleoka complex, moderately steep

SOURCE: US Dept of Agriculture, Soil Data Mart; Soil Survey for Allegheny County, PA

SOILS MAP

PROJECT: 14083
DRAWN: RJS
DATE: JAN. 2015
SCALE: 1" = 1000'
FIGURE: 3
EXPLANATION

CROP LINES

- Redstone coal
- Pittsburgh coal

Anticline
Showing axial-plane trace and direction of plunge.

Syncline
Showing axial-plane trace and direction of plunge.

Structure contour
Altitude of the base of the Pittsburgh coal, in feet above mean sea level. Contour interval 20 feet.

PROJECT LOCATION

SOURCE: PA Dept. of Environmental Resources, Bur. of Topographic & Geologic Survey; Coal Resources of Allegheny Co., PA

SPRINGS & EXHIBITION
AUTHORITY OF PITTSBURGH
I-579 URBAN OPEN SPACE CAP
CITY OF PITTSBURGH
ALLEGHENY COUNTY, PENNSYLVANIA
COAL CROP LINES AND STRUCTURE CONTOURS

PROJECT: 14083
DRAWN: RJS
DATE: JAN. 2015
SCALE: 1" = 2000'
FIGURE: 4
PROJECT LOCATION

SOURCE: PA Bureau of Topographic & Geologic Survey, DCNR; Bedrock Geology of Pennsylvania

SPORTS & EXHIBITION
AUTHORITY OF PITTSBURGH
I-579 URBAN OPEN SPACE CAP
CITY OF PITTSBURGH
ALLEGHENY COUNTY, PENNSYLVANIA

GENERAL GEOLOGY MAP

PROJECT: 14083
DRAWN: RJS
DATE: JAN. 2015
SCALE: 1" = 1000'
FIGURE: 5
<table>
<thead>
<tr>
<th>AGE GROUP</th>
<th>FORMATION</th>
<th>SECTION</th>
<th>MEMBER</th>
<th>THICKNESS IN FEET</th>
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</thead>
<tbody>
<tr>
<td>PENNSYLVANIAN</td>
<td>CONEWHAH</td>
<td></td>
<td>UNDERCLAY AND LIMESTONE</td>
<td>8'-13'</td>
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<td></td>
<td>SANDY SILTSTONE</td>
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</tr>
<tr>
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<td></td>
<td>PITTSBURGH LIMESTONE MEMBER</td>
<td>70'(±)</td>
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<tr>
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<td>INTERBEDDED SANDSTONE, LIMESTONE, SHALE, SILTSTONE AND CLAYSTONE</td>
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<td>CONNELLSVILLE SANDSTONE</td>
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<td>LITTLE CLARKSBURG COAL</td>
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<td></td>
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<td>CLARKSBURG CLAYSTONE &amp; LIMESTONE</td>
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<td>MORGANTOWN MEMBER (SANDSTONE WITH SHALE)</td>
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<tr>
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<td>WHEELERSBURG CLAYSTONE</td>
<td>5'-15'</td>
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<tr>
<td></td>
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<td>WHEELERSBURG SANDSTONE</td>
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</tr>
<tr>
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<td></td>
<td>BIRMINGHAM &quot;SCHENLEY&quot; RED BEDS</td>
<td>5'-15'</td>
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<tr>
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<td>BIRMINGHAM SANDSTONE AND SHALE</td>
<td>45'-70'</td>
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<td>DUQUESNE COAL</td>
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<tr>
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<td></td>
<td>DUQUESNE CLAYSTONE &amp; LIMESTONE</td>
<td>10'-15'</td>
</tr>
<tr>
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<td></td>
<td>GRAFTON SANDSTONE</td>
<td>5'-10'</td>
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<td>RED BEDS</td>
<td>20'-25'</td>
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<td></td>
<td>ANES LIMESTONE</td>
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</tr>
<tr>
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<td></td>
<td></td>
<td>HARLEM COAL</td>
<td></td>
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<td>PITTSBURGH RED BEDS</td>
<td>10'-50'</td>
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<td></td>
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<td>UPPER SALTBURG SANDSTONE</td>
<td>15'-20'</td>
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<tr>
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<td>BAKERSTOWN COAL And LIMESTONE</td>
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<tr>
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<td></td>
<td>MIDDLE And LOWER SALTBURG SANDSTONE</td>
<td>Max. 50'</td>
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<td>WOODS RUN LIMESTONE And COAL</td>
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<td>RED CLAYSTONE</td>
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<td>BUFFALO SANDSTONE</td>
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<td>MAHONING COAL (ERRATIC)</td>
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<td>LOWER MAHONING SANDSTONE</td>
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</tbody>
</table>

**ANTICIPATED BEDROCK**
ENVIRONMENTAL & ENVIRONMENTAL SERVICES, INC.

ENVIRONMENTAL FACILITIES
HAZARDOUS GENERATOR CAPTIVE FACILITIES

SOURCE: http://www.emappa.dep.state.pa.us/emappa

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

Corporate Office: Cannonsburg, PA (724) 916-0000
Branch Offices: King of Prussia, PA (610) 364-0033
Hollidaysburg, PA (814) 666-7600
Baltimore, MD (410) 614-7552

www.agesinc.com

SPORTS & EXHIBITION AUTHORITY OF PITTSBURGH
1-579 URBAN OPEN SPACE CAP
CITY OF PITTSBURGH
ALLEGHENY COUNTY, PENNSYLVANIA

HAZARDOUS WASTE MAP

PROJECT: 14083
DRAWN: RJS
DATE: JAN. 2015
SCALE: 1" = 2000'
FIGURE: 14
APPENDIX C

FIELD VISIT CHECKLIST
FIELD VISIT CHECKLIST

PROJECT NAME: I-77 URBAN OPEN SPACE CAP

S.R. 1-579 SECTION/SEGMENT — STATION/OFFSET

PROJECT LOCATION: BETWEEN BIDLELOW & CENTRE AVENUE BRIDGES

COUNTY: ALLEGHENY MUNICIPALITY(IES): CITY OF PITTSBURGH

DATE OF FIELD VISIT: 1-8-2015 WEATHER: LT. SNOW, COLD

PARTY: D. MAFFIT

ARRIVED SITE: 0800 AM/PM DEPARTED SITE: 1000 AM/PM

PROJECT DESCRIPTION: CONCRETE BRIDGE OVER I-77 BETWEEN BRIDGES; SUPPORTED ON CONSTRUCTED ABUTMENTS AND MIDDLE PIER.

1.0 General Site Inspection

1.1 Inspect slopes on site and note any apparent instability or potential for instability.

*** If slope movement exists, complete section 2.0. ***

THE SIDES OF INTERSTATE ARE SUPPORTED BY CONCRETE RETAINING WALLS, WHICH APPEAR IN GOOD CONDITION.

1.2 Inspect existing on site drainage and associated drainage structures (culverts, pipes, inlets, etc.). Note any problems with existing drainage facilities. Any concerns of future development, adequate on site drainage or adjacent roadways should be noted.

THE SITE APPEARS TO BE ADEQUATELY DRAINED. ALTHOUGH NO DRAINAGE OUTLETS WERE OBSERVED ON THE WEST SIDE OF THE SITE. ON THE EAST SIDE A DRAIN IS LOCATED A LONG THE BASE OF THE RETAINING WALL; THE PARKING LOT STORIES TOWARD THE DRAIN.
1.3 Inspect site for possible hazardous waste contamination. Evidence of possible contamination (55 gallon drums, stressed vegetation, stained soil, paint, oil containers, etc.) should be noted. Previous use of site (gasoline station, industrial plant, etc.) should be investigated for presence of underground tanks or contaminated soil.

* Non-vegetated areas and landfills should also be noted.

**NO EVIDENCE OF HAZARDOUS WASTE CONTAMINATION**

**WAS OBSERVED**

1.4 Inspect site for erosion and note any significant washout areas, evidence of runoff, etc.

**AS THE SITE IS MOSTLY PAVEMENT, NO EROSION OR WASHOUT AREAS WERE OBSERVED**

1.5 Investigate any potential for flooding at the site (old flood markings, etc.).

**NO SIGNS OF FLOODING WERE OBSERVED.**

**THE "BATHTUB" WHERE I-579 IS LOCATED APPEARS TO BE ADEQUATELY DRAINED**

1.6 Determine whether any significant grading, earthwork or excavation will adversely affect any Department structures, roadways, right-of-way, etc.

**THE NEW CAP IS BE SELF SUPPORTED AND NOT IMPACT ON EXISTING FOUNDATIONS. THE MIDDLE PIER CONSTRUCTION WILL ADVERSELY AFFECT EXISTING ROADWAYS AND THE OPE RAMP TO DOWNTOWN**
1.7 Does there appear to be any wetland habitats in the area being investigated as well as adjacent areas?

- NO WETLAND HABITAT WAS OBSERVED

1.8 Inspect site for any sinkholes, settlement or possible evidence of mine subsidence.

- POSSIBLE SINKING WAS OBSERVED ON 1-579 N.A.

    TOWARD THE SUE FLOW STREAME WHERE A SUE W MAN HOLE

    WAS OBSERVED.

1.9 Note presence of any geologic hazards (sink holes, rockfalls, landsliding, etc.).

- NONE OBSERVED

1.10 Inspect existing pavement(s) and note any signs of distress (settlement, cracking, subbase failure, etc.).

- MOOR CRACKING WAS NOTED ALONG 1-579

    THE TRIANGULAR PAVING LOT ON THE EASTSIDE OF THE

    SITE SHOWS CRACKING AND BLANK. A "BREAK" IN THIS

    SIDE TO THE 1-579 WALL WAS OBSERVED

1.11 Inspect existing structures (bridges, culverts, etc.) and note any deterioration and/or
general condition.

- MOOR VERTICAL CRACKING WAS OBSERVED IN THE

    RETAINING WALLS ON BOTH SIDES OF 1-579
1.12 Note any previous drilling, if any, at site (benching, grouting, disturbance to ground/vegetation, instrumentation, etc.). Determine locations for drilling/investigation at site.

**NO PREVIOUS BORING LOCATIONS OBVIOUS**

1.13 Note previous construction, if any, at site (widening, relocation, structure replacement, etc.).

**NO PREVIOUS CONSTRUCTION NOTED**

1.14 Note presence of all utilities at site, both above and below ground (electric, gas, telephone, cable, water, sewer, railroad, etc.).

- Probable Electric line along walkway to tunnel at west side.
- Tunnel at west side on plan, electric.
- Under bridges on both sides of site.

1.15 Note presence of all buildings/structures in vicinity.

**SITE SKETCH**

1.16 Note traffic patterns for any future drilling.

**HEAVY TRAFFIC ALONG 1-574 - DRILL AT NIGHT**
1.17 Interview, if possible, any local residents, project/design engineers, municipal/state employees (police, fire, maintenance, etc.), utility company employees, etc. Note results of interview(s).

1.18 Photograph significant features at site and note.

SEE PHOTOS

1.19 Miscellaneous comments.
APPENDIX D
PREVIOUS STRUCTURE AND
BORING INFORMATION
APPENDIX E
LOWER HILL REDEVELOPMENT
PROJECT BORINGS
**BORING LOG**

**PROJECT:** Mellon Arena (Phases II & III)
**BORING NO.:** B15
**PROJECT NO.:** 0514-372
**DRILLER:** Jose Daugherty
**FIELD GEOLOGIST:** David Christner
**WATER LEVEL DATA:** None Encountered
**DATE:** 10/19/09
**TIME:** 8:00 AM
**CONDITIONS:** Cloudy

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Depth (ft)</th>
<th>Grain Recovery Sample Length</th>
<th>Lithology Change (Depth, ft)</th>
<th>Soil Density</th>
<th>Consistency</th>
<th>Rock Hardness</th>
<th>Color</th>
<th>Black</th>
<th>Asphait</th>
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<td></td>
<td></td>
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<td>Silty clay</td>
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<td>4</td>
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<td></td>
<td></td>
<td>Brown</td>
<td>Sandy clay/</td>
<td>Clastics</td>
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<td>6</td>
<td>2.0</td>
<td>4.0</td>
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<td></td>
<td></td>
<td>Brown</td>
<td>Alternating layers of Silty Sandy clay/chalk &amp; flint</td>
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<tr>
<td>4</td>
<td>8</td>
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<td>Brown</td>
<td>Clastics</td>
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</tr>
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</table>

**FIELD SCREEN (PPI):**

**REMARKS:**

Probe Rejection: Rock
## Test Boring Record

**Driller:** Joe Salisbury  
**Drill Rig:** CME-55 Truck Mount  
**Water Level:** O-Hr. 31.7', 24 Hrs. Rec'ed  
**Casing Hammer:** Wt. lbs., Drop in.  
**Sampler Hammer:** Wt. lbs., Drop in.  
**Sampler Size:** in. O.D., Casing Size in. I.D.  
**Core Bit Size:** NG2  
**Orientation:** Vertical  
**Location:** City of Pittsburgh, Allegheny County, PA  
**Boring No.:** B-23  
**Elevation:** 841.5  
**Surface:** The New Pittsburgh Arena  
**Started:** 08/22/07  
**Completed:** 08/29/07  
**Project No.:** 07054  
**Drilling Fluid:** Water  

<table>
<thead>
<tr>
<th>Elevation</th>
<th>In-situ Tests and Instrumentation</th>
<th>% ROD</th>
<th>RUN-REC</th>
<th>SPOON BLOW</th>
<th>BOTTOM DEPTH OF SAMPLE</th>
<th>DEPTH (FL)</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>841.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0</td>
<td>0.0</td>
<td>TOPSOIL And GRASS</td>
<td></td>
</tr>
</tbody>
</table>
| 841.2     |                                 |      |        | 2         | 1.5                   | 3.5     | Brown and Gray SILTY ROCK  
FRAGMENTS (Shale, Silt, Gravel), Little to Some Sand, Trace to Little Clay, Trace Organics, Loose to Dense, Damp to Moist |        |
<p>|           |                                 |      | 3       |           | 1.5                   | 3       | Slag and Roots in S-4 | (Fill) |
| 826.5     |                                 |      |        | 4         | 1.5                   | 5.0     | Brown SILTY CLAY, Scme Sand, Little Gravel, Stiff, Moist | (Alluvial) |
| 823.5     |                                 |      |        | 5         | 16.5                  | 18.0    | Brown SILTY SAND And GRAVEL, Trace to Little Clay, Medium Dense, Moist | (Alluvial) |</p>
<table>
<thead>
<tr>
<th>ELEV.</th>
<th>Tests and Instrumenta.</th>
<th>ROD %</th>
<th>RUN/REG</th>
<th>SPOON BLOWS</th>
<th>BOTTOM DEPTH OF SAMPLE</th>
<th>DEPTH (ft)</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
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<tbody>
<tr>
<td>006</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>35.5</td>
<td>Gray and Dark Gray SANDSTONE With Interbedded Siltstone Seams, Very Thinly to Irregular Bedding, Very Broken to Blocky, Medium Hard to Hard</td>
<td>Auger Refusal @ 35.5</td>
</tr>
<tr>
<td>011.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30.0</td>
<td>Brown and Gray Decomposed SHALE FRAGMENTS, Little Sand, Little Silt, Little Clay, Very Dense, Dry to Moist</td>
<td>Water @ 30.0</td>
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<tr>
<td></td>
<td></td>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td>31</td>
<td>(Residual)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>50/4</td>
<td>31.4</td>
<td></td>
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<td>50/4</td>
<td>33.4</td>
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<td></td>
<td>6</td>
<td>25.5</td>
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<td>25.0</td>
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</table>
# Test Boring Record

**Driller:** Joe Salisbury  
**Drill Rig:** CME-55 Truck Mount  
**Water Level:** O-Hr. 31.7', 24 Hr. Backfilled  
**Casing Hammer:** Wt. 140 lbs, Drop 30 in.  
**Sampler Size:** 2 in. O.D., Casing Size 3.5 in. I.D.  
**Core Bit Size:** MO2  
**Orientation:** Vertical  

<table>
<thead>
<tr>
<th>Elevation</th>
<th>RDP %</th>
<th>Run Rec.</th>
<th>SPT @ Blow</th>
<th>Bottom Depth</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>193.5</td>
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<td>Continued From Previous Page</td>
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</tbody>
</table>
| 16        | 5.0   | 5.0      |            | 53.0         | .Calcareous With Limestone  
|           |       |          |            |              | Nodules From 55.8-56.5'  
| 56.6      |       |          |            |              | .Clay Seam From 56.5-56.6'  
| 764.9     | 5.0   | 5.0      |            | 58.0         | Gray SILTY CLAY SHALE With  
|           |       |          |            |              | Siltstone Seams, Thily Laminated  
|           |       |          |            |              | to Irregular Bedding. Very Broken  
|           |       |          |            |              | to Blocky, Soft to Medium Hard  
| 772.7     | 5.0   | 5.0      |            | 63.0         | (RQD=39%)  
| 769.2     |       |          |            | 68.0         | Gray Fossiliferous LIMESTONE,  
|           |       |          |            |              | Thin to Indistinct bedding,  
|           |       |          |            |              | Blocky to Massive, Hard  
|           |       |          |            | 68.8         | (RQD=80%)  
|           |       |          |            | 72.5         | Red and Gray Calcareous  
|           |       |          |            | 73.0         | CLAYSTONE, Irregular bedding,  
|           |       |          |            |              | Very Broken to Blocky, Very Soft  
|           |       |          |            |              | to Medium Hard  
|           |       |          |            | (RQD=32%)    |
# Test Boring Record

**Driller:** Joe Salisbury  
**Drill Rig:** CMR-55 Truck Mount  
**Water Level:** 0-Hr. 31.7' 24 Hr. Backfilled  
**Casing Hammer:** Wt. lbs. Drop in.  
**Sampler Hammer:** Wt. 140 lbs. Drop 30 in.  
**Sampler Size:** 2 in. O.D. Casing Size 3 1/2" in. I.D.  
**Core Bit Size:** NQ2  
**Orientation:** Vertical  
**Surveyor:** JPC  
**Location:** City of Pittsburgh, Allegheny County, PA  
**Surface Elevation:** 841.5'  
**Boring No.:** B-23  
**Sheet No.:** 4 of 5 sheets  
**For Lemieux Group LP**  
**The New Pittsburgh Arena**  
**Started:** 08/22/07  
**Completed:** 08/23/07  
**Project No.:** 07054  
**Drilling Fluid:** Water

<table>
<thead>
<tr>
<th>Elevation</th>
<th>In-situ Tests and Instrumentation</th>
<th>RQD</th>
<th>Penetration</th>
<th>Spoon Bows</th>
<th>Bottom Depth of Sample</th>
<th>Depth (ft)</th>
<th>Description</th>
<th>Remarks</th>
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<td>744.7</td>
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<td></td>
<td>26</td>
<td>5.0</td>
<td>5.0</td>
<td>76.0</td>
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<td>'Very Soft Carbonaceous From 73.2-73.6'</td>
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<td>26</td>
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<td>83.0</td>
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<td>'Slickensides Throughout'</td>
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<td>34</td>
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<td>5.0</td>
<td>68.0</td>
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<td>'Calcite Nodules From 76.6-79.9'</td>
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<td>36</td>
<td>5.0</td>
<td>5.0</td>
<td>93.0</td>
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<td>Sandy With Numerous Calcite</td>
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<td></td>
<td></td>
<td>96.0</td>
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<td>Streaks And Nodules Below 90'</td>
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<td>744.7</td>
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<td>32</td>
<td>5.0</td>
<td>5.0</td>
<td>96.0</td>
<td></td>
<td>Gray Very Fine-Grained SANDSTONE;</td>
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<td></td>
<td></td>
<td></td>
<td>Thickly Laminated to Thinly</td>
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<td>Bedded, Blocky to Massive, Hard</td>
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<td></td>
<td></td>
<td>(RQD=86%)</td>
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## TEST BORING RECORD

**Driller:** Joe Salisbury  
**Drill Rig:** CME-55 Truck Mount

**Surface:** Boring No. B-23  
**Elevation:** 641.5

**Location:** City of Pittsburgh, Allegheny County, PA

**Location:** The New Pittsburgh Arena

**Boring for:** Lesieux Group LP

**Started:** 08/22/07  
**Completed:** 08/23/07  
**Project No.:** 07054

**Drilling Fluid:** Water

### ELEVATION

<table>
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<th>ELEVATION</th>
<th>Tests and Instrumentation</th>
<th>RQD</th>
<th>RD-REG</th>
<th>SPONGE BLOWS</th>
<th>BOTTOM OF SAMPLE</th>
<th>DEPTH (Ft)</th>
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<td>88</td>
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<td>726.2</td>
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<td>.Shaly Cleavage Below 107.3'</td>
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<td>.Limestone Seam With Pyrite From 114.7-115.3'</td>
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<td>53</td>
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<td>116.0</td>
<td>116.0</td>
<td>Dark Gray SILTSTONE, Irregular Bedding, Very Broken To Broken, Medium Hard</td>
<td>(RQD=0%)</td>
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**Bottom of Boring @ 116.0'**