

APPENDIX 1

GEOTECHNICAL REPORT

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GEOTECHNICAL INVESTIGATION

**VA MEDICAL CENTER PARKING GARAGE
FAIRWAY DRIVE
HOLIDAYSBURG, PENNSYLVANIA**

Prepared For:

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Prepared by:

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**ACA Project #P13274x10
January 3, 2014**

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1.0 INTRODUCTION

1.1 Authority

This report has been prepared in accordance with the objective and scope of investigation outlined by ACA Engineering, Inc. in its technical proposal dated July 24, 2013, which was presented to Mountain Research, LLC for review and approval.

1.2 Project Objective

The overall objective of the project is to construct a 450 space three-story parking garage at the south lot adjacent to the James E. Van Zandt VA Medical Center in Hollidaysburg, PA

1.3 Scope of Geotechnical Investigation

In order to achieve the above objective, the investigation program consisted of the following tasks:

- ◆ Conduct field reconnaissance.
- ◆ Prepare and perform an exploration program to delineate and characterize the subsurface materials by drilling test borings.
- ◆ Provide inspection during the drilling of test borings to supervise the drilling operation and to log the test borings.
- ◆ Formulate and perform a laboratory testing program on soils to determine material parameters needed for subsequent analyses.
- ◆ Prepare a geotechnical engineering report that documents the data and analyses performed as well as presents the discussions and evaluation of the subsurface conditions, the conclusions regarding the geotechnical engineering behavior of the subsurface materials, and a set of recommendations for the following design aspects:
 - Site preparation
 - Foundation recommendations
 - Slab on Grade recommendations
 - Retaining wall recommendations
 - Pavement recommendations

2.0 SUBSURFACE EXPLORATION PROGRAM

Fifteen (15) soil borings with sampling, B-1 through B-15, were conducted at the proposed site from November 11 through November 14, 2013, by Mountain Research, LLC, under the general supervision of ACA Engineering, Inc., to determine the subsurface conditions (see Test Boring Logs in Appendix E). Test

boring locations were selected by TimHaahs and field located by Mountain Research, LLC. The approximate locations are shown on the Boring Location Plan in Appendix D.

2.1 Soil Sampling

The soil sampling program consisted of obtaining split spoon samples. The spoon samples were obtained by conducting Standard Penetration Test (SPT) by driving a two (2)-inch O.D. Split Spoon Sampler (ASTM D1586). The sampler was generally driven 18 inches into the soil with blows from a 140-pound hammer falling a distance of 30 inches, and the number of blows required to drive the sampler for each six (6)-inch interval was recorded. The cumulative number of blows for the last two six (6)-inch intervals (blows/foot) is termed as Standard Penetration Resistance, which can be correlated with relative density of granular soils or consistency of fine-grained soils and, in turn, their shear strength and compressibility characteristics. The description of the soil samples, based on visual identification which was modified in the light of laboratory test results, and the SPT values at various depths are recorded on the boring logs.

2.2 Rock Core Sampling

Rock was initially sampled by using a diamond bit with NQ2 doubletube core barrel which provides a 2.03 inch diameter core (ASTM D-2113). The rock type description, the core recovery for each coring interval and the Rock Quality Designation (RQD) values expressed in percent for each run are recorded on the test boring logs. The RQD values reflect the quality and fracture spacing of the rock and are calculated as a summation of all unbroken core samples of four (4) inches or more in length divided by the total length of each coring interval. The core recovery and RQD values provide a qualitative understanding of the physical and engineering properties of bedrock.

2.3 Groundwater Readings

Groundwater was not encountered in any of the test borings during drilling operations. It should be noted that the groundwater level at the site may fluctuate in response to precipitation and run-off volumes.

3.0 LABORATORY TESTING PROGRAM

In order to determine the soil parameters, ACA performed laboratory testing to evaluate the on-site soil condition. The test results are in Appendix F. A brief description of testing methodology and test results is presented below.

3.1 Water Content Tests (ASTM D2216)

These tests were performed on selected representative soil samples to determine the water content of in-place soils at the time of drilling. In general, the soil samples were moist, based on an empirical scale of dry, moist, and wet. These conditions, however, would vary depending upon the seasonal and local precipitation.

3.2 Gradation Tests (ASTM D422)

Gradation tests consisting of sieve analysis tests were conducted on selected representative soil samples on which moisture content tests have been conducted. The data from these tests are included in Appendix F.

3.3 Atterberg Limits Tests (ASTM D4318)

Liquid and plastic limit tests were performed on samples that a gradation test had been conducted. In general, the samples tested exhibited low plasticity. The data from these tests are included in Appendix F.

3.4 Unconfined Compression Tests (ASTM D7012)

Unconfined compression tests were performed on two (2) representative samples of the bedrock encountered in the test borings. The data from these tests are included in Appendix F.

3.5 Resistivity Tests (AASHTO T288 Mod)

Resistivity test were performed on two (2) composite samples of soil at a depth of two (2) to four (4) and six (6) to eight (8) feet below the ground surface. Based on the moisture content, soil from two (2) to four (4) feet is highly corrosive, and soil from six (6) to eight (8) feet is moderately corrosive. The data from these tests are included in Appendix F.

4.0 GENERAL SITE CONDITIONS

This section of the report presents project location, general surface and subsurface conditions as well as design and construction considerations of the proposed site and the interaction of these conditions with the construction of the project.

4.1 Site Location

The site is located along Fairway Drive in Hollidaysburg, Blair County, PA. The site is bordered to the north and west by the James E Van Zandt VA

Medical Center complex, to the east by Fairway Drive, and to the south by commercial properties.

4.2 General Geology

The project area lies within the Appalachian Mountain Section of the Ridge and Valley physiographic province. A review of the Geologic Map of Pennsylvania, dated 1980, prepared by the Commonwealth of Pennsylvania Department of Environmental Resources, indicates the bedrock across the project area is Silurian age belonging to the Wills Creek Formation. The Wills Creek Formation is a variegated gray, grayish-red, yellowish-gray and greenish-gray calcareous shale with interbedded limestone, dolomite, and sandstone zones.

4.3 Soil Conditions

According to the Soil Survey of Blair County, Pennsylvania (see map in Appendix B), the soils in the project area have been classified as Urban land-Edom complex, 0 to 8 percent slopes (map symbol UZB).

The Urban land-Edom complex, 0 to 8 percent slopes map unit consists of areas covered by houses, roads, and other structures and areas of deep, well drained Edom soils. The areas are so intermingled that it was not practical to map them separately. The permeability of the Edom soils is moderately slow to moderate. Runoff is medium, and the erosion hazard is moderate. The available water capacity is moderate. The soil is slightly acid and neutral throughout in unlimed areas.

5.0 DISCUSSION AND EVALUATION OF SITE CONDITIONS

This section of the report presents general surface and subsurface conditions as well as design and construction considerations of the proposed site and the interaction of these conditions with the construction of the new structure, retaining walls, roadways, and slopes.

5.1 Surface Conditions

The site is currently an asphalt parking area. The topography of the site is generally level.

5.2 Subsurface Conditions

Fifteen (15) soils borings with sampling, B-1 through B-15, were conducted at the proposed site from November 11 through November 14, 2013, by Mountain Research, LLC, under the general supervision of ACA Engineering,

Inc., to determine the subsurface conditions.

- ◆ Asphalt, mixed with 2B fill material, was encountered at the ground surface in each test boring. The thickness of the asphalt/2B mix ranged from approximately twelve (12) to twenty (20) inches.
- ◆ Natural soils were encountered beneath the asphalt in each test boring. The natural soils consisted of black, light brown, brown, gray, and orange, firm to stiff, silty clay with varying amounts of gravel and rock fragments; and grey, olive, brown, and light brown, soft to hard, clayey silt with varying amounts of weathered to highly weathered shale and shale fragments.
- ◆ Underlying the natural soils, weathered rock was encountered in all test borings except B-4 and B-8. Buff and gray, weathered to highly weathered limestone; and red, gray, light gray, dark gray, brown, light brown, and olive, highly weathered and fragmented shale with varying amounts of sand, clay and silt.
- ◆ Rock was encountered in test boring B-14 at a depth of approximately thirty eight (38) feet below the ground surface. The rock consisted of gray and red, moderately weathered, thinly bedded, somewhat to highly fragmented siltstone. The Rock Quality Designation (RQD) values ranged from seven (7) to sixty three (63) percent.
- ◆ Groundwater was not encountered in any of the test borings during drilling operations. It should be noted that the groundwater level at the site may fluctuate in response to precipitation and run-off volumes.

5.3 Seismic Classification

The site is located in an area anticipated to have a 0.2 second spectral response acceleration of 0.144g and 1.0 second spectral response acceleration of 0.049g according to the 2009 International Building Code prepared by the International Code council. Site class definition for very dense soil and soft rock is Class C, and the corresponding site coefficients of F_a and F_v are 1.2 and 1.7 respectively. Therefore, the adjusted 0.2 second spectral response acceleration is 0.115g and the adjusted 1.0 second spectral response acceleration is 0.056g for this site.

6.0 RECOMMENDATIONS

The analysis and recommendations presented in this report are based on the subsurface conditions disclosed by the site reconnaissance, field exploration, laboratory testing, and office research programs. The following engineering

recommendations are presented concerning site preparation, fill construction, building foundations, slab on grade, retaining walls, slope construction and pavements. It should be noted that soil conditions on site are highly variable and might not become evident until construction is underway.

6.1 Site Preparation

- 6.1.1 Strip the entire proposed construction area of all concrete, asphalt, subbase, and soils contaminated with more than five (5) percent organics by weight. Any soft or unsuitable material encountered should be completely removed and replaced with clean, inert, soil material approved by ACA in accordance with the "GENERAL FILL CONSTRUCTION" section of this report. Also, remove or relocate all of the utilities, if any, as necessary to accommodate the proposed construction.
- 6.1.2 Remove remaining soils, where necessary, to proposed subgrade elevations.
- 6.1.3 Prior to structure support or backfilling operations, all areas should be proofrolled to detect any soft yielding zones. Any yielding zones discovered should be removed or stabilized.
- 6.1.4 Stabilization of isolated unstable subsurface materials may be possible using crushed stone which is "bridged" or "choked" into the yielding materials. An alternate method of subgrade stabilization for the case of soft, moist soils would be to scarify, dry out, and then recompact the moist areas. Diversion ditches and drains may be required in order to stabilize any low areas of the site.
- 6.1.5 All proofrolled areas should be inspected by ACA to evaluate that all unsuitable materials have been removed.
- 6.1.6 Upon subgrade approval, fill the site to grade where necessary as per the "General Fill Construction" section of this report.

6.2 General Fill Construction

- 6.2.1 The soil used for fill construction should be uncontaminated, clean, on-site or off-site material approved by ACA. The soil shall be free of organic matter, peat, rock or gravel larger than 6 inches in any dimension, and other deleterious materials and shall include the following ASTM D-2487 soil classification groups: GW, GP, GM, GC, SW, SP, SM, SC, ML and CL, or a combination of these group symbols.

- 6.2.2 In the areas which are to receive fill, either as part of an undercut and replacement process or for grade raising, the subgrade should first be properly prepared. The subgrade should be scarified.
- 6.2.3 Clayey and silty soils were encountered on site and are susceptible to breakdown by pumping under traffic loads. These soils are also highly sensitive to moisture. When soft clay or silt pockets are encountered during construction and if pumping is initiated, construction traffic should be rerouted and the area should then be restabilized either by drying and recompacting or by adding drainage and then drying and recompacting. Areas allowed to break down will gradually worsen and spread.
- 6.2.4 The first lift of material should be only approximately four (4) inches thick in the loose state. Each lift of soil thereafter should be placed in maximum eight (8) inch loose thickness and should be within plus or minus two (± 2) percent of optimum moisture content as determined by the Modified Proctor Test (ASTM D1557).
- 6.2.5 All fill should be compacted to a minimum density of 95 percent of maximum dry density as determined by the Modified Proctor Test (ASTM D1557).
- 6.2.6 During fill construction and/or subgrade preparation, the contractor should maintain good site drainage. Exposed surfaces should be positively sloped to cause runoff to flow away from the site. If water does pond in any sectors, those areas should be drained and all mud zones or softened soils should be aerated and recompacted before further construction takes place.
- 6.2.7 All fill densities should be evaluated by ACA using nuclear densometers or other approved methods. At least one (1) test per every 3,000 square feet on each lift should be conducted.
- 6.2.8 The above recommendations encompass essential aspects of fill construction. They are not, however, intended to be a complete set of earthwork specifications.

6.3 Building Foundations

Based on the lowest floor elevation of 1134.3', the structure will coincide with the existing ground surface. Based on the elevation of bedrock encountered in the test borings and the anticipated loads for the building, it is recommended that the building be supported by deep foundations.

Caisson Foundations

The weathered shale encountered at depths ranging from six (6) to fifteen (15) feet below that ground surface is adequate to support a matrix of drilled straight shaft caissons. A net, total combined load contact bearing pressure (CBP) of five (5) tons/ft² and skin friction of 100 psf through the natural soils and 500 psf through the weathered shale can be used in the caisson design. In the event additional bearing capacity is required, the siltstone bedrock encountered at a depth of approximately thirty eight (38) feet below the ground surface is adequate to support a matrix of drilled straight shaft caissons with a net, total combined load contact bearing pressure (CBP) of fifteen (15) tons/ft²

ESTIMATED CAISSON DEPTHS*		
Test Boring No.	Type of Material at Bottom of Caisson Elevation	Approximate Caisson Depth
B-1	Weathered Shale	14'
B-2	Weathered Shale	15'
B-3	Weathered Shale	10'
B-4	Weathered Shale	14'
B-5	Weathered Shale	15'
B-6	Weathered Shale	15'
B-7	Weathered Shale	10'
B-8	Weathered Shale	15'
B-9	Weathered Shale	10'
B-10	Weathered Shale	6'
B-11	Weathered Shale	10-15'
B-12	Weathered Shale	10-15'
B-13	Weathered Shale	10-15'
B-14	Weathered Shale	20'
B-15	Weathered Shale	15'

*For caissons bearing in weathered shale.

FOUNDATION PARAMETERS			
Type of Material	Approximate Depth	Skin Friction (psf)	Bearing Capacity (psf)
Natural Soils	5 – 15'	100	2,000
Weathered Shale	15 – 38'	500	10,000
Siltstone Bedrock	38' +	5,000	30,000

1. Caissons should be seated two (2) feet into the rock or at earth auger refusal, whichever occurs first. Earth auger refusal is defined as material which cannot be excavated with foundation drilling rigs applying a minimum of 20,000 pounds of down force and 50,000 foot-pounds of torque, such as a Hughes Tool Company LDH Digger or equal, on a suitable open-helix earth auger in good condition.
2. Any contributory shaft friction and/or adhesion that may develop is to be considered as contributing to the factor of safety and should not be included for downloading design purposes.
3. Concrete design should not allow high variability of slump. A high slump will increase unwanted segregation during placement. A low slump will cause arching within the casing during extraction of the casing, thus allowing soils and water intrusion into the concrete shaft.
4. Temporary or permanent steel casings should be used to protect against water seepage and instability of the vertical cuts.
5. Caisson excavations should be completely dewatered prior to concrete placement. Concreting should immediately follow excavation except when final dewatering is required.
6. Attention should be given to not allowing any surrounding soil or water to mix with concrete if the casings are removed. Concrete should be poured as near as possible to the top of the design caisson elevations prior to casing removal.
7. When withdrawing any temporary steel casings, it is critical that a good head of fluid concrete be maintained inside the casing to prevent groundwater or soil "blow-in" below the bottom edge of the casing.
8. The bearing surface materials should be inspected by an ACA geotechnical engineer for evaluation of its physical characteristics, consistency of support capabilities, and continuity of equivalent structural consideration among the caissons.
9. All grade beams exposed to freezing conditions should be at least three and one-half (3.5) feet below the adjacent finished exterior grade to assure proper frost protection.

6.4 Slab on Grade

The floor slabs will be supported by natural soils. Any soft or unsuitable material encountered should be overexcavated two (2) feet and replaced with suitable material, placed and compacted as per the "GENERAL FILL CONSTRUCTION" of this report. After the overexcavation is completed, any soft areas that may still exist should be stabilized using a minimum of six (6) inches of AASHTO No. 1 stone (maximum size 4"). It may be possible to reuse some of the material provided it is suitable material and properly dried prior to backfill placement. The following are general recommendations for the slab on grade:

- 6.4.1 The floor slab may be designed with a modulus of subgrade reaction (k) of 120 pounds per cubic inch. Floor slabs should be mesh reinforced and should have ample construction joints to help control the locations of shrinkage and settlement cracking. In addition, floor slabs should not be structurally connected to walls or columns.
- 6.4.2 All bearing surfaces should be free of water, contamination, and carbonaceous material prior to concrete placement. Furthermore, concrete should not be placed on frozen soil.
- 6.4.3 Prior to concrete placement, an ACA geotechnical engineer or soils technician should evaluate the suitability of the bearing materials for support of the proposed loads and ensure that no unsuitable materials are present.
- 6.4.4 The use of a polyethylene moisture barrier beneath the floor slab is recommended to break capillary moisture rise. The slab should be placed on a minimum of six (6) inches of granular subbase materials, such as PennDOT 2A, compacted as per the "GENERAL FILL CONSTRUCTION" section of this report.

6.5 Excavated Soils/Materials

The suitability and usage of the excavated materials should be made on site by an ACA engineer during construction operations due to the variable nature of the existing materials. In general, the materials on the site are suitable to use within the engineered fill beneath any buildings or paved areas with the exception of any organic material, coal, or carbonaceous shale that may be encountered.

6.6 New Pavement Support

The following are recommendations for new pavement support for the proposed roadway from the parking garage to Fairway Drive. Any soft, wet zones revealed during site preparation should be removed and/or stabilized as per the "SITE PREPARATION" section. In order to ensure a drained pavement condition, the subgrade should be properly sloped to allow for drainage of water through the subbase materials to collection or outlet points. It is recommended that "stub" or "finger" pavement drains be installed around the catch basins and in other topographically low areas. The pavement drains should consist of 4-inch diameter, perforated PVC pipe surrounded by a minimum of four (4) inches of AASHTO No. 57 stone wrapped in filter fabric. The pavement drain invert should be approximately 12 to 14 inches below the finished grade and should connect to the catch basins or outlet at a suitable location down gradient and away from the pavement areas. Catch basins should include weep holes to receive drainage from the pavement subgrade.

Flexible Pavement Design:

Standard Traffic Areas:

- ◆ Six (6) inches of No. 2A Subbase
- ◆ Three and one-half (3.5) inches of 19 mm Superpave Binder Course
- ◆ One and one-half (1.5) inches of 9.5 mm Superpave Wearing Course

Heavy Duty Areas:

- ◆ Ten (10) inches No. 2A subbase
- ◆ Three and one-half (3.5) inches of 19 mm Superpave Binder Course
- ◆ One and one-half (1.5) inches of 9.5 mm Superpave Wearing Course

Rigid Pavement Design

- ◆ Six (6) inches No. 2A subbase
- ◆ Six (6) inches air-entrained concrete

It should be noted that if poor drainage or other deleterious conditions are allowed to develop, the pavement design given above may become invalid.

6.7 Retaining/Below Grade Walls

It is also our understanding that retaining walls and below grade walls may be utilized on site. Retaining walls should be designed as a retaining wall in "active" conditions. Below grade walls should be designed as walls in "at

rest” conditions. Determination of lateral earth pressure for a horizontal backfill slope can be made utilizing the following relationship:

$$P = \frac{1}{2} \gamma H^2 K + P_s$$

where: P = lateral earth pressure
 γ = unit weight of backfill material
H = height of wall from base of footing to top of wall
K: K_a = coefficient of active earth pressure
 K_p = coefficient of passive earth pressure
 K_o = coefficient of at rest earth pressure
 P_s = uniform surcharge load
where: $P_s = \gamma H K$

Design of the retaining walls should be based on the following criteria:

$$K_a = [(1 - \sin \phi) / (1 + \sin \phi)]$$

$$K_p = [(1 + \sin \phi) / (1 - \sin \phi)]$$

$$K_o = 1 - \sin \phi$$

SOIL PROPERTIES		
Material	Total Unit Weight γ (pcf)	Effective Stress Friction Angle ϕ (deg)
Natural Soils	120	30
New Fill	120	28

Surcharges due to live loads should be considered when estimating loads on permanent structures.

Cohesive soil (clay) should not be used as a backfill material due to its poor drainage characteristics. Proper drainage should be installed to carry water away from the wall.

7.0 GENERAL CONSIDERATIONS

This report has been prepared to present our recommendations with regard to geotechnical aspects of the proposed construction to the owner of the VA Medical Center Parking Garage in Hollidaysburg, Blair County, Pennsylvania. The scope of our services is limited to the specific project and location described herein and the description of the project represents ACA's understanding of the significant aspects relevant to soil, groundwater, and foundation characteristics. In the event that any changes are planned in the design or location of the development from those outlined in this report, ACA should be informed so that the changes can be

reviewed and the conclusions of this report modified as necessary in writing. As a check, we request that we be authorized to review the project plans and specifications to confirm that the recommendations contained in this report have been interpreted and implemented in accordance with our intent. ACA would welcome the opportunity to provide further assistance with regard to foundation designs.

It is recommended that all construction operations dealing with earthworks and foundation construction be reviewed by an experienced geotechnical engineer who can evaluate the conditions encountered and make decisions regarding whether the intent of the recommendations is fulfilled in the actual construction. If requested, ACA Engineering, Inc. and Mountain Research, LLC would welcome the opportunity to provide field monitoring services during construction.

The analysis and recommendations presented herein are based upon data obtained from borings at the locations indicated on the plan and from any other information discussed in the report. Information presented regarding subsurface conditions between borings is based on the engineering judgment of ACA and Mountain Research and could be interpreted differently by others. In the performance of subsurface explorations, specific information is obtained at specific locations at specific times. However, it should be recognized that variations may exist between boring locations and, also, that such situations as groundwater levels vary from time to time. The nature and extent of variations may not become evident until construction is initiated or even completed. If variations become evident during construction it will be necessary to reevaluate the recommendations presented herein after performing on site observations during the construction period.

In preparing this report, the professional services of ACA Engineering, Inc. have been performed, findings obtained, and recommendations prepared in accordance with generally accepted engineering principles and practices. This statement is in lieu of all warranties, either expressed or implied. If you require additional information or clarification of the report recommendations, please contact our office.

ACA ENGINEERING, INC.

Michael G. Suchar, P.E.
Vice President

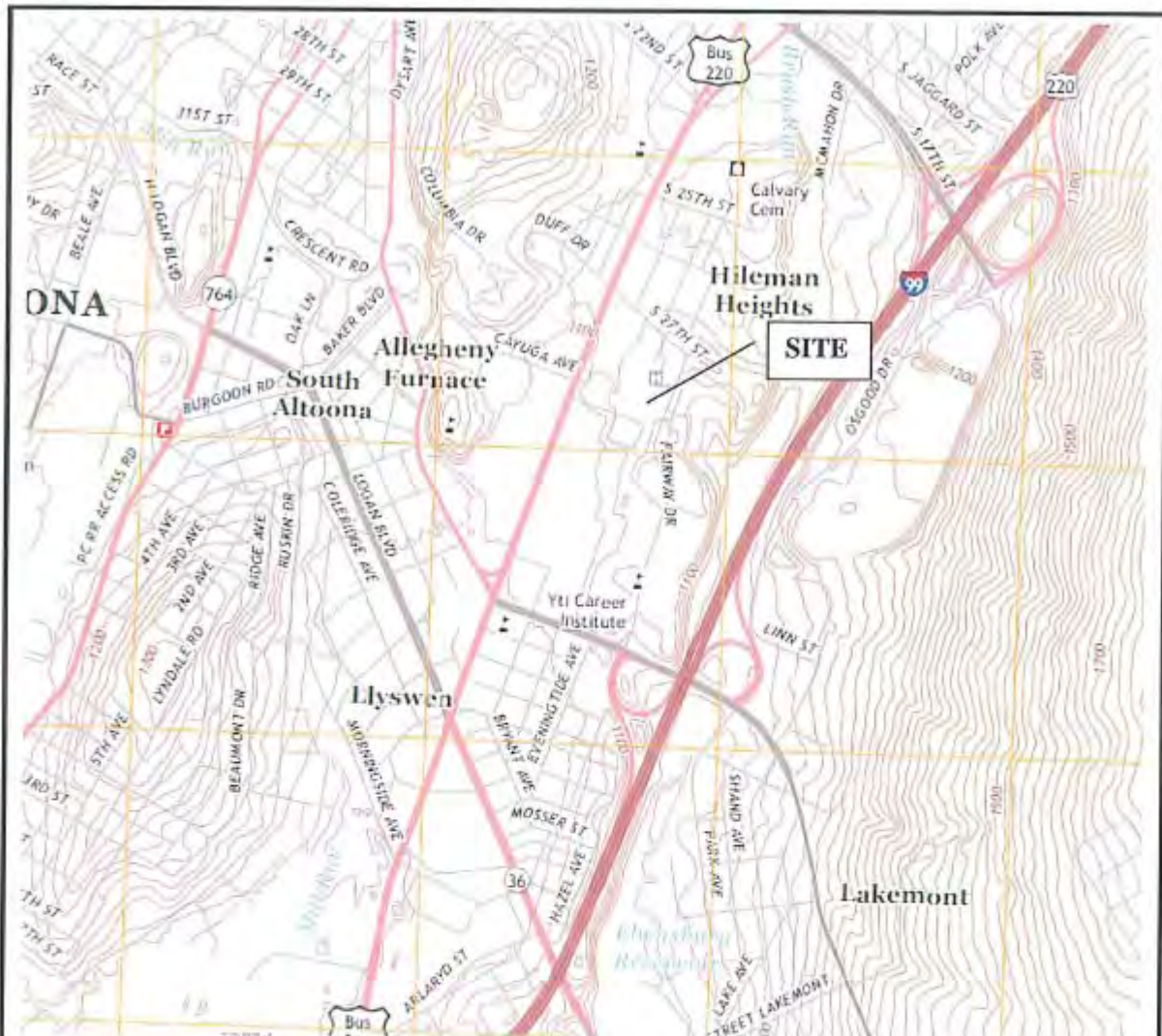
Reviewed By:

Thomas R. Beatty, P.G.
President

APPENDICES

APPENDIX A

U.S.G.S. MAP



SITE LOCATION MAP

Source: U.S.G.S. Holidaysburg Quadrangle
Blair County, PA
7.5 Minute Series (Topographic)
Scale: 1:24,000

Project: VA Medical Center Parking Garage
Fairway Drive
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APPENDIX B
SOIL SURVEY MAP



SOIL SURVEY MAP

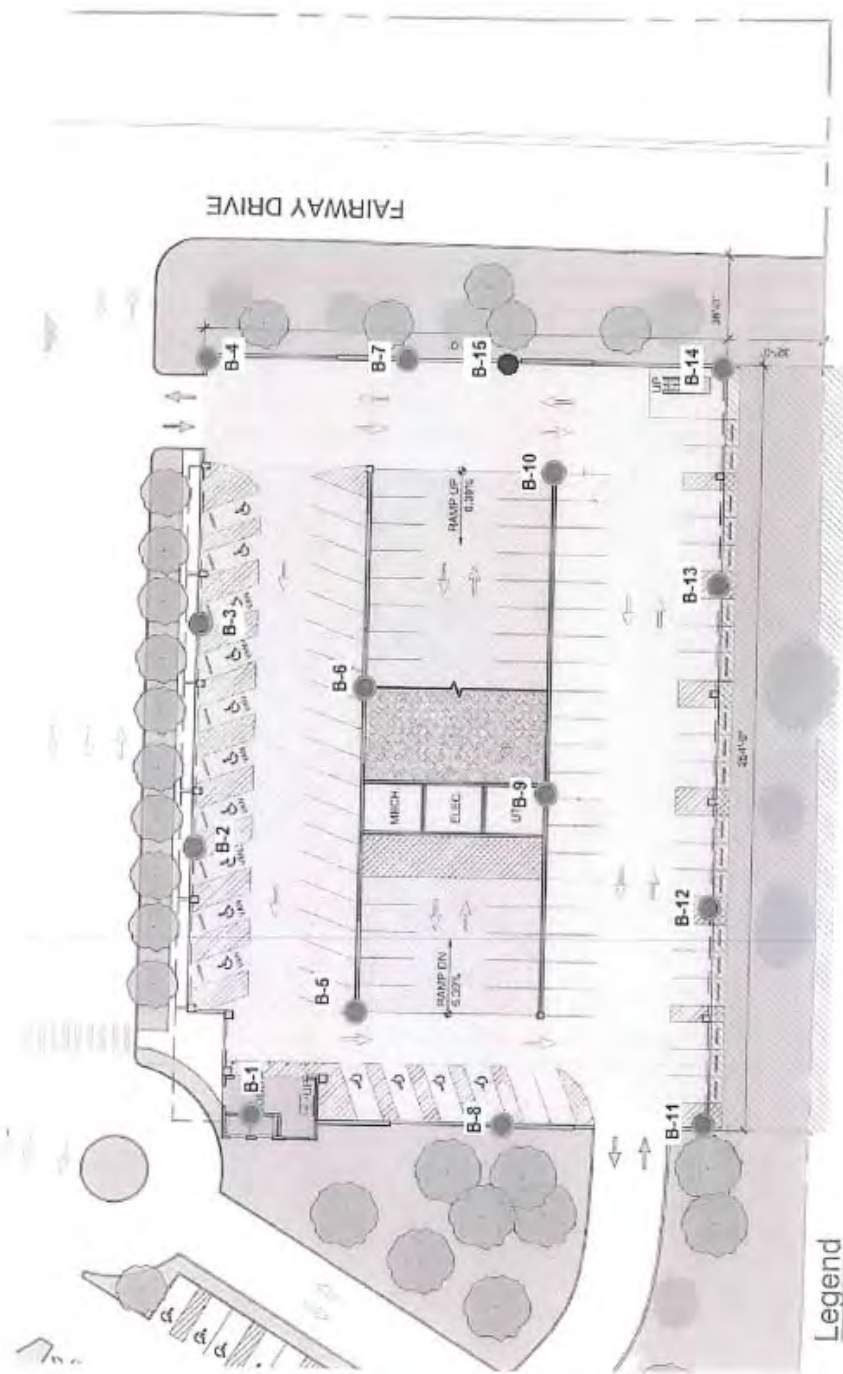
Source: U.S.D.A. Soil Conservation Service
Blair County, PA
Sheet Number 20
Scale: 1:15 840

Project: VA Medical Center Parking Garage
Fairway Drive
Altoona, PA

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APPENDIX C

BORING LOCATION PLAN



Legend

● Boring Location

APPENDIX D

**TEST BORINGS LOGS AND
SOIL CLASSIFICATION CHARTS**

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC

Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-1

Engineer/Geologist: Joel Banaszak



SUBSURFACE PROFILE				SAMPLE					N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery			
0		Ground Surface									
0		0.0 - 0.5' - ASPHALT; DRY, HARD.	0.0								
0.5		0.5 - 1.2' - SUBBASE; GREY; DRY.	0.5								
1		1.2 - 1.7' - SILTY CLAY (CL-ML); BROWN/GREY; MIXED WITH GRAVEL; DRY.	1.2				75				
1.7		1.7 - 1.9' - SILTY CLAY (CL-ML); ORANGE; STIFF; MOIST	1.7	S-1	SS	1.0 - 3.0	26	1.9			
2							12				
3							9				
3.6		1.9 - 3.6' - SILTY CLAY (CL-ML); LIGHT BROWN; MIXED WITH GRAVEL; STIFF; DRY.	3.6	S-2	SS	3.0 - 5.0	16	2.0			
4							20				
4.8		3.6 - 4.0' - SILTY CLAY (CL-ML); GREY; MIXED WITH SHALE FRAGMENTS; DRY.	4.8				16				
5							8				
6		4.0 - 4.8' - SILTY CLAY (CL-ML); BROWN; MIXED WITH SHALE FRAGMENTS; DRY.		S-3	SS	5.0 - 7.0	33	1.1			
7							50-4"				
8		4.8 - 8.0' - LIMESTONE - GREY; FRAGMENTED; WEATHERED; DRY.	8.0								
9											
10		8.0 - 13.0' - NO RECOVERY - CUTTINGS APPEAR TO BE PRIMARILY SILT.									
11											
12											
13			13.0								
14											
15				S-4	SS	14.0-14.8	19	0.8			
16							50-4"				
17				S-5	SS	15.0 - 15.4	50-5"	0.7			
18		13.0 - 22.9' - SHALE; BROWN/GREY; HIGHLY WEATHERED; WITH BROWN SAND; DRY.									
19				S-6	SS	18.0 - 18.4	50-5"	0.9			
20											

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/11/13

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Pittsburgh, PA 15202
Phone: (412) 761-1990
Fax: (412) 761-1998

Hole Size: 4"

Weather: Sunny 40's

Sheet: 1 of 2

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC

Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-1

Engineer/Geologist: Joel Banaszak



**ACA
ENGINEERING**

SUBSURFACE PROFILE				SAMPLE				N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery		
21										
22				S-7	SS	21.0 - 21.1	50-1"	0.1		
23			22.9							
24				S-8	SS	23.0 - 23.4	50-5"	0.4		
25		22.9 - 28.0' - SHALE; OLIVE/BROWN; HIGHLY WEATHERED; DRY.								
26										
27				S-9	SS	26.0 - 26.3	50-4"	0.0		
28			28.0							
29		28.0 - 34.1' LIMESTONE; BUFF; DRY; MIXED WITH GREY SHALE - HIGHLY WEATHERED; DRY.								
30				S-10	SS	29.0 - 29.4	50-5"	0.4		
31										
32										
33										
34				S-11	SS	34.0 - 34.1	50-1"	0.1		
35		End of Test Boring	34.1							
36										
37										
38										
39										
40										

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/11/13

ACA Engineering, Inc.
40 Western Avenue
Pittsburgh, PA 15202
Phone: (412) 761-1990
Fax: (412) 761-1998

Hole Size: 4"

Weather: Sunny 40's

Sheet: 2 of 2

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC

Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-2

Engineer/Geologist: Joel Banaszak

ACA
ENGINEERING

SUBSURFACE PROFILE				SAMPLE					N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery			
0		Ground Surface									
0		0.0 - 1.0' - ASPHALT: MIXED WITH SUBBASE; GREY; DRY.	0.0								
1			1.0								
2							3				
3		1.0 - 5.0' - SILTY CLAY (CL): GREY/OLIVE; VERY STIFF; DRY.		S-1	SS	2.0 - 4.0	7	2.0			
4							17				
5							17				
6		5.0 - 5.9' - CLAYEY SILT (CL-ML): GREY/LIGHT BROWN; DRY.	5.0								
7		5.9 - 6.1' - CLAYEY SILT (CL-ML): LIGHT BROWN; MOIST.	5.9				8				
8		6.1 - 8.0' CLAYEY SILT (CL-ML): OLIVE/LIGHT BROWN; STIFF; DRY.		S-2	SS	6.0 - 8.0	9	2.0			
9							11				
10		8.0 - 8.4' LIMESTONE: BUFF; WEATHERED.	8.0				19				
11		8.4 - 9.1' CLAYEY SILT (CL-ML): LIGHT BROWN; MIXED WITH SHALE FRAGMENTS; DRY.	9.1				7				
12				S-3	SS	9.0 - 11.0	33	1.5			
13							28				
14							35				
15		9.1 - 19.9' SHALE: DARK GREY; FRAGMENTED; DRY		S-4	SS	14.0 - 14.2	50-3"	0.2			
16											
17											
18											
19				S-5	SS	19.0 - 19.9	49	0.8			
20			19.9				50-5"				

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/11/13

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Fax: (412) 761-1998

Hole Size: 4"

Weather: Sunny 40's

Sheet: 1 of 1

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC

Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-3

Engineer/Geologist: Joel Banaszak

**ACA
ENGINEERING**

SUBSURFACE PROFILE				SAMPLE					N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery			
0		Ground Surface	0.0								
1		0.0 - 1.0' - ASPHALT: GREY/BLACK; MIXED WITH SUBBASE: DRY.	1.0								
2		1.0 - 5.0' - CLAYEY SILT (CL-ML): ORANGE/LIGHT BROWN, STIFF; DRY.	5.0	S-1	SS	2.0 - 4.0	2 4 9 11 10 10 14 12	1.2			
3											
4											
5											
6		5.0 - 8.0' - SHALE: WEATHERED; GREY; COLOR CHANGE IN AUGER CUTTINGS.	8.0	S-2	SS	4.0 - 6.0	32 50-4"	0.6			
7											
8											
9		8.0 - 13.0' - SHALE: GREY/LIGHT BROWN; WEATHERED; MIXED WITH CLAYEY SILT - STIFF/TIGHT/DRY.	13.0	S-3	SS	9.0 - 9.8	46 50-1"	0.5			
10											
11											
12											
13		13.0 - 14.6' - SHALE: GREY; SOME SILTS; DRY.	14.6	S-4	SS	14.0 - 14.6	46 50-1"	0.5			
14											
15		End of Test Boring	14.6								
16											
17											
18											
19											
20											

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/12/13

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Phone: (412) 761-1990
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Hole Size: 4"

Weather: Snow Flurries 30's

Sheet: 1 of 1

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC

Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-4

Engineer/Geologist: Joel Banaszak

**ACA
ENGINEERING**

SUBSURFACE PROFILE				SAMPLE					N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery			
0		Ground Surface									
0.0 - 1.0'		ASPHALT; GREY/BLACK; MIXED WITH SUBBASE; DRY.	0.0								
1.0 - 1.5'		CLAYEY SILT (CL-ML); GREY; STIFF; DRY.	1.0								
1.5 - 6.5'		CLAYEY SILT (CL-ML); LIGHT BROWN; STIFF; DRY.	1.5								
2.0 - 4.0				S-1	SS	2.0 - 4.0	2 4 6 9	1.8			
6.0 - 8.0				S-2	SS	6.0 - 8.0	10 11 20 32	2.0			
9.0 - 11.0				S-3	SS	9.0 - 11.0	23 28 28 39	1.6			
14.0 - 14.4				S-4	SS	14.0 - 14.4	50-5"	0.4			
19.0 - 19.2				S-5	SS	19.0 - 19.2	50-3"	0.2			
End of Test Boring			19.2								

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/12/13

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Phone: (412) 761-1990
Fax: (412) 761-1998

Hole Size: 4"

Weather: Snow Flurries 30's

Sheet: 1 of 1

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC

Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-5

Engineer/Geologist: Joel Banaszak

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SUBSURFACE PROFILE				SAMPLE					N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery			
0		Ground Surface	0.0								
1		0.0 - 1.0' - ASPHALT - GREY, MIXED WITH SUBBASE; DRY.	1.0								
2		1.0 - 3.0' - CLAYEY SILT (CL-ML); LIGHT BROWN/OLIVE; STIFF; DRY.	3.0	S-1	SS	2.0 - 4.0	5 8 5 7	2.0			
3											
4		3.0 - 8.0' - WEATHERED SHALE; MIXED WITH CLAYEY SILT - GREY; 7' BGS - AUGER CUTTINGS LIGHT BROWN/ORANGE; SILT WITH SHALE FRAGMENTS.	8.0	S-2	SS	6.0 - 7.5	15 26 50	1.4			
5											
6											
7											
8		8.0 - 9.0' - CLAYEY SILT (CL-ML); ORANGE/LIGHT BROWN; HARD; DRY.	9.0	S-3	SS	9.0 - 11.0	20 21 22 21	2.0			
9											
10		9.0 - 13.0' - CLAYEY SILT (CL-ML); GREY; HARD; DRY.	13.0	S-4	SS	14.0 - 15.4	30 30 50-5"	1.4			
11											
12											
13											
14											
15		13.0 - 19.2' - CLAYEY SILT (CL-ML); GREY - SOME ORANGE, BUT SPARSE; MIXED WITH SHALE FRAGMENTS; HARD; DRY.	19.2	S-5	SS	19.0 - 19.2	50-3"	0.1			
16											
17											
18											
19											
20		End of Test Boring									

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/12/13

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Hole Size: 4"

Weather: Snow Flurries 30's

Sheet: 1 of 1

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC

Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-6

Engineer/Geologist: Joel Banaszak



SUBSURFACE PROFILE				SAMPLE					N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery			
0		Ground Surface									
0		0.0 - 1.0' - ASPHALT: GREY; MIXED WITH SUBBASE; DRY.	0.0								
1			1.0								
2							3				
3				S-1	SS	2.0 - 4.0	5	1.8			
4							5				
5		1.0 - 9.7' - CLAYEY SILT (CL-ML): LIGHT BROWN/GREY; STIFF; DRY.					7				
6											
7				S-2	SS	6.0 - 8.0	5	1.4			
8							6				
9							8				
10			9.7	S-3	SS	9.0 - 11.0	13	1.8			
11							15				
12							40				
13							26				
14		9.7 - 20.0' - SHALE: SHALE FRAGMENTS WITH SOME SILT; NO RECOVERY BEYOND 10' BGS - AUGER CUTTINGS APPEAR TO BE GREY FRAGMENTED SHALE.									
15				S-4	SS	14.0 - 14.0	50-0"	0.0			
16											
17											
18											
19				S-5	SS	19.0 - 19.0	50-0"	0.0			
20			20.0								

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/12/13

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Hole Size: 4"

Weather: Snow Flurries 30's

Sheet: 1 of 1

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC


Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-7

Engineer/Geologist: Joel Banaszak

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SUBSURFACE PROFILE				SAMPLE					N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery			
0		Ground Surface	0.0								
1		0.0 - 1.0' - ASPHALT, MIXED WITH SUBBASE; DRY.	1.0								
2		1.0 - 5.5' - CLAYEY SILT (CL-ML); LIGHT ORANGE/BROWN; SOFT; DRY.	5.5	S-1	SS	2.0 - 4.0	1	1.2			
3							1				
4							3				
5							5				
6		5.5 - 9.4' - SHALE, SHALE, MIXED WITH CLAYEY SILT; DRY.	9.4	S-2	SS	6.0 - 8.0	8	1.3			
7							13				
8							28				
9							50				
10		End of Test Boring	9.4	S-3	SS	9.0 - 9.4	50-5*	0.3			
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/12/13

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40 Western Avenue
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Phone: (412) 761-1990
Fax: (412) 761-1998

Hole Size: 4"

Weather: Snow Flurries 30's

Sheet: 1 of 1

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC

Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-8

Engineer/Geologist: Joel Banaszak

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SUBSURFACE PROFILE				SAMPLE				N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery		
0		Ground Surface	0.0							
1		0.0 - 1.0' - ASPHALT; MIXED WITH SUBBASE; DRY.	1.0							
2		1.0 - 1.8' - FILL; BASE MATERIAL/2B SILTS.	1.8							
3		1.8 - 8.0' - CLAYEY SILT (CL-ML); BROWN/ORANGE; FIRM TO VERY STIFF, DRY.	8.0	S-1	SS	2.0 - 4.0	4 4 3 3	1.0		
4										
5										
6										
7		6.0 - 8.0	8.0	S-2	SS	6.0 - 8.0	6 8 7 7	2.0		
8										
9										
10										
11		8.0 - 14.0' - CLAYEY SILT (CL-ML); GREY; MIXED WITH SHALE FRAGMENTS; HARD; DRY.	14.0	S-3	SS	9.0 - 11.0	8 10 27 30	1.7		
12										
13										
14										
15		End of Test Boring	14.0	S-4	SS	14.0 - 14.0	50-0"	0.0		
16										
17										
18										
19										
20										

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/12/13

ACA Engineering, Inc.

40 Western Avenue

Pittsburgh, PA 15202

Phone: (412) 761-1990

Fax: (412) 761-1998

Hole Size: 4"

Weather: Snow Flurries 30's

Sheet: 1 of 1

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC

Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-9

Engineer/Geologist: Joel Banaszak

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SUBSURFACE PROFILE				SAMPLE					N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery			
0		Ground Surface	0.0								
1		0.0 - 1.0' - ASPHALT; GREY/BLACK; MIXED WITH SUBBASE; DRY.	1.0								
2		1.0 - 2.0' - CLAYEY SILT (CL-ML); GREY; DRY.	2.0								
3		2.0 - 8.0' - CLAYEY SILT (CL-ML); LIGHT BROWN/ORANGE; STIFF TO VERY STIFF; DRY.		S-1	SS	2.0 - 4.0	5 6 7 10	1.8			
4											
5											
6											
7		8.0 - 14.0' - SHALE; GREY; WEATHERED; DRY.		S-2	SS	6.0 - 8.0	5 7 9 10	0.7			
8											
9											
10				S-3	SS	9.0 - 9.3	50-4"	0.0			
11											
12											
13											
14				S-4	SS	14.0 - 14.3	50-4"	0.0			
15		End of Test Boring	14.3								
16											
17											
18											
19											
20											

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/13/13

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Hole Size: 4"

Weather: Cloudy/Snow 20's

Sheet: 1 of 1

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC

Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-10

Engineer/Geologist: Joel Banaszak

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SUBSURFACE PROFILE				SAMPLE					N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery			
0		Ground Surface									
0		0.0 - 1.0' - ASPHALT: GREY; MIXED WITH SUBBASE; DRY.	0.0								
1		1.0 - 2.0' - CLAYEY SILT (CL-ML); ORANGE/BROWN; DRY.	1.0								
2		2.0 - 2.8' - CLAYEY SILT (CL-ML); GREY; MIXED WITH SHALE FRAGMENTS; HARD; DRY.	2.0				8				
3			2.6	S-1	SS	2.0 - 3.9	8	1.6			
4							28				
5		2.8 - 6.2' - SHALE: GREY; DRY.					50-5"				
6				S-2	SS	6.0 - 6.2	50-3"	0.1			
7		End of Test Boring	6.2								
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/13/13

ACA Engineering, Inc.
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Hole Size: 4"

Weather: Cloudy/Snow 20's

Sheet: 1 of 1

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC

Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-11

Engineer/Geologist: Joel Banaszak

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SUBSURFACE PROFILE				SAMPLE					N-Value blows/ft 10 30 50	Water Level	Remarks							
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery										
0		Ground Surface	0.0															
1		0.0 - 1.4' - ASPHALT, GREY, MIXED WITH SUBBASE, DRY.	1.4															
2		1.4 - 7.0' - SILTY CLAY (CL-ML); GREY/BLACK, FIRM, SATURATED.	7.0	S-1	SS	2.0 - 4.0	6 5 3 3	1.3										
3																		
4																		
5																		
6																		
7		7.0 - 8.0' - SHALE, MIXED WITH ORANGE SILTY CLAY.	8.0	S-2	SS	9.0 - 10.9	5 6 32 50-5"	1.5										
8		8.0 - 13.0' - SHALE, LIGHT BROWN; MIXED WITH ORANGE SILTY CLAY; SOME SHALE FRAGMENTS; MOIST.	13.0															
9																		
10																		
11																		
12		13.0 - 14.6' - SILTY CLAY (CL-ML); OLIVE; HARD; DRY.	13.0	S-3	SS	14.0 - 15.4	33 44 50-5"	1.0										
13																		
14																		
15		End of Test Boring	15.4															
16																		
17																		
18																		
19																		
20																		

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/14/13

ACA Engineering, Inc.
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Phone: (412) 761-1990
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Hole Size: 4"

Weather: Sunny 30's

Sheet: 1 of 1

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC


Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-12

Engineer/Geologist: Joel Banaszak

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SUBSURFACE PROFILE				SAMPLE					N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery			
0		Ground Surface	0.0								
1		0.0 - 1.0' - ASPHALT; GREY/BLACK; MIXED WITH SUBBASE; DRY.	1.0								
2		1.0 - 5.0' - SILTY CLAY (CL); GREY/BLACK; STIFF; SLIGHTLY MOIST.	5.0	S-1	SS	2.0 - 4.0	5	0.7			
3							5				
4							6				
5							7				
6		5.0 - 13.0' - SHALE: LIGHT GREY TO GREY; WEATHERED; DRY; 12' BGS - AUGER CUTTING - BLACK/BROWN.	13.0	S-2	SS	6.0 - 7.4	45	1.1			
7							43				
8							50-5"				
9											
10											
11											
12											
13		13.0 - 14.4' - SHALE: GREY; HIGHLY WEATHERED; DRY.	14.4	S-3	SS	9.0 - 9.3	50-4"	0.0			
14											
15		End of Test Boring									
16											
17											
18											
19											
20											

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/13/13

ACA Engineering, Inc.
40 Western Avenue
Pittsburgh, PA 15202
Phone: (412) 761-1990
Fax: (412) 761-1998

Hole Size: 4"

Weather: Cloudy/Snow 20's

Sheet: 1 of 1

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC

Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-14

Engineer/Geologist: Joel Banaszak

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SUBSURFACE PROFILE				SAMPLE					N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery			
0		Ground Surface									
0		0.0 - 1.0' - ASPHALT: GREY; MIXED WITH SUBBASE; DRY.	0.0								
1			1.0								
2											
3		1.0 - 6.5' - CLAYEY SILT (CL-ML); LIGHT BROWN; HARD; MIXED WITH SHALE FRAGMENTS; DRY.		S-1	SS	2.0 - 3.5	43 44 50	1.5			
4											
5											
6											
7		6.5 - 8.2' - SHALE: ORANGE; WEATHERED; MIXED WITH CLAYEY SILT; DRY.	6.5	S-2	SS	6.0 - 7.0	25 50	1.3			
8											
9		8.2 - 11.0' - SHALE: OLIVE/LIGHT BROWN; MIXED WITH SHALE FRAGMENTS; DRY.	8.2								
10				S-3	SS	9.0 - 9.5	50	0.3			
11			11.0								
12											
13											
14		11.0 - 18.0' - CLAYEY SILT (CL-ML); GREY; HARD; MIXED WITH GREY SHALE FRAGMENTS; DRY.		S-4	SS	14.0 - 14.5	50	0.3			
15											
16											
17											
18		18.0 - 20.0' - CLAYEY SILT (CL-ML); GREY; HARD; MIXED WITH SHALE/ROCK FRAGMENTS; DRY.	18.0								
19											
20			20.0	S-5	SS	19.0 - 19.5	50	0.2			

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/14/13

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40 Western Avenue
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Phone: (412) 761-1990
Fax: (412) 761-1998

Hole Size: 4"

Weather: Sunny 30's

Sheet: 1 of 3

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC

Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-14

Engineer/Geologist: Joel Banaszak



SUBSURFACE PROFILE				SAMPLE					N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery			
0		Ground Surface									
0		0.0 - 1.0' - ASPHALT: GREY; MIXED WITH 2B FILL; DRY.	0.0								
1			1.0								
2											
3				S-1	SS	2.0 - 3.5	43	1.5			
4		1.0 - 6.5' - CLAYEY SILT (CL-ML): LIGHT BROWN; HARD; MIXED WITH SHALE FRAGMENTS; DRY.					44				
5							50				
6											
7		6.5 - 9.2' - SHALE: ORANGE; WEATHERED; MIXED WITH CLAYEY SILT; DRY.	6.5	S-2	SS	6.0 - 7.0	25	1.3			
8							50				
9			9.2								
10		8.2 - 11.0' - SHALE: OLIVE/LIGHT BROWN; MIXED WITH SHALE FRAGMENTS; DRY.		S-3	SS	9.0 - 9.5	50	0.3			
11											
12			11.0								
13											
14		11.0 - 18.0' - CLAYEY SILT (CL-ML): GREY; HARD; MIXED WITH GREY SHALE FRAGMENTS; DRY.		S-4	SS	14.0 - 14.5	50	0.3			
15											
16											
17											
18			18.0								
19		18.0 - 20.0' - CLAYEY SILT (CL-ML): GREY; HARD; MIXED WITH SHALE/ROCK FRAGMENTS; DRY.		S-5	SS	19.0 - 19.5	50	0.2			
20			20.0								

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/14/13

ACA Engineering, Inc.
40 Western Avenue
Pittsburgh, PA 15202
Phone: (412) 761-1990
Fax: (412) 761-1998

Hole Size: 4"

Weather: Sunny 30's

Sheet: 1 of 3

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC

Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-14

Engineer/Geologist: Joel Banaszak

**ACA
ENGINEERING**

SUBSURFACE PROFILE				SAMPLE				N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery		
21		20.0 - 38.0' - CLAYEY SILT (CL-ML); SAPPROLITE HIGHLY WEATHERED SHALE - GREY; DRY.								
22										
23										
24										
25				S-6	SS	24.0 - 24.5	50	0.1		
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38			38.0							
39										
40										

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/14/13

ACA Engineering, Inc.
40 Western Avenue
Pittsburgh, PA 15202
Phone: (412) 761-1990
Fax: (412) 761-1998

Hole Size: 4"

Weather: Sunny 30's

Sheet: 2 of 3

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC

Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-14

Engineer/Geologist: Joel Banaszak



SUBSURFACE PROFILE				SAMPLE					N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery			
41		38.0 - 43.0' - SILTSTONE: GREY; MILDLY WEATHERED; FRAGMENTED; THINLY BEDDED; ROD=39%		R-1	Core	38.0 - 43.0		3.9			
42											
43			43.0								
44		43.0 - 48.0' - SILTSTONE: RED; THINLY BEDDED; SOMEWHAT FRAGMENTED; ROD=63%		R-2	Core	43.0 - 48.0		5.0			
45											
46											
47		48.0 - 53.0' - SILTSTONE: GREY; THINLY BEDDED; HIGHLY FRAGMENTED; ROD=7%		R-3	Core	48.0 - 53.0		3.6			
48			48.0								
49											
50		End of Test Boring									
51											
52											
53			53.0								
54											
55											
56											
57											
58											
59											
60											

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/14/13

ACA Engineering, Inc.
40 Western Avenue
Pittsburgh, PA 15202
Phone: (412) 761-1990
Fax: (412) 761-1998

Hole Size: 4"

Weather: Sunny 30's

Sheet: 3 of 3

Project No: P13274x10

Project: VA Medical Center Parking Garage

Client: Mountain Research, LLC


Location: Hollidaysburg, PA

Elevation: 1130' +/-

Borehole #: B-15

Engineer/Geologist: Joel Banaszak

**ACA
ENGINEERING**

SUBSURFACE PROFILE				SAMPLE					N-Value blows/ft 10 30 50	Water Level	Remarks
Depth	Symbol	Description	Depth	Number	Type	Sample Depth	Blows/ft	Recovery			
0		Ground Surface	0.0								
1		0.0 - 1.0' - ASPHALT; GREY/BLACK; MIXED WITH SUBBASE; DRY.	1.0								
2		1.0 - 6.0' - CLAYEY SILT (CL-ML); LIGHT BROWN; VERY STIFF; DRY.	6.0	S-1	SS	2.0 - 4.0	2	1.6			
3							9				
4							11				
5							9				
6		6.0 - 14.3' - SHALE; RED; MIXED WITH CLAYEY SILT; WEATHERED; DRY.	14.3	S-2	SS	6.0 - 8.0	21	1.5			
7							28				
8							23				
9							18				
10							21				
11							36				
12							48				
13							50-3"				
14				S-3	SS	9.0 - 10.7		1.5			
15		End of Test Boring	14.3	S-4	SS	14.0 - 14.3	50-4"	0.2			
16											
17											
18											
19											
20											

Drilled By: Mountain Research, LLC

Drill Method: Hollow Stem Auger

Drill Date: 11/14/13

ACA Engineering, Inc.
40 Western Avenue
Pittsburgh, PA 15202
Phone: (412) 761-1990
Fax: (412) 761-1998

Hole Size: 4"

Weather: Cloudy/Snow 20's

Sheet: 1 of 1

APPENDIX E

LABORATORY TEST RESULTS



WATER CONTENT REPORT

PROJECT: VA Medical Center Parking Garage
CLIENT: Mountain Research, LLC

FILE NO.: P13274x10

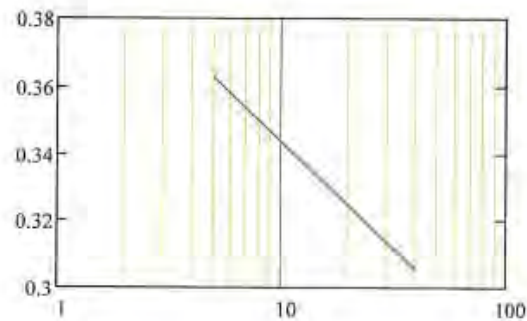
DATE: 12/5/2013

BORING NO.	SAMPLE DEPTH (ft.)	MOISTURE CONTENT (%)
B-1	1.0 - 3.0	12.4
B-1	3.0 - 5.0	18.0
B-2	2.0 - 4.0	18.2
B-2	6.0 - 8.0	24.4
B-3	2.0 - 4.0	20.6
B-3	4.0 - 6.0	11.9
B-4	2.0 - 4.0	18.8
B-4	6.0 - 8.0	10.4
B-5	2.0 - 4.0	27.4
B-5	6.0 - 8.0	18.5
B-6	2.0 - 4.0	15.6
B-6	6.0 - 8.0	25.5
B-7	2.0 - 4.0	32.3
B-7	6.0 - 8.0	11.6
B-8	2.0 - 4.0	18.9
B-8	6.0 - 8.0	12.1
B-9	2.0 - 4.0	29.6
B-9	6.0 - 8.0	25.2
B-10	2.0 - 3.4	17.9
B-10	6.0 - 6.2	2.6
B-11	2.0 - 4.0	20.8
B-11	9.0 - 10.9	21.5
B-12	2.4 - 4.0	25.9
B-12	6.0 - 7.4	9.5
B-13	2.0 - 4.0	27.3
B-13	6.0 - 8.0	11.3
B-14	2.0 - 4.0	9.6
B-14	6.0 - 7.0	11.5
B-15	2.0 - 4.0	13.0
B-15	6.0 - 8.0	16.5

PROJECT: VA Medical Center Garage
LOCATION: Hollidaysburg, PA
CLIENT: Mountain Research, LLC

FILE NUMBER: P13274x10
DATE TESTED: 12/9/13
SAMPLE: B-2 (2.0'-4.0')

ATTERBERG LIMITS (ASTM D-4318)



Liquid Limit: LL = 32

Plastic Limit: PL = 17

Plasticity Index: PI = 14

% Passing No. 200 Sieve: 70.6



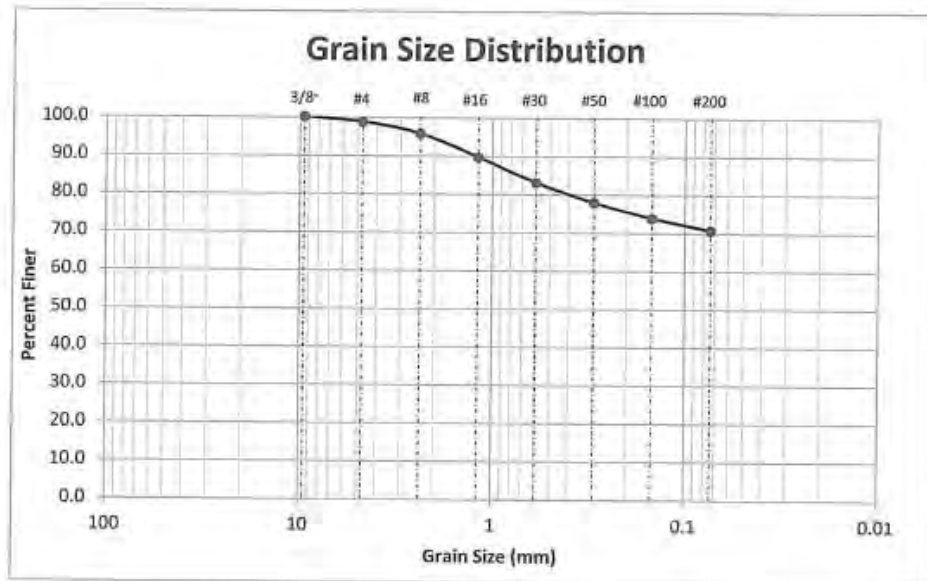
PARTICLE SIZE ANALYSIS REPORT

PROJECT: VA Medical Center Parking Garage
CLIENT: Mountain Research, LLC

FILE NO.: P13274x10
DATE: 12/5/2013

Boring No: B-2 **Sample No:** S-1 **Depth:** 2.0 - 4.0

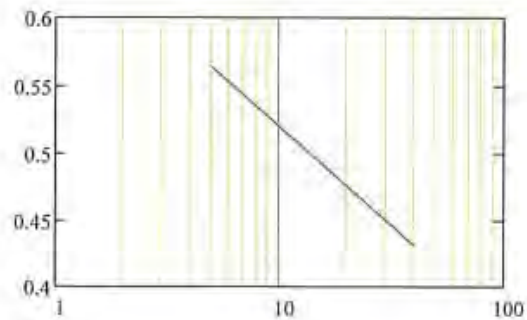
SIEVE SIZE (MM)	CUMULATIVE WEIGHT (GRAMS)	PERCENT FINER
3/8"	0	100.0
#4	1.12	98.7
#8	3.66	95.7
#16	8.84	89.6
#30	14.44	83.0
#50	18.84	77.8
#100	22.24	73.7
#200	24.92	70.6
PAN		0.0
DRY WEIGHT:		84.7



PROJECT: VA Medical Center Garage
LOCATION: Hollidaysburg, PA
CLIENT: Mountain Research, LLC

FILE NUMBER: P13274x10
DATE TESTED: 12/9/13
SAMPLE: B-12 (2.0'-4.0')

ATTERBERG LIMITS (ASTM D-4318)



Liquid Limit: LL = 46

Plastic Limit: PL = 26

Plasticity Index: PI = 20

% Passing No. 200 Sieve: 68.2



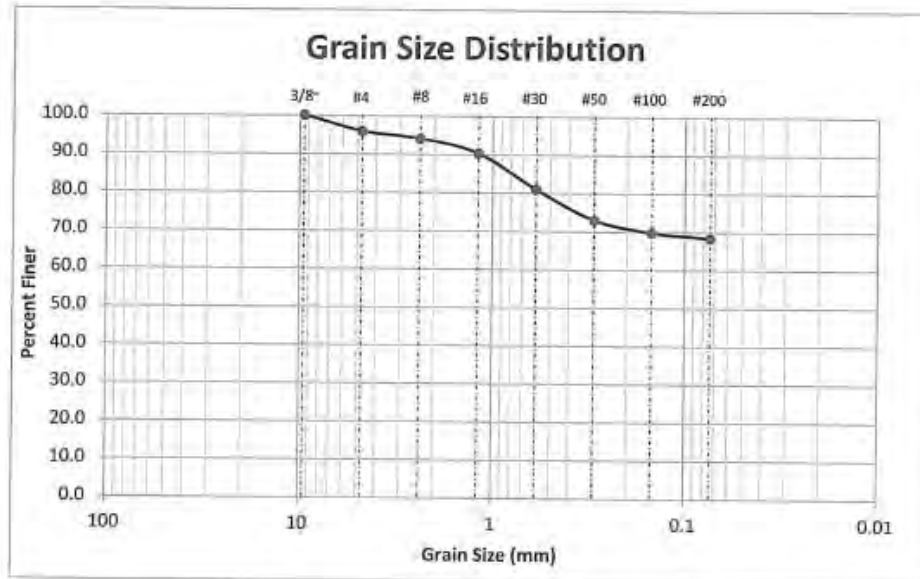
PARTICLE SIZE ANALYSIS REPORT

PROJECT: VA Medical Center Parking Garage
CLIENT: Mountain Research, LLC

FILE NO.: P13274x10
DATE: 12/5/2013

Boring No: B-12 **Sample No:** S-1 **Depth:** 2.0 - 4.0

SIEVE SIZE (MM)		CUMULATIVE WEIGHT (GRAMS)	PERCENT FINER
3/8"	9.51	0	100.0
#4	4.76	2.04	95.8
#8	2.38	2.97	93.9
#16	1.19	4.82	90.1
#30	0.595	9.39	80.8
#50	0.297	13.3	72.8
#100	0.149	14.87	69.6
#200	0.074	15.54	68.2
PAN			0.0
DRY WEIGHT:			48.9



ACA ENGINEERING, INC.
410 N Balph AVENUE
Pittsburgh, PA 15202-1707

Project: VA Medical Center Parking Garage
Location: Hollidaysburg, PA
Client: Mountain Research, LLC

Project #: P13274x10
Date: 12/4/2013
Page: 1

UNCONFINED COMPRESSIVE STRENGTH

Boring No.	B-14	B-14				
Depth - ft.	40.0	50.0				
Load - lbs.	12,640	7,640				
Compressive Strength, psi	4,023	2,432				
Compressive Strength, lbs/s.f.	579,375	350,192				
Compressive Strength, T/s.f.	290	175				

Soil Resistivity
AASHTO - T288 Mod (4 electrode method)

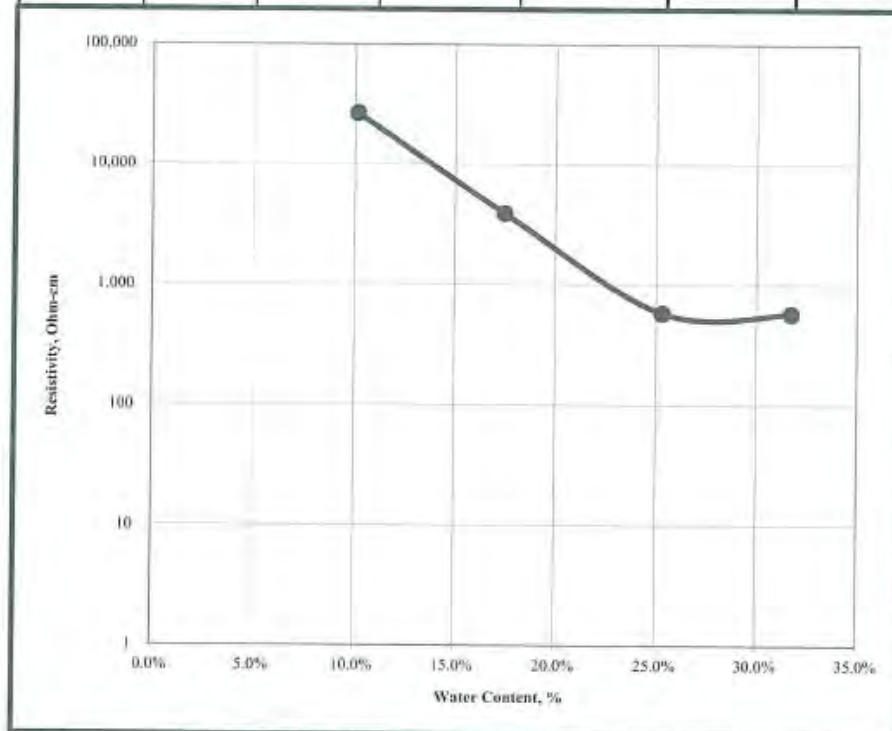
Client: ACA Engineering, Inc.
Client Project: VA Medical Ctr. Parking Garage; P13274X10
Project No.: 33904

Boring: B-11
Depth: 2.0'-4.0'
Sample: S-1
Lab Sample No.: 33904001

SOIL BOX PARAMETERS	
Soil Box Length, cm	11.2
Soil Box Area, cm ²	6.89
Electrode Spacing, cm	6.89
Soil Box Factor, cm	
(Area/Spacing)	1
Soil Box Volume, cc	77

MINIMUM RESISTIVITY TESTED	
WC at Min. Resistivity Tested, %	31.7%
Min. Resistivity Tested, Ohm-cm	575

Water Content					Resistivity Ohm-cm	% Change
Tare #	Tare+WS grams	Tare+DS grams	Tare wt. grams	Water Content %		
422	31.31	29.42	10.79	10.1%	26500	NA
443	31.26	28.21	10.76	17.5%	3900	85%
497	31.99	27.70	10.74	25.3%	580	85%
417	34.54	28.80	10.70	31.7%	575	1%



Input Validation: tmp

Reviewed By: SVG

Date Tested: 12/9/2013

Soil Resistivity
AASHTO - T288 Mod (4 electrode method)

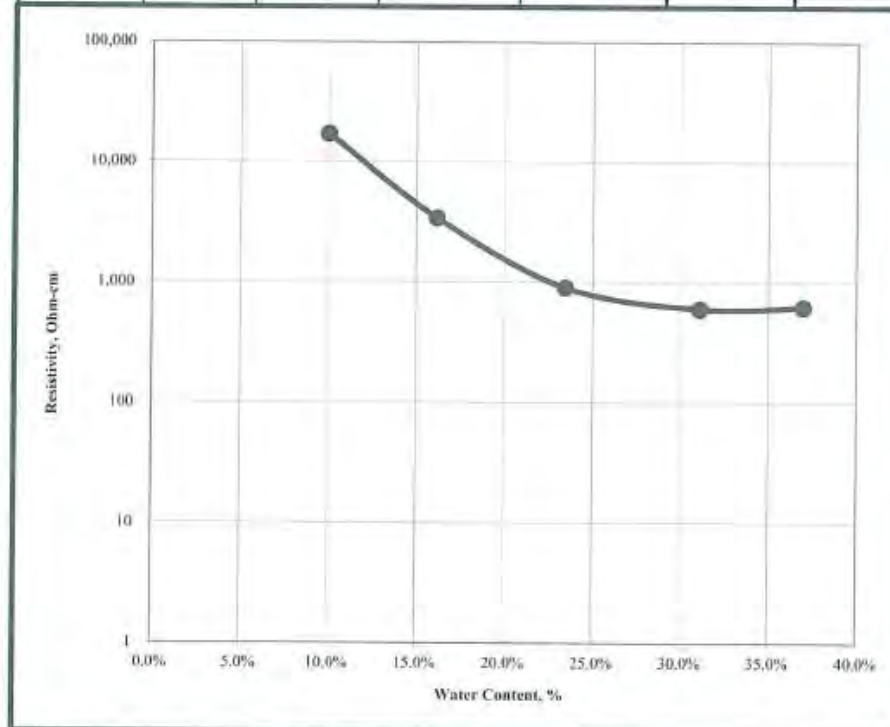
Client ACA Engineering, Inc.
Client Project VA Medical Ctr. Parking Garage; P13274X10
Project No. 33904

Boring B-11
Depth 5.0'-7.0'
Sample S-2
Lab Sample No. 33904002

SOIL BOX PARAMETERS	
Soil Box Length, cm	11.2
Soil Box Area, cm ²	6.89
Electrode Spacing, cm	6.89
Soil Box Factor, cm (Area/Spacing)	1
Soil Box Volume, cc	77

MINIMUM RESISTIVITY TESTED	
WC at Min. Resistivity Tested, %	37.0%
Min. Resistivity Tested, Ohm-cm	600

Water Content					Resistivity Ohm-cm	% Change
Tare #	Tare+WS grams	Tare+DS grams	Tare wt. grams	Water Content %		
404	30.88	29.05	10.75	10.0%	17000	NA
406	33.70	30.50	10.70	16.2%	3400	80%
413	30.93	27.10	10.76	23.4%	900	74%
412	33.59	28.17	10.73	31.1%	600	33%
498	31.41	25.82	10.70	37.0%	620	-3%



Input Validation: tmp

Reviewed By: SVG

Date Tested: 12/9/2013

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