

FINAL GEOTECHNICAL ENGINEERING REPORT

**Addition to Warehouse Building 360
Veterans Administration Hospital
Perry Point, Cecil County, Maryland**

Schnabel Reference 15614012.00
May 15, 2015





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Mr. Jason Azar
Nobis Engineering, Inc.
20410 Century Boulevard
Suite 230
Germantown, Maryland 20874

Subject: Project 15614012.00, DRAFT Geotechnical Engineering Report, Addition to Warehouse Building 360, Veterans Administration Hospital, Perry Point, Cecil County, Maryland

Dear Mr. Azar:

SCHNABEL ENGINEERING CONSULTANTS, INC. (Schnabel) is pleased to submit our DRAFT geotechnical engineering report for this project. This study was performed in accordance with our proposal dated March 17, 2015.

SCOPE OF SERVICES

Our proposal dated March 17, 2015 defines the scope of services for this project. Our services include subsurface exploration, soil laboratory testing, and development of geotechnical engineering recommendations. The objective of this study is to evaluate the subsurface conditions and provide recommendations regarding the design of foundations. Services not described in our agreement are not included in this study. We would be happy to provide additional support services to the design team as the project demands.

PROJECT DESCRIPTION

Site Description

The project site is located north and west of Building 360 at the Perry Point Veterans Administration (VA) Medical Center in Perry Point, Cecil County, Maryland. The area where the proposed building addition is planned is currently a grassed field with several sidewalks and a gazebo. The site is bounded by a parking lot to the north, Building 360 to the east, Avenue D to the south and 5th Street to the west. The site is approximately 1,200 feet northeast of the Susquehanna River. A Site Vicinity Map is included as Figure 1.

Existing Building 360 is a one-story 36,198 square feet masonry building with a finished floor elevation (FFE) at EL 36. The existing building is supported on shallow spread footings. Based on the foundation plan dated October 10, 1984, the existing footings had design bearing capacities ranging from 1,000 to 3,000 pounds per square foot (psf).

Various utilities were observed at the site including underground electric, gas, sanitary sewer, storm drains, water and communication lines. The grass field is generally flat and slopes up near the existing building. A retaining wall separates the north and south sides of Building 360 in the front, where the north side is about EL 36 and the south side is about EL 42. Elevations at the site range from EL 33 at the northwest end of the grass field up to EL 42 near the existing building.

An abandoned foundation was observed north of the gazebo in the grass field. Based on a *Building Number and Location Plan* from 1918, provided to us by Nobis, the location of the proposed building used to be a coal storage area.

Schnabel obtained the site information from the topographic drawing No. CU-300 dated March 25, 2015, prepared by OKKS, and through our site visits.

Proposed Construction

An addition to Building 360 is planned. The addition will be a one-story, metal building on the northwest side of the existing structure and will be approximately 24,203 square feet. The addition will not have a basement. The FFE will be at EL 36, matching the FFE of the existing structure. We understand the addition will have maximum column loads of about 60 kips and maximum floor loads of about 375 psf.

Two new, micro-bioretenment facilities are planned north of the proposed building. A new asphalt drive way, two parking areas and concrete walkways are also planned.

Nobis provided the project details and structural load information.

SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM

We performed a subsurface exploration and field testing program to identify the subsurface stratigraphy underlying the site and to evaluate the geotechnical properties of the materials encountered. This program included nine (9) test borings. Exploration methods used are discussed below. The appendices contain the results of our exploration.

Subsurface Exploration Methods

Test Borings

Schnabel's subcontractor, DMY Engineering Consultants, drilled nine test borings under our observation between April 13 and 15, 2015. The Standard Penetration Test (SPT) was performed at selected depths in the borings. Appendix A includes specific observations, remarks, and logs for the borings; classification criteria; drilling methods; and sampling protocols. Figure 2, included at the end of this report, indicates the approximate test boring locations. We will retain soil samples up to 90 days beyond the issuance of this report, unless you request other disposition.

The SPT samples were obtained using a hydraulically driven automatic trip hammer (ATH). Most correlations with SPT data are based on N-values collected with a safety hammer. The energy applied to the split-spoon sampler using the ATH is about 33 percent greater than that applied using the safety

hammer, resulting in lower N-values. The hammer blows shown on the boring logs are uncorrected for the higher energy. However, we correct SPT N values for the higher energy when using N values in our analyses.

Soil Laboratory Testing

Our laboratory performed tests on selected samples collected during the subsurface exploration. The testing aided in the classification of materials encountered in the subsurface exploration and provided data for use in the development of recommendations for design of foundations, earthwork, stormwater management and pavements. The results of the laboratory tests are included in Appendix B and are summarized in the Site Geology and Subsurface Conditions section of this report. Selected test results are also shown on the boring logs in Appendix A.

Index Testing

We performed index testing on samples collected as part of the exploration to provide soil classifications and to provide parameters for use with published correlations with soil properties. Index testing included performing natural moisture content, Atterberg Limit, and gradation tests on jar and bulk samples of soil representing Strata A and B.

Compaction and California Bearing Ratio Testing

We performed Standard Proctor compaction and California Bearing Ratio (CBR) testing to evaluate compaction characteristics and to provide soil parameters for pavement design. Testing was performed on one bulk sample representing Stratum A.

SITE GEOLOGY AND SUBSURFACE CONDITIONS

Regional Geology

We reviewed existing geologic data and information in our files. Based on this review, the geologic stratigraphy consists of Pleistocene Age upland Talbot Formation soils. Based on the geologic map, the Talbot formation soils in this area generally consist of coarse gravel and sand; and some silt. In our test borings, lean and fat clays were also encountered. Fill soils were encountered above the Talbot formation soils at this site. The fill soils were likely placed during construction of the existing buildings, retaining walls, roadways and parking areas at the site. The geologic information for this site was obtained from the *Geologic Map of Cecil County*, 1986, by Michael W. Higgins and Louis C. Conant.

Site Geology

We characterized the following generalized subsurface stratigraphy based on the exploration and laboratory test data included in the appendices.

Ground Cover:

All the borings, except boring P-1, were drilled in grassed areas and encountered 3 to 8 inches depth of topsoil. Boring P-1 was drilled in an asphalt paved area and encountered 2 inches depth of asphalt

overlying 4 inches depth of gravel base. The topsoil, asphalt and gravel base depths were estimated based on visual identification procedures.

Stratum A: Existing Fill and Possible Fill

Stratum A Existing Fill and Possible Fill soils were encountered in all of the test borings, except boring SWM-1, from below the ground cover to a depth of 2 to 32 feet below the existing ground surface. Boring P-1 was terminated within the fill soils at a depth of 6.5 feet below the ground surface. The fill soils consisted of multi-colored, Lean Clay, Silt and Silty Sand FILL, with varying amounts of rock fragments, gravel, sand, roots, mica, coal, and brick fragments. The fill soils had a standard penetration test (SPT) N-values ranging from 4 blows per foot (bpf) to 93/10 inches (93 blows for 10 inches of penetration) indicating variable consistencies and densities.

It should be noted that the soil from a depth of 22 feet to 32 feet below the ground surface in boring B-5 was classified as Possible Fill. The SPT for sample 7 (23.5 – 25 feet) was observed in the split-spoon by our representative and appeared to be natural soil. The next SPT for sample 8 (28.5 – 29.8 feet) also appeared to be natural soil, with the exception of a smaller brick fragment observed on the outside of the sample. It is possible that this brick fragment was “left over” from a previous SPT test within the fill soils above and “contaminated” sample 8. Thus we classified the soils as Possible Fill, however, there is a possibility that these soils are actually natural, Stratum B soils.

We performed a Standard Proctor Compaction test and a CBR test on a bulk sample representing this stratum. The sample consisted of gravelly lean clay with sand (CL). The compaction test resulted in a maximum dry density of 120 pounds per cubic foot (pcf) at an optimum moisture content of 11 percent. Natural moisture content values of Stratum A soils tested in our laboratory varied from 11.6 to 23.9 percent, or 0.6 to 12.9 percent above the optimum value. We obtained a laboratory CBR value of 2.5 with a swell value of 0.9 percent for this sample. A Liquid Limit (LL) of 27 and a Plasticity Index (PI) of 12 were obtained in the laboratory test.

Stratum B: Talbot Formation

Stratum B Talbot Formation soils were encountered below the ground cover or Stratum A Existing Fill soils in all the borings, except boring P-1, to the boring termination depths which ranged from 10 to 38.8 feet below the ground surface. The Stratum B soils consisted of multi-colored, FAT CLAY (CH), LEAN CLAY (CL), and SILT (ML), with varying amounts of sand and mica; gray, CLAYEY SAND (SC); orangish brown, SILTY SAND (SM), with varying amounts of clay; brown, POORLY GRADED SAND WITH SILT (SP-SM); and brown and gray, POORLY GRADED GRAVEL (GP, GC-GM), with varying amounts of sand and silt. The coarse-grained soils in this stratum had SPT N-values ranging from 22 bpf to 50/4 inches, indicating densities ranging from medium dense to very dense. The fine-grained soils in this stratum had SPT N-values ranging from 5 to 26 bpf, indicating consistencies ranging from medium stiff to very stiff.

Laboratory tests performed on samples representing this stratum resulted in moisture contents ranging from 13.7 to 32.2 percent. Liquid Limits (LL) ranged from 19 to 35 and Plasticity Indices (PI) ranged from 4 to 16.

Groundwater

We observed and recorded groundwater readings during or immediately after drilling. The test boring logs in Appendix A include groundwater observations obtained during our subsurface exploration. These data include depths to groundwater encountered during drilling, upon drilling completion, and following completion of the boring. Short term groundwater readings were recorded in some borings up to about 3 hours after drilling. Table 2, below, shows our groundwater observations at each boring location:

Table 1: Summary of Groundwater Readings

Boring ID	Approximate Ground Surface Elevation (feet)	Highest Observed Groundwater ⁽¹⁾		Cave-In ⁽¹⁾	
		Depth (feet)	Elevation (feet)	Depth (feet)	Elevation (feet)
B-1	34.0	5.0	29.0	20.0	14.0
B-2	38.0	Dry	--	22.0	16.0
B-3	40.0	11.5	28.5	18.0	22.0
B-4	35.0	13.5	21.5	20.0	15.0
B-5	41.5	15.0	26.5	22.0	19.5
B-6	36.0	5.0	31.0	17.0	19.0
P-1	37.0	Dry	--	3.0	34.0
SWM-1	33.0	2.0	31.0	8.0	25.0
SWM-2	34.0	2.5	31.5	6.0	28.0

(1) Measured up to 3 hours after completion of drilling

The groundwater levels on the logs indicate our estimate of the hydrostatic water table at the time of our subsurface exploration. The final design should anticipate the fluctuation of the hydrostatic water table depending on variations in precipitation, river levels, tidal action, surface runoff, pumping, evaporation, leaking utilities, and similar factors.

Based on our observations, the average groundwater elevation is at about EL 28. Therefore, we expect that groundwater will impact the design of the proposed micro-bioretenention SWM facilities such that underdrains will likely be required. Groundwater may also impact construction of Geopier shafts and pavement subdrains and building floor drainage may also be required. Considerations for groundwater are included with our recommendations below.

Seismic Site Classification

We evaluated the Seismic Site Class and Seismic Site Coefficients for this project according to the International Building Code (IBC) Section 1615 (2012). We recommend Site Class D be used for seismic design on the project. This Site Class was evaluated based on Standard Penetration Test N-values and extrapolation of the soil parameters to 100 feet.

We mapped the project using the United States Geological Survey (USGS) software. Based on the recommended site class and project location, the following seismic design parameters were calculated:

Table 2: Seismic Design Parameters

Period	Mapped Maximum Considered Spectral Response Acceleration		Design Spectral Response Acceleration
	For Site Class D	Site Adjusted	
Short (0.2 sec)	$S_s = 0.164 \text{ g}$	$S_{ms} = 0.263 \text{ g}$	$S_{ds} = 0.175 \text{ g}$
1 second	$S_1 = 0.055 \text{ g}$	$S_{m1} = 0.133 \text{ g}$	$S_{d1} = 0.089 \text{ g}$

GEOTECHNICAL ENGINEERING RECOMMENDATIONS

We based our geotechnical engineering analysis on the information developed from our subsurface exploration and soil laboratory testing, along with the project development plans, site plans, and structural loading furnished to our office. We recommend shallow spread footings for support of the proposed building addition. The following sections of the report provide our detailed recommendations.

Spread Footings

General

The test borings encountered up to 22 feet depth of fill soils below the existing site grades within the proposed building footprint. Additionally, some possible fill soils were encountered below the fills soils to a depth of 32 feet. The fill soils contained brick fragments and coal. Based on the 1918 *Building Number and Location Plan*, the area of existing Building 360 and the proposed addition used to be a coal storage area. Several structures were also located in the area. The brick fragments and coal encountered in the test borings are likely the remains of the demolished structure foundations and onsite coal storage. We do not recommend direct support of the building foundations on the existing fills.

We considered a deep foundation such as auger cast piles (ACP) to span through the fill soils and bear in the natural Stratum B Talbot Formation soils. We believe a deep foundation system would be much more costly than improving the fill soils. Therefore, we do not provide pile recommendations in this report. We can provide recommendations for a deep foundation system as an additional cost.

We considered undercutting and replacing the fill with new compacted structural fill, however, removing this depth of fill would not be economically practical. Recommendations for improving the fill using stone columns are provided below.

Stone Columns

Unless all existing fill below footing foundations is completely removed and replaced with new compacted fill, there is an inherent risk of unpredictable and unacceptable settlement of footing foundations supported on fill soils. This is a risk that the owner must assume if the fill soils are not completely removed. We recommend that the fill soils be improved with stone columns to reduce the risk of uncontrolled settlements. The term "stone columns" refers to rammed aggregate piers, Geopiers, vibro-columns, or a similar type of ground improvement columns. The design of the stone column and its performance is the responsibility of the specialty contractor. A licensed engineer retained by the stone column specialty contractor should design the stone column size and spacing using the guidelines provided in FHWA-SA-98-086 or other relevant publications. The stone column should be designed to consider the footing loads and the weight of the fills placed for the floor support. The stone-column

specialty contractor should submit the design and the planned installation method of the stone column for our review and acceptance, before construction.

We recommend that the stone column be designed to support spread footings with an allowable bearing pressure of 3,000 psf and be designed to limit settlements of the shallow foundations to 1 inch or less. It should also be designed to limit differential settlements to ½ inch or less for similarly loaded footings. The stone columns should be installed through the fill soils, and a minimum of 5 feet into the natural, Stratum B soils. If the method of installation of the stone column does not facilitate the observation of the bearing soils, then we recommend the stone column be installed to a maximum depth of 22 feet below the existing ground surface. The area of stone column treatment below the footing (horizontally) should be at least twice the width (2B) of the footing. The installation of the stone column or should be monitored full-time by a Schnabel representative.

The grades at which natural soils considered suitable for foundation support were encountered in the test borings are presented in Table 3.

Table 3: Estimated Elevation of Suitable Foundation Soils

Boring ID	Estimated Elevation of Suitable Subgrade Soils (feet)	Depth Below Proposed FFE 36 (feet)
B-1	32.0	4.0
B-2	33.5	2.5
B-3	30.5	5.5
B-4	20.5	15.5
B-5	19.5 ⁽¹⁾	16.5
B-6	26.5	9.5

(1) Medium dense to very dense possible fill soils encountered from EL 19.5 to EL 9.5 are considered suitable foundation soils.

For planning purposes, the elevation of suitable materials may be considered to vary linearly between boring locations. All footing subgrades should be observed by our representative prior to placement of concrete.

Column and wall footings should be at least 24 and 12 inches wide, respectively, for shear considerations. Exterior footings should be founded at least 30 inches below final exterior grades for frost protection. Interior footings may be founded at minimal depths below the floor slabs. Interior footings subject to freezing should be founded at least 30 inches below slab grade.

The proposed addition is planned directly next to the existing building. New footings adjacent to existing footings should be founded at the same elevation in order to reduce differential settlements. Where bearing grades between adjacent footings vary, the slope edges of adjacent footings should be steeper than 45 degrees (1H:1V).

Obstructions

Although the project site was relatively flat, we encountered deep fills at this site. The fill soils contained asphalt and brick fragments. In addition, an abandoned foundation was observed in the grass field near the location of boring SWM-2. Photograph 1 shows the observed foundation:



Photograph 1 – Abandoned Foundation near Boring SWM-2

Based on our site observations and the test borings, we believe there is a possibility that some structure may have been previously constructed in the area of the proposed building addition. If a building with a basement was previously constructed at this site, there may be buried foundations, slabs, utilities or other obstructions below the ground surface. If any such obstructions are encountered during construction, the contractor should be prepared to remove them.

Floor Slabs

We understand up to two feet of fill and up to six feet of cut will be required to reach the proposed FFE. The test borings encountered fill soils up to a depth of about 17 feet below the proposed FFE. Due to the uncertainty of the quality and origin of the fill, the fills should not be considered suitable for direct support of the floor slabs. The floor slab should bear on Stratum B natural soils or new compacted fill. **Unless all existing fill below floor slabs is completely removed and replaced with new compacted fill, there is an inherent risk of unpredictable and unacceptable settlement of fill and floor slabs.** Therefore, we recommend that stone columns be placed below the floor slab.

A licensed engineer retained by the stone column specialty contractor should design the stone column size and spacing using the guidelines provided in FHWA-SA-98-086 or other relevant publications. The stone column spacing may be wider beneath the floor slab than it is beneath footings. The stone columns

should be designed to consider the floor dead and live loads as well as the weight of the fills placed for the floor support. The stone-column specialty contractor should submit the design and the planned installation method of the stone column for our review and acceptance, before construction.

We recommend a modulus of subgrade reaction, k , of 150 pci should be used in the design of floor slabs supported on Stratum B soils or fill soils improved with stone columns. The recommended modulus value is for a 1-ft-square plate. Some slab design software may consider different definitions of k for input. The Structural Engineer should contact our office if their software considers a different definition of k .

A four-inch crushed stone or washed gravel capillary moisture barrier should underlie floor slabs-on-grade. Moisture barrier material should consist of AASHTO M43 No. 57 crushed stone. The Contractor should compact the stone in place with at least two passes of suitable vibratory compaction equipment.

The Contractor should re-compact floor slab subgrades immediately before placing capillary moisture barrier materials to repair any disturbance that may occur due to construction operations. Since floors will be slab-on-grade, footing and utility excavations should be backfilled with compacted structural fill as defined in the Site Grading and Earthwork Section of this report.

Lateral Earth Pressure

We understand that some of the proposed Warehouse addition walls will retain earth. We assumed the walls will be cantilevered or semi-rigid (fixed) and backfilled with soils meeting the requirements for compacted structural fill, as described in the Site Grading and Earthwork section of this report. Retaining walls should be designed as shown on Figures 3 and 4 at the end of this report.

Horizontal forces on cantilevered walls should be resisted by friction acting on the base of the wall and passive earth pressure acting on the front of the wall foundation. Horizontal forces on semi-rigid walls should be resisted by the stiffness of the wall. The recommended parameters shown on Figures 3 and 4 consider a horizontal ground surface behind and in front of the walls. We should be contacted to provide alternative parameters if sloping ground surface conditions are anticipated. The retaining walls should be backfilled with compacted structural fill as recommended herein. Only light hand-operated equipment should be used to compact backfill against walls. The Structural Engineer of Record should approve the size of the compaction equipment.

The passive soil resistance shown in Figure 3 assumes that the wall is "tight" against the surrounding soils, and that lateral footing movements of about $0.06h$ is allowed (Foundation Design, Principles and Practices, Second Edition, Donald P. Coduto). A factor of safety of 1.5 should be used when evaluating the passive and sliding resistance.

We have assumed that drainage will be provided behind the retaining walls. Therefore the earth pressure recommendations provided on Figures 3 and 4 do not include hydrostatic pressure. Wall drainage may be provided using weep holes when free-draining backfill is used. Weep holes should be four inches in diameter and installed on 8-foot centers. A filter plug consisting of at least one cubic foot of drainage material wrapped in drainage geotextile should be placed at the back of each weep hole.

Pavements

Existing Pavement

During our subsurface exploration at the site, we observed the condition of the existing asphalt parking lot adjacent to Building 360. The parking lot appeared to generally be in fair to poor condition with areas of severe cracking. Areas near manholes appear to have settled and created voids below the pavement. Photograph 2 shows an example of the deteriorated pavement:



Photograph 2 – Cracking and Voids in Existing Parking Lot

Boring P-1, performed in the parking lot area encountered 2 inches of asphalt overlying 4 inches of graded aggregate base. We recommend that the existing asphalt be milled to the top of the asphalt base course or a minimum of 2 inches. Following milling, a selective patching program to repair any deeper damage to pavements that are still evident should be performed, as the proposed milling depth will only remove surficial cracks. The pavement should then be resurfaced to the original pavement grade with HMA.

New Pavement

We understand a new asphalt driveway is planned from the existing parking to the north side of the proposed building. New asphalt parking is also planned on the backside of existing Building 360. Traffic loading was not provided to us at the time of this report. We have assumed the following:

- Two-Way Average Daily Traffic = 100 vehicles per day
- Percent Single Axle Trucks = 2%
- Percent Tractor-Trailer Trucks = 1%

- Design Life = 25 Years
- Initial and Final Serviceability Indices = 4.5 and 2.8, respectively
- Reliability = 85%
- Overall Standard Deviation = 0.49
- Laboratory CBR Value = 2.5
- Design CBR Value = 3.0 (New Compacted Fill)

The Contractor should prepare pavement subgrades and place compacted structural fill for pavement support as described in the Site Grading and Earthwork section of this report. Dense-graded aggregate placed as pavement base course should be compacted to at least 95 percent of maximum dry density according to ASTM D698, Standard Proctor. Dense-graded aggregate should be placed in maximum 6-inch thick loose lifts.

Final pavement subgrades should be proofrolled under the observation of the Geotechnical Engineer immediately prior to placing subbase or base course aggregate to evaluate their suitability to support the pavement.

We developed the recommended pavement sections according to the AASHTO 1993 design method for flexible pavements. Our analysis considers that proper grading will be maintained to provide runoff from the pavement surface and beyond the limits of paved areas. We recommend the following pavement section:

Table 4: Recommended Pavement Section

Section Type	Thickness (inches)
Asphalt Pavement	
Hot Mix Asphalt (HMA) Superpave 9.5 mm Gap Graded, PG 64-22, Level 2	1.5
HMA Superpave 19.0 mm, PG 64-22, Level 2	2.5
Dense-Graded Aggregate Base Course	6.0

Adequate control of surface drainage will be a very important consideration for the overall performance of this pavement design. The area surrounding pavements should be graded to direct surface water away from paved areas. Utility excavations within pavement areas should be backfilled with compacted structural fill.

Groundwater was not observed within 5 feet of the existing ground surface at the pavement boring location. Therefore, pavement subdrains will likely not be required. However, if groundwater is encountered within two feet of the pavement subgrade during construction, we recommend pavement subdrains be installed. Pavement subdrains should discharge into a ditch or into a storm sewer.

Stormwater Management

We understand that two new micro-bioretenion facilities will be constructed at the site. The Maryland Department of the Environment (MDE) has set particular standards and specifications for the design and

construction of stormwater infiltration devices. These regulations include parameters on soil textures, depth of limiting zones, topographic conditions, and other considerations.

Depth to Limiting Zones

Table 4.4 of the 2000 MDE Maryland Stormwater Design Manual recommends that a minimum two foot vertical distance be provided between the bottom of the bioretention system and any limiting zone.

Limiting zones are defined as a seasonably high groundwater table or bedrock. Bedrock was not encountered at this site. Therefore, bedrock is not a limiting factor.

Groundwater was observed below the existing ground surface in borings SWM-1 and SWM-2 at depths of 2.0 feet (EL 31) and 5.0 feet (EL 29), respectively. These groundwater depths were recorded approximately 1.5 to 2 hours after completion of the borings. The bottom of the proposed BMPs should be a minimum of 2 feet above the groundwater elevation.

Fill is also considered a limiting zone as MDE does not allow SWM structures founded in existing fills to be designed for infiltration. Fill was encountered in boring SWM-2 to a depth of 4.5 feet below the existing ground surface. Table 5 summarizes the limiting zones for the SWM structures at this site.

Table 5: Summary of Limiting Zones

Boring ID	Approximate Ground Surface Elevation (feet)	Groundwater Limiting Zone		Fill Limiting Zone		Acceptable Basin Depth/Elevation	
		Depth (feet)	Elevation (feet)	Depth (feet)	Elevation (feet)	Depth (feet)	Elevation (feet)
SWM-1	33.0	2.0	31.0	--	--	N/F	N/F
SWM-2	34.0	5.0	29.0	4.5	29.5	N/F	N/F

N/F – Infiltration is not feasible because of limiting zones.

-- No limiting zone.

Soil Textures

The 2000 MDE Maryland Stormwater Design Manual requires USDA Soil Textural Classifications for each type of soil at the infiltration device. These classifications are used to correlate the material with typical minimum infiltration rates.

A soil sample from the test boring collected at or below the infiltration test depth was classified based on soil laboratory testing in accordance with the USDA Soil Textural Classification System. The 2000 MDE Maryland Stormwater Design Manual recommends the minimum infiltration rates be assigned to the tested soils as shown in Table 6, below:

Table 6: USDA Minimum Infiltration Rates

Boring ID	Test Depth / Elevation (feet)	USDA Textural Classification	Minimum Infiltration Rate (inches/hour)
SWM-1 ⁽¹⁾	5.0 / EL 28.0	CLAY LOAM	0.09
SWM-2 ⁽²⁾	N/A	N/A	N/A

(1) Infiltration test was performed in case groundwater was only perched

(2) Infiltration test was not performed due to fill and groundwater limiting zones

In-Situ Infiltration Tests

In order to confirm the infiltration rate from the soil textural classification, an in-situ infiltration test is required. The results of the infiltration tests are summarized in Table 7, below. The results of the tests are also included in Appendix C.

Table 7: Field Infiltration Rates

Boring ID	Test Depth / Elevation (feet)	USDA Textural Classification	Field Infiltration Rate (inches/hour)
SWM-1 ⁽¹⁾	5.0 / EL 28.0	CLAY LOAM	0.00
SWM-2 ⁽²⁾	N/A	N/A	N/A

(1) Infiltration test was performed in case groundwater was only perched

(2) Infiltration test was not performed due to fill and groundwater limiting zones

It should be noted that the recorded infiltration rate from the field infiltration testing is only an approximation of the in-situ soil infiltration rate at the location tested, and a variation of the actual infiltration rate for the facility should be expected. It is our understanding that the design infiltration rate should be the lesser value from Tables 6 and 7.

Conclusion

The micro-bioretenion facilities planned will be in fill soils and/or will be within two feet of the groundwater table. Therefore, these facilities should be designed using underdrains and should not consider any infiltration.

Site Grading and Earthwork

Existing grades in the area of the proposed addition range from about EL 34 up to about EL 42. The finished floor elevation for the proposed addition is about EL 36. Therefore, up to about 2 feet of fills and about 6 feet of cuts are planned at the site. Recommendations for compacted fill subgrade preparation, fill soil requirements and placement and compaction criteria are presented in subsequent sections.

Compacted Fill Subgrades

Subgrades to receive compacted structural fill for building or pavement support should be stripped of vegetation, topsoil, and organic matter. Schnabel's subsurface exploration indicated topsoil to depths of three to eight inches below the ground surface. We recommend a topsoil stripping depth of 12 inches be considered for the site during the project planning.

Stratum A fill and possible fill soils were encountered at this site to depths of up to 32 feet below the existing ground surface or 27 feet below the proposed FFE. The fill soils at this site had highly variable consistencies and contained construction debris such as coal and brick fragments. These soils are not considered suitable for support of compacted structural fill. Compacted structural fill subgrades should consist of suitable natural soils of Stratum B or the subgrades should be undercut a minimum of 2 feet and replaced with new compacted fill.

The Geotechnical Engineer should evaluate the suitability of the fill subgrades. The stripped subgrades should be proofrolled with a loaded dump truck to evaluate the subgrade suitability for support of the compacted structural fill prior to any undercutting or initiation of fill placement. Areas that exhibit excessive pumping, weaving, or rutting should be scarified, dried and re-compacted, or undercut and replaced with compacted structural fill as recommended by the Geotechnical Engineer. Subgrade evaluation techniques complementary to proofrolling could include a combination of probing with a penetrometer, drilling hand augers, or observing test pits.

When removal of unsuitable materials is required, the excavation should be performed in a manner to limit disturbance of the underlying suitable material. The excavation should be performed under the observation of the Geotechnical Engineer to evaluate required excavation depths.

Undercut volumes should be evaluated by cross sectioning. Other methods of calculating volumes of undercut, such as counting trucks, are less accurate and generally result in additional expense.

Compacted structural fill subgrades should be free of snow, ice, and frozen soils. If snow, ice, or frozen soils are present at subgrade levels, these materials should be removed as recommended by the Geotechnical Engineer.

Some existing structures present on site will need to be removed before earthwork construction. These structures include an existing retaining wall, a concrete walk area, utilities and any other subsurface features. Therefore, buried foundations and other associated debris may be encountered during grading activities. Existing foundations should be completely removed from the proposed building area. Existing foundations and walls in the proposed pavement areas should be removed to at least 4 feet below the design pavement subgrade level. Existing utilities and drainage structures within the building area should be removed and replaced with compacted structural fill.

Compacted structural fill subgrades should not be steeper than about 4H:1V. If steeper slopes are present, subgrades should be benched to permit placement of horizontal lifts of fill.

Compacted Fill

Compacted structural fill and backfill should consist of non-organic, on-site soils from Stratum B or off-site soils, classifying as SC, SM, SP, SW, GC, GM, GP or GW according to ASTM D2487. Fill materials should not contain particles larger than 3 inches.

Compacted structural fill should be placed in maximum 8-inch thick horizontal, loose lifts. Fill should be compacted to at least 95 percent of the maximum dry density per ASTM D698, Standard Proctor, except that the top 12 inches in pavement areas should be compacted to at least 100 percent of the same

standard. Soil moisture contents at the time of compaction should be within 2 percent of the soils' optimum moisture content.

Backfill placed in excavations, trenches, and other areas that large compaction equipment cannot access should be placed in maximum 6-inch thick lifts. Backfill should meet the material, placement, and compaction requirements outlined above.

Stratum B soils meeting the criteria above may be re-used as compacted fill. Successful re-use of the excavated, on-site soils as compacted structural fill will depend on their natural moisture contents during excavation. Laboratory test results indicate the Stratum B soils encountered ranged from about 14 to 32 percent. These moisture contents are likely wet of the optimum moisture content. Scarifying and drying of these soils should be anticipated to achieve the recommended compaction. Drying of these soils will likely result in some delays, and may not be possible during cooler, wetter weather. We recommend that the earthwork be performed during the warmer, drier times of the year.

CONSTRUCTION CONSIDERATIONS

Spread Footings

The Contractor should exercise care during excavation for spread footings so that as little disturbance as possible occurs at the foundation level. The Contractor should carefully clean loose or soft soils from the bottom of the excavation before placing concrete. A Geotechnical Engineer from our firm should observe footing subgrades prior to concrete placement to evaluate whether subgrade soils are as anticipated in this report.

Groundwater was observed as high as 5 feet below the existing ground surface at borings B-1 and B-6. The Contractor should anticipate groundwater during excavation for footings in these areas. We anticipate that pumping from sump pits within the footing excavations can control groundwater. To protect bearing materials from deteriorating, three-inch mud-mats consisting of lean concrete should be placed over them immediately after excavation and evaluation of spread footing subgrades. Forms may be used if necessary, but less subgrade disturbance is expected if excavations are made to the required dimensions, and concrete is placed against the soil. If footings are formed, the forms should be pulled and the excavation backfilled as soon as possible. Water should not be allowed to pond along the outside of footings for long periods of time.

Stone Columns

The subsurface exploration encountered deep fills below the site. The origin and quality of the fills are unknown. In addition, our test borings encountered construction debris, including asphalt and brick fragments. An abandoned foundation was also observed in the grass field near boring SWM-2. **The test borings were performed at discrete locations; therefore there is a risk that obstructions such as buried foundations, boulders or other large materials could be encountered between the locations of our borings.** If these materials are encountered, they could obstruct the installation of the stone columns. The contractor should have a contingency plan for this. Should the installation of a stone column encounter an obstruction, the contractor may do one of the following with prior approval from the geotechnical engineer: (1) the stone column may be off-set a maximum of 1.5 feet from the original

location in an effort to avoid the obstruction; (2) use additional stone columns to “surround” the obstructions; or (3) remove the obstruction. Geotechnical engineering personnel must observe the installation of the stone columns on a continuous basis, and record logs of the installation.

The method of installation of the stone columns must consider the existing underground and overhead utilities at the site, as well as the existing building foundations. Vibration and soil displacement from the stone column installation must not damage these utilities and other site structures. **The stone column contractor should retain the services of a vibration consultant to provide guidance on the vibration threshold values for these structures.** A vibration monitoring plan should be prepared, submitted for review, and implemented during construction.

Stormwater Management

Infiltration and Underdrain Requirements

Groundwater was encountered in borings SWM-1 and SWM-2 at depths of 2 feet and 5 feet, respectively. In addition, 4.5 feet of existing fill was encountered below the existing ground surface at boring SWM-2. The infiltration test performed adjacent to boring SWM-1 had a minimum infiltration rate less than 0.52 inches per hour. Therefore, based on the 2000 Maryland Stormwater Design Manual, infiltration is not considered feasible and underdrains are a required part of the stormwater management designs.

The design and construction of an underdrain system is not foolproof. System failures may occur due to various causes. Periodic maintenance, including flushing, and possible chemical treatment to flush out soil particles and remove mineral or bacterial deposits that may restrict flow in the pipes will be required. Adequate cleanouts should be included in the underdrain system design to permit access to the entire system. Generally, cleanouts will also be located at upstream ends of laterals and at critical intersections. The underdrain system should be laid out to provide redundant flow paths where possible.

General

All stormwater management facilities shall be setback a minimum distance of ten feet from existing structure foundations to reduce the risk of groundwater seepage into the structure. The stormwater management facilities should not conflict with utilities and should be setback the distance recommended by the utility owner.

Dewatering

The contractor should anticipate groundwater during excavating for the stone columns. Depending on the method of installation, the stone columns can be cased to protect the hole from groundwater intrusion and the casing can be pulled up as the stone lifts are compacted. Alternatively, the stone columns can be constructed by vibrating the stone into the ground.

Engineering Services During Construction

The engineering recommendations provided in this report are based on the information obtained from the subsurface exploration and laboratory testing. However, conditions on the site may vary between the

discrete locations observed at the time of our subsurface exploration. The nature and extent of variations between borings may not become evident until during construction.

To account for this variability, we should provide professional observation and testing of subsurface conditions revealed during construction as an extension of our engineering services. These services will also help in evaluating the contractor's conformance with the plans and specifications in accordance with IBC, MDE and Cecil County requirements. Because of our unique position to understand the intent of the geotechnical engineering recommendations, retaining Schnabel for these services will allow the owner to receive consistent service throughout the project construction.

General Specification Recommendations

An allowance should be established to account for possible additional costs that may be required to construct earthwork and foundations as recommended in this report. Additional costs may be incurred for a variety of reasons including variation of soil between borings, greater than anticipated unsuitable soils, need for borrow fill material, wet on-site soils, obstructions, temporary dewatering, etc.

We recommend that the construction contract include unit prices for scarifying and drying wet and/or loose subgrade soils, and provide an allowance for this work. In addition, the construction contract should include an allowance for undercutting soft or loose, near-surface soils, and replacement with compacted structural fill. Add/deduct unit prices should also be established in the contract so adjustments can be made for the actual volume of materials handled.

We also recommend an allowance be established for installation of pavement subdrains. Add/deduct unit prices should be provided so adjustments for the actual length of drains installed can be made.

The project specifications should indicate the Contractor's responsibility for providing adequate site drainage during construction. Inadequate drainage will most likely lead to disturbance of soils by construction traffic and increased volume of undercut.

This report may be made available to prospective bidders for informational purposes. We recommend that the project specifications contain the following statement:

Schnabel Engineering Consultants, Inc., has prepared this geotechnical engineering report for this project. This report is for informational purposes only and is not part of the contract documents. The opinions expressed represent the Geotechnical Engineer's interpretation of the subsurface conditions, tests, and the results of analyses performed. Should the data contained in this report not be adequate for the Contractor's purposes, the Contractor may make, before bidding, independent exploration, tests and analyses. This report may be examined by bidders at the office of the Owner, or copies may be obtained from the Owner at nominal charge.

Additional data and reports prepared by others that could have an impact upon the Contractor's bid should also be made available to prospective bidders for informational purposes.

LIMITATIONS

We based the analyses and recommendations submitted in this report on the information revealed by our exploration. We attempted to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction.

This report has been prepared to aid in the evaluation of this site and to assist in the design of the project. It is intended for use concerning this specific project. We based our recommendations on information on the site and proposed construction as described in this report. Substantial changes in loads, locations, or grades should be brought to our attention so we can modify our recommendations as needed. We would appreciate an opportunity to review the plans and specifications as they pertain to the recommendations contained in this report, and to submit our comments to you based on this review.

We have endeavored to complete the services identified herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project. No other representation, express or implied, is included or intended, and no warranty or guarantee is included or intended in this report, or other instrument of service.

Nobis Engineering, Inc.
Addition to Warehouse Building 360
Perry Point, Cecil County, Maryland

We appreciate the opportunity to be of service for this project. Please call us if you have any questions regarding this report.

Sincerely,

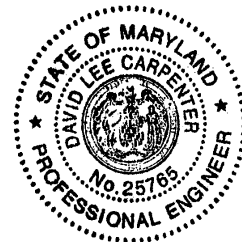
SCHNABEL ENGINEERING CONSULTANTS, INC.



Christopher D. Calhoun, PE
Project Engineer



David L. Carpenter, PE
Senior Engineer



Professional Certification. I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the state of Maryland.

License No. 25765, Expiration Date: 01/15/16



Kenneth E. Derrenbacher, PE
Principal



CDC:DC:KD:MHJ

Figures

Appendix A: Subsurface Exploration Data
Appendix B: Soil Laboratory Test Data
Appendix C: Field Test Data

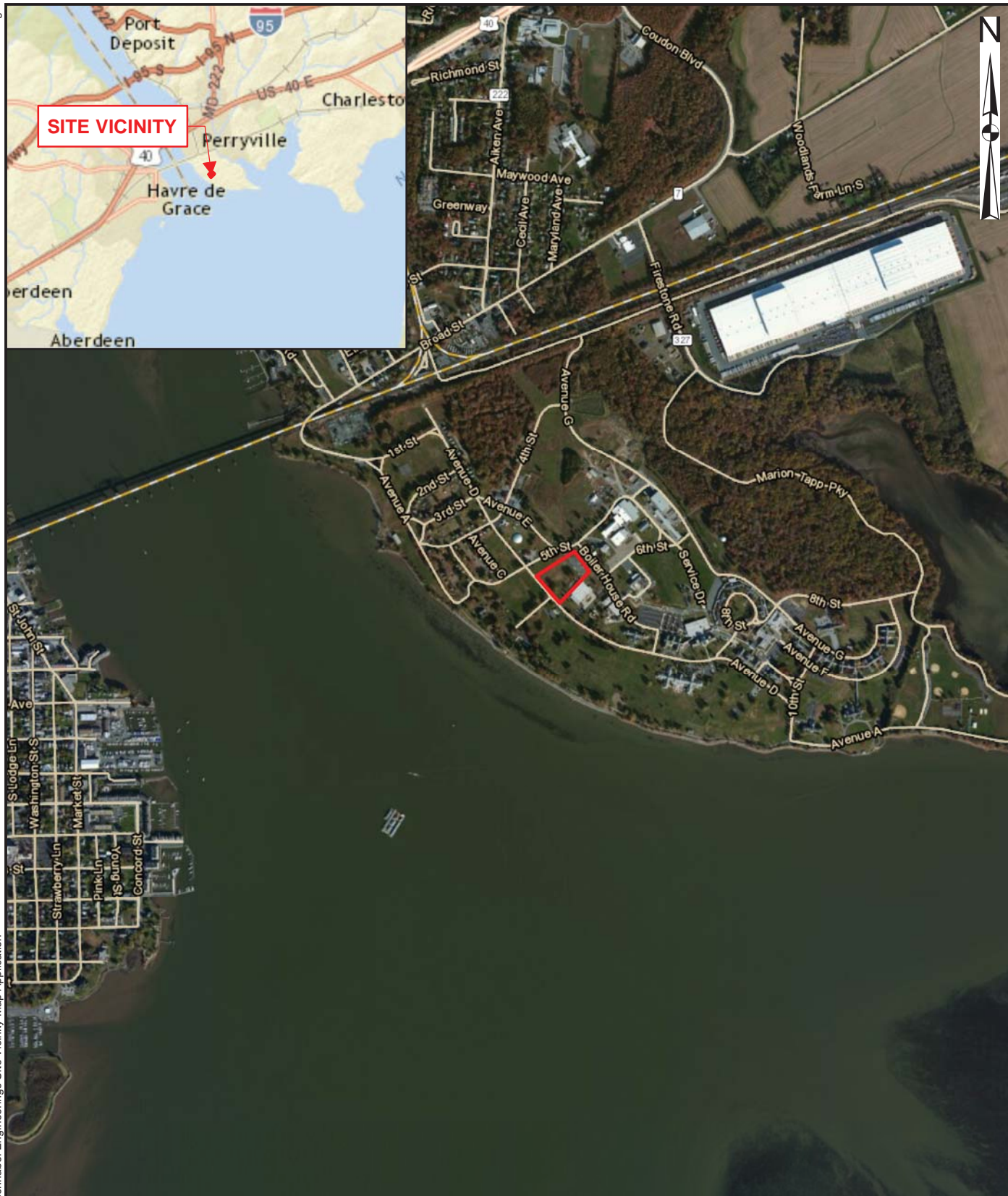
FIGURES

Figure 1: Site Vicinity Map

Figure 2: Test Boring Location Plan

Figure 3: Lateral Earth Pressure Recommendations for Cantilevered Walls

Figure 4: Lateral Earth Pressure Recommendations for Fixed Walls



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
 Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap

NOT TO SCALE

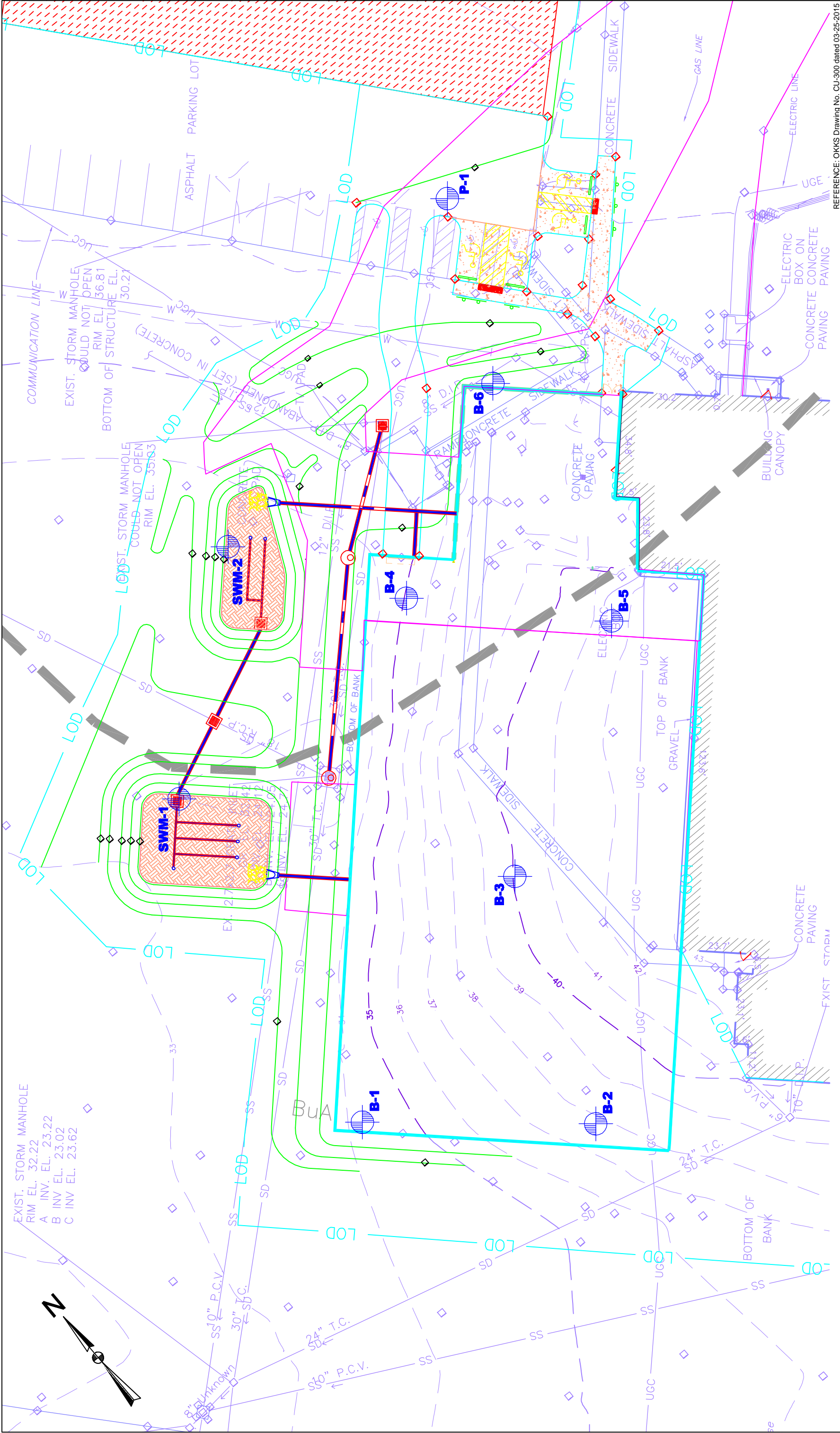


ADDITION TO WAREHOUSE BUILDING 360,
 VETERANS ADMINISTRATION HOSPITAL,
 PERRY POINT, CECIL COUNTY, MARYLAND

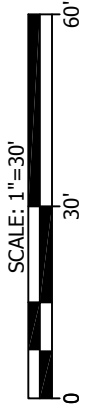
PROJECT NO. 15614012.00

SITE VICINITY
 MAP

FIGURE 1



LEGEND
- - - APPROXIMATE TEST BORING LOCATION



SCALE: 1"=30'



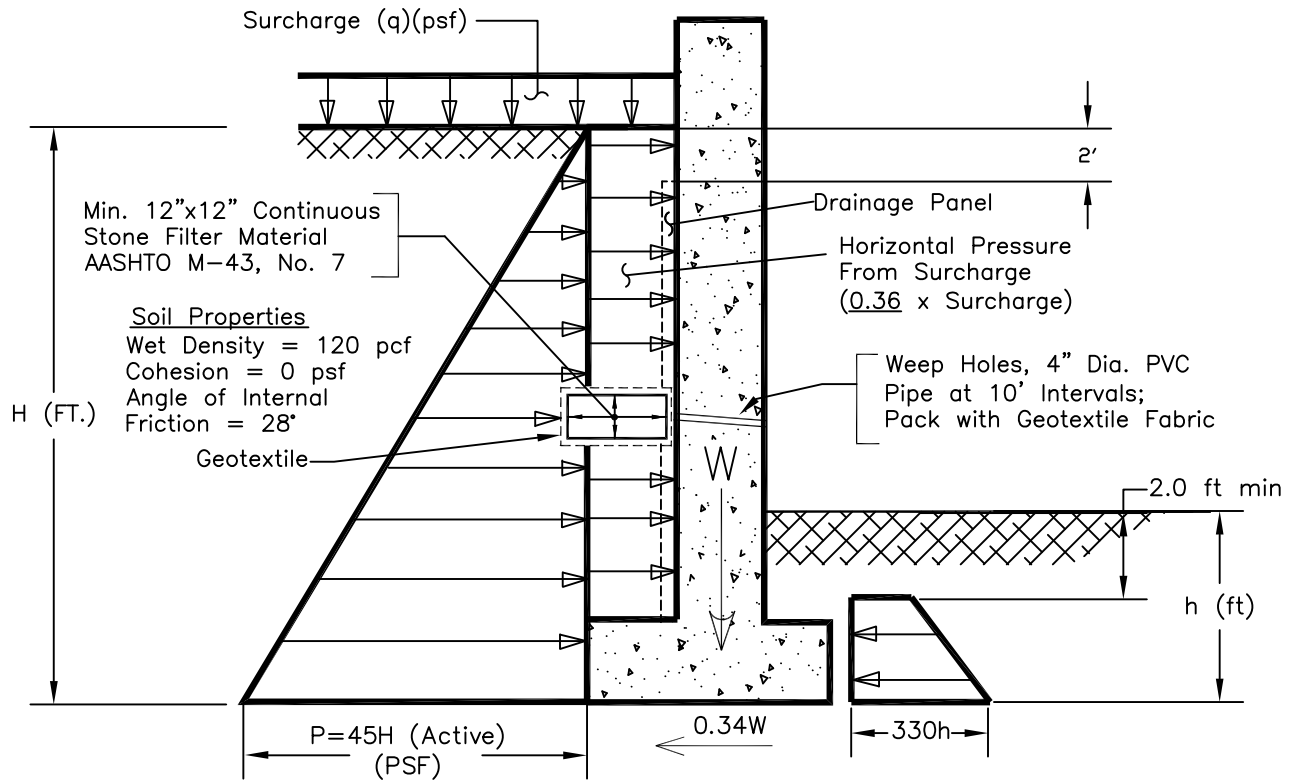
ADDITION TO WAREHOUSE BUILDING 360,
VETERANS ADMINISTRATION HOSPITAL,
PERRY POINT, CECIL COUNTY, MARYLAND
PROJECT 15614012.00

TEST BORING LOCATION PLAN

FIGURE 2

REFERENCE: OKKS Drawing No. CU-300 dated 03-25-2015

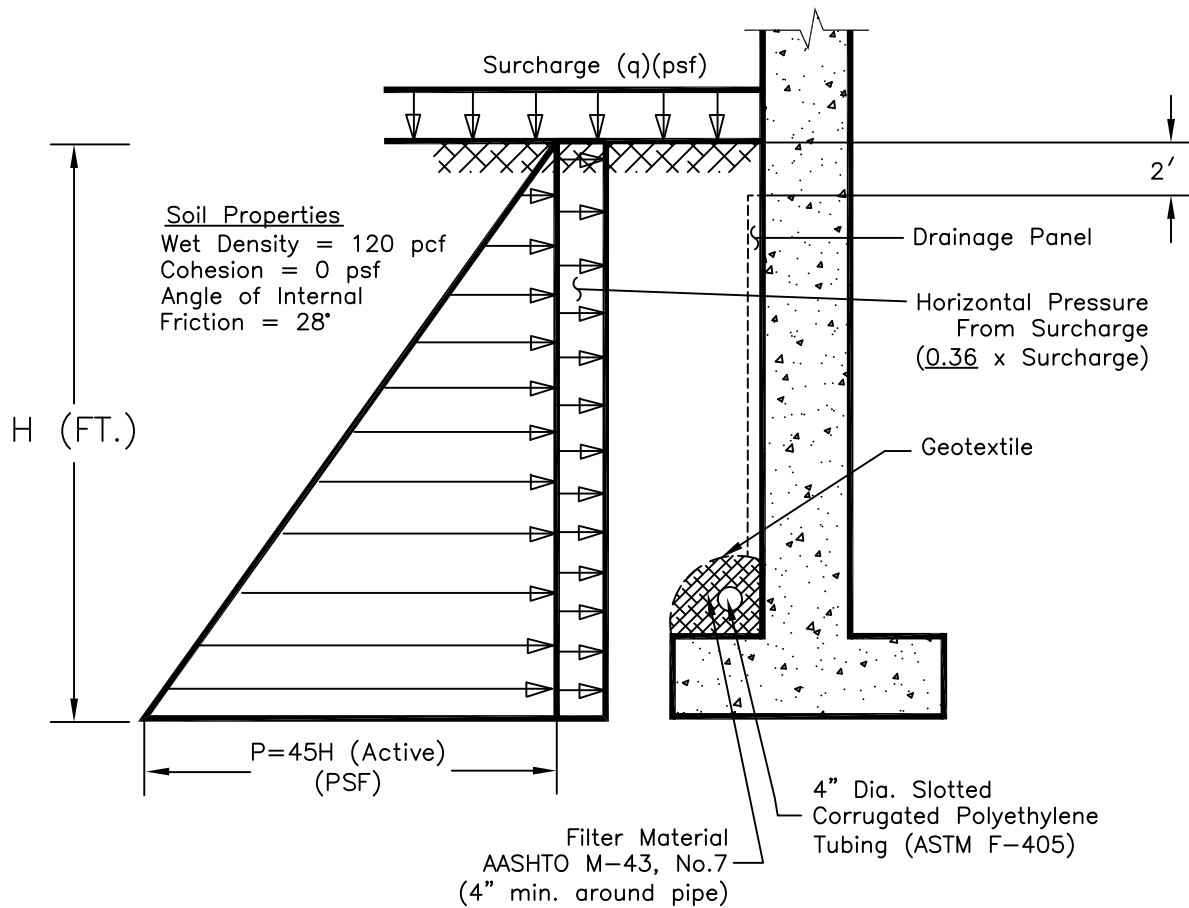
Lateral Earth Pressures For Cantilever Retaining Walls



Geotextile Requirements

Grab strength lbs. (ASTM D4632)	120 lbs. (min.)
Elongation (%) (ASTM D4632)	N/A
Puncture strength (ASTM 4833)	60 lbs. (min.)
Burst strength (ASTM 3786)	225 PSI (min.)
Trapezoidal tear (ASTM D4533)	50 lbs. (min.)
Apparent opening size (ASTM D-5741)	< #70 U.S. Standard Sieve
Permittivity (ASTM D4491)	1.0 sec ⁻¹ (min.)
Ultraviolet degradation at 150 hours (ASTM D4355)	70% strength retained

Lateral Earth Pressures For Semi-Rigid Walls



Geotextile Requirements

Grab strength lbs. (ASTM D4632)	120 lbs. (minimum)
Elongation (%) (ASTM D4632)	N/A
Puncture strength (ASTM 4833)	60 lbs. (minimum)
Burst strength (ASTM 3786)	225 PSI (minimum)
Trapezoidal tear (ASTM D4533)	50 lbs. (minimum)
Apparent opening size (ASTM D-5741)	< #70 U.S. Standard Sieve Minimum
Permittivity (ASTM D4491)	1.0 sec^{-1} (minimum)
Ultraviolet degradation at 150 hours (ASTM D4355)	70% strength retained

APPENDIX A

SUBSURFACE EXPLORATION DATA

Subsurface Exploration Procedures

General Notes for Subsurface Exploration Logs

Identification of Soil

Boring Logs, B-1 through B-6, P-1, SWM-1 and SWM-2

SUBSURFACE EXPLORATION PROCEDURES

Test Borings – Hollow Stem Augers

The borings are advanced by turning a continuous flight auger with a center opening of 2¼ or 3¼ inches. A plug device blocks off the center opening while augers are advanced. Cuttings are brought to the surface by the auger flights. Sampling is performed through the center opening in the hollow stem auger, by standard methods, after removal of the plug. Usually, no water is introduced into the boring using this procedure.

Standard Penetration Test Results

The numbers in the Sampling Data column of the boring logs represent Standard Penetration Test (SPT) results. Each number represents the blows needed to drive a 2-inch O.D., 1⅝-inch I.D. split-spoon sampler 6 inches, using a 140-pound hammer falling 30 inches. The sampler is typically driven a total of 18 or 24 inches. The first 6 inches are considered a seating interval. The total of the number of blows for the second and third 6-inch intervals is the SPT “N value.” The SPT is performed according to ASTM D1586.

The SPT samples were obtained using a hydraulically driven automatic trip hammer (ATH). Most correlations with SPT data are based on N-values collected with a safety hammer. The energy applied to the split-spoon sampler using the ATH is about 33 percent greater than that applied using the safety hammer, resulting in lower N-values. The hammer blows shown on the boring logs are uncorrected for the higher energy. However, we correct SPT N values for the higher energy when using N values in our analyses.

Soil Classification Criteria

The group symbols on the logs represent the Unified Soil Classification System Group Symbols (ASTM D2487) based on visual observation and limited laboratory testing of the samples. Criteria for visual identification of soil samples are included in this appendix. Some variation can be expected between samples visually classified and samples classified in the laboratory.

Pocket Penetrometer Results

The values following “PP=” in the sampling data column of the logs represent pocket penetrometer readings. Pocket penetrometer readings provide an estimate of the unconfined compressive strength of fine-grained soils.

Boring, Hand Auger and Test Pit Locations and Elevations

Borings locations were staked by taping from existing site features. Approximate boring locations are shown on Figure 2. Ground surface elevations at the boring locations were obtained from the site topographic plan and are indicated on the boring logs. Locations and elevations should be considered no more accurate than the methods used to determine them.

GENERAL NOTES FOR SUBSURFACE EXPLORATION LOGS

1. Numbers in sampling data column next to Standard Penetration Test (SPT) symbols indicate blows required to drive a 2-inch O.D., 1½-inch I.D. sampling spoon 6 inches using a 140 pound hammer falling 30 inches. The Standard Penetration Test (SPT) N value is the number of blows required to drive the sampler 12 inches, after a 6 inch seating interval. The Standard Penetration Test is performed in general accordance with ASTM D1586.
2. Visual classification of soil is in accordance with terminology set forth in "Identification of Soil." The ASTM D2487 group symbols (e.g., CL) shown in the classification column are based on visual observations.
3. Estimated water levels indicated on the logs are only estimates from available data and may vary with precipitation, porosity of the soil, site topography, and other factors.
4. Refusal at the surface of rock, boulder, or other obstruction is defined as an SPT resistance of 50 blows for 1 inch or less of penetration.
5. The logs and related information depict subsurface conditions only at the specific locations and at the particular time when drilled or excavated. Soil conditions at other locations may differ from conditions occurring at these locations. Also, the passage of time may result in a change in the subsurface soil and water level conditions at the subsurface exploration location.
6. The stratification lines represent the approximate boundary between soil and rock types as obtained from the subsurface exploration. Some variation may also be expected vertically between samples taken. The soil profile, water level observations and penetration resistances presented on these logs have been made with reasonable care and accuracy and must be considered only an approximate representation of subsurface conditions to be encountered at the particular location.
7. Key to symbols and abbreviations:



S-1, SPT
5+10+1

Sample No., Standard Penetration Test
Number of blows in each 6-inch increment



SH-1, SH
Rec=24", 100%

Sample No., 2" or 3" Shelby Tube Sample
Recovery in inches, Percent Recovery

LL

Liquid Limit

MC

Moisture Content (percent)

PL

Plastic Limit

PP

Pocket Penetrometer Reading (tsf)

%Passing#200

Percent by weight passing a No. 200 Sieve

IDENTIFICATION OF SOIL

I. DEFINITION OF SOIL GROUP NAMES (ASTM D2487)

SYMBOL GROUP NAME

Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels – More than 50% of coarse fraction retained on No. 4 sieve Coarse, ¾” to 3” Fine, No. 4 to ¾”	Clean Gravels Less than 5% fines	GW	WELL GRADED GRAVEL
			GP	POORLY GRADED GRAVEL
		Gravels with fines More than 12% fines	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	Sands – 50% or more of coarse Fraction passes No. 4 sieve Coarse, No. 10 to No. 4 Medium, No. 40 to No. 10 Fine, No. 200 to No. 40	Clean Sands Less than 5% fines	SW	WELL GRADED SAND
			SP	POORLY GRADED SAND
		Sands with fines More than 12% fines	SM	SILTY SAND
			SC	CLAYEY SAND
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays – Liquid Limit less than 50 Low to medium plasticity	Inorganic	CL	LEAN CLAY
			ML	SILT
		Organic	OL	ORGANIC CLAY ORGANIC SILT
			Silts and Clays – Liquid Limit 50 or more Medium to high plasticity	Inorganic
	MH	ELASTIC SILT		
	Organic	OH		ORGANIC CLAY ORGANIC SILT
	Highly Organic Soils	Primarily organic matter, dark in color and organic odor		PT

II. DEFINITION OF SOIL COMPONENT PROPORTIONS (ASTM D2487)

Examples

Adjective Form	GRAVELLY SANDY	>30% to <50% coarse grained component in a fine-grained soil	GRAVELLY LEAN CLAY
	CLAYEY SILTY	>12% to <50% fine grained component in a coarse-grained soil	SILTY SAND
"With"	WITH GRAVEL WITH SAND	>15% to <30% coarse grained component in a fine-grained soil	FAT CLAY WITH GRAVEL
	WITH GRAVEL WITH SAND	>15% to <50% coarse grained component in a coarse-grained soil	POORLY GRADED GRAVEL WITH SAND
	WITH SILT WITH CLAY	>5% to <12% fine grained component in a coarse-grained soil	POORLY GRADED SAND WITH SILT

III. GLOSSARY OF MISCELLANEOUS TERMS

SYMBOLS	Unified Soil Classification Symbols are shown above as group symbols. A dual symbol "-" indicates the soil belongs to two groups. A borderline symbol "/" indicates the soil belongs to two possible groups.
FILL	Man-made deposit containing soil, rock and often foreign matter.
PROBABLE FILL	Soils which contain no visually detected foreign matter but which are suspect with regard to origin.
DISINTEGRATED ROCK (DR)	Residual materials with a standard penetration resistance (SPT) between 60 blows per foot and refusal. Refusal is defined as an SPT of 100 blows for 2" or less penetration.
PARTIALLY WEATHERED ROCK (PWR)	Residual materials with a standard penetration resistance (SPT) between 100 blows per foot and refusal. Refusal is defined as an SPT of 100 blows for 2" or less penetration.
BOULDERS & COBBLES	Boulders are considered rounded pieces of rock larger than 12 inches, while cobbles range from 3 to 12-inch size.
LENSES	0 to ½-inch seam within a material in a test pit.
LAYERS	½ to 12-inch seam within a material in a test pit.
POCKET	Discontinuous body within a material in a test pit.
MOISTURE CONDITIONS	Wet, moist or dry to indicate visual appearance of specimen.
COLOR	Overall color, with modifiers such as light to dark or variation in coloration.



TEST BORING LOG

Project: VA Hospital Warehouse Addition

Perry Point, Maryland

Boring Number: **B-1**

Contract Number: 15614012.00

Sheet: 1 of 1

Contractor:

Contractor Foreman: R. Balbuena

Schnabel Representative: C. Calhoun

Equipment: CME-45C (Truck)

Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)

Dates Started: 4/13/15 Finished: 4/13/15

Location: See Location Plan

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/13	12:38 PM	9.0'	8.5'	---
Completion	4/13	12:55 PM	---	23.5'	---
Casing Pulled	4/13	1:11 PM	5.0'	---	20.0'

Ground Surface Elevation: 34.0 (ft) Total Depth: 25.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	DATA	TESTS	REMARKS
0.3	Topsoil=3-inches	FILL	33.7	A		S-1, SPT 1+2+4 REC=6", 33%	MC = 18.2%	Fill
2.0	PROBABLE FILL, sampled as lean clay; moist, brown, estimated <5% gravel, roots		32.0			S-2, SPT 5+10+13 REC=12", 67%	MC = 32.2%	Talbot Formation
4.5	LEAN CLAY; moist, brown, estimated <5% roots, mica	CL	29.5	B	5	S-3, SPT 4+8+10 REC=18", 100%		
	Change: estimated <5% gravel	ML	26.5			S-4, SPT 5+9+9 REC=18", 100%		
7.5	SILT; moist, gray and orangish brown, estimated <5% mica		24.5		10	S-5, SPT 4+4+5 REC=18", 100%		
9.5	LEAN CLAY; moist, brown and streaked bluish gray	CL	20.0		15	S-6, SPT 2+3+4 REC=18", 100%		
14.0	SILTY SAND; wet, orangish brown, contains lenses of sandy lean clay	SM	19.5		20	S-7, SPT 5+10+15 REC=18", 100%		
14.5	FAT CLAY; moist, gray, estimated <5% mica	CH	17.0					
17.0	SANDY FAT CLAY; wet, reddish purple and bluish gray	CH	12.0					
22.0	SANDY LEAN CLAY; wet, gray, estimated <5% mica	CH	9.0					
25.0	CLAYEY SAND; wet, gray, contains lenses of sandy lean clay	SC						

Bottom of Boring at 25.0 ft.
Boring backfilled upon completion



TEST BORING LOG

Project: VA Hospital Warehouse Addition

Perry Point, Maryland

Boring Number: **B-2**

Contract Number: 15614012.00

Sheet: 1 of 1

Contractor:

Contractor Foreman: R. Balbuena

Schnabel Representative: C. Calhoun

Equipment: CME-45C (Truck)

Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)

Dates Started: 4/13/15 Finished: 4/13/15

Location: See Location Plan

Ground Surface Elevation: 38.0 (ft) Total Depth: 25.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/13	---	Dry	---	---
Completion	4/13	---	Dry	23.5'	---
Casing Pulled	4/13	---	Dry	---	22.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	DATA	TESTS	REMARKS
0.4	Topsoil=5-inches	FILL	37.6	A		S-1, SPT 1+2+2 REC=8", 44%	MC = 15.8%	Fill
	FILL, sampled as lean clay; moist, brown, estimated <5% gravel, roots Change: estimated 5 - 10% gravel					S-2, SPT 2+2+2 REC=10", 56%		
4.5	LEAN CLAY; moist, brown with speckles of orange, estimated 5 - 10% sand, estimated <5% gravel		33.5		5	S-3, SPT 5+7+7 REC=16", 89%		
7.5	SANDY LEAN CLAY; moist, brown and gray	CL	30.5	B	10	S-4, SPT 5+9+10 REC=18", 100%	LL = 35 PL = 19 MC = 22.4% % Passing #200 = 89.6	Talbot Formation
12.0	SILT; moist, orangish brown and bluish gray	CL	26.0		15	S-5, SPT 5+5+6 REC=18", 100%		
	Change: brown and light brown, estimated <5% mica	ML			20	S-6, SPT 3+3+6 REC=18", 100%		
22.0	SILT WITH SAND; moist, reddish brown with streaks of black	ML	16.0			S-7, SPT 3+5+7 REC=18", 100%		
25.0			13.0		25			

Bottom of Boring at 25.0 ft.
Boring backfilled upon completion



TEST BORING LOG

Project: VA Hospital Warehouse Addition

Perry Point, Maryland

Boring Number: **B-3**

Contract Number: 15614012.00

Sheet: 1 of 1

Contractor:

Contractor Foreman: R. Balbuena

Schnabel Representative: C. Calhoun

Equipment: CME-45C (Truck)

Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)

Dates Started: 4/15/15 Finished: 4/15/15

Location: See Location Plan

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/15	9:20 AM	19.0'	18.5'	---
Completion	4/15	9:27 AM	---	23.5'	---
Casing Pulled	4/15	9:41 AM	11.5'	---	21.5'
After Drilling	4/15	12:58 PM	15.0'	---	18.0'

Ground Surface Elevation: 40.0 (ft) Total Depth: 25.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	DATA	TESTS	REMARKS
0.3	Topsoil=3-inches		39.7			S-1, SPT 5+2+3 REC=6", 33%	MC = 11.6%	Fill
2.0	FILL, sampled as lean clay; moist, brown and orangish brown, estimated <5% gravel, roots	FILL	38.0			S-2, SPT 5+12+12 REC=18", 100%		
	FILL, sampled as sandy silt; moist, orangish brown and black, estimated <5% roots, contains coal	FILL		A	5	S-3, SPT 5+7+10 REC=16", 89%		
9.5	SILTY SAND, fine to medium grained sand; moist, orangish brown	SM	30.5		10	S-4, SPT 6+10+12 REC=18", 100%		Talbot Formation
12.0	LEAN CLAY; moist, brown and bluish gray	CL	28.0		15	S-5, SPT 4+7+9 REC=18", 100%		
	Change: wet, grayish brown and brown	CL			20	S-6, SPT 4+6+8 REC=18", 100%		
22.0	SANDY LEAN CLAY; wet, gray, estimated <5% mica	CL	18.0			S-7, SPT 1+3+3 REC=18", 100%		
25.0	Bottom of Boring at 25.0 ft.		15.0		25			

TEST BORING LOG 15614012.00.GPJ SCHNABEL DATA TEMPLATE 2008_07 06.GDT 5/15/15



TEST BORING LOG

Project: VA Hospital Warehouse Addition

Perry Point, Maryland

Boring Number: **B-4**

Contract Number: 15614012.00

Sheet: 1 of 1

Contractor:

Contractor Foreman: R. Balbuena

Schnabel Representative: C. Calhoun

Equipment: CME-45C (Truck)

Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)

Dates Started: 4/15/15 Finished: 4/15/15

Location: See Location Plan

Ground Surface Elevation: 35.0 (ft) Total Depth: 25.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/15	12:05 PM	13.5'	13.5'	---
Completion	4/15	12:23 PM	---	23.5'	---
Casing Pulled	4/15	12:35 PM	---	---	---
After Drilling	4/15	1:08 PM	15.0'	---	20.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	DATA	TESTS	REMARKS
0.3	Topsoil=3-inches	FILL	34.7	A		S-1, SPT 1+2+2 REC=8", 44%	MC = 15.6%	Fill
	FILL, sampled as lean clay; moist, brown, estimated <5% roots, contains coal					S-2, SPT 10+13+5 REC=12", 67%		
3.5	FILL, sampled as; graded aggregate and brick fragments, moist, red and white Change: some brown lean clay		31.5		5	S-3, SPT 2+3+4 REC=6", 33%		
		FILL				S-4, SPT 4+7+10 REC=18", 100%		
9.0	FILL, sampled as lean clay; moist, orangish brown and bluish gray Change: wet, contains brick fragments		26.0		10			
		CH		B		S-5, SPT 4+4+4 REC=18", 100%		Talbot Formation
14.5	FAT CLAY; moist, grayish brown and orangish brown, contains lenses of sandy fat clay		20.5		15			
		CL				S-6, SPT 9+12+14 REC=18", 100%		
17.0	LEAN CLAY; moist, grayish brown and orangish brown		18.0		20			
						S-7, SPT 10+12+14 REC=18", 100%		
24.5		GP	10.5					
25.0	POORLY GRADED GRAVEL, coarse gravel sized; wet, gray, estimated 5 - 10% sand		10.0		25			
	Bottom of Boring at 25.0 ft.							

TEST BORING LOG 15614012.00.GPJ SCHNABEL DATA TEMPLATE 2008_07 06.GDT 5/15/15



TEST BORING LOG

Project: VA Hospital Warehouse Addition

Perry Point, Maryland

Boring Number: **B-5**

Contract Number: 15614012.00

Sheet: 1 of 2

Contractor:

Contractor Foreman: R. Balbuena

Schnabel Representative: C. Calhoun

Equipment: CME-45C (Truck)

Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)

Dates Started: 4/15/15 Finished: 4/15/15

Location: See Location Plan

Ground Surface Elevation: 41.5 (ft) Total Depth: 38.8 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/15	10:21 AM	19.5'	---	---
Completion	4/15	11:10 AM	---	38.5'	---
Casing Pulled	4/15	11:31 AM	15.0'	---	23.5'
After Drilling	4/15	1:03 PM	17.0'	---	22.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	DATA	TESTS	REMARKS
0.3	Topsoil=3-inches		41.2			S-1, SPT 1+3+3 REC=8", 44%	MC = 13.7%	Fill
2.0	FILL, sampled as sandy silt; moist, brown and orangish brown, estimated <5% gravel, roots, contains coal	FILL	39.5			S-2, SPT 3+5+5 REC=18", 100%		
4.5	FILL, sampled as silt; moist, orangish brown, estimated <5% mica, contains coal	FILL	37.0		5	S-3, SPT 3+4+7 REC=18", 100%		
	Change: orangish brown and black, estimated 5 - 10% sand, contains brick fragments, contains coal	FILL			10	S-4, SPT 5+10+14 REC=18", 100%		
14.5	FILL, sampled as silt; moist, light brown and bluish gray	FILL	27.0	A	15	S-5, SPT 2+3+3 REC=18", 100%		
19.5	FILL, sampled as silty sand, fine to medium grained sand; wet, gray, contains brick fragments	FILL	22.0		20	S-6, SPT 2+3+1 REC=14", 78%		
22.0	PROBABLE FILL, sampled as poorly graded sand with silt; wet, gray	FILL	19.5		25	S-7, SPT 10+12+14 REC=18", 100%		
27.0	PROBABLE FILL, sampled as lean clay; moist, orangish brown and bluish gray, estimated <5% mica, estimated 5 - 10% rock fragments, contains brick fragments	FILL	14.5			S-8, SS 4+43+50/4" REC=12", 75%		

(continued)



TEST BORING LOG

Project: VA Hospital Warehouse Addition

Perry Point, Maryland

Boring Number: **B-5**

Contract Number: 15614012.00

Sheet: 2 of 2

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
32.0	SILTY, CLAYEY GRAVEL WITH SAND; wet, brown	FILL	9.5	A			LL = 19 PL = 15 MC = 13.7% % Passing #200 = 14.4	Talbot Formation
		GC-GM			35	S-9, SPT 38+21+22 REC=8", 44%		
37.0	POORLY GRADED SAND WITH SILT, fine to coarse grained sand; wet, brown		4.5	B				
		SP-SM						
38.8			2.7			S-10, SPT 50/4" REC=4", 100%		

Bottom of Boring at 38.8 ft.



TEST BORING LOG

Project: VA Hospital Warehouse Addition

Perry Point, Maryland

Boring Number: **B-6**

Contract Number: 15614012.00

Sheet: 1 of 1

Contractor:

Contractor Foreman: R. Balbuena

Schnabel Representative: C. Calhoun

Equipment: CME-45C (Truck)

Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)

Dates Started: 4/13/15 Finished: 4/13/15

Location: See Location Plan

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/13	9:32 AM	18.5'	18.5'	---
Completion	4/13	9:40 AM	---	23.5'	---
Casing Pulled	4/13	10:00 AM	11.5'	---	22.0'
End of Day	4/13	1:18 PM	5.0'	---	17.0'

Ground Surface Elevation: 36.0 (ft) Total Depth: 25.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	DATA	TESTS	REMARKS
0.3	Topsoil=3-inches		35.7			S-1, SPT 1+3+5 REC=12", 67%	MC = 12.3%	Fill
2.0	FILL, sampled as lean clay; moist, brown and black, estimated <5% gravel, contains coal	FILL	34.0			S-2, SPT 3+4+4 REC=10", 56%		
	FILL, sampled as sandy lean clay; moist, brown and black, estimated <5% gravel, contains coal Change: estimated <5% roots	FILL		A	5	S-3, SPT 1+2+3 REC=6", 33%		
9.5	LEAN CLAY; moist, gray Change: gray and light brown	CL	26.5		10	S-4, SPT 2+4+4 REC=8", 44%		Talbot Formation
17.0	SILT WITH SAND; wet, brown and gray Change: brown	ML	19.0	B	15	S-5, SPT 5+8+11 REC=18", 100%		
25.0			11.0		20	S-6, SPT 6+12+50/5" REC=16", 94%		High blow count due to piece of gravel
					25	S-7, SPT 5+7+9 REC=18", 100%		
Bottom of Boring at 25.0 ft.								

TEST BORING LOG 15614012.00.GPJ SCHNABEL DATA TEMPLATE 2008_07 06.GDT 5/15/15



TEST BORING LOG

Project: VA Hospital Warehouse Addition

Perry Point, Maryland

Boring Number: **P-1**

Contract Number: 15614012.00

Sheet: 1 of 1

Contractor:

Contractor Foreman: R. Balbuena

Schnabel Representative: C. Calhoun

Equipment: CME-45C (Truck)

Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)

Dates Started: 4/13/15 Finished: 4/13/15

Location: See Location Plan

Ground Surface Elevation: 37.0 (ft) Total Depth: 6.5 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/13	10:00 AM	Dry	---	---
Completion	4/13	10:27 AM	Dry	5.0'	---
Casing Pulled	4/13	10:30 AM	Dry	---	3.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.2	Asphalt=2-inches		36.8	A			LL = 27 PL = 15 MC = 13.9% % Passing #200 = 55.1	Bulk sample from 0 to 5 feet Fill
0.5	Gravel Base=4-inches		36.5					
	FILL, sampled as; graded aggregate base, moist, brown and black	FILL						
4.5	FILL, sampled as gravelly lean clay with sand; moist, brown and dark brown, estimated <5% mica	FILL	32.5				MC = 23.9%	Classified from auger cuttings
6.5			30.5					

Bottom of Boring at 6.5 ft.
Boring backfilled upon completion



TEST BORING LOG

Project: VA Hospital Warehouse Addition

Perry Point, Maryland

Boring Number: **SWM-1**

Contract Number: 15614012.00

Sheet: 1 of 1

Contractor:

Contractor Foreman: R. Balbuena

Schnabel Representative: C. Calhoun

Equipment: CME-45C (Truck)

Method: 3-1/4" I.D. Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)

Dates Started: 4/13/15 Finished: 4/13/15

Location: See Location Plan

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/13	11:30 AM	2.0'	2.5'	---
Completion	4/13	11:42 AM	---	8.5'	---
Casing Pulled	4/13	11:45 AM	5.7'	---	7.9'
End of Day	4/13	1:15 PM	6.0'	---	8.0'

Ground Surface Elevation: 33.0 (ft) Total Depth: 10.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.3	Topsoil=3-inches		32.7			S-1, SPT 1+2+3 REC=18", 100%		Talbot Formation
	LEAN CLAY; moist, brown and orangish brown Change: wet							
3.0			30.0			S-2, SPT 3+7+9 REC=18", 100%		
3.5	LEAN CLAY; moist, brown, estimated <5% roots		29.5					
	SILT WITH SAND; moist, pinkish brown and orangish brown, estimated <5% mica			B	5	S-3, SPT 3+8+10 REC=18", 100%	LL = 25 PL = 17 MC = 15.2% % Passing #200 = 74.7	USDA Classification: CLAY LOAM
9.7			23.3			S-4, SPT 3+8+8 REC=18", 100%		
10.0	SILTY SAND WITH SAND, medium grained sand; moist, orangish brown		23.0		10			

Bottom of Boring at 10.0 ft.

Offset 3 feet and placed 5" diameter infiltration pipe at 5 feet

Water encountered at 2 feet may be perched water



TEST BORING LOG

Project: VA Hospital Warehouse Addition

Perry Point, Maryland

Boring Number: **SWM-2**

Contract Number: 15614012.00

Sheet: 1 of 1

Contractor:

Contractor Foreman: R. Balbuena

Schnabel Representative: C. Calhoun

Equipment: CME-45C (Truck)

Method: 3-1/4" I.D. Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)

Dates Started: 4/13/15 Finished: 4/13/15

Location: See Location Plan

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/13	10:58 AM	5.0'	5.0'	---
Completion	4/13	11:05 AM	---	8.5'	---
Casing Pulled	4/13	11:15 AM	2.5'	---	6.5'
End of Day	4/13	1:17 PM	2.5'	---	6.0'

Ground Surface Elevation: 34.0 (ft) Total Depth: 10.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.7	Topsoil=8-inches		33.3	A		S-1, SPT 1+2+5 REC=18", 100%		Fill
2.0	FILL, sampled as silt; moist, brown, estimated <5% gravel, roots, contains coal	FILL	32.0			S-2, SPT 4+4+5 REC=18", 100%		
4.5	FILL, sampled as lean clay; moist, brown and black, estimated <5% gravel, contains coal	FILL	29.5			S-3, SPT 3+4+2 REC=18", 100%		
7.0	FAT CLAY; wet, gray and orangish brown	CH	27.0	B		S-4, SPT 5+8+7 REC=18", 100%		Talbot Formation
10.0	SILT; moist, reddish orange and bluish gray, estimated <5% mica	ML	24.0					

Bottom of Boring at 10.0 ft.

APPENDIX B

SOIL LABORATORY TEST DATA

Summary of Soil Laboratory Tests
Gradation Curves (4 sheets)
Moisture-Density Relationship
California Bearing Ratio Test

Summary Of Laboratory Tests

Appendix
Sheet 1 of 1
Project Number: 15614012.00

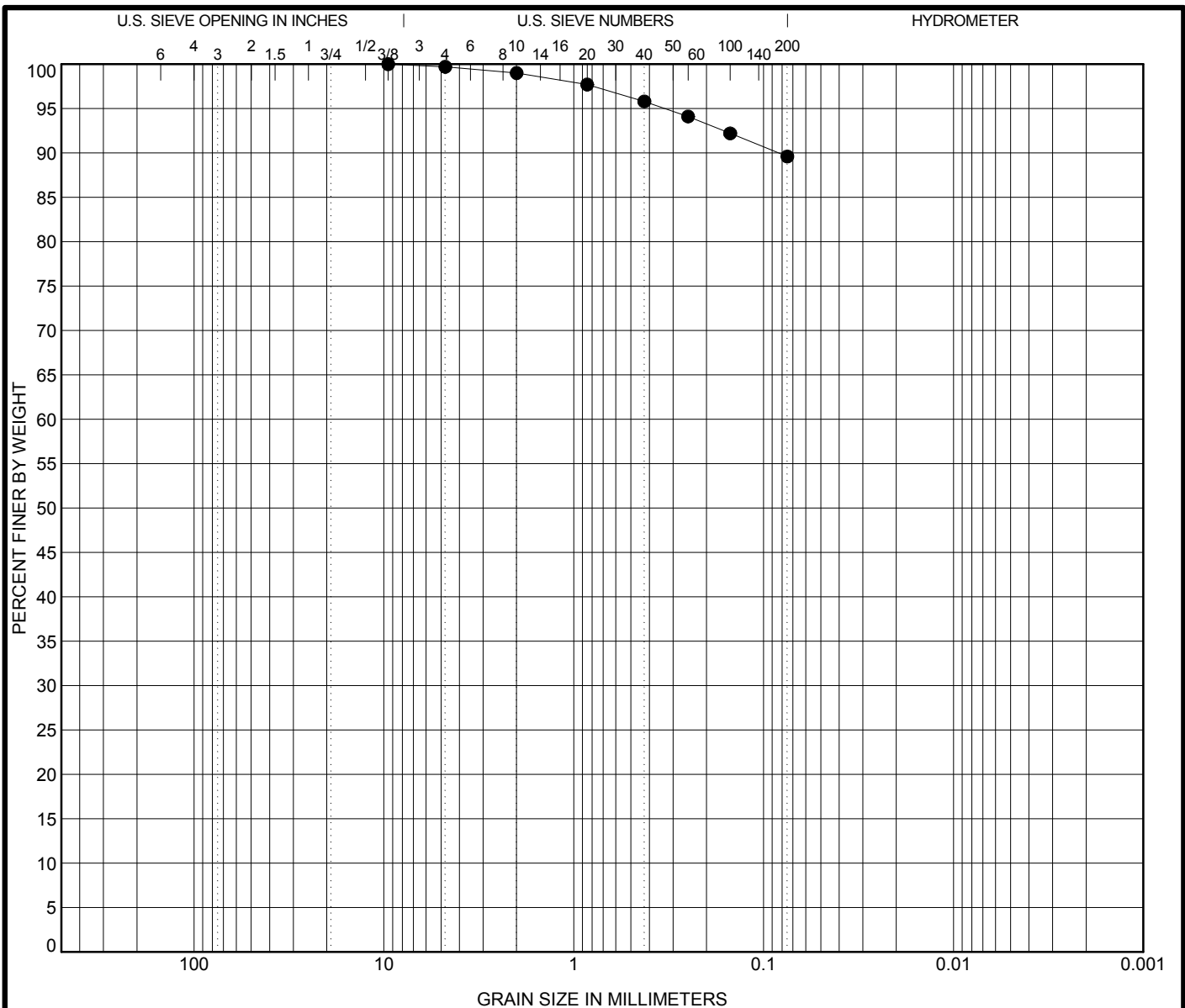
Boring No.	Sample Depth ft Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	% Retained No. 4 Sieve	Proctor Test Method	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	CBR Value
B-2	5.0 - 6.5	Jar	LEAN CLAY (CL), brown and speckled orange	B	22.4	35	19	16	89.6	0.3	--	--	--	--
	33.0 - 31.5													
B-5	33.5 - 35.0	Jar	SILTY, CLAYEY GRAVEL WITH SAND (GC-GM), brown	B	13.7	19	15	4	14.4	55.6	--	--	--	--
	8.0 - 6.5													
P-1	0.0 - 5.0	Bulk	FILL, sampled as gravelly lean clay, with sand (CL), brown and dark brown	A	13.9	27	15	12	55.1	22.9	698B	120.0	11.0	2.5
	37.0 - 32.0													
SWM-1	5.0 - 6.5	Jar	CLAY LOAM (USDA)	B	15.2	25	17	8	74.7	--	--	--	--	--
	28.0 - 26.5													

Notes:

1. Soil tests in general accordance with ASTM, ASTM standards.
2. Soil classifications are in general accordance with ASTM D2487, USDA(as applicable), based on testing indicated and visual classification.
3. Key to abbreviations: NP=Non-Plastic; ND=Not Detected; ; P=Present; T=Trace; -- indicates no test performed



Project: VA Hospital Warehouse Addition
Perry Point, MD



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen		Sample Description					LL	PL	PI			
●	B-2	5.0 ft	LEAN CLAY (CL), brown and speckled orange					35	19	16		
Test Method			D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
ASTM D6913			9.5				0.3	10.1	89.6			

Percent Finer

Sieve Size	No. 200	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.
% Finer	89.6	92.2	94.1	95.8	97.7	99.0	99.7	100.0



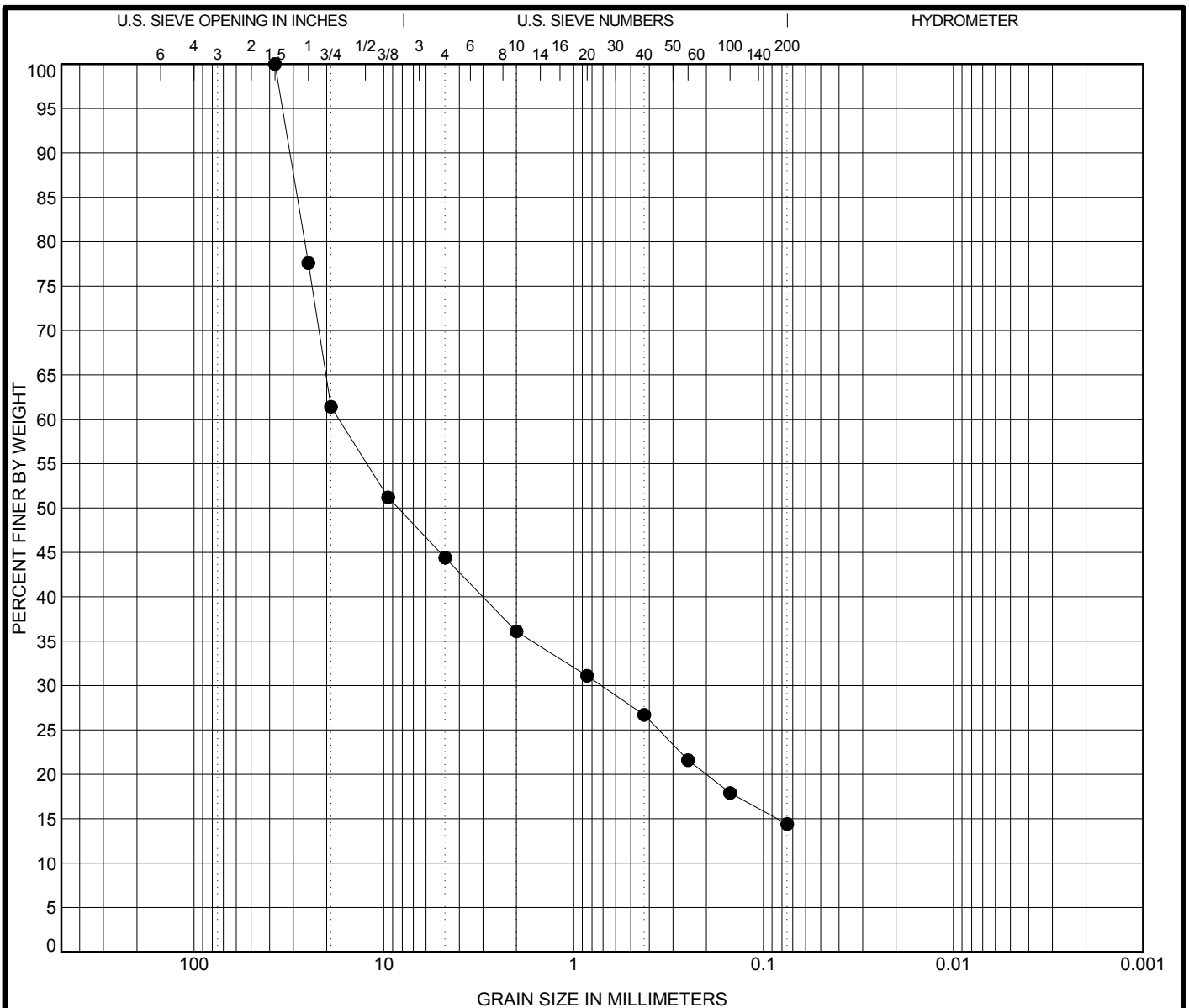
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GRADATION CURVE

Project: VA Hospital Warehouse Addition

Perry Point, MD

Contract: 15614012.00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen	Sample Description					LL	PL	PI		
B-5 33.5 ft	SILTY, CLAYEY GRAVEL WITH SAND (GC-GM), brown					19	15	4		
Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
ASTM D6913	37.5	17.276	0.715		55.6	30.0	14.4			

Percent Finer

Sieve Size	No. 200	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.	3/4 in.	1 in.	1.5 in.
% Finer	14.4	17.9	21.6	26.7	31.1	36.1	44.4	51.2	61.4	77.6	100.0



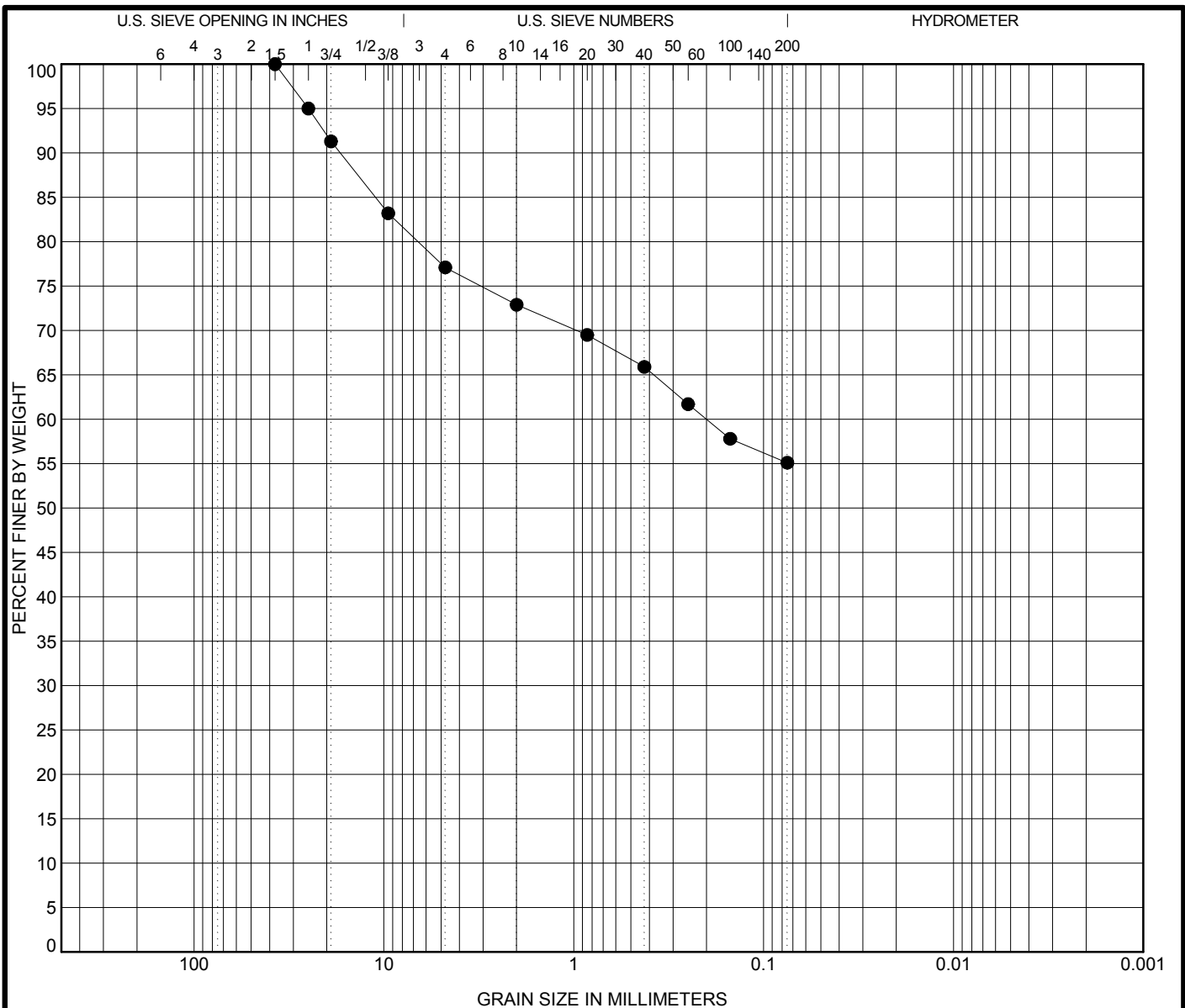
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GRADATION CURVE

Project: VA Hospital Warehouse Addition

Perry Point, MD

Contract: 15614012.00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen		Sample Description					LL	PL	PI			
●	P-1	0.0 ft	FILL, sampled as gravelly lean clay, with sand (CL), brown and dark brown					27	15	12		
Test Method		D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay		
ASTM D6913		37.5	0.2			22.9	22.0	55.1				

Percent Finer

Sieve Size	No. 200	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.	3/4 in.	1 in.	1.5 in.
% Finer	55.1	57.8	61.7	65.9	69.5	72.9	77.1	83.2	91.3	95.0	100.0



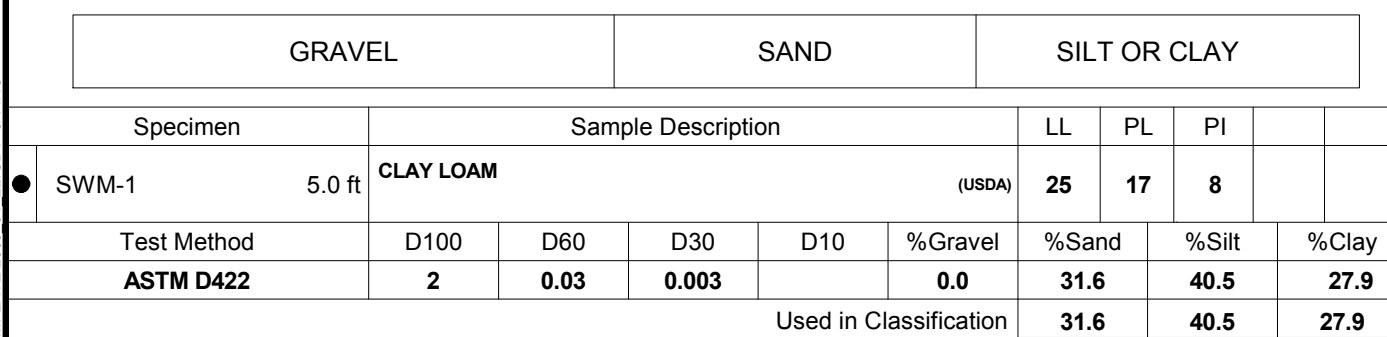
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GRADATION CURVE

Project: VA Hospital Warehouse Addition

Perry Point, MD

Contract: 15614012.00



Sieve Size	No. 200	No. 100	No. 60	No. 40	No. 20	No. 10
% Finer	74.7	90.0	95.9	98.9	99.9	100.0



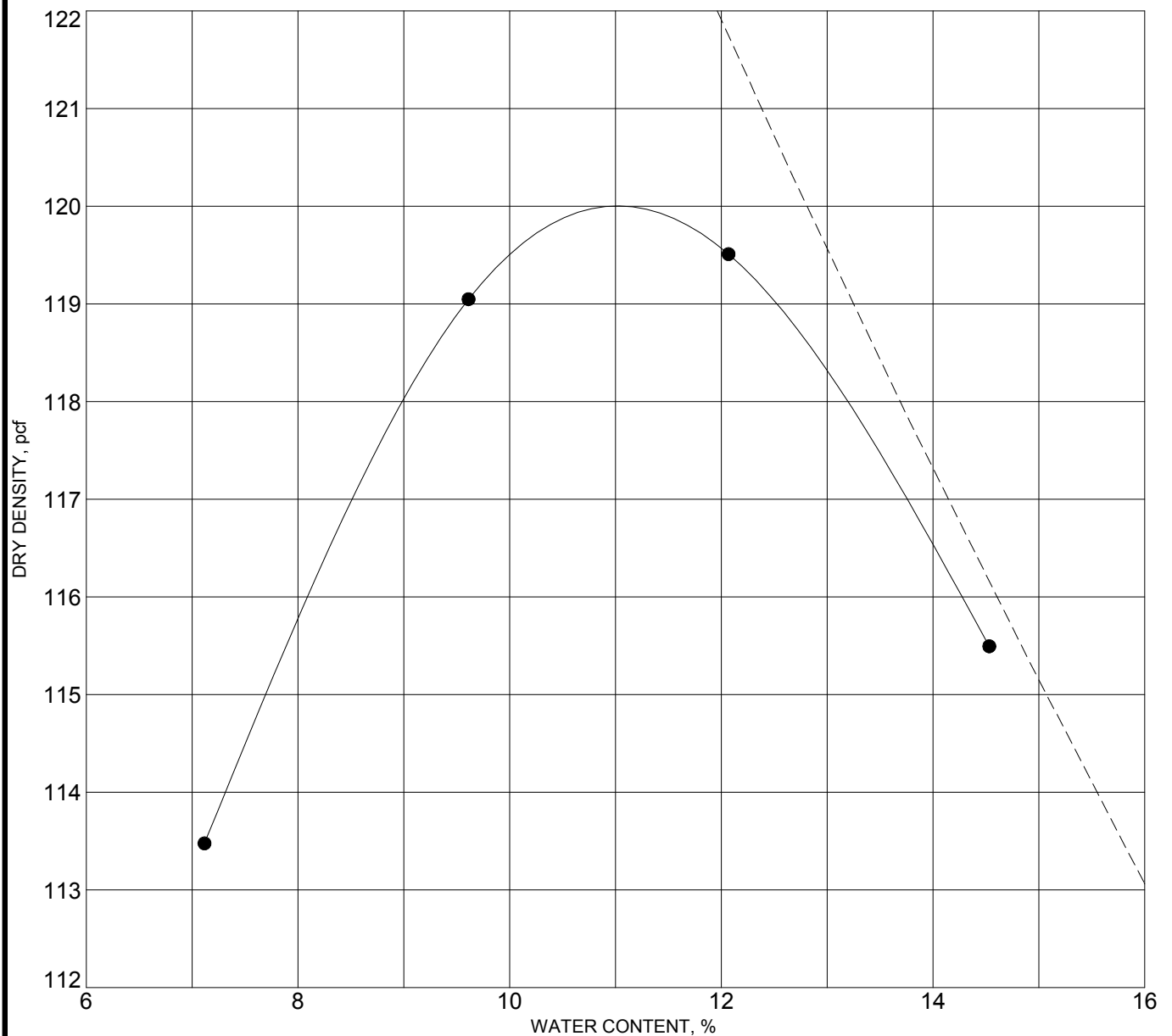
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ENGINEERING

GRADATION CURVE

Project: VA Hospital Warehouse Addition

Perry Point, MD

Contract: 15614012.00



Sample Description: FILL, sampled as gravelly lean clay, with sand (CL), brown and dark brown

Sample Source: P-1, 0.0 ft

Test Methods: ASTM D698 Method B

Measured Specific Gravity: 2.55

Max. Dry Density (pcf): 120.0

Opt. Moisture (%): 11.0

Liquid Limit (LL): 27

Plasticity Index (PI): 12

% Retained #4 Sieve: 22.9

% Passing # 200 Sieve: 55.1

Comments:



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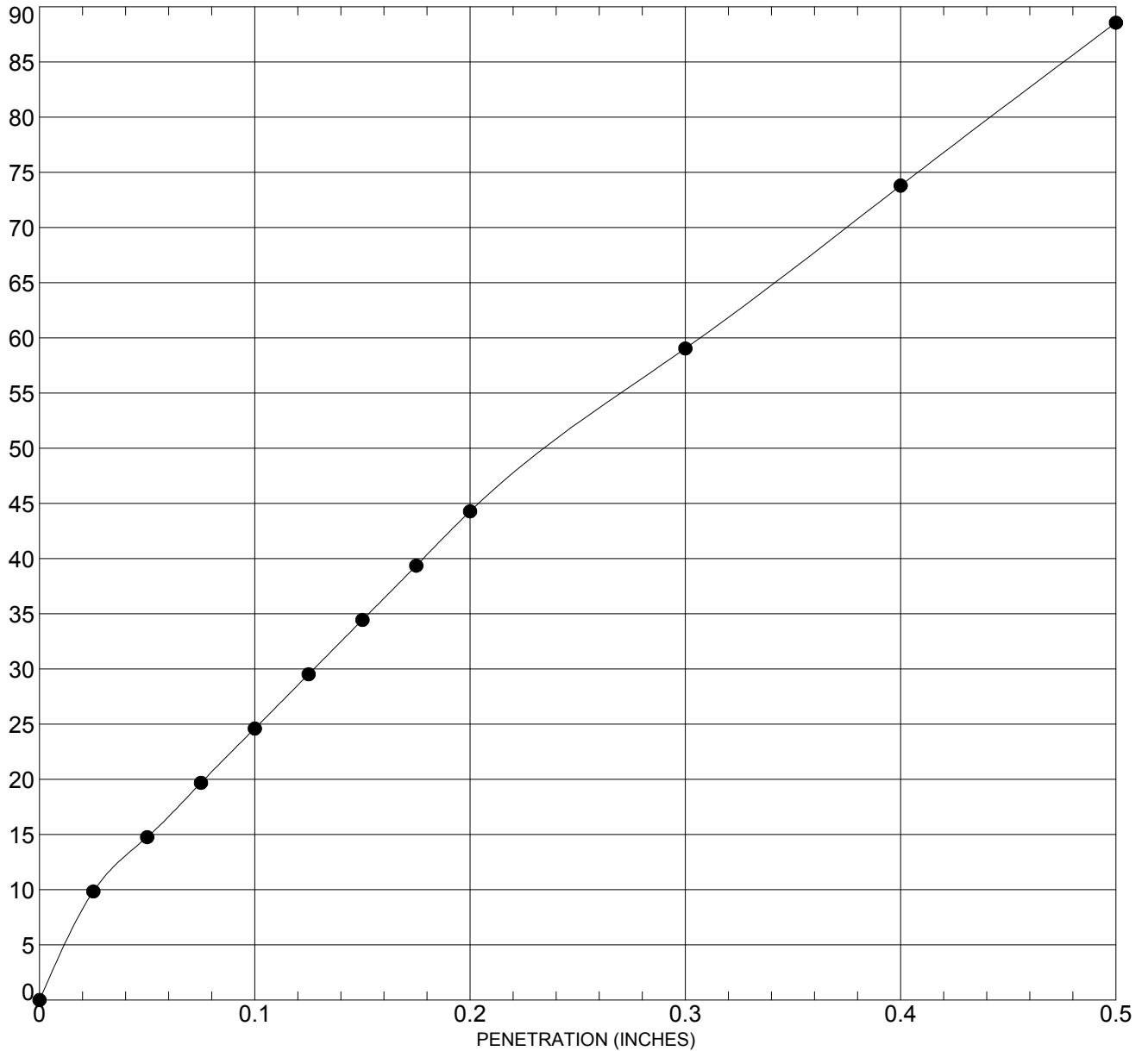
MOISTURE DENSITY RELATIONSHIP

Project: VA Hospital Warehouse Addition

Perry Point, MD

Contract: 15614012.00

STRESS ON PISTON (psi)



Sample Description: FILL, sampled as gravelly lean clay, with sand (CL), brown and dark brown

Sample Source: P-1

Sample Depth: 0.0 ft

Test Method: ASTM D1883

Liquid Limit (LL): 27

Plasticity Index (PI): 12

% Retained #4 Sieve: 22.9

% Passing # 200 Sieve: 55.1

Dry Density Before Soaking (pcf): 1269.3

Dry Density After Soaking (pcf): 1258.6

Maximum Dry Density (pcf): 120

Moisture Content Before Soaking (%): 11.0

Moisture Content After Soaking (Avg) (%): 0.9

Moisture Content Top Inch After Soak (%):

Optimum Moisture Content (%): 11

CBR: 2.5, Unsoaked

Surcharge (psf): 10

Swell (%): 0.9



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CALIFORNIA BEARING RATIO TEST

Project: VA Hospital Warehouse Addition

Perry Point, MD

Contract: 15614012.00

APPENDIX C

FIELD TEST DATA

Infiltration Test Procedures
Infiltration Test Data Sheet

INFILTRATION TEST PROCEDURES

We performed in-situ infiltration testing in general accordance with the 2000 MDE Stormwater Design Manual, stormwater regulations, at an offset location (within about five feet) to boring SWM-1. Infiltration testing was performed by auguring a hole to the depth indicated. The auger was removed and a 5-inch diameter PVC pipe was installed. Approximately 24 inches (depth) of water column was poured into the pipe and the water was allowed to pre-soak the soils for about 24 hours. After the presoak was completed, additional water was added until the depth of water in the pipe was 24 inches and the water level was measured at the beginning and end of a one hour period. This process was repeated three times and the test results were averaged.



INFILTRATION TEST DATA SHEET

Project: VA Hospital Warehouse Addition	Project No: 15614012.00
Test No: SWM-1	Date: 4/13./15
Location: SWM-1	SE Rep. C. Calhoun
Test Depth: 5.0'	Sfc EL: 33.0'
Test EL: 28.0'	Basin EL: --

PRESOAK:

Date: 4/13/2015	24-Hour Reading
Time: 11:50 AM	4/14/2015
Depth of Water: 4' 6.5"	9:25 AM
Soil Description: CLAY LOAM (USDA)	4' 4"
SILT WITH SAND (ML), moist, pinkish brown and orangish brown (USCS)	

TEST:

Run	Date	Begin		End		Rate (in/hr)
		Time	Depth (feet)	Time	Depth (feet)	
1	4/14/15	9:25 AM	4' 4"	10:25 AM	4' 3.5"	0.00
2	4/14/15	10:25 AM	4' 3.5"	11:25 PM	4' 3.5"	0.00
3	4/14/15	11:25 AM	4' 3.5"	12:25 PM	4' 3.5"	0.00
4	4/14/15	12:25 PM	4' 3.5"	1:25 PM	4' 3.5"	0.00
Avg						0.00

*Top of pipe at 6' 6.5" (1' 6.5" stick up)