GEOTECHNICAL ENGINEERING REPORT
BEHAVIORAL AND SOCIAL SCIENCES CENTER
MORGAN STATE UNIVERSITY
BALTIMORE, MARYLAND

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1.0 EXECUTIVE SUMMARY

This report presents the results of subsurface exploration, laboratory testing, and geotechnical engineering analysis for the proposed Behavioral and Social Sciences Center building and associated site development.

The project includes the design and construction of a new 137,000 GSF building within the new West Campus. The new building will be 5 stories high. The proposed lowest floor grade will be at EL 253.5, which is at about the existing grade on the south corner of the site. The proposed 2nd floor grade will be at EL 273.5, which is at about the existing grade on the northwest corner of the site.

Stratum A Fill and Probable Fill soils were encountered from the ground surface in all borings to depths of 8.5 to 32.5 feet. The fill soils encountered generally consisted of Silts, Lean Clay, Silty Sand, Poorly Graded Sand, Clayey Gravel, and Clayey Sand. The fill soils had densities of loose to dense with standard penetration test resistance of N= 2 to 30 blows per foot (bpf), and consistencies of soft to hard with standard penetration test resistance of N= 3 to 30 blows per foot (bpf).

Patuxent Formation deposits and residual soils were encountered below the fill materials. Disintegrated rock was encountered below the residual soils.

Bedrock was encountered at elevations of EL 210 to EL 222 in the borings performed within the proposed building footprint.

Groundwater levels observed in our exploration are near the lowest floor elevation of EL 253.5, and could adversely impact the proposed earthwork, utility, and basement construction.

Buried foundations and other associated debris related to the previous development at the site, may be encountered during grading activities. Existing foundations and walls in the proposed building pavement areas should be removed to at least 3-feet below the design subgrade level. Existing utilities and drainage structures within the building area should be removed and replaced with compacted structural fill.

We recommend drilled shafts for support of the proposed building and spread footings for support of the Morgan Wall and the tiered wall. Drilled shafts founded on suitable Bedrock of Stratum E may be designed for a net allowable bearing pressure of 80 ksf. Spread footings supported on new compacted fills may be designed for a net allowable soil bearing pressure of 2,000 psf. The existing fills below the spread footings should be removed to at least 4-feet below the footing subgrades and replaced with new compacted structural fill.

A slab on grade floor may be used and a modulus of subgrade reaction, k, of 75 pci may be used in the design of floor slabs when supported on suitable compacted structural fill. A subdrainage system should be installed below the slab on grade floor. The test borings encountered fill soils below the proposed structure footprint to depths of up to 24-feet below the proposed lowest floor grades. The fill soils primarily consisted of Silts, Lean Clay, Silty Sand, and Poorly Graded Sands. No documentation of the source or placement methods of the fills was available. Two options are presented to reduce the risk of floor settlement and distress. Section 9.1.1 contains recommendations for undercutting of existing fill to at least 4-feet below the floor subgrades and replaced with new compacted structural fill. The undercut subgrade should be compacted with at least four passes of a suitable vibratory roller under the observation of a Schnabel representative.

Ground improvement recommendations are provided in Section 9.1.2.

It should be noted that the recommendations provided were developed to reduce the risk of future floor settlements and distress. However, there will always be a potential for floor settlements unless all the fills below the building are completely removed, or the floor supported on the drilled shafts.

Groundwater is expected to be encountered at the floor slab subgrade. Undercutting the fills below the floor subgrade will likely require some type of dewatering program. The type of dewatering program and practicality of performing undercutting and replacement of the floor subgrade soils will not be known until the excavation starts, and could impact the construction schedule and budget. If the owner does not want to take this risk of dealing with dewatering or the possibility of floor settlements, then the ground below the floor subgrade should be improved with aggregate piers.

Fill soils were encountered in the SWM borings at depths of 8.5-feet and 10-feet below the existing ground surface in the two SWM borings performed. The bottom of bioretention facilities are typically about 3-feet below the existing ground surface. Infiltration is not permitted within fill soils. Therefore, the stormwater management structures should be designed for storage and treatment, and should include an underdrain system.

Milling of the surface course of asphalt is planned for the existing parking lot at the north end of the site. We believe that the proposed milling and re-surfacing program will not be adequate to structurally improve the existing pavements. Recommendations for new flexible pavements for the parking lot and access road are provided.

We are providing this executive summary solely for purposes of overview. Any party that relies on this report must read the full report. This executive summary omits several details, any one of which could be very important to the proper application of the report.

2.0 SCOPE OF SERVICES

Our proposal dated March 7, 2013 defines the scope of services for this project. The scope of services include performing a subsurface exploration program consisting of soil borings, soil laboratory testing and development of geotechnical engineering recommendations regarding the design of earthwork, foundation, pavement, and stormwater management structures for the project.

3.0 DESCRIPTION OF SITE AND PROPOSED CONSTRUCTION

3.1 Site Description

The project site is located northeast of the Morgan State University (MSU) Business School at the MSU Campus in Baltimore, Maryland. The project is the location of the former Northwood Shopping Center which has since been demolished. The previous buildings have been demolished to ground level. The project site is bounded by Hillen Road to the east, an alley to the north, Fenwick Avenue to the west and the Business School to the south and southwest. A Vicinity Map is included as Figure 1.

The site slopes from EL 288 at the northwest corner down to EL 240 at the southeast corner. An existing parking lot occupies the north portion of the site. A 15 to 25 feet tall stockpile currently occupies the center of the site. The southern portion of the site is used as a staging area for the construction of the adjacent Business School. Access to the site is from Hillen Road. The site grades within the proposed building footprint vary from about EL 272 down to about EL 240. Known utilities at the site include overhead electric and an underground electric vault which runs east-west across the center portion of the site.

We obtained the site information from the topographic site plan provided to us and through our site visits.

3.2 Proposed Construction

The project includes the design and construction of a new 137,000 GSF building within the new West Campus. The building site is the former location of the Northwood Shopping Center. The previous buildings have been demolished to ground level. We understand that some previous foundations are present below ground within the proposed building footprint and that the foundation locations are mapped on as-built plans.

The new building will be 5 stories high. The proposed lowest floor grade will be at EL 253.5, which is at about the existing grade on the south corner of the site. The proposed 2nd floor grade will be at EL 273.5, which is at about the existing grade on the northwest corner of the site. The following design foundation loads were provided to us:

- Interior Columns – Dead Load = 900 kips, Live Load = 650 kips
- Exterior Columns – Dead Load = 600 kips, Live Load = 450 kips
- Walls – Dead Load = 40 kip/ft. , Live Load = 15 kip/ft.

A tiered wall is planned outside of the northeast corner of the building. The tiered wall will have two tiers and the tiers is expected to be no more than 7 feet in height. A “Morgan Wall” is planned at the northwest boundary of the site. The Morgan Wall will be about 220 feet long. The Morgan Wall is a boundary wall that will retain no more than 2 feet. The existing paved lots are planned for resurfacing. A service road is planned at the west side of the building. A truck and bus loop is planned around the parking lot. Three new stormwater management (SWM) facilities are planned within the parking lot. The bottom of the SWM facilities will be about 4 feet below the parking lot grades.

The design team provided the project details. The structural load information was provided by Cagley and Associates.

3.3 Regional Geology

The site is generally underlain by existing fill soils, coastal plan deposits, residual soils, disintegrated rock and bedrock. The fills soils encountered were likely placed during site grading and utility construction for the previous shopping center that once occupied the site. The coastal plain deposits consist of Patuxent Formation deposits from the lower cretaceous geologic age. The Patuxent Formation soils typically consist of highly variable interbedded sand, gravel, silt and clay containing ferruginous (ironite) cements. At this site, the Patuxent formation is primarily sands and clays. Residual soils, including Disintegrated Rock, are derived from the chemical and physical weathering of the underlying parent material. Based on the geologic map of the Baltimore East Quadrangle Maryland, dated 1979, by Juergen Reinhardt and William P. Crowley, the parent bedrock is the Baltimore Gneiss of the Piedmount Formation.

4.0 SUBSURFACE EXPLORATION 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 consisted of test borings. Exploration methods used are discussed below. The appendices to this report contain the results of our exploration.

4.1 Subsurface Exploration and Field Testing

4.1.1 Test Borings

Our subcontractor, Connelly and Associates, drilled 18 test borings under our observation between March 19 and March 26, 2014. 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, indicate 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.

5.0 LABORATORY TESTING

Our laboratory performed tests on selected samples obtained 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, below-grade walls, and pavements. Moisture contents and index test results are shown on the boring logs in Appendix A. The complete test results are included in Appendix B.

5.1 Soils Testing

5.1.1 Index Testing

We performed natural moisture content, Atterberg Limit, and gradation tests on 8 jar and 2 bulk samples of soil representing Strata A and B to provide soil classifications and to provide parameters for use with published correlations with soil properties. The results are presented in the Summary of Laboratory Tests in Appendix B.

5.1.2 Compaction and CBR Testing

We performed a Standard Proctor Compaction test and CBR test on two bulk samples from the stockpile. The samples consisted of CLAYEY SAND with gravel, and classified (CL) in accordance with ASTM classification system. The compaction test resulted in a maximum dry density of 123.4 and 124.2 pcf at an optimum moisture content of 11.2 and 10.6 percent respectively. Natural moisture content values of the stockpile soils tested in our laboratory was 14.2 percent, or 3 to 4 percent above the optimum value. We obtained laboratory CBR values of 3.6 and 2.6 with swell values of 1.7 and 1.0 percent, respectively.

6.0 SUBSURFACE CONDITIONS

6.1 Generalized Subsurface Stratigraphy

We characterized the following generalized subsurface stratigraphy based on the exploration and laboratory test data included in the appendices. During our exploration, we encountered the following stratigraphy:

Ground Cover

Asphalt thicknesses of 2 to 6-inches over 2 to 6-inches of crushed aggregate was encountered at boring locations B-1, MW-2, P-1 and P-2. Three inches of topsoil was encountered at boring location MW-1. The asphalt and topsoil depths were measured to the nearest inch and was identified based on our visual identification procedures.

Stratum A: Fill and Probable Fill Soils

Fill and Probable Fill were encountered from the ground surface in all borings to depths of 8.5 to 32.5 feet. The fill soils encountered generally consisted of Silts, Lean Clay, Silty Sand, Poorly Graded Sand, Clayey Gravel, and Clayey Sand. The fill soils encountered are believed to be fill used during previous site grading for the previous shopping center that once occupied the site and the current stockpile. The fill soils had densities of loose to dense with standard penetration test resistance of N= 2 to 30 blows per foot (bpf), and consistencies of soft to hard with standard penetration test resistance of N= 3 to 30 blows per foot (bpf).

Laboratory tests performed on samples from Stratum A had moisture content values of 8.3 to 37.1 percent.

Stratum B: Patuxent Formation

Patuxent Formation deposits were encountered below the ground cover or fill soils in borings B-1, B-2, B-3, B-4, B-8, B-11, MW-1, MW-2, P-2, RW-1, and SWM-2 to depths of 10 to 32.5-feet below the ground surface. The Stratum B soils consisted of Lean Clay (CL), Poorly Graded Sand (SP), Silt (ML/MH), Sandy Silt (ML), and Silty Sand (SM), with various amounts of gravel. The Stratum B soils had standard penetration test resistance N values, ranging from 6 bpf to 37 bpf, indicating variable soil consistencies and densities.

Laboratory tests performed on samples from Stratum B had moisture content values of 19.6 to 22.3 percent.

Stratum C: Residual Soils

Residual soils of Stratum C were encountered below the fills or Patuxent Formation soils to depths ranging from 23.5 to 63.5-feet below the ground surface. The Stratum C soils consisted of Silt (ML) and Silty Sand (SM) with various amounts of rock fragments, and Poorly Graded Sand (SP) with various amounts of rock fragments and mica. The Stratum C soils had standard penetration test resistance N values, ranging from 2 bpf to 52 bpf, indicating variable soil consistencies and densities.

Laboratory tests performed on a sample from Stratum C had a moisture content value of 28.9 percent.

Stratum D: Disintegrated Rock

Disintegrated Rock material was encountered below the Stratum C residual soils to depths varying from 29 to 65.5-feet below the ground surface. Disintegrated Rock is defined as residual earth material with a Standard Penetration Resistance between 60 blows per foot and auger refusal. This material may exhibit certain rock-like qualities and some denser portions of this material could possess characteristics of soft rock.

Stratum E: Baltimore Gneiss (Bedrock)

Bedrock was encountered below Stratum D at elevations of EL 210 to EL 222 in the borings performed within the proposed building footprint. Five to ten foot of Rock coring was performed in borings B-1, B-3, B-4, B-5, B-7, B-8, B-10 and B-11. Rock was identified in the remaining borings in the building footprint as auger refusal. Rock Quality Designation (RQD) values of 47 to 100 percent and recovery of 80 to 100 percent were measured. The bedrock encountered is the Baltimore Gneiss.

Some variation is likely to occur between the visual and actual classifications. The above N values indicate the low and high SPT resistances encountered in a particular layer as determined from the number of blows required to drive a two inch O.D., 1⅜ inch I.D. sampling spoon one-foot (bpf) using a 140-pound hammer falling 30-inches. This test is conducted after seating the sampler six inches in the bottom of the hole according to ASTM D1586.

The symbols indicated on the test boring logs represent the United Soil Classification System (ASTM D-2487) group symbols based on our visual observations of the specimen recovered criteria for visual identification of soil specimens are given in Appendix A of this report.

6.2 Groundwater

Water level readings recorded in the test borings are indicated on the test boring logs. Readings were taken during drilling, at completion of drilling, and up to three days after completion. Groundwater results are summarized in the following table.

Summary of Groundwater Readings

Boring ID	Approximate Ground	Water Levels				Caved Depths	
	Surface	Encountered Reading		Final Reading		Final Reading	
	Elevation	Depth	Elevation	Depth	Elevation	Depth	Elevation
B-1	272	26	246	22	250	24	248
B-2	257	18.5	238.5	DRY	-	9.5	247.5
B-3	268	DRY	-	14	254	20	248
B-4	245	DRY	-	19	226	22	223
B-5	269	28	241	16	253	21.5	247.5
B-6	275	28.5	246.5	DRY	-	10.5	264.5
B-7	254	24	230	12	242	13	241
B-8	258	8.5	249.5	12	246	13	245
B-9	280	43.5	236.5	DRY	-	10	270
B-10	257	23.5	233.5	8	249	26	231
B-11A	254	2.5	251.5	4.5	249.5	9.5	244.5
MW-1	278	DRY	-	DRY	-	11	267
MW-2	282	DRY	-	DRY	-	6	276
P-1	270	DRY	-	DRY	-	6	264
P-2	280	DRY	-	DRY	-	4.5	273.5
RW-1	262	28.5	233.5	13	249	15	247
SWM-1	272	DRY	-	DRY	-	7	265
SWM-2	271	DRY	-	DRY	-	3	265

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, surface runoff, pumping, evaporation, leaking utilities, and similar factors.

Groundwater levels observed in our exploration are near the lowest floor elevation of EL 253.5, and could adversely impact the proposed earthwork, utility, and basement construction. Recommendations to address the impact of groundwater are discussed in Sections 9.2 and 13.3.

7.0 SITE GRADING AND EARTHWORK

Proposed building and site grades will require placement of up to 8-feet of compacted structural fill. Cuts of up to 19-feet are also anticipated. Recommendations for compacted fill subgrade preparation, fill soil requirements, placement and compaction criteria are presented in subsequent sections.

7.1 Compacted Fill Subgrades

Subgrades to receive compacted structural fill for building or pavement support should be stripped of vegetation, topsoil, and organic matter. Our subsurface exploration indicated topsoil to a depth of 6 inches near boring MW-1 at the northwest corner of the site.

We expect that the compacted structural fill subgrades for the new pavements will consist of soils of Stratum A. Compacted structural fill subgrades for the building floor slab-on-grade, will consist of soils of Strata A, B, or C.

Loose and soft existing fill soils were encountered in several borings across the site. These loose and soft soils are not considered suitable for support of the proposed compacted structural fill under the building. These soils should be excavated from areas to receive compacted structural fill. The soft or loose soils may possibly be recompacted if earthwork is performed during warm, dry weather. However, the Contractor may need to scarify and dry these soils to achieve adequate compaction.

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 recompacted, 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.

Subgrades outside of the building limits that exhibit unsuitable movements during proofrolling may be stabilized by using crushed stone and geotextile working platforms. Recommendations for working platforms should be provided by the Geotechnical Engineer. When excavation of unsuitable materials is required, it 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 the required excavation depths.

Compacted structural fill subgrades should be kept free of ponded water. If springs or other flowing water is present at the compacted structural fill subgrade level, the Contractor should direct water to discharge beyond the fill limits and notify the Geotechnical Engineer. Recommendations for discharging springs should be provided by the Geotechnical Engineer.

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.

Buried foundations and other associated debris related to the previous development at the site, may be encountered during grading activities. Existing foundations and walls in the proposed building pavement areas should be removed to at least 3-feet below the design subgrade level. Existing utilities and drainage structures within the building area should be removed and replaced with compacted structural fill.

7.2 Compacted Fill

Compacted structural fill and backfill in building and pavement areas should consist of material classifying SC, SM, SP, SW, GC, GM, GP or GW according to ASTM D2487. In addition, fill materials should exhibit Liquid Limit and Plasticity Index values of less than 50 and 20, respectively. Fill materials should not contain particles larger than 3 inches. The on-site stockpile soils and soils of Strata A and B are generally expected to meet these criteria. Some selective excavation and separation of the suitable fills soils from unsuitable fills will be required.

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 98 percent of the same standard.

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.

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 soils encountered in proposed borrow areas are 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.

8.0 FOUNDATION 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. Based on our analysis, we recommend drilled shafts for support of the proposed building and spread footings for support of the Morgan Wall and the tiered wall. The following sections of the report provide our detailed recommendations.

8.1 Drilled Shafts on Rock

We recommend the proposed structure be supported on straight-sided drilled shafts founded on rock. Drilled shafts founded on suitable Bedrock of Stratum E may be designed for a net allowable bearing pressure of 80 ksf. This bearing pressure provides a factor of safety of at least three against general bearing capacity failure based on the bedrock type, the RQD data presented on the boring logs, and our assumption that the shafts will be constructed, cleaned and inspected as recommended below. Drilled shafts should be at least 36 inches in diameter to permit hand cleaning and observation of the bearing materials.

Bearing grades between borings may be assumed to vary linearly. The estimated grades are for design purposes only. The estimates included in the table below are based on our interpretation of the test boring data and the ground surface elevations at the boring location as estimated from the topographic plans provided to us.

The estimated elevations at which suitable rock is expected to be encountered at the boring locations are:

Estimated Drilled Shaft Bearing Grades

Boring Number	Estimated Drilled Shaft Bearing Grade (ft)
B-1	EL 222
B-2	EL 215
B-3	EL 216
B-4	EL 215
B-5	EL 213
B-6	EL 213
B-7	EL 209
B-8	EL 210
B-9	EL 213
B-10	EL 217
B-11A	EL 217

Actual drilled shaft bearing elevations should be evaluated during construction by the Geotechnical Engineer. Drilled shaft bearing grades and design pressures may have to be adjusted in the field depending on the actual conditions encountered.

Bearing elevations may vary considerably over relatively short distances and drilled shaft depths may vary from depths based on the estimated rock elevations. Removal of rock in the shafts may be required due to sloping rock, rock ledges, boulders, mud seams, and zones of unsuitable rock. A budget should be established to account for these extra costs.

Because rock excavation quantities are frequently a subject of contention on drilled shaft projects, we strongly recommend that a definition of rock be included in the specifications. Veering of the rock auger on sloping rock surfaces should also be considered practical refusal if, in the judgment of the Geotechnical Engineer's field representative, the shaft cannot be advanced vertically without the use of a rock core barrel.

We suggest that the following definition be provided in the drilled shaft section of the specifications for defining suitable bearing material:

> *Suitable bearing shall be defined as rock auger refusal using a drill rig with at least 45,000 pounds of down pressure and 90,000 foot-pounds of torque. Rock augers shall be equipped with carbide teeth. Rock auger refusal shall be defined as a penetration of 2 inches or less over a time period of at least 5 minutes.*

After reaching suitable bearing material, the contractor should be required to clean the bottom of the shaft and drill a minimum of one probe hole per shaft to a depth below the bearing grade equal to at least 1.5 times the shaft diameter to locate possible soil-filled or open seams and fractures. Probe holes drilled by the contractor should be a minimum of 1 inch in diameter and should be drilled with an air drill. More than one probe hole may be needed where questionable conditions are encountered. The Geotechnical Engineer's representative should observe the drilled shaft bearing surface and the probe hole to evaluate the suitability of the rock for the design allowable bearing pressure.

We expect that settlement of drilled shafts will not exceed about ½ at the base plus the elastic compression of the shaft. Differential settlements between adjacent caissons are not expected to exceed about one-half this value.

To achieve the individual axial shaft capacity, the center-to-center spacing of the drilled shafts should be a minimum of three times the shaft diameter (D). If the spacing of drilled shafts is less than 3D, we must be notified so that we can evaluate the reduced efficiency of the shaft due to group effects.

8.1.1 Lateral Resistance of Drilled Shafts

The stiffness of the drilled shafts and the passive resistance of the surrounding soils will be used to resist the lateral loads and moments at the foundation level. We expect that the computer program LPile, COM624, or similar program will be used to analyze the lateral capacities and deflections of the drilled shafts.

Recommended soil parameters for use in calculating the lateral resistances of the piles are provided in Figure 4 at the end of this report. The soil parameters shown on the figure were selected based on the test boring data, our local experience, and published data. If it is determined that a drilled shaft length greater than the estimated length recommended above is required for lateral support, then the longer shaft length should be used for design.

Drilled shafts should be spaced at a minimum of center-to-center spacing of eight times the shaft diameter (8D) in the direction of the lateral loading to avoid group action. The shafts must also not be spaced closer than three times the shaft diameter (3D) in any other direction to avoid group action.

If the spacing of drilled shafts in the direction of loading is less than 8D, the lateral shaft capacities may be estimated from the following relationships:

Reduction Factors for Group Action

Shaft spacing in the direction of loading	Ratio of lateral resistance of group to single shaft
8D	1.00
6D	0.70
4D	0.40
3D	0.25

8.2 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 C be used for seismic design on this 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 USGS software. Based on the recommended site class and the project location, the following seismic design parameters were calculated:

Seismic Parameters

	Mapped Maximum Considered Spectral Response Acceleration		Design Spectral Response Acceleration
Period	For Site Class B	Site Adjusted	
Short (0.2 sec)	S_s = 0.133g	S_{ms} = 0.159g	S_{DS} = 0.106g
1 second	S_1 = 0.052g	S_{m1} = 0.088g	S_{D1} = 0.059g

9.0 FLOOR SLAB RECOMMENDATIONS

A modulus of subgrade reaction, k, of 75 pci may be used in the design of floor slabs under 100 psf, 200 psf, and 400 psf floor loads, when supported on suitable compacted structural fill. The recommended modulus value is based on 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.

The test borings encountered fill soils below the proposed structure footprint to depths of up to 24-feet below the proposed lowest floor grades. The fill soils primarily consisted of Silts, Lean Clay, Silty Sand, and Poorly Graded Sands. No documentation of the source or placement methods of the fills was available. Some of the fills were soft. Therefore, due to the uncertainty of the quality of the fill, we do not recommend that the existing fills be used for direct support of the floor slab. We recommend two options be considered for supporting the floor slab.

It should be noted that the two options recommended below were developed to reduce the risk of future floor settlements and distress. However, there will always be a potential for floor settlements and distress unless all the fills below the building are completely removed and replaced with compacted structural fill or the floor supported on the drilled shafts.

9.1.1 Undercut and Replacement

The existing fills should be removed to at least 4-feet below the floor subgrades and replaced with new compacted structural fill. The undercut subgrade should be compacted with at least four passes of a suitable vibratory roller under the observation of a Schnabel representative. Unsuitable soils at the undercut subgrade should be further undercut as described in Section 7. The proposed floor slabs should be supported on a minimum depth of 4-feet of new compacted structural fill.

Groundwater is expected to be encountered at the floor slab subgrade. Undercutting the fills below the floor subgrade will likely require dewatering. If the owner does not want to take this risk of dealing with dewatering, the associated costs, or the possibility of floor settlements, then the ground below the floor subgrade should be improved with aggregate piers.

9.1.2 Compacted Aggregate Piers

Aggregate piers may be considered for improving the Stratum A fill soils below the floor subgrade. The soils are improved by partially removing the compressible fill soils and replacing them with aggregate piers of compacted aggregate. The construction process is as follows:

- Drill a hole.
- Place a bottom bulb of open-graded stone (typically AASHTO No. 57) in the bottom of the shaft.
- Compact the bottom bulb with repeated strokes with a hydraulic ram.
- Form the pier shaft on the bottom bulb by repeatedly placing lifts of dense-graded aggregate (typically Maryland No. CR-6) and compacting each lift with the hydraulic ram until the pier reaches the ground surface.

The compacted aggregate pier program, including pier diameter, depth and spacing, should be designed by the Aggregate Pier Contractor. The program should be designed to limit total settlements to 1 inch and should consider the groundwater levels at the site. The Geotechnical Engineer should be retained to review the design for conformance with our recommendations. The compacted aggregate pier program should include a Quality Control Plan. The Quality Control Plan should include performing at least one modulus load test on an individual pier. The estimated minimum depth to suitable bearing material for the aggregate pier is provided in the table below:

Estimated Minimum Depth to Suitable Bearing Material

Boring Number	Estimated Minimum Depth Below Floor Grade (ft)
B-1	0
B-2	20
B-3	0
B-4	8
B-5	0
B-6	7
B-7	23
B-8	4
B-9	5

Boring Number	Estimated Minimum Depth Below Floor Grade (ft)
B-10	10
B-11A	5

9.2 Floor Slab Subdrainage

Groundwater readings indicate the presence of groundwater at about the same level of the lowest floor slab grade of EL 253.5. Therefore, a permanent subdrainage system is recommended to maintain groundwater levels below the lowest floor slab elevation. In addition, subdrains for the walls are recommended and are discussed later in this report. The subdrainage system should include an underfloor drainage blanket and a series of interior underslab subdrains. A recommended subdrainage system detail is shown on Figure 5.

The drainage blanket should consist of a 6-inch thick layer of drainage filter material placed beneath the floor slab. Since this layer is part of the subdrainage system, the drainage filter material should be protected from inclusion of non-filter materials.

Interior underslab subdrains should be constructed on maximum 25-feet centers and connected to headers at both ends of the subdrain. Subdrains should consist of 4-inch diameter, corrugated, slotted, polyethylene pipe according to ASTM F405 (perforated Schedule 40 PVC pipe). Slot widths (perforations) should not exceed ⅛ inch. Drainage pipes should be surrounded by at least 4 inches of drainage filter material on all sides. The drainage filter material should be wrapped with non-woven drainage geotextile. Pipe inverts should be set at least 12-inches below the bottom of the floor slab.

The subdrainage system should drain by gravity to a sump pit installed in the lowest level, where drainage can be discharged by pump. Elevator pits and other portions of the structure that extend below the subdrainage system should be water proofed and designed to resist full hydrostatic pressure.

The design and construction of a subdrainage 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 subdrainage 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 subdrain system should be laid out to provide redundant flow paths where possible.

Subdrainage requirements have been prepared to assist in the design of a subdrainage system for this project. These recommendations are based on the subsurface and groundwater data reviewed herein. If substantially different groundwater flow quantities are encountered during construction or if the lowest floor levels are changed, we should be contacted so that we may evaluate effects on the recommendations given herein. Construction plans should depict the entire subdrainage system, including sump pumps and cleanout locations and the layout of interior collection or trunk lines. Our office can prepare subdrainage system design drawings upon request.

Figure 5 illustrates recommended subdrainage details as discussed above.

10.0 RETAINING STRUCTURE RECOMMENDATIONS

The proposed construction includes below grade building walls, a tiered retaining wall and a Morgan Wall. Recommendations for the design of these walls are presented in the following sections.

10.1 Spread Footings

We consider spread footings suitable for support of the proposed tiered retaining wall and Morgan Wall. The test borings encountered fill soils below the proposed walls to depths of up to 10 below the existing ground surface. The fill soils primarily consisted of Lean Clay, Silty Sand, and Poorly Graded Sands. No documentation of the source or placement methods of the fills was available. Therefore, due to the uncertainty of the quality of the fill, we recommend that the existing fills not be used for direct support of the wall footings. The existing fills should be removed to at least 2-feet below the wall footing subgrades and replaced with new compacted structural fill. The undercut subgrade should be compacted with at least four passes of a suitable vibratory roller under the observation of a Schnabel representative.

We recommend footings supported on new compacted fills be designed for a net allowable soil bearing pressure of 2,000 psf. This bearing pressure provides a factor of safety against general bearing capacity failure of at least 3.0. The above allowable soil bearing pressure may be increased by 33 percent for wind and seismic loads when used in conjunction with load combinations defined in IBC Section 1605.3.2, Alternative Basic Load Combinations for use with allowable stress design. This increase is not applicable for other allowable stress load combinations, strength design or load and resistance factor design. The above allowable bearing pressure of 2,000 psf may be increased by 33 percent when evaluating toe pressures.

Settlements of shallow foundations supported on properly placed compacted structural fill are not expected to exceed about one inch. Differential settlements between similarly loaded footings are not expected to exceed about one-half this value.

Wall footings should be at least 16 inches wide for shear considerations. Exterior footings should be founded at least 2.5-feet below final exterior grades for frost protection

It should be noted that the recommendations contained herein were developed to reduce the risk of future wall settlements. However, there will always be a potential for wall settlements unless all the fills below the wall footings are completely removed, the ground improved or the floor supported on the drilled shafts. Drilled shaft and ground improvement recommendations are provided in other sections of this report.

10.2 Basement and Retaining Walls

Below-grade building walls will be braced by the structure preventing movement. Braced basement and loading dock walls and cantilevered tiered walls and the Morgan Wall, should be designed considering equivalent fluid pressures presented in the table below. Where applicable, the design should consider surcharge loads using a rectangular earth pressure distribution. The surcharge pressure ordinate should be obtained by multiplying the surface surcharge pressure, q, by the factor in the table below. Horizontal forces on the wall should be resisted by friction acting on the base of the wall and passive earth pressure acting on the front of the wall foundation.

Recommended Design Parameters for Walls

Wall Type	Equivalent Fluid Pressure Factor γ_A	Surcharge Pressure Factor	Friction Factor	Passive Equivalent Fluid Pressure Factor γ_P
Braced (Basement wall and Loading Dock Wall)	63H	0.5	0.36	Not Permitted
Cantilevered (Tiered Wall and Morgan Wall)	42H	0.33	0.36	375h

(Where H is the H is the retained height of the wall and h is the height of the soil above the bottom of the footing on the passive side of the wall)

The above parameters 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.

These design parameters do not consider hydrostatic pressure since we recommend subdrainage behind the walls. Basement walls should be backfilled as recommended in Section 7. Basement walls should be damp proofed.

Earth pressure recommendations provided do not include hydrostatic pressure since subdrainage will be provided behind the retaining walls. Subdrainage should consist of perimeter subdrains located on top of the wall footing, next to the wall. Subdrains should consist of four-inch slotted, corrugated polyethylene tubing according to ASTM F405 (perforated Schedule 40 PVC pipe) surrounded by at least six inches of drainage filter material. A drainage geotextile should wrap around the drainage material. Subdrains should drain by gravity to an outlet, or to a sump or storm sewer.

Geocomposite drainage panels should be installed on all basement and loading dock walls, and should be placed as described in Figure 5. The Contractor should bind the edges of the panels with drainage geotextile to limit the potential for soil intrusion into the drainage system.

The tiered wall and the Morgan Wall subdrainage may be provided using weepholes. Weepholes should be four inches in diameter and installed on 10-feet centers. A filter plug consisting of at least one cubic foot of drainage filter material wrapped in drainage geotextile should be placed at the back of each weephole.

Drainage filter material should consist of AASHTO No. 57 aggregate. Drainage geotextile should be a non-woven geotextile as described on Figure 5.

11.0 STORMWATER MANAGEMENT RECOMMENDATIONS

We understand that new SWM structures will be constructed at the site. The SWM structures will consist of bioretention facilities within the parking lot islands. 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.

The MDE Stormwater Management Manual states that infiltration is not allowed in existing fills. Fill soils were encountered in the SWM borings at depths of 8.5-feet and 10-feet below the existing ground surface in the two SWM borings performed. The bottom of bioretention facilities are typically about 3-feet below the existing ground surface. Infiltration is not permitted in fill soils and the stormwater management structures should be designed for storage and treatment, and should include an underdrain system.

12.0 PAVEMENT RECOMMENDATIONS

12.1 Mill and Replace Existing Pavements

We understand that milling of the surface course of asphalt will be performed in the existing parking lot at the north end of the site. We observed that most of the parking lot is in poor condition. Therefore, we believe that milling 1 to 2 inches will not completely remove the cracks and distresses. Thus, the remaining cracks will reflect through the new overlays. Furthermore, repeated heavy construction truck traffic is expected to damage the existing pavements. We believe that the proposal milling and re-surfacing program will not be adequate to structurally improve the existing pavements. Should the milling and resurfacing program be pursued, then we recommend that prior to milling, a visual pavement survey be performed to identify distressed areas that will require partial or full-depth repairs. Partial-depth and full-depth repairs of the existing asphalt should be performed prior to milling. Following milling, a selective patching program to repair any deeper damage pavements that are still evident should again be performed, as the proposed milling depths will only remove surficial cracks.

12.2 New Pavements

The Contractor should prepare pavement subgrades and place compacted structural fill for pavement support as described in Section 7.0 of this report. 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. Dense-graded aggregate placed as pavement base course should be compacted to at least 95 percent of maximum dry density according to AASHTO D1557, Modified Proctor Dense-graded aggregate should be placed in maximum 8-inch thick loose lifts.

The flexible pavement sections were designed using recommendations provided by AASHTO's "Guide for Design of Pavement Structures," 1993. Our design also considers that proper grading will be maintained to provide runoff from the pavement surface to beyond the limits of paved areas or into inlets and discharged beyond the paved areas.

Design traffic volumes were not provided to us at the time of this report. In an effort to meet the project schedule, we assume the following design traffic volumes for our analysis:

Design Traffic Volume

Traffic Data	Parking Lot Travel Lanes	Access Road/Bus Loop
Two Way Traffic (ADT)	600	300
% Single Unit Trucks/Busses	5%	10%
% Tractor Trailer Trucks	0%	2%

The following design assumptions were used in our design of the flexible pavement:

Design Life = 25 years
Layer Coefficients: HMA surface = 0.44
HMA Base = 0.40
Graded Aggregate Base = 0.12

Subgrade Resilient Modulus = 4,500 psi
Initial Serviceability Index = 4.2
Final Serviceability Index = 2.4
Reliability Level = 90%
Overall Standard Deviation = 0.49

Soil laboratory testing of two bag samples from the stockpile material recorded CBR values of 2.6 and 3.6. Our design was based on a design CBR value of 3.0. This design CBR value is slightly less than the average CBR values determined from lab testing. A CBR value of 3.0 correlates to a resilient modulus of about 4,500 psi.

Based on our assumptions and our design, we recommend the following pavement sections for new pavements.

Recommended New Pavement Sections

Type Section	Thickness (inches)
Parking Lot	
9.5 MM Hot Mix Asphalt Surface Course	2
19.0 MM Hot Mix Asphalt Base Course	3.5
Graded Aggregate Base	8
Access Road and Bus Loop	
9.5 MM Hot Mix Asphalt Surface Course	2
19.0 MM Hot Mix Asphalt Base Course	4
Graded Aggregate Base	8.0

We recommend that reinforced concrete pavement be used in dumpster pad and dumpster approach pad areas. These pads should be designed based on a modulus of subgrade reaction value, k, of 75 pci. The recommended modulus value is for a 1-ft-square plate. Some pavement design software may consider different definitions of k for input. The Civil Engineer should contact our office if their software considers a different definition of k.

Adequate control of surface drainage will be a very important consideration for the overall performance of this pavement design. The areas 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.

13.0 CONSTRUCTION CONSIDERATIONS

13.1 Site Grading and Earthwork

Traffic on stripped or undercut subgrades should be limited to reduce disturbance of underlying soils. Also, using lightweight, track-mounted dozer equipment for stripping will limit the disturbance of underlying soils, and may reduce the undercut volume needed. The Contractor should provide site drainage to maintain subgrades free of water and to avoid saturation and disturbance of the subgrade soils before placing compacted structural fill, pavement base course or moisture barrier material. This will be important during all phases of the construction work. The Contractor should be responsible for reworking of subgrades and compacted structural fill that were initially considered suitable but were later disturbed by equipment and/or weather. We recommend that the earthwork be performed during the warmer, drier times of the year.

Grading activities for the building floor slab on grade will likely encounter groundwater. Therefore, the Contractor will likely need to provide temporary dewatering such as trenching and/or pumping from sumps to control the surface and/or groundwater.

13.2 Foundations

13.2.1 Spread Footings

The Contractor should exercise care during excavation for spread footings for the walls 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 actual footing subgrades during construction to evaluate whether subgrade soils meet the requirements as recommended in this report.

Footing subgrades needing undercut may be concreted at the elevation of the undercut or backfilled to the original design subgrade elevation with compacted structural fill. Concreting should take place the same day as excavation of footings.

13.2.2 Drilled Shafts on Rock

Drilled shafts should be constructed according to good engineering practice. Temporary steel casing must be used limit the possibility of the wall collapse and limit the intrusion of groundwater into the excavation prior to the placement of concrete. Temporary casing should extend the full length of the shaft into the residual soils and disintegrated rock above the bedrock so that groundwater can be sealed off. The contractor should be required to dewater the shafts if the water cannot be sealed. The contractor should be prepared to place drilled shaft concrete using tremie methods if groundwater cannot be easily controlled by pumping. Excessive pumping should be avoided as it can lower groundwater levels in the vicinity of the pumping activity, cause migration of soil fines, and induce ground collapse, all of which can adversely affect adjacent foundations, floor slabs and pavements.

The contractor should include costs in their bid for confined space entry, including lowering a gas meter into each drilled shaft to evaluate the presence of gas prior to sending personnel into the drilled shafts. At a minimum, the atmosphere in the drilled shafts should be monitored for explosive gases, hydrogen sulfide, and oxygen. The contractor should be prepared, at his own expense, to ventilate the shafts, if necessary.

After excavation to suitable bearing material, the contractor should thoroughly clean the bearing surface of all loose material, including mud and soft, unsuitable disintegrated rock within crevices and seams. This will require personnel entry into the shafts to perform hand cleaning. Drilled shafts should have no more than an average of ½ inch of sediment at the base of the drilled shaft and no more than 1½ inch of sediment in any portion of the base of the drilled shaft at the time it is poured. A probe hole at the shft bottom and visual inspection of the shafts will be required.

The Contractor should be responsible for providing an essentially horizontal bearing surface. Irregularities or steps within the bearing surface will generally be acceptable if not sloped. Sloped surfaces steeper than 20 degrees must be leveled using vertical steps.

For drilled shafts constructed in dry conditions, concrete may be placed using free fall methods provided that proper techniques are used to avoid hitting the reinforcing steel cage or shaft sidewalls. Shafts should be filled with concrete as the casing is withdrawn. A minimum concrete head of 8-feet above the bottom of the casing should be provided so that discontinuities do not develop in the drilled shaft due to intrusion of soil into the shaft. Concrete volume should be recorded by the Geotechnical Engineer. A concrete slump of 6 inches (± 1 inch) is recommended for drilled shafts constructed in dry conditions to reduce the possibility of the concrete arching within the casing during withdrawal.

For drilled shafts constructed in wet conditions where groundwater cannot be lowered adequately, concrete should be pumped to the bottom of the shaft using proper tremie techniques. We recommend that pump hoses and tremie pipes be lubricated with a rich cement grout prior to concrete placement to ease the flow of concrete. A concrete slump of 8 inches (± 1 inch) is recommended for drilled shafts constructed in wet conditions. Superplasticizing agents should be used to achieve the required slump. The tremie pipe should be kept at the bottom of the shaft until the pipe is full of concrete and then lifted only slightly to initiate the flow of concrete. The bottom of the tremie pipe should be kept at least 10-feet below the top of the concrete at all times.

To ensure that the reinforcing steel cage is properly spaced and aligned in the drilled shaft, the Contractor should be required to use SHAFTSPACER™ and BARBOOT™ alignment devices, or their technical equivalents.

13.3 Construction Dewatering

Based on the groundwater observations in the borings, temporary dewatering of excavations below the groundwater table should be expected during construction. A system of sumps and pumps may be effective for temporary groundwater control during construction and deep wells are not expected to be required, unless undercutting of fills is planned. Ineffective groundwater control will result in softening of foundation and slab subgrades and the need to remove softened and otherwise unsuitable subgrade materials.

The contractor should be prepared to address fluctuations and localized increases in groundwater flow. The localized increase in groundwater may result in over-excavation of subgrades if not properly handled during construction. The contractor should be prepared to augment a general dewatering system with more specific and localized techniques for effective management of groundwater during construction such as dewatering wells.

13.4 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 must 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. Because of our unique position to understand the intent of the geotechnical engineering recommendations, retaining Schnabel for these services will allow us to provide consistent service throughout the project construction.

14.0 GENERAL SPECIFICATION RECOMMENDATIONS

An allowance should be established to account for possible additional costs that may be required to construct earthwork, pavements, 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, drilled shaft rock excavation, temporary dewatering, etc.

We recommend that the construction contract include unit prices for scarifying and drying wet and/or loose subgrade soils, rock excavation in drilled shafts, removal and replacement of unsuitable 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.

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.

15.0 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.

FIGURES

arcgis

Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013
Copyright:© 2014 Esri, DeLorme, HERE, TomTom
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP,

NOT TO SCALE

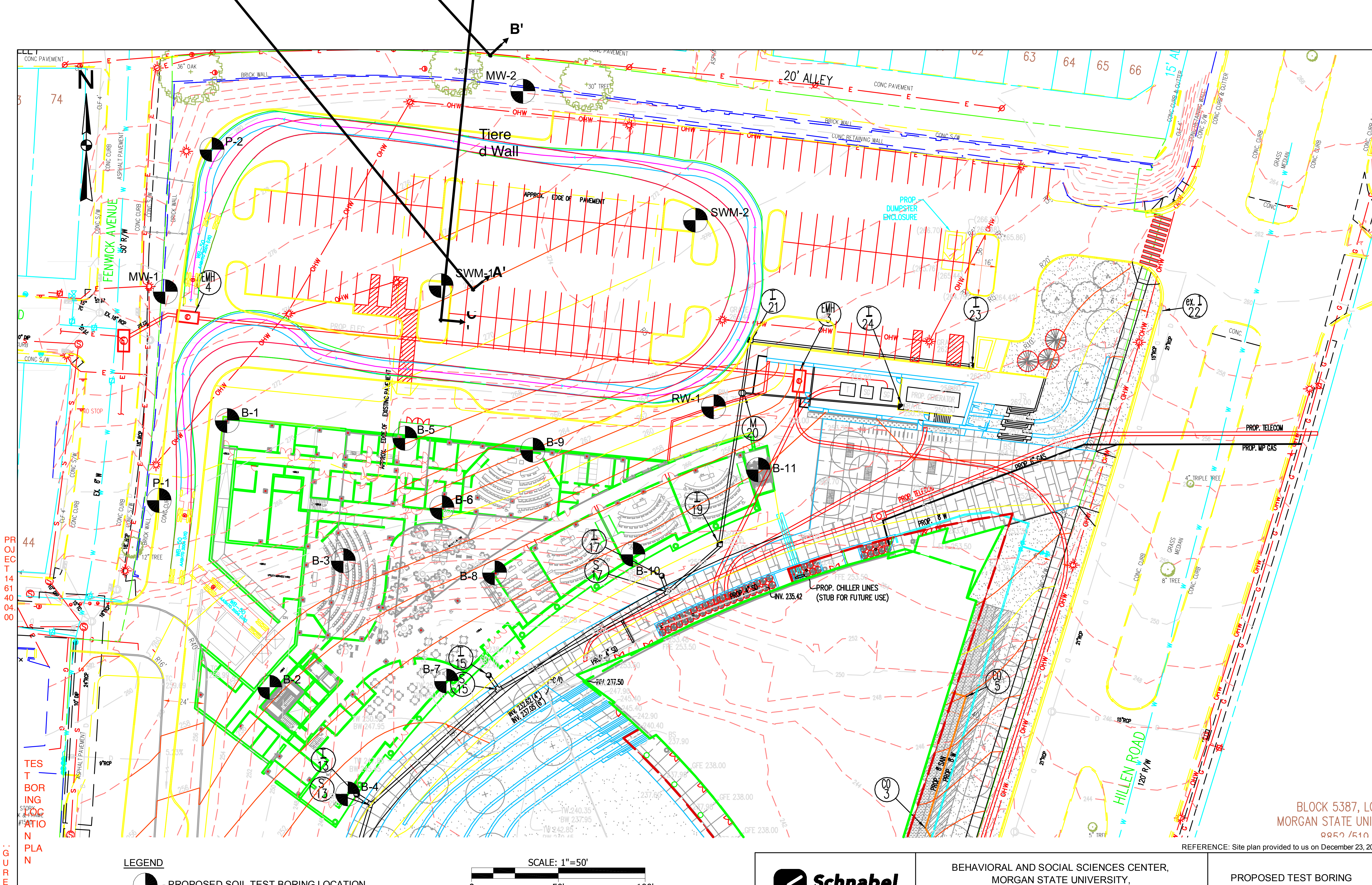
Schnabel ENGINEERING

BEHAVIORAL AND SOCIAL SCIENCES CENTER,
MORGAN STATE UNIVERSITY,
BALTIMORE, MARYLAND
PROJECT NO. 14614004.00

SITE VICINITY MAP

FIGURE 1

4/3/2014 This Map was created in Schnabel Engineering's Site Vicinity Map Application.



REFERENCE: Site plan provided to us on December 23, 2013

LEGEND

- PROPOSED SOIL TEST BORING LOCATION

SCALE: 1"=50'

0 50' 100'

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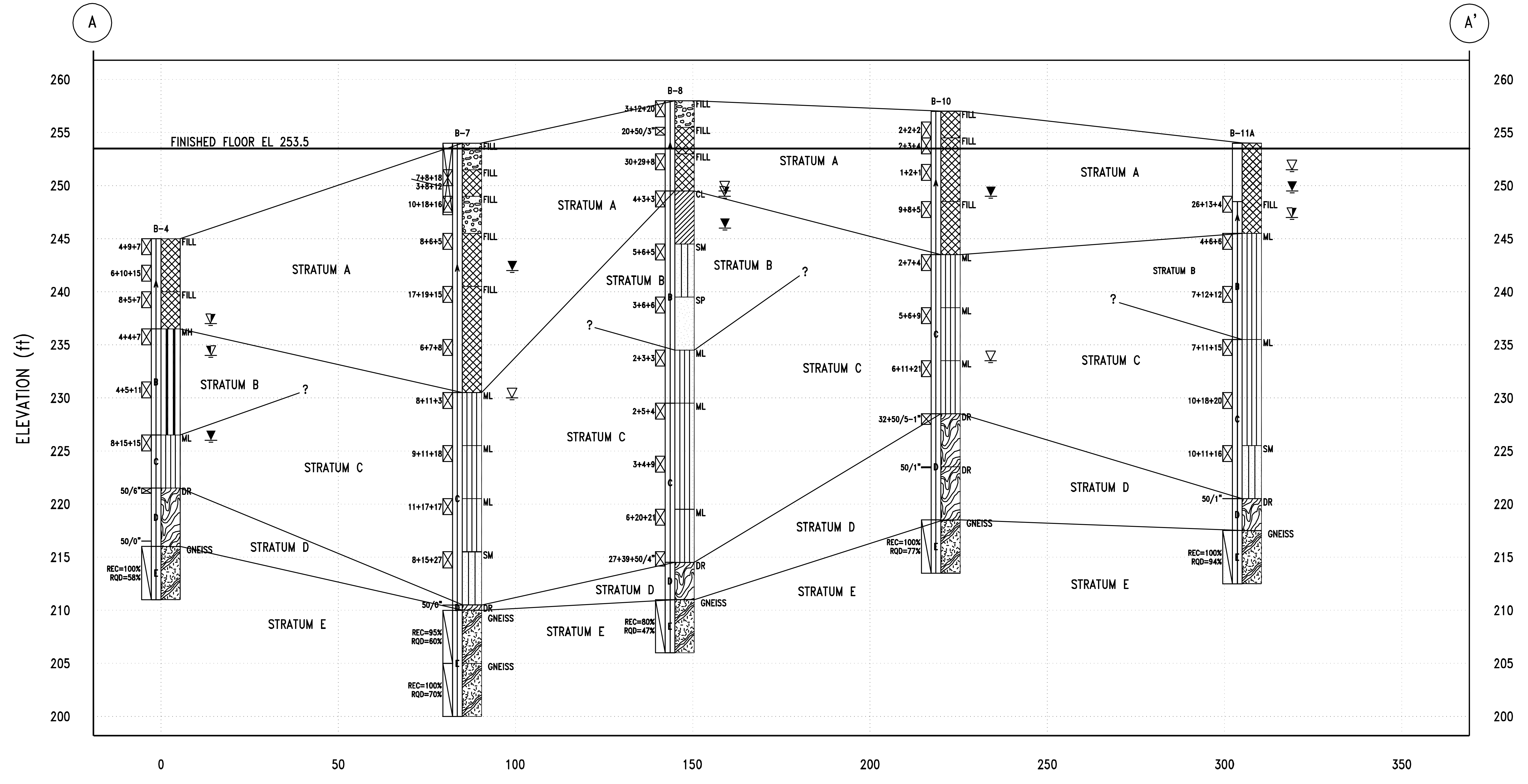
MORGAN STATE UNIVERSITY,
BALTIMORE, MARYLAND
PROJECT P3614021.00

PROPOSED TEST BORING LOCATION PLAN

FIGURE 1



Fill (made ground)	MH	ML	Disintegrated Rock
Gneiss	Crushed Stone	SM	CL
SP			

NOTE: SEE SECTION 6 IN THE REPORT FOR STRATA DESCRIPTIONS

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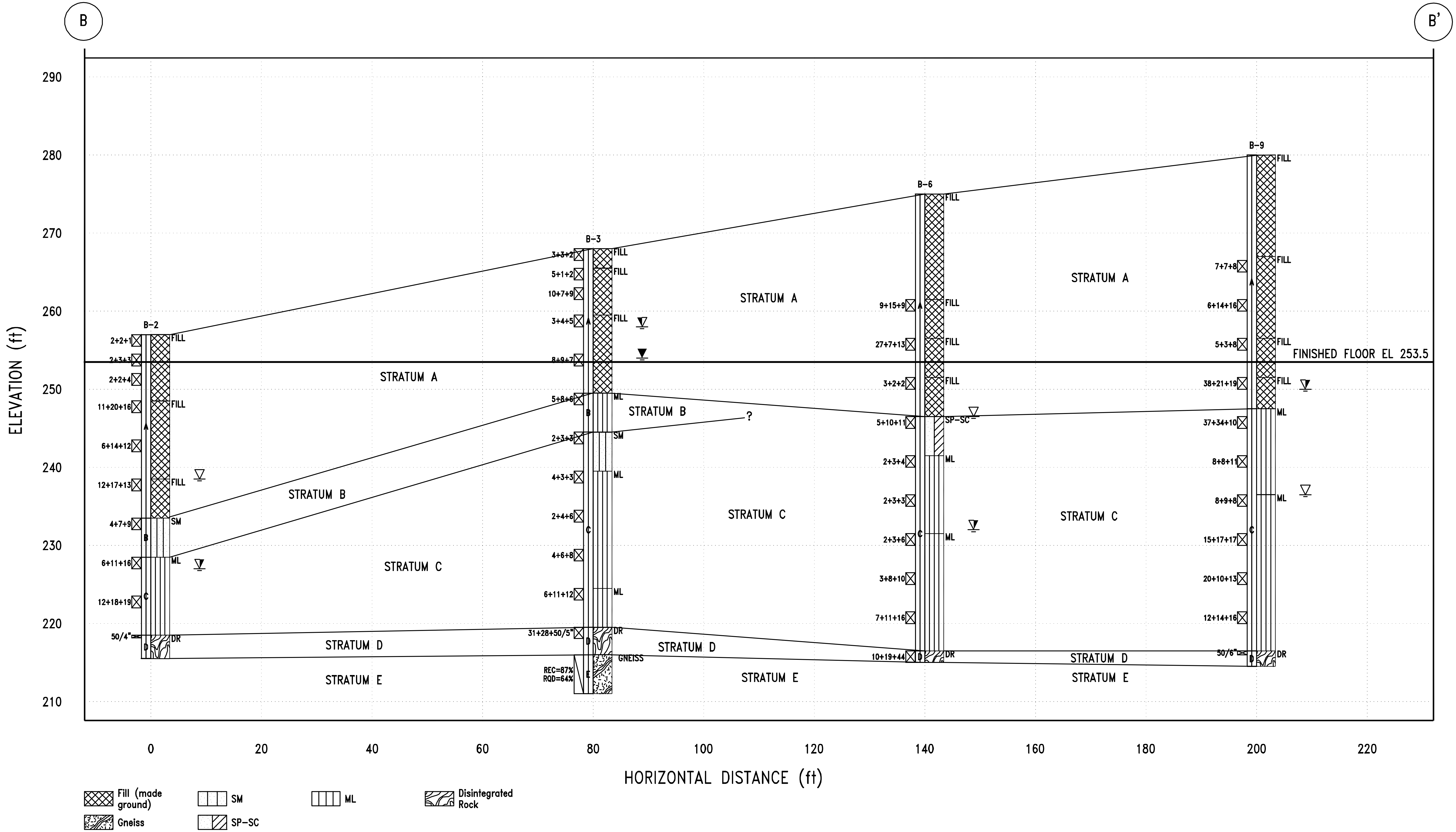
TEST BORING
CROSS SECTION A-A'

PROJECT NO. 14614004.00
FIGURE 3A



NOTE: SEE SECTION 6 IN THE REPORT FOR STRATA DESCRIPTIONS

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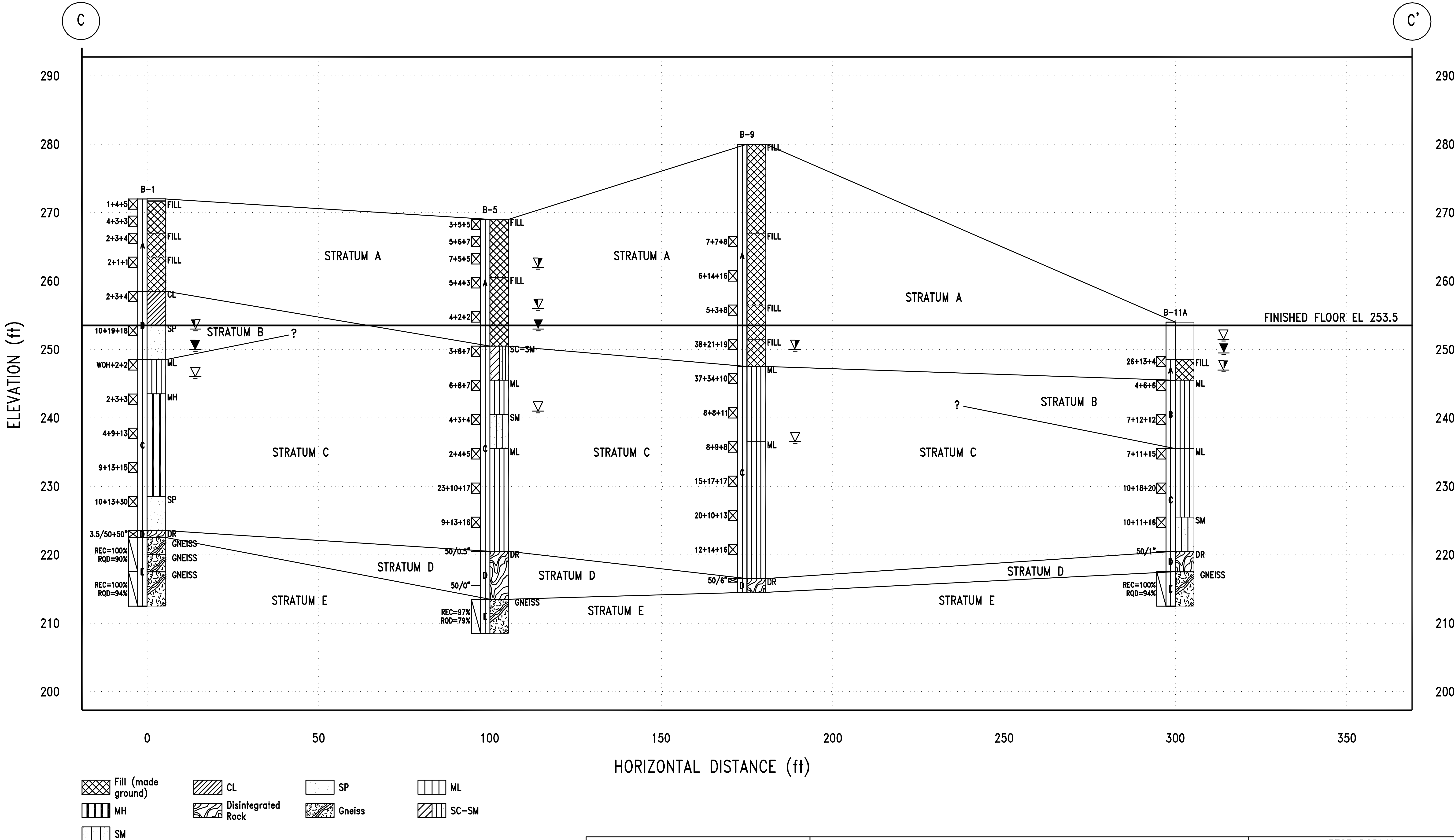
BALTIMORE, MARYLAND

TEST BORING
CROSS SECTION B–B'

PROJECT NO. 14614004.00
FIGURE 3B



NOTE: SEE SECTION 6 IN THE REPORT FOR STRATA DESCRIPTIONS

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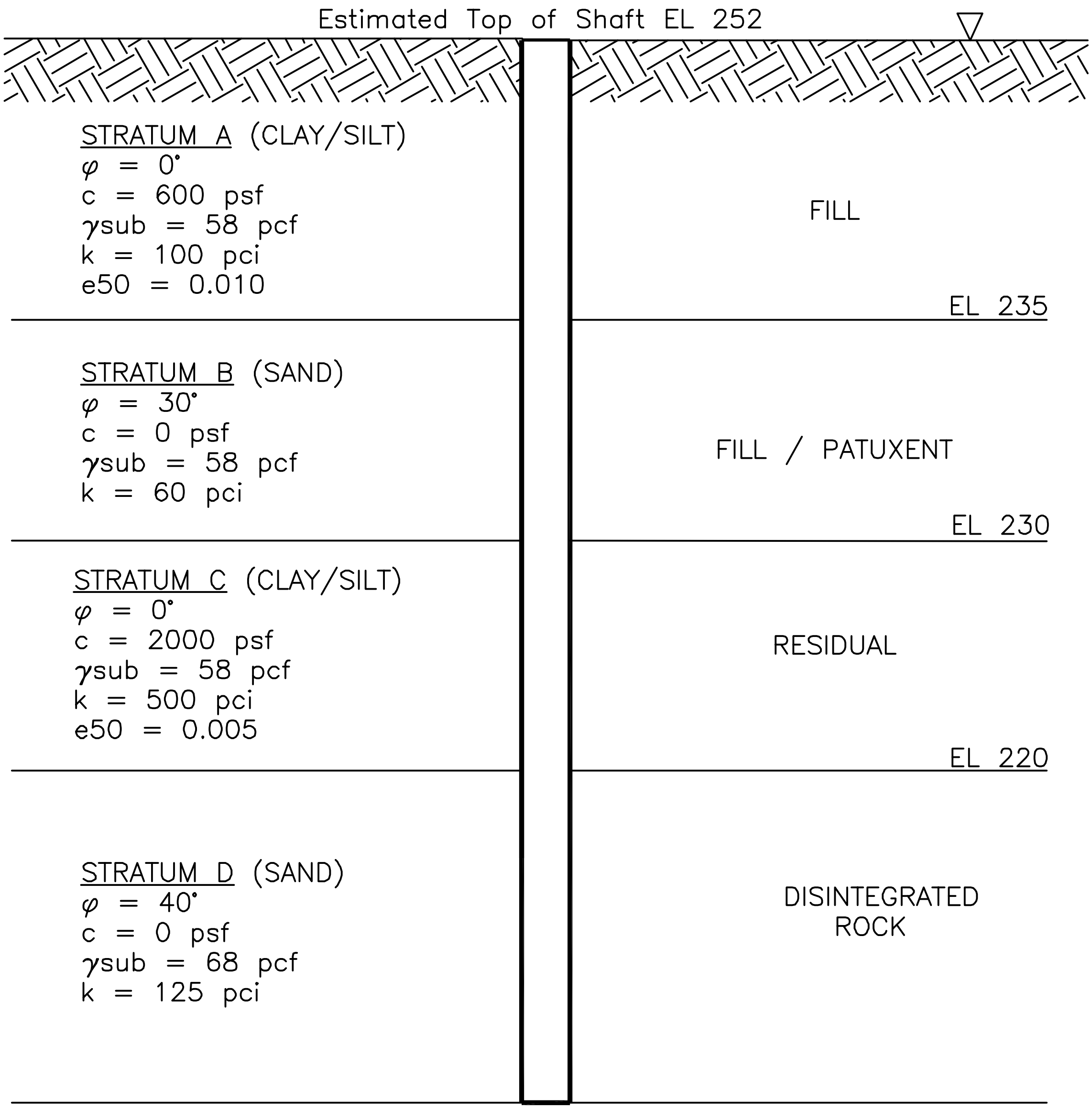
TEST BORING
CROSS SECTION C-C'

PROJECT NO. 14614004.00
FIGURE 3C

SOIL PARAMETERS FOR LATERAL RESISTANCE OF DRILLED SHAFTS

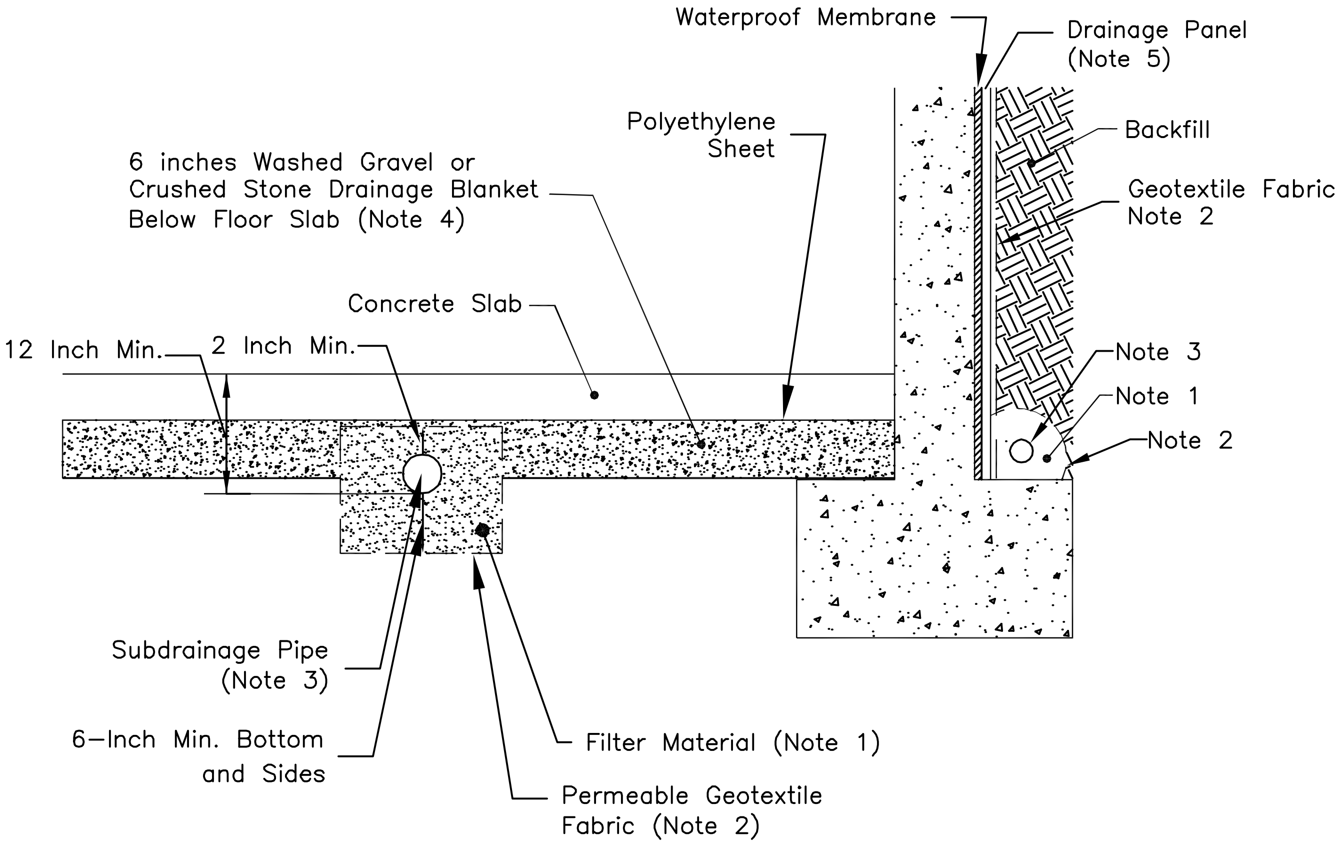


LEGEND

γ = Moist Unit Weight (pcf)
γsub = Submerged Unit Weight (pcf)
φ = Internal Angle of Friction (°)
c = cohesive strength (psf)
k = Soil or Rock Modulus Parameter k (pci)
e50 = Strain @ 50% soil strength

Schnabel ENGINEERING	BEHAVIORAL AND SOCIAL SCIENCES CENTER MORGAN STATE UNIVERSITY BALTIMORE, MARYLAND	SOIL PARAMETERS FOR LATERAL RESISTANCE CONTRACT: 14614004.00 4/11/14 — FIGURE NO. 4

Typical Foundation Drainage System



Legend:

1. Filter material graduation should satisfy requirements for AASHTO M-43, Size No. 57.
2. Permeable fabric should have equivalent open size not larger than the No. 70 U.S. standard sieve size and satisfy requirements on Figure No. 4.
3. Subdrainage piping should be 4 inch diameter, slotted corrugated polyethylene (PE) tubing according to ASTM F-405 with maximum 1/8 inch slot width for at least the lower 120 degree sector. Piping should be installed to outlet into storm sewer or sump with a pump.
4. Washed gravel or crushed stone drainage blanket should satisfy graduation requirements for AASHTO size No. 57 and be 6 inches thick.
5. Drainage panels should have a minimum flow rate of 5 gallons per minute per foot at a hydraulic gradient of 0.1 per ASTM D-4716.

Schnabel ENGINEERING	BEHAVIORAL AND SOCIAL SCIENCES CENTER MORGAN STATE UNIVERSITY BALTIMORE, MARYLAND	TYPICAL FOUNDATION DRAINAGE SYSTEM PROJECT NO. 14614004.00 4/11/14 FIGURE NO. 5

APPENDIX A

SUBSURFACE EXPLORATION DATA

Subsurface Exploration Procedures
General Notes for Subsurface Exploration Logs
Identification of Soil
Descriptive Criteria for Rock Core Logging
Supplemental Rock Descriptive Terms
Boring Logs, B-1 through B-11, WM-1, MW-2, RW-1, SWM-1, SWM-2

SUBSURFACE EXPLORATION PROCEDURES

Test Borings – Hollow Stem Augers

The borings are advanced by turning an auger with a center opening of 2¼ or 3¼ inches. 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 Standard Penetration Test (SPT) is performed in the borings at regular depth intervals to collect soil samples. The numbers in the Sampling Data column of the boring logs represent SPT results. Each number represents the blows needed to drive a 2-inch O.D., 1⅜-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 Standard Penetration Test is performed according to ASTM D1586.

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.

Disintegrated rock is defined as residual material with SPT N values between 60 blows per foot and refusal. Refusal is defined as auger refusal.

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.

Rock Core Drilling

The drillers core drilled rock using special core bits set with carbide steel or diamond, depending upon the rock texture. The bit was fitted onto a double-tube, swivel-type core barrel in which an exterior tube and bit rotate, and an interior barrel remains stationary to receive the rock core. Drillers circulated water between the barrels and across the bit face to provide cooling and to flush away cuttings. The size of bits is indicated on individual boring logs.

The length of rock core recovered expressed as a percentage of the total length cored is shown on the logs. Rock Quality Designation (RQD) is also given for rock core drilled with NP-size core drilling equipment. RQD is defined as the total length of NP-size rock fragments recovered which are greater than 4 inches in length, discounting drilling breaks, expressed as a percentage of the total length cored. RQD is preferred to core recovery as a measure of engineering characteristics of rock.

Boring Locations and Elevations

Borings locations were staked using GPS equipment with accuracy of 10 feet. 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., 1⅜-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	Sample No., Standard Penetration Test
5+10+1	Number of blows in each 6-inch increment
Run #1, CORE	Core No., Rock Core
Run = 5.0 ft	Run length in feet
REC = 60", 100%	Recovery in inches, Percent Recovery
RQD = 60", 100%	RQD in inches, Percent RQD
S-1, SAMPLE	Sample No., Hand Auger or Test Pit sample

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	CH	FAT CLAY
			MH	ELASTIC SILT
		Organic	OH	ORGANIC CLAY
				ORGANIC SILT
Highly Organic Soils	Primarily organic matter, dark in color and organic odor		PT	PEAT

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.

DESCRIPTIVE CRITERIA FOR ROCK CORE LOGGING

Rock is defined as natural subsurface material yielding SPT blow counts of N ≥ 100/2 inches (Martin, 1977). Rock descriptions may include the following descriptive elements, as applicable, generally in the order indicated. Supplemental descriptors may also be used, depending on project performance objectives and available information.

ROCK TYPE, strength, weathering, fracturing, color, recovery, RQD

Rock Type General terms are used following the NRCS (2001) rock type classification chart based on visual identification. Some of the NRCS rock types common to our geographic area of practice are listed below. Mineralogical modifiers may be added where they help define distinct units (e.g., Garnet-Muscovite Schist).

Sedimentary:	Conglomerate, Sandstone, Mudstone, Siltstone, Claystone, Shale, Limestone, Dolomite, Coal, Chert
Igneous:	Pegmatite, Granite, Diorite, Gabbro, Diabase, Rhyolite, Monzonite, Andesite, Basalt
Metamorphic:	Gneiss, Schist, Phyllite, Slate, Quartzite, Marble, Amphibolite, Hornfels

Strength (modified from Hoek, 2001) The estimated Uniaxial Compressive Strength associated with each rock strength term is based on the field strength index test for intact rock samples as follows.

- Extremely Strong — >36,000 psi — Specimen can only be chipped with a geological hammer.
- Very Strong — 15,000 - 36,000 psi — Specimen requires many blows of a geological hammer to fracture it.
- Strong — 7,500 - 15,000 psi — Specimen requires more than one blow of a geological hammer to fracture it.
- Medium Strong — 3,500 - 7,500 psi — Specimen cannot be peeled with a pocket knife; can be fractured with one blow from a geological hammer.
- Weak — 700 - 3,500 psi — Specimen can be peeled with a pocket knife with difficulty; shallow indentation made by firm blow with point of a geological hammer.
- Very Weak — 150 - 700 psi — Material crumbles under firm blows with point of a geological hammer; can be peeled with a pocket knife.

Weathering (modified from ACOE, 1994; and USBR, 2001)

- Fresh Mineral crystals appear bright and show no discoloration. Fractures show little or no staining on their surfaces. Discoloration does not extend into intact rock.
- Slightly Weathered Rock is generally fresh except along fractures. Some fractures are stained and discoloration may extend up to 0.5 inches into rock.
- Moderately Weathered Significant portions of rock appear dull and discolored. Rock may be significantly weaker than in its fresh state near fractures. Soil zones of limited extent may occur along some fractures.
- Highly WeatheredRock appears dull and discolored throughout. Majority of rock mass is significantly weaker than in its fresh state. Isolated zones of stronger rock and/or soil may occur throughout.
- Severely Weathered Significant portions of rock mass essentially weathered to soil. Rock fabric may still be discernable (i.e., saprolite). Isolated zones of stronger rock may occur locally. Quartz may be present as hard, fractured dikes or veins.

Fracturing (from ACOE, 1994)

Very Slightly Fractured	> 6.5 ft
Slightly Fractured	2 ft - 6.5 ft
Moderately Fractured	8 in - 2 ft
Highly Fractured	2.5 in - 8 in
Intensely Fractured	< 2.5 in

Color (from Munsell Color System; and GSA, 1995) Color descriptions include a primary color and up to two shade or secondary color modifiers, and may also include a color pattern term to define the relationship between multiple colors.

Shade: Light, Dark

Secondary: Blackish, Brownish, Grayish, Greenish, Reddish, Yellowish, Orangeish

Primary: Black, Brown, Gray, Green, Red, Yellow, Orange, White

Pattern: and, to, with mottles of, with speckles of, with streaks of, with bands of

- **Recovery** is defined as the total length of recovered core in a core run divided by the total length of the core run, times 100 percent. A core run may be any depth interval of concern. Only natural fractures are considered for determining the length of core pieces. Mechanical breaks formed during or after coring do not count against the length determination. The length of recovered core pieces is measured along the core axis, between fracture midpoints.

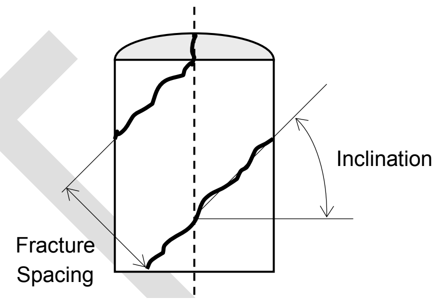
- **RQD** (ASTM D6032, Deere & Deere, 1988, 1989) is defined as the total length of core pieces at least four inches long recovered from a core run divided by the total length of the core run, times 100 percent. A core run may be any depth interval of concern. Only natural fractures are considered for determining the length of core pieces. Mechanical breaks formed during or after coring do not count against the length determination. The length of recovered core pieces should be measured along the core axis, between fracture midpoints. Core pieces that are highly to severely weathered, very weak, or contain numerous pores should not count toward RQD.

SUPPLEMENTAL ROCK DESCRIPTIVE TERMS

In addition to the basic rock descriptive elements provided on the preceding Descriptive Criteria for Rock Core Logging sheet, rock descriptions may include the following supplemental descriptive elements depending on project performance objectives and available information.

Bedding Thickness & Inclination Bedding is defined as the layered arrangement of sediment deposits in sedimentary rock. Bedding thickness is the average perpendicular distance between bedding surfaces. Bedding thickness intervals follow Bieniawski (1989). Inclination is measured in degrees from a plane perpendicular to the core axis (see Inclination Measurement Figure shown below).

Very Thickly Bedded	> 6.5 ft
Thickly Bedded	2 ft - 6.5 ft
Medium Bedded	8 in - 2 ft
Thinly Bedded	2.5 in - 8 in
Very Thinly Bedded	< 2.5 in



Inclination Measurement Figure

Foliation Character & Inclination Foliation is defined as the planar arrangement of textural features in metamorphic rock. Inclination is measured in degrees from a plane perpendicular to the core axis (see Inclination Measurement Figure).

Strongly Foliated	Foliation is easily discernable throughout.
Moderately Foliated	Foliation is discernable with some difficulty.
Poorly Foliated	Foliation is generally not discernable.

Fracture Set Data Individual fractures or fracture sets may be characterized by the following descriptive elements, when applicable and discernable: fracture type, inclination (as per Inclination Measurement Figure above), average spacing, roughness and infilling condition. An example fracture set data description for an individual stratum is: *4 joints at 80-90°, moderately spaced, slightly rough, with spotty iron staining and partially filled with pyrite*. If fractures are rare, they can be described individually by listing the depth, followed by the descriptive terms in this section.

FRACTURE TYPE

Fracture	Any natural break in rock; 'Fracture' is the general term used for individual breaks that do not fall into any of the following fracture-type categories
Joint	A relatively planar fracture without shear displacement; occurs with other similarly oriented joints generally at regularly spaced intervals
Shear	A fracture along which differential movement has taken place parallel to the surface (i.e., shear displacement) sufficient to produce slickensides or polishing
Fault	A major fracture along which there has been appreciable shear displacement accompanied by gouge and/or a severely fractured zone
Bedding Fracture	A fracture along a bedding plane
Foliation Fracture	A fracture along a foliation plane
Vein Fracture	A fracture along the contact of an intrusive vein

Average Spacing (NRCS, 2001)

Very Widely Spaced	> 6.5 ft
Widely Spaced	2 ft - 6.5 ft
Moderately Spaced	8 in - 2 ft
Closely Spaced	2.5 in - 8 in
Very Closely Spaced	< 2.5 in

Roughness (Bieniawski, 1989)

Very Rough	- Most surface asperities extend > 2 mm from the average planar surface.
Rough	- Most surface asperities extend 0.5 to 2 mm from the average planar surface.
Slightly rough	- Most surface asperities extend < 0.5 mm from the average planar surface.
Smooth	- Generally smooth to touch with few surface asperities.
Slickensided	- Infilling material contains slickensides.

Infilling Condition

Coverage	*Type*
Spotty Filling of (≤ 50% coverage)	Calcite
Partially Filled with (50 to 100% coverage)	Chlorite
Filled with (100% coverage)	Clay
	Gypsum
	Iron Staining
	Manganese
	Mica
	Pyrite
	Quartz
	Talc

References for Rock Descriptive Terms:

ASTM D6032, Standard Test Method For Determining Rock Quality Designation of Rock Core

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USBR *Engineering Geology Field Manual*. (2001). http://www.usbr.gov/pmts/geology/

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Schnabel ENGINEERING	**TEST BORING LOG**	**Project:** Behavioral and Social Sciences Center Morgan State University Baltimore, Maryland	**Boring Number:** **B-1** **Contract Number:** 14614004.00 **Sheet:** 1 of 2

Contractor: Connelly and Associates, Inc.
Frederick, Maryland

Contractor Foreman: J. Leatherman

Schnabel Representative: J. Spencer

Equipment: CME-55 (Truck)

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

Hammer Type: Auto Hammer (140 lb)

Dates Started: 3/20/14 **Finished:** 3/21/14

Location: See Location Plan

Ground Surface Elevation: 272± (ft) **Total Depth:** 59.5 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	3/21	8:30 AM	26.0'	---	---
Completion ▼	3/21	10:12 AM	22.0'	49.5'	---
Casing Pulled ▼	3/21	11:20 AM	19.0'	---	20.0'
After Drilling ▼	3/24	4:30 PM	22.0'	---	24.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.2	Asphalt=2-inches		271.8	A		S-1, SPT 1+4+5 REC=9", 50%		Fill
0.4	Gravel=2-inches		271.6					
	FILL, sampled as silty sand; moist, light brown	FILL				S-2, SPT 4+3+3 REC=6", 33%		
5.0	FILL, sampled as sandy clay with gravel; moist, reddish brown, contains gravel	FILL	267.0		5	S-3, SPT 2+3+4 REC=3", 17%		
8.5	FILL, sampled as clayey sand; moist, light brown, contains root hairs	FILL	263.5		10	S-4, SPT 2+1+1 REC=12", 67%	LL = 31 PL = 16 MC = 29.1% % Passing #200 = 40.1	
13.5	LEAN CLAY; moist, dark brown	CL	258.5	B	15	S-5, SPT 2+3+4 REC=18", 100%		Patuxent Formation
18.5	POORLY GRADED SAND WITH GRAVEL; moist, orangish brown ▼ ▼	SP	253.5		20	S-6, SPT 10+19+18 REC=18", 100%		
23.5	SILT; moist, light brown ▽	ML	248.5	C	25	S-7, SPT WOH+2+2 REC=18", 100%	PP = 0.75 tsf	Residual
28.5	SANDY ELASTIC SILT; moist, grayish brown	MH	243.5			S-8, SPT 2+3+3 REC=18", 100%	LL = 54 PL = 32	

(continued)

TEST BORING LOG (Schnabel Engineering)	**Project:** Behavioral and Social Sciences Center Morgan State University Baltimore, Maryland	**Boring Number:** B-1 **Contract Number:** 14614004.00 **Sheet:** 2 of 2

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
							MC = 28.9% % Passing #200 = 57.0 PP = 0.75 tsf	
	Change: orangish brown with speckles of black, contains mica, sand				35	S-9, SPT 4+9+13 REC=18", 100%		
		MH						
	Change: dark gray			C	40	S-10, SPT 9+13+15 REC=18", 100%	PP = 2.50 tsf	
43.5	POORLY GRADED SAND; moist, gray	SP	228.5		45	S-11, SPT 10+13+30 REC=18", 100%		
48.5	DISINTEGRATED ROCK, sampled as silty sand; moist, gray, contains mica	DR	223.5	D		S-12, SPT 3.5/50+50" REC=3.5", 29%		Disintegrated Rock Augers grinding
49.5	GNEISS, weak, highly weathered, highly fractured (2.5 - 8 in), blackish gray		222.5		50	R-1, CORE Run = 5.0 ft REC=60", 100% RQD=54", 90%		
52.0	GNEISS, strong, slightly weathered, moderately fractured (8 in - 2 ft), bluish gray		220.0					
54.5	GNEISS, strong, slightly weathered, moderately fractured (8 in - 2 ft), banded pink		217.5	E	55	R-2, CORE Run = 5.0 ft REC=60", 100% RQD=56.5", 94%		
59.5	Bottom of Boring at 59.5 ft.		212.5					

TEST BORING LOG — Schnabel Engineering

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, Maryland

Boring Number: **B-2**
Contract Number: 14614004.00
Sheet: 1 of 2

Contractor: Connelly and Associates, Inc.
Frederick, Maryland

Contractor Foreman: J. Leatherman

Schnabel Representative: J. Spencer

Equipment: CME-55 (Truck)

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

Hammer Type: Auto Hammer (140 lb)

Dates Started: 3/26/14 **Finished:** 3/26/14

Location: See Location Plan

Ground Surface Elevation: 257± (ft) **Total Depth:** 41.5 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	3/26	11:03 AM	18.5'	---	---
Completion ▼	3/26	11:47 AM	30.0'	38.5'	---
Casing Pulled	3/26	12:18 PM	Dry	---	9.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	FILL, sampled as sandy silt with gravel; moist, light brown	FILL		A		S-1, SPT 2+2+1 REC=5", 28%		Fill
	Change: brown					S-2, SPT 2+3+3 REC=15", 83%		
					5	S-3, SPT 2+2+4 REC=12", 67%		
8.5	FILL, sampled as poorly graded sand with gravel; moist, light brown, contains brick fragments	FILL	248.5		10	S-4, SPT 11+20+16 REC=15", 83%		
					15	S-5, SPT 6+14+12 REC=12", 67%		
18.5	▽ FILL, sampled as sandy silt; moist, light brown, contains brick fragments	FILL	238.5		20	S-6, SPT 12+17+13 REC=15", 83%		
23.5	SILTY SAND; wet, brown	SM	233.5	B	25	S-7, SPT 4+7+9 REC=3", 17%	MC = 22.3%	Patuxent Formation
28.5	SANDY SILT; moist, orangish brown, contains mica ▼	ML	228.5	C		S-8, SPT 6+11+16 REC=18", 100%	PP = 2.75 tsf	Residual

(continued)

Schnabel Engineering TEST BORING LOG	**Project:**	Behavioral and Social Sciences Center Morgan State University Baltimore, Maryland	**Boring Number:** **B-2** **Contract Number:** 14614004.00 **Sheet:** 2 of 2

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	Change: bluish gray	ML		C	35	S-9, SPT 12+18+19 REC=18", 100%		
38.5	DISINTEGRATED ROCK, sampled as silty sand; moist, gray	DR	218.5	D	40	S-10, SPT 50/4" REC=4", 100%		Disintegrated Rock Auger grinding
41.5			215.5					

Bottom of Boring at 41.5 ft.
Auger refusal at 41.5 feet

TEST BORING LOG

Schnabel Engineering

Project: Behavioral and Social Sciences Center, Morgan State University, Baltimore, Maryland

Boring Number: B-3
Contract Number: 14614004.00
Sheet: 1 of 2

Contractor: Connelly and Associates, Inc. Frederick, Maryland
Contractor Foreman: J. Leatherman
Schnabel Representative: J. Spencer
Equipment: CME-55 (Truck)
Method: 3-1/4" I.D. Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)
Dates Started: 3/24/14 **Finished:** 3/24/14
Location: See Location Plan

Ground Surface Elevation: 268± (ft) **Total Depth:** 57.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	3/24	---	Dry	---	---
Completion	3/24	12:25 PM	Dry	52.0'	---
Casing Pulled	3/24	1:00 PM	10.0'	---	40.5'
After Drilling	3/26	12:30 PM	14.0'	---	20.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	FILL, sampled as silty sand with gravel; moist, brown	FILL		A		S-1, SPT 3+3+2 REC=3", 17%		Fill
2.5	FILL, sampled as silty sand with gravel; moist, brown	FILL	265.5	A		S-2, SPT 5+1+2 REC=12", 67%		
					5	S-3, SPT 10+7+9 REC=18", 100%		
8.5	FILL, sampled as silty sand with gravel; moist, brown, contains wood	FILL	259.5	A		S-4, SPT 3+4+5 REC=12", 67%		
					10			
					15	S-5, SPT 8+9+7 REC=18", 100%		
18.5	SILT; moist, gray, contains sand	ML	249.5	B		S-6, SPT 5+8+6 REC=18", 100%	PP = 2.25 tsf	Patuxent Formation
					20			
23.5	SILTY SAND; moist, gray and light brown	SM	244.5	C		S-7, SPT 2+3+3 REC=10", 56%		Residual
					25			
28.5	SILT WITH SAND; moist, orangish brown	ML	239.5	C		S-8, SPT 4+3+3 REC=10", 56%	PP = 1.75 tsf	

(continued)

Schnabel Engineering TEST BORING LOG	Project: Behavioral and Social Sciences Center Morgan State University Baltimore, Maryland	Boring Number: **B-3** Contract Number: 14614004.00 Sheet: 2 of 2

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
		ML		C	35	S-9, SPT 2+4+6 REC=18", 100%		
					40	S-10, SPT 4+6+8 REC=18", 100%		
43.5	SILT WITH SAND; moist, blackish gray, contains mica, gravel	ML	224.5		45	S-11, SPT 6+11+12 REC=18", 100%		Auger chattering
48.5	DISINTEGRATED ROCK, sampled as silty sand; moist, blackish gray, contains mica	DR	219.5	D	50	S-12, SPT 31+28+50/5" REC=18", 106%		Disintegrated Rock
52.0	GNEISS, medium strong, moderately weathered, highly fractured (2.5 - 8 in), gray with streaks of orange		216.0	E	55	R-1, CORE Run = 5.0 ft REC=52", 87% RQD=38.5", 64%		Auger refusal
57.0	Bottom of Boring at 57.0 ft.		211.0					

Schnabel ENGINEERING **TEST BORING LOG**	**Project:** Behavioral and Social Sciences Center Morgan State University Baltimore, Maryland	**Boring Number:** **B-4** **Contract Number:** 14614004.00 **Sheet:** 1 of 2

Contractor: Connelly and Associates, Inc.
Frederick, Maryland

Contractor Foreman: J. Leatherman

Schnabel Representative: J. Spencer

Equipment: CME-55 (Truck)

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

Hammer Type: Auto Hammer (140 lb)

Dates Started: 3/19/14 **Finished:** 3/20/14

Location: See Location Plan

Ground Surface Elevation: 245± (ft) **Total Depth:** 34.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	3/20	---	Dry	---	---
Completion ▽	3/20	9:30 AM	8.0'	29.0'	---
Casing Pulled ▽	3/20	9:41 AM	11.0'	---	24.0'
After Drilling ▽	3/21	8:10 AM	19.0'	---	22.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	FILL, sampled as sandy silt with gravel; moist, light brown	FILL		A		S-1, SPT 4+9+7 REC=12", 67% S-2, SPT 6+10+15 REC=14", 78%		Fill
5.0	FILL, sampled as sandy silt with gravel; moist, brown	FILL	240.0	A	5	S-3, SPT 8+5+7 REC=15", 83%		
8.5	SANDY ELASTIC SILT; moist, light brown	MH	236.5	B	10 15	S-4, SPT 4+4+7 REC=12", 67% S-5, SPT 4+5+11 REC=10", 56%	LL = 54 PL = 31 MC = 19.6% % Passing #200 = 52.7 PP = 2.00 tsf	Patuxent Formation
18.5	SILT; moist, mottled gray, contains mica	ML	226.5	C	20	S-6, SPT 8+15+15 REC=18", 100%	PP = 2.00 tsf	Residual
23.5	DISINTEGRATED ROCK, sampled as silt with rock fragments; moist, light brown	DR	221.5	D	25	S-7, SPT 50/6" REC=2", 33% S-8, SPT 50/0" REC=0"		Disintegrated Rock Rig chatter
29.0	GNEISS, medium strong, highly		216.0	E				Auger refusal

(continued)

Schnabel ENGINEERING **TEST BORING LOG**

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, Maryland

Boring Number: **B-4**
Contract Number: 14614004.00
Sheet: 2 of 2

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	weathered, highly fractured (2.5 - 8 in), gray with bands of black			E		R-1, CORE Run = 5.0 ft REC=60", 100% RQD=34.5", 58%		
34.0			211.0					

Bottom of Boring at 34.0 ft.

TEST BORING LOG

Project:	Behavioral and Social Sciences Center Morgan State University Baltimore, Maryland
Boring Number:	**B-5**
Contract Number:	14614004.00
Sheet:	1 of 2

Contractor: Connelly and Associates, Inc.
Frederick, Maryland

Contractor Foreman: J. Leatherman

Schnabel Representative: J. Spencer

Equipment: CME-55 (Truck)

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

Hammer Type: Auto Hammer (140 lb)

Dates Started: 3/21/14 **Finished:** 3/24/14

Location: See Location Plan

Ground Surface Elevation: 269± (ft) **Total Depth:** 60.5 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	3/21	12:23 PM	28.0'	---	---
Completion	3/24	9:15 AM	7.0'	55.5'	---
Casing Pulled	3/24	9:49 AM	13.0'	---	37.0'
After Drilling	3/26	12:53 PM	16.0'	---	21.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	FILL, sampled as clayey gravel with sand; moist, gray	FILL		A		S-1, SPT 3+5+5 REC=14", 78%		Fill
	Change: brown					S-2, SPT 5+6+7 REC=18", 100%	LL = 33 PL = 15 MC = 9.2% % Passing #200 = 28.7	
	Change: contains wood				5	S-3, SPT 7+5+5 REC=14", 78%		
8.5	FILL, sampled as sandy silt with gravel; moist, brown, contains brick fragments	FILL	260.5		10	S-4, SPT 5+4+3 REC=12", 67%		
					15	S-5, SPT 4+2+2 REC=1", 6%		
18.5	SILTY, CLAYEY SAND; moist, grayish brown, contains mica	SC-SM	250.5	C	20	S-6, SPT 3+6+7 REC=18", 100%	LL = 22 PL = 17 MC = 15.1% % Passing #200 = 30.4	Residual
23.5	SANDY SILT; moist, light gray	ML	245.5		25	S-7, SPT 6+8+7 REC=18", 100%		
28.5	SILTY SAND; moist, light gray with bands of orange	SM	240.5			S-8, SPT 4+3+4 REC=9", 50%		

(continued)

TEST BORING LOG 14614004.00.GPJ SCHNABEL DATA TEMPLATE 2008_07_06.GDT 4/11/14

Schnabel Engineering TEST BORING LOG	Project: Behavioral and Social Sciences Center Morgan State University Baltimore, Maryland	Boring Number: B-5 Contract Number: 14614004.00 Sheet: 2 of 2

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
		SM						
33.5	SANDY SILT; moist, orangish brown, contains mica	ML	235.5	C	35	S-9, SPT 2+4+5 REC=18", 100%	PP = 0.50 tsf	
	Change: gray				40	S-10, SPT 23+10+17 REC=12", 67%		Auger grinding
	Change: blackish gray with bands of orange				45	S-11, SPT 9+13+16 REC=18", 100%		
48.5	DISINTEGRATED ROCK, sampled as; no recovery	DR	220.5	D	50	S-12, SPT 50/0.5" REC=0", 0%		Disintegrated Rock Auger grinding
					55	S-13, SS 50/0" REC=0"		
55.5	GNEISS, medium strong, moderately weathered, moderately fractured (8 in - 2 ft), gray with bands of black		213.5	E		R-1, CORE Run = 5.0 ft REC=58", 97% RQD=47.5", 79%		Auger refusal
60.5			208.5		60			

Bottom of Boring at 60.5 ft.

TEST BORING LOG	Project: Behavioral and Social Sciences Center, Morgan State University, Baltimore, Maryland	Boring Number: B-6
		Contract Number: 14614004.00
		Sheet: 1 of 2

Contractor: Connelly and Associates, Inc. Frederick, Maryland

Contractor Foreman: J. Leatherman

Schnabel Representative: J. Spencer

Equipment: CME-55 (Truck)

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

Hammer Type: Auto Hammer (140 lb)

Dates Started: 3/25/14 **Finished:** 3/25/14

Location: See Location Plan

Ground Surface Elevation: 275± (ft) **Total Depth:** 60.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	3/25	2:05 PM	28.5'	---	---
Completion ▼	3/25	3:06 PM	43.0'	58.5'	---
Casing Pulled	3/25	3:40 PM	Dry	---	8.0'
After Drilling	3/26	12:45 PM	Dry	---	10.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	FILL, sampled as clayey sand with gravel; moist, brown and gray	FILL					LL = 37 PL = 17 MC = 14.2% % Passing #200 = 44.0	Fill
13.5	FILL, sampled as silty sand with gravel; moist, gray	FILL	261.5	A		S-1, SPT 9+15+9 REC=10", 56%	MC = 37.1%	
18.5	FILL, sampled as silty sand with gravel; moist, gray, contains brick fragments	FILL	256.5			S-2, SPT 27+7+13 REC=12", 67%		
23.5	FILL, sampled as silty sand; moist, light brown	FILL	251.5			S-3, SPT 3+2+2 REC=2", 11%		
28.5	▽ POORLY GRADED SAND WITH CLAY; moist, reddish brown	SP-SC	246.5	C		S-4, SPT 5+10+11 REC=15", 83%		Residual

(continued)

Schnabel Engineering TEST BORING LOG	Project: Behavioral and Social Sciences Center, Morgan State University, Baltimore, Maryland	Boring Number: B-6
		Contract Number: 14614004.00
		Sheet: 2 of 2

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
		SP-SC						
33.5	SILT; moist, light gray	ML	241.5		35	S-5, SPT 2+3+4 REC=18", 100% RQD=1.5", 8%		
	Change: moist, light brown				40	S-6, SPT 2+3+3 REC=18", 100%		
43.5	SANDY SILT; moist, orangish brown	ML	231.5	C	45	S-7, SPT 2+3+6 REC=18", 100%		
	Change: blackish gray, contains mica				50	S-8, SPT 3+8+10 REC=18", 100%		
					55	S-9, SPT 7+11+16 REC=18", 100%		
58.5	DISINTEGRATED ROCK, sampled as sandy silt; moist, blackish gray, contains mica	DR	216.5	D		S-10, SPT 10+19+44 REC=18", 100%		Disintegrated Rock Augers grinding
60.0			215.0		60			

Bottom of Boring at 60.0 ft.
Auger refusal at 60 feet

Schnabel ENGINEERING TEST BORING LOG	**Project:** Behavioral and Social Sciences Center Morgan State University Baltimore, Maryland	**Boring Number:**	**B-7**
		Contract Number: 14614004.00 **Sheet:** 1 of 2	

Contractor: Connelly and Associates, Inc.
Frederick, Maryland

Contractor Foreman: J. Leatherman

Schnabel Representative: J. Spencer

Equipment: CME-55 (Truck)

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

Hammer Type: Auto Hammer (140 lb)

Dates Started: 3/19/14 **Finished:** 3/19/14

Location: See Location Plan

Ground Surface Elevation: 254± (ft) **Total Depth:** 54.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	3/19	12:03 PM	24.0'	---	---
Completion	3/19	12:37 PM	Dry	43.5'	---
Casing Pulled	3/19	2:30 PM	N/a	---	36.0'
After Drilling ▼	3/21	8:05 AM	12.0'	---	13.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	FILL, sampled as crushed stone; moist, gray	FILL		A		S-1, SPT 3+8+12 REC=18", 22%		Fill
2.5	FILL, sampled as sandy gravel; moist, brown	FILL	251.5			S-2, SPT 7+8+18 REC=12", 67%		
5.0	FILL, sampled as crushed stone; moist, light gray	FILL	249.0		5	S-3, SPT 10+18+16 REC=10", 56%		Auger griding
8.5	FILL, sampled as silty sand with gravel; moist, light brown, contains brick fragments ▼	FILL	245.5		10	S-4, SPT 8+6+5 REC=15", 83%		
13.5	PROBABLE FILL, sampled as sandy silt with gravel; moist, light brown	FILL	240.5		15	S-5, SPT 17+19+15 REC=2", 11%		Repushed spoon
					20	S-6, SPT 6+7+8 REC=11", 61%		
23.5	SANDY SILT; moist, light brown with speckles of orange ▽	ML	230.5	C	25	S-7, SPT 8+11+3 REC=8", 44%	PP = 1.00 tsf	Residual
28.5	SILT; moist, bluish gray	ML	225.5			S-8, SPT 9+11+18 REC=2", 11%		

(continued)

Schnabel Engineering TEST BORING LOG	Project: Behavioral and Social Sciences Center Morgan State University Baltimore, Maryland	Boring Number: B-7 Contract Number: 14614004.00 Sheet: 2 of 2

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
		ML						
33.5	SANDY SILT; moist, light brown with bands of orange	ML	220.5	C	35	S-9, SPT 11+17+17 REC=18", 100%	PP = 2.00 tsf	
38.5	SILTY SAND; moist, orangish brown with speckles of black	SM	215.5		40	S-10, SPT 8+15+27 REC=18", 100%		
43.5	DISINTEGRATED ROCK, sampled as; no recovery	DR	210.5	D		S-11, SPT 50/0" REC=0"		Auger griding Disintegrated Rock
44.0	GNEISS, slightly weathered, highly fractured (2.5 - 8 in), bluish gray with bands of pink		210.0		45	R-1, CORE Run = 5.0 ft REC=57", 95% RQD=36", 60%		Auger refusal
49.0	GNEISS, strong, slightly weathered, highly fractured (2.5 - 8 in), bluish gray with bands of pink		205.0	E	50	R-2, CORE Run = 5.0 ft REC=60", 100% RQD=42", 70%		
54.0			200.0					

Bottom of Boring at 54.0 ft.
Boring refusal at 7 feet offset 15 feet north
Boring 7A auger grinding 2 to 8 feet. Auger cutting contains large gravel, brick and other construction debris

Schnabel ENGINEERING — **TEST BORING LOG**

Project: Behavioral and Social Sciences Center, Morgan State University, Baltimore, Maryland

Boring Number: **B-8**
Contract Number: 14614004.00
Sheet: 1 of 2

Contractor: Connelly and Associates, Inc., Frederick, Maryland
Contractor Foreman: J. Leatherman
Schnabel Representative: J. Spencer
Equipment: CME-55 (Truck)
Method: 3-1/4" I.D. Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)
Dates Started: 3/24/14 **Finished:** 3/24/14
Location: See Location Plan

Ground Surface Elevation: 258± (ft) **Total Depth:** 52.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	3/24	2:09 PM	8.5'	---	---
Completion ▼	3/24	4:00 PM	9.0'	47.0'	---
Casing Pulled	3/24	4:24 PM	Dry	---	7.0'
After Drilling ▼	3/26	1:17 PM	12.0'	---	13.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	FILL, sampled as crushed stone with asphalt	FILL		A		S-1, SPT 3+12+20 REC=12", 67%		Fill
2.5	FILL, sampled as silty sand with gravel; moist, brown	FILL	255.5	A		S-2, SPT 20+50/3" REC=9", 100%		Auger grinding
5.0	FILL, sampled as silty sand with gravel; moist, gray, contains mica	FILL	253.0	A	5	S-3, SPT 30+29+8 REC=12", 67%		
8.5	LEAN CLAY WITH SAND; moist, gray	CL	249.5	B	10	S-4, SPT 4+3+3 REC=18", 100%	PP = 1.50 tsf	Patuxent Formation
13.5	SILTY SAND; moist, gray	SM	244.5	B	15	S-5, SPT 5+6+5 REC=18", 100%		
18.5	POORLY GRADED SAND WITH SILT; moist, gray with bands of orange	SP	239.5	B	20	S-6, SPT 3+6+6 REC=18", 100%		
23.5	SILT WITH SAND AND GRAVEL; moist, light brown	ML	234.5	B	25	S-7, SPT 2+3+3 REC=12", 67%		
28.5	SILT WITH SAND; moist, orangish brown	ML	229.5	C		S-8, SPT 2+5+4 REC=15", 83%		Residual

(continued)

TEST BORING LOG 14614004.00.GPJ SCHNABEL DATA TEMPLATE 2008_07_06.GDT 4/11/14

TEST BORING LOG	Project: Behavioral and Social Sciences Center Morgan State University Baltimore, Maryland	Boring Number: **B-8** Contract Number: 14614004.00 Sheet: 2 of 2

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
		ML		C	35	S-9, SPT 3+4+9 REC=18", 100%	PP = 2.75 tsf	
38.5	SANDY SILT; moist, gray	ML	219.5		40	S-10, SPT 6+20+21 REC=18", 100%		
						S-11, SPT 27+39+50/4" REC=0", 0%		
43.5	DISINTEGRATED ROCK, sampled as; No recovery	DR	214.5	D	45			Disintegrated Rock Auger grinding
47.0	GNEISS, weak, highly weathered, highly fractured (2.5 - 8 in), light gray to dark gray		211.0	E	50	R-1, CORE Run = 5.0 ft REC=48", 80% RQD=28", 47%		Auger refusal
52.0			206.0					

Bottom of Boring at 52.0 ft.

Schnabel ENGINEERING — **TEST BORING LOG**

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, Maryland

Boring Number: **B-9**
Contract Number: 14614004.00
Sheet: 1 of 2

Contractor: Connelly and Associates, Inc.
Frederick, Maryland
Contractor Foreman: J. Leatherman
Schnabel Representative: J. Spencer
Equipment: CME-55 (Truck)
Method: 3-1/4" I.D. Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)
Dates Started: 3/25/14 **Finished:** 3/25/14
Location: See Location Plan

Ground Surface Elevation: 280± (ft) **Total Depth:** 65.5 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	3/25	11:05 AM	43.5'	---	---
Completion ▼	3/25	12:13 PM	30.0'	63.5'	---
Casing Pulled	3/25	12:50 PM	Dry	---	10.0'
After Drilling	3/26	12:47 PM	Dry	---	10.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	FILL, sampled as clayey sand with gravel; moist, tan and gray	FILL					LL = 32 PL = 15 MC = 12.5% % Passing #200 = 41.2	Fill
13.0	FILL, sampled as silty sand with gravel; moist, brown	FILL	267.0	A	15	S-1, SPT 7+7+8 REC=18", 100%		
					20	S-2, SPT 6+14+16 REC=18", 100%		
23.5	FILL, sampled as gravel with silt and sand; moist, gray	FILL	256.5		25	S-3, SPT 5+3+8 REC=3", 17%		
28.5	FILL, sampled as gravel with clay and sand; moist, gray ▼	FILL	251.5			S-4, SPT 38+21+19 REC=6", 33%		Water in spoon

(continued)

Schnabel ENGINEERING

TEST BORING LOG

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, Maryland

Boring Number: **B-9**
Contract Number: 14614004.00
Sheet: 2 of 2

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
		FILL		A				
32.5	SANDY SILT; moist, orangish brown	ML	247.5					
					35	S-5, SPT 37+34+10 REC=12", 67%		Residual
					40	S-6, SPT 8+8+11 REC=0", 0%		
43.5	SANDY SILT; moist, orangish brown	ML	236.5	C				
					45	S-7, SPT 8+9+8 REC=18", 100%		
	Change: light brown				50	S-8, SPT 15+17+17 REC=6", 33%		
					55	S-9, SPT 20+10+13 REC=18", 100%		
					60	S-10, SPT 12+14+16 REC=0", 0%		Auger grinding
63.5	DISINTEGRATED ROCK, sampled as sandy silt; moist, blackish gray	DR	216.5	D		S-11, SPT 50/6" REC=6", 100%		
65.5			214.5		65			

Bottom of Boring at 65.5 ft.
Auger refusal at 65.5 feet

TEST BORING LOG 14614004.00.GPJ SCHNABEL DATA TEMPLATE 2008_07_06.GDT 4/11/14

TEST BORING LOG

Schnabel ENGINEERING

Project:	Behavioral and Social Sciences Center Morgan State University Baltimore, Maryland
Boring Number:	**B-10**
Contract Number:	14614004.00
Sheet:	1 of 2

Contractor: Connelly and Associates, Inc.
Frederick, Maryland

Contractor Foreman: J. Leatherman

Schnabel Representative: J. Spencer

Equipment: CME-55 (Truck)

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

Hammer Type: Auto Hammer (140 lb)

Dates Started: 3/20/14 **Finished:** 3/20/14

Location: See Location Plan

Ground Surface Elevation: 257± (ft) **Total Depth:** 43.5 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	3/20	10:48 AM	23.5'	---	---
Completion	3/20	12:08 PM	7.0*	38.5'	---
Casing Pulled	3/20	12:24 PM	10.0*	---	31.5'
After Drilling ▼	3/21	7:55 AM	8.0'	---	26.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	FILL, sampled as clayey gravel; moist, gray	FILL		A		S-1, SPT 2+2+2 REC=5", 28%		Fill
2.5	FILL, sampled as sandy silt; moist, brown, contains gravel	FILL	254.5			S-2, SPT 2+3+4 REC=6", 33%		
					5	S-3, SPT 1+2+1 REC=1", 6%		
8.5	FILL, sampled as clayey gravel with sand; moist, brown, contains root hairs	FILL	248.5		10	S-4, SPT 9+8+5 REC=8", 44%	LL = 30 PL = 15 MC = 8.3% % Passing #200 = 27.6	
13.5	SANDY SILT; moist, yellowish brown	ML	243.5	C	15	S-5, SPT 2+7+4 REC=10", 56%		Residual Auger grinding
18.5	SILT; moist, light brown with streaks of orangish pink, contains sand	ML	238.5		20	S-6, SPT 5+6+9 REC=18", 100%	PP = 0.75 tsf	
23.5	SANDY SILT; moist, light gray	ML	233.5		25	S-7, SPT 6+11+21 REC=18", 100%	PP = 2.00 tsf	
28.5	DISINTEGRATED ROCK, sampled as silty sand; moist, light gray orangish	DR	228.5	D		S-8, SPT 32+50/5-1" REC=10", 83%		Disintegrated Rock

(continued)

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	brown	DR						
33.5	DISINTEGRATED ROCK, sampled as silty sand; moist, orangish brown	DR	223.5	D	35	S-9, SPT 50/1" REC=1", 100%		Auger grinding
38.5	GNEISS, slightly weathered, highly fractured (2.5 - 8 in), bluish gray with bands of pinkish black		218.5	E	40	R-1, CORE Run = 5.0 ft REC=60", 100% RQD=46", 77%		Auger refusal
43.5			213.5					

Bottom of Boring at 43.5 ft.
* Water used while drilling

Schnabel ENGINEERING

TEST BORING LOG

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, Maryland

Boring Number: B-11
Contract Number: 14614004.00
Sheet: 1 of 1

Contractor: Connelly and Associates, Inc.
Frederick, Maryland

Contractor Foreman: J. Leatherman

Schnabel Representative: J. Spencer

Equipment: CME-55 (Truck)

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

Hammer Type: Auto Hammer (140 lb)

Dates Started: 3/20/14 **Finished:** 3/20/14

Location: See Location Plan

Ground Surface Elevation: 257± (ft) **Total Depth:** 5.5 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	3/20	1:15 PM	2.5'	---	---
Completion ▼	3/20	3:30 PM	7.0'	36.5'	---
Casing Pulled	3/20	3:50 PM	Dry	---	2.5'
After Drilling ▼	3/21	7:51 AM	4.5'	---	9.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
1.0	FILL, sampled as crushed stone; geotextile fabric at 1 foot	FILL	256.0	A		S-1, SPT 2+2+2 REC=0", 0%		
	FILL, sampled as sandy lean clay with gravel; wet, tan	FILL				S-2, SPT 2+2+1 REC=3", 17%		
5.5			251.5		5	S-3, SPT 50/3"	LL = NP MC = 10.3% % Passing #200 = 18.5	Obstruction Auger refusal

Bottom of Boring at 5.5 ft.
Hit obstruciton at 5.5 feet, offset boring 8 feet northeast

TEST BORING LOG 14614004.00.GPJ SCHNABEL DATA TEMPLATE 2008_07_06.GDT 4/11/14

TEST BORING LOG — Schnabel Engineering

Project: Behavioral and Social Sciences Center, Morgan State University, Baltimore, Maryland

Boring Number: B-11A
Contract Number: 14614004.00
Sheet: 1 of 2

Contractor: Connelly and Associates, Inc. Frederick, Maryland
Contractor Foreman: J. Leatherman
Schnabel Representative: J. Spencer
Equipment: CME-55 (Truck)
Method: 3-1/4" I.D. Hollow Stem Auger
Hammer Type: Auto Hammer (140 lb)
Dates Started: 3/20/14 **Finished:** 3/20/14
Location: See Location Plan
Ground Surface Elevation: 254± (ft) **Total Depth:** 41.5 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	3/20	1:15 PM	2.5'	---	---
Completion ▼	3/20	3:30 PM	7.0'	36.5'	---
Casing Pulled	3/20	3:50 PM	Dry	---	2.5'
After Drilling ▼	3/21	7:51 AM	4.5'	---	9.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
5.5	FILL, sampled as silty gravel with sand; moist, gray Change: brown	FILL	248.5	A	5	S-1, SPT 26+13+4 REC=0", 0%		Fill
8.5	SILT WITH SAND; moist, yellowish brown, contains gravel	ML	245.5	B	10	S-2, SPT 4+6+6 REC=6", 33%	PP = 1.25 tsf	Patuxent Formation
					15	S-3, SPT 7+12+12 REC=3", 17%		
18.5	SILT; moist, light brown with speckles of black, contains mica	ML	235.5	C	20	S-4, SPT 7+11+15 REC=18", 100%	PP = 3.00 tsf	Residual Hard drilling
					25	S-5, SPT 10+18+20 REC=18", 100%		
28.5	SILTY SAND; moist, dark gray, contains mica	SM	225.5			S-6, SPT 10+11+16 REC=18", 100%		

(continued)

Schnabel Engineering TEST BORING LOG	Project: Behavioral and Social Sciences Center Morgan State University Baltimore, Maryland	Boring Number: B-11A Contract Number: 14614004.00 Sheet: 2 of 2

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
		SM		C				
33.5	DISINTEGRATED ROCK, sampled as; No recovery	DR	220.5	D	35	S-7, SPT 50/1" REC=0"		Grinding Disintegrated Rock
36.5	GNEISS, strong, slightly weathered, moderately fractured (8 in - 2 ft), bluish gray		217.5	E	40	R-1, CORE Run = 5.0 ft REC=60", 100% RQD=56.5", 94%		Auger refusal
41.5			212.5					

Bottom of Boring at 41.5 ft.

TEST BORING LOG

Schnabel Engineering

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, Maryland

Boring Number: MW-1
Contract Number: 14614004.00
Sheet: 1 of 1

Contractor: Connelly and Associates, Inc.
Frederick, Maryland
Contractor Foreman: J. Leatherman
Schnabel Representative: J. Spencer
Equipment: CME-55 (Truck)
Method: 3-1/4" I.D. Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)
Dates Started: 3/26/14 **Finished:** 3/26/14
Location: See Location Plan

Ground Surface Elevation: 278± (ft) **Total Depth:** 15.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	3/26	---	Dry	---	---
Completion	3/26	9:10 AM	Dry	13.5'	---
Casing Pulled	3/26	9:18 AM	Dry	---	12.0'
After Drilling	3/26	1:31 PM	Dry	---	11.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	Topsoil=3-inches		277.7	A		S-1, SPT WOH+1+1 REC=9", 50%		Fill
	FILL, sampled as silty sand; moist, dark brown, contains roots	FILL		A				
2.5	FILL, sampled as poorly graded sand; moist, orangish brown, contains silt	FILL	275.5	A		S-2, SPT 2+2+2 REC=6", 33%		
5.0	FILL, sampled as silty sand with gravel; moist, brown	FILL	273.0	A	5	S-3, SPT 3+6+4 REC=18", 100%		
8.5	FILL, sampled as lean clay with sand; moist, brown	FILL	269.5	A		S-4, SPT 2+2+3 REC=18", 100%		
9.5	SILTY SAND; moist, dark gray, contains root hairs	SM	268.5	B	10			Patuxent Formation
13.5	SANDY SILT; moist, orangish brown, contains mica	ML	264.5	B		S-5, SPT 4+5+5		
15.0			263.0		15			

Bottom of Boring at 15.0 ft.

TEST BORING LOG 14614004.00.GPJ SCHNABEL DATA TEMPLATE 2008_07_06.GDT 4/11/14

TEST BORING LOG

Schnabel Engineering

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, Maryland

Boring Number: MW-2
Contract Number: 14614004.00
Sheet: 1 of 1

Contractor: Connelly and Associates, Inc.
Frederick, Maryland

Contractor Foreman: J. Leatherman

Schnabel Representative: J. Spencer

Equipment: CME-55 (Truck)

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

Hammer Type: Auto Hammer (140 lb)

Dates Started: 3/26/14 **Finished:** 3/26/14

Location: See Location Plan

Ground Surface Elevation: **Total Depth:** 10.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	3/26	---	Dry	---	---
Completion	3/26	10:16 AM	Dry	13.5'	---
Casing Pulled	3/26	10:23 AM	Dry	---	6.0'
After Drilling	3/26	1:26 PM	Dry	---	6.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	Asphalt=3-inches			A		S-1, SPT 4+6+4 REC=6", 33%		Fill
0.6	Crushed Stone Base=3-inches							
	FILL, sampled as sandy lean clay witgh gravel; moist, reddish brown, contains mica	FILL				S-2, SPT 2+2+2 REC=6", 33%		
5.0	FILL, sampled as lean clay; moist, reddish brown	FILL			5	S-3, SPT 2+2+2 REC=8", 44%		
8.5	SILT WITH SAND; moist, gray, contains mica	ML		B		S-4, SPT 3+5+6 REC=15", 83%		Patuxent Formation
10.0					10			

Bottom of Boring at 10.0 ft.
Boring offset 7' south overhead power lines

Schnabel ENGINEERING **TEST BORING LOG**

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, Maryland

Boring Number: **P-1**
Contract Number: 14614004.00
Sheet: 1 of 1

Contractor: Connelly and Associates, Inc.
Frederick, Maryland
Contractor Foreman: J. Leatherman
Schnabel Representative: J. Spencer
Equipment: CME-55 (Truck)
Method: 3-1/4" I.D. Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)
Dates Started: 3/26/14 **Finished:** 3/26/14
Location: See Location Plan

Ground Surface Elevation: 270± (ft) **Total Depth:** 10.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	3/26	---	Dry	---	---
Completion	3/26	9:49 AM	Dry	---	---
Casing Pulled	3/26	9:54 AM	Dry	---	6.3'
After Drilling	3/26	1:37 PM	Dry	---	6.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	Asphalt=3-inches		269.7			S-1, SPT 3+2+4 REC=6", 33%		Fill
0.6	Crushed Stone Base=4-inches	FILL	269.4					
2.0	FILL, sampled as silty sand with gravel; moist, brown		268.0			S-2, SPT 2+3+3 REC=10", 56%		
	PROBABLE FILL, sampled as silt with sand; moist, grayish brown, contains mica	FILL						
5.0	PROBABLE FILL, sampled as silt with sand; moist, orangish brown, contains mica	FILL	265.0	A	5	S-3, SPT 3+3+3 REC=6", 33%		
8.5	PROBABLE FILL, sampled as silty sand with rock fragments; moist, gray, contains mica	FILL	261.5			S-4, SPT 22+54+6 REC=6", 33%		
10.0	Bottom of Boring at 10.0 ft.		260.0		10			

TEST BORING LOG 14614004.00.GPJ SCHNABEL DATA TEMPLATE 2008_07_06.GDT 4/11/14

TEST BORING LOG

Schnabel ENGINEERING

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, Maryland

Boring Number: **P-2**
Contract Number: 14614004.00
Sheet: 1 of 1

Contractor: Connelly and Associates, Inc.
Frederick, Maryland

Contractor Foreman: J. Leatherman

Schnabel Representative: J. Spencer

Equipment: CME-55 (Truck)

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

Hammer Type: Auto Hammer (140 lb)

Dates Started: 3/26/14 **Finished:** 3/26/14

Location: See Location Plan

Ground Surface Elevation: **Total Depth:** 10.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	3/26	---	Dry	---	---
Completion	3/26	8:34 AM	Dry	8.5'	---
Casing Pulled	3/26	8:38 AM	Dry	---	4.5'
After Drilling	3/26	1:29 PM	Dry	---	4.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.5	Asphalt=6-inches					S-1, SPT 3+3+4 REC=12", 67%		Fill
1.0	Crushed Stone Base=6-inches							
2.0	FILL, sampled as poorly graded sand with gravel; moist, light brown	FILL				S-2, SPT 4+4+7 REC=12", 67%		
	FILL, sampled as poorly graded sand with gravel; moist, light brown			A				
	Change: orangish brown	FILL			5	S-3, SPT 13+18+16 REC=18", 100%		
8.5	SANDY SILT; moist, light gray	ML		B		S-4, SPT 9+13+13 REC=12", 67%		Patuxent Formation
10.0					10			

Bottom of Boring at 10.0 ft.

Schnabel ENGINEERING

TEST BORING LOG

Project: Behavioral and Social Sciences Center, Morgan State University, Baltimore, Maryland

Boring Number: RW-1

Contract Number: 14614004.00

Sheet: 1 of 2

Contractor: Connelly and Associates, Inc. Frederick, Maryland

Contractor Foreman: J. Leatherman

Schnabel Representative: J. Spencer

Equipment: CME-55 (Truck)

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

Hammer Type: Auto Hammer (140 lb)

Dates Started: 3/25/14 **Finished:** 3/25/14

Location: See Location Plan

Ground Surface Elevation: 262± (ft) **Total Depth:** 40.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	3/25	8:36 AM	28.5'	---	---
Completion	3/25	8:51 AM	Dry	38.5'	---
Casing Pulled	3/25	9:07 AM	Dry	---	22.0'
After Drilling ▼	3/26	1:15 PM	13.0'	---	15.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	FILL, sampled as poorly graded sand with gravel; moist, gray	FILL		A		S-1, SPT 9+10+13 REC=10", 56%		Fill
						S-2, SPT 7+7+9 REC=0", 0%		
					5	S-3, SPT 7+8+4 REC=6", 33%		
8.5	LEAN CLAY WITH SAND; moist, gray	ML	253.5	B	10	S-4, SPT 4+4+7 REC=18", 100%	LL = 31 PL = 16 MC = 14.2% % Passing #200 = 56.8 PP = 2.50 tsf	Patuxent Formation
	▼ Change: gray with streaks of orange				15	S-5, SPT 3+5+6 REC=18", 100%		
18.5	SILTY SAND; moist, brown, contains mica	SM	243.5	C	20	S-6, SPT 2+5+6 REC=18", 100%		Residual
23.5	SANDY SILT; moist, orangish brown, contains mica	ML	238.5		25	S-7, SPT 4+8+11 REC=18", 100%	PP = 2.75 tsf	
	▽ Change: grayish brown					S-8, SPT 6+13+13 REC=18", 100%		

(continued)

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, Maryland

Boring Number: **RW-1**
Contract Number: 14614004.00

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
		ML						
33.5	SILTY SAND; moist, blackish gray, contains mica	SM	228.5	C	35	S-9, SPT 14+21+31 REC=18", 100%		Auger grinding
38.5	DISINTEGRATED ROCK, sampled as poorly graded sand with rock fragments; moist, light gray	DR	223.5	D		S-10, SPT 50/5" REC=5", 100%		Disintegrated Rock
40.0	Bottom of Boring at 40.0 ft.		222.0		40			

TEST BORING LOG — Schnabel Engineering

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, Maryland

Boring Number: SWM-1
Contract Number: 14614004.00
Sheet: 1 of 1

Contractor: Connelly and Associates, Inc.
Frederick, Maryland
Contractor Foreman: J. Leatherman
Schnabel Representative: J. Spencer
Equipment: CME-55 (Truck)
Method: 3-1/4" I.D. Hollow Stem Auger

Hammer Type: Auto Hammer (140 lb)
Dates Started: 3/25/14 **Finished:** 3/25/14
Location: See Location Plan

Ground Surface Elevation: 272± (ft) **Total Depth:** 10.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	3/25	---	Dry	---	---
Completion	3/25	9:44 AM	Dry	8.5'	---
Casing Pulled	3/25	9:52 AM	Dry	---	6.0'
After Drilling	3/26	1:06 PM	Dry	---	7.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	FILL, sampled as silty sand; moist, light brown	FILL				S-1, SPT 6+3+4 REC=12", 67%		Fill
2.5	FILL, sampled as sandy lean clay with gravel; moist, reddish brown	FILL	269.5			S-2, SPT 4+2+3 REC=18", 100%		
5.0	FILL, sampled as sandy lean clay with gravel; moist, brown, contains brick fragments	FILL	267.0	A	5	S-3, SPT 3+4+5 REC=15", 83%		
8.5	FILL, sampled as sandy lean clay with gravel; moist, brown, contains brick fragments	FILL	263.5			S-4, SPT 2+2+4 REC=12", 67%		
10.0			262.0		10			

Bottom of Boring at 10.0 ft.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, Maryland

Boring Number: **SWM-2**
Contract Number: 14614004.00
Sheet: 1 of 1

Contractor: Connelly and Associates, Inc.
Frederick, Maryland

Contractor Foreman: J. Leatherman

Schnabel Representative: J. Spencer

Equipment: CME-55 (Truck)

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

Hammer Type: Auto Hammer (140 lb)

Dates Started: 3/25/14 **Finished:** 3/25/14

Location: See Location Plan

Ground Surface Elevation: 271± (ft) **Total Depth:** 10.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	3/25	---	Dry	---	---
Completion	3/25	4:22 PM	Dry	---	---
Casing Pulled	3/25	4:26 PM	Dry	---	3.0'
After Drilling	3/26	1:11 PM	Dry	---	3.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	FILL, sampled as gravel with silt and sand	FILL		A		S-1, SPT 4+5+6 REC=0", 0%		Fill
2.5	FILL, sampled as silty sand with gravel; moist, brown	FILL	268.5	A		S-2, SPT 12+13+9 REC=5", 28%		
					5	S-3, SPT 3+2+3 REC=0", 0%		
8.5	SILTY SAND WITH GRAVEL; moist, gray		262.5	B		S-4, SPT 5+3+1 REC=2", 11%		Patuxent Formation
10.0			261.0		10			

Bottom of Boring at 10.0 ft.

APPENDIX B

SOIL LABORATORY TEST DATA

Summary of Laboratory Tests
Gradation Curves
Moisture-Density Relations
California Bearing Ratio Test

Summary Of Laboratory Tests

Boring No.	Sample Depth ft	Elevation ft	Sample Type	Description of Soil Specimen	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-1	8.5 - 10.0	263.5 - 262.0	Jar	CLAYEY SAND (SC), light brown	29.1	31	16	15	40.1	11.6	--	--	--	--
B-1	28.5 - 30.0	243.5 - 242.0	Jar	SANDY ELASTIC SILT (MH), light brown	28.9	54	32	22	57.0	2.1	--	--	--	--
B-2	23.5 - 25.0	233.5 - 232.0	Jar	SANDY SILT WITH GRAVEL, light brown (VISUAL)	22.3	--	--	--	--	--	--	--	--	--
B-4	8.5 - 10.0	236.5 - 235.0	Jar	SANDY ELASTIC SILT (MH), light brown	19.6	54	31	23	52.7	3.9	--	--	--	--
B-5	2.5 - 4.0	266.5 - 265.0	Jar	CLAYEY GRAVEL WITH SAND (GC), dark brown	9.2	33	15	18	28.7	36.3	--	--	--	--
B-5	18.5 - 20.0	250.5 - 249.0	Jar	SILTY, CLAYEY SAND (SC-SM), brown	15.1	22	17	5	30.4	3.0	--	--	--	--
B-6	0.0 - 10.0	275.0 - 265.0	Jar	CLAYEY SAND WITH GRAVEL (SC), brown	14.2	37	17	20	44.0	15.3	698B	123.4	11.2	3.6

Notes:
1. Soil tests in general accordance with ASTM standards.
2. Soil classifications are in general accordance with ASTM D2487(as applicable), based on testing indicated and visual classification.
3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed

Schnabel ENGINEERING

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, MD

Summary Of Laboratory Tests

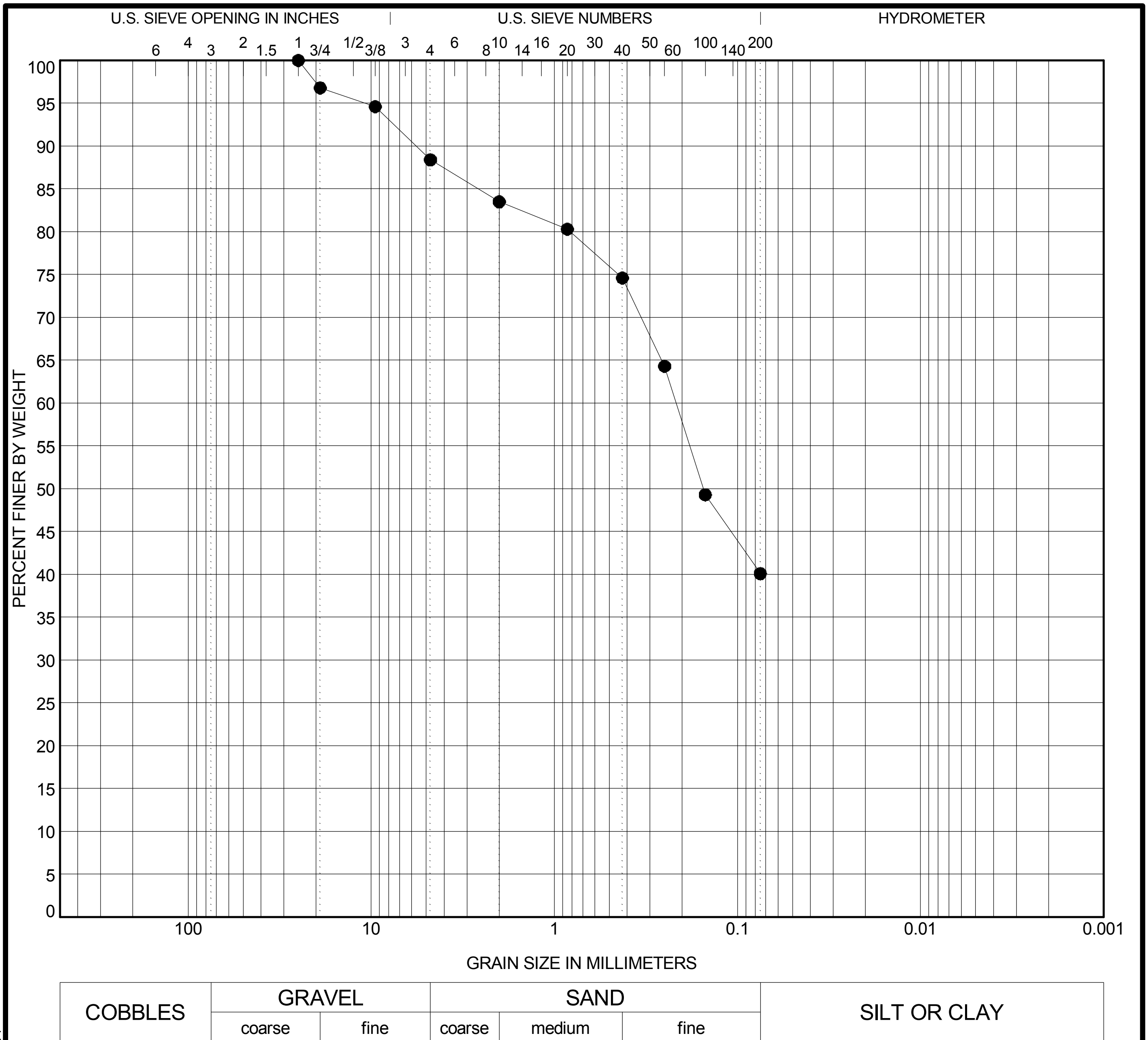
Project Number: 14614004.00

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	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-6	13.5 - 15.0 261.5 - 260.0	Jar	SILTY SAND WITH GRAVEL, gray (VISUAL)	37.1	--	--	--	--	--	--	--	--	--
B-9	0.0 - 13.0 280.0 - 267.0	Jar	CLAYEY SAND WITH GRAVEL (SC), dark brown	12.5	32	15	17	41.2	19.0	698B	124.2	10.6	2.6
B-10	8.5 - 10.0 248.5 - 247.0	Jar	CLAYEY GRAVEL WITH SAND (GC), dark green	8.3	30	15	15	27.6	48.1	--	--	--	--
B-11	5.0 - 6.5 252.0 - 250.5	Jar	SILTY GRAVEL WITH SAND (GM), dark brown	10.3	NP	NP	NP	18.5	52.8	--	--	--	--
RW-1	8.5 - 10.0 253.5 - 252.0	Jar	LEAN CLAY WITH SAND (CL), brown	14.2	31	16	15	56.8	14.6	--	--	--	--

Notes:
1. Soil tests in general accordance with ASTM standards.
2. Soil classifications are in general accordance with ASTM D2487(as applicable), based on testing indicated and visual classification.
3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed

Schnabel ENGINEERING

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, MD



	Specimen		Sample Description	LL	PL	PI		
●	B-1	8.5 ft	**CLAYEY SAND (SC), light brown**	**31**	**16**	**15**		

Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
ASTM D6913	**25**	**0.216**			**11.6**	**48.3**	**40.1**	

Percent Finer

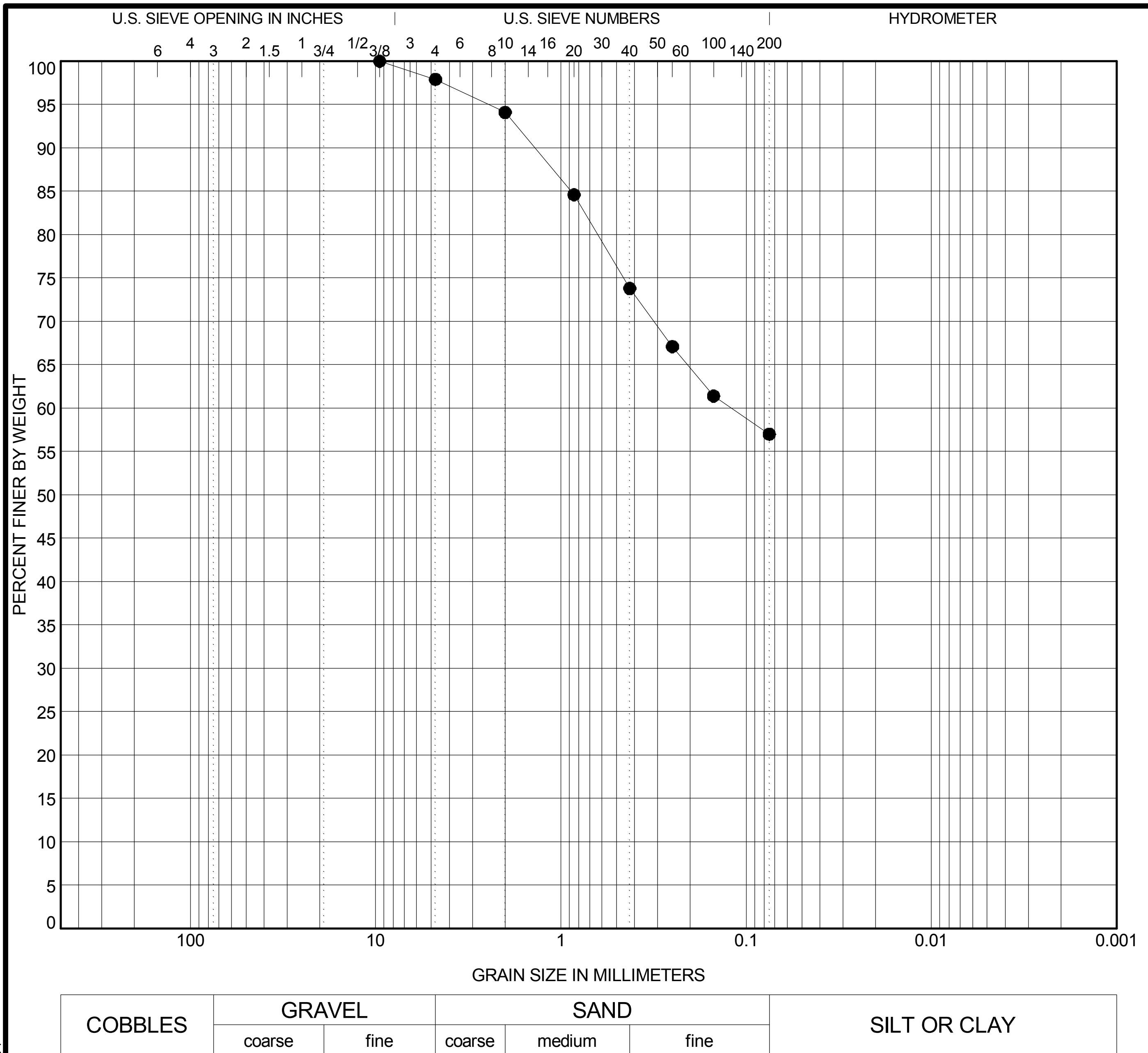
Sieve Size	No. 200	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.	3/4 in.	1 in.
% Finer	40.1	49.3	64.3	74.6	80.3	83.5	88.4	94.6	96.8	100.0

Schnabel ENGINEERING

GRADATION CURVE

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, MD

Contract: 14614004.00



Specimen		Sample Description	LL	PL	PI		
● B-1	28.5 ft	**SANDY ELASTIC SILT (MH), light brown**	**54**	**32**	**22**		

Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
ASTM D6913	**9.5**	**0.12**			**2.1**	**40.9**	**57.0**	

Percent Finer

Sieve Size	No. 200	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.
% Finer	57.0	61.4	67.1	73.8	84.6	94.1	97.9	100.0

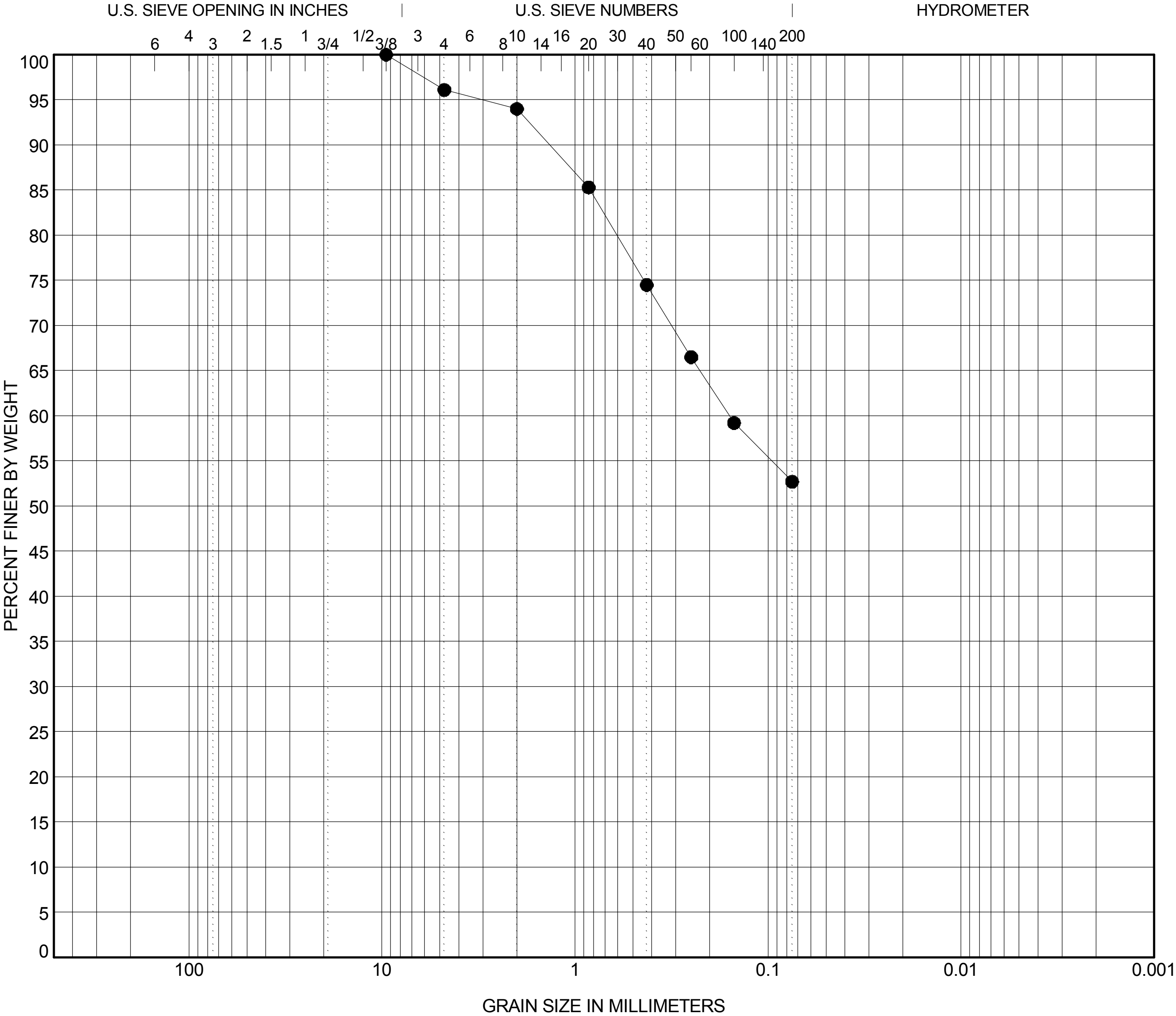
Schnabel ENGINEERING

GRADATION CURVE

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, MD

Contract: 14614004.00

SIEVE 1/SHEET 14614004.00.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 4/11/14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen		Sample Description	LL	PL	PI		
●	B-4	8.5 ft	**SANDY ELASTIC SILT (MH), light brown**	**54**	**31**	**23**		

Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
ASTM D6913	**9.5**	**0.159**			**3.9**	**43.4**	**52.7**	

Percent Finer

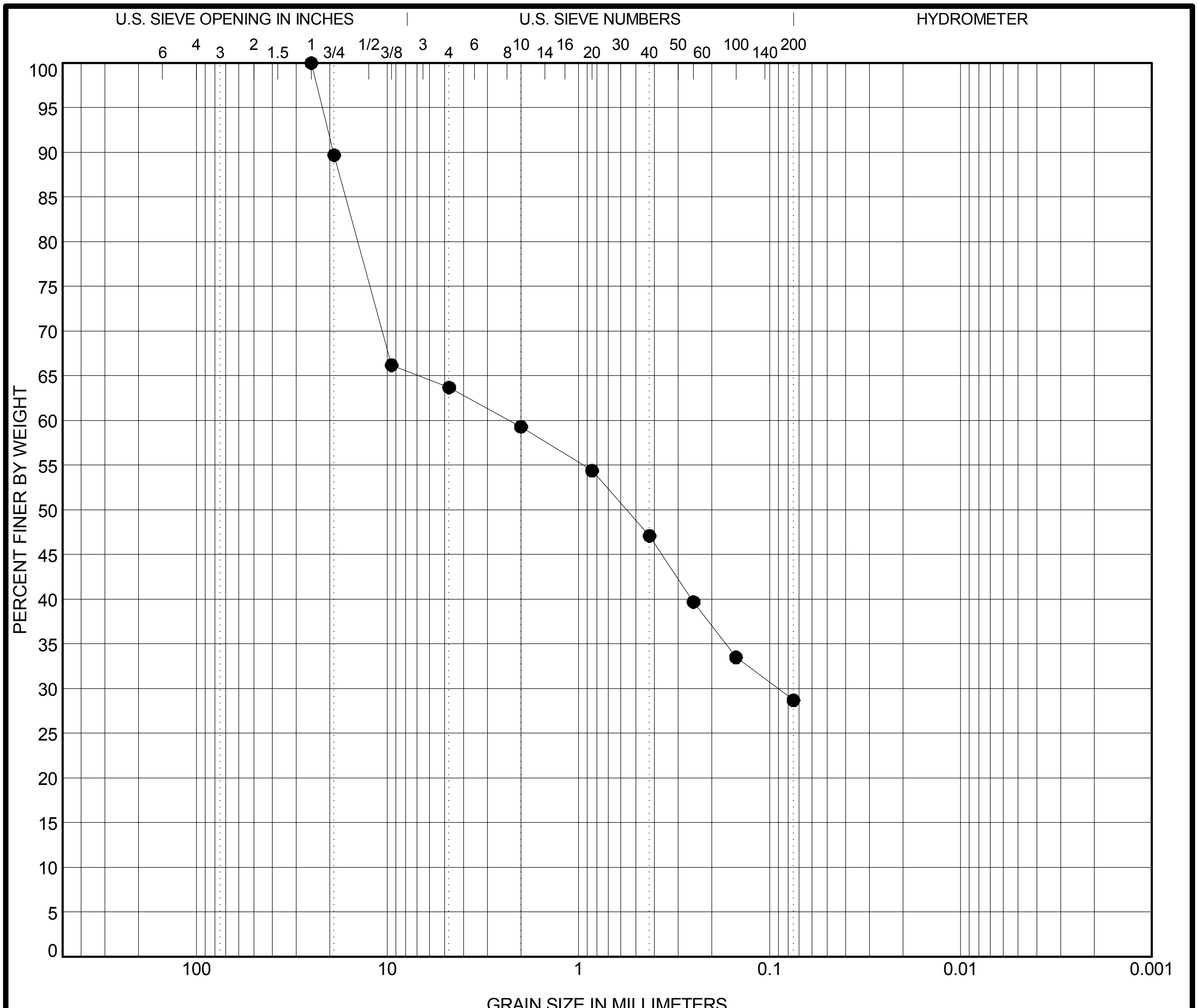
Sieve Size	No. 200	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.
% Finer	52.7	59.2	66.5	74.5	85.3	94.0	96.1	100.0

Schnabel ENGINEERING

GRADATION CURVE

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, MD

Contract: 14614004.00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen		Sample Description	LL	PL	PI		
●	B-5	2.5 ft	**CLAYEY GRAVEL WITH SAND (GC), dark brown**	**33**	**15**	**18**		

Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
ASTM D6913	**25**	**2.295**	**0.09**		**36.3**	**35.0**	**28.7**	

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.
% Finer	28.7	33.5	39.7	47.1	54.4	59.3	63.7	66.2	89.7	100.0

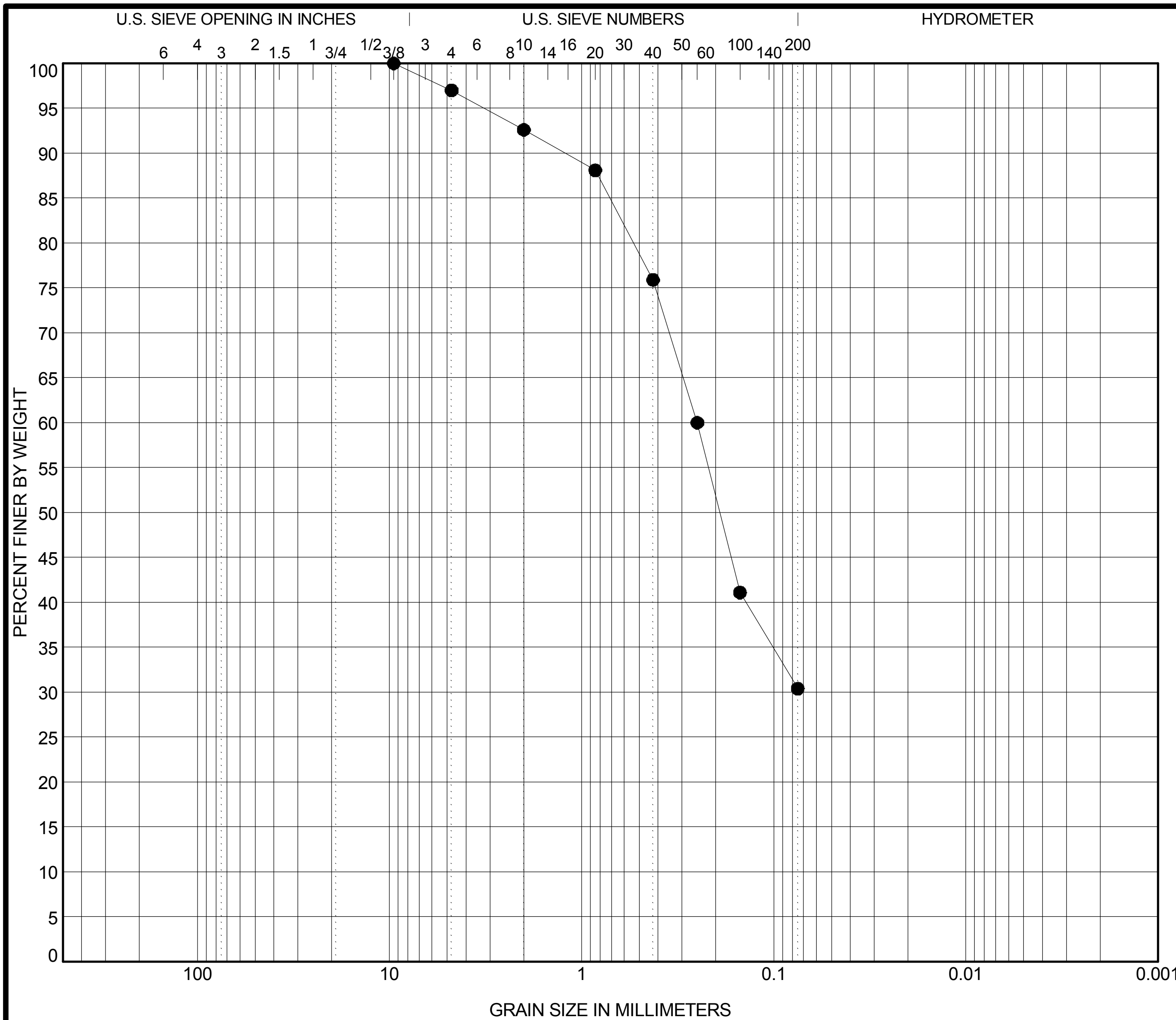
Schnabel ENGINEERING

GRADATION CURVE

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, MD

Contract: 14614004.00

SIEVE 1/SHEET 14614004.00.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 4/11/14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen		Sample Description	LL	PL	PI		
●	B-5	18.5 ft	**SILTY, CLAYEY SAND (SC-SM), brown**	**22**	**17**	**5**		

Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
ASTM D6913	**9.5**	**0.25**			**3.0**	**66.6**	**30.4**	

Percent Finer

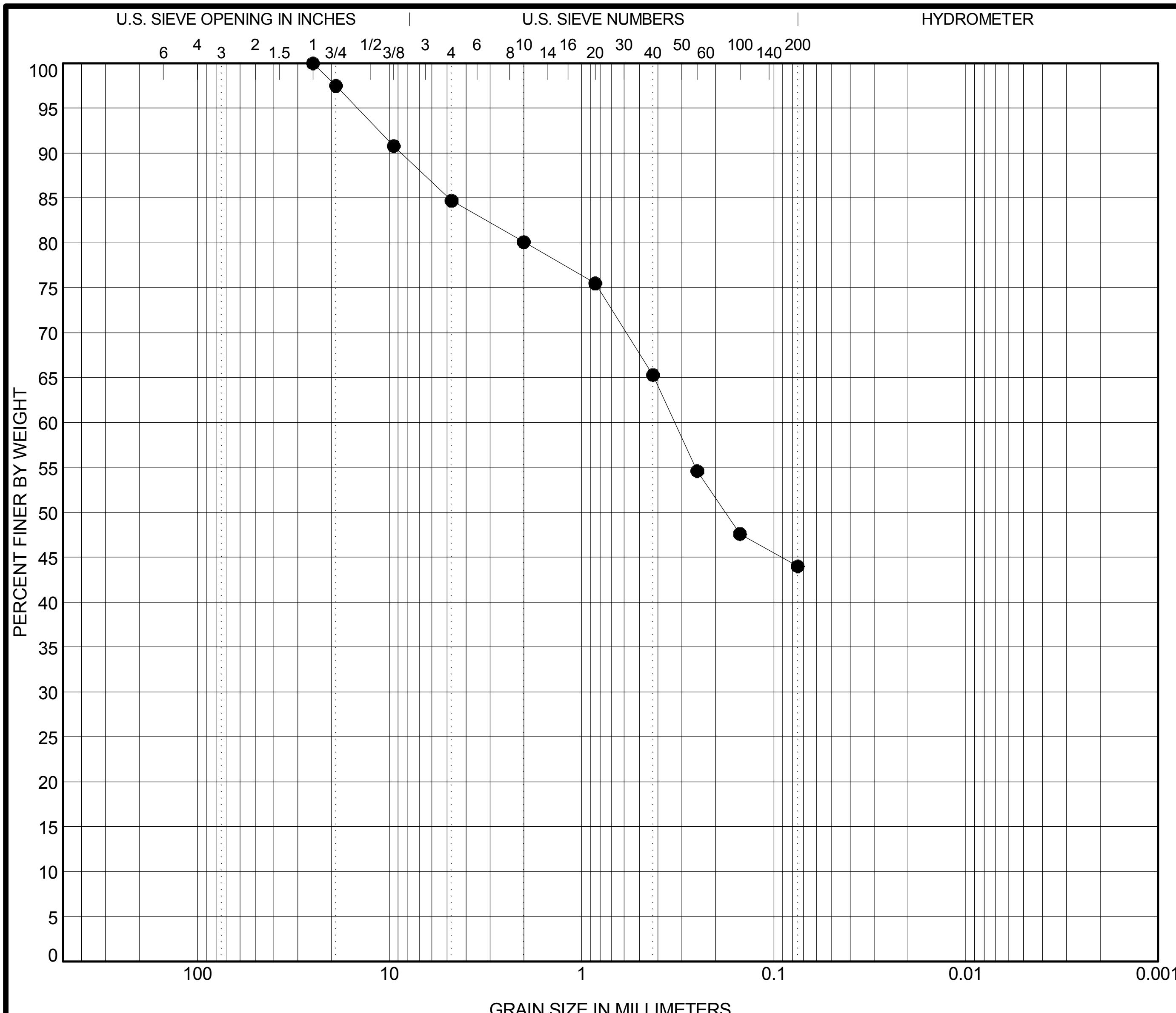
Sieve Size	No. 200	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.
% Finer	30.4	41.1	60.0	75.9	88.1	92.6	97.0	100.0

Schnabel ENGINEERING

GRADATION CURVE

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, MD

Contract: 14614004.00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen		Sample Description	LL	PL	PI
● B-6	0.0 ft	**CLAYEY SAND WITH GRAVEL (SC), brown**	**37**	**17**	**20**

Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
ASTM D6913	**25**	**0.327**			**15.3**	**40.7**	**44.0**	

Percent Finer

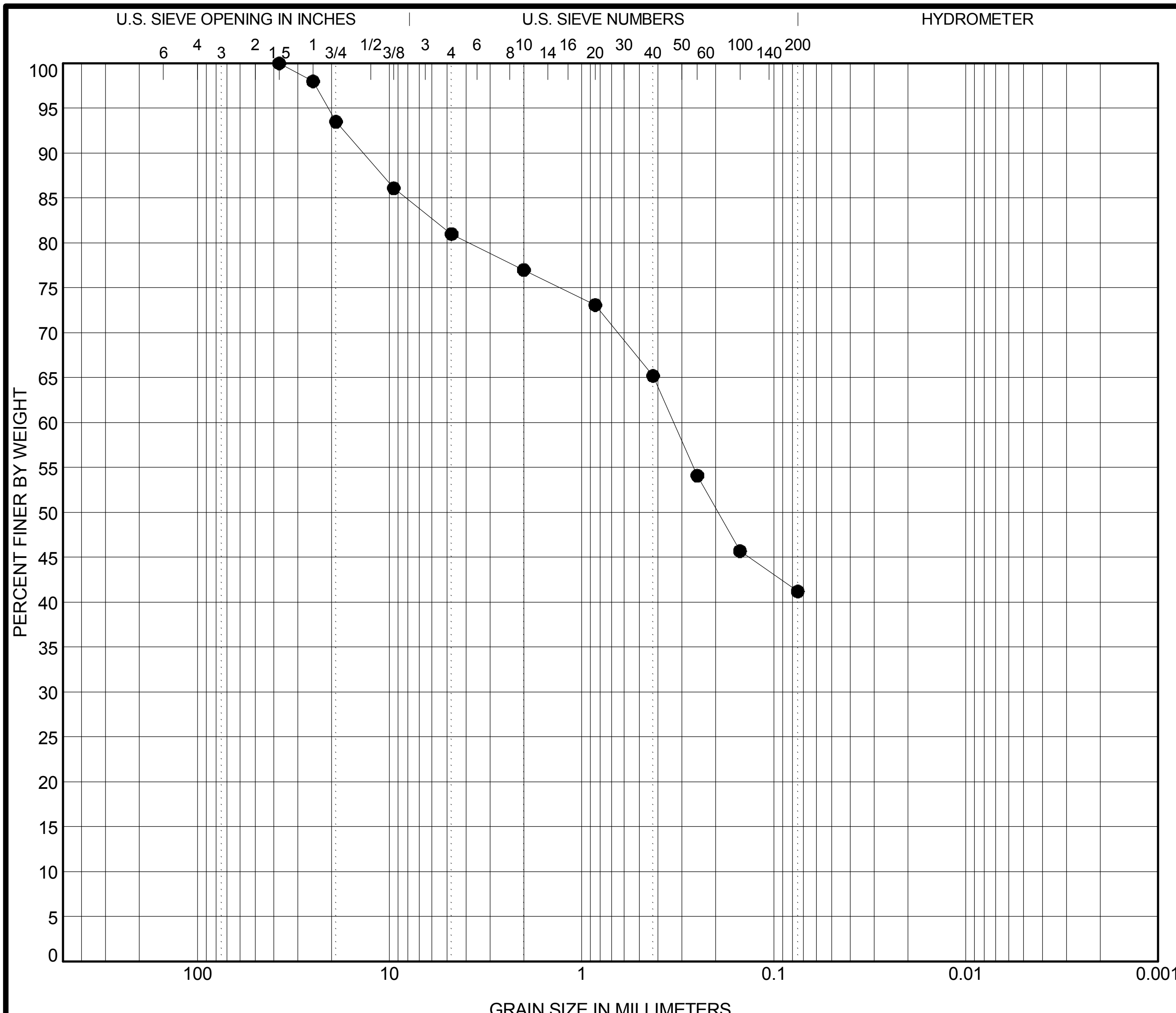
Sieve Size	No. 200	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.	3/4 in.	1 in.
% Finer	44.0	47.6	54.6	65.3	75.5	80.1	84.7	90.8	97.5	100.0

Schnabel ENGINEERING

GRADATION CURVE

Project: Behavioral and Social Sciences Center
Morgan State University
Baltimore, MD

Contract: 14614004.00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen		Sample Description	LL	PL	PI		
●	B-9	0.0 ft	**CLAYEY SAND WITH GRAVEL (SC), dark brown**	**32**	**15**	**17**		

Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
ASTM D6913	**37.5**	**0.331**			**19.0**	**39.8**	**41.2**	

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	41.2	45.7	54.1	65.2	73.1	77.0	81.0	86.1	93.5	98.0	100.0

Schnabel ENGINEERING

GRADATION CURVE

Project: Behavioral and Social Sciences Center
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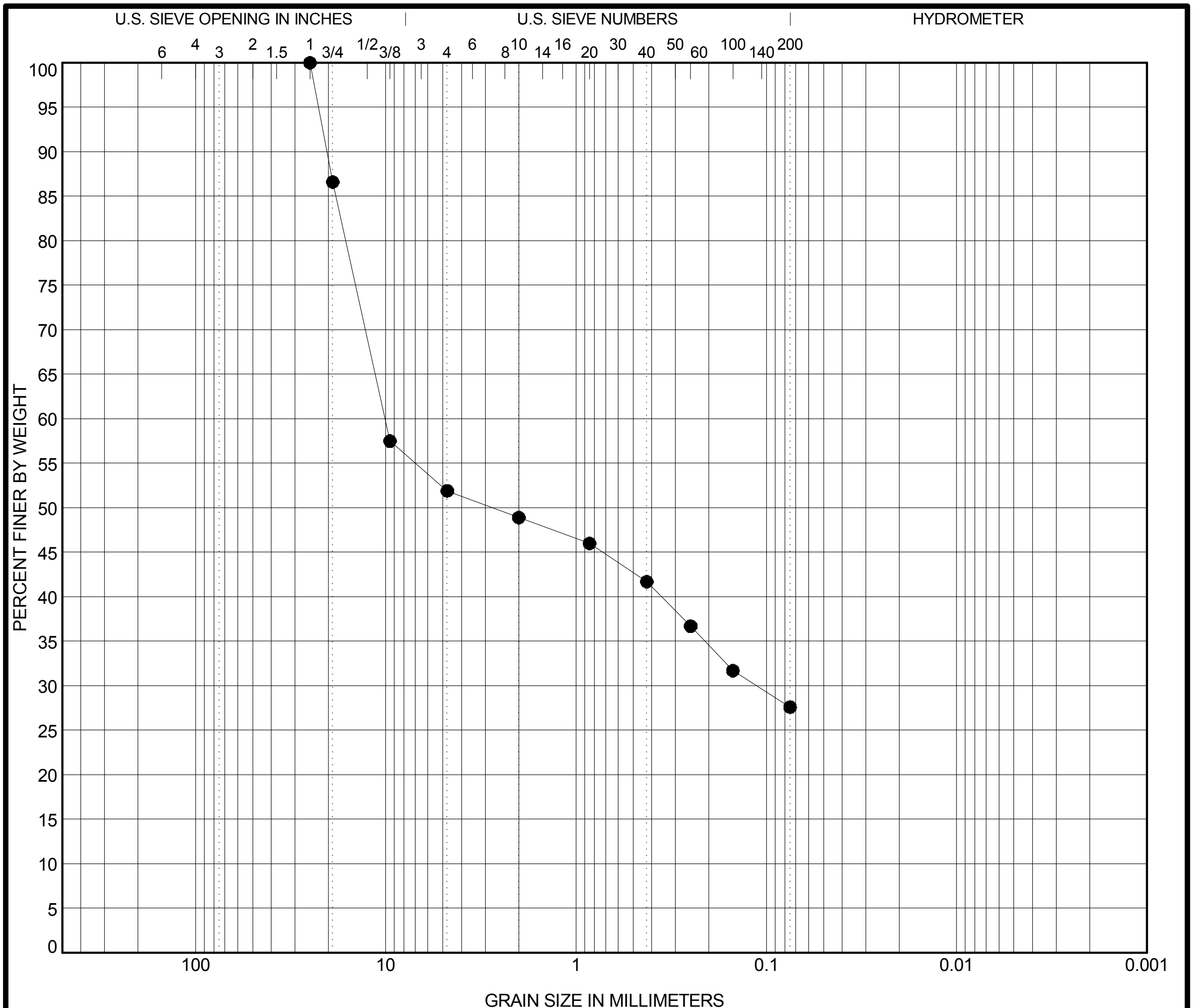

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen		Sample Description	LL	PL	PI		
●	B-10	8.5 ft	**CLAYEY GRAVEL WITH SAND (GC), dark green**	**30**	**15**	**15**		

Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
ASTM D6913	**25**	**10.083**	**0.113**		**48.1**	**24.3**	**27.6**	

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.
% Finer	27.6	31.7	36.7	41.7	46.0	48.9	51.9	57.5	86.6	100.0

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GRADATION CURVE

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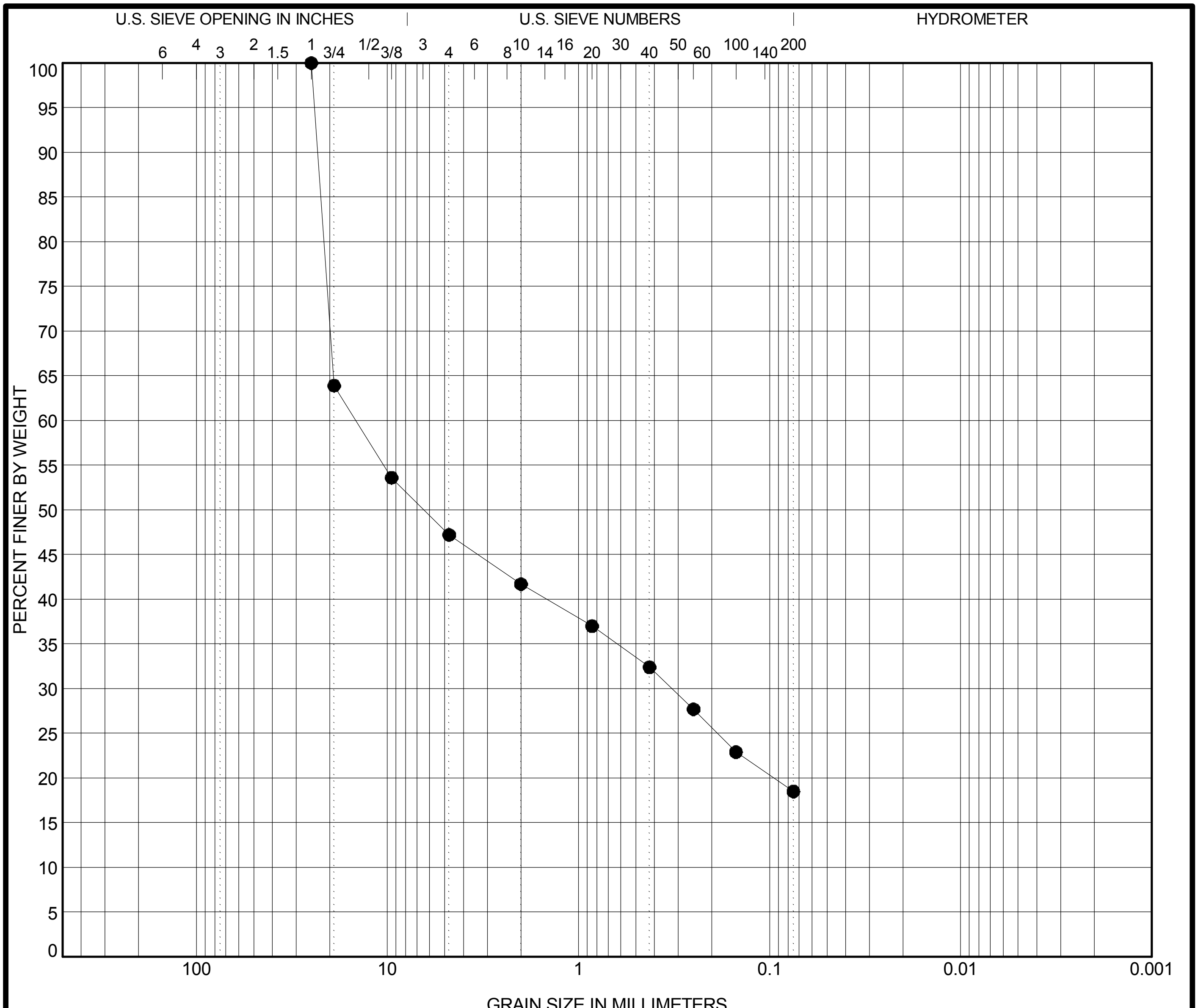

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen		Sample Description	LL	PL	PI		
●	B-11	5.0 ft	**SILTY GRAVEL WITH SAND (GM), dark brown**	**NP**	**NP**	**NP**		

Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
ASTM D6913	**25**	**14.614**	**0.324**		**52.8**	**28.7**	**18.5**	

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.
% Finer	18.5	22.9	27.7	32.4	37.0	41.7	47.2	53.6	63.9	100.0

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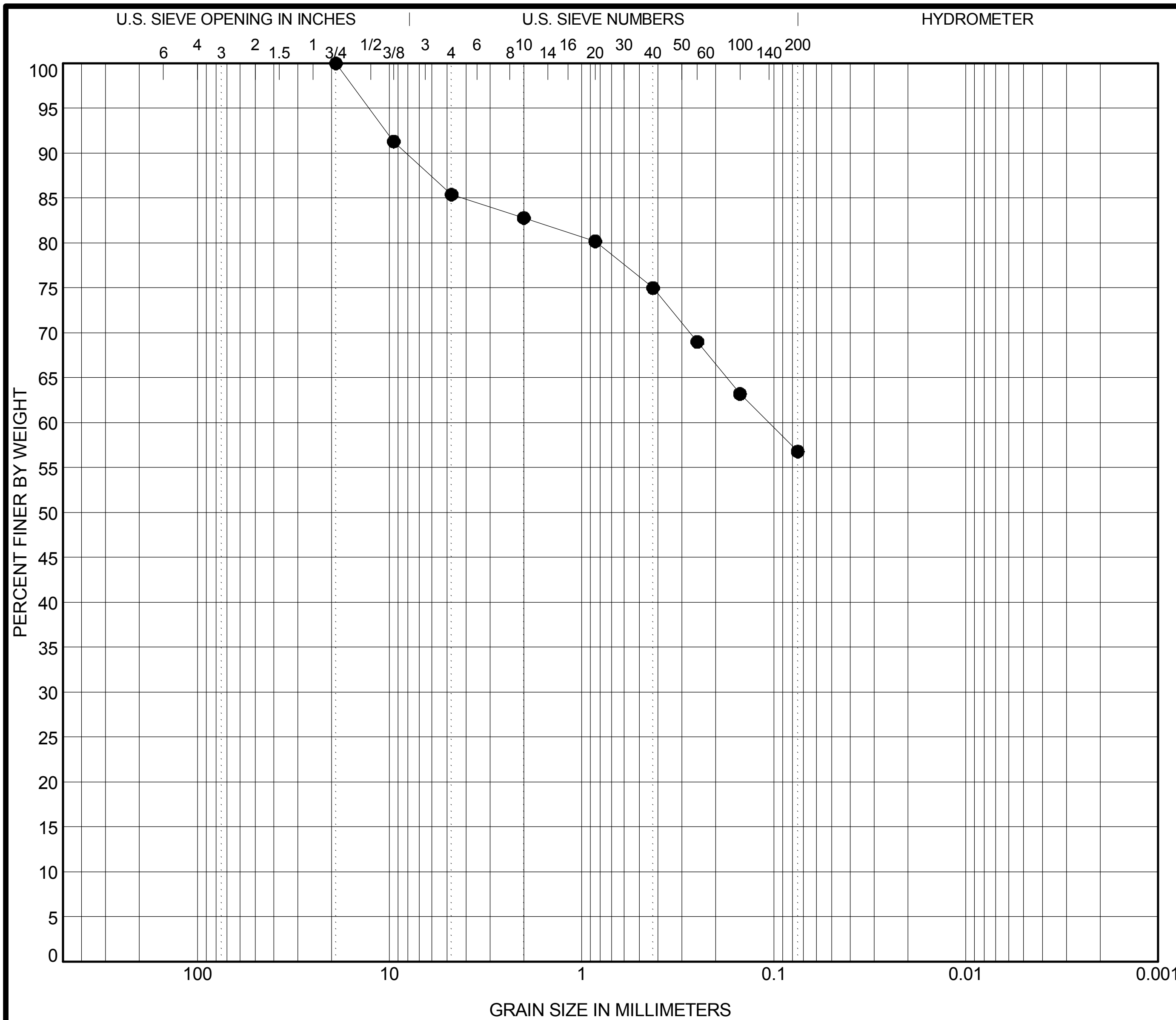

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen		Sample Description	LL	PL	PI		
●	RW-1	8.5 ft	**LEAN CLAY WITH SAND (CL), brown**	**31**	**16**	**15**		

Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
ASTM D6913	**19**	**0.106**			**14.6**	**28.6**	**56.8**	

Percent Finer

Sieve Size	No. 200	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4	3/8 in.	3/4 in.
% Finer	56.8	63.2	69.0	75.0	80.2	82.8	85.4	91.3	100.0

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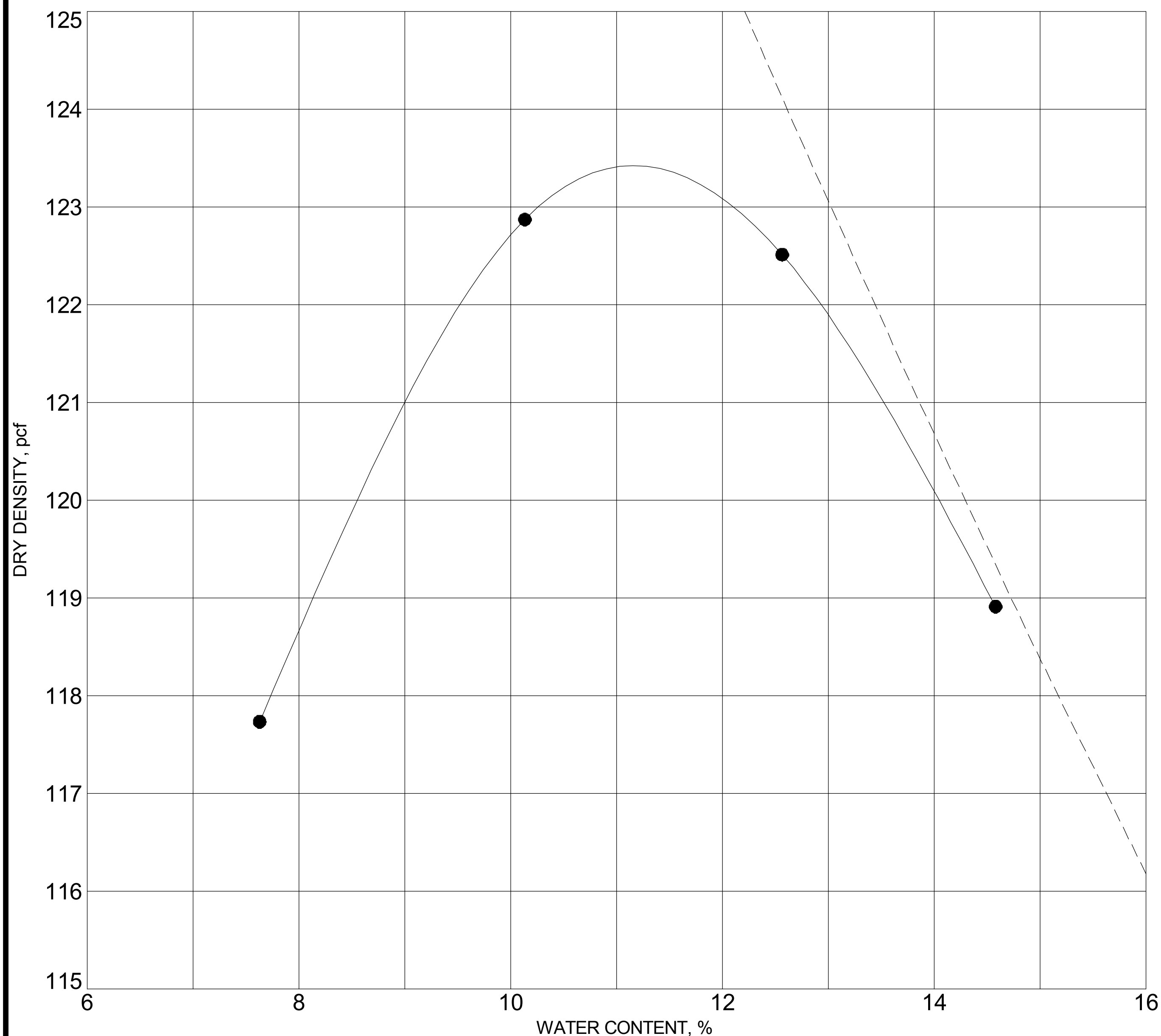
SIEVE 1/SHEET 14614004.00.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 4/11/14



Sample Description: CLAYEY SAND WITH GRAVEL (SC), brown

Sample Source: B-6, 0.0 ft

Test Methods: ASTM D698 Method B

Measured Specific Gravity: 2.65

Max. Dry Density (pcf): 123.4

Opt. Moisture (%): 11.2

Liquid Limit (LL): 37

Plasticity Index (PI): 20

% Retained #4 Sieve: 15.3

% Passing # 200 Sieve: 44.0

Comments:

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MOISTURE DENSITY RELATIONSHIP

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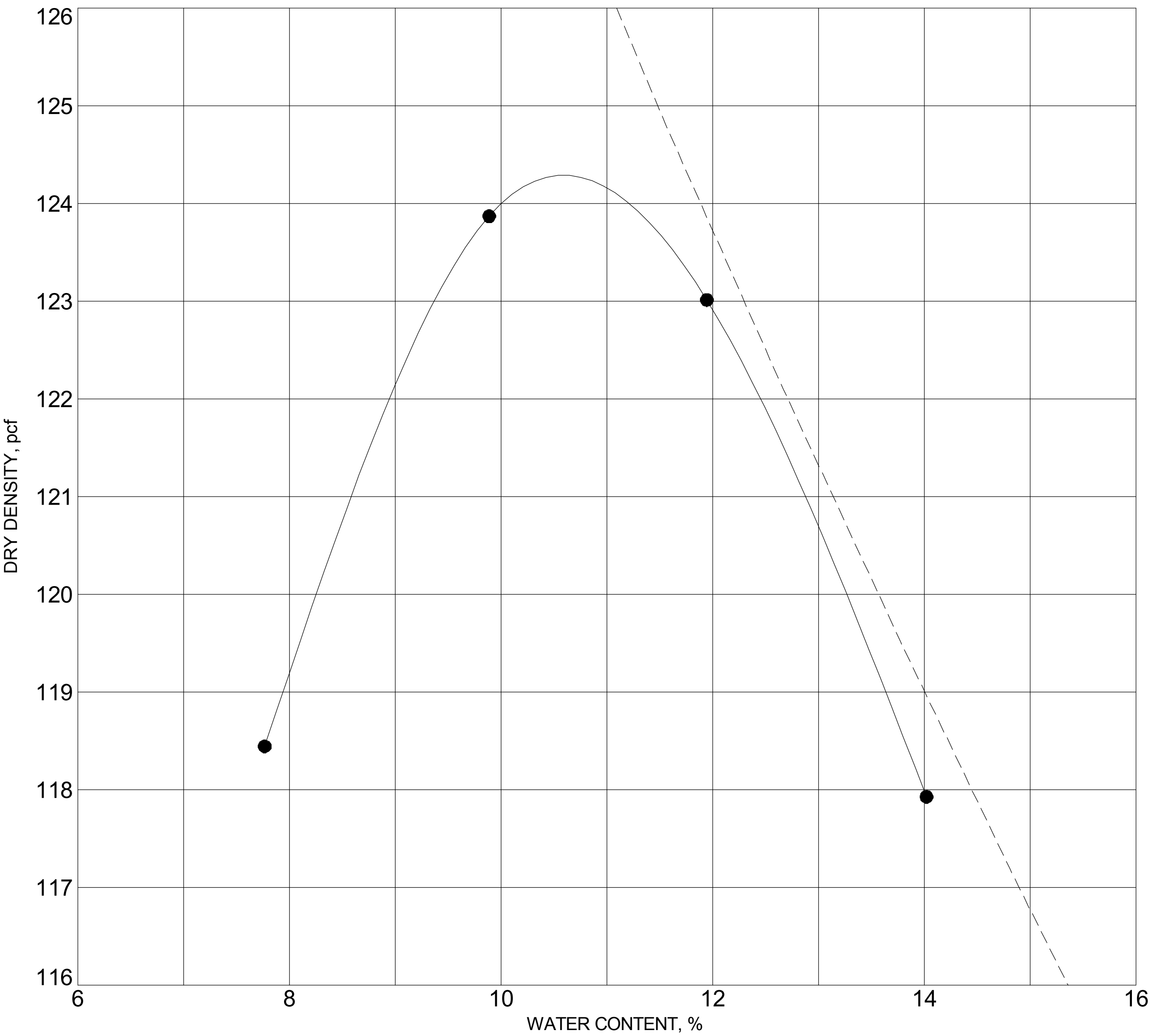
COMPACTION 14614004.00.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 4/11/14



Sample Description:	CLAYEY SAND WITH GRAVEL (SC), dark brown
Sample Source:	B-9, 0.0 ft
Test Methods:	ASTM D698 Method B

Measured Specific Gravity:	2.60
Max. Dry Density (pcf):	124.2
Opt. Moisture (%):	10.6

Liquid Limit (LL):	32
Plasticity Index (PI):	17
% Retained #4 Sieve:	19.0
% Passing # 200 Sieve:	41.2

Comments:

MOISTURE DENSITY RELATIONSHIP

Project: Behavioral and Social Sciences Center
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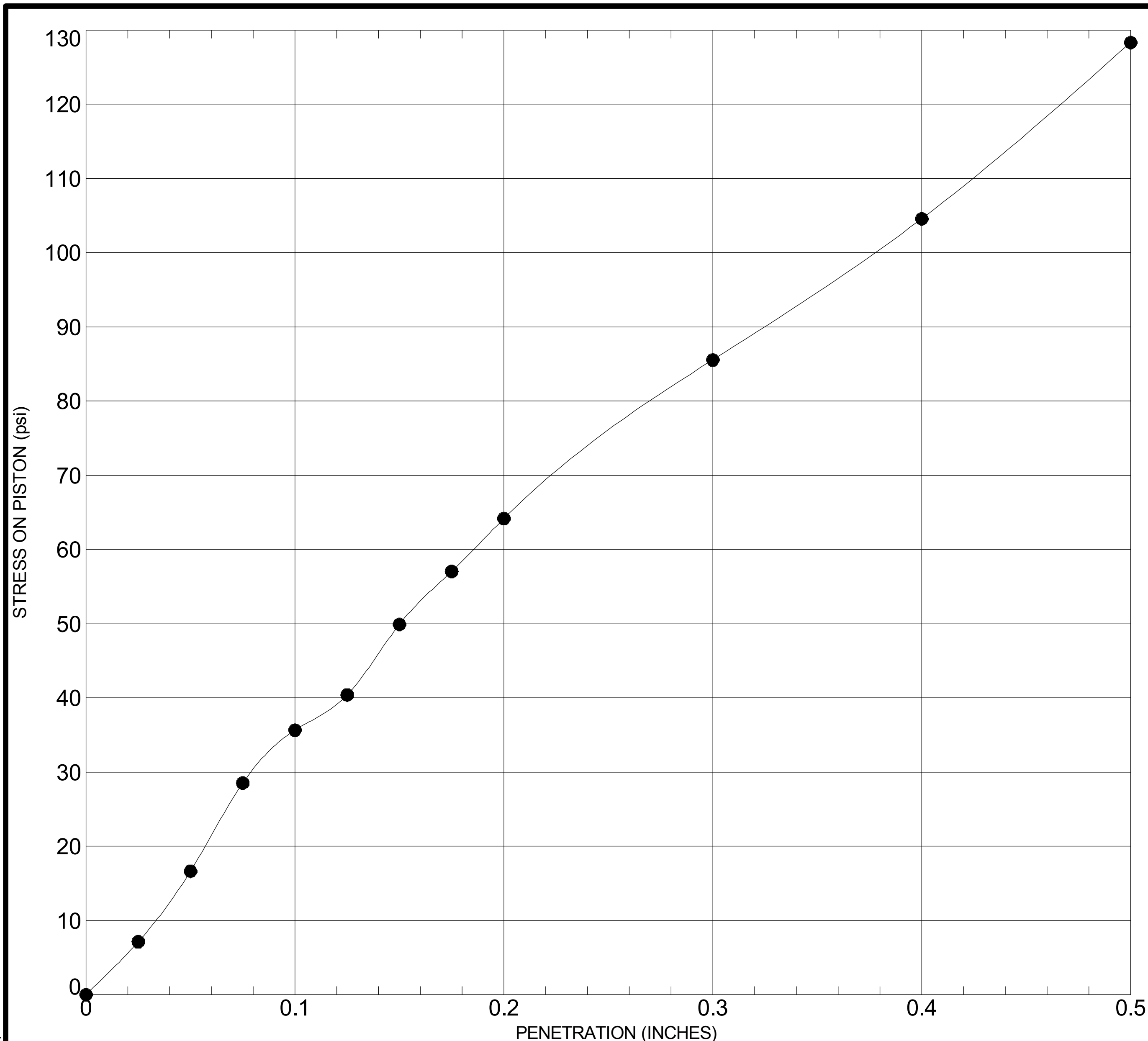
Baltimore, MD

Contract: 14614004.00

COMPACTION 14614004.00.GPJ SCHNABEL DATA TEMPLATE 2008_04_22.GDT 4/11/14



Sample Description:	CLAYEY SAND WITH GRAVEL (SC), brown	Dry Density Before Soaking (pcf):	117.2
		Dry Density After Soaking (pcf):	115.2
		Maximum Dry Density (pcf):	123.4
		Moisture Content Before Soaking (%):	11.4
Sample Source:	B-6	Moisture Content After Soaking (Avg) (%):	15.7
Sample Depth:	0.0 ft	Moisture Content Top Inch After Soak (%):	
Test Method:	ASTM D1883	Optimum Moisture Content (%):	11.2
Liquid Limit (LL):	37	CBR:	3.6, Soaked
Plasticity Index (PI):	20	Surcharge (psf):	50
% Retained #4 Sieve:	15.3	Swell (%):	1.7
% Passing # 200 Sieve:	44.0		

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CALIFORNIA BEARING RATIO TEST

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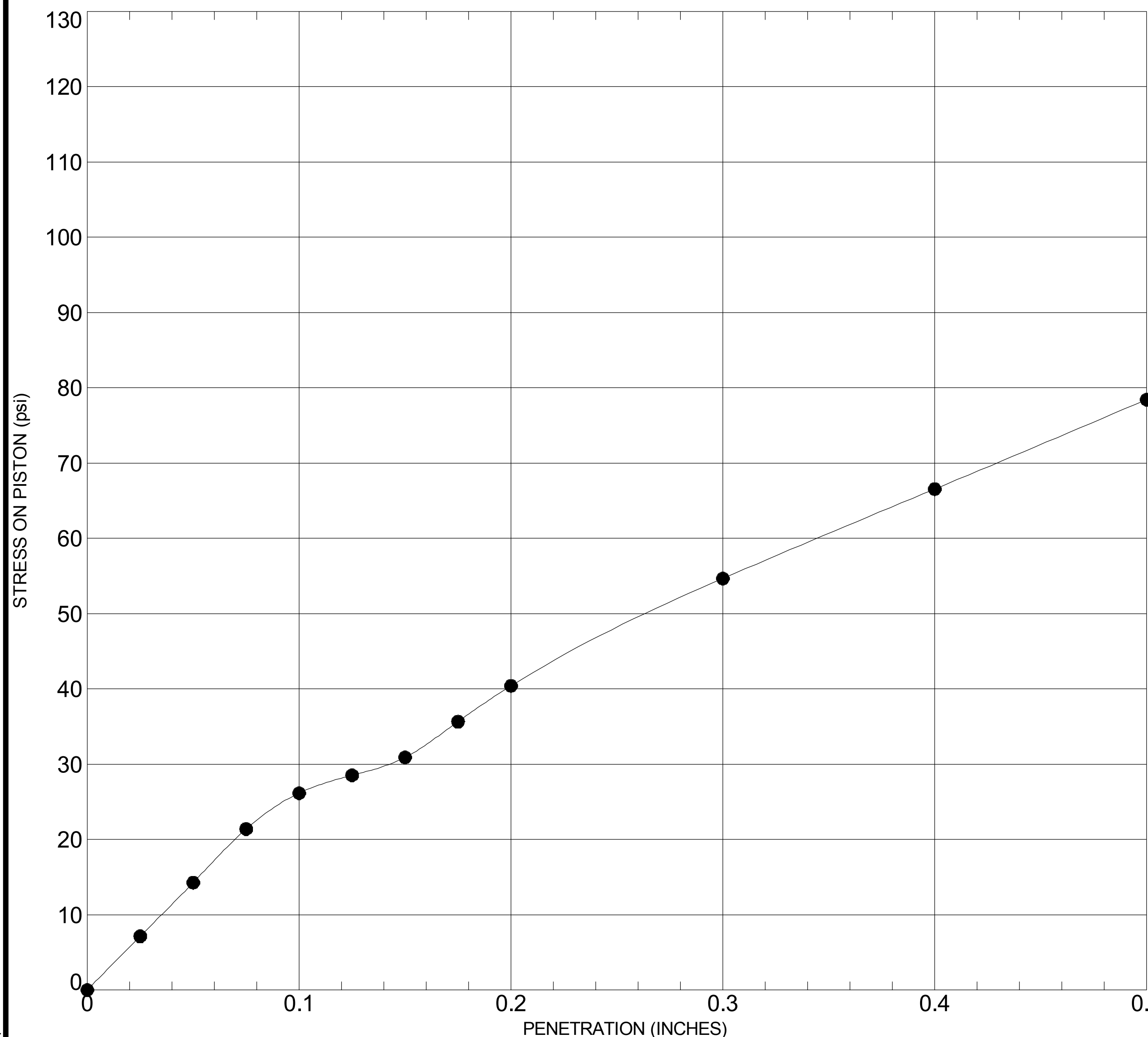

Sample Description:	CLAYEY SAND WITH GRAVEL (SC), dark brown
Sample Source:	B-9
Sample Depth:	0.0 ft
Test Method:	ASTM D1883

Dry Density Before Soaking (pcf):	118.0
Dry Density After Soaking (pcf):	116.9
Maximum Dry Density (pcf):	124.2
Moisture Content Before Soaking (%):	10.6
Moisture Content After Soaking (Avg) (%):	14.4
Moisture Content Top Inch After Soak (%):	
Optimum Moisture Content (%):	10.6

Liquid Limit (LL):	32
Plasticity Index (PI):	17
% Retained #4 Sieve:	19.0
% Passing # 200 Sieve:	41.2

CBR:	2.6, Soaked
Surcharge (psf):	50
Swell (%):	1.0

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CALIFORNIA BEARING RATIO TEST

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