Geotechnical Engineering Report

William Paterson University Athletic Field Improvements Wayne, NJ

Prepared for:

William Paterson University

300 Pompton Road
Wayne, NJ 07470

August 2015

CHA Project No.:
30059.1001.32000

CHA

6 Campus Drive
Parsippany, NJ 07054-4406

This report has been prepared and reviewed by the following qualified engineers employed by CHA.

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1.0 INTRODUCTION

This report summarizes the results of a geotechnical exploration performed by CHA for the proposed construction of a new synthetic turf field and bleachers as well as a restroom addition at William Paterson University in Wayne, New Jersey. The project site is shown on Figure 1 – Site Location Map, included in Appendix A.

The primary objectives of this exploration were to explore the subsurface conditions at the proposed sites and to provide geotechnical recommendations for the design and construction of the proposed synthetic turf, bleachers, and restroom foundations.

2.0 PROJECT AND SITE DESCRIPTION

The project site is located at the existing soccer field on the William Paterson University campus at 300 Pompton Road, in Wayne, New Jersey. The project site is shown on the Site Location Map, Figure 1, in Appendix A. The site consists of a soccer field bordered by asphalt roadways and the William Paterson Recreation Center to the north; a wetland area to the east; a football field and softball field to the south and southeast, respectively; and an inclined viewing area that contains bleachers with access from gravel pedestrian walkways to the west. The ground surface within the soccer field is relatively level and ranges in elevation from El. 456.8 feet to El. 457.9 feet. The surrounding areas to the west slope downward toward the soccer field from El. 480 feet to El. 456 feet, with existing bleachers at approximately at El. 465 feet. Photos of the site and subsurface explorations are included in Appendix B.

Based on preliminary site plans, the proposed project will include construction of a synthetic turf field in place of the existing grass field; construction of new elevated lighting on the north and south sides of the field; construction of a press box and re-grading of the area west of the field to enhance bleacher seating; and construction of a restroom building within the wooded area south of the field. We understand that no major (± 1.0-foot) changes in site grading will occur as a result of construction of the turf soccer field. Re-grading of the sloped area to the west of the soccer field is anticipated to be required to facilitate construction of the proposed bleachers.

3.0 SUBSURFACE EXPLORATION

3.1 Test Boring Program

CHA conducted a subsurface exploration at the project site on June 17th and June 18th, 2015. The exploration consisted of advancing six (6) borings, numbered B-1, B-2, B-3, B-4, B-6, and B-7. Boring number B-5 was an anticipated boring but was omitted due to probable underground utility conflicts.

The borings were advanced to depths ranging from 5 to 22 feet below grade. Borings were backfilled with soil cuttings, except within the existing field, where crushed stone and topsoil were used to backfill the boreholes. An elevation at each boring was interpolated based on contours shown on the site survey drawing. The location and elevation of the borings should be considered accurate only to the degree implied by the method used to determine them. The boring locations are shown on Figure 2, Boring Location Plan, included within Appendix A. Typed copies of the boring logs are included in Appendix C.

CHA retained Craig Test Boring, Inc. of Mays Landing, New Jersey to advance the borings. The field exploration was performed under the observation of a CHA geotechnical engineer who confirmed proper drilling and sampling methods were utilized for the exploration, observed and described soil samples, and prepared field logs documenting the subsurface conditions. Typed copies of the boring logs are included in Appendix C.

The borings were advanced with an ATV mounted rubber track drill rig utilizing 4-inch diameter flush joint casing and a 3-7/8 inch diameter roller bit. Split spoon samples were obtained in each boring continuously to a depth of 12 feet and at maximum 5-foot intervals thereafter, unless refusal was encountered. Standard Penetration Testing (SPT) was performed in general accordance with ASTM Standard D1586 "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils." The split spoon samples were advanced using an automatic 140 (±) pound trip hammer falling 30 (±) inches. "Blow counts" were recorded on the boring logs, and indicate the penetration resistance for a six-inch advancement of the split spoon. Initially, the spoon was driven six inches to seat the sampler in undisturbed material. The number of blows required to drive the sampler the next 12 inches was taken as the standard penetration test (SPT) resistance or "N" value. This value is considered to be indicative of the soil's in-place density or consistency. The final 6-inch increment that the spoon was driven was not included in the determination of "N". Refusal is defined as a resistance of greater than 50 blows per six inches of penetration.

3.2 Laboratory Analysis

Select soil samples were submitted for laboratory analysis to aid in development of the geotechnical engineering recommendations. Testing was completed in accordance with applicable ASTM standards and included Particle Size Analysis (ASTM D422), Atterberg Limits (ASTM D4318), and Water Content Determination (ASTM D2216). The test results for specific samples are included on the boring logs in Appendix C and complete results of the testing are included in Appendix D.

4.0 SUBSURFACE CONDITIONS

The subsurface conditions at the site were assessed based on a review of published geologic maps and the results of the test borings performed on-site, and are summarized below.

4.1 Regional Geology

According to the *Surficial Geologic Map of the Pompton quadrangle, Morris, Passaic, Essex and Bergen Counties, New Jersey (*Stanford, S.D., et al, 2007) the surficial soil at the site are mapped as stratified sands, gravels, silts, clays, and tills.

According to *The Bedrock Geologic Map of New Jersey:* (Lacombre, Pierre, and Duran, P.B., et al, 1989) the bedrock at the site is mapped as a series of graywacke and shale of the Martinburg Formation.

4.2 Subsurface Stratigraphy

Subsurface conditions encountered in individual borings are detailed and described on the boring logs included in Appendix C of this report. Subsurface conditions can generally be described as follows, in order of increasing depth:

<u>Topsoil</u> – Topsoil was encountered at the ground surface in borings B-1, B-2, B-3, and B-7 to depths of roughly 6 to 12 inches.

<u>Fill</u> - Fill was encountered below the topsoil layer extending to depths between 2.2 feet and 4 feet within borings B-1, B-2 and B-7. Fill material contained varying amounts of fine, medium, and coarse sand, varying amounts of fine and coarse gravel, and varying amounts of silt. The fill was generally brown or gray in color and visually classified as moist. Based on SPT “N” values that ranged from 9 blows per foot (bpf) to SPT refusal, the fill material was loose to very compact.

Silt/ Clayey Silt – Silt or Clayey Silt was encountered at the ground surface or within the sand layers within borings B-2, B-4, and B-6. The silt or clayey contained varying amounts of fine to coarse sand and trace to some fine gravel. The silt was described as dark brown, brown, or gray in color and moist. SPT N-values within the silt ranged from 4 to 37 bpf indicating very loose to compact conditions, and SPT N values within the clayey silt ranged from 8 to 45 bpf, indicating medium stiff to hard conditions.

Sand – Sand was encountered below the existing fill or topsoil layer within borings B-1, B-2, B-3, B-6 and B-7, extending to depths ranging from 1.5 to 22 feet. The sand contained varying amounts of silt and fine gravel. The sand was brown or gray and visually classified as moist or wet. Based on "N" values that ranged from 4 bpf to SPT refusal, the sand was very loose to very compact in terms of relative density.

Bedrock – Roller- bit refusal, likely due to bedrock, was encountered at depths ranging from 5 feet to 10 feet within borings B-1, B-3, B-6, and B-7.

4.3 Groundwater Conditions

Groundwater observations were made during drilling operations through observation of soil sample moisture content and by direct measurement of standing water within the borings. Groundwater was observed at a depth of 3.9 feet within boring B-3 during drilling; however, groundwater was not present within any remaining borings during or upon completion of drilling.

Note that groundwater levels at the site at any given time may differ from those shown on the subsurface logs due to seasonal factors, which include but not limited to temperature and precipitation.

5.0 GEOTECHNICAL RECOMMENDATIONS

The recommendations provided in this report are based on the results of the subsurface exploration and laboratory testing. The following sections outline our recommendations for design and construction of the project.

5.1 Shallow Spread Foundations

Based upon the subsurface conditions encountered during the exploration, conventional spread footing foundations are suitable for support of the proposed bleachers and press box. Foundations consisting of a concrete slab-on-grade bearing on crushed stone over native soils or bedrock are acceptable. Individual spread footings or strip footings may be utilized for support of concentrated loads. The ground surface below the proposed foundation footprints should be stripped of topsoil, existing fill, and any deleterious materials and the exposed subgrade should be prepared in accordance with *Section 5.3 – Site and Subgrade Preparation*. Engineered fill should be used to raise grades, if required, to the footing elevation. If engineered fill is used to raise grades, it should extend laterally within the zone of influence, which is defined by an imaginary line drawn from the edge of the footing at a slope of one horizontal to two vertical (1H:2V). Footing excavations shall be backfilled with engineered fill. Engineered fill shall be placed and compacted in accordance with *Section 5.4 – Engineered Fill*.

Foundations for the proposed press box structure should be designed to bear on compacted engineered fill utilizing a maximum net allowable soil bearing pressure equal to 3,000 pounds per square foot (psf) or on bedrock utilizing a net allowable bearing pressure of 10,000 pounds per square foot (psf). Existing fill is not suitable for support of shallow footings and should be removed. Foundations should bear below the minimum frost depth of 3 feet from outside grade.

Footings should be constructed as soon as possible after excavation to minimize the risk of bearing surface disturbance by exposure to precipitation or other adverse conditions. On-site soils may be moisture sensitive and become unstable if exposed to precipitation or the bearing surface is disturbed. Any disturbed, frozen or loosened subgrade soil should be removed and replaced with engineered fill or the bottom of the footings should be lowered as required.

If it is anticipated that footing subgrades will be exposed for some time or if wet weather conditions are anticipated, we recommend that a mud mat consisting of 2.0 to 3.0 inches of concrete be placed on the soil subgrades immediately after exposure. The mud mat will provide a firm and stable working platform during foundation construction and will protect the sensitive soils. Use of a mud mat will also aid in keeping the foundation reinforcement clean.

An alternate method to protecting the subgrade soils with a mud mat is to place a geotextile fabric on the exposed bearing grade and place a minimum of 6.0 inches of AASHTO No. 57 crushed stone on the fabric. The actual thickness of the stone layer should be based on site conditions encountered. The crushed stone should be underlain by a six-ounce per square yard or heavier, non-woven filter fabric with an apparent opening size (AOS) equal to or smaller than the U.S. Standard sieve size of 70, such as a Mirafi 160N or equal. This alternative to the mud mat will also provide a firm and stable working platform during foundation construction and will protect the subgrade soils.

A detailed settlement analysis was beyond the scope of this study. However, based on the information obtained during this study and the recommendations outlined herein, we anticipate that total settlement of the proposed footings will be less than 1.0 inch. These estimates are based on the assumption that proper site preparation and construction monitoring is performed and that foundations are constructed in accordance with the practices recommended in this report.

5.2 Stadium Light Foundations

Drilled shaft foundations are recommended for support of the stadium lights; however, due to shallow bedrock conditions at boring B-1, a drilled rock socket will likely be required. In lieu of a drilled rock socket, the pole may be supported by a spread footing bearing on rock using the same design parameters provided in Section 5.1. Side friction resistance may be considered in the design of the drilled shafts; see Table 2 for values of allowable unit side friction, in pounds per square foot (psf).

Table 1: Allowable Side Friction of Drilled Shaft at Location B-1

Depth (ft)	Allowable Unit Side Resistance (psf)
0 to 4.66	0
>4.66 (rock socket)	1,500

Table 2: Allowable Side Friction of Drilled Shaft at Location B-4

Depth (ft)	Allowable Unit Side Resistance (psf)
0 to 3.66	0
3.66 to 4.5	0 to 100[1]
4.5 to 18.5	100[1] to 250[2]
Below 18.5	300

[1]Allowable unit side resistance calculated at depths of 3.66 ft bgs and 4.5 ft bgs, respectively. Interpolate values of allowable unit side resistance for depths in between.

[2]Allowable unit side resistance calculated at depths of 4.5 ft bgs and 18.5 ft bgs, respectively. Interpolate values of allowable unit side resistance for depths in between.

End bearing of drilled shafts may be considered in design. Shafts should bear at a depth that is less than 5 feet below grade or at that depth required to adequately resist design loads. Recommend values for allowable end bearing are provided in Table 3 and Table 4 below.

Table 3: Allowable End Bearing Capacity of Drilled Shaft at Location B-1

Depth (ft)	End Bearing Capacity (psf)
> 4.66 (rock socket)	10,000

Table 4: Allowable End Bearing Capacity of Drilled Shaft at Location B-4

Depth (ft)	End Bearing Capacity (lb)
5 to 22	2,200.00
Below 22	3,200.00

Based on the stadium light heights, the foundation design will likely be governed by overturning and should be evaluated utilizing lateral soil analysis during design. Tables 5 and 6 outline the recommended geotechnical lateral analysis parameters at the two locations explored.

Table 5: Lateral Analysis Parameters at Location B-1

Strata	Location	Soil Type	Effective Unit Weight (pcf)	Friction Angle (º)	Undrained Shear Strength (psf)	Lateral Soil Modulus – k (pci)	E_{50}
Silt	0 to 2 ft bgs	Sand (Reese)	110	34	0	60	0
Sand	2 to 4 ft bgs	Sand (Reese)	125	40	0	120	0
Rock	Below 4 ft bgs	Strong Rock(Vuggy Limestone)	70	0	4,000	200	0.005

Table 6: Lateral Analysis Parameters at Location B-4

Strata	Location	Soil Type	Effective Unit Weight (pcf)	Friction Angle (º)	Lateral Soil Modulus – k (pci)
Silt	0 to 4 ft bgs	Sand (Reese)	115	34	60
Silt	Below 4 ft bgs	Sand (Reese)	50	30	25

A specialty contractor will be required for drilled shaft foundations. Concrete should be placed immediately after drilling and inspection are completed.

Cobbles and boulders may be present within the soil layers encountered at the site. Contractors should be advised of these potential conditions, and the possible need to construct rock sockets, and be responsible for employing drilling methods that will allow for shaft construction in these conditions.

It is the contractor's responsibility to use drilling methods that will maintain a stable excavation. If groundwater is encountered, the contractor may need to utilize measures such as drilling slurry and/or steel casing to minimize potential groundwater intrusion or base softening due to contact with water.

It is recommended that the concrete for the drilled shafts have a design slump of at least 7 inches in order to ensure concrete workability and plastic flow around the reinforcing cage, avoid arching of the concrete upon withdrawal of the temporary casing (if used), and promote uniform slurry (if used) displacement as the concrete is poured. Furthermore, a positive head of concrete should be maintained above groundwater during the withdrawal of the casing. Additional design and construction considerations regarding drilled shaft installation are as follows:

- The rebar cage for the shafts should be adequately sized to permit concrete to flow around the cage. Clear spacing between all bars should be greater than five times the diameter of the largest coarse aggregate.
- The water/cement ratio should be no greater than 0.45 to improve strength and durability, and low range water reducers should be used.
- Concrete should be placed rapidly and continuously.
- Concrete used to construct shafts in the wet should be placed using tremie methods to minimize concrete segregation. The contractor must maintain the tremie pipe discharge below the concrete level to minimize void development and drill slurry encapsulation in the concrete mass as it is being placed.

These measures will aid in reducing groundwater and soil contamination in the shaft concrete and safeguard the integrity of the shafts.

5.3 Turf Field

The subgrade for the turf fields is anticipated to consist of sandy soil with fines. Some of the existing soils are susceptible to frost heave, and adequate drainage is required to reduce the potential for damage to the turf fields due to frost heave. Full protection against frost heave would require replacing all frost-susceptible soil within the depth of frost penetration with free-draining soil; for economic reasons, full frost protection measures are not typically undertaken. During construction, careful inspection of the subgrade should be performed to identify the presence of frost-susceptible soils. Subgrade areas observed to consist of fine grained soils should be removed from the subgrade to a depth of at least 12 inches and replaced with soil fill having less than 20 percent passing a No. 200 sieve. A geotechnical engineer should oversee the subgrade preparation and provide recommendations for removal of frost-susceptible soil, if encountered.

These fields shall be constructed utilizing a subbase of crushed stone compacted to 95 percent of the maximum dry density as determined by the modified Proctor test (ASTM D1557), underlain by a geotextile separation/stabilization fabric. The geotextile used will provide a stable base for construction of the turf field. Underdrains in the form of perforated pipe, panels, or a similar system should be used to drain the subbase course.

5.4 Groundwater and Control of Water

Based on the groundwater information obtained and described in *Section 4.3* of this report, a groundwater depth of 4 feet is recommended for design of the proposed footings. It is not anticipated that groundwater will be encountered during excavation for shallow footings, however localized areas of perched water may be encountered. It is the responsibility of the contractor to maintain dry conditions so that foundation construction may be completed in the dry. Groundwater should be maintained at a minimum depth of 2.0 feet below excavation bottom at all times to maintain stable conditions. Dewatering methods suitable for use at this site include the use of sumps, diversion and drainage ditches, toe drains and other similar methods. Pumps should be of sufficient capacity to control the groundwater, and operated in a manner which will limit the withdrawal of fines from the soil. It is recommended that pumps be installed in sumps lined with filter fabric such as Mirafi 160N or equal and AASHTO No. 57 crushed stone in accordance with requirements previously specified herein. Surface runoff should be diverted away from excavations during construction.

5.5 Site and Subgrade Preparation

The areas within the proposed improvement footprints should be stripped of existing stands and bleachers, topsoil, underground utilities, and any existing fill materials to subgrade elevation. Any remaining deleterious materials should be subsequently removed, and the subgrade should be observed by a geotechnical engineer. Subgrade soils for footings should consist of sand or bedrock as described in the report. Any areas consisting of deleterious materials or soils unsuitable for subgrade support should be over-excavated. The exposed subgrade should then be proof rolled using a smooth drum roller with a weight of at least 10 tons when operated in the static mode. The roller should operate in its vibratory mode, and complete at lease six (6) passes over the subgrade at a speed not exceeding 3 feet per second (fps). Any areas which pump to weave during proof rolling or which appear to contain significant proportions (more than 20 percent) of fines, should be undercut by a minimum of 12 inched, or greater depths if recommended by the geotechnical engineer, and stabilized with engineered fill as specified in *Section 5.5 – Engineered Fill*. If the vibratory roller tends to “bring up” moisture, the subgrade should be proof rolled with the roller operating in the static mode.

5.6 Engineered Fill

Engineered fill shall be used for backfilling of excavations and undercuts and when raising grades beneath structures. Material suitable for use as engineered fill should consist of sound, durable, non-plastic sand and gravel free of stumps, roots, other organics and any frozen or deleterious materials. The engineered fill shall conform to the following gradation:

Table 7: Gradation Requirements for Engineered Fill

Sieve Size	Percent Passing by Weight
4-inch	100
No. 40	0 to 70
No. 200	0 to 12

The on-site soils may meet the requirements for structural fill; however, construction phase testing as indicated in *Section 7.0 – Observation During Construction*, should be performed on bulk samples to make this determination. On-site soils that are not tested or that do not meet the requirements for engineered fill may be used as fill at the site in landscaped areas where it will not affect the stability of the proposed construction, as determined by the engineer.

5.7 Seismic Site Classification and Design Parameters

Based on the site location, subsurface conditions, and in accordance with the 2009 International Building Code (New Jersey Edition), which makes use of 2008 USGS hazard data, the seismic site class for the proposed structures is D resulting in the following seismic design parameters:

- Mapped Spectral Response Acceleration at Short Periods (S_s) 0.359g
- Mapped Spectral Response Acceleration at 1 Second Period (S_1) 0.071g
- Site Coefficient (F_a) 1.4
- Site Coefficient (F_v) 2.4

6.0 EXCAVATIONS

In general, all excavation should be performed in accordance with the Occupational Safety and Health Administration (OSHA) standards and other applicable State and Federal regulations. In areas where sufficient sloping of excavation cuts is not possible, the excavation should be shored, sheeted and braced. All excavation support systems should be designed by a Professional Engineer licensed in New York State.

7.0 OBSERVATION DURING CONSTRUCTION

A qualified geotechnical engineer should carefully inspect the final excavation surface for spread foundations and concrete slabs to ascertain that the subgrade has been properly prepared. The inspection of subgrade should include probing at select locations, specifically to verify the bearing capacity of the supporting soils and where load bearing soils may have been disturbed. A qualified geotechnical engineer should observe all drilled shaft construction to ascertain ha shaft construction conforms to project plans and specifications and that materials encountered are consistent with the findings described herein.

Materials used as engineered fill, including those used beneath footings, floor slabs and pavement should be tested by a qualified soils laboratory to verify they meet the specified gradations and to determine their maximum dry density for compaction. In-place density tests should be performed to verify that compaction methods and equipment achieve the required densities.

8.0 CLOSURE

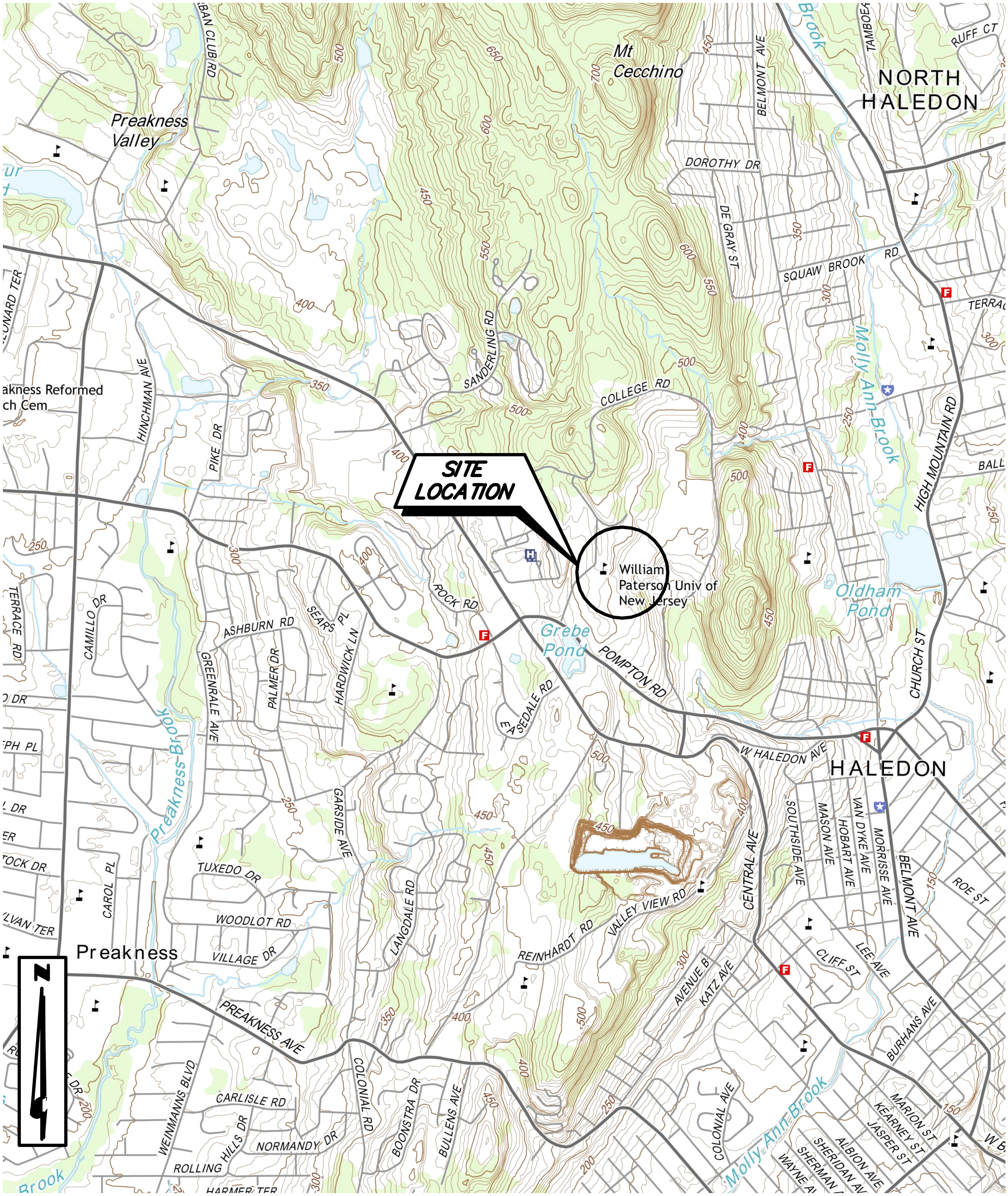
The geotechnical recommendations presented in this report are based, in part, on project and subsurface information available at the time this report was prepared and in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made. Some variation of subsurface conditions may occur between locations explored that may not become evident until construction. Depending on the nature and extent of the variations, it may be necessary to re-evaluate the recommendations presented in this report.

CHA does not accept responsibility for designs based upon our recommendations unless we are engaged to review the final plans and specifications to determine whether any changes in the project affect the validity of our recommendations and whether our recommendations have been properly implemented in the design.

This report has been prepared solely for design purposes and shall not be incorporated by reference or other means in the Contract Documents. If this report is included in the Contract Documents, it shall be for information only. Earthwork specification clauses shall take precedence.

APPENDIX A

Figures



SOURCE: U.S.G.S. 7.5' Topographic
QUADRANGLE: PATERSON, NJ

SCALE: 1"=2000'

CHA
6 Campus Drive
Parsippany, NJ 07054-4406
973.538.2120 · www.chacompanies.com

SITE LOCATION MAP

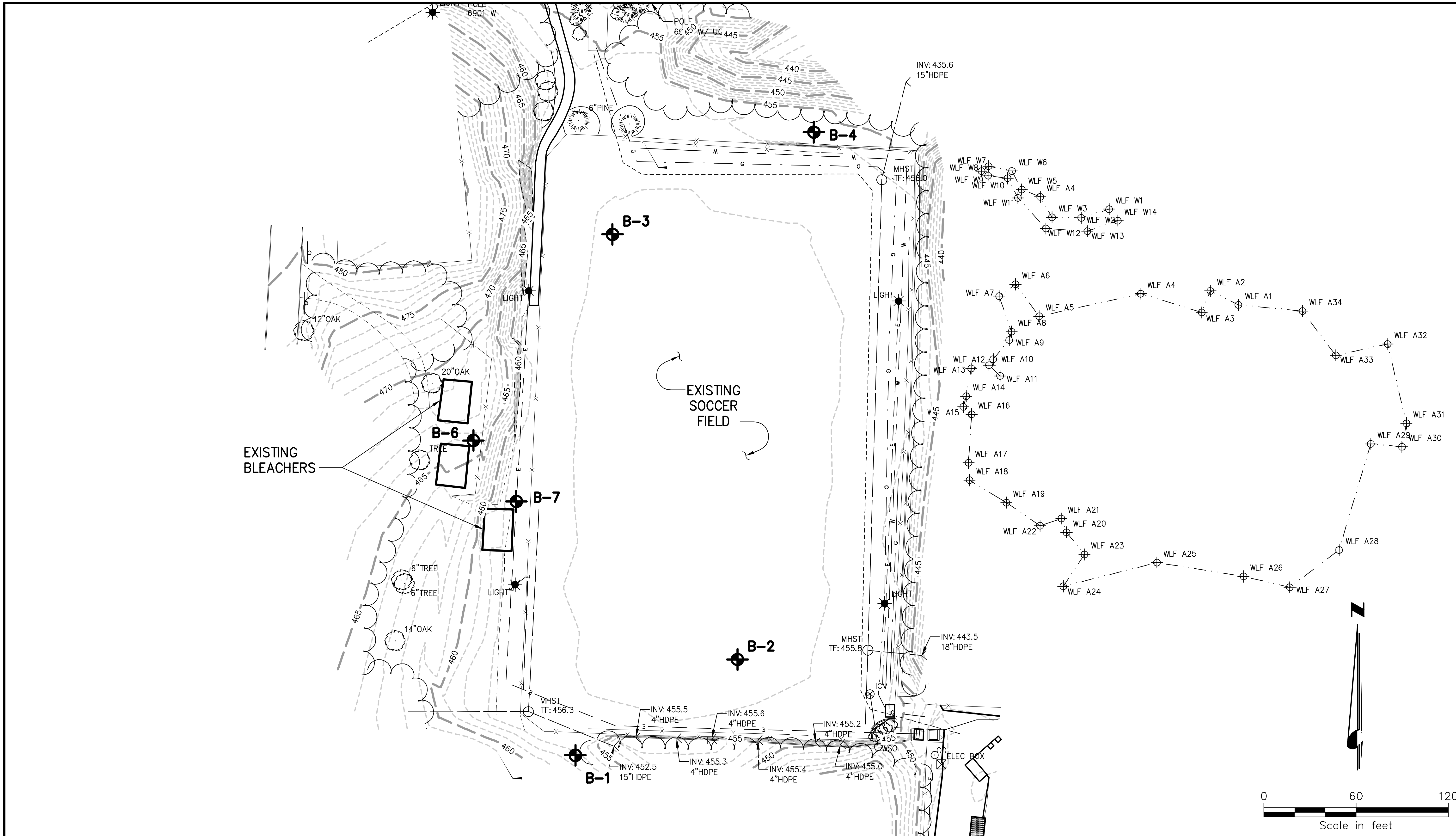
WILLIAM PATERSON UNIVERSITY
ATHLETIC FIELD STUDY
WAYNE, NEW JERSEY

PROJECT NO. 30059

DATE: 08/2015

FIGURE 1

File: V:\PROJECTS\ANY\K4\30059\CADD\FIGURES\30059_SITELOC.DWG Saved: 8/14/2015 10:19:48 AM Plotted: 8/14/2015 10:20:24 AM User: Gray, Timmolyn



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LEGEND

B-1 APPROXIMATE BORING LOCATION

CHA
6 Campus Drive
Parsippany, NJ 07054-4406
973.538.2120 · www.chacompanies.com

BORING LOCATION PLAN

WILLIAM PATERSON UNIVERSITY
ATHLETIC FIELD STUDY
WAYNE, NEW JERSEY

PROJECT NO. 30059

DATE: 08/2015

FIGURE 2

APPENDIX B

Photographs

1

Drilling operations at boring B-2, looking southeast.

2

Drilling operations at boring B-7, looking north.

3

Mobilization after boring B-7, looking south.

4

Location of boring B-6, looking north.

5

Location of boring B-4, looking southeast.

APPENDIX C

Boring Logs

LEGEND TO SUBSURFACE LOGS

SAMP./CORE NUMBER	SAMP. ADV(ft) LEN CORE(ft)	RECOVERY (ft)	Blows per 6" on Split Spoon Sampler	"N" VALUE or RQD%	SAMPLE	DEPTH (Feet)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEVATION (Feet)	Remarks on Character of Drilling, water return, etc	WATER LEVELS AND/OR WELL DATA
S1	2.0	1.8	2-3-4-5	7				<u>f. SAND</u>, Some Silt, trace f. gravel, brown, loose, moist (SM)	100		
R1	2.0	2.0	N/A	88%				<u>Mica SCHIST</u>, gray, soft, slightly weathered, closely fractured, good RQD			
1	2	3	4	5	6	7	8	9 10	11	12	13

Subsurface Logs present material classifications, test data, and observations from subsurface investigations at the subject site as reported by the inspecting geologist or engineer. In some cases, the classifications may be made based on laboratory test data when available. It should be noted that the investigation procedures only recover a small portion of the subsurface materials at the site. Therefore, actual conditions between borings and sampled intervals may differ from those presented on the Subsurface Logs. The information presented on the logs provide a basis for an evaluation of the subsurface conditions and may indicate the need for additional exploration. Any evaluation of the conditions reported on the logs must be performed by Professional Engineers or Geologists.

1. <u>SAMP./CORE NUMBER</u> – Samples are numbered for identification on containers, laboratory reports or in text reports.

2. <u>SAMP.ADV/LEN.CORE</u> – Length of sampler advance or length of coring run measured in feet.

3. <u>RECOVERY</u> – Amount of sample actually recovered after withdrawing sampler or core barrel from bore hole measured in feet.

4. <u>SAMPLE BLOWS/6"</u> – Unless otherwise noted, blow counts represent values obtained by driving a 2.0" (O.D.), 1-3/8" (I.D.) split spoon sampler into the subsurface strata with a 140 pound weight falling 30" as per ASTM International D1586. After an initial penetration of 6" to seat the sampler into undisturbed material, the sampler is then driven an additional 2 or 3 six inch increments. Refusal is defined as a resistance greater than 50 blows per 6" of penetration.

5. <u>"N" Value or RQD %</u> – "N" VALUE – The sum of the second and third sample blow increments is generally termed the Standard Penetration Test (SPT) "N" value. Refusal (R) is defined as a resistance greater than 50 blows for 6 inches of penetration. CORE RQD – Core Rock Quality Designation, RQD, is defined as the summed length of all pieces of core equal to or longer than 4 inches divided by the total length of the coring run. Fresh, irregular breaks distinguishable as being caused by drilling or recovery operations are ignored and the pieces are counted as intact lengths. RQD values are valid only for cores obtained with NX size core barrels.

6. <u>SAMPLE</u> – Graphical presentation of sample type and advance or core run length. See Table 1.

7. <u>DEPTH</u> – Depth as measured from the ground surface in feet.

8. <u>GRAPHICS</u> – Graphical presentation of subsurface materials. See Table 4. Dual soil classification and rock graphics may vary and are not shown on Table 4.

9. <u>DESCRIPTION AND CLASSIFICATION</u> – SOIL – Recovered samples are visually classified in the field by the supervising geologist or engineer unless otherwise noted. Particle size and plasticity classification is based on field observations, and using the Unified Soil Classification System (USCS). See Table 4. USCS symbols are presented in parentheses following the soil description. Where necessary, dual symbols may be used for combinations of soil types. Relative proportions, by weight and/or plasticity, are described in general accordance with "Suggested Methods of Test for Identification of Soils" by D.M. Burmister, ASTM Special Publication 479, 6-1970. See Table 2. Soil density or consistency description is based on the penetration resistance. See Table 3. Soil moisture description is based on the observed wetness of the soil recovered being dry, moist, wet, or saturated. Water introduced into the boring during drilling may affect the moisture content of the materials. Other geologic terms may also be used to further describe the subsurface materials. ROCK – Rock core descriptions are based on the inspector's observations and may be examined and described in greater detail by the project engineer or geologist. Terms used in the description of rock core are presented in Table 5.

10. <u>DIVISION LINES</u> – Division lines between deposits are based on field observations and changes in recovered material. Solid lines depict contacts between two deposits of different geologic depositional environment of known elevation. Dashed lines represent estimated elevation of contacts between two deposits of different geologic depositional environment. Dotted lines depict transitions of deposits within the same depositional environment, such as grain size or density.

11. <u>ELEVATION</u> – Elevation of strata changes in feet.

12. <u>REMARKS</u> – Miscellaneous observations.

13. <u>WATER LEVELS & WELL DATA</u> – Hollow water level symbol, if present, represents level at which first saturated sample or water level was encountered. Solid water level symbol, if present, depicts the most probable static water elevation at the time of drilling or as measured in an installed observation well at a later date. Subsurface water conditions are influenced by factors such as precipitation, stratigraphic composition, and drilling/coring methods. Conditions at other times may differ from those described on the logs. For graphical presentation of observation/monitoring well construction, see Table 6. Elevations of changes in construction are noted at the bottom of each section.

LEGEND TO SUBSURFACE LOGS

TABLE 1
TYPICAL SAMPLE TYPES

SPLIT SPOON (1 3/8" I.D.)
NX SIZE ROCK CORE
SHELBY TUBE "UNDISTURBED"
AUGER SAMPLE

TABLE 2
SAMPLE MATERIAL PROPORTIONS

ADJECTIVE	PERCENTAGE OF SAMPLE
"and"	35% – 50%
"some"	20% – 35%
"little"	10% – 20%
"trace"	< 10%

Standard split spoon samples may not recover particles with any dimension larger than 1 3/8". Therefore, reported gravel percentages may not reflect actual conditions.

TABLE 3
DENSITY/CONSISTENCY

GRANULAR SOILS		COHESIVE SOILS	
Blows/ft.	Density	Blows/ft.	Consistency
< 5	Very Loose	< 2	Very Soft
5–10	Loose	2–4	Soft
11–30	Med. Compact	5–8	Med. Stiff
31–50	Compact	9–15	Stiff
> 50	Very Compact	16–30	Very Stiff
		> 30	Hard

TABLE 4
USCS CLASSIFICATION, PARTICLE SIZE, & GRAPHICS

	MAJOR PARTICLE SIZE DIVISION	USCS SYMBOL	GRAPHIC SYMBOL	GENERAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL Coarse: 3"–3/4" Fine: 3/4"–#4 Classification based on > 50% being gravel	GW		Well graded gravels, gravel & sand mix.
		GP		Poorly graded gravels, gravel & sand mix.
		GM		Gravel, sand and silt mix.
		GC		Gravel, sand and clay mix.
	SAND Coarse: #4–#10 Med.: #10–#40 Fine: #40–#200 Classification based on > 50% being sand	SW		Well graded sand, sand & gravel mix.
		SP		Poorly graded sand, sand & gravel mix.
		SM		Sand and silt mix.
		SC		Sand and clay mix.
FINE GRAINED SOILS	SILT & CLAY Classification based on > 50% passing #200 sieve.	ML		Inorganic silt, low plasticity.
		CL		Inorganic clay, low plasticity.
		OL		Organic silt/clay, low plasticity.
		MH		Inorganic silt, high plasticity.
		CH		Inorganic clay, high plasticity.
		OH		Organic silt/clay, high plasticity.
	ORGANIC SOILS	Pt		Peat and other highly organic soils.
	FILL	Fill		Miscellaneous fill materials.

TABLE 5
ROCK CLASSIFICATION TERMS

HARDNESS:

Very Soft	Carves
Soft	Grooves with knife
Med. Hard	Scratched easily with knife
Hard	Scatched with difficulty
Very Hard	Cannot be scratched with knife

WEATHERING:

Fresh	Slight or no staining of fractures, little or no discoloration, few fractures.
Slightly	Fractures stained, discoloration may extend into rock 1", some soil in fractures.
Moderately	Significant portions of rock stained and discolored, soil in fractures, loss of strength.
Highly	Entire rock discolored and dull except quartz grains, severe loss of strength.
Complete	Weathered to a residual soil.

BEDDING:		FRACTURE SPACING:		RQD:	
Massive	> 40"	Massive/V. Wide	> 6'	Excellent	> 90%
Thick	12' – 40"	Thick/Wide	2' – 6'	Good	76% – 90%
Medium	4" – 12"	Med./Med.	8" – 24"	Fair	51% – 75%
Thin	< 4"	Thin/Close	2 1/2" – 8"	Poor	25% – 50%
		V. Thin/V. Close	< 2 1/2"	V. Poor	< 25%

TABLE 6
WELL CONSTRUCTION

SOLID PVC PIPE	
SCREENED PVC PIPE	BENTONITE PLUG
STAINLESS STEEL SCREENED PIPE	AIR ENTRAINED CEMENT
FINE GRAINED WASHED SAND	NATURAL SOIL/ ROCK FILL
WASHED SAND	BENTONITE/ CEMENT GROUT

William Paterson University Athletic Field Study
SUBSURFACE LOG
HOLE NUMBER B-1

PROJECT NUMBER: 30059.1001.32000

LOCATION: Wayne, New Jersey	DRILL FLUID: Water @ 4'
CLIENT: William Paterson University of New Jersey	DRILLING METHOD: 4" FJC
CONTRACTOR: Craig Test Boring	HAMMER TYPE: Automatic
DRILLER: R. Warden	ROD SIZE: NW
INSPECTOR: J. King	DRILL RIG TYPE & MODEL: Rubber Track ATV, CME 850
START DATE and TIME: 6/17/2015 11:45:00 AM	
FINISH DATE and TIME: 6/17/2015 12:15:00 PM	
SURFACE ELEV: 456.00 (ft; Estimated)	CHECKED BY: S. Doehla

WATER LEVEL OBSERVATIONS	DATE	TIME	READING TYPE	WATER DEPTH (ft)	CASING BOTTOM (ft)	HOLE BOTTOM (ft)
	6-17-15	12:15 PM	During Drilling	None	4	5

SAMP./CORE NUMBER	SAMP. ADV. (ft) LEN. CORE (ft)	RECOVERY (ft)	Blows Per 6" on Split Spoon Sampler	"N" Value or RQD%	SAMPLE	DEPTH (Feet)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEVATION (Feet)	Remarks on Character of Drilling, Water Return, etc.	WATER LEVELS AND/OR WELL DATA
								TOPSOIL		Groundwater observations made during drilling may not represent static conditions.	
S-1	2	1.5	4-7-4-8	11				**SILT**, Some f. Sand, Some f.c. Gravel, brown, medium compact, moist **(FILL)**		Photoionization Detector Reading (PID) = 0.0 PPM for all samples/	
						2		**Similar Soil** **(FILL)**	454		
S-2	2	0.5	15-15-21-19	36				**c. GRAVEL**, (Cobble fragment)		PID = 0.0 PPM Cobble present during sampling from 2 feet to 4 feet.	
S-3	0.7	0.6	10-100/2"	R		4		**f.m.c. SAND**, Some f.c. Gravel, trace silt, brown, very compact, moist **(SP)**	452	PID = 0.0 PPM Split spoon refusal at 4.66 feet.	
								End of Boring at 5 ft		Roller-bit refusal at 5 feet interpreted as top of bedrock.	
						6			450		
						8			448		
						10			446		
						12			444		

PROJECT NUMBER: 30059.1001.32000

William Paterson University Athletic Field Study

SUBSURFACE LOG

HOLE NUMBER B-2

LOCATION: Wayne, New Jersey	DRILL FLUID: Water @ 4'
CLIENT: William Paterson University of New Jersey	DRILLING METHOD: 4" FJC
CONTRACTOR: Craig Test Boring	HAMMER TYPE: Automatic
DRILLER: R. Warden	ROD SIZE: NW
INSPECTOR: J. King	DRILL RIG TYPE & MODEL: Rubber Track ATV, CME 850
START DATE and TIME: 6/17/2015 10:00:00 AM	
FINISH DATE and TIME: 6/17/2015 11:00:00 AM	
SURFACE ELEV: 457.40 (ft; Estimated)	CHECKED BY: S. Doehla

WATER LEVEL OBSERVATIONS	DATE	TIME	READING TYPE	WATER DEPTH (ft)	CASING BOTTOM (ft)	HOLE BOTTOM (ft)
	6-17-15	11:00 AM	During Drilling	None	10	12

SAMP./CORE NUMBER	SAMP. ADV. (ft) LEN. CORE (ft)	RECOVERY (ft)	Blows Per 6" on Split Spoon Sampler	"N" Value or RQD%	DEPTH (Feet)	DESCRIPTION AND CLASSIFICATION	ELEVATION (Feet)	Remarks on Character of Drilling, Water Return, etc.	WATER LEVELS AND/OR WELL DATA
					0	**TOPSOIL**			
						f. SAND, And Silt, brown, medium compact, moist **(FILL)**			
S-1	2	1	3-9-14-11	23			456	Photoionization Detector Readings (PID) = 2.3 PPM	
					2	Becomes very compact **(FILL)**			
S-2	2	1.2	65-123-15-9	R			454	PID = 0.0 PPM	
					4	**f.m. SAND**, trace silt **(SP)**			
S-3	2	0.8	11-10-11-9	21		**SILT**, Some f. Sand, Some f.c. Gravel, brown, medium compact, moist **(SM)**	452	PID = 0.0 PPM	
					6	**Clayey SILT**, trace f. sand, dark gray, loose, moist **(ML)**		Groundwater observations made during drilling may not represent static conditions.	
S-4	2	0.7	6-4-4-3	8			450	PID = 0.0 PPM	
					8	**Clayey SILT**, Some f. Sand, little f.c gravel, dark gray, compact, moist **(ML)**			
S-5	2	1.3	11-10-35-32	45		**f. SAND**, And Silt, Some f.c. Gravel, brown, compact, moist **(SM)**	448	PID = 0.0 PPM	
					10	Become very compact **(SM)**			
S-6	2	1	51-32-32-30	64			446	PID = 0.0 PPM	
					12	End of Boring at 12 ft			
							444		

PROJECT NUMBER: 30059.1001.32000

William Paterson University Athletic Field Study

SUBSURFACE LOG

HOLE NUMBER B-3

LOCATION: Wayne, New Jersey	DRILL FLUID: Water
CLIENT: William Paterson University of New Jersey	DRILLING METHOD: 4" FJC
CONTRACTOR: Craig Test Boring	HAMMER TYPE: Automatic
DRILLER: R. Warden	ROD SIZE: NW
INSPECTOR: J. King	DRILL RIG TYPE & MODEL: Rubber Track ATV, CME 850
START DATE and TIME: 6/18/2015 10:50:00 AM	
FINISH DATE and TIME: 6/18/2015 12:00:00 PM	
SURFACE ELEV: 457.20 (ft; Estimated)	CHECKED BY: S. Doehla

WATER LEVEL OBSERVATIONS

DATE	TIME	READING TYPE	WATER DEPTH (ft)	CASING BOTTOM (ft)	HOLE BOTTOM (ft)
6-18-15	12:00 PM	During Drilling	3.9	0	4

SAMP./CORE NUMBER	SAMP. ADV. (ft) LEN. CORE (ft)	RECOVERY (ft)	Blows Per 6" on Split Spoon Sampler	"N" Value or RQD%	DEPTH (Feet)	DESCRIPTION AND CLASSIFICATION	ELEVATION (Feet)	Remarks on Character of Drilling, Water Return, etc.
					0	**TOPSOIL**	457.2	Photoionization Detector Reading (PID) = 0.2 PPM
S-1	2	1.2	2-12-15-14	27		**SILT**, c.m.f. Sand, little c.f. gravel, little silt **(SM)**	456	
					2	Becomes wet **(SM)**		PID = 0.4 PPM
S-2	2	0.8	17-11-19-20	30			454	Groundwater observations made during drilling may not represent static conditions.
					4	**Similar Soil**, with cobble fragments **(SM)**		PID = 0.3 PPM
S-3	2	0.7	30-36-41-57	77			452	
					6	**Similar Soil** **(SM)**		PID = 0.0 PPM
S-4	1.5	0.7	48-50-46-100/5.5"	96			450	
					8	End of Boring at 8 ft		Split spoon refusal at 7.9 feet. Roller-bit refusal at 8 feet interpreted as top of bebrock.

William Paterson University Athletic Field Study
SUBSURFACE LOG
HOLE NUMBER B-4

PROJECT NUMBER: 30059.1001.32000

LOCATION: Wayne, New Jersey	DRILL FLUID: Water @ 4'
CLIENT: William Paterson University of New Jersey	DRILLING METHOD: 4" FJC
CONTRACTOR: Craig Test Boring	HAMMER TYPE: Automatic
DRILLER: R. Warden	INSPECTOR: J. King
START DATE and TIME: 6/18/2015 8:40:00 AM	ROD SIZE: NW
FINISH DATE and TIME: 6/18/2015 10:20:00 AM	DRILL RIG TYPE & MODEL: Rubber Track ATV, CME 850
SURFACE ELEV: 455.50 (ft; Estimated)	CHECKED BY: S. Doehla

WATER LEVEL OBSERVATIONS	DATE	TIME	READING TYPE	WATER DEPTH (ft)	CASING BOTTOM (ft)	HOLE BOTTOM (ft)
	6-18-15	8:40 AM	During Drilling	None	20	22

SAMP./CORE NUMBER	SAMP. ADV. (ft) LEN. CORE (ft)	RECOVERY (ft)	Blows Per 6" on Split Spoon Sampler	"N" Value or RQD%	DEPTH (Feet)	DESCRIPTION AND CLASSIFICATION	ELEVATION (Feet)	Remarks on Character of Drilling, Water Return, etc.	WATER LEVELS AND/OR WELL DATA
					0	**SILT**, Some f. Sand, Some f.c. Gravel, dark brown, medium compact, moist **(SM)**			
S-1	2	1	6-7-23-26	30			454	Photoionization Detector Reading (PID) = 0.0 PPM	
					2	**Similar Soil (SM)**			
						SILT, Some f. Sand, trace f. gravel, gray, medium compact, moist **(ML)**			
S-2	2	0.7	31-14-16-10	30			452	PID = 0.4	
					4	No Recovery			
S-3	2	0	8-3-3-2	6			450		
					6	**SILT**, trace f. sand, gray, loose, moist **(ML)**		PID = 0.4 PPM	
S-4	2	0.6	4-4-4-3	8			448		
					8	**SILT**, Some f. Gravel, trace f. sand, dark gray, medium compact, moist **(ML)**		PID = 0.0 PPM	
S-5	2	0.7	2-6-6-2	12			446		
					10	No Recovery		PID = 0.2 PPM	
S-6	2	0	3-2-3-4	5			444		
					12				
							442		

PROJECT NUMBER: 30059.1001.32000

William Paterson University Athletic Field Study
SUBSURFACE LOG
HOLE NUMBER B-4

SAMP./CORE NUMBER	SAMP. ADV. (ft) LEN. CORE (ft)	RECOVERY (ft)	Blows Per 6" on Split Spoon Sampler	"N" Value or RQD%	SAMPLE	DEPTH (Feet)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEVATION (Feet)	Remarks on Character of Drilling, Water Return, etc.	WATER LEVELS AND/OR WELL DATA
S-7	2	0.4	11-4-6-5	10		16		**SILT**, Some f. Sand, brown, loose, moist **(ML)**	440	PID = 0.2 PPM	
						18			438		
S-8	2	0.8	6-7-7-15	14		20		**SILT**, Some f. Sand, Some f. Gravel, medium compact, moist **(SM)**	436	PID = 0.0 PPM Groundwater observations made during drillingm ay not represent static conditions.	
						22		End of Boring at 22 ft	434		
						24			432		
						26			430		
						28			428		
						30			426		

PROJECT NUMBER: 30059.1001.32000

William Paterson University Athletic Field Study
SUBSURFACE LOG
HOLE NUMBER B-6

LOCATION: Wayne, New Jersey	DRILL FLUID: Water
CLIENT: William Paterson University of New Jersey	DRILLING METHOD: 4" FJC
CONTRACTOR: Craig Test Boring	HAMMER TYPE: Automatic
DRILLER: R. Warden	ROD SIZE: NW
INSPECTOR: J. King	DRILL RIG TYPE & MODEL: Rubber Track ATV, CME 850
START DATE and TIME: 6/17/2015 2:20:00 PM	
FINISH DATE and TIME: 6/17/2015 3:10:00 PM	
SURFACE ELEV: 466.00 (ft; Estimated)	CHECKED BY: S. Doehla

WATER LEVEL OBSERVATIONS	DATE	TIME	READING TYPE	WATER DEPTH (ft)	CASING BOTTOM (ft)	HOLE BOTTOM (ft)
	6-17-15	3:10 PM	During Drilling	None	8	10

SAMP./CORE NUMBER	SAMP. ADV. (ft) LEN. CORE (ft)	RECOVERY (ft)	Blows Per 6" on Split Spoon Sampler	"N" Value or RQD%	DEPTH (Feet)	DESCRIPTION AND CLASSIFICATION	ELEVATION (Feet)	Remarks on Character of Drilling, Water Return, etc.	WATER LEVELS AND/OR WELL DATA
					0	**f. SAND**, Some Silt, brown/gray, very loose, moist **(SM)**	466	Groundwater observations made during drilling may not represent static conditions.	
S-1	2	1	2-2-2-4	4	1	**SILT**, trace f. sand, dark gray, loose, moist **(ML)**			
					2	Becomes medium stiff **(ML)**	464	Photoionization Detector Reading (PID) = 0.0 PPM for all samples	
S-2	2	0.5	2-3-2-12	5					
					4	**SILT**, Some f. Sand , Some f.c. Gravel, dark gray, compact, moist **(SM)**	462	PID= 0.0 ppm	
S-3	2	0.5	10-13-22-31	35					
					6	**SILT**, And f. Sand, Some f.c. Gravel, gray, compact, moist **(SM)**	460	PID= 0.0 ppm	
S-4	2	1.2	29-17-14-26	31					
					8	**Similar Soil** **(SM)**	458	PID= 0.0 ppm	
S-5	1.6	1.3	10-15-22-100/1"	37				Split spoon refusal at 9.6 feet.	
					10	End of Boring at 10 ft	456	Roller-bit refusal at 10 feet interpreted as top of bedrock.	
					12		454		

PROJECT NUMBER: 30059.1001.32000

William Paterson University Athletic Field Study
SUBSURFACE LOG
HOLE NUMBER B-7

LOCATION: Wayne, New Jersey		DRILL FLUID: Mud Rotary	DRILLING METHOD: 4" FJC
CLIENT: William Paterson University of New Jersey		HAMMER TYPE: Automatic	ROD SIZE: NW
CONTRACTOR: Craig Test Boring		DRILL RIG TYPE & MODEL: Rubber Track ATV, CME 850	
DRILLER: R. Warden	INSPECTOR: J. King		
START DATE and TIME: 6/17/2015 1:15:00 PM			
FINISH DATE and TIME: 6/17/2015 1:50:00 PM			
SURFACE ELEV: 456.00 (ft; Estimated)	CHECKED BY: S. Doehla		

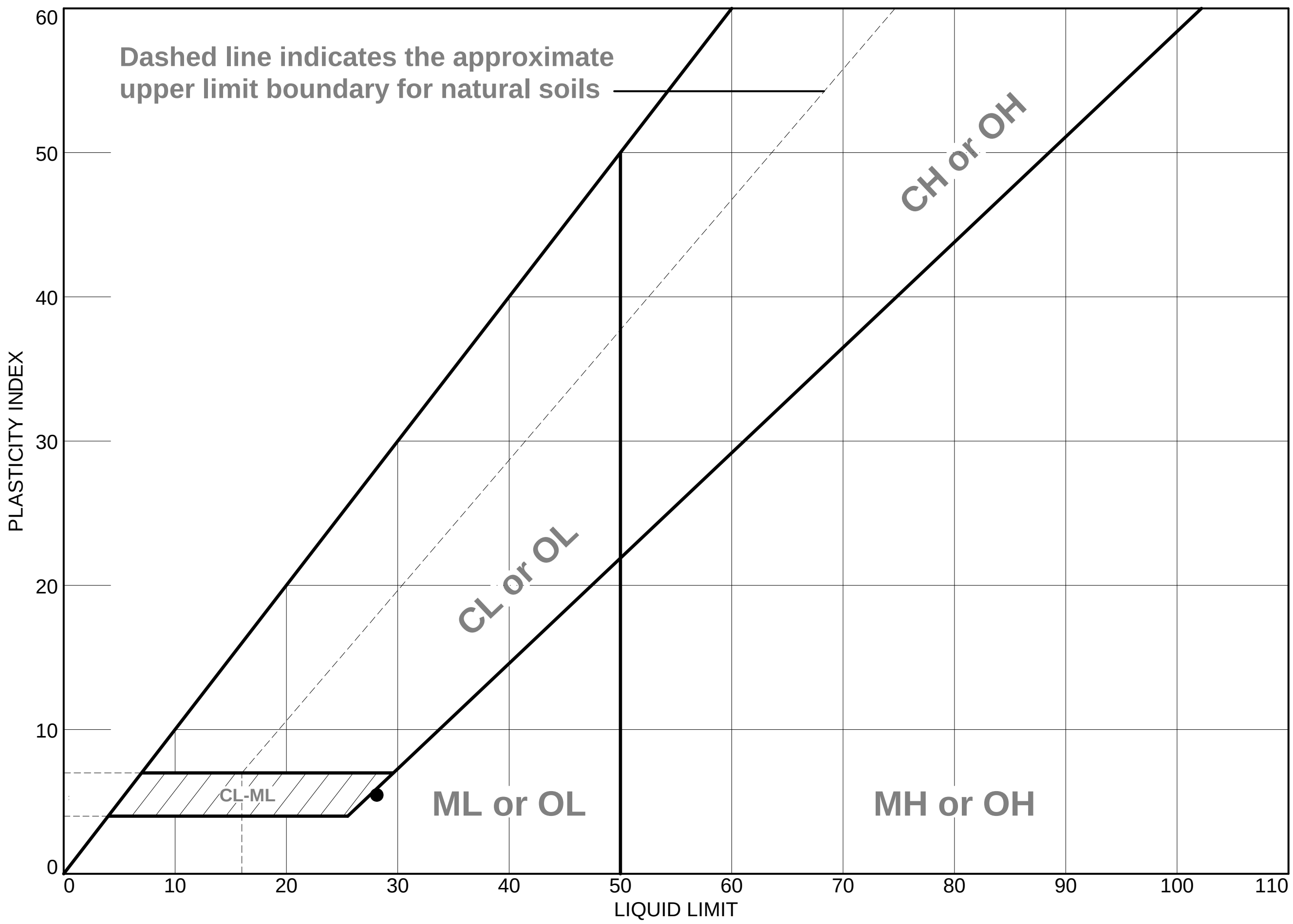
WATER LEVEL OBSERVATIONS	DATE	TIME	READING TYPE	WATER DEPTH (ft)	CASING BOTTOM (ft)	HOLE BOTTOM (ft)
	6-17-15	3:50 PM	During Drilling	None	4	6

SAMP./CORE NUMBER	SAMP. ADV. (ft) LEN. CORE (ft)	RECOVERY (ft)	Blows Per 6" on Split Spoon Sampler	"N" Value or RQD%	SAMPLE	DEPTH (Feet)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEVATION (Feet)	Remarks on Character of Drilling, Water Return, etc.	WATER LEVELS AND/OR WELL DATA
								TOPSOIL		Groundwater observations made during drilling may not represent static conditions. Photoionization Detector Reading (PID) = 0.0 PPM for all samples	
S-1	2	0.7	5-4-5-10	9				**f. GRAVEL**, trace f.m.c. sand, gray, loose, moist **(FILL)**			
						2		Becomes medium compact **(FILL)**	454		
S-2	2	0.7	7-5-11-15	16				**f. SAND**, Some Silt, trace f. gravel, brown, medium compact, moist **(SM)**		PID = 0.0 PPM	
						4		Becomes compact **(SM)**	452		
S-3	1.9	0.8	14-23-23-100/5"	46						PID = 0.0 PPM	
										Split spoon refusal at 5.9 feet.	
						6		End of Boring at 6 ft	450	Roller-bit refusal at 6 feet interpreted as top of bedrock.	
						8			448		
						10			446		
						12			444		

APPENDIX D

Laboratory Test Results

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●		28.2	22.8	5.4			

Project No. ST15-067 **Client:** CHA Companies

Project: William Paterson University Athletic Field - Wayne, NJ

CHA # 30059.1001.42000

●**Location:** B-2 **Sample Number:** S-4

Remarks:

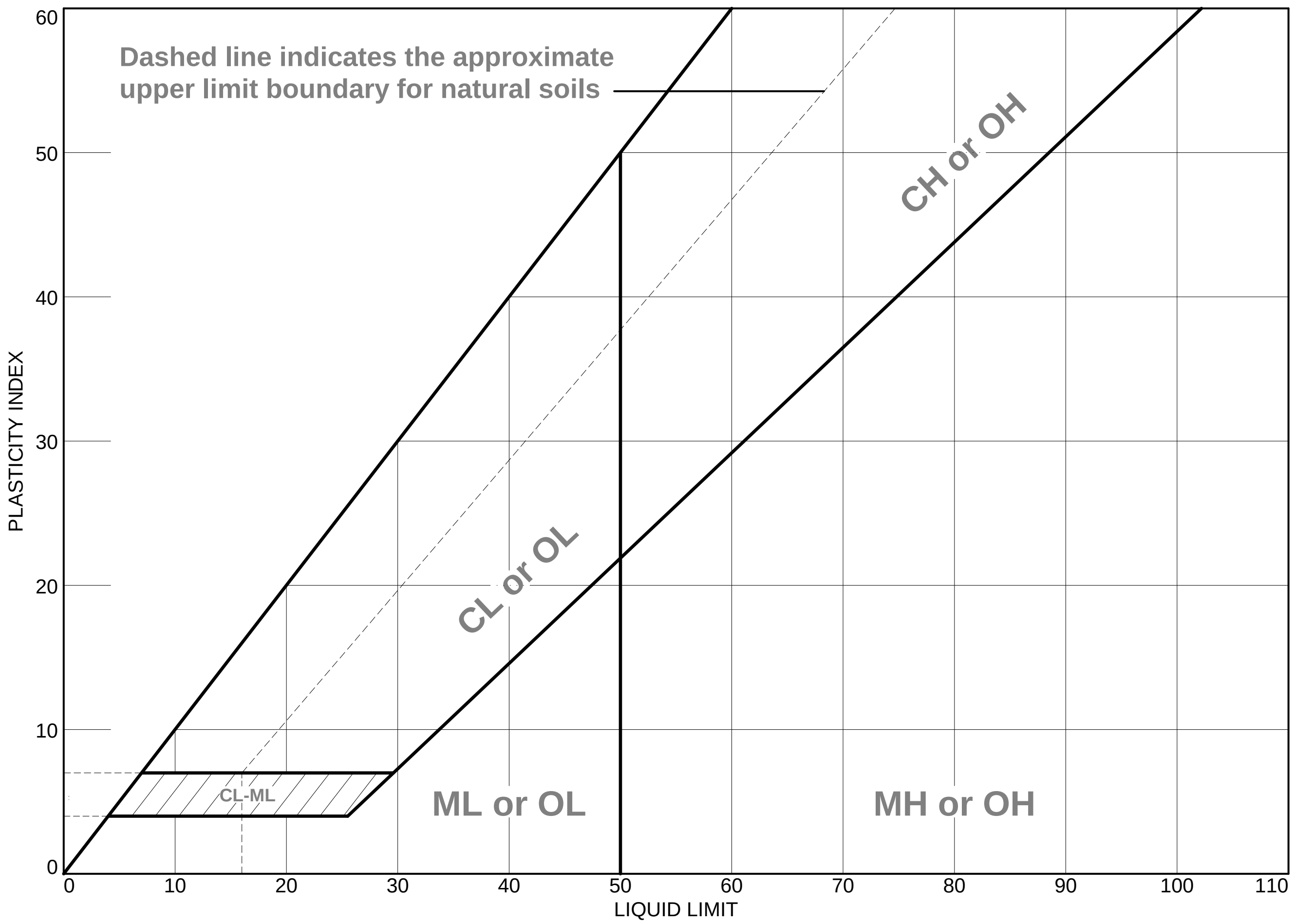
●Water Content: 17.1 %

QCQA Laboratories, Inc.

Schuylerville, NY

Figure 15-333

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●		NV	NP	NP			

Project No. ST15-067 **Client:** CHA Companies

Project: William Paterson University Athletic Field - Wayne, NJ

CHA # 30059.1001.42000

●**Location:** B-4 **Sample Number:** S-7

Remarks:

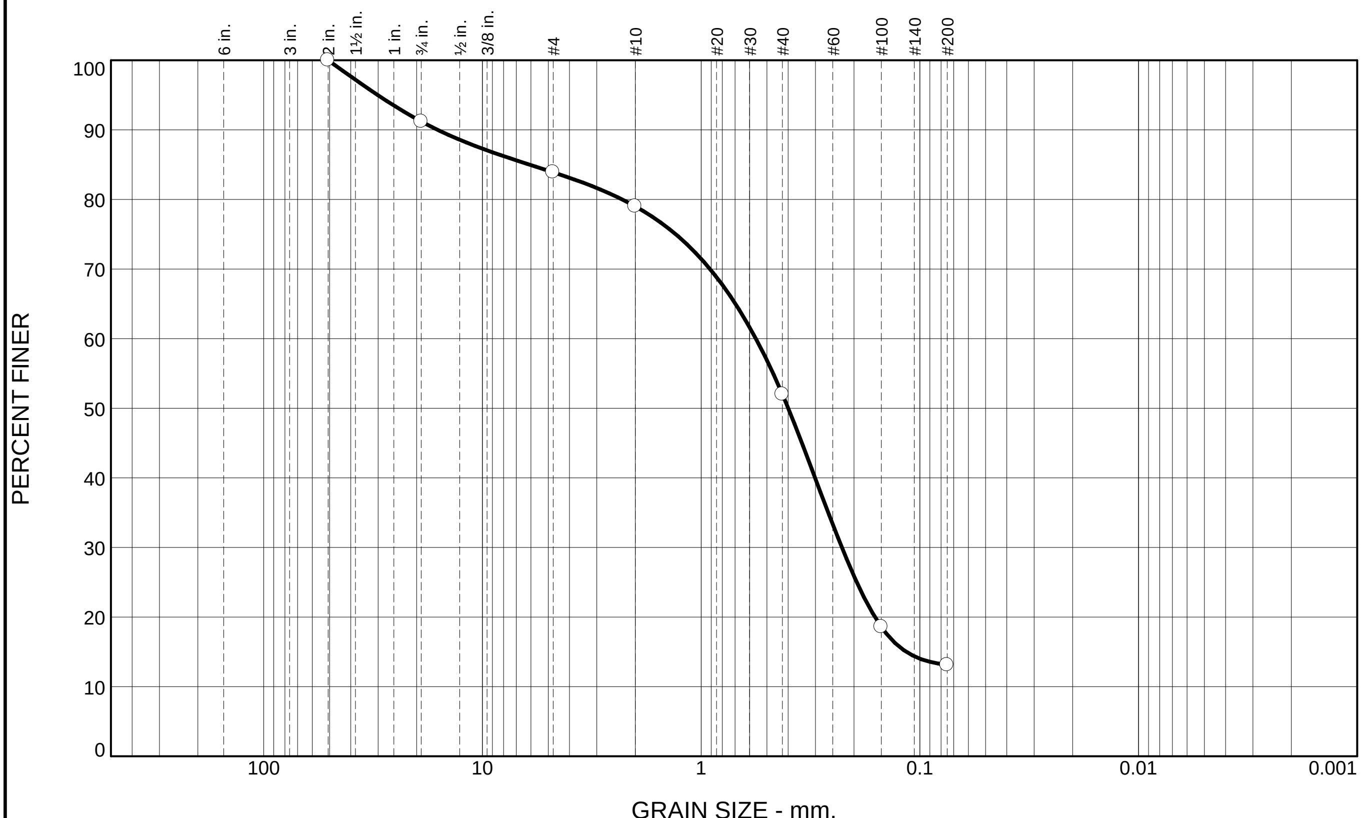
●Water Content: 13.7 %

QCQA Laboratories, Inc.

Schuylerville, NY

Figure 15-334

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	8.8	7.3	4.9	27.0	38.9	13.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2	100.0		
.75	91.2		
#4	83.9		
#10	79.0		
#40	52.0		
#100	18.6		
#200	13.1		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 16.0285 D_{85}= 6.0879 D_{60}= 0.5619
D_{50}= 0.3998 D_{30}= 0.2271 D_{15}= 0.1152
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Water Content: 9.4 %

Location: B-3
Sample Number: S-1

Date: 8/6/15

QCQA Laboratories, Inc.

Schuylerville, NY

Client: CHA Companies
Project: William Paterson University Athletic Field - Wayne, NJ
CHA # 30059.1001.42000
Project No: ST15-067

Figure 15-335