GEOTECHNICAL REPORT

Malcom Randall VA Medical Center
Boiler Building

Prepared by:

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SDVOSB
Service Disabled Veteran Owned Small Business
CVE

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Attachment A:
- Soil Boring Logs (3)
- Boring Location Plan
- Key to Soil Boring Logs
- Field Exploration Procedures
- Key to Soil Classification (Unified Soil Classification System)

1.0 PROJECT INFORMATION

1.1 General

The Malcom Randall VA Medical Center (hereinafter referred to as the 'VA') requested a study to determine the best approach to replace their existing, aged steam boiler plant. Gator Engineering & Aquifer Restoration (GEAR), with Cape Design Engineering Company (CDE) as its team partner, was contracted to accomplish this study.

The recommendation was made to provide a new building with two levels that houses boilers and auxiliary equipment as well as piping, locker rooms, control room and a storage room, space for electrical panels service, fuel oil pumps and piping, natural gas piping and controls, make up water piping, condensate piping, and control panels. The preferred location was Location 2A, this geotechnical study was performed in this location.

1.2 Project Description

The Malcom Randall VA Medical Center is located at 1601 SW Archer Road in Gainesville, Florida. The site (Location 2A) for the planned Boiler Building is located in the back section of the Center off of SW 16th Avenue. The general site location is shown on the Boring Location Plan figure in **Attachment A**.

The proposed project includes the construction of a two-story structure to house the boiler plant. No specific building details are known as this geotechnical exploration is part of a feasibility study to explore for potential issues on this specific site. Therefore, it is assumed the structure will consist of load bearing masonry walls with steel interior and exterior columns and a poured-in-place concrete slab-on-grade first floor. Also assumed is the column, wall, and floor loads will not exceed 100 kips, 5 kips per linear foot (klf) and 200 pounds per square foot (psf), respectively. Finally, it is assumed the building area will be supported on less than 2 feet of fill above the presently existing ground surface.

Trucks will access the boiler plant on a regular basis; therefore, it is assumed that a heavy-duty pavement section will be necessary, and will consist of either a flexible (asphalt) or rigid (concrete) pavement section. The anticipated frequency and typical loading of the trucks is not known at this time.

If actual project information varies from these conditions, then the recommendations in this report may need to be re-evaluated. Any changes in these conditions should be provided so the need for re-evaluation of our recommendations can be assessed prior to final design.

2.0 FIELD EXPLORATION

A field exploration was performed on July 7, 2012, based on a copy of an aerial plan that showed the approximate location of the boiler building. This plan was modified to show the approximate location of the borings and is included as the Boring Location Plan figure in **Attachment A**. The boring locations were determined in the field by our personnel referencing the existing parking areas and adjacent buildings roadways; thus, the attached figure should be considered approximate.

2.1 SPT and Auger Borings

To explore the subsurface conditions within the area of the proposed structure, three Standard Penetration Test (SPT) borings were located and performed. The borings were advanced to depths of approximately 25 and 35 feet below the existing ground surface. The upper 4 to 5 feet of each boring was advanced with a hand-held bucket auger due to the potential presence of utilities in this area. The remainder of each boring was advanced in general accordance with the methodology outlined in ASTM D 1586. The auger and split-spoon soil samples recovered during performance of the borings were visually described in the field by the field crew, and representative portions of the samples were transported to our laboratory for further evaluation. A summary of the field procedures is included in **Attachment A**.

3.0 LABORATORY TESTING

Representative soil samples obtained during the field exploration were visually classified by a geotechnical engineer using the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. A Key to the Soil Classification System is included in **Attachment A**.

Quantitative laboratory testing was performed on selected soil samples encountered during the field exploration. The purpose of this testing was to better define the composition of the soils encountered, and to provide data for correlation to their anticipated strength and compressibility characteristics. The laboratory testing determined the natural moisture content, percent fines (percent passing the US No. 200 Sieve) and Atterberg Limits (Liquid Limit and Plasticity Index) of the selected soil samples. These results are shown on the Log of Boring records at the respective depths from which the tested samples were recovered.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 General Soil Profile

Detailed boring records are included in **Attachment A**. When reviewing these records, it should be understood that the soil conditions will vary between the boring locations. The following paragraph summarizes the soil conditions encountered.

Borings SB-1 and SB-3 encountered the parking area surficial pavement layer consisting of an asphalt surface layer, about 2 inches thick, underlain by an 11-inch thick limerock base layer. Boring SB-2 was located in the unpaved area between the parking areas and encountered a surfical layer of fine sands (SP) with trace amounts of roots. Below the surficial pavement and sand layers were generally fine sands with silt (SP-SM) and silty sands (SM) that were encountered to a depth of about 13 feet in a dense to very dense state. Underlying the silty soil strata was generally loose to medium dense, clayey to very clayey fine sands (SC) to the terminating depth of the shallower borings of 25 feet. Strata of dense to very dense fine sands with silt (SP-SM) and silty fine sands (SM) were occasionally encountered within this general stratum. The clayey to very clayey sand stratum continued to a depth of about 28 feet in the deeper boring, underlain by stiff sandy clays (CH) through the terminating depth of 35 feet.

4.2 Groundwater Level

The groundwater level was not encountered within the depths explored at the boring locations. However, that does not mean that groundwater does not exist at these locations. It should be anticipated that groundwater levels will fluctuate seasonally and with changes in climate. In addition, it is possible that groundwater may perch on top of the shallow silty sands following rain events due to their relatively slow permeability. Therefore, groundwater may be encountered within the depths explored at these locations at some time in the future. As such, we recommend that the groundwater table be verified prior to construction.

4.3 Review of Soil Survey Map

The results of a review of the USDA Natural Resource Conservation Service (NRCS) Web Soil Survey of Alachua County are shown in the table below. The soil map units identified by the Soil Survey at the site are the Arrendondo-Urban land complex, 0 to 5 percent slopes, and the Urban land-Millhopper Complex. Each soil map unit number, soil type, drainage class, frequency of ponding/flooding, hydrologic group, and estimated seasonal high groundwater levels reported in the Soil Survey are as follows:

Soil No.	Soil Type	Drainage Class	Frequency of Ponding/Flooding	Hydrologic Group	Depth to the Water Table (inches)
4	Arrendondo-Urban land complex, 0 to 5 percent slopes	Well Drained	None	A	> 80 inches
45	Urban land-Millhopper complex	Moderately Well Drained	None	---	42 to 72

The "Water table" above refers to a saturated zone in the soil that occurs during specified months. Estimates of the upper limit shown in the Web Soil Survey are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

4.4 Normal Seasonal High Groundwater Level

In general, the seasonal high groundwater level is affected by a number of factors, including the amount of impervious surface area in the site vicinity, the drainage characteristics of the soils, the land surface elevation, relief points such as canals, drainage ditches, swamp areas, etc., and distance to relief points. At this site, the soil borings did not encounter the groundwater level within the depths explored, or 25 to 35 feet below existing grade. Based on the seasonal high water levels presented by the Soil Survey as shown in the table above, it is our opinion that the groundwater level at this site is being influenced significantly by factors caused by the development of the area. Therefore, we recommend installing piezometers within the project area to measure groundwater levels over time so that a reasonable estimate of the seasonal high groundwater level can be made.

5.0 DESIGN RECOMMENDATIONS

5.1 General

The following evaluation and recommendations are based on the assumed project information as presented in this report, the results of the field exploration and laboratory testing performed, and the construction techniques recommended in Section 7.0 below. If the assumed project conditions are incorrect or changed after this report, or subsurface conditions encountered during construction are different from those reported, we should be notified so these recommendations can be re-evaluated and revised, if necessary. It is recommend that the foundation plans and earthwork specifications be reviewed by a geotechnical engineer to verify that the recommendations in this report have been properly interpreted and implemented.

5.2 Foundation Design Recommendations

Based on the results of this exploration, the subsurface conditions at the site are considered adaptable for support of the proposed structure when constructed on a properly designed shallow foundation system, provided the site preparation and earthwork construction recommendations outlined in Section 6.0 of this report are performed, the following parameters may be used for foundation design.

5.2.1 Bearing Pressure

The maximum allowable net soil bearing pressure for use in shallow foundation design should not exceed 2,000 psf. Net bearing pressure is defined as the soil bearing pressure at the foundation bearing level in excess of the natural overburden pressure at that level. The foundations should be designed based on the maximum load that could be imposed by all loading conditions.

5.2.2 Foundation Size

The minimum widths recommended for any isolated column footings and continuous wall footings are 24 inches and 18 inches, respectively. Even though the maximum allowable soil bearing pressure may not be achieved, these width recommendations should control the size of the foundations.

5.2.3 Bearing Depth

The exterior foundations should bear at a depth of at least 24 inches below the exterior final grades, and the interior foundations should bear at a depth of at least 24 inches below the finish floor elevation to provide confinement to the bearing level soils. It is recommended that stormwater be diverted away from the building exterior to reduce the possibility of erosion beneath the exterior footings.

5.2.4 Bearing Material

The foundations may bear in either the compacted suitable natural soils or compacted structural fill. The bearing level soils, after compaction, should exhibit densities equivalent to 95 percent of the modified Proctor maximum dry density (ASTM D 1557), to a depth of at least one foot below the foundation bearing levels.

5.2.5 Settlement Estimates

Post-construction settlements of the structure will be influenced by several interrelated factors, such as: 1) subsurface stratification and strength/compressibility characteristics; 2) footing size, bearing level, applied loads, and resulting bearing pressures beneath the foundations; and 3) site preparation and earthwork construction techniques used by the contractor. Settlement estimates for the structure are based on the use of site preparation/earthwork construction techniques as recommended in Section 6.0 of this report. Any deviation from these recommendations could result in an increase in the estimated post-construction settlements of the structure.

Due to the sandy nature of the near-surface soils, the majority of settlement is expected to occur in an elastic manner and fairly rapidly during construction. Using the recommended maximum bearing pressure, the supplied/assumed maximum structural loads, and the field and laboratory test data that have been correlated to geotechnical strength and compressibility characteristics of the subsurface soils, it is estimated that total settlements of the structure could be on the order of one inch or less.

Differential settlements result from differences in applied bearing pressures and variations in the compressibility characteristics of the subsurface soils. Because of the general uniformity of the subsurface conditions and the recommended site preparation and earthwork construction techniques outlined in Section 6.0, anticipated differential settlements of the structure should be within tolerable magnitudes.

5.2.6 Floor Slab

The concrete poured-in-place floor slab can be constructed as a slab-on-ground, provided unsuitable material is removed and replaced with compacted structural fill as outlined in Section 6.0. The recommend modulus of subgrade reaction of 200 pci should be used for design of the floor slab. It is recommended that the floor slab bearing soils be covered with an impervious membrane to reduce moisture entry and floor dampness. A 6-mil thick plastic membrane is commonly used for this purpose. Care should be exercised not to tear large sections of the membrane during placement of reinforcing steel and concrete. In addition, it is recommend that a minimum separation of 2 feet be maintained between the finished floor levels and the estimated normal seasonal high groundwater level.

5.2.7 Soil Properties for Wall Backfill

Understanding that there may be an underground aspect of this structure that will require a retaining wall, It is our opinion that the foundation soils are suitable to support a retaining wall to a depth of about 10 feet. However, the silty soils encountered beginning at a depth of 4 to 5 feet below existing grade may be difficult to excavate and compact at the foundation bearing elevation. Therefore, excavation of these soils to a depth of 12 to 24 inches and replacement of suitable sand backfill may be necessary. Preliminarily, the wall foundations may be designed for the net allowable soil bearing pressure given above; however, once the final wall design details are known, a geotechnical engineer should be consulted to provide final recommendations for foundation design and construction.

In general, walls that have adjacent compacted fill will be subjected to lateral earth pressures. Walls that are restrained at the top and bottom will be subjected to at-rest soil pressures, while walls that are not restrained at the top, and where sufficient movement is anticipated, will be subjected to active earth pressures. Surcharge effects for sloped backfill, point or area loads behind the walls, and adequate drainage provisions should be incorporated in the wall design. Passive resistance, resulting from footing embedment at the wall toe, could be neglected for safer design.

The following soil parameters are recommended to be used in design of the wall(s) for the project:

- Retained Soil Unit Weight, Saturated (γ_{sat}) = 120 pcf
- Retained Soil Unit Weight, Moist (γ_m) = 110 pcf
- Retained Soil Angle of Internal Friction (ø) = 30 degrees
- Coefficient of Active Earth Pressure, k_a = 0.33
- Coefficient of Passive Earth Pressure, k_p = 3.0
- Coefficient of At-Rest Earth Pressure, k_o = 0.5
- Foundation Soil Unit Weight, Moist (γ_m) = 115 pcf
- Foundation Soil Unit Weight, Saturated (γ_{sat}) = 125 pcf
- Foundation Soil Angle of Internal Friction (ø) = 30 degrees

The above parameters are based on clean sand backfill (SP) placed behind the wall, and compaction of the wall foundation soils as discussed in Section 6.5. A coefficient of friction for poured in-place concrete of 0.45 may be used in the wall design.

It is recommend that the retaining walls earth pressure analysis include slope stability, overturning about the toe, sliding of the base of the wall and a check that the resulting vertical pressure against the base of the retaining wall (i.e., the retaining wall footing) is within the middle-one-third of the base. The walls should be designed to include all temporary construction and permanent traffic and surcharge loads acting on the walls

5.3 Pavement Considerations

Based on the results of the exploration, the subsurface conditions at the site are considered favorable for support of a heavy-duty flexible or rigid pavement section when constructed on properly prepared subgrade soils as outlined in Section 6.0 of this report. Typical pavement sections used to support truck traffic are shown on the following table. If requested, a project-specific pavement design can be prepared if specific traffic data is provided.

TYPICAL PAVEMENT SECTION	
Pavement Layer	**Heavy-Duty Truck Areas**
Asphaltic Concrete Wearing Surface	2.0"
Limerock Base (1)	8.0"
Stabilized Subgrade (1)	12.0"
(1) Groundwater should be maintained at least 2.5 feet below the pavement surface.	

CONCRETE TYPICAL PAVEMENT SECTION	
Pavement Layer	**Heavy-Duty Truck Areas**
Concrete Wearing Surface	6"
Stabilized Subgrade (1)	6.0"
(1) Groundwater should be maintained at least 2.5 feet below the pavement surface.	

5.3.1 Wearing Surface

The wearing surface should consist of Florida Department of Transportation (FDOT) Type S asphaltic concrete having a minimum Marshall Stability of 1,500 lbs. Concrete pavement should have a minimum 28-day strength of 3,000 psi. Specific requirements for Type S asphaltic concrete wearing surface are outlined in the latest edition of the *Florida Department of Transportation, Standard Specifications for Road and Bridge Construction.*

5.3.2 Base and Subgrade

The limerock base course should have a minimum Limerock Bearing Ratio (LBR) of 100 and should be compacted to 98 percent of the modified Proctor maximum dry density (AASHTO T-180) value.

The subgrade material should have a minimum LBR of 40 and be compacted to 98 percent of the modified Proctor maximum dry density (AASHTO T-180) value.

6.0 SITE PREPARATION AND EARTHWORK RECOMMENDATIONS

Site preparation as outlined in this section should be performed to provide more uniform foundation bearing conditions, to reduce the potential for post-construction settlements of the planned structure(s) and to maintain the integrity of a flexible pavement section.

6.1 Clearing and Stripping

Prior to construction, the location of existing underground utility lines within the construction area should be established. Provisions should then be made to relocate interfering utilities to appropriate locations. It should be noted that, if underground pipes are not properly removed or plugged, they may serve as conduits for subsurface erosion, which may subsequently lead to excessive settlement of overlying structures.

The "footprint" of the proposed building plus a minimum additional margin of 5 feet, and of the hardscape areas (parking/driveway) plus a minimum additional margin of 3 feet, should be stripped of all existing pavement layers (asphalt surface and limerock base) as well as surface vegetation, stumps, debris, organic topsoil, or other deleterious materials. During grubbing operations, roots with a diameter greater than 0.5-inch, stumps, or small roots in a concentrated state, should be grubbed and completely removed.

Based on the results of this field exploration, it should be anticipated that 13 to 14 inches of pavement material and 6 inches of topsoil or soils containing significant amounts of organic materials may be encountered across the site. The actual depths of unsuitable soils and materials should be determined by a designated representative using visual observation and judgment during earthwork operations. Any topsoils removed from the building and parking/drive areas can be stockpiled and used subsequently in areas to be grassed.

6.2 Compaction

After completing the clearing and stripping operations, the exposed surface area should be compacted with a vibratory drum roller having a minimum static, at-drum weight, on the order of 10 tons. Typically, the material should exhibit moisture contents within ±2 percent of the modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557) have been achieved within the upper 2 feet of the compacted natural soils at the site.

Should the bearing level soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated; the disturbed soils should be removed and backfilled with dry structural fill soils, which are then compacted; or the excess moisture content within the disturbed soils should be allowed to dissipate before recompacting.

Care should be exercised to avoid damaging any nearby structures while the compaction operation is underway. Prior to commencing compaction, occupants of adjacent structures should be notified, and the existing conditions of the structures should be documented with photographs and survey (if deemed necessary). Compaction should cease if deemed detrimental to adjacent structures, and we should be contacted immediately. It is recommended that the vibratory roller remain a minimum of 50 feet from existing structures. Within this zone, use of a track-mounted bulldozer or a vibratory roller, operating in the static mode, is recommended.

6.3 Structural Backfill and Fill Soils

Any structural backfill or fill required for site development should be placed in loose lifts not exceeding 12 inches in thickness and compacted by the use of the above described vibratory drum roller. The lift thickness should be reduced to 8 inches if the roller operates in the static mode or if track-mounted compaction equipment is used. If hand-held compaction equipment is used, the lift thickness should be further reduced to 6 inches.

Structural fill is defined as a non-plastic, inorganic, granular soil having less than 10 percent material passing the No. 200 mesh sieve and containing less than 4 percent organic material. It should be noted that soils with more than 10 to 12 percent passing the No. 200 sieve will be more difficult to compact, due to their nature to retain soil moisture, and may require drying. Typically, the material should exhibit moisture contents within ±2 percent of the modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557) have been achieved within each lift of the compacted structural fill.

We recommend that material excavated from the pipeline trenches which will be reused as backfill be stockpiled a safe distance from the excavations and in such a manner that promotes runoff away from the open trenches and limits saturation of the materials.

6.4 Foundation Areas

After satisfactory placement and compaction of the required structural fill, the foundation areas may be excavated to the planned bearing levels. The foundation bearing level soils, after compaction, should exhibit densities equivalent to 95 percent of the modified Proctor maximum dry density (ASTM D 1557), to a depth of one foot below the bearing level. For confined areas, such as the footing excavations, any additional compaction operations can probably best be performed by the use of a lightweight vibratory sled or roller having a total weight on the order of 500 to 2000 pounds.

6.5 Retaining Wall Areas

To reduce the loads applied to the retaining wall structures, groundwater drainage behind the wall should be promoted. It is recommended that a granular backfill be placed directly behind the walls. These soils should be relatively clean sands containing less than 5-percent passing the No. 200 sieve and containing less than 2- percent organic material. Positive drainage of these backfill soils should also be provided by such means as a sock enclosed perforated pipe toe-drain or weep holes.

To avoid wall damage during the compaction process, heavy compaction equipment should not be used within 5 feet of the wall. Hand-held compaction equipment should be used in these areas. The fill soil should be placed in loose lifts of 6 inches or less and compacted to achieve a maximum density of 95-percent of the modified Proctor maximum dry density (ASTM D 1557). Backfill densities in excess of 95-percent of the modified Proctor maximum dry density can result in overstressing of the retaining walls.

6.6 Pavement Areas

After completing the clearing/stripping operations in the pavement areas, any underlying clayey sands and sandy clays that are within 2 feet of the bottom of the pavement base should be over-excavated from within the pavement areas. Structural backfill and fill required to achieve the finish pavement grades then can be placed and compacted as described Section 6.3 above. As an exception, densities of at least 98 percent of the modified Proctor maximum dry density (ASTM D1557) should be obtained within the upper one foot of the materials immediately below the proposed base course.

6.7 Excavation Protection

Excavation work for below-ground construction will be required to meet OSHA Excavation Standard Subpart P regulations for Type C Soils. The use of excavation support systems will be necessary where there is not sufficient space to allow the side slopes of the excavation to be laidback to at least 2H:1V (2 horizontal to 1 vertical) to provide a safe and stable working area and to facilitate adequate compaction along the sides of the excavation.

The method of excavation support should be determined by the contractor but can consist of a trench box, drilled-in soldier piles with lagging, interlocking steel sheeting or other methods. The support structure should be designed according to OSHA sheeting and bracing requirements by a Florida registered Professional Engineer.

7.0 QUALITY CONTROL TESTING

A representative number of field in-place density tests should be made in the upper 2 feet of compacted natural soils, in each lift of compacted backfill and fill, and in the upper 12 inches below the bearing levels in the footing excavations. The density tests are considered necessary to verify that satisfactory compaction operations have been performed. It is recommend that density testing be performed as listed below:

one location for every 5,000 square feet of building area with a minimum of three tests;

25-percent of any isolated column footing locations;

one location for every 100 linear feet of continuous wall footings;

one location for every 10,000 square feet of pavement area with a minimum of three tests; and

one location for every 100 feet of retaining wall backfill.

8.0 REPORT LIMITATIONS

This report has been prepared for the exclusive use of the VA and their clients for specific application to the design and construction of the Malcom Randall VA Medical Center Boiler Building project. The work for this project was performed in accordance with generally accepted geotechnical engineering practice. No warranty, express or implied, is made.

The analyses and recommendations contained in this report are based on the data obtained from the borings performed for the proposed Boiler Building structure. This testing indicates subsurface conditions only at the specific locations and times, and only to the depths explored. These results do not reflect subsurface variations that may exist away from the boring locations and/or at depths below the boring termination depths. Subsurface conditions and ground water levels at other locations may differ from conditions occurring at the tested locations. In addition, it should be understood that the passage of time may result in a change in the conditions at the tested locations. If variations in subsurface conditions from those described in this report are observed during construction, the recommendations in this report must be reevaluated.

If changes in the design or location of the structure occur, the conclusions and recommendations contained in this report may need to be modified. It is recommended that these changes be provided for further consideration. Neither G.E.A.R, nor Meskel & Associates Engineering are responsible for conclusions, interpretations, opinions or recommendations made by others based on the data contained in this report.

Gator Engineering & Aquifer Restoration, Inc.

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)		
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	
	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	
	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)		
SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

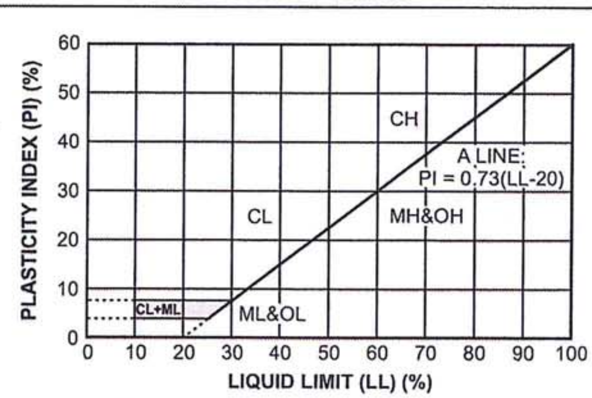
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent .... GW, GP, SW, SP
More than 12 percent .... GM, GC, SM, SC
5 to 12 percent .... Borderline cases requiring dual symbols

PLASTICITY CHART



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BORING SB-1

PROJECT NO. 0010-0003

PROJECT NAME Malcom Randall VA Medical Center Boiler Building

PROJECT LOCATION Gainesville, Florida **CLIENT** VAMC Gainesville

DATE STARTED 7/7/12 **COMPLETED** 7/7/12 **STATION** ______ **OFFSET** ______

DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Rotary Wash Drill

LOGGED BY Wilson **CHECKED BY** Kelly **GROUND ELEVATION** ______ **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE NUMBER	MATERIAL DESCRIPTION	UCSC	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	2-1/8" Asphalt; 11" Limerock Base											
	2	Brown Silty Fine SAND	SM										
	3					14	38						
	4	Light Brown to Brown Fine SAND with Nodules of Brown Clayey Fine SAND	SP-SC										
5	5	Medium Dense to Very Dense, Dark Brown Silty Fine SAND	SM										
	6			5-8-4-5	12								
	7			7-9-8-9	17	21	20		NP	NP			
10													
15	8	Loose to Medium Dense, Gray to Light Gray Clayey to Very Clayey Fine SAND	SC	2-5-6	11								
	9			11-18-31	49								
20	10	Dense to Very Dense, Pale Brown Fine SAND with Silt	SP-SM										
25	11			18-31-38	69								

Bottom of borehole at 25.0 feet.

NOTES Boring advanced by hand auger to 5 feet (utilities)
NR - Not Recorded

GROUND WATER LEVELS

AT TIME OF DRILLING	
Not Encountered	—

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1173 Spring Centre S. Blvd., Suite C
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(407) 682-2009

BORING SB-2

PROJECT NO. 0010-0003

PROJECT NAME Malcom Randall VA Medical Center Boiler Building
PROJECT LOCATION Gainesville, Florida **CLIENT** VAMC Gainesville
DATE STARTED 7/7/12 **COMPLETED** 7/7/12 **STATION** **OFFSET**
DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Rotary Wash Drill
LOGGED BY Wilson **CHECKED BY** Kelly **GROUND ELEVATION** **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE NUMBER	MATERIAL DESCRIPTION	UCSC	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Brown Fine SAND, Trace Roots	SP										
	2, 3, 4	Brown Fine SAND with Silt	SP-SM			4	6						
5	5	Medium Dense to Very Dense, Dark Brown Silty Fine SAND	SM	3-5-8-11	13								
	6			11-8-10-17	18	16	27						
10	7			14-17-38-32	55								
15	8	Dense to Very Dense, Pale Brown Fine SAND with Silt	SP-SM	18-28-35	63								
20	9			11-17-27	44								
25	10	Dense, Grayish Brown Silty Fine SAND	SM	21-24-34	58								

GROUND WATER LEVELS

AT TIME OF DRILLING	
Not Encountered	—

NOTES Boring advanced by hand auger to 4 feet (utilities)
NR - Not Recorded

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Gator Engineering & Aquifer Restoration, Inc.
1173 Spring Centre S. Blvd., Suite C
Altamonte Springs, Florida 32714
(407) 682-2009

BORING SB-2

PROJECT NO. 0010-0003

PROJECT NAME Malcom Randall VA Medical Center Boiler Building

PROJECT LOCATION Gainesville, Florida **CLIENT** VAMC Gainesville

DEPTH (ft)	SAMPLE DEPTH	NUMBER	MATERIAL DESCRIPTION	UCSC	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
25			Dense, Grayish Brown Silty Fine SAND *(continued)*	SM											
		11	Stiff, Greenish Gray to Yellowish Gray Sandy CLAY	CH		3-5-6	11								
30		12													
		13				6-7-7	14								
35		14													

Bottom of borehole at 35.0 feet.

NOTES Boring advanced by hand auger to 4 feet (utilities)
NR - Not Recorded

GROUND WATER LEVELS

∇ AT TIME OF DRILLING	▼
Not Encountered	—

Gator Engineering & Aquifer Restoration, Inc.
1173 Spring Centre S. Blvd., Suite C
Altamonte Springs, Florida 32714
(407) 682-2009

BORING SB-3

PROJECT NO. 0010-0003

PROJECT NAME Malcom Randall VA Medical Center Boiler Building

PROJECT LOCATION Gainesville, Florida **CLIENT** VAMC Gainesville

DATE STARTED 7/7/12 **COMPLETED** 7/7/12 **STATION** **OFFSET**

DRILLING CONTRACTOR Reliable Drilling **DRILLING METHOD** Rotary Wash Drill

LOGGED BY Wilson **CHECKED BY** Kelly **GROUND ELEVATION** **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE NUMBER	MATERIAL DESCRIPTION	UCSC	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		1-3/4" Asphalt; 11" Limerock Base											
	1, 2	Grayish Brown Fine SAND with Silt, Trace Gravel (Rock Fragments)	SP-SM										
	3	Brown Fine SAND with Silt	SP-SM										
5	4	Medium Dense to Very Dense, Dark Brown Silty Fine SAND	SM	14-18-15-17	33	11	24						
	5			16-25-31-31	56								
10	6			8-15-23-29	38								
15	7	Loose to Medium Dense, Gray to Light Gray Clayey to Very Clayey Fine SAND	SC	5-5-4	9								
20	8	Medium Dense, Gray Very Clayey Fine SAND, Trace Gravel (Rock Fragments	SC	4-5-8	13								
25	9			6-5-6	11								

Bottom of borehole at 25.0 feet.

NOTES Boring advanced by hand auger to 4 feet (utilities)
NR - Not Recorded

GROUND WATER LEVELS

AT TIME OF DRILLING	
Not Encountered	—