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April 24, 2014

Jaime Teachout
21418 Florence Road
Mandeville, LA 70471

Report No. 140216

Geotechnical Investigation
Lot at 1716 Claiborne Street
Mandeville, Louisiana

Mr. Teachout:

Submitted here is the report of our geotechnical investigation for the above-referenced project. These services were requested and authorized by acceptance of our proposal dated February 27, 2014.

1.0 General

It is our understanding that a residential structure will be constructed on a lot at 1716 Claiborne Street in Mandeville, Louisiana. The lot is located on the south side of Claiborne Street, west of Foy Street and east of Lamarque Street. The lot is about 122-ft wide by 132-ft long. We understand the existing site grade will be raised by 1.5 ft and a first floor slab will be placed for the carport. The living area of the house will be elevated about 10 ft above the carport slab. Current plans are to support the residence on a shallow spread and strip footings providing subsurface conditions are suitable.

The planned building footprint area is generally cleared of trees. Some trees were present around the perimeter of the site. A house was previously located at the site. No other information concerning construction was made available at the time of this investigation.

The specific purposes of this investigation were:

1) to make exploratory soil borings for the lot;
2) to verify field classifications of the soils encountered in the borings by examination of the soil samples and laboratory tests performed on selected samples; and

The strength characteristics of the fine-grained soils encountered in the borings were investigated by means of an unconfined compressive strength test performed on a selected Shelby tube sample. The results of the unconfined compressive strength test in terms of cohesion are plotted as a small open circle in the data section of the graphic log. The water contents and dry density were also determined for the compressive strength test specimen. The water content is plotted as a small shaded circle in the data section of the logs. The dry density is tabulated to the nearest lb per cu ft under the "Dry Density" column of the logs.

The classification and volume change properties of the soils encountered are generally investigated by means of visual examination and Atterberg liquid and plastic limit tests. The numerical difference between the liquid and plastic limits is defined as the plasticity index (PI). The magnitude of the plasticity index and the proximity of the natural water content to the plastic limit are indicators of the potential for clay to shrink or swell upon changes in moisture content or to consolidate under loading. The magnitude of the plastic limit is an indicator of the optimum moisture content for compaction, and the proximity of the natural water content to the plastic limit is an indicator of the strength. The results of the liquid and plastic limit tests are plotted as small crosses interconnected by dashed lines in the data section of the logs.

To assist in classifying soils, tests were performed to determine the percent fines passing the No. 200 sieve. The percentage of fines resulting from each test is tabulated at the appropriate depth under the far right column of the graphic logs.

Water content tests were performed to corroborate field classifications and to extend the usefulness of the SPT blow count data. The results of the water content tests are plotted as small shaded circles in the data section of the graphic boring logs.

4.0 General Soil Conditions

4.1 General. A general description of subsurface soil and groundwater conditions encountered in the borings made for this investigation is provided in the following subsections. The graphical logs of the borings shown on Figures 3 and 4 should be referred to for the specific soil conditions encountered at each location explored.

4.2 Soil Stratification. Subsurface soils encountered within the maximum 25-ft exploration depth of the borings made for this investigation consist of medium stiff to very stiff sandy clays (CL) underlain by stiff clays (CH). The sandy clays (CL) were found to extend to a depth of about 7 ft and appear to be fill materials. The underlying clays (CH) generally contain silty seams and pockets and traces of organics. The medium stiff sandy clays (CL) are considered to have low strength and high compressibility. The stiff to very stiff sandy clays (CL) are considered to have low-moderate to high strength and moderate-high to low compressibility. The stiff clays (CH) are considered to have low-moderate strength and moderate-high compressibility. The sandy clays (CL) have low shrink/swell potential and the clays (CH) have high shrink/swell potential.

4.3 Groundwater Observations. As indicated previously, observations were made continuously during auger drilling to detect groundwater seepage entering the open boreholes.

3) after analysis of the soil boring data, to provide recommendations for site preparation, earthwork construction, and shallow foundation design and construction.

2.0 Field Investigation

Subsurface soil conditions were explored by means of two (2) borings. The boring locations were chosen, marked, and located in the field by representatives of Burns Cooley Dennis, Inc. based upon our understanding of the drawings provided by Mr. Teachout. The approximate locations at which the borings were made relative to existing site features are illustrated on Figure 1 of this report.

A synopsis of the Unified Soil Classification System is presented on Figure 2 along with symbols and terminology typically utilized on graphical soil boring logs. Graphical logs of the borings are presented on Figures 3 and 4. The graphical logs illustrate the types of soil encountered with depth below the ground surface at the individual boring locations.

The borings were advanced by dry augering to a completion depth of 25 ft for Boring 1 and to a depth of 15 ft for Boring 2. All soils encountered during drilling were examined and classified in the field by a geotechnical engineering technician. Relatively undisturbed samples were obtained from selected depths in the borings by pushing a 3-in. OD thin-wall Shelby tube sampler approximately 2 ft into the soil. The Shelby tube samples were extruded from the sampling tube in the field. An approximate 6-in. long portion of each Shelby tube sample was sealed with melted paraffin in a cylindrical cardboard container to prevent moisture loss and structural disturbance. An additional portion of each Shelby tube sample was sealed in jars to provide material for visual examination and testing in the laboratory.

Observations were made continuously during drilling to detect any groundwater seepage emerging in the open boreholes. Notes pertaining to observed groundwater conditions are indicated in the lower right corner of the graphic logs.

All soils encountered during drilling were carefully examined and classified by a geotechnical engineering technician. Unless other disposition is requested, we routinely discard soil samples after about six months of storage. The boreholes were plugged with cement bentonite grout after completion of drilling and sampling in accordance with Louisiana regulations.

3.0 Laboratory Investigation

An evaluation of the strength, compressibility, and classification of the subsurface soils encountered in the borings was considered to be of primary importance for this investigation. These properties were evaluated by visual examination and from results of the routine laboratory index tests described in the following paragraphs. The strength and compressibility characteristics of the soils encountered in the borings were estimated by means of field classifications of consistency and from results of the pocket penetrometer tests and unconfined compressive strength tests.

Free water was encountered initially during drilling at depths of 3 ft and 8 ft in Borings 1 and 2, respectively. After a brief 15-minute waiting period, free water was observed at a depth of 2 ft in Boring 1 and at a depth of 8 ft in Boring 2. It should be recognized that the groundwater levels at this site are influenced by rainfall, Lake Pontchartrain, local drainage conditions, and other environmental factors.

5.0 Discussion and Recommendations

5.1 General. The depth and lateral extent of the apparent sandy clay (CL) fill materials encountered in both borings should be further investigated prior to construction. Fill materials may have been placed for construction of the previous structure, or may have been used to backfill excavations from the previous structure after foundation elements were removed. Possible remnants from the previous house should be identified and removed. The ensuing excavations should be properly backfilled with select fill as described subsequently in this report.

A major issue in construction will be the presence of groundwater, which was encountered as shallow as 2 ft beneath the existing grade. It is our opinion that dewatering will likely be required since construction/excavation can be difficult. Dewatering is discussed in the following subsection. The site grade can also be raised to elevate the building sufficiently above the groundwater table to facilitate construction and improve foundation performance.

Footing depths may need to be increased to accommodate load variations due to code requirements or to address increased loading. Footing depths may also need to be increased if unstable soils are encountered at the recommended foundation depth.

Details of our recommendations for site preparation, earthwork construction, and for the design and construction of the recommended foundation system are included in the following subsections.

5.2 Site Preparation and Earthwork. As an initial step of site preparation within the planned construction areas, stripping should be performed to remove vegetation, debris, organic matter, topsoil and any obviously weak or high moisture content surficial soils. The stability of the exposed soils should then be evaluated. The existing sandy clay (CL) fill materials encountered in the borings can be permitted to remain in place if they are found to be stable and the owner is willing to accept the risk that the foundations will not perform properly. Otherwise, the sandy clays (CL) should at least partially removed to a depth of 3 ft beneath the building footprint area. If documentation can be provided that indicates that the fill materials were properly placed and compacted, then the fill materials can remain in place if they are determined to be stable.

The level of the groundwater table will be a major consideration in construction since it was encountered as shallow as 2 ft beneath the ground surface in the borings. Groundwater seepage will need to be controlled during construction and likely the groundwater level will need to be lowered slightly prior to construction. We recommend that the specifications require the contractor to maintain the area in a relatively dry condition. Adequate surface drainage will also be required to minimize the amount of surface water entering the area. We recommend that the

Contractor retain the services of a dewatering expert to assist them in evaluating dewatering methods. We recommend maintaining water at least 2 ft beneath the footing level during construction. As discussed previously, the site grade can be elevated above what is currently planned to reduce potential for problems during construction.

Dewater to maintain a water level 3 ft below grade beam.

The stability of the soils exposed should be verified after stripping and any undercutting to remove undocumented fill materials is performed. The exposed soils can be proofrolled to demonstrate stability by making multiple passes with a loaded dump truck or other rubber-tired equipment. Stability is defined as the absence of significant pumping, rutting, or yielding of soils during compaction or proofrolling. If stability is not evident in some areas, either additional excavation or treatment of the in situ soils with an admixture, or a combination of these approaches, might be required to achieve stable conditions.

It should be noted that the soils exposed after stripping, excavation and undercutting are susceptible to pumping under wet conditions. The construction techniques and types of equipment utilized and site drainage provided during construction will have a great effect on the performance of these soils throughout the project. The routing of heavy rubber-tired equipment should be controlled to minimize, as much as possible, traffic over the site. All traffic should be discouraged during periods of inclement weather. If pumping is initiated in clay soils as a construction expedient, the pumping can be counteracted by treating these materials with hydrated lime. It is estimated that about 4 to 6 percent hydrated lime by dry weight of soil could be required.

PI within 10 - 15 & LL < 40

Imported fill soils should consist of select, nonorganic and debris-free silty clays (CL) having a plasticity index (PI) within the range of 10 to 24 and a liquid limit less than 45. All fill soils should be free of organic matter, debris and any other deleterious material. Any overexcavated soils which have been temporarily stockpiled can be utilized as fill providing the soils are non-organic, debris-free, and meet the requirements for select fill.

6" lifts

The fill materials should be compacted from lifts not exceeding 9 in. in loose thickness to not less than **95** percent of standard Proctor (ASTM D 698) maximum dry density. Fill materials should be placed in horizontal lifts at moisture contents within 3 percentage points of the optimum water content. Stability must be evident during compaction of each lift before any subsequent lifts of fill material are added. All backfill over utilities, storm drains, etc., should be placed in accordance with the preceding recommendations, except the lift thickness should be reduced to about 4 in. to 5 in. where hand-operated compaction equipment is used. Finished site grades should be sloped to promote quick runoff of storm water away from the constructed areas. Fill slopes should be no steeper than 1V:3H extending down to existing grades.

Increased moisture contents resulting from rainfall can substantially reduce the strength of the on-site and proposed fill soils. In addition, the existing sandy clay (CL) soils encountered directly beneath the ground surface are very susceptible to surface erosion. Therefore, we recommend that proper surface drainage be provided throughout the site to prevent surface water from percolating into the subsurface soils.

Laboratory classification tests, including Atterberg limit determinations and grain-size analyses, should be performed on the fill soils initially and routinely during earthwork operations to check for compliance with the recommendations provided herein. Field moisture/density tests should be performed frequently in the compacted on-site soils and in each compacted lift of fill material to assist in evaluating whether the recommended moisture contents and dry densities are being achieved. As a guide for earthwork construction, we suggest that a minimum of two tests should be performed per lift.

5.3 Building Foundation. In conjunction with the recommended earthwork construction, it is our opinion that the planned residential structure can be supported on a shallow foundation system as planned. The foundations for the house can consist of strip footings supporting wall loads and spot footings supporting column loads. Spot footings and exterior strip footings should be brought to bear at a depth of not less than 24 in. below the lowest grades adjacent to the footings. The strip footings should be proportioned for critical loading conditions using a net allowable soil bearing pressure of 1,200 lbs per sq ft. We recommend a minimum base width of 18 in. for the grade beams. Square or spot footings with widths of 24 in. or greater should also be designed assuming a net allowable bearing capacity of 1,800 lbs per sq ft when total dead plus live loads are applied. These allowable bearing pressures include an appropriate factor of safety with respect to soil shear strength.

Spot footings can be connected with grade beams if needed to better accommodate structural loadings. Footings can be designed for lateral loading considering an allowable passive equivalent fluid unit weight of 200 lbs per cu ft per ft and a sliding resistance coefficient against the base of 0.4, where lateral loads against the structure are not accommodated in uplift and compression.

The living area's structural floor system can be supported above the carport area as planned. The structural floor system should be adequately reinforced for anticipated loading conditions and deflections.

We estimate that total post-construction settlement under compressive structural loads will be on the order of 1 in. Differential settlements between adjacent footings may be on the order of 3/4 in. Differential settlements of strip footings are not expected to be more than 3/4 in. over a distance of 30 ft.

All foundation excavations should be carefully inspected by a knowledgeable soil technician or engineer to verify bearing on generally strong soils. Foundation elements should be promptly poured after completion of the excavations. Drainage should be maintained away from the foundation excavations during construction. Ponded water in the foundation excavations can weaken the exposed soils. Foundation soils exposed in the bottom of the foundation excavations should be inspected prior to concrete placement. If these materials are found to be weak or loose, overexcavation and backfilling will be required to provide strong foundation soils immediately beneath the footings can be extended deeper to expose stronger soils. Ground water is likely to be encountered in footing excavations. The contractor should be prepared to remove the water from the excavations. The overexcavated soil can also be replaced with lean concrete or the footing depth can be extended.

6.0 Report Limitations

The analyses, conclusions, and recommendations discussed in this report are based on conditions as they existed at the time of our field investigation and further on the assumption that the exploratory borings are representative of subsurface conditions throughout the area investigated. It should be noted that actual subsurface conditions between and beyond the borings might differ from those encountered at the boring locations. If subsurface conditions are encountered during construction that vary from those discussed in this report, Burns Cooley Dennis, Inc. should be notified immediately in order that we may evaluate the effects, if any, on earthwork and foundation design and construction.

Burns Cooley Dennis, Inc. should be retained for a general review of final design drawings and specifications. It is advised that we be retained to observe earthwork and foundation construction for the project in order to help confirm that our recommendations are valid or to modify them accordingly. Burns Cooley Dennis, Inc. cannot assume responsibility or liability for the adequacy of recommendations if we do not observe construction.

This report has been prepared for the exclusive use of Jaime Teachout and any approved consultants for specific application to the geotechnical aspects of design and construction for the new residential structure located at 1716 Claiborne Street in Mandeville, Louisiana. The only warranty made by us in connection with the services provided is we have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of our profession practicing in the same or similar locality. No other warranty, express or implied, is made or intended.

We appreciate the opportunity to provide you with our services. If we can furnish you any additional information or further assist you in any way, please call on us.

Very truly yours,

BURNS COOLEY DENNIS, INC.

STATE OF LOUISIANA
Jeffrey W. Williams
REG. No. 29498
REGISTERED
PROFESSIONAL ENGINEER
IN
CIVIL ENGINEERING

Jeffrey W. Williams, P.E.
Principal

JWW/tgr
Copies Submitted: (3)

FIGURES

Note: Drawing provided by property owner April 2014.

Boring Locations		
LOT AT 1716 CLAIBORNE STREET MANDEVILLE, LOUISIANA		
BURNS COOLEY DENNIS, INC. 14140 DEDEAUX ROAD, SUITE C GULFPORT, MISSISSIPPI 39503		
JOB NO. 140216	SCALE: See Figure	FIGURE 1

LOG OF BORING NO. 2

LOT AT 1716 CLAIBORNE STREET
MANDEVILLE, LOUISIANA

TYPE: 4" Continuous-flight auger

LOCATION: See Figure 1

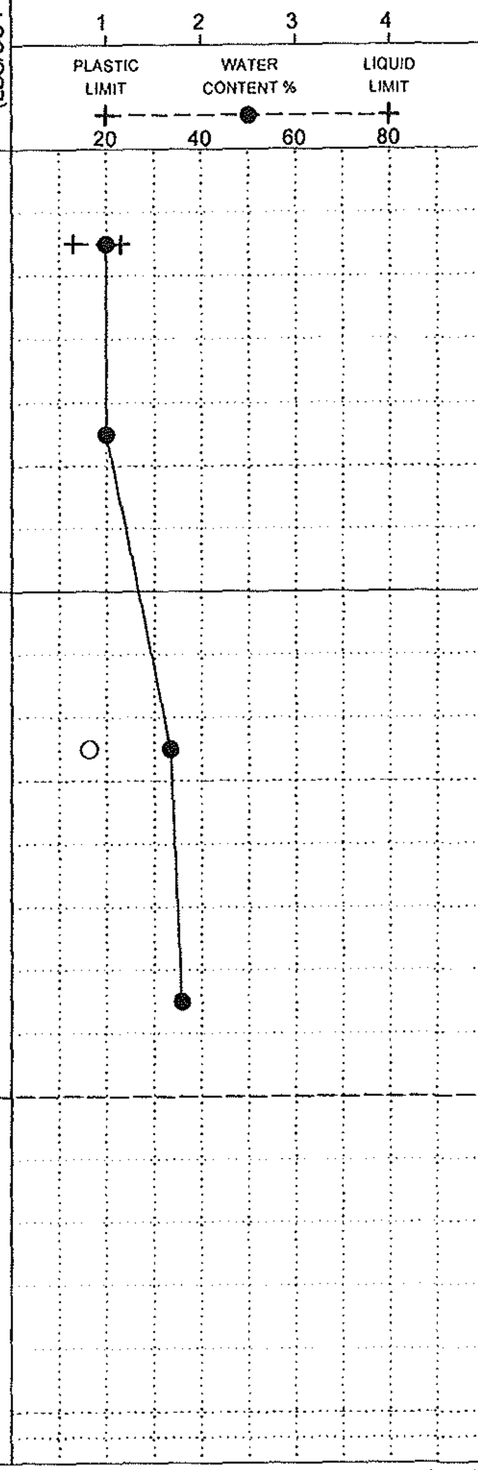
SURFACE EL: ±ft

DEPTH, FT	DESCRIPTION OF MATERIAL	POCK. PEN. (TSF) & BLOWS PER FT	DRY DENSITY (LBS/CU FT)
0	Stiff tan and light gray sandy clay (CL) - with sand pockets to 7'		
	(Possible Fill)	1.50	
	- very stiff below 3.5'	3.75	
7	Stiff tan and light gray clay (CH) with silt pockets and seams and trace of organics	3.75	
			88
		3.75	
15			

○ - UC Cohesion, kips/sq ft △ - UU

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT

% PASSING NO. 200 SIEVE



BORING DEPTH: 15 ft

DATE: 04/08/14

COMMENTS:

GROUNDWATER DATA: Free water encountered at an approximate depth of 8' during auger drilling. Water level at an approximate depth of 8' after about 15 minutes.

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FIGURE 4

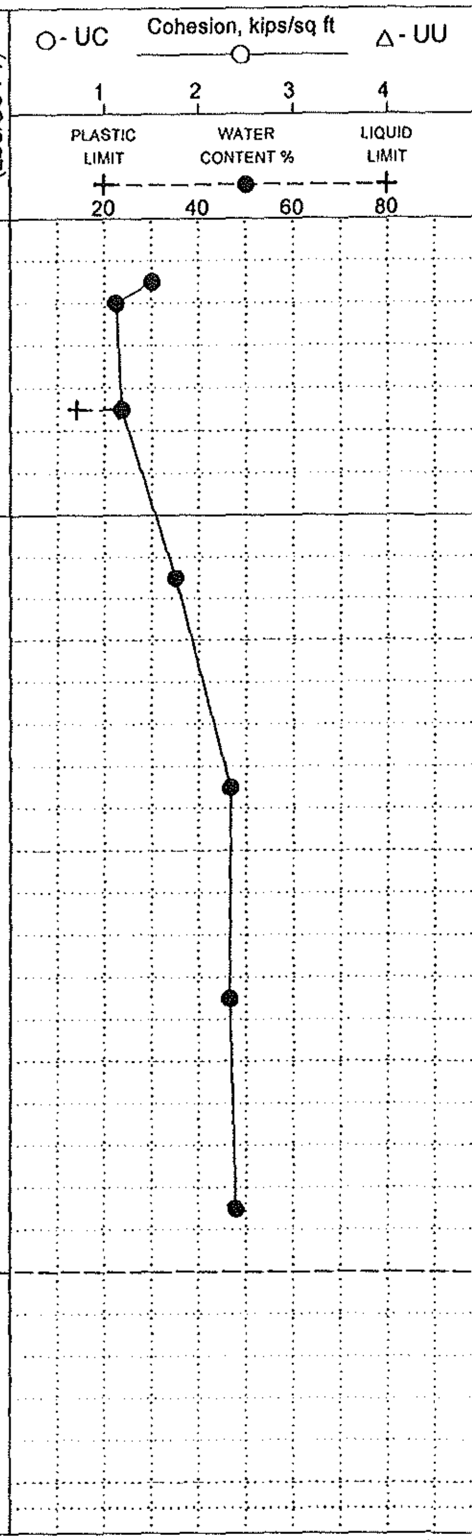
LOG OF BORING NO. 1
LOT AT 1716 CLAIBORNE STREET
MANDEVILLE, LOUISIANA

TYPE: 4" Continuous-flight auger

LOCATION: See Figure 1

SURFACE EL: ±ft

DEPTH, FT	DESCRIPTION OF MATERIAL	POCK. PEN. (TSF) & BLOWS PER FT	DRY DENSITY (LBS/CU FT)	% PASSING NO. 200 SIEVE
0	Medium stiff tan and gray sandy clay (CL) (Possible Fill)			
		0.75		
		0.75		51.9
5		0.50		
7	Stiff gray clay (CH) with silt pockets			
		2.25		
10				
	- with trace of organics below 13'	2.50		
15				
		3.25		
20				
		3.25		
25				
30				



BORING DEPTH: 25 ft

DATE: 04/08/14

COMMENTS:

GROUNDWATER DATA: Free water encountered at an approximate depth of 3' during auger drilling. Water level at an approximate depth of 2' after about 15 minutes.

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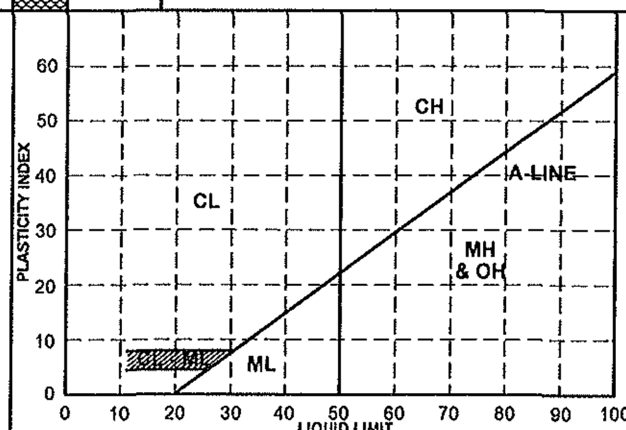
FIGURE 3

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			SYMBOL & LETTER	DESCRIPTION
COARSE-GRAINED SOILS More than half of material larger than No. 200 sieve size	GRAVELS More than half of coarse fraction larger than No. 4 sieve size	Clean Gravels (Little or no fines)	GW	WELL GRADED GRAVEL, GRAVEL-SAND MIXTURE
			GP	POORLY GRADED GRAVEL, GRAVEL-SAND MIXTURE
		Gravels with fines (Appreciable amount of fines)	GM	SILTY GRAVEL, GRAVEL-AND-SILT MIXTURE
			GC	CLAYEY GRAVEL, GRAVEL-SAND-CLAY MIXTURE
	SANDS More than half of coarse fraction smaller than No. 4 sieve size	Clean Sands (Little or no fines)	SW	WELL GRADED SAND, GRAVELLY SAND
			SP	POORLY GRADED SAND, GRAVELLY SAND
		Sands with fines (Appreciable amount of fines)	SM	SILTY SAND, SAND SILT MIXTURE
			SC	CLAYEY SAND, SAND-CLAY MIXTURES
FINE-GRAINED SOILS More than half of material smaller than No. 200 sieve size	SILTS AND CLAYS	Liquid Limit (LL) less than 50	ML	SILT, WITH LITTLE OR NO PLASTICITY
			ML	CLAYEY SILT, SILT WITH SLIGHT TO MEDIUM-PLASTICITY
			ML	SANDY SILT
			CL	SILTY CLAY, LOT TO MEDIUM-PLASTICITY
			CL	SANDY CLAY, LOW TO MEDIUM-PLASTICITY (30% TO 50% SAND)
	SILTS AND CLAYS	Liquid Limit (LL) greater than 50	MH	SILT, FINE SANDY OR SILTY SOIL WITH HIGH-PLASTICITY
			CH	CLAY, HIGH-PLASTICITY
			OH	ORGANIC CLAY, MEDIUM TO HIGH-PLASTICITY
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOIL

TERMS CHARACTERIZING SOIL STRUCTURE

- **Slickensided** - Clays with polished and striated planes created as a result of volume changes related to shrinking, swelling and/or changes in overburden pressure.
- **Fissured** - Clays with a blocky or jointed structure generally created by seasonal shrinking and swelling.
- **Laminated** - Composed of thin alternating layers of varying color and texture.
- **Calcareous** - Containing appreciable quantities of calcium carbonate.
- **Parting** - Paper thin (less than 1/8 inch).
- **Seam** - 1/8 inch to 3 inches in thickness.
- **Layer** - Greater than 3 inches in thickness.



PLASTICITY CHART
(FOR CLASSIFICATION OF FINE-GRAINED SOILS)

DENSITY AND CONSISTENCY

COARSE-GRAINED SOILS: DENSITY	PENETRATION RESISTANCE, N Blows/Ft	FINE-GRAINED SOILS: CONSISTENCY	COHESION Kips/Sq. Ft	PENETRATION RESISTANCE, N Blows/Ft
Very Loose	0 - 4	Very Soft	<0.25	0 - 1
Loose	5 - 10	Soft	0.25 - 0.50	2 - 4
Medium Dense	11 - 30	Medium Stiff	0.50 - 1.00	5 - 8
Dense	31 - 50	Stiff	1.00 - 2.00	9 - 15
Very Dense	>50	Very Stiff	2.00 - 4.00	16 - 30
		Hard	>4.00	>30

PARTICLE SIZE IDENTIFICATION

- **Cobbles** - Greater than 3 inches
- **Gravel** - Coarse - 3/4 inch to 3 inches; Fine - 4.76 mm to 3/4 inch
- **Sand** - Coarse - 2 mm to 4.76 mm; Medium - 0.42 mm to 2 mm; Fine - 0.074 mm to 0.42 mm
- **Silt & Clay** - Less than 0.074 mm

RELATIVE COMPOSITION

Slightly	5 - 15%
With	16 - 29%
Sandy (or gravelly)	30% - 50%

SAMPLE TYPES (Shown in Sample Column)

- Shelby Tube
- Split Spoon
- No Recovery
- Auger
- Dennison Barrell
- Core

CLASSIFICATION, SYMBOLS AND TERMS USED ON GRAPHICAL BORING LOGS

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1402 CORINNE STREET
HATTIESBURG, MISSISSIPPI 39401

REVISED 8/15/05	DRAWN BY: ALR	CHECKED BY: BCD
PROJECT NO. ALL	SCALE: N.T.S.	FIGURE 2