REPORT OF GEOTECHNICAL CHARACTERIZATION

FULTON PORT SITE C

FULTON, MISSISSIPPI

REPORT DATE:

JULY 10, 2009

PREPARED FOR:

Mendrop-Wages, LLC

RIDGELAND, MISSISSIPPI

PREPARED BY:

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July 10, 2009

Mr. Chad Wages
Mendrop-Wages, LLC
Post Office Box 2905
Ridgeland, Mississippi 39157

RE: Preliminary Geotechnical Site Characterization
Ethanol Plant
Fulton, Mississippi
AQT No. 520900014

Dear Mr. Wages,

Submitted herein are the results of our preliminary geotechnical site characterization for the proposed ethanol plant development to be built northwest of Spring Street and the South Access Road in Fulton, Mississippi. This work was authorized by Mr. Chad Wages with Mendrop-Wages, LLC.

The attached report provides a characterization of the subsurface soil and groundwater conditions in the vicinity of the planned facility based upon the collection of data from seven widely spaced borings at the site.

This report is intended to provide an adequate understanding of soil and groundwater conditions in sufficient detail to develop a general understanding of site preparation, foundation construction and pavement design options. A more thorough geotechnical investigation should complement this preliminary work after project details have been resolved in more detail.

We appreciate this opportunity to work with you on this project. Please contact this office if you have any questions.

Sincerely,
AQUATERRA ENGINEERING, LLC

S. Lane Cox

S. Lane Cox
Engineer Intern

VICTOR R. DONALD
REGISTERED PROFESSIONAL
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Victor R. Donald, P.E.
Project Engineer

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1.0 INTRODUCTION

Mendrop-Wages, LLC is in the planning stages of development of an approximate 38-acre tract of land located northwest of the corner of Spring Street and the South Access Road in Fulton, Mississippi. A site vicinity map indicating the general location of the development is illustrated on Figure 1

1.1 Purpose

Aquaterra Engineering, LLC was retained by Mendrop-Wages, LLC to conduct a preliminary geotechnical investigation for the proposed development. This investigation was intended to provide an understanding of the subsurface conditions as necessary to develop general plans for site preparation, and to develop conceptual options for foundation and pavement design.

This Preliminary Site Characterization Report includes a description of the site from a geotechnical perspective and of subsurface conditions encountered at the boring locations. The report also includes general opinions regarding site preparation and foundation options.

We envision that, subsequent to the completion of the plans for the locations of various components of the plant, this preliminary characterization will be complemented with a subsequent site characterization to more completely define the subsurface characteristics, because the borehole spacing provided by this study is inadequate for final design.

1.2 Scope

The geotechnical investigation conducted for this project included the following:

- Site Reconnaissance: A visual review and documentation of site conditions pertinent to the geotechnical study at the time of our field exploration.
- Soil Borings: Seven widely-spaced soil borings were advanced to depths ranging from 15 to 50 feet for this portion of the investigation. The boring locations are illustrated on Figure 2.
- Laboratory Testing: The determination of index and engineering properties of selected soil samples by performing geotechnical laboratory testing, including: moisture content, Atterberg limits, grain size analysis, and unconfined compressive strength.
- Reporting: Characterization of the subsurface conditions encountered at the site.

1.3 Procedures

This investigation followed procedures established by our firm as routine for a geotechnical investigation of this nature with sampling and analyses in general accordance with appropriate guidelines established by ASTM. Appendix A describes the field and laboratory procedures utilized to accomplish this geotechnical investigation.

1.4 Limitations

The subsurface characterization presented in this report is based upon the assumption that the soil borings made for this investigation represent the soil and groundwater conditions throughout the project site. Exploration locations are very widely spaced in this preliminary site characterization study. As a result, variations in soil or groundwater conditions are likely between the exploration locations. Accordingly, this investigation can only be considered a preliminary assessment of subsurface conditions, and more data is essential to complete the final designs.

This investigation program and associated characterization are intended for specific application to the project generally described in Section 3 at the site described in Section 2. The data or the analyses and recommendations presented in this report and in any subsequent report or memorandum are not necessarily applicable for any other project or location.

The only warranty made regarding our services that 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 is expressed or implied.

2.0 PROJECT INFORMATION

The following paragraphs present the project information that was available at the time this report was prepared. We understand that this information is preliminary in nature, and is subject to change as plans are finalized. Any recommendations that are provided in this report are based upon our understanding of the plans for construction as summarized below. If these plans change to a significant degree, our recommendations should be reconsidered.

2.1 Information Sources

Information related to this project was provided by Mr. Chad Wages of Mendrop-Wages, Inc. and Mr. Chris Francoeur with Bluefire Ethanol, Inc. Information was provided in a preliminary meeting with Mr. Wages and in subsequent email correspondence. The information included preliminary site layouts, and anticipated loads.

2.2 Anticipated Construction and Associated Loads

We understand that you are planning a new ethanol plant at the subject site. Figure 2 provides a preliminary layout of the planned equipment. The following information about the construction and associated loads are provided below.

- The fermentation area (near Boring B-3) will have several large tanks that will be supported by 4 or more legs. The largest of these tanks will be 180,000 gallons.
- The ARU (near Boring B-1) will also have several large, heavy vessels supported on legs, as well as a large, concrete cooling tower basin. The largest vessel is estimated to be over 100,000 lbs when operating, and there will be several of them.
- The distillation tower will stand close to 100' tall approximately where Boring B-1 is located. The tower will be about six feet in diameter and partially filled with liquid.
- The boiler is a fluid bed combustor and will stand on legs. The 250,000-lb/hr boiler will also stand on legs adjacent to it. They are located in the vicinity of Boring B-4.
- The boiler stack is located approximately where Boring B-2 is shown. It will probably stand 100' tall.

2.3 Anticipated Sitework

We have not been provided any data regarding site grading. We do not expect that, other than clearing and grubbing of the wooded areas, substantial grading will be necessary. The site is gently sloping, so we would expect some one to two feet of excavation and one to two feet of fill may be required.

3.0 SITE CONDITIONS

In a preliminary geotechnical investigation of this nature, local topography and surface conditions, geologic setting and site-specific soil and groundwater conditions are important. The following paragraphs summarize our findings relative to these topics.

3.1 Physical Setting

The site is located on an approximate 38-acre tract of land located northwest of the intersection of Spring Street and the South Access Road in Fulton, Mississippi. The property is located about 1,000 feet east of the Tennessee-Tombigbee Waterway.

The tract consists of a combination of overgrown fields and moderately wooded areas. Trees in the moderately wooded areas appeared to vary up to about 48 inches in diameter. Surface topography across the site appeared to vary on the order of 6 to 8 feet. With the exception of a small, rectangular constructed pond measuring some 100 feet by 50 feet, there was no standing water observed across the site at the time of our preliminary investigation.

3.2 Geologic Setting

According to the Mississippi State Geological Survey, *Bulletin 64*, this site lies within the flood plain of the Tombigbee River and consists of alluvial soils overlying soils of the Cretaceous Age Eutaw Formation. Alluvial deposition is typically characterized by near-surface fine-grained soils (clays) generally transitioning to more coarse-grained materials (silts, sands, and gravels) with depth. The consistency of the alluvial soils can vary significantly due to method of deposition.

Soils associated with the Eutaw Formation are generally composed of irregularly bedded glauconitic sands interstratified with laminated layers, thin laminae, and some more massive layers of clay, most of which is dark gray to nearly black. Small lenses and stringers of small pebbles are scattered through the sand, especially in the lower part of the formation. The sand at the base of the Eutaw is in many places cemented by limonite into hard tubular and corrugated sandstone.

Very stiff to hard clays encountered at the site are probably a part of the Selma Chalk formation. This deposit is a massive deposit of highly plastic clays that probably underlie the entire area.

3.3 Soil Conditions

Soil and groundwater conditions at the site were investigated by means of seven widely-spaced soil borings. These borings were located as shown on Figure 2. The soil boring logs in Appendix A provide details of the conditions encountered at each boring location and the field and laboratory data collected.

The soil conditions at this site were extremely variable in the upper 30 feet. The upper soils consisted predominately of alternating layers of sandy clay (Unified Soils Classification System - CL), clayey sand (SC), silty sand (SM), and sand (SP) with some clayey silt (ML) deposits at grade. The sandy soils varied in color from red to tan to light gray to brown. The sandy clay was generally very soft to firm. The consistency of the more granular clayey sand, silty sand, and sand varied from very loose to dense. These deposits were encountered to depths ranging from 17 feet to 33 feet, and through the 25-foot terminal depths of borings B-4, B-5, and B-7. A one-foot thick sandstone layer was noted at 17 feet in Boring B-3.

Below depths of 23 feet to 33 feet in the remaining borings, much more uniform conditions were encountered. Very stiff to hard, light gray to dark gray to dark brown, clay (CH) was present. The clay extended through the 25- to 50-foot terminal depths of the borings. The deeper clay appears to be associated with the Eutaw Formation.

The six deeper borings terminated in the very stiff to hard gray clays. The clays were encountered as shallow as 28 feet at Boring B-1 and as deep as 33 feet in Boring B-2. The fact that all six of these borings that extended below 20 feet encountered this formation leads to the tentative conclusion that the formation is present throughout the site, and that is will be encountered within the upper 35 feet. However, a more detailed site investigation is necessary to confirm this conclusion, and to understand the degree of variability in the depth to the surface of this formation.

The information collected in the soil borings has been interpreted to develop a conceptual presentation of subsurface conditions. This is presented on Figure 3. The illustration shown on that figure is provided to depict general conditions that can be expected based upon the soil borings made for this preliminary investigation. The soil boring logs in Appendix A include the field and laboratory data collected and a description of soil conditions specific to each boring.

3.4 Groundwater Conditions

As described in Appendix A, the soil borings were dry augured to document groundwater conditions in the borings. The soil boring logs illustrate the groundwater conditions observed in each boring. Groundwater was observed in all borings with the exception of Boring B-7. Groundwater was first encountered at depths ranging from 6 feet to 11 feet. The borings were left open for a period of 15 minutes to observe any rise in the groundwater level. The groundwater was observed to rise in all of the borings to depths ranging from 4.5 feet to 9.5 feet. Groundwater levels will vary with seasonal rainfall, the relative permeability of the soils, and seasonal variations. The depth to groundwater should be verified prior to the initiation of activities that could be impacted by groundwater.

3.5 Seismic Classification

Based upon the site location, USGS data indicate an estimated peak ground acceleration of 0.2g. The preliminary geotechnical data collected at the site indicates some borings with loose to very loose sands in the upper 10 feet and below the water table. These loose sands would be expected to liquefy during a Maximum Considered Earthquake (MCE) event as specified by the International Building Code (IBC). Additional evaluation will be required to address the liquefaction potential for the site and to develop potential mitigation measures.

The IBC requires that sites be classified based upon the prevailing soil conditions within the upper 100 feet. The presence of potentially liquefiable soils in the upper 100 feet would cause the site to fall under a Site Class "F" classification. However, since the reason for the Site Class F condition is liquefaction, the code allows for the establishing design parameters using the prescribed IBC methodology, as long as measures are undertaken for mitigation of the liquefaction issue.

If liquefaction issues are mitigated, the preliminary data indicates a Site Class "E" condition (N_{ch} < 15 bpf, S_u<1,000 psf) will prevail for the project site. The site specific ground motion parameters for use in evaluating the seismic design code criteria are provided in the inset tables.

TABLE A: Probabilistic Ground Motion Values

Spectral Response Acceleration	Ground Motion Values for Recurrence Period of 2% in 50 years (%g) [(2)]
0.2 sec Sa [(1)]	33.8
1.0 sec Sa	12.9

TABLE B: Site Design Spectral Response Accelerations (Site Class E)

Period (s)	Sa (%g)	Fa	Fv	S_{DS} (g)	S_{D1}(g)
0.2	33.8	2.5	-	0.50	-
1.0	12.9	-	3.5	-	0.29

Notes: (1) Sa is the Spectral Response Acceleration at noted period.
(2) Data from IBC 2006 Maps-Chapter 16.

4.0 PRELIMINARY GEOTECHNICAL CONSIDERATIONS

Figure 3 includes a presentation of preliminary geotechnical considerations including site preparation, pavement design and foundation options. This figure illustrates foundation options that appear feasible based upon this preliminary investigation.

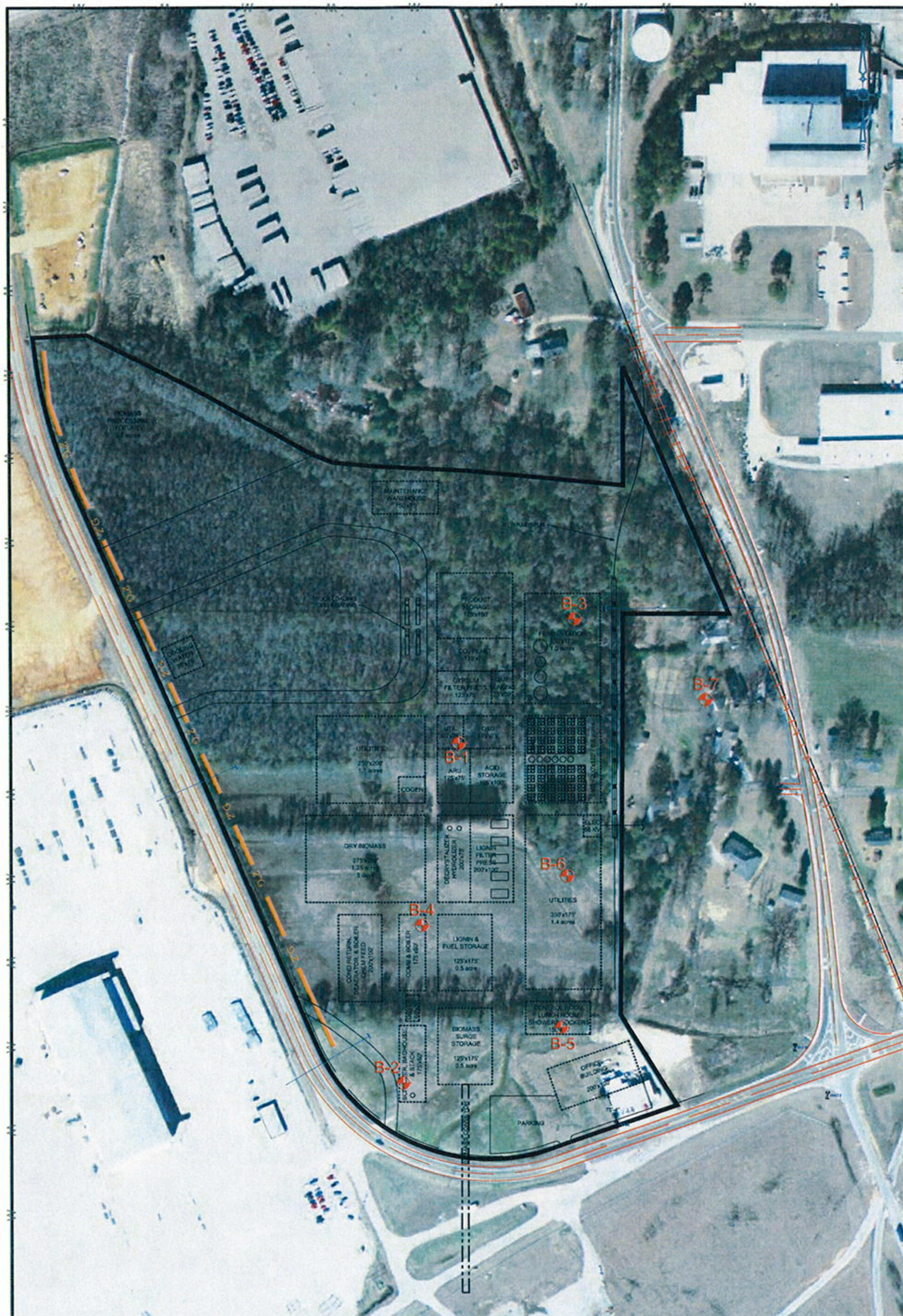
As shown on that figure, the near surface soils are variable and, in some areas, extremely weak. For example, Boring B-2 below 8 feet noted very loose clayey sands, and the upper 10 feet at Boring B-4 noted soft sandy clay and loose clayey sand. However, other areas indicated more competent near-surface conditions, such as the presence of medium dense clayey sand and sand in the upper 17 feet, underlain by a sandstone layer and still silty clay at Boring B-3. In addition to the weak nature of some shallow deposits, many of the more fine grained areas deposits will be compressible. Such conditions would not be conducive to shallow foundation support of structures which bear significant loads. Large area loads in some specific areas will be subject to differential settlements, and special consideration to settlements and slope stability (in the case of mass fills) will be necessary.

Deep foundations installed into the very stiff to hard clays below 30 feet will achieve adequate end bearing, but relatively low skin friction can be expected from deep foundations within the upper 30 feet. If large area fills are necessary, the potential exists for downdrag of piles, and proper precautions would be necessary to overcome downdrag effects. Installation of deep foundations will be difficult in areas as a result of sandstone layering and dense sands that appear, from the preliminary investigation, to be randomly present across the site.

Another important consideration at this site is related to seismicity issues. As noted in Section 3.5, the site has the potential for liquefaction in isolated areas, based upon the preliminary investigation. Additional investigation data may allow a reevaluation of this potential. Also, the use of a proper foundation choice and/or ground modification techniques in these isolated areas may alleviate this potential design concern.

As noted in this report, the information collected to date is only sufficient to allow a conceptual understanding of conditions. The recommendations provided on Figure 3 must therefore be considered preliminary only. We can provide a recommended site exploration plan for a subsequent investigation to confirm these preliminary evaluations after your plans have been finalized.

ENGINEER: BMS	aquaterra engineering	Site Location Map	FIGURE NO.
DRAWN: SLC		Ethanol Plant Fulton, Mississippi	1
CHECKED: VRD		Mendrop-Wages, LLC Ridgeland, Mississippi	
DATE: 7/06/09			
PROJ: 5209000014			



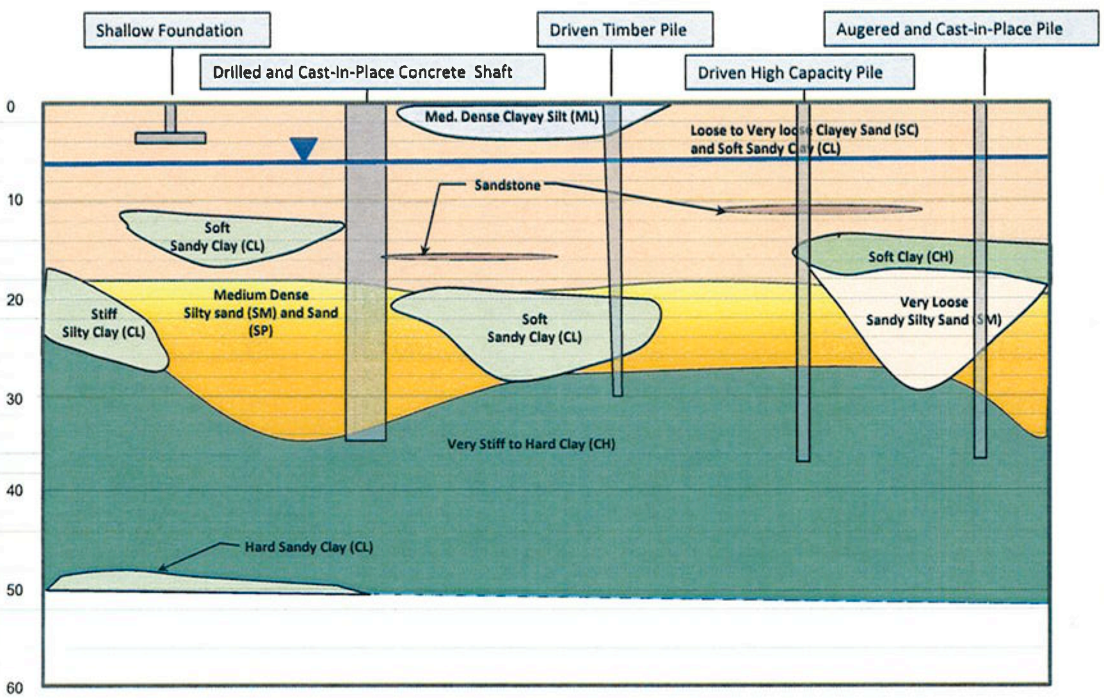
SOIL BORING LOCATIONS	ENGINEER: BMS		SOIL BORING LOCATION	FIGURE NO.
100 50 0 100 200 300	DRAWN: SLC	aquaterra engineering	Ethanol Plant Fulton, Mississippi	2
SCALE IN FEET	CHECKED: VRD		Mendrop-Wages, LLC Ridgeland, Mississippi	
	DATE: 7/9/09			
	PROJ: 523900116			

General Notes

Site Preparation is a critical aspect of satisfactory pavement and foundation performance. The subgrade soils are extremely moisture sensitive. The clayey silts, and sandy clays will lose strength during wet periods. Good drainage should be established well in advance of the construction operations to minimize construction difficult and/or delays.

Pavements for parking and driveway areas at this site should use a rigid (concrete) design unless excellent site drainage is provided. Even with rigid pavements, good site drainage and site preparation is critical. Subgrade improvement with geotextiles or cement stabilization will probably be required beneath pavements

Preliminary Status - All of the opinions provided here are preliminary and subject to revision based upon our understanding of final designs. Examples of information which are necessary in order to finalize this design include, but are not limited to, structural loads for the planned building, final site grading plans, anticipated traffic types and volumes, and anticipated construction time period. Furthermore the density of soil boring data is not sufficient to form an adequate opinion as to the variation in soil conditions.



Conceptual Subsurface Conditions And Foundation Options

Notes Regarding Preliminary Foundation Design Options

(See the graphical representation of each option)

Shallow Foundations in most areas will be subject to very low bearing capacities and high settlements because of the weak, near surface soils which would support footings. Preliminary estimates of allowable bearing capacities of 1,000 lbs/sq ft for continuous and 1,200 lbs/sq ft for isolated footings would be required. Some areas may allow higher bearing capacities.
Settlements of less than one inch would occur only for column loads of less than 20 kips and wall loads of less than 1 kip per lineal foot.

Drilled and Cast-In-Place Concrete Shafts will be suitable for support of the structural loading. The drilled shafts should terminate at a depth of about 35 feet below existing grade within the very stiff to hard clay formation and above the ground water table. These units would require temporary casing or mud slurry,
Only minimal settlements would be expected.

Driven Timber Piles driven into the very stiff to hard clays below 30 feet would also be a reasonable foundation choice. Although this is a low cost, deep foundation alternative, driving could be difficult because of isolated dense sand deposits and sandstone layers. Predrilling would probably be required, and sandstone layers would be difficult to penetrate with predrilling.
Only minimal settlements would be expected.

Driven High Capacity Piles are a viable option, but non-displacement piles, such as open-ended steel pipe piles or H-Piles would be necessary to achieve penetration within the upper sand deposits without over driving. Even with high capacity piles, the infrequent sandstone layering could be difficult to penetrate.
Only minimal settlements would occur for high capacity piles driven into the hard clay.

Augered and Cast-in-Place Piles are a viable alternative to driven piles because they would achieve penetration of the dense sands. Additionally, the augered piles may more easily penetrate sandstone layers when encountered. However, these piles are subject to quality problems if inexperienced contractors without strict quality control parameters are used. A pile integrity program that documents pile quality subsequent to installation is necessary for these type of piles.
Only minimal settlements would occur for auger cast piles placed within the hard c.

Note: Subsurface conditions as illustrated on this figure are interpreted from the seven, widely spaced soil borings made for this preliminary investigation. The amount of data available is insufficient to provide an adequate understanding of subsurface conditions.
Additional exploration is required to confirm variability.
See the Soil Boring Logs within Appendix A for more specific information.

Preliminary Evaluation **Site Preparation & Foundations**		
Ethanol Plant Fulton, Mississippi		
Engr: VRD 5209000014	aquaterra engineering	Fig No. 3

Appendix A

Field And Laboratory Procedures
Soil Boring Logs
Soil Boring Legend
Terms Used on Boring Logs

This geotechnical investigation was conducted utilizing standard procedures developed by Aquaterra Engineering, LLC for investigations of this nature. The following paragraphs describe the field and laboratory procedures utilized. Soil boring logs are included that provide data collected and a description of soil and groundwater conditions. This appendix also provides a legend that describes the terms and symbols used in the boring logs.

FIELD INVESTIGATION

The field investigation was conducted on June 24, 2009 and June 25, 2009. It included a site reconnaissance to document site characteristics pertinent to the geotechnical investigation and the conduct of a soil exploration program. An Aquaterra Engineering Technician documented information collected during the field investigation.

Site Reconnaissance

The engineering technician walked the project site and documented observations that are of significance to the geotechnical investigation. Such observations include topography, vegetation, trees, drainage, other structures, surface soil conditions, and trafficability. These observations were reported to the project engineer in the form of field notes.

Soil Borings

A total of 7 soil borings were advanced using all-terrain mounted soil boring rig at the locations shown on Figure 2. The drill crew and Engineering Technician measured the locations from established points on the site.

Soil Boring Advancement. The soil borings were initially advanced in the dry by rotating a four-inch diameter, short-flight earth auger with the drilling rig, removing the auger from the boring, and cleaning the cuttings from the auger before sampling or reinserting the auger into the boring. This technique allowed for the observation of soil cuttings and description of soil conditions encountered. This dry auger technique also allowed detection of free groundwater within the upper 10 to 16 feet of the borings.

With the exception of Boring B-7, the borings were advanced below a depth ranging from 10 feet to 16 feet using rotary wash boring techniques. In this case, the soil boring was advanced with a four-inch diameter drill bit, and cuttings from the borehole were circulated to the ground surface using drilling fluids injected through the drill stem. The drilling fluids stabilized the borehole during sampling procedures.

Soil Sampling. The soil sampling program included the collection of both disturbed and undisturbed soil samples. Relatively undisturbed samples were obtained by pushing a three-inch diameter, Shelby tube sampler a distance of two feet into the soil in general accordance with ASTM D1587. A shaded portion in the "Samples" column of the attached boring logs indicates depths at which these undisturbed samples were collected.

After the Shelby tube was removed from the boring, the sample was carefully extruded in the field and visually classified. Relative strength estimates of the sample were obtained by penetrometer readings. These penetrometer readings in units of tons per square foot are indicated by the symbol "(P)" in the "Field Test Results" column of the boring logs. Disturbed portions of the sample were discarded and the undisturbed sample was placed in a protective container for transportation to the laboratory. An additional portion of the sample was placed in a plastic jar to minimize moisture loss during transport to the laboratory and to aid in visual classification of the sample.

In more granular conditions, the standard penetration test (SPT) was performed. In this case, representative disturbed samples were obtained in cohesionless soils by driving a 2-inch OD split-spoon sampler a distance of 18 inches into the soil with blows from a 140 pound hammer falling a distance of 30-inches (ASTM D 1586). Two crossed slashes in the "Samples" column of the boring logs indicate depths at which split-spoon samples were collected. The number of blows required to drive the sampler for each 6-inch increment was recorded. The penetration resistance is the number of blows required to drive the split-spoon sampler the final 12 inches of penetration. Information related to the penetration resistance is presented in the "Field Test Results" column of the boring logs as the number of blows per foot (b/f). Representative samples removed from the split spoon sampler and placed in plastic jars to minimize moisture loss provided a sample for laboratory testing.

Groundwater Observations. During the soil boring advancement and sampling operation, observations for free groundwater were made. Information regarding water level observations is recorded in the "Groundwater Level" column on the soil boring logs. Where free water was encountered, the depth of this observation is noted in that column as a open triangle. After encountering free water, boring operations were suspended for several minutes to allow the water level to rise and stabilize in the borehole. The water level was again recorded and is illustrated on the attached boring logs as a triangle containing a vertical line.

Boring Abandonment. Upon completion of the field investigation phase of this study, all borings greater than 25 feet in depth were sealed with cement/bentonite grout and soil cuttings in accordance with Mississippi Department of Environmental Quality regulations. Borings having a depth of 25 feet or less were sealed with soil cuttings.

LABORATORY TESTING

The soil samples were delivered to the Aquaterra Engineering laboratory for testing. The project engineer reviewed the soil boring logs developed in the field and assigned laboratory testing on select samples to provide the data necessary for the anticipated designs. Laboratory testing was accomplished to determine index and strength properties of the soils encountered. These procedures are discussed below.

Index Properties

Moisture Content (ASTM D 2216). Moisture content tests were performed to better understand the classification and shrink/swell potential of the soils encountered. The moisture content is the ratio of the weight of water in the sample to the dry weight of the sample. These tests were performed in general accordance with ASTM D 2216. The results of these tests are tabulated within the Laboratory Data section of the attached boring logs.

Atterberg Limits (ASTM D 4318). Liquid limit (LL) and plastic limit (PL) determinations were performed to assist in classification by the Unified Soil Classification System (USCS). These tests were performed in general accordance with ASTM D 4318. This test determines the moisture content at which the soil begins to act as a viscous liquid (liquid limit) and the moisture content at which the soil changes from a plastic state to a semi-solid state (plastic limit). The plasticity index (PI) was calculated as LL - PL for each Atterberg limit determination. The results of these tests are tabulated within the Laboratory Data section of the attached boring logs.

Grain Size Determinations (ASTM D 1140). Selected granular soil samples were tested to determine the particle gradation as an aid in classification and to further understand the engineering characteristics. In order to know only the portion of soil particles passing the No. 200 sieve ASTM D 1140 was the test procedure used to determine the percentage of fines in the sample. The attached boring logs indicate the percent of the soil particles passing the No. 200 sieve (percent fines) in the appropriate column.

Strength Tests

Unconfined Compression (ASTM D 2166). The undrained shear strength of selected undisturbed soil samples was determined by means of unconfined compression tests (ASTM D 2166). In an unconfined compression test, a cylindrical sample of soil is subjected to a uniformly increasing axial strain until failure develops. For purely cohesive soils, the undrained shear strength, or cohesion, is taken to be equal to one-half of the maximum observed normal stress on the sample during the test.

The results of the undrained shear strength values determined from the results of the shear strength tests are presented within the Laboratory Data section of the attached boring logs. Also shown are the natural water contents and unit dry weights determined as a part of each unconfined compression test.

SOIL BORING LOG

No. B-1

SHEET 1 OF 1

PROJECT: Geotechnical Investigation
Ethanol Plant
Fulton, Mississippi

CLIENT: Mendrop-Wages, LLC
Ridgeland, Mississippi

FILE: 0520900014
DATE: 6/24/09
DRILLER: R. Warren
TECH.: T. Moore
ENGINEER: B. Schreiner

Location: See Figure 2.

Lat: 34° 14' 49.0" N
Long: 88° 24' 51.1" W

Depth (feet)	Samples	Groundwater Level	Field Test Results	Undrained Shear Strength (ksf)	Unit Weight (pcf) Moist	Unit Weight (pcf) Dry	Percent Fines	Natural Moisture Content and Atterberg Limits (Plastic Limit / Moisture Content / Liquid Limit)	Plasticity Index (PI)	Description	Strata Break Depth
0										Soft tan and light gray **SANDY CLAY (CL)**	
	SPT		2 b/ft 1-1-1				58.3	32			
	SPT		6 b/ft 1-3-3					19 / 23 / 40	21	- firm below 4'	
	SPT	▽	7 b/ft 1-4-3								
10	SPT	▽	7 b/ft 3-3-4					22 / 25 / 37	15		
	SPT		6 b/ft 1-1-5								14.0
	SPT		9 b/ft 3-5-4				22.9	25		Loose tan and light gray **CLAYEY SAND (SC)**	18.0
20	SPT		4 b/ft 2-2-2					20 / 30 / 34	14	Soft tan and light gray **SANDY CLAY (CL)**	
	Tube		0.5 (P)					25			28.0
30	SPT		21 b/ft 15-9-12					21		Very stiff dark brown **CLAY (CH)**	
	Tube		4.5 (P)	2.63	127	105		16 / 21 / 49	33	- gray below 33'	
40	Tube		4.5 (P)								
	Tube		4.5 (P)	6.75	133	114		17		- hard below 43'	
50	Tube		4.5 (P)								50.0
										Boring Terminated at 50'	
60											

Chart scale: 20, 40, 60, 80

STRATA BOUNDARIES MAY NOT BE EXACT

Groundwater Level Data

▽ Groundwater first encountered at 11'

▽ Caved in at 8' after 15 minutes

Advancement Method

0' - 16': Short-flight Auger
16' - 50': Rotary Wash

Abandonment Method

Boring sealed with a cement-betonite grout mix after completion.

Notes

aquaterra engineering

PROJECT: Geotechnical Investigation
Ethanol Plant
Fulton, Mississippi

CLIENT: Mendrop-Wages, LLC
Ridgeland, Mississippi

SOIL BORING LOG

No. B-2

SHEET 1 OF 1

FILE: 0520900014
DATE: 6/24/09
DRILLER: R. Warren
TECH.: T. Moore
ENGINEER: B. Schreiner

Location: See Figure 2.

Lat: 34° 14' 42.2" N
Long: 88° 24' 52.4" W

FIELD DATA		LABORATORY DATA						
Depth (feet)	Field Test Results	Undrained Shear Strength (ksf)	Unit Weight (pcf) Moist	Unit Weight (pcf) Dry	Percent Fines	Natural Moisture Content and Atterberg Limits (Plastic Limit / Moisture Content / Liquid Limit)	Plasticity Index PI	DESCRIPTION
0 – 11.0	4.5 (P)				47.4	15		Medium dense red **CLAYEY SAND (SC)**
	7 b/ft 3-4-3							- tan and light gray below 4'
	2 b/ft 1-1-1					21		- very loose and saturated below 8'
10	WOH					16 / 23 / 19	3	
11.0 – 17.0	4 b/ft 1-1-3				32.2	22		Loose light gray **SILTY SAND (SM)** - with trace clay
						21		
17.0 – 33.0	28 b/ft 7-13-15							Medium dense light gray **SAND (SP)**
20								
	26 b/ft 8-12-14				3.7	29		
30	41 b/ft 18-20-21							- dense below 28'
33.0 – 50.0	3.5 (P)	3.13	117	87		29 / 34 / 94	65	Very stiff light gray and brown **CLAY (CH)**
40	4.5 (P)							
	4.5 (P)	3.67	131	109		20		
50	4.5 (P)							**Boring Terminated at 50'**
60								

Strata Break Depth: 11.0, 17.0, 33.0, 50.0

STRATA BOUNDARIES MAY NOT BE EXACT

Groundwater Level Data

Groundwater first encoutered at 8'

Groundwater rose to 6.25' after 15 minutes

Advancement Method

0' - 10': Short-flight Auger
10' - 50': Rotary Wash

Abandonment Method

Boring sealed with a cement-betonite grout mix after completion.

Notes

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PROJECT: Geotechnical Investigation
Ethanol Plant
Fulton, Mississippi

CLIENT: Mendrop-Wages, LLC
Ridgeland, Mississippi

SOIL BORING LOG

No. B-3

SHEET 1 OF 1

FILE: 0520900014
DATE: 6/24/09
DRILLER: R. Warren
TECH.: T. Moore
ENGINEER: B. Schreiner

Location: See Figure 2.
Lat: 34° 14' 51.4" N
Long: 88° 24' 46.9" W

Depth (feet)	Field Test Results	Undrained Shear Strength (ksf)	Unit Weight Moist (pcf)	Unit Weight Dry (pcf)	Percent Fines	Natural Moisture Content and Atterberg Limits (Plastic Limit / Moisture Content / Liquid Limit)	Plasticity Index PI	Description	Strata Break Depth
0–2								Loose red and tan **SILTY SAND (SM)**	2.0
2–11	28 b/ft 8-12-16					19		Medium dense tan and light gray **CLAYEY SAND (SC)**	
	29 b/ft 11-12-17								
	32 b/ft 11-14-8				17.7	15			
10	23 b/ft 8-12-11								11.0
11–17	12 b/ft 2-6-6				5.2	31		Medium dense tan **SAND (SP-SM)** - slightly silty	
	6 b/ft 2-2-4								17.0
17–18								Hard **SANDSTONE**	18.0
18–23	4.5 (P)	1.91	123	97		26 / 26 / 40	14	Stiff light gray **SILTY CLAY (CL)**	23.0
23–48	4.5 (P)	6.17	116	91		28		Hard dark gray **CLAY (CH)**	
30	4.5 (P)	1.546*	125	104		21 / 21 / 53	32		
	4.5 (P)								
40	4.5 (P)	3.30	122	99		17 / 23 / 51	34	- very stiff from 38' to 48'	
	4.5 (P)								48.0
48–50	4.5 (P)	5.06	141	123		11 / 14 / 29	18	Hard light gray **SANDY CLAY (CL)**	50.0
								Boring Terminated at 50'	

STRATA BOUNDARIES MAY NOT BE EXACT

Groundwater Level Data

▽ Groundwater first encountered at 10'

▽ Caved in at 7.6' after 15 minutes

Advancement Method

0' - 13': Short-flight Auger
13' - 50': Rotary Wash

Abandonment Method

Boring sealed with a cement-betonite grout mix after completion.

Notes

* Slickensided Failure at 2.2% Strain

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AQ LOG 520900014 FULTON PORT SITE C.GPJ AQUATERR.GDT 7/9/09

SOIL BORING LOG
No. B-4
SHEET 1 OF 1

PROJECT: Geotechnical Investigation
Ethanol Plant
Fulton, Mississippi

CLIENT: Mendrop-Wages, LLC
Ridgeland, Mississippi

FILE: 0520900014
DATE: 6/25/09
DRILLER: R. Warren
TECH.: T. Moore
ENGINEER: B. Schreiner

Location: See Figure 2.
Lat: 34° 14' 44.9" N
Long: 88° 24' 52.1" W

Depth (feet)	Field Test Results	Undrained Shear Strength (ksf)	Unit Weight (pcf) Moist	Unit Weight (pcf) Dry	Percent Fines	Natural Moisture Content and Atterberg Limits (Plastic Limit / Moisture Content / Liquid Limit)	Plasticity Index PI	DESCRIPTION	Strata Break Depth
	4 b/ft 1-1-3					15 / 22 / 29	14	Soft light gray and brown **SANDY CLAY (CL)**	
	5 b/ft 1-2-3							- firm below 4'	6.0
	5 b/ft 1-2-3				37.8	23		Loose light gray and brown **CLAYEY SAND (SC)**	
10	6 b/ft 1-2-4								
	11 b/ft 0-0-11				24.6	23			12.5
	17 b/ft 5-7-10							Medium dense light gray **SILTY SAND (SM)**	18.0
20	28 b/ft 8-15-13				4.8	32		Medium dense light gray **SAND (SP)**	
	47 b/ft 8-19-28							- dense between 23' - 28'	29.0
30	15 b/ft 5-9-6							Very stiff dark gray **CLAY (CH)**	
	4.25 (P)								35.0
								Boring Terminated at 35'	
40									
50									
60									

STRATA BOUNDARIES MAY NOT BE EXACT

Groundwater Level Data

▽ Groundwater first encountered at 10'

▽ Groundwater rose to 9.6' after 15 minutes

Advancement Method

0' - 13': Short-flight Auger
13' - 25': Rotary Wash

Abandonment Method

Boring backfilled with soil cuttings upon completion.

Notes

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PROJECT: Geotechnical Investigation
Ethanol Plant
Fulton, Mississippi

CLIENT: Mendrop-Wages, LLC
Ridgeland, Mississippi

SOIL BORING LOG
No. B-5
SHEET 1 OF 1

FILE: 0520900014
DATE: 6/25/09
DRILLER: R. Warren
TECH.: T. Moore
ENGINEER: B. Schreiner

Location: See Figure 2.

Lat: 34° 14' 42.6" N
Long: 88° 24' 47.6" W

FIELD DATA		LABORATORY DATA							
Depth (feet)	Field Test Results	Undrained Shear Strength (ksf)	Unit Weight (pcf) Moist	Unit Weight (pcf) Dry	Percent Fines	Natural Moisture Content and Atterberg Limits (Plastic Limit / Moisture Content / Liquid Limit) 20 40 60 80	Plasticity Index PI	DESCRIPTION	Strata Break Depth
						10		Medium dense reddish-tan **CLAYEY SILT (ML)** (Fill)	
	13 b/ft 9-9-4				60.7	181 21	3	- with gravel and sand	4.0
	8 b/ft 1-4-4					25		Loose brown and light gray **SAND (SP)** - with wood fragments	
	8 b/ft 1-4-4								
10	10 b/ft 1-4-6							- medium dense below 8'	11.0
	2 b/ft 2-1-1					13 22 20	9	Soft gray **SANDY CLAY (CL)**	
	2 b/ft 0-1-1					23			18.0
20	1@18"					32		Very Loose gray **SILTY SAND (SM)**	
	9 b/ft 4-5-4					30		- loose below 23'	
30	6 b/ft 2-3-3								31.0
	3.5 (P)							Very stiff dark gray **CLAY (CH)**	35.0
40								**Boring Terminated at 35'**	
50									
60								*STRATA BOUNDARIES MAY NOT BE EXACT*	

Groundwater Level Data	Advancement Method	Notes
▽ Groundwater first encountered at 6'	0' - 10': Short-flight Auger 10' - 25': Rotary Wash	
	Abandonment Method	
▽ Caved in at 4.5' after 15 mintues	Boring backfilled with soil cuttings upon completion.	

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AQ LOG 520900014 FULTON PORT SITE C.GPJ AQUATERR.GDT 7/9/09

PROJECT: Geotechnical Investigation
Ethanol Plant
Fulton, Mississippi

CLIENT: Mendrop-Wages, LLC
Ridgeland, Mississippi

SOIL BORING LOG

No. B-6

SHEET 1 OF 1

FILE: 0520900014
DATE: 6/24/09
DRILLER: R. Warren
TECH.: T. Moore
ENGINEER: B. Schreiner

Location: See Figure 2.
Lat: 34° 14' 46.4" N
Long: 88° 24' 48.3" W

Depth (feet)	Field Test Results	Percent Fines	Natural Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit)	PI	DESCRIPTION	Strata Break Depth
0–8	2 b/ft 1-1-1; 21 b/ft 4-9-12; 11 b/ft 3-5-6	56.5	20		Soft tan and light gray **SANDY CLAY (CL)** - very stiff from 4' to 6' - stiff below 6'	8.0
8–10	10 b/ft 7-7-3	6.2	31		Medium dense brown **SAND (SP-SM)** - slightly silty	10.0
10–18	2 b/ft 0-1-1; 8 b/ft 1-4-4		32 – 80 – 82; 42	50	Soft brown **CLAY (CH)** - slightly sandy	18.0
18–23			23		Medium dense gray **SAND (SP)**	23.0
23–30	10 b/ft 2-4-6; 4.5 (P)		21 – 35 – 71	50	Stiff gray **CLAY (CH)**	30.0

Boring Terminated at 30'

STRATA BOUNDARIES MAY NOT BE EXACT

Groundwater Level Data	Advancement Method	Notes
Groundwater first encoutered at 8'	0' - 10': Short-flight Auger 10' - 25': Rotary Wash	
Groundwater rose to 6.2' after 15 minutes	**Abandonment Method** Boring backfilled with soil cuttings upon completion.	

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PROJECT: Geotechnical Investigation
Ethanol Plant
Fulton, Mississippi

CLIENT: Mendrop-Wages, LLC
Ridgeland, Mississippi

SOIL BORING LOG

No. B-7

SHEET 1 OF 1

FILE: 0520900014
DATE: 6/24/09
DRILLER: R. Warren
TECH.: T. Moore
ENGINEER: B. Schreiner

Location: See Figure 2.

Depth (feet)	Undrained Shear Strength (ksf)	Unit Weight Moist (pcf)	Unit Weight Dry (pcf)	Percent Fines	Moisture Content	Plastic Limit	Liquid Limit	PI	DESCRIPTION	Strata Break Depth
				68.3	17				Stiff tan and light gray **SANDY CLAY (CL)** - with root fragments	
					22	13	38	25		9.0
10				25.9	13				Medium dense light gray **SILTY SAND (SM)**	
				29.8	22					15.0
									Boring Terminated at 15'	

Depth scale: 10, 20, 30, 40, 50, 60

STRATA BOUNDARIES MAY NOT BE EXACT

Groundwater Level Data
No free water encountered.

Advancement Method
0' - 15': Short-flight Auger

Abandonment Method
Boring backfilled with soil cuttings upon completion.

Notes

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AQ LOG 520900014 FULTON PORT SITE C.GPJ AQUATERR.GDT 7/9/09

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SOIL BORING LEGEND

SYMBOLS

Clay (CH)	Sand (SP/SW)	Silt (ML)	Gravel (GP/GW)	Fill (Poor Quality)
Silty Clay (CL)	Silty Sand (SM)	Sandy Silt (ML)	Sandy Gravel (GW/GP)	Organics (Peat)
Sandy Clay (CL)	Clayey Sand (SC)	Clayey Silt (ML)	Chalk	Asphalt
Clay or High Plasticity Silt (OH-MH)	Gravelly Sand (SW/SP)	Clayey Silt/Silty Clay (CL-ML)	Rock	Concrete

(Predominant Type Shown Heavy)

SAMPLING

Auger

Split Spoon

Shelby Tube

Probe Core

No Recovery

Rock Core

GROUNDWATER

Groundwater Initially Encountered

Groundwater Level After a Specified Period of Time

Static Groundwater Level After a Specified Period of Time

ND - Not Determined; as the presence of groundwater is masked in borings advanced with rotary wash methods. Actual depth to water may vary from the conditions observed in the borings.

FIELD TESTS

(P) Pocket Penetrometer

(T) Torvane

(b/f) Standard Penetration Test (blows per foot)

(PID) Photo-Ionization Detector

(OVA) Organic Vapor Analyzer

STRENGTH TERMS

Noncohesive Soils

(More than 50% retained on No. 200 sieve.)

Includes gravels, sands and silts. Density determined by Standard Penetration Resistance.

Cohesive Soils

(50% or more passing the No. 200 sieve.)

Consistency determined by laboratory shear strength testing or by field visual-manual procedures.

Descriptive Term (Density)	Standard Penetration Resistance (blows per foot)	Descriptive Term (Consistency)	Undrained Shear Strength (kips per square foot)
Very Loose	less than 4	Very Soft	less than 0.25
Loose	5 to 9	Soft	0.25 to 0.50
Medium Dense	10 to 29	Firm	0.50 to 1.00
Dense	30 to 50	Stiff	1.00 to 2.00
Very Dense	above 50	Very Stiff	2.00 to 4.00
		Hard	above 4.00

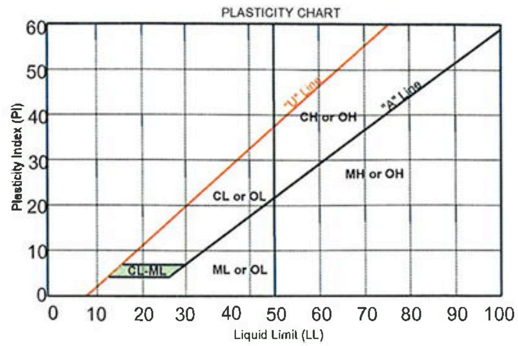
TERMS USED ON BORING LOGS

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 and CLAY-	Less than 0.074 mm

RELATIVE COMP0SITION

TRACE -	0 - 5%
SLIGHTLY -	5 to 15%
WITH -	15 to 29%
SANDY or GRAVELLY-	30 to 50%



CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

ASTM Designation: D 2487 - 93
(Based on Unified Soil Classification System)

MAJOR DIVISIONS			SOIL CLASSIFICATION	
			Group Symbol	Group Name
COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve)	GRAVELS (More than half of coarse fraction larger than No. 4 sieve)	Clean Gravel (little or no fines)	GW	WELL GRADED GRAVEL , GRAVEL-SAND MIXTURE
			GP	POORLY GRADED GRAVEL, GRAVEL-SAND MIXTURE
		Gravel with Fines (appreciable amount of fines)	GM	SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURE
			GC	CLAYEY GRAVEL, GRAVEL-CLAY-SAND MIXTURE
	SANDS (More than half of coarse fraction smaller than No. 4 sieve)	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 SANDS, SAND-SILT MIXTURE
			SC	CLAYEY SAND, SAND-CLAY MIXTURE
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS and CLAYS (Liquid Limit less than 50)	(Liquid Limits less than 50)	ML	SILT WITH LITTLE OR NO PLASTICITY
			CL-ML	CLAYEY SILT, SILT WITH SLIGHT TO MEDIUM PLASTICITY
			CL	SILTY CLAY, LOW TO MEDIUM PLASTICITY
			CL	SANDY CLAY, LOW TO MEDIUM PLASTICITY
		(Liquid Limits greater than 50)	MH	SILT, FINE SANDY OR SILTY SOIL WITH HIGH PLASTICITY
			CH	CLAY, HIGH PLASTICITY
			OH	ORGANIC CLAY, MEDIUM TO HIGH PLASTICITY
			PT	PEAT, HUMUS, SWAMP SOIL

BLOCKY - HAVING A STRUCTURE THAT CAN BE BROKEN DOWN INTO SMALLER ANGULAR LUMPS WHICH RESIST FURTHER BREAKDOWN

CALCAREOUS - CONTAINING APPRECIABLE QUANTITIES OF CALCIUM CARBONATE

FISSURED - HAVING DEFINITE PLANES OF FRACTURE WITH LITTLE RESISTANCE TO FRACTURING

FRIABLE - EASILY CRUMBLED

GLAUCONITIC - CONTAINING A GREEN, PEPPERLIKE MINERAL COMMONLY OCCURRING IN SOILS OF MARINE ORIGIN

HOMOGENEOUS - HAVING THE SAME COLOR AND APPEARANCE THROUGHOUT

JOINTED - A FISSURED CONDITION WITH FRACTURE PLANES THAT ARE NUMEROUS AND LIMITED IN EXTENT

INDURATED - HARDENED BY PRESSURE OR CEMENTATION

LAYER - A SOIL DEPOSIT WITH A THICKNESS OF ABOUT SIX INCHES

ORGANIC - CONTAINING REMAINS OF LIVING ORGANISMS

PARTING - A VERY SMALL THICKNESS OF SOIL WITHIN ANOTHER SOIL

SEAM - A BED OF SOIL LESS THAN SIX INCHES THICK DEPOSITED WITHIN ANOTHER SOIL MASS

SLICKENSIDED - HAVING FRACTURE PLANES THAT APPEAR POLISHED AND GLOSSY

STRATIFIED - COMPOSED OF ALTERNATING LAYERS OF VARYING MATERIAL OR COLOR