SUBSURFACE EXPLORATION
PROPOSED SITE FOR
MILLHAVEN NORTH
MILLHAVEN PLANTATION PROPERTY
OUACHITA PARISH, LOUISIANA

PREPARED FOR:

MILLHAVEN PLANTATION, LLC
P.O. BOX 2303
MONROE, LOUISIANA 71207

PREPARED BY:

ARDAMAN & ASSOCIATES, INC.
7222 GREENWOOD ROAD
SHREVEPORT, LOUISIANA 71119

ARDAMAN PROJECT NO.: 113-12-94-8617
AAI SHREVEPORT FILE NO.: 12.94.080

JUNE 21, 2012

TABLE OF CONTENTS

GENERAL 1

PROJECT INFORMATION 1

FIELD OPERATIONS 2

LABORATORY TESTING 3

SITE GEOLOGY 3

SOIL CONDITIONS 4

GROUNDWATER 5

SUBGRADE PREPARATION 5

FILL RECOMMENDATIONS 6

FOUNDATION INFORMATION 6

SETTLEMENT 8

EXCAVATIONS 8

PAVEMENT INFORMATION 9

CONSTRUCTION CONCERNS 13

LIMITATIONS 14

LIST OF APPENDICES

APPENDIX A. Site Map and Logs of Boring 15

APPENDIX B. Specifications and Procedures 49

APPENDIX C. Drilled Shaft and Driven Pile Capacities 55

Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

June 21, 2012

Millhaven Plantation, LLC
P.O. Box 2303
Monroe, Louisiana 71207

Attention: Ms. Rebecca H. Harrod
Member-Manager

Reference: Subsurface Exploration and Geotechnical Engineering Evaluation
Proposed Site for Millhaven North
Millhaven Plantation Property
Ouachita Parish, Louisiana
Ardaman Project No.: 113-12-94-8617
AAI Shreveport File No.: 12.94.080

Gentlemen:

Attached is our Subsurface Exploration Report for the above referenced project. Ardaman & Associates, Inc. (AAI) will be happy to assist you further on this project by furnishing any Construction Materials Testing (CMT) Services you or your contractor may require if this project moves forward. AAI's local West Monroe office is can provide all of your CMT needs during the construction phase of the project.

It has been a pleasure to perform this work for you. If we can be of any further assistance, please do not hesitate to call on us.

Very truly yours,

ARDAMAN & ASSOCIATES, INC.

Prepared By:

James M. Belt, P.E.
Branch Manager

Reviewed By:

Lloyd G. Hoover, P.E.
Principal Engineer

cc: (3) client

SUBSURFACE EXPLORATION
AND
GEOTECHNICAL ENGINEERING EVALUATION
PROPOSED SITE FOR MILLHAVEN NORTH
MILLHAVEN PLANTATION PROPERTY
OUACHITA PARISH, LOUISIANA

GENERAL

This study was authorized by Ms. Rebecca Harrod and Mr. Fredrick Huenefeld, III, owner/partners of Millhaven Plantation, LLC in May of 2012. The purposes of the study were to (1) explore the subsurface conditions present at this site, (2) determine the pertinent engineering properties of the materials encountered, and (3) develop preliminary recommendations for design of foundations, floor slabs, and pavement systems compatible with the soils encountered at this site.

PROJECT INFORMATION

The site of the proposed development is on approximately (726) acres of agricultural property situated on the east side of Louisiana Highway 594, north of Kansas City Southern Railway's railroad and south of Huenefeld Road in the Millhaven community just east of the City of Monroe in Ouachita Parish, Louisiana. At the time of this investigation the property was in cultivation with a recently planted crop of Soy Beans except for a small parcel adjacent to HWY 594 which supported a grove of mature Pecan trees.

Topography of the site appears relatively flat with north-south trending irrigation/drainage ditches having been constructed on the property. Natural drainage appears to have been towards the southeastern corner of the property. A topographic survey of the property was in progress at the time of this investigation and elevations were not yet available, however *Google Earth* indicates elevation differential over most of the site is on the order of three (3) to four (4) feet per mile west to east and north to south with surface elevations between 69 and 63 feet above MSL. Based on our interpretation of site topography, fill might be required at each building site to re-grade the site for positive drainage or to achieve the minimum FEMA flood hazard elevation for this area.

Based on information provided by the Civil Engineer, Lazenby & Associates, Inc. and the client, AAI understands the property is proposed for development as an industrial park. The exact nature of the tenant(s) is not known at this time but it is assumed infrastructure development would need to

accommodate light commercial/retail warehouse operations to moderately heavy industrial/manufacturing usage. Seventy (70) acres located in the southwest corner of the property are currently under consideration for a prospective multi-modal transportation tenant needing access to the KCS rail line and Interstate 20.

FIELD OPERATIONS

The subsurface exploration at this site consisted of drilling a total of twenty-five (25) test borings; five (5) to a depth if fifty (50) feet and twenty (20) to a depth of twenty (20) feet below the existing ground surface. This investigation was conducted between May 23rd and May 30th 2012. Test boring depths and locations were suggested by Lazenby. Test borings were located in the field by AAI utilizing hand held GPS equipment, *Google Earth,* and the site plan provided by Lazenby. The locations are accurate within the limitations of the methodology used. The locations of our test borings are estimated on the *Google Earth* map included in Appendix "A" of this report.

The test borings were advanced to a maximum depth of about thirty (30) feet utilizing continuous-flight augers in general accordance with provisions outlined in *ASTM D1452, Standard Practice for Soil Investigation and Sampling by Auger Borings*. Below this depth mud rotary drilling methods in general accordance with applicable provisions outlined in *ASTM D 5783, Guide for Use of Direct rotary Drilling with Water-Based Drilling Fluid for Geoenvironmental Exploration and Installation of Subsurface Water Quality Monitoring Devices* were employed. Samples were obtained for laboratory evaluation in general accordance with provisions of *ASTM D1586, Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils* and/or *ASTM D1587, Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes*.

Standard, thin-walled, seamless Shelby tube samplers (ASTM D1587) were used to obtain specimens of cohesive materials. Soils which contained enough cohesionless material or were sufficiently dense to prevent recovery of undisturbed specimens with Shelby Tube samplers were evaluated by means of the Standard Penetration test (ASTM D1586). This test consists of determining the number of blows required by a 140 pound hammer dropped 30 inches to achieve one foot penetration of the soil. This number is then related to "in situ" relative density of the material.

These soil samples were taken continuously to a depth of ten (10) feet below the existing ground surface. Below this depth, samples were obtained at intervals of five (5) feet as the borings were advanced. All samples obtained were logged, packaged, and sealed in the field to protect them from disturbance and maintain their in situ moisture content during transportation to our laboratory. The results of the boring program (Logs of Boring) are included as Appendix "A" of this report.

LABORATORY TESTING

Upon return to our laboratory selected samples were subjected to standard laboratory tests under the supervision of a geotechnical engineer. These soil properties were used to evaluate shear strength, to classify the soils, and to evaluate their potential for volumetric change. Our laboratory testing program included the ASTM standard methods outlined below. The results of our laboratory testing program are included on the Logs of Boring in Appendix "A".

ASTM D 1140 – Amount of Material in Soils Finer Than the No. 200 (75-µm) Sieve
ASTM D 1883 – CBR (California Bearing Ratio) of Laboratory-Compacted Soils
ASTM D 2166 – Unconfined Compressive Strength of Cohesive Soil
ASTM D 2216 – Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 4318 – Liquid Limit, Plastic Limit, and Plasticity Index of Soils

SITE GEOLOGY

The site proposed for the Project lies on sedimentary sequences making up the geologic formation existing on the current Ouachita River floodplain and throughout the eastern half of Ouachita Parish. This formation is identified as Quaternary aged Holocene (Recent) Alluvium and Natural Levee deposits in the geologic literature. In this geographic area, fluvial deposits of Holocene age generally consist of unconsolidated clays, silt, sand, and some limited basal deposits of fine to medium gravel. Clays are generally stiff in consistency and over consolidated from annual cycles of desiccation. Grain size distribution of these sediments generally are more coarse with depth, from fine grained overbank, back swamp and oxbow deposits to coarse grained point bar deposits. In the vicinity of Monroe, the alluvial valley occupied by the Ouachita River is a topographic low entrenched into unconsolidated Tertiary sediments of the Eocene aged Cockfield Formation. Outside the Valley, Cockfield sediments are extensively exposed on the surface in upland areas of western Ouachita Parish.

Within this portion of the Alluvial Valley, fluvial Holocene sediments vary in thickness but are generally known to be 60 to 100 feet thick. Test borings taken at this site did not penetrate through the Recent Alluvium formation.

SOIL CONDITIONS

Soil conditions encountered on this site are typical of the sedimentary sequences encountered in this general area of central Ouachita Parish. The area has been intensively farmed for decades and a well-developed topsoil system is no longer discernible on the site. However a residual layer consisting mostly of silt, very fine sand, and some vegetative matter does exist on the surface. AAI observed this surficial layer to be approximately four (4) to six (6) inches thick across the site. This type material is generally considered to be undesirable for construction purposes and would be considered the topsoil layer for this site.

Below the topsoil veneer, clay soils were generally encountered over the entire site. This surficial stratum was found to be slightly desiccated near the surface, medium stiff to very stiff in strength consistency, moderately to highly plastic, with Unified Soils Classifications of (CL) *lean clay* and (CH) *fat* clay. Thickness of this stratum varies from about fifteen (15) feet to at least thirty-five (35) feet. Fat clay soils are known as active soils and are susceptible to significant volumetric changes with changes in moisture content. Lean clay soils have slight potential for shrink and swell and are generally considered inactive. Lean clay soils were encountered from the topsoil layer to depths that vary from a little as two (2) feet to about eight feet. On average the thickness of the lean clay soils was about four (4) feet. Fat clay soils were encountered below the lean clay layer and extent to depth of fifteen (15) to thirty-five (35) feet. Below the fat clay, medium dense to dense silty sand (SM) was generally encountered to the depth explored.

Soil conditions described in this section are of a generalized nature and intended to emphasize key features and characteristics. For a more detailed description of the subsurface materials encountered refer to the soil profiles on each Log of Boring in Appendix "A" of this report. Strata contacts indicated on our Logs are approximate. Actual transitions may be gradual in nature.

GROUNDWATER

Shallow groundwater was encountered in all of out our deeper test borings and some of the shallow test borings performed at this site. Based on our field observations static water levels were between the depths of sixteen (16) and eighteen (18) feet below the surface. Groundwater levels can be expected to fluctuate during the year in response to climatic conditions and water levels in any nearby streams. Water encountered in the upper clay strata (6 to 8 foot depths) likely represents a perched watertable. Perched water is temporary but can produce significant seepage from fractures, fissures or root holes and seriously impair construction activities during the wetter seasons of the year.

Based on the stratigraphy and anticipated type of construction, we do not anticipate shallow groundwater adversely impacting construction activities for pavements or buildings on this site. However if deep excavations are needed, construction could be impacted if excavations are required more than seven (7) or eight (8) feet below the existing ground elevation.

SUBGRADE PREPARATION

Prior to subsequent construction activity, surficial vegetation should be removed and wasted. Top soil stripping on the order of four (4) inches or less is anticipated. However, additional excavation and backfill may be required if previously undetected weak spots are encountered during the stripping operation or where trees are removed. Provide drainage of the exposed subgrade by sloping grades and ditching away from the construction site.

After stripping and rough site grading is complete the exposed surface of areas where structures, paving or fill are to be placed should be proof rolled to identify any isolated weak soils. Isolated weak spots should be investigated, removed, or repaired under the supervision of the geotechnical engineer prior to subsequent construction activity. After establishment of a stable subgrade layer, the exposed soils should be scarified to a minimum of eight (8) inches, the moisture content adjusted to within one (1) percent below to three (3) percent above optimum and recompacted to ninety-five (95) percent of the laboratory maximum as determined by *ASTM D698, Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbs/ft^3)* prior to placement of any fill or base materials.

The surface soils across this site are composed almost entirely of silty clay. In a dry condition it easily supports wheeled traffic. However, this type soil is subject to extreme changes in shear strength with relatively minor changes in moisture content. This material will have very little capacity to support construction equipment when it becomes wet. If construction is initiated during wetter periods of the year, consideration should be given to treating the clay subgrade with Hydrated Lime after establishing positive site drainage and prior to attempting scarification, recompaction or any fill placement. Ten (10) percent Hydrated Lime by volume is generally sufficient to establish a working table when properly executed. Treatment to a depth of one (1) foot is recommended. Actual Lime quantity required may increase or could decrease depending on soil moisture conditions at the time of construction. If lime treatment is used, compaction of the subgrade layer should be under the direction and to the satisfaction of the geotechnical engineer.

FILL RECOMMENDATIONS

Where fill materials will be required to achieve the finished grade elevations, the material should be placed in controlled lifts. Lifts should be placed in thin horizontal layers not exceeding eight (8) inches compacted thickness. Each lift of fill should be moisture conditioned to within two (2) percentage points of optimum moisture and compacted to a minimum of ninety-five (95) percent of the laboratory maximum as determined by ASTM D698.

All imported fill material should be *"select"*. Select materials classify SC or CL (clayey sand or sandy lean clay) in accordance with ASTM D2487 and should have liquid limits no greater than thirty-eight (38), plasticity indices (PI) between eight (8) and eighteen (18), and no more than sixty (60) percent passing the U.S. Standard No. 200 Sieve. Onsite soils classifying (CL) are suitable for reuse as fill with adequate processing and moisture conditioning. Typical specifications for compaction of sandy clay and clayey sand type soils are included in Appendix "B" or this report.

FOUNDATION INFORMATION

The (CL) soils encountered on the surface of this site are generally considered to have slight potential for volumetric instability with changes in moisture content and are of fair bearing quality. We would anticipate a minimum of (1) to (2) feet of fill would be required to establish positive drainage around any building pads. With attention to footing placement depth and slab design, lightly loaded structures can be supported on shallow foundation systems on the site.

Heavily loaded structures will likely require support from a deep foundation system to minimize differential consolidation settlement in the medium stiff clays encountered at this site.

Shallow Foundations - Stiffened, monolithic slab/foundation slab-on-grade designs such as post-tensioned or rebar reinforced ribbed slabs are better suited to the soil conditions encountered for support of light to moderately loaded structures. However, where fill depths will be such a minimum of four (4) feet of select fill or native CL soil can be maintained between the bottom of foundations and the underlying CH soil (6 feet between the bottom of slabs and CH soils), conventionally reinforced continuous and isolated spread footings can be used.

The base of the footings (or turned down slabs) can be placed approximately two (2) feet below finished floor elevations in the prepared sandy lean clay or in density controlled fill. Continuous (strip) footings can be proportioned for an allowable bearing pressure of 1,500 PSF. A minimum footing width of eighteen (18) inches should be maintained for all continuous footings.

Areas of concentrated load can be supported by isolated spread (spot) footings. The base of the footings should be placed on the previously described stratum. An allowable bearing pressure of 2,000 PSF can be used to proportion all spread footings. A minimum footing width of twenty-four (24) inches should be maintained for all spread footings. The bearing pressures provided above contain a minimum factor of safety of two (2) against shear failure of the bearing stratum and were selected to limit settlement potential to an inch or less.

The slabs for proposed structures can be placed directly on the density controlled fill or prepared subgrade. A Modulus of Subgrade Reaction (k_s) of 150 PCI be used for the prepared lean clay subgrade or density controlled select fill. Use of a polyethylene moisture (vapor) barrier is recommended under all climate controlled areas. It is recommended the slab be structurally tied to the foundation.

Deep Foundations – The use of straight-sided cast in place concrete caissons (drilled shafts), augured-cast-in-place (ACIP) piles, and all types of driven piles are feasible at this site. Drilled shafts installed to tip depth of less than thirty-five (35) feet are feasible to support moderately heavy loads. ACIP piles and driven piles will be most suitable to support heavy vertical loading or loading with a significant lateral component.

For drilled shafts and ACIP piles, shaft stems need to be reinforced to resist tensile forces that may develop in the soils active moisture zone. The active zone should be considered to extend from the ground surface to a depth of approximately ten (10) feet for purposes of steel reinforcement design. This typically requires tensile reinforcement for the entire shaft lengths.

Ultimate loads for various diameter straight-sided shafts are outlined in Appendix "C". The drilled shaft curves can also be used to estimate capacities for ACIP piles. Also included in Appendix "C" are Ultimate capacity curves for two (2) types of driven piles. Fourteen (14) inch square precast concrete and class B timber piles with a twelve (12) inch butt and seven (7) inch tip are provided. A set of drilled shaft curves were generated for the soil conditions encountered at the location of each of our fifty (50) foot borings. Driven pile curves were generated for conditions encountered at B-1 only.

Casing of drilled shaft boreholes may be required at this site due to perched water encountered and the slicken-sided nature of the clay soils. It is recommended at a minimum one (1) test shaft be drilled prior to production installation of the foundation to establish an installation procedure for production piles.

SETTLEMENT

Settlement from consolidation should be negligible if the site is prepared as specified in this report, fill materials are placed as specified in this report, and the allowable bearing pressure is not exceeded.

EXCAVATIONS

OSHA requires certain excavations with a depth of five (5) or more feet to have a safety system in-place to protect workers from exposure to hazards in and around the excavation. The owner should be aware his contractor is generally responsible for jobsite safety, however contractual agreements should be reviewed to ensure the responsibility is clearly defined. In part, the safety system requires inspection by a competent person, provisions for safe access and egress of the excavation, use of barricades to prevent surface traffic from inadvertently entering the excavation, testing for hazardous atmospheres, and protection from water accumulation, support of side walls, and support as necessary to ensure stability of adjacent structures or equipment.

The clay soils generally encountered within the upper twenty (20) feet at this site classify as Type B (cohesive fissured soil) per Appendix B to Subpart P of 29 CFR 1926 (Sloping and Benching Guidelines). If water is present, the soils must be considered Type C. Where soft clays or cohesionless soils are locally encountered, a classification of Type C must also be used.

If sheeting and shoring is required, the system can be designed for equivalent fluid unit weights of 170 PCF passive case and 84 PCF active case for the stiff to very stiff silty clay found within the upper twenty (20) feet at the site.

PAVEMENT INFORMATION

The pavement section recommendations for this site are based upon subsurface conditions implied by the test borings and the assumption traffic will be inclusive of typical private vehicle and commercial truck loading. Actual traffic volumes are not defined at this time and the suggested pavement sections are typical of what would be sufficient for an industrial facility with a moderate level of traffic loading. Facilities with very high or exclusive volumes of tractor trailer traffic may need a heavier section.

The existing (CL) surface soils, recompacted as required in the Subgrade Preparation Section of this report will have a California Bearing Ratio (CBR) value in the range of four (4) to seven (7) or Modulus of Subgrade Reaction (k) in the order of 135 PCI. Density controlled select fill materials of the type specified will have CBR values on the order of fifteen (15) with "k_s" values of 200 PSI per inch.

AAI recommends the CL and CL-ML subgrade soil be chemically stabilized with Portland cement to create a stable pavement base or subbase layer. This office recommends the upper twelve (12) inches of the pavement subgrade be stabilized with Type I Portland cement. The cement stabilized soil or "soil-cement" subgrade/base layer should achieve a minimum unconfined compressive strength of 150 PSI at seven (7) days of age. Eight (8) percent by volume cement can be used for cost estimation for cement stabilization. The actual quantity required should be verified by the geotechnical engineer during the construction phase of the project in accordance with Louisiana Department of Transportation and Development Test Method TR 432.

Construction of the soil-cement subgrade layer should be in accordance with the provisions outlined in Section 303 of the *Louisiana Standard Specifications for Roads and Bridge, 2006 Edition.* Compaction of the finished subbase layer should not be less than 95% of the maximum laboratory density as determined by LDOTD TR 418. Heavy construction traffic should not utilize cement stabilized areas until the materials have cured sufficiently to obtain minimum specified strength.

Although not encountered at the surface in the locations of our test borings, soils classifying (CH) are unsuitable for pavement subgrade support or Portland cement stabilization without chemical treatment to stabilize the strength and potential for shrinking and swelling. Where (CH) soils will exist within two (2) feet of finished pavement subgrade elevation, the active soil should either be removed and replaced with select fill or treated with Hydrated Lime such that a minimum of two (2) feet of inactive materials will exist beneath the pavement base layer and any active clay soils. Fifteen (15) percent hydrated lime by volume be used for estimation cost of lime treatment operations. Lime treatment should reduce the "in-situ" plasticity index to fifteen (15) or less. The actual Lime quantity should be verified by the geotechnical engineer during the construction phase of the project in accordance with Louisiana Department of Transportation and Development Test Method TR 433.

General recommended procedures for lime treatment are included in Appendix "B" of this report. Lime treated subgrade should be compacted to a minimum of ninety-five (95) percent of the laboratory maximum as determined by ASTM D698 at a moisture content of one (1) to three (3) percent *above* optimum moisture content.

AAI's recommendation of typical specifications for crushed aggregate base material and geotechnical fabric materials included in our proposed pavement sections are outlined in Appendix "B" of this report. Aggregate base course layers in excess of four (4) inches in thickness should be compacted to not less than 98% of the laboratory maximum as determined by ASTM D698, Method C. Layers of four (4) inches or less can be compacted by establishing a rolling pattern under the direction of the geotechnical engineer that produces the maximum density.

Rigid Pavement – Based on soil types encountered and our experience in this geographic area, AAI recommends rigid pavement sections be utilized for all heavy duty applications. Minimum flexural strength of the concrete should be 650 pounds per square inch (PSI) at twenty-eight (28)

days of age or have compressive strength value of 4,000 PSI. AAI recommends the use of air entrainment chemicals that improve workability of the concrete mix and improve durability of the pavement surface. Control joint spacing should not exceed twelve (12) feet for un-reinforced pavement of the thicknesses outlined below. All concrete paving should include provisions to mechanically control temperature induced shrinkage cracking and provide for load transfer across construction joints. Rigid pavement sections suggested for various applications at this site are summarized in the table below.

RIDGID PAVEMENT SECTIONS

Pavement Layer	Light Duty Auto Parking Applications	Medium Duty Channelized Auto Applications	Heavy Duty Access Drives and Truck Parking/Staging Applications
Portland Cement Concrete Wearing Course Thickness	5 inches	6 inches	9 inches
Base/Drainage Course Thickness	4 inches crushed stone base material	4 inches crushed stone base material	6 inches crushed stone base material
Geotechnical Fabric Layer Requirement	Optional	Optional	Optional
Subbase Course Thickness[1]	Density controlled cement stabilized CL fill as needed for grading per Fill Section of this report	Density controlled, cement stabilized CL fill as needed for grading per Fill Section of this report	Density controlled cement stabilized CL fill as needed for grading per Fill Section of this report
Subgrade Layer	Density controlled cement stabilized CL or Lime treated, cement stabilized CH subgrade prepared per this report	Density controlled cement stabilized CL or Lime treated, cement stabilized CH subgrade prepared per this report	Density controlled cement stabilized CL or Lime treated, cement stabilized CH subgrade prepared per this report

[1] Maximum total thickness of cement stabilized layer below base course layer is twelve inches, fill of insitu subgrade soil.

Flexible Pavement – Flexible paving structurally similar to the above light and medium duty rigid sections are provided for your cost comparison. Hot mixed asphaltic concrete (HMAC) mixtures should meet applicable requirements for materials, production, placement and acceptance as outlined in the *Louisiana Standard Specifications for Roads and Bridges, 2000 Edition*, Section 501 for Marshall mixtures or *LSSRB, 2006,* Section 502 for level 1 Superpave mixtures. For parking lot and light duty drive applications we recommend utilizing the ½ inch Nominal HMAC mix of either type. This mix produces a more aesthetic surface finish and generally holds up well under automobile parking lot use. The following flexible pavement sections are suggested for this site:

FLEXIBLE PAVEMENT SECTIONS

Pavement Layer	Light duty Auto Parking Applications	Medium Duty Channelized Auto Applications	Heavy Duty Access Drives and Truck Parking/Staging Areas,
Hot Mixed Asphaltic Concrete Wearing and Binder Course Thickness	2.0 inches	3.5 inches	6.0 inches
Base Course Thickness	6.0 inches crushed stone base material	6.0 inches crushed stone base material	12.0 inches crushed stone base material
Geotechnical Fabric Layer Requirement	Yes	Yes	Yes
Subbase Course Thickness[2]	Density controlled cement stabilized CL fill as needed for grading per Fill Section of this report	Density controlled cement stabilized CL fill as needed for grading per Fill Section of this report	Density controlled cement stabilized CL fill as needed for grading per Fill Section of this report
Subgrade Layer	Density controlled cement stabilized CL or Lime treated, cement stabilized CH subgrade prepared per this report	Density controlled cement stabilized CL or Lime treated, cement stabilized CH subgrade prepared per this report	Density controlled cement stabilized CL or Lime treated, cement stabilized CH subgrade prepared per this report

[2] Maximum total thickness of cement stabilized layer below base course layer is twelve inches, fill of insitu subgrade soil.

CONSTRUCTION CONCERNS

The upper soils at the site are fine-grained materials composed of a significant silt and/or clay fraction. Silty and clayey soils are subject to extreme changes in shear strength with varying moisture conditions and, if construction is initiated during wetter seasons of the year, it may be very difficult to move equipment about the site. Once the silt or clay becomes saturated, compaction operations can be seriously hampered by a tendency of the silt to "pump" or the clay to shear. Consequently, it is imperative adequate site drainage be established and maintained prior to and during construction operations to prevent water ponding on or adjacent to the site resulting in subsequent saturation of the soil. Compaction operations may be expedited by using light compaction equipment and thin lifts of soil. Rolling only as necessary to obtain compaction is advisable because further repetitive loading may cause the subgrade to "pump" or fail.

Compaction operations and installation of the foundations should be supervised by an AAI inspector. All foundation excavations should be inspected to verify cleanliness and bearing stratum suitability. Concrete should be placed in foundation excavations as soon as practical after forming and imbed placements have been approved, to avoid prolonged exposure of the bearing stratum and possible disturbance due to standing water, desiccation or construction operations.

Earthwork performed during wet periods of the climatic cycle may warrant special considerations. The use of hydrated lime, fly ash or Portland cement stabilization should be considered to provide a working platform. The need for such techniques is dependent upon earthwork scheduling with respect to weather patterns and good site management of drainage during the construction phase.

When the structures are complete, the ground surface should slope away from the structure and downspouts should carry runoff water several feet away from the structure, preferably into paved areas or sewers, before discharging.

The placement of irrigated landscaping adjacent to the foundation perimeter is not recommended without use of properly designed moisture barriers that permanently prevent water infiltration under the building's foundation. It is also recommended all trees with canopy drip lines overlapping the building foot print be removed prior to construction. New plantings should be limited to small or dwarf varieties whose root zones will not infiltrate the bearing soil of the foundation when mature.

LIMITATIONS

This study has been prepared in accordance with generally accepted geotechnical engineering principles and practices in this area at this time. We make no other warranty either express or implied.

The conclusions and recommendations submitted in this report are based upon the data obtained from the exploratory borings drilled at the locations indicated in Appendix "A", the proposed type of construction and our experience in the area. Our findings include interpolation and extrapolation of the subsurface conditions identified at the exploratory borings and variations in the subsurface conditions may not become evident until excavations are performed. If conditions encountered during construction appear to be different from those described in this report, we should be notified at once so that supplemental recommendations if required can be made.

This study has been prepared for the exclusive use by our client for design purposes. We are not responsible for technical interpretations by others of our exploratory information, which has not been described or documented in this report. As the project evolves, we should provide continued consultation and field services during design and construction to review and monitor the implementation of our recommendations, and to verify that the recommendations have been appropriately interpreted. Design changes may require additional analysis or modifications of the recommendations presented herein.

We recommend the geotechnical engineer of record (AAI) be retained to provide, construction materials testing, on-site observation of excavations, and verification of foundation bearing strata during the construction phase of this project.

APPENDIX A

SITE MAP
LOGS OF BORING
CBR DATA

A.1.

BORING LOCATIONS

TEST BORING LOCATIONS

MILLHAVEN NORTH
MILLHAVEN PLANTATION SITE
OUACHITA PARISH, LOUISIANA

A.2.

LOGS OF BORING

LOG OF BORING NO. B-1

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/23/12

SURFACE ELEV:

DRILLING METHOD(S): 0 - 25 feet Auger 25- 50 feet Rotary Wash

GROUNDWATER INFORMATION: Water encountered at eighteen (18) feet depth

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N = 9	14					92				Medium tan silty clay with trace sand
			N = 7	21		40	20	20					--Brownish gray 4.0
	5		P = 3.0	29	92	69	28	41		1.84	2.0		Medium brown clay
			P = 1.5	41									
	10		P = 2.2	35	86	79	31	48		1.10	1.0		--Reddish brown with calcium nodules 13.0
	15		P = 1.5	24									Medium light brown sandy silty clay 18.0
	20		P = 1.2	29	95					1.37	1.6		Medium brownish gray clay
	25		P = 1.2	28					94				--Gray with trace fine sand
	30		N = 13	25									
	35		N = 18	36		61	25	36	87				--Stiff 38.0
	40		N = 28	23					41				Medium dense tan silty fine sand 43.0
	45		N = 21	22					6				Medium dense tan sand with silt and trace fine gravel
			N = 34	24									--Dense 50.0
	50												Bottom of boring at 50 feet
	55												

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

LOG OF BORING NO. B-2

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/29/12

SURFACE ELEV:

DRILLING METHOD(S): 0 - 30 feet Auger 30- 50 feet Rotary Wash

GROUNDWATER INFORMATION: Water encountered at eight (8) feet depth

SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	FIELD DATA: N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
		X	N=8	15		33	18	15	93				Stiff grayish tan silty clay with trace sand
		■	P=1.5	17	102					10.6	3.4		--Hard 4.0
	5	■	P=3.5	30					96				Very stiff grayish brown clay
		■	P=3.0	31	89					2.68	1.1		--Slicken-sided
	10	■	P=2.5 ▼	37									
	15	■	P=2.0	41	80					2.10	1.6		--Slicken-sided with calcium nodules 18.0
	20	X	N=0	29					75				Very loose, wet sandy silt 23.0
	25	■	P=1.25	32		61	26	35					Medium stiff red, brown and gray clay 28.0
	30	X	N=23	25					40				Medium dense tan silty sand
	35	X	N=17	21									38.0
	40	X	N=14	32					74				Stiff tan and gray sandy silty clay 43.0
	45	X	N=24	22					11				Medium dense tan sand with silt
	50	X	N=31	20									--Dense 50.0
	55												Bottom of boring at 50 feet

TUBE SAMPLE | AUGER SAMPLE | SPLIT SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

12.94.080

ARDAMAN & ASSOCIATES,INC.

LOG OF BORING NO. B-3

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/30/12

SURFACE ELEV:

DRILLING METHOD(S): 0 - 30 feet Auger 30 -50 feet Rotary Wash

GROUNDWATER INFORMATION: Water encountered at fifteen and one-half (15.5) feet and stayed at eighteen (18) feet

DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
		N=5	16		25	20	5	88				Medium stiff grayish tan very silty clay
		N=7	20		34	19	15					4.0
5		N=10	20		23	20	3	83				Medium dense grayish tan sandy silt 6.0
		P=2.5	36	85					1.79	2.0		Very stiff reddish brown clay, slicken-sided
		P=1.75	39									--Stiff red, brown and gray
10												
		P=1.5	38	81					1.17	3.1		
15												18.0
		P=2.5	25	98					1.78	3.2		Very stiff tan and gray silty clay
20												23.0
		N=11	25					14				Medium dense tan silty sand
25												
		N=21	21									
30												
		N=13	25					18				
35												
		N=7	25									--Loose grayish tan
40												43.0
		N=28	21					7				Medium dense grayish tan sand with silt
45												
		N=26	21									50.0
50												Bottom of boring at 50 feet
55												

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

LOG OF BORING NO. B-4

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/30/12

SURFACE ELEV:

DRILLING METHOD(S): 0 - 30 feet Auger 30- 50 feet Rotary Wash

GROUNDWATER INFORMATION: Water encountered at seventeen (17) feet depth, caved in

FIELD DATA				LABORATORY DATA										
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSi	DESCRIPTION OF STRATUM	
			N=5	24		44	23	21	93				Medium stiff light gray silty clay with fine sand	2.0
	5		P=1.0	35	88	56	28	28	90	1.02	4.9		Medium stiff gray clay with slicken-sides and fine sand	
			P=0.25	34		53	24	29					--Soft	
			P=2.0	34	86					1.48	9.3		--Stiff brown clay with slicken-sides	
	10		P=1.0	40										
	15		P=1.0	39	80					1.33	2.1			18.0
	20		N=4	28					71				Loose grayish brown sandy silt	23.0
	25		N=0	24									Very loose grayish tan silty sand	
	30		N=2	40									--Very loose with organics	
	35		N=22	25					25				--Medium dense tan silty sand	
	40		N=32	22									--Dense	
	45		N=28	25					25				--Medium dense	
	50		N=39	21									--Dense	50.0
	55												Bottom of boring at 50 feet	

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

LOG OF BORING NO. B-5

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/30/12

SURFACE ELEV:

DRILLING METHOD(S): 0 - 25 feet Auger 25- 50 feet Rotary Wash

GROUNDWATER INFORMATION: Water encountered at six (6) feet depth

SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N=5	16		21	21	NP	85				Loose light gray sandy silt 2.0
			N=5	21		30	20	10					Medium stiff tan silty clay with trace fine sand
	5		P=2.0	25	99	32	21	11	87	1.43	3.6		
			P=0.5 ▼	27	94					0.76	8.2		--Soft, wet reddish brown silty clay 8.0
			P=1.0	41						0.82	1.6		Medium stiff red, brown and gray clay
	10												
			P=0.25	34									--Soft gray and brown
	15												
			P=1.0	57									--Medium stiff gray with organics
	20												
			P=1.25	45									
	25												
			N=5	44		80	32	48					
	30												33.0
			N=5	28									Medium stiff grayish brown sandy silty clay
	35												38.0
			N=7	27					28				Loose grayish tan silty sand
	40												
			N=12	26									--Medium dense with gray clay seams
	45												48.0
			N=19	23					4				Medium dense tan sand 50.0
	50												Bottom of boring at 50 feet
	55												

DESCRIPTION OF STRATUM

REMARKS:

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

LOG OF BORING NO. B-6

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/23/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N=4	16		26	20	6	92				Medium stiff grayish tan clayey silt
													2.0
			P=2.5	20	103	35	21	14	93	2.09	6.9		Stiff brown silty clay with trace sand
													4.0
				26	96	55	24	31		1.71	2.6		Very stiff brown clay with slicken-sides
	5		P=1.75	32									--Red, brown and gray
			P=2.5	39									--Red and gray with calcium nodules
	10												
			P=1.5	26	91				94				--Stiff tan and gray silty with trace sand
	15												
			P=1.75	29						0.95	1.5		--Stiff with slicken-sides
	20												20.0
													Bottom of boring at 20 feet
	25												

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

LOG OF BORING NO. B-7

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/24/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encoutnered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N=5	17		27	21	6	92				Medium stiff grayish tan clayey silt
													2.0
			P=2.0	21	99	33	21	12	96	1.38	2.5		Stiff reddish tan silty clay
													4.0
			P=2.0	25					98				Stiff grayish tan clay
	5		P=1.75	34	87	84	33	51		2.21	1.9		--Slicken-sided
			P=2.5	17									--Very stiff brown and gray
	10												
			P=2.0	37									--Red and gray
	15												
			P=1.75	28	92					1.70	4.3		--Red, brown and gray with slicken-sides
													20.0
	20												Bottom of boring at 20 feet
	25												

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

LOG OF BORING NO. B-8

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/24/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N=6	21		35	20	15	93				Medium stiff grayish tan silty clay with trace sand
			P=1.3	22	102	44	18	26	92	1.98	4.5		--Stiff grayish brown
													4.0
	5		P=1.25	31		70	24	46	97				Stiff brown clay with slicken-sides
			P=2.3	33	88					1.52	1.7		--Very stiff with slicken-sides and calcium nodules
			P=1.0	40									--Stiff tan and gray
	10												
			P=2.7	27	97					2.83	2.6		
	15												
			P=3.75	57									--Very stiff reddish tan with organics
													20.0
	20												Bottom of boring at 20 feet
	25												

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

12.94.080

ARDAMAN & ASSOCIATES,INC.

LOG OF BORING NO. B-9

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/24/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N=5	17		26	20	6	89				Medium stiff tan clayey silt
													2.0
			P=1.5	22	101	43	19	24	94	2.65	9.0		Stiff grayish tan silty clay
	5		P=1.25	22		30	19	11					
													6.0
			P=2.5	35	85					1.92	2.2		Very stiff reddish brown clay with slicken-sides
			P=2.0	33									
	10												
			P=2.5	33	85					2.12	1.4		
	15												
			P=0.25	30					86				--Gray with sand
													20.0
	20												Bottom of boring at 20 feet
	25												

REMARKS:

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

LOG OF BORING NO. B-10

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/24/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N = 7	17		26	19	7	92				Medium stiff light brown clayey silt with trace sand
													2.0
			N = 7	24		48	22	26	94				Medium stiff brown silty clay with trace sand
	5		P = 1.0	23	101	37	22	15	92	1.21	3.4		--Grayish tan
													6.0
			P = 1.25	36									Stiff brown and gray clay with slicken-sides
	10		P = 1.5	33	87					1.61	1.7		--Red, brown and gray
	15		P = 1.75	40									
			P = 1.5	25	97					1.95	3.3		--Brown and tan with slicken-sides
													20.0
	20												Bottom of boring at 20 feet
	25												

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

LOG OF BORING NO. B-11

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/24/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N = 4	17		21	19	2	85				Loose tan sandy silt
			N = 3	22		NP	NP	NP	87				4.0
	5		N = 6	24					97				Medium stiff grayish tan silty clay
			P = 2.3	37	84	83	32	51		1.97	2.1		6.0 Very stiff brown and gray clay with slicken-sides
	10		P = 2.3	37	84					1.47	2.1		--Brown
	15		P = 1.5	40									--Stiff red, brown and gray clay
	20		P = 2.0	25	100					1.66	2.3		--Very stiff with slicken-sides 20.0
													Bottom of boring at 20 feet
	25												

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

LOG OF BORING NO. B-12

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/25/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N = 8	16		35	20	15	95				Medium stiff grayish tan silty clay with trace sand
			P = 4.5	23	95	40	17	23	96	2.44	4.8		--Stiff
													4.0
			P = 2.5	24					98				Very stiff brown and tan clay
	5		P = 2.0	28	95	52	23	29		2.11	2.9		--Stiff red, brown and gray with slicken-sides
			P = 2.0	35									
	10												
			P = 1.5	35	85					1.03	1.8		--Brown and gray with slicken-sides
	15												
			P = 1.0	47									--Dark gray
													20.0
	20												Bottom of boring at 20 feet
	25												

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

LOG OF BORING NO. B-13

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/25/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N = 3	16		22	20	2	89				Loose tan silt with trace sand
													2.0
			N = 6	22		34	17	17	95				Medium stiff grayish tan silty clay with trace sand
	5		P = 1.0	26	96	44	22	22	99	1.48	3.3		--With slicken-sides
													6.0
			P = 1.5	34	87					1.36	3.5		Stiff brown and gray clay with slicken-sides
			P = 1.5	42									--Stiff red, brown and gray with calcium nodules
	10												
			P = 1.75	37									--Tan and gray
	15												
			P = 1.5	35	87					1.70	2.7		--Red, brown and gray with calcium nodules and slicken-sides
													20.0
	20												Bottom of boring at 20 feet
	25												

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

12.94.080

ARDAMAN & ASSOCIATES,INC.

LOG OF BORING NO. B-14

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/25/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N=3	18		30	20	10	94				Medium stiff tan silty clay with trace sand
			N=5	23		31	19	12	96				4.0
	5			26	94	51	25	26	98	2.12	1.9		Very stiff grayish brown clay with slicken-sides
			P=3.0	32	89					2.59	2.1		
			P=1.25	44									--Stiff red, brown and gray
	10												
			P=2.5	20	102					1.53	2.2		--Very stiff with silt seams
	15												18.0
			N=2	26									Very loose reddish tan silt with trace sand
	20												20.0
													Bottom of boring at 20 feet
	25												

REMARKS:

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

LOG OF BORING NO. B-15

PROJECT: Millhaven North-Millhaven | **SHEET** 1 of 1

CLIENT: Millhaven Plantation LLC | **LOCATION:** Ouachita Parish, Louisiana

DATE: 5/25/12 | **SURFACE ELEV:**

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N=6	15		NP	NP	NP	88				Loose grayish tan silt with trace sand 2.0
	5		N=6	21		34	19	15					Medium stiff grayish tan silty clay with trace sand
			P=0.75	22		33	16	17	96				
			P=2.5	24	99				94	1.54	5.9		--Stiff tan, gray and red 8.0
	10		P=2.5	32	90					2.00	3.7		Very stiff reddish brown clay with slicken-sides
			P=1.25	41									--Stiff gray and tan
	15		P=2.0	41	81					1.71	1.9		--Stiff red, brown and gray with calcium nodules and slicken-sides 20.0
	20												Bottom of boring at 20 feet
	25												

REMARKS:

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

LOG OF BORING NO. B-16

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/24/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N = 10	13		NP	NP	NP	86				Medium dense grayish tan silt with sand
			N = 9	19		NP	NP	NP	78				4.0
	5		N = 6	20									Medium stiff grayish tan silty clay
			P = 2.6	26	97				97	1.23	4.3		--Changes to red and brown clay at 7 feet
				34	88					1.36	1.6		7.0 Stiff reddish brown clay with slicken-sides
	10												
			P = 1.5	22	104					1.98	3.0		--Stiff red, brown and gray with tan silt seams
	15												18.0
			P = 0.5	28									Medium stiff tan clayey silt
	20												20.0 Bottom of boring at 20 feet
	25												

REMARKS:

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

LOG OF BORING NO. B-17

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/24/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N = 9	16		NP	NP	NP	83				Medium dense light brown silt with sand
													2.0
			N = 5	23		35	19	16	93				Medium stiff grayish tan silty clay with trace sand
	5			27	96	47	18	29		2.31	2.6		--Stiff
													6.0
			N = 7	26					62				Medium stiff reddish tan sandy silty clay
													8.0
			P = 1.5	38	82					1.75	6.9		Stiff reddish brown clay with slicken-sides
	10												
			P = 1.0	49	71					1.20	2.1		--Medium stiff
	15												
													18.0
			P = 0.50	38									Medium stiff grayish tan clayey silt
	20												20.0
													Bottom of boring at 20 feet
	25												

TUBE SAMPLE | AUGER SAMPLE | SPLIT SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

LOG OF BORING NO. B-18

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/24/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N=3	20		22	20	2	91				Loose grayish tan silt with sand
													2.0
			N=5	23		39	20	19	87				Medium stiff grayish tan silty clay with trace sand
				24	101	43	18	25	97	1.85	3.0		
	5		P=1.0	27	98					1.79	2.8		--Changes to reddish brown clay at 7 feet
													7.0
			P=2.0	34	89					1.90	2.0		Stiff reddish brown clay with slicken-sides
	10												
			P=0.25	53									--Soft brownish gray clay with organics
	15												
			P=0.75	63									--Soft dark gray clay with organics
													20.0
	20												Bottom of boring at 20 feet
	25												

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

LOG OF BORING NO. B-19

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/24/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N=8	13		21	19	2	84				Medium dense tan silt with trace sand 2.0
	5		N=5	21		28	17	11					Medium stiff tan silty clay with trace sand
			P=2.25	24		34	17	17	99				--Stiff reddish tan and gray silty clay 6.0
				30	92					2.13	2.7		Stiff reddish tan clay with slicken-sides
	10		P=2.5	31	91					1.70	1.8		--Very stiff red, brown and gray with slicken-sides
	15		P=1.5	49	73					1.28	3.0		--Stiff reddish brown clay with slicken-sides 18.0
			P=0.25	27					96				Soft reddish tan clayey silt 20.0
	20												Bottom of boring at 20 feet
	25												

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

LOG OF BORING NO. B-20

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/24/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N=3	17		NP	NP	NP	87				Loose tan silt with trace sand 2.0
			N=4	23		23	19	4	86				Soft reddish tan clayey silt with sand 4.0
	5		P=3.0	21	104					2.46	3.6		Stiff reddish tan silty clay 6.0
			P=1.7	23	103	20	16	4	70	0.66	4.9		Medium stiff reddish tan clayey sandy silt 8.0
	10		P=2.5	34	87					1.92	2.2		Very stiff red and gray clay with slicken-sides
	15		P=1.25	41									--Stiff tan and gray clay with slicken-sides 18.0
			P=2.0	27									Stiff reddish tan silty clay 20.0
	20												Bottom of boring at 20 feet
	25												

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

LOG OF BORING NO. B-21

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/26/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N = 3	15		25	19	6	86				Soft tan clayey silt with sand
													2.0
			N = 5	20		28	18	10	91				Medium stiff reddish tan silty clay with sand
	5		N = 4	23					86				
													6.0
			P = 2.5	34	86	73	32	41		1.80	2.0		Very stiff reddish brown clay with slicken-sides
			P = 1.5	35	86					1.76	2.2		--Stiff red, brown and gray clay with slicken-sides
	10												
			P = 1.75	37									
	15												
													18.0
			P = 1.75	22	102					0.62	2.8		Medium stiff tan and gray silty clay
	20												20.0
													Bottom of boring at 20 feet
	25												

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

LOG OF BORING NO. B-22

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/26/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: No water encountered

FIELD DATA				LABORATORY DATA									
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N=5	15		28	17	11	86				Medium stiff grayish tan silty clay with sand
			N=5	22		32	18	14	88				--Reddish tan
													4.0
	5		P=1.5	27	94	49	18	31	99	2.30	4.1		Stiff reddish tan and gray clay
			P=1.5	28									
			P=2.0	43	78					2.06	1.9		--Stiff reddish brown clay with slicken-sides
	10												
			P=2.0	37	83					2.68	6.4		--Grayish brown with slicken-sides
	15												
													18.0
			P=1.25	24									Stiff grayish tan silty clay
	20												20.0
													Bottom of boring at 20 feet
	25												

REMARKS:

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

LOG OF BORING NO. B-23

PROJECT: Millhaven North-Millhaven | **SHEET** 1 of 1

CLIENT: Millhaven Plantation LLC | **LOCATION:** Ouachita Parish, Louisiana

DATE: 5/26/12 | **SURFACE ELEV:**

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: Water encountered at six (6) feet depth after 24 hours

FIELD DATA				LABORATORY DATA										
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM	
			N=4	29		51	23	28	95				Soft gray clay with trace sand	2.0
				30	92	45	19	26	97	0.99	5.4		Medium stiff grayish tan silty clay	4.0
	5		P=0	27		NP	NP	NP	96				Medium dense grayish tan silt with trace sand	6.0
			P=1.5	38	83					1.33	14.9		Medium stiff grayish brown clay with slicken-sides	
			P=0.75	31										
	10													
			P=1.25	45									--Stiff red, brown and gray with calcium nodules	18.0
	15													
				25	102					1.54	6.4		Medium stiff grayish tan silty clay	20.0
	20												Bottom of boring at 20 feet	
	25													

REMARKS:

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

LOG OF BORING NO. B-24

PROJECT: Millhaven North-Millhaven

SHEET 1 of 1

CLIENT: Millhaven Plantation LLC

LOCATION: Ouachita Parish, Louisiana

DATE: 5/25/12

SURFACE ELEV:

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: Water encountered at sixteen (16) feet depth

SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N=5	15		26	18	8	85				Medium stiff grayish tan silty clay with sand
													2.0
			P=1.0	17		46	21	25	94				Stiff grayish tan silty clay with trace sand
													4.0
			P=1.5	36		63	20	43	99				Stiff red, brown and gray clay
	5		P=0.25	41									--Soft with calcium nodules
			P=1.0	28	94					1.15	2.9		--Stiff brownish gray with slicken-sides
	10												
			P=1.5	43	78					1.76	4.6		--Stiff grayish tan with slicken-sides
	15												
			P=1.0	45									--Stiff reddish brown
													20.0
	20												Bottom of boring at 20 feet
	25												

TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

REMARKS:

12.94.080

ARDAMAN & ASSOCIATES,INC.

LOG OF BORING NO. B-25

PROJECT: Millhaven North-Millhaven | **SHEET** 1 of 1

CLIENT: Millhaven Plantation LLC | **LOCATION:** Ouachita Parish, Louisiana

DATE: 5/26/12 | **SURFACE ELEV:**

DRILLING METHOD(S): Auger

GROUNDWATER INFORMATION: Water encountered at seven and one-half (7.5) feet depth

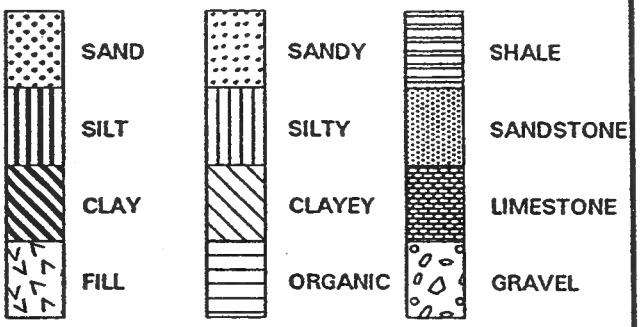
SOIL & ROCK SYMBOL	DEPTH (FT)	SAMPLE TYPE	N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF	MOISTURE CONTENT, %	DRY DENSITY POUNDS/CU.FT	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %	MINUS NO. 200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN (%)	CONFINING PRESSURE PSI	DESCRIPTION OF STRATUM
			N = 10	13					83				Medium dense tan silt with sand with trace clay
			P = 2.0	17		NP	NP	NP	82				
	5		P = 1.0	26		NP	NP	NP					6.0
			P = 0.5	26	102	23	19	4	75	0.85	8.0		Medium stiff reddish tan sandy clayey silt 8.0
	10		P = 0.5	44	75					0.50	1.2		Soft, wet reddish tan silty clay 13.0
			P = 1.0	36									Stiff brownish gray clay with slicken-sides
	15		P = 1.25	36									--With calcium nodules 20.0
	20												Bottom of boring at 20 feet
	25												

TUBE SAMPLE | AUGER SAMPLE | SPLIT SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

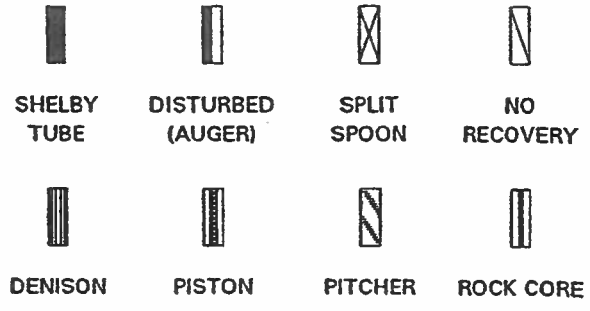
REMARKS:

KEY TO SOIL CLASSIFICATION TERMS AND SYMBOLS

SOIL OR ROCK TYPES



SAMPLER TYPES



CONSISTENCY OF COHESIVE SOILS (MAJOR PORTION PASSING NO. 200 SIEVE)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH, KIPS/SQ FT
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.5
FIRM	0.5 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	GREATER THAN 4.0

RELATIVE DENSITY OF GRANULAR SOILS (MAJOR PORTION RETAINED ON NO. 200 SIEVE)

DESCRIPTIVE TERM	RELATIVE DENSITY,%
VERY LOOSE	LESS THAN 15
LOOSE	15 TO 35
MEDIUM DENSE	35 TO 65
DENSE	65 TO 85
VERY DENSE	GREATER THAN 85

WATER LEVELS

▼ - DEPTH GROUNDWATER FIRST ENCOUNTERED DURING DRILLING

▽ - GROUNDWATER LEVEL AFTER 24 HOURS (UNLESS OTHERWISE NOTED)

TERMS DESCRIBING SOIL STRUCTURE

Parting: paper thin in thickness

Seam: 1/8" - 3" in thickness

Layer: greater than 3" in thickness

Calcareous: containing appreciable quanties of calcium carbonate

Ferrous: containing appreciable quantities of iron

Well-graded: having wide range in grain size & similar proportions of all intermediate sizes

Poorly graded: predominately one grain size or having a range of sizes with few or no particles of some intermediate sizes

Fissured: containing shrinkage cracks, frequently filled with fine sand or silt, usually more or less vertical

Interbedded: composed of alternate layers of different soil types

Laminated: composed of thin layers of varying color and texture

Slickensided: having inclined planes of weakness that are slick & glossy in appearance

NOTE: Clays possessing slickensided or fissured structure may exhibit lower measured shear strength than indicated by the described consistency. The consistency of such soil is interpreted using the measured shear strength along with pocket penetrometer results.