Exhibit P, Petty South Geotechnical Report

**PRELIMINARY**
**GEOTECHNICAL EXPLORATION**
**PETTY COMPANY SOUTH**
**160 ACRES – NWC LA HWY 594 & MILLHAVEN RD.**
**OUACHITA PARISH, LOUISIANA**

**PREPARED**
**FOR**
**LOUISIANA ECONOMIC DEVELOPMENT**
**C/O DENMON ENGINEERING, INC.**
**P.O. BOX 8460**
**MONROE, LOUISIANA 71211**

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

**AAI PROJECT NO.: 113-14-94-8651**
**AAI SHREVEPORT FILE NO.: 14.94.104**

**DECEMBER 15, 2014**

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Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

December 15, 2014

Louisiana Economic Development
c/o Denmon Engineering , Inc.
P.O. Box 8460
Monroe, Louisiana 71211

Attention: Mr. Randy Denmon, P.E.

Reference: Preliminary Geotechnical Exploration
Petty Company South
160 Acre Site – NWC LA HWY 594 & Millhaven Road
Ouachita parish, Louisiana
AAI Project No.: 113-14-94-8652
AAI Shreveport File No.: 14.94.104

Gentlemen:

Attached is AAI's Preliminary Geotechnical Exploration Report for the above referenced project. Ardaman & Associates, Inc. (AAI) would be pleased to assist you or the future purchaser further on this project by furnishing any additional site specific geotechnical studies or providing any Construction Materials Testing Services that may be required. We are a full service laboratory with a local presence in West Monroe, Louisiana.

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.**

James M. Belt, P.E.
Senior Project Engineer
Branch Manager Shreveport Area Operations

cc: (2) client

Location: 7222 Greenwood Road, Shreveport, Louisiana 71119 Phone (318) 636-3673 Fax (318) 636-3723
Mailing Address: PO Box 19220, Shreveport, Louisiana 71149-0220
Louisiana: Alexandria, Baton Rouge, Monroe, New Orleans, Shreveport
Florida: Bartow, Cocoa, Fort Myers, Miami, Orlando, Port St. Lucie, Sarasota, Tallahassee, Tampa, West Palm Beach

**PRELIMINARY**
**GEOTECHNICAL EXPLORATION**
**PETTY COMPANY SOUTH**
**160 ACRE SITE – NWC LA HWY 595 & MILLHAVEN ROAD**
**OUACHITA PARISH, LOUISIANA**

## GENERAL

This study was authorized on behalf of Louisiana Economic Development by Mr. Randy Denmon, P.E. of Denmon Engineering, Inc. in July 2014. 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, (3) characterize the sites soil and groundwater conditions, and (4) determine if unfavorable soil conditions exist at the site. Item 4 is general in nature and each boring has brief analysis and conditions presented. Access to the site was delayed for several months due to active agricultural activity on the property and then after harvest by unusually wet site conditions in late summer and early fall.

## PROJECT DESCRIPTION

The tract lies west of Louisiana Highway 594 and north of the railroad line along the north side of Millhaven Road and consists of a total of approximately one hundred sixty (160) acres. It is bordered to the south by a Union Pacific Railroad line, to the east by HWY 594, to the north by East Ouachita High School and to the west by undeveloped wooded property. The property is under active agricultural use and is owned by the Petty Company. This report is part of a prerequisite for the Louisiana Economic Development "Certified Site" program.

## FIELD EXPLORATION PROGRAM

The geotechnical investigation consisted of a total of three (3) test borings. The borings were performed in separate areas over the proposed site. Two (2) borings were advanced to a depth of twenty-five (25) and one boring was advanced to a depth of approximately one hundred (100) feet below the existing ground surface (BGS). This investigation was conducted in October 2014. Boring depths were specified by the client. Test boring locations were selected by the geotechnical engineer based on our understanding of the proposed type development and our experience in this general area of Ouachita Parish.

The test borings were advanced utilizing continuous-flight, solid stem augers to a depth of about twenty-five (25) feet. Below this depth the borings were advanced by mud-rotary methods to total depth. 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. A two (2) inch diameter, blunt-nose, split-spoon sampler was used to obtain samples of soils which contained primarily granular material and those cohesive soils sufficiently dense to prevent recovery of undisturbed specimens with Shelby Tube samplers. Relative strength of samples collected by split-spoon was evaluated by means of the Standard Penetration Test (ASTM D1586). This test consists of determining the number of blows required by a one hundred forty (140) pound hammer dropped thirty (30) inches to achieve one (1) foot penetration of the soil. This number is then related to "in situ" relative density of the material.

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 PROGRAM

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 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.*

## SOIL CONDITIONS

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 profile on each Log of Boring in Appendix "A". Strata contacts indicated on our Logs are approximate. Actual transitions may be gradual in nature. Actual transitions may be gradual in nature. The soils described are at the specific boring locations within the depths explored. Soils at other locations or depths may be different than those encountered during this exploration.

The soil types generally encountered within the eight (8) feet at the test boring locations are of fair to good bearing quality and have low potential for shrink and swell with changes in moisture content. These type soils are not considered active or expansive and generally suitable for support of lightly loaded structures on a shallow foundation system.

**B-1**

This test boring was performed in the northeast area of the property. At this location, the upper five (5) to six (6) feet is loose to medium dense non-plastic silt with sand. Below the surficial silt stratum, stiff moderately plastic lean clay and medium stiff highly plastic fat clay were encountered. The boring was terminated in the fat clay stratum at the twenty-five (25) foot depth.

**B-2**

This test boring was performed in the central area of the property. At this location, the upper two (2) feet is medium dense, non-plastic silt with sand. Below the surficial silt stratum, medium stiff to stiff moderately plastic lean clay exists to the ten (10) foot depth. Below ten (10) feet, stiff to medium stiff highly plastic fat clay with minor strata of interbedded moderately plastic lean clay exists to the thirty-five (35) foot depth. Below this depth, medium dense to dense sand exists to a depth of seventy-five (75) feet. Below the sand stratum, very stiff lean clay with fine sand partings is encountered. The boring was terminated in the clay stratum at the one hundred (100) foot depth.

**B-3**

This test boring was performed in the southwestern area of the property. At this location, the upper ten (10) feet is medium stiff to stiff, moderately plastic lean clay with some sand. Below the ten (10) foot depth, stiff, highly plastic fat clay was encountered. The boring was terminated in the fat clay stratum at the twenty-five (25) foot depth.

## GROUNDWATER

Shallow groundwater was observed during advancement of the test borings performed on this site. Groundwater was observed at a depth range of eighteen (18) to twenty (20) feet BGS. The occurrence of groundwater during advancement of the test borings is noted on each Log of Boring. All borings were backfilled upon completion of sampling operations; therefore the observed groundwater level may not be representative of true static conditions in the subsurface of this site. The shallow groundwater table level should be expected to fluctuate with the climatic seasons of the year and with localized weather events. Groundwater within the upper twenty (20) feet BGS is typical in the alluvial sediments found in this general area of Ouachita Parish.

Based on AAI's understanding of the properties proposed use, groundwater is not anticipated to adversely impact surficial construction activity. However surface moisture may be problematic if construction activities are attempted during the wetter seasons of the year or good management of site water is not practiced. Attention is advised to the Construction Considerations section of this report to minimize construction delays due to saturated surface soils. Execution of deep utility excavations should anticipate the occurrence of groundwater seepage.

## PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

### SUBGRADE PREPARATION

Prior construction activity on this site, top soil stripping will be required. Provide drainage of the exposed subgrade by sloping grades and ditching away from the construction site so positive drainage can be maintained throughout the construction phase of the project. Existing natural drainage should help in keeping this site well drained during any construction.

As a general practice after the undisturbed subgrade is exposed, the upper twelve (12) inches should be scarified; moisture conditioned, and then compacted to a minimum of ninety-five (95) percent of the laboratory maximum density as determined by ASTM D698 at one (1) to three (3) percent above optimum moisture content prior to subsequent fill placement.

### FILL MATERIAL RECOMMENDATIONS

Where projects may require the existing grades be raised with fill materials the materials should be placed in a controlled manner. Fill materials should be placed in thin horizontal layers not exceeding eight (8) inches in loose thickness, moisture conditioned to within two (2) percentage points of optimum moisture and re-compacted to a minimum of ninety-five (95) percent ASTM D698.

All imported fill material should be "select". Select materials classify as SC or CL (clayey sand or sandy lean clay) in accordance with the Unified Soils Classification System and will have liquid limits (LL) no greater than thirty-eight (38), plasticity indices (PI) between eight (8) and eighteen (18) with no more than sixty (60) percent passing the No. 200 sieve. Typical specifications for compaction of sandy clay and clayey sand soils are included in Appendix "B" of this report.

Onsite soils encountered within the upper ten (10) feet at the test boring locations, although not considered expansive, contain a high percentage of silt. Silty soils are highly moisture sensitive and require constant maintenance during construction or chemical stabilization to maintain suitable density and strength. These type soils are generally a poor choice for structural fill and better suited for general site use and under pavements where chemical stabilization may be considered.

## FOUNDATION INFORMATION

The information presented herein is general in nature and intended only for determining site feasibility during preliminary planning considerations of future commercial, manufacturing, or industrial developments and is not represented as suitable for final design purposes. A site/project specific geotechnical evaluation is required for determining final project design parameters for individual developments.

### Light to Moderately Loaded Structures

As previously noted, the near surface soils encountered within the upper eight (8) feet below the existing ground surface at the test boring locations are considered inactive and are of fair and better bearing quality. As such, they are suitable for support of a shallow foundation system. Conventionally reinforced, slab-on-grade, shallow foundation systems are feasible for this site.

In general the base of footings should be placed a minimum of one (1) to two (2) feet below the ground surface or finished grade at the time of construction. For preliminary planning purposes, footings placed in the surficial silt or lean clay stratum can be proportioned for a net allowable bearing value of 2,000 PSF. The bearing value contains a minimum factor of safety of three (3) against shear failure of the bearing stratum and was selected to limit consolidation settlement to one inch. A minimum footing width of eighteen (18) inches should be maintained for all continuous footings as protection against potential isolated shear failure. A minimum footing width of twenty-four (24) inches should be maintained for all spread footings.

The floor slabs for proposed structures can be placed directly on prepared subgrade soils or on density controlled fill. Use of a polyethylene moisture (vapor) barrier, sufficiently durable to survive construction installation is recommended under all climate controlled areas of future buildings.

Some consolidation settlement should be expected in the clay soils beneath this site. However, if the site is properly prepared and allowable bearing capacities not exceeded, settlement should be limited to an inch or less.

**Heavily Loaded Structures**

Heavily loaded structures will induce settlement in the silt and clay strata encountered within the upper twenty-five (25) feet at the test boring locations if a shallow foundation system is utilized. The most positive means of transferring structural loads to the subsurface for settlement sensitive structures will be to use deep or moderately deep foundation systems. A variety of both driven and cast in place pile support systems have been used successfully in this general geographic area of Ouachita Parish. However the designer must consider installation requirements for each type and any adverse impact they could have on neighboring developed properties or business activity. Two (2) often used options with relatively low site impact potential are straight sided drilled and cast-in-place caissons (straight sided shafts) and augured cast-in-place (ACIP) pressure grouted piles.

Considering the near surface silt and sand strata encountered at the test borings may require casing of the borehole to install straight sided drilled shafts, the most economical way to support heavily loaded structures may be with an ACIP pile system. The table below provides allowable capacities of commonly used sizes of drilled shafts or ACIP piles for up to a length of fifty (50) feet. The capacities include a minimum safety factor of three (3).

**ALLOWABLE CAST IN PLACE PILE CAPACITIES**

| Pile Diameter (inches) | Tip Depth (feet BGS) | Total Capacity (tons) | Skin Friction Capacity (tons) |
|---|---|---|---|
| 18 | 20 | 10.90 | 9.60 |
| 24 | 20 | 15.09 | 12.80 |
| 30 | 20 | 19.23 | 16.00 |
| | | | |
| 18 | 40 | 23.88 | 19.86 |
| 24 | 40 | 33.72 | 26.47 |
| 30 | 40 | 44.56 | 33.09 |
| | | | |
| 18 | 60 | 46.07 | 40.28 |
| 24 | 60 | 64.10 | 53.71 |
| 30 | 60 | 83.51 | 67.13 |

## SITE SEISMIC CLASSIFICATION

Based on the soil profile encountered at test boring B-2 and our estimation of soil strength, a Seismic Site Classification of "Class D" per the 2009 International Building Code (IBC) is recommended for this site. AAI estimates the project area has mapped acceleration parameters for 1.0 second and 0.2 second spectral response of approximately $S_1$ = 0.08g and $S_s$ = 0.19g per 2009 IBC Figures 1613.5(2) and 1613.5(1) respectively. Site Coefficient's of $F_v$ = 2.4 and $F_a$ = 1.6 are appropriate per 2009 IBC Tables 1613.5.3(1) and (2) for a Seismic Site Classification of "D" and the mapped acceleration parameters above. The adjusted maximum considered earthquake spectral response acceleration parameters of $S_{M1}$ = 0.192g and $S_{Ms}$ = 0.304g were determined from the preceding values. The estimated design spectral accelerations of $S_{D1}$ and $S_{Ds}$ are 0.128g and 0.203 respectively.

## CONSTRUCTION CONSIDERATIONS

The upper soils at the site are fine-grained materials composed of significant silt and clay fractions. Silty and/or clayey soils are subject to changes in shear strength with varying moisture conditions. If construction is initiated during wetter seasons of the year, it may be difficult to move equipment

about the site. Once these type soils become saturated, compaction operations can be hampered by a tendency of the silt to "pump" and the clay to "shear".

Consequently it is recommended, adequate site drainage be established prior to, during, and following construction operations to prevent water ponding on or adjacent to construction areas. 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. Once soils begin to pump, it is usually necessary to either start the moisture conditioning process over or remove and replace the saturated material. AAI can provide experience soils technicians to monitor the contractor's compaction operations and assist in expediting the site work.

Compaction operations and installation of the foundations should be supervised by a qualified soils technician under the supervision of the Geotechnical Engineer. All foundation excavations should be inspected to verify cleanliness and adequate bearing. Concrete should be placed in foundation excavations as soon as practical after forming and final clean-up have been approved, to avoid prolonged exposure of the bearing stratum and possible disturbance due to standing water, desiccation or other construction operations.

Earthwork performed during wet periods of the climatic cycle may warrant special considerations. The use of hydrated lime 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.

## LIMITATIONS

This study has been prepared in accordance with generally accepted preliminary 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 preliminary exploratory borings drilled at the location(s) indicated in Appendix A, the different possible type of construction, and our experience in the area. Our findings include interpolation and extrapolation of the subsurface conditions identified at the exploratory boring(s) and variations in the subsurface conditions may not become evident until excavations are performed.

This study has been prepared for the exclusive use by our client for preliminary purposes only. 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 site is eventually developed additional borings should be taken. Significant design changes could be required or modifications of the recommendations presented herein. We recommend on-site observation of excavations and foundation bearing strata by a representative of the geotechnical engineer.

# APPENDIX A

## SITE MAP
## AND
## LOGS OF BORING


**SITE LOCATION**

**PETTY COMPANY SOUTH**
**160 ACRE SITE**

# LOG OF BORING NO. B-1

**PROJECT:** Petty Company South-Site 5 — **SHEET** 1 of 1

**CLIENT:** Louisiana Economic Development-%Denmon Engineering — **LOCATION:** Northeast Corner

**DATE:** 10/21/14 — **SURFACE ELEV:** 68'+/-

**DRILLING METHOD(S):** Auger

**GROUNDWATER INFORMATION:** Water encountered at eighteen (18) 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 18 | 97 | NP | NP | NP | 87 | 1.42 | 4.8 | | Medium dense light brown to tan silt (ML) with sand |
| | | | | 12 | | | | | | | | | |
| | 5 | | | 16 | | 26 | 23 | 3 | 90 | | | | |
| | | | | | | | | | | | | | 8.0 |
| | | | P=1.0 | 25 | | | | | | | | | Stiff tan lean clay (CL) |
| | | | | | | | | | | | | | 8.0 |
| | | | P=0.5 | 36 | 86 | 73 | 28 | 45 | 99 | 1.93 | 8.6 | | Stiff to medium brownish gray fat clay (CH) |
| | 10 | | | | | | | | | | | | |
| | | | P=0.25 | 28 | 95 | | | | | 0.73 | 13.8 | | –With silt and sand seams |
| | 15 | | | | | | | | | | | | |
| | | | P=0.75 | 54 | 69 | | | | | 1.02 | 4.6 | | –Dark gray with organics |
| | 20 | | | | | | | | | | | | |
| | | | P=0.5 | 61 | | | | | | | | | |
| | | | | | | | | | | | | | 25.0 |
| | 25 | | | | | | | | | | | | Bottom of boring at 25 feet |
| | 30 | | | | | | | | | | | | |
| | 35 | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | |
| | 45 | | | | | | | | | | | | |
| | 50 | | | | | | | | | | | | |
| | 55 | | | | | | | | | | | | |

**REMARKS:**

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

# LOG OF BORING NO. B-2

**PROJECT:** Petty Company South-Site 5 — **SHEET** 1 of 2

**CLIENT:** Louisiana Economic Development-%Denmon Engineering — **LOCATION:** Center

**DATE:** 10/22/14 — **SURFACE ELEV:** 67' +/-

**DRILLING METHOD(S):** Auger 0 - 25 feet Rotary 25-100 feet

**GROUNDWATER INFORMATION:** Water encountered at twenty (20) feet depth

| 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 = 13 | 13 | | | | | | | | | Medium dense tan silt (ML) with sand |
| | | | | | | | | | | | | 2.0 |
| | | N = 6 | 22 | | 39 | 18 | 21 | 96 | | | | Medium stiff to stiff reddish brown to tan lean clay (CL) |
| 5 | | P = 1.25 | 25 | 100 | | | | | 3.88 | 8.0 | | |
| | | P = 1.25 | 27 | 96 | 36 | 20 | 16 | 99 | 1.76 | 4.7 | | |
| | | P = 0.75 | 22 | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| | | | | | | | | | | | | 11.5 |
| | | P = 0.5 | 32 | 94 | | | | | 2.12 | 15.0 | | Stiff grayish brown fat clay (CH) |
| 15 | | | | | | | | | | | | |
| | | P = 1.25 | 50 | 72 | 58 | 27 | 31 | 88 | 1.88 | 7.0 | | --Medium gray fat clay (CH) with organics |
| 20 | | | | | | | | | | | | |
| | | | 29 | | | | | | | | | |
| 25 | | | | | | | | | | | | |
| | | N = 7 | 25 | | | | | | | | | |
| 30 | | | | | | | | | | | | |
| | | | | | | | | | | | | 32.5 |
| | | P = 1.75 | 27 | | 45 | 21 | 24 | | | | | Stiff reddish brown lean clay (CL) |
| 35 | | | | | | | | | | | | |
| | | | | | | | | | | | | 36.5 |
| | | N = 23 | 20 | | | | | 9 | | | | Medium dense tan sand with silt (SP-SM) |
| 40 | | | | | | | | | | | | |
| | | | | | | | | | | | | 42.0 |
| | | N = 20 | 23 | | | | | | | | | Medium dense tan sand (SP) |
| 45 | | | | | | | | | | | | |
| | | N = 25 | 22 | | | | | | | | | |
| 50 | | | | | | | | | | | | |
| | | N = 35 | 20 | | | | | 4 | | | | --With gravel lenses |
| 55 | | | | | | | | | | | | |

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

**REMARKS:**

# LOG OF BORING NO. B-2

**PROJECT:** Petty Company South-Site 5 — **SHEET** 2 of 2

**CLIENT:** Louisiana Economic Development-%Denmon Engineering — **LOCATION:** Center

**DATE:** 10/22/14 — **SURFACE ELEV:** 67' +/-

**DRILLING METHOD(S):** Auger 0 - 25 feet Rotary 25-100 feet

**GROUNDWATER INFORMATION:** Water encountered at twenty (20) 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 |
| | 60 | | N = 17 | 20 | | | | | | | | | --Medium dense tan sand (SP) |
| | 65 | | N = 20 | 14 | | | | | | | | | --Medium dense gray sand (SP) with trace gravel |
| | 70 | | N = 41 | 21 | | | | | | | | | --Dense |
| | | | | | | | | | | | | | 72.0 |
| | 75 | | N = 32 | 21 | | | | | 37 | | | | Dense gray clayey sand (SC) with gravel lenses |
| | | | | | | | | | | | | | 76.5 |
| | 80 | | N = 28 | 31 | | 48 | 26 | 22 | | | | | Very stiff gray lean clay (CL) with sand partings |
| | 85 | | N = 25 | 32 | | | | | | | | | |
| | 90 | | N = 29 | 33 | | | | | | | | | |
| | 95 | | N = 30 | 32 | | | | | | | | | |
| | 100 | | N = 46 | 30 | | 39 | 21 | 18 | | | | | |
| | | | | | | | | | | | | | 100.0 |
| | 105 | | | | | | | | | | | | Bottom of boring at 100 feet |
| | 110 | | | | | | | | | | | | |

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

**REMARKS:**

# LOG OF BORING NO. B-3

**PROJECT:** Petty Company South-Site 5 — **SHEET** 1 of 1

**CLIENT:** Louisiana Economic Development-%Denmon Engineering — **LOCATION:** Southwest Corner

**DATE:** 10/21/14 — **SURFACE ELEV:** 65' +/-

**DRILLING METHOD(S):** Auger

**GROUNDWATER INFORMATION:** Water encountered at seventeen and one-half (17.5) feet depth

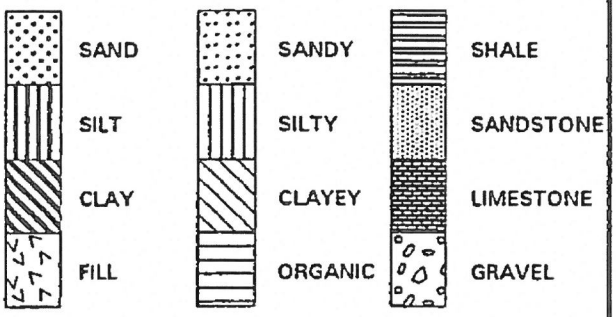
| FIELD DATA | | | | LABORATORY DATA | | | | | | | | | DESCRIPTION OF STRATUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOIL & ROCK SYMBOL | DEPTH (FT) | SAMPLE TYPE | N: SPT, BLOWS/FT T: THD, BLOWS/FT P: HAND PEN, TSF | MOISTURE CONTENT, % | DRY DENSITY POUNDS/CU.FT | LIQUID LIMIT, % | PLASTIC LIMIT, % | PLASTICITY INDEX, % | MINUS NO. 200 SIEVE, % | COMPRESSIVE STRENGTH, KSF | FAILURE STRAIN (%) | CONFINING PRESSURE PSI | |
| | | | N=12 | 15 | | 31 | 20 | 11 | 89 | | | | Medium stiff tan lean clay (CL) with sand |
| | | | P=2.75 | 17 | 110 | | | | | 4.85 | 8.5 | | --Very stiff |
| | 5 | | P=0.75 | 18 | 107 | 27 | 18 | 9 | 79 | 1.83 | 13.9 | | --Stiff to medium, very silty |
| | | | P=0.25 | 22 | | | | | | | | | |
| | 10 | | P=0.25 | 23 | 105 | 26 | 20 | 6 | 88 | 0.79 | 11.3 | | |
| | | | | | | | | | | | | | 11.5 |
| | | | P=1.0 | 40 | 80 | | | | | 2.52 | 7.2 | | Stiff brownish gray fat clay (CH) |
| | 15 | | | | | | | | | | | | |
| | | | P=0.25 | 28 | 95 | | | | | 2.79 | 15.0 | | |
| | 20 | | | | | | | | | | | | |
| | | | P=0 | 29 | | | | | | | | | --With silt and sand lenses |
| | 25 | | | | | | | | | | | | 25.0 |
| | | | | | | | | | | | | | Bottom of boring at 25 feet |
| | 30 | | | | | | | | | | | | |
| | 35 | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | |
| | 45 | | | | | | | | | | | | |
| | 50 | | | | | | | | | | | | |
| | 55 | | | | | | | | | | | | |

**REMARKS:**

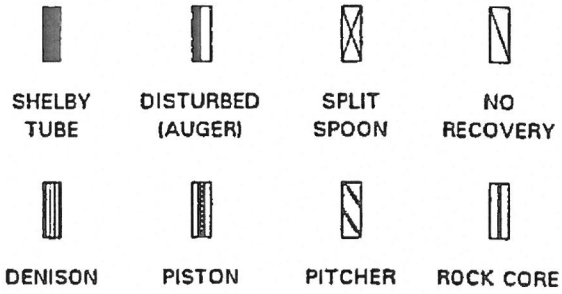
TUBE SAMPLE | AUGER SAMPLE | SPLIT-SPOON | ROCK CORE | THD CONE PEN. | NO RECOVERY

# 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, TONS/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.

# APPENDIX B

## MATERIAL SPECIFICATIONS

## SPECIFICATIONS FOR COMPACTION
## OF
## SANDY CLAY AND CLAYEY SAND SOILS

The thickness of lifts used should be no more than the height of the teeth on sheepsfoot rollers. Generally, for a forty-eight (48) inch diameter or smaller drum roller, the maximum compacted lift thickness acceptable is six (6) inches. For rollers with drums of sixty (60) inches in diameter and larger with teeth about nine (9) inches long, a nine (9) inch final compacted lift thickness will be acceptable. The sole determination of the thickness of a lift will be the capability of the contractor's equipment to obtain the required compaction.

When obtaining the average density of a lift to determine its conformance to specifications, the lift should be immediately rejected if any density is more than 2% below the required average.

Generally, sheepsfoot rollers are most suitable for compaction of sandy clay and clayey sand soils, the contractor may use spiketooth rollers, rubber tired rollers, or any fill compaction equipment that has sufficient mass to compact the soil. Generally, the drums of sheepsfoot rollers should be filled with water or for additional weight with both water and sand. Tractors or other vehicles used primarily for hauling WILL NOT be allowed as fill compaction equipment. The contractor should also have smooth wheel rollers to seal the working area at the end of the day's operations so overnight rains will not saturate the soil and delay his work. These rollers should also be used to seal the surface whenever rainfall is imminent.

The soil engineer or his representative will perform density tests and will accept or reject a lift within two (2) hours after being tested. No material will be placed on any lift that has not been accepted by the engineer.