# Exhibit Z. West Feliciana Industrial Park Site Preliminary Geotechnical Engineering Report

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# West Feliciana Industrial Park Site Preliminary Geotechnical Engineering Report

January 4, 2017

Baton Rouge Area Chamber
564 Laurel Street
Baton Rouge, LA 70801

Attention : Mr. Jim A. Cavanaugh
Site Development Director
Email: jim@brac.org
Phone: (225) 339-1163

Re: **General Geotechnical Site Characterization Report**
**West Feliciana Industrial Park**
**St. Francisville, Louisiana**
**PSI Project No. 02591115**

Dear Mr. Cavanaugh:

Professional Service Industries, Inc. is pleased to submit this General Geotechnical Site Characterization Report for the West Feliciana Industrial Park Site Study. This report includes the results of field and laboratory testing, and information regarding the compatibility of this site with industrial development, suitability of soils for building foundations and on-site roadways, requirements of soil augmentation for construction of a typical 100,000 square feet (sf) industrial manufacturing building and depth of groundwater.

We appreciate the opportunity to perform this Preliminary Geotechnical Site Evaluation Report. If you have any questions pertaining to this report, or if we may be of further service, please contact our office.

Respectfully submitted,

**PROFESSIONAL SERVICE INDUSTRIES, INC.**

Matthew Champagne
Staff Scientist
Geotechnical Services

Reda M. Bakeer, Ph.D., P.E.
Chief Engineer
Geotechnical Services

# GENERAL GEOTECHNICAL SITE CHARACTERIZATION REPORT

**WEST FELICIANA INDUSTRIAL PARK**
**WEST FELICIANA PARISH, LOUISIANA**
**PSI PROJECT NO.: 02591115**

**PREPARED FOR**

**BATON ROUGE AREA CHAMBER**
**564 LAUREL STREET**
**BATON ROUGE, LA 70801**

**January 4, 2017**

**BY**
**PROFESSIONAL SERVICE INDUSTRIES, INC.**
**11950 INDUSTRIPLEX BLVD.**
**BATON ROUGE, LOUISIANA 70809**

Name: Reda M. Bakeer, Ph.D., P.E.
Date: January 4, 2017
License No.: 27123
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**APPENDIX**

# PROJECT INFORMATION

## Project Authorization

Professional Service Industries, Inc. (PSI) has completed a General Geotechnical Site Study at the West Feliciana Industrial Park site, located in West Feliciana Parish, Louisiana. Our services were provided in general accordance with PSI Proposal No. 254-190974-R1, dated September 27, 2016. Authorization of the services was provided by Mr. Kyle Zeringue, Senior Vice President, Business Development, Baton Rouge Area Chamber (BRAC.)

## Project Description

The primary objectives for this preliminary report are to provide general information regarding the compatibility of this site with industrial development; suitability of the naturally occurring soils for building foundations and on-site roadways; requirements of soil augmentation, if any, for construction of a typical 100,000 square feet (sf) industrial manufacturing building; and the depth of free groundwater table at the boring locations during our drilling operations. This general geotechnical site characterization report will provide an initial baseline of the site subsurface conditions that will likely be encountered during future site development. However, as with any geotechnical investigations, particularly given the size of this subject site and the relatively limited number of exploration locations, variations between exploration locations may and should be expected to exist, and there remains a distinct possibility that other conditions may exist on site that were not encountered within the scope of this investigation.

The opinions and information to be presented in this preliminary report are estimates for preliminary consideration only, are based on limited geotechnical exploration, and are not to be used for final design and construction. A detailed geotechnical exploration and analyses should be performed once design and function of the proposed development have been finalized.

## Purpose and Scope of Services

The purposes of PSI's limited geotechnical services are to:

- Perform 3 soil borings and 2 Cone Penetrometer Test (CPTu) soundings at the subject site as per the request of the Client;
- Evaluate the general subsurface soil conditions and groundwater depth at the subject site at the exploration locations during our field activities;
- Perform limited laboratory testing on selected soil samples recovered from the borings; and,
- Provide a general discussion regarding compatibility of this site for industrial development, suitability of soils for building foundations and on-site pavement improvement, and requirements of soil augmentation for construction of a typical 100,000 square foot industrial manufacturing building.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, surface water, groundwater, or air on or below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes. Prior to development of this site, an environmental assessment is advisable. Additionally, PSI did not provide any service to investigate or detect the presence of moisture, mold or other biological

contaminants in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence or the amplification of the same. The Client acknowledges that mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. The Client further acknowledges that site conditions are outside of PSI's control, and that mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, PSI cannot and shall not be held responsible for the occurrence or recurrence of mold amplification.

## SITE AND SUBSURFACE CONDITIONS

### Site Location and Description

It is understood that, the subject site is approximately 518 acres in size and is located on the west side of LA Highway 964. It starts approximately 2.1 miles south of the intersection of LA Highway 964 with LA Highway 61 in West Feliciana Parish, Louisiana. The site extends southward approximately 1.4 miles along LA Highway 964. The site is bisected by a right-of-way (ROW) corridor for high voltage powerlines to an eastern portion that is approximately 93 acres and a western portion that is approximately 425 acres. It is bound by LA Highway 964 and the Hood Container of Louisiana, LLC facility to the south and elsewhere by mostly undeveloped, rural/agricultural or woodedland. The site is used primarily at this time for agricultural purposes and contains several dirt and gravel farm access roads. PSI's track-mounted drill rig was used to perform this field exploration. All of the borings were located just off of existing field roads in view of its present use. PSI made no attempt to enter the cultivated portions of the site. A Site Vicinity Map based on Google Earth Image dated August 26, 2015 is presented in the Appendix.

### Site Geology

Based on the Geological Map of Louisiana (1984), the site is encompasses several geological formations. The northern portion of the site is located within the High Terraces Formation (Qth-I) geologic unit. The High Terraces geologic is characterized by tan to orange clay, silt and sand with amount of basal gravels overlain by loess. The central portion of the site is located within the Prairie Terraces Formation (Qtp-I) geologic unit. The Prairie Terraces Formation is characterized by light gray to light brown clay, sandy clay, silt, sand and some gravels overlain by loess. The southern portion of the site is located within the Alluvium Formation (Qal) geologic unit. The Alluvium Formation is characterized by gray to brownish gray clay and silty clay with some sand and gravel locally. As per the U.S. Geological Society (USGS), these deposits are encountered on past and present courses of major streams. A drainage or seepage drainage feature is located within the eastern portion of the site. It should be noted that due to the size of the site and its present and form uses, variations in geological formations and limited exploration locations, all of the characteristics of the above formations may not be reflected in the soil borings and CPTu soundings of this limited investigation.

### Field Exploration

The subsurface conditions at the subject site were explored by drilling and recovering soil samples from soil borings, and through Cone Penetrometer Testing (CPTu) soundings. Borings B-1 and B-3 extended to a depth of approximately 30 feet below the existing ground surface. CPTu soundings CPT-1-2 and CPT-2 extended to a depth of about 100 feet below the existing ground surface. Refer to the Boring Location Plan given in the Appendix for the approximate boring locations based on Google Earth Image dated August 26, 2015.

The soil borings were performed with a truck-mounted drilling rig using hollow stem auger and wet rotary drilling techniques. Samples were generally obtained at two (2) foot intervals from the ground surface to a depth of ten (10) feet and at five (5) foot intervals thereafter to the boring termination depths. Drilling and sampling were accomplished in general accordance with ASTM Standard Procedures.

Undisturbed samples of cohesive soils were generally obtained using thin-walled tubes in general accordance with the procedures for "Thin-Walled Tube Geotechnical Sampling of Soils" (ASTM D1587). These samples were extruded in the field with a hydraulic ram.

For cohesionless and semi-cohesive soils, the Standard Penetration Test (SPT) was performed to obtain standard penetration values of the soil. The standard penetration value (N) is defined as the number of blows of a 140-pound hammer falling 30 inches that is required to advance the split-barrel sampler one (1) foot into the soil. To perform the test and obtain a sample, the sampler is lowered to the bottom of the previously cleaned drill hole and advanced by blows from the hammer. The number of blows is recorded for each of three (3) successive increments of six (6) inches penetration. The "N" value is obtained by adding the second and third incremental numbers. The results of the standard penetration test indicate the relative density of cohesionless soils and thereby provide a basis for estimating the relative strength of the soil profile components. Samples of granular soils were obtained utilizing a two (2) inch O.D. split-barrel sampler in general accordance with procedures for "Penetration Test and Split-Barrel Sampling of Soils" (ASTM D-1586).

CPTu soundings were performed utilizing a track-mounted Geoprobe Model 7822DT direct-push rig. The CPTu soundings were performed in general accordance with ASTM D5778, utilizing an electric cone penetrometer with a 60º, 1.4 inch diameter cone, that was hydraulically pushed. As the soundings were performed, the cone tip resistance, sleeve friction and pore pressure were measured essentially continuously throughout the depth of exploration at each one to two inch depth interval. From this data, information regarding soil types, in-situ strength parameters and groundwater levels can be interpreted.

The samples were identified according to the project number, boring number and depth, and placed in polyethylene plastic wrapping to protect against moisture loss. In addition, undisturbed samples were wrapped in aluminum foil prior to placing in the plastic wrapping and were transported to the laboratory in containers to minimize further disturbance.

## Laboratory Testing

In addition to the field exploration, selected soil samples obtained from the borings were tested in the laboratory to evaluate the subsurface soil properties. Laboratory testing on selected soil samples included natural moisture content, Atterberg limits, percent passing the number 200 sieve, and unconfined compression tests. The samples which were not altered by laboratory testing will be retained for six (6) months from the date of this report and then will be discarded without further notice.

The soil samples obtained from the drilling operation were classified in general accordance with ASTM D 2487 or D 2488. Laboratory test data and detailed descriptions of the soils can be found on the boring logs which are included in the Appendix. A key to terms and symbols used on the logs is also given in the Appendix. The logs of the CPTu soundings are also included in

the Appendix along with the results of the dissipation test performed during the performance of the CPT-2 sounding.

## Subsurface Conditions

Based on the field observations and the results of the laboratory testing, the soils were classified and the boring and CPTu logs were developed. The boring logs are presented in the Appendix along with a key to the terms and symbols used on the logs. It should be noted that due to the size of the site variations existed between the subsoil conditions encountered at the boring and CPTu locations. In view of the site size and the limited number of borings made at this time, generalized subsurface profiles for each exploration location are presented in Table 1 through Table 5. The borings were made within the presently accessible areas to our drill rig along the existing farm road.

**Table 1: Generalized Soil Profile - Boring B-1**

| Depth Range[1] (feet) | Description |
|---|---|
| 0 – 4 | Firm to stiff lean clay (CL) |
| 4 – 12 | Firm Silt (ML) with trace sand |
| 12 – 30 | Very stiff lean clay (CL) with ferrous stains |

(1) *The approximate depth range is referenced from existing ground surface at the boring location.*

**Table 2: Generalized Soil Profile - Boring B-2**

| Depth Range[1] (feet) | Description |
|---|---|
| 0 – 17 | Firm to stiff lean clay (CL) and fat clay (CH) |
| 17 – 22 | Poorly graded silty sand (SM) |
| 22 – 30 | Stiff lean clay with trace sand (CL) |

(1) *The approximate depth range is referenced from existing ground surface at the boring location.*

**Table 3: Generalized Soil Profile - Boring B-3**

| Depth Range[1] (feet) | Description |
|---|---|
| 0 – 6 | Silty clay (CL-ML) with trace sand |
| 6 – 12 | Stiff lean clay (CL) with trace sand |
| 12 – 17 | Clayey sand (SC) |
| 17 – 30 | Firm lean clay (CL) with ferrous stains |

(1) *The approximate depth range is referenced from existing ground surface at the boring locations.*

**Table 4: Generalized Soil Profile - Sounding CPT-1-2**

| Depth Range[1] (feet) | Description |
|---|---|
| 0 – 6 | Medium dense silty sand (SM) |
| 6 – 17 | Firm to stiff clay (CL) |
| 17 – 29 | Stiff to very stiff clay with sand (CL) |
| 29 – 68 | Dense to very dense poorly graded sand (SP) |
| 68 - 89 | Medium dense to dense silty sand with clay (SC-SM) |
| 89 – 100 | Dense poorly graded sand (SP) |

(1) *The approximate depth range is referenced from existing ground surface at the CPTu location.*

**Table 4: Generalized Soil Profile - Sounding CPT-2**

| Depth Range[1] (feet) | Description |
|---|---|
| 0 – 2 | Medium dense silty sand (SM) |
| 2 – 15 | Firm to stiff clay (CL) |
| 15 – 22 | Dense poorly graded sand (SP) |
| 22 – 43 | Firm to stiff clay (CL) |
| 43 – 67 | Medium dense to dense poorly graded sand (SP) |
| 67 – 77 | Medium dense to dense silty, clayey sand (SC-SM) |
| 77 – 100 | Dense to very dense poorly graded sand (SP) |

(1) *The approximate depth range is referenced from existing ground surface at the CPTu location.*

The above subsurface descriptions are generalized in nature to highlight the major subsurface stratification features and material characteristics at each exploration location. The boring and CPTu logs included in the Appendix should be reviewed for specific information at the individual exploration locations. These records include soil descriptions, stratifications, penetration resistances, locations of the samples, and laboratory test data. The stratifications shown on the boring and CPTu sounding logs represent the conditions only at the actual exploration locations. Due to the size of the site, variations may occur and should be expected between exploration locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. This is particularly important considering the site size and the limited number of borings performed which were all performed within the immediate vicinity of the existing farm roads.

## Groundwater Information

Free groundwater was encountered only in one of the three soil borings during the exploration (B-3). In addition, groundwater depth was determined in CPT-2 via dissipation test and was estimated in CPT 1-2 based on the data collected. The groundwater depth measured in the borings during our drilling activities are shown in the following table.

**Table 6: Groundwater Depth Measured During Drilling**

| Boring | Groundwater Depth During Drilling (feet below the existing ground surface) |
|---|---|
| B-1 | Not Encountered |
| B-2 | Not Encountered |
| B-3 | 20 |
| CPT-1-2 | 23 |
| CPT-2[1] | 23 |

(1) *Groundwater depth was measured in CPT sounding CPT-2 via dissipation test*

It should be noted that groundwater level fluctuations at this site may occur due to seasonal and climatic variations, the stage of the Mississippi River due to its relative close proximity to the subject site, alteration of drainage patterns, land usage and ground cover. Additionally, perched water may be encountered in discontinuous zones within the overburden. This condition develops as rainwater in entrapped in the more pervious surface cultivated soils underlain by less pervious cohesive soils. We recommend the Contractor determine the actual groundwater levels at the time any future construction activities begin. This is particularly important if the proposed construction will include relatively deep excavations. Any excavation or dewatering plans that fall within 1,500 feet from the Mississippi River may be subject to review and approval of the U.S. Army Corps of Engineers (USACE)

## EVALUATION AND DISCUSSIONS

The foundations suitable for a given structure primarily depend on several factors including the subsurface conditions, the function of the structure, the loads it may carry, the cost of the foundation and the criteria set by the Design Engineer with respect to vertical and differential movements which the structure can withstand without damage. Detailed column loads for a typical 100,000 sq. ft. industrial manufacturing building were not provided at the time of this study; however, the structural column loads are assumed to be on the order of 100 kips, with wall loads on the order of about 5 kips per lineal foot. Grading plans are also not available at this time, but for the purpose of our preliminary analysis, a maximum of about 4 feet to achieve final design grades is assumed. The proposed designs should also consider the requirements of the U.S. Army Corps of Engineers (USACE) with regard to any construction to be made within 1,500 feet from the existing flood protection structure along the adjacent Mississippi River.

Again, it should be noted that the exploration locations were performed on or near the shoulder of existing access farm roads. No attempt was made to enter cultivated areas typically used for planting crops. It should be assumed that the upper soils encountered in the cultivated areas will require significantly more effort to achieve proper compaction and may contain far more organic material and other additives (fertilizers, etc.) in the upper soils than the areas explored during this preliminary exploration.

The choice of type of deep foundation should be based on the tolerance criteria for the performance of the structures and economics of construction. Grade supported foundations or surface coverings will likely be governed by the anticipated load and settlement tolerances, particularly where a significant amount of new fill is placed. Driven piles should be viable foundation types considering the subsurface and groundwater conditions encountered and should be anticipated to carry the structural loads anticipating that settlement will occur as a result of new fill, building and slab loads. As previously discussed, construction in some areas of the site will be subjected to review and approval of the USACE. Lightly-loaded equipment pads may be able to be supported on shallow spread footings, or mat foundations, as long as the PVR issues described below are mitigated and settlement potential considered. Prior to new fill placement, site preparation should include removal of surficial topsoil, organic materials, and soft soil or demucking of wet areas or drainage conveyances and proofrolling in the presence of the Geotechnical Engineer to assess general stability and firmness prior to fill placement.

Based on the limited number of soil borings and CPTu soundings, field data and laboratory test results, the proposed site is generally feasible for industrial development. The subsurface soils explored are suitable for building foundations and site roadways after proper preparation. Potential Vertical Rise (PVR) should be further evaluated considering the actual fill theckness needed to raise the site to achieve final design grades. PVR in portions of this site could be mitigated by undercutting the clay soils to a predetermined depth and replacing with moisture-conditioned, properly compacted lean clay (CL) soils, or with the addition of chemical treatment such as lime mixing. Based on the anticipated new fill thickness on the order of around 4 feet, PVR is not anticipated to adversely impact the project with great significance. The effects of PVR should be considered if lesser fills are planned. The suitability of reuse of excavated soils (ponds, etc.) as structural fill may require the use of lime treatment or soil mixing.

Site pavements should be underlain by at least 12 inches of properly compacted low plasticity engineered fill material or otherwise or chemically treated with lime prior to base material placement due to the near surface fat clay soils. At this time, we assume pavement areas will receive at least two to four feet of fill to achieve final grades.

Areas within 1,500 feet of the existing levee to the west of the site should anticipate USACE interaction per the Hurricane and Storm Damage Risk Reduction System (HSDRRS) Design Guidelines and will likely be subject to the requirements of the Lower Mississippi Valley (MVN) and New Orleans District (NOD). Special permitting should also be anticipated for any geotechnical borings, new fill or excavations, and any loading or changes in loading configurations within the referenced area of the site. Supplemental exploration and sampling methods, laboratory testing and engineering analysis (including, but not limited to, slope stability, seepage analysis, impact of pile driving, and settlement analysis) following the HSDRRS Design Guidelines may be required for the project. Additionally, the USACE permits typically prohibit excavation or deep foundation installation during periods of high water (typically late April through late July but may vary dependent on the weather conditions in the region) as detailed by the permit requirements. Strict monitoring of pile driving is also mandated by the USACE in terms of vibration and potential impact on the adjacent flood protection system.

As stated previously, PSI's opinions and information presented in this site evaluation report are provided for planning purposes and preliminary considerations only; they are based on a very limited geotechnical exploration, and are not to be used for final design and construction.

## REPORT LIMITATIONS

The preliminary information submitted in this report is based on the available subsurface data obtained by PSI at the time of our field exploration. PSI warrants that the preliminary findings contained herein have been made in accordance with generally accepted drilling procedures and visual soil classification methods in the local area. No other warranties are implied or expressed. This report has been prepared for the exclusive use of the Baton Rouge Area Chamber for the specific purpose of determining general subsurface information at the subject site to develop a general geotechnical site characterization.

# APPENDIX


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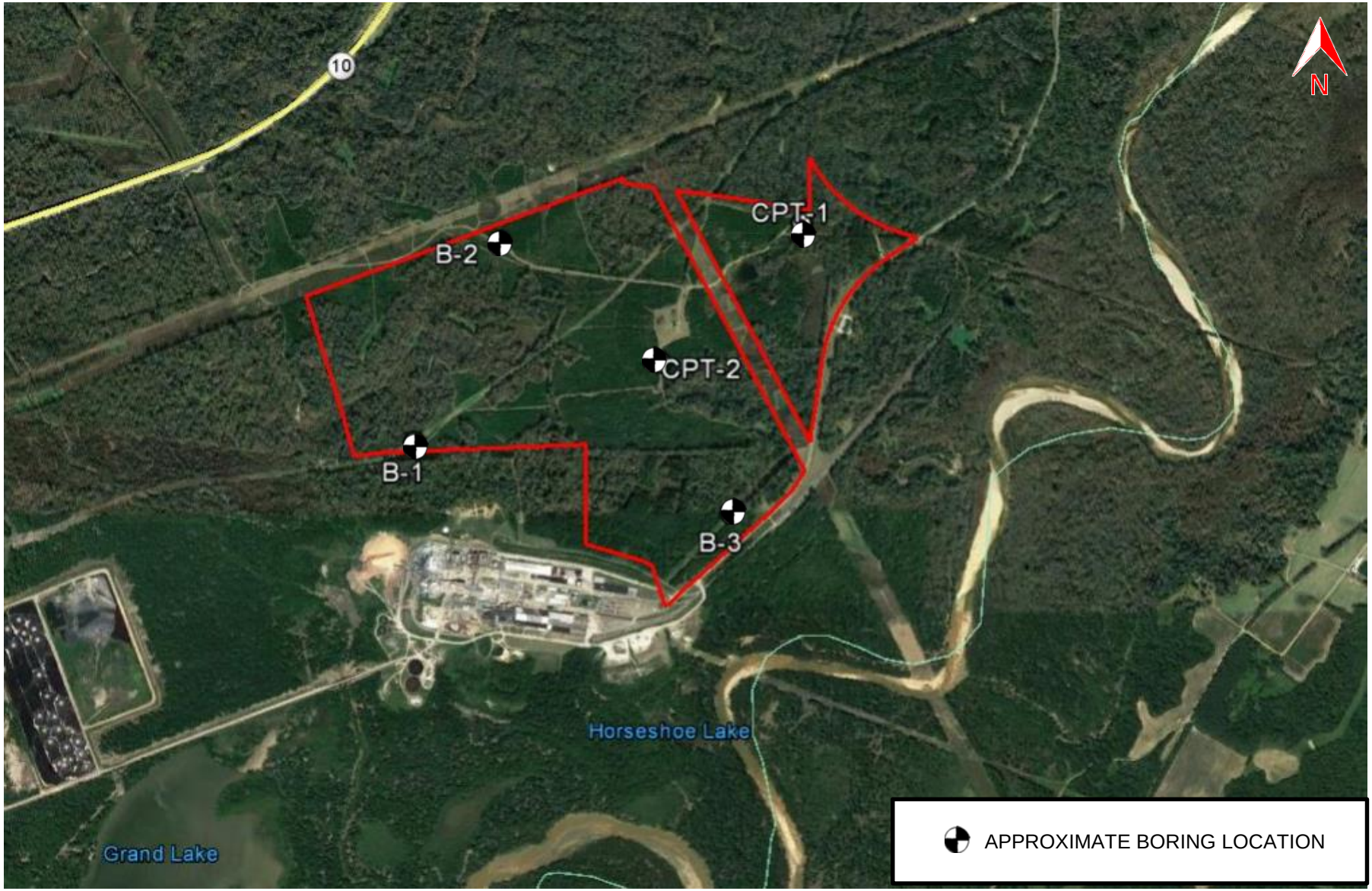
## SITE VICINITY MAP

PSI PROJECT NO.: 02591115

GOOGLE EARTH IMAGE DATED AUGUST 26, 2015

GEOTECHNICAL ENGINEERING REPORT
**WEST FELICIANA INDUSTRIAL PARK**
WEST FELICIANA PARISH, LOUISIANA

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## BORING LOCATION PLAN

PSI PROJECT NO.: 02591115

GOOGLE EARTH IMAGE DATED AUGUST 26, 2015

GEOTECHNICAL ENGINEERING REPORT
**WEST FELICIANA INDUSTRIAL PARK**
WEST FELICIANA PARISH, LOUISIANA

# LOG OF BORING B-1

WEST FELICIANA INDUSTRIAL PARK
ST. FRANCISVILLE, LOUISIANA

TYPE OF BORING: Hollow Stem Auger | LOCATION: Site Characterization | PSI Project No.: 02591115

| DEPTH, FT. | SOIL TYPE | USCS SYMBOL | SAMPLES | SOIL DESCRIPTION | N-BLOWS/FT. | MOISTURE CONTENT (%) | LIQUID LIMIT (LL) | PLASTIC LIMIT (PL) | PLASTICITY INDEX (PI) | % PASSING No. 200 SIEVE | SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 | SHEAR STRENGTH (tsf) HAND PEN (tsf) | SHEAR STRENGTH (tsf) UC (tsf) | SHEAR STRENGTH (tsf) TORVANE (tsf) | SHEAR STRENGTH (tsf) UU (tsf) | UNIT DRY WEIGHT (pcf) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.5 | | CL | | Stiff brown **LEAN CLAY** with ferrous stains | | 16 | 31 | 21 | 10 | | | 0.92 | | | | |
| | | | | | | 24 | | | | 99 | | 0.92 | | | | |
| 5.0 | | ML | | Firm to stiff brown **SILT** | | 27 | | | | | | | | 0.70 | | |
| 7.5 | | | | | | 27 | 36 | 25 | 11 | | | | | 0.50 | 0.35 | 99 |
| 10.0 | | | | | | 25 | | | | | | | | 0.30 | | |
| 12.5 | | CL | | Very stiff tan **LEAN CLAY** with sand and ferrous stains | | 17 | | | | | | 1.42 | | | | |
| 15.0 | | | | | | | | | | | | | | | | |
| 17.5 | | | | | | 17 | 42 | 16 | 26 | | | 1.50 | | | 1.62 | 114 |
| 20.0 | | | | | | | | | | | | | | | | |
| 22.5 | | | | | | 21 | | | | 93 | | 1.33 | | | | |
| 25.0 | | | | | | | | | | | | | | | | |
| 27.5 | | | | | | 27 | | | | | | 1.08 | | | | |
| 30.0 | | | | Boring terminated at 30 feet | | | | | | | | | | | | |
| 32.5 | | | | | | | | | | | | | | | | |
| 35.0 | | | | | | | | | | | | | | | | |
| 37.5 | | | | | | | | | | | | | | | | |
| 40.0 | | | | | | | | | | | | | | | | |
| 42.5 | | | | | | | | | | | | | | | | |
| 45.0 | | | | | | | | | | | | | | | | |
| 47.5 | | | | | | | | | | | | | | | | |
| 50.0 | | | | | | | | | | | | | | | | |

DEPTH OF BORING: 30 FEET
DATE DRILLED: 11/23/16
NOTE:

▽ GROUNDWATER DURING DRILLING: N/ A
▼ GROUNDWATER UPON COMPLETION: N/ A
▼ DELAYED GROUNDWATER: N / A

BORINGLOG_BATONROUGE - PSIHOUSTON.GDT - 1/4/17 10:34 - 0254

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*(225) 293-8378*

# LOG OF BORING B-2

WEST FELICIANA INDUSTRIAL PARK
ST. FRANCISVILLE, LOUISIANA

TYPE OF BORING: Hollow Stem Auger | LOCATION: Site Characterization | PSI Project No.: 02591115

| DEPTH, FT. | SOIL TYPE | USCS SYMBOL | SAMPLES | SOIL DESCRIPTION | N-BLOWS/FT. | MOISTURE CONTENT (%) | LIQUID LIMIT (LL) | PLASTIC LIMIT (PL) | PLASTICITY INDEX (PI) | % PASSING No. 200 SIEVE | SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 | SHEAR STRENGTH (tsf) HAND PEN (tsf) | SHEAR STRENGTH (tsf) UC (tsf) | SHEAR STRENGTH (tsf) TORVANE (tsf) | SHEAR STRENGTH (tsf) UU (tsf) | UNIT DRY WEIGHT (pcf) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CL | | Firm to stiff brown **LEAN CLAY** | | 25 | | | | | | | | 0.35 | | |
| 2.5 | | | | | | 24 | | | | | | | | 0.20 | 0.59 | 99 |
| 5.0 | | CH | | Firm to stiff brown **FAT CLAY** with sand | | 26 | 51 | 24 | 27 | | | | | 0.55 | | |
| 7.5 | | | | | | 25 | | | | 86 | | | | 0.45 | | |
| | | CL | | Stiff brown **LEAN CLAY** with ferrous nodules | | 20 | | | | | | | | 0.65 | | |
| 10.0 | | | | | | | | | | | | | | | | |
| 12.5 | | | | | | | | | | | | | | | | |
| 15.0 | | | | | | 19 | 38 | 16 | 22 | | | | | 0.50 | 0.77 | 111 |
| 17.5 | | SM | | Gray poorly graded **SILTY SAND** | | | | | | | | | | | | |
| | | | | | | 12 | | | | 30 | | | | | | |
| 20.0 | | | | | | | | | | | | | | | | |
| 22.5 | | CL | | Stiff gray tan **LEAN CLAY** with trace sand | | | | | | | | | | | | |
| | | | | | | 17 | 44 | 13 | 31 | | | | | 0.55 | | |
| 25.0 | | | | | | | | | | | | | | | | |
| 27.5 | | | | | | | | | | | | | | | | |
| | | | | | | 22 | | | | | | 0.75 | | | | |
| 30.0 | | | | Boring terminated at 30 feet | | | | | | | | | | | | |
| 32.5 | | | | | | | | | | | | | | | | |
| 35.0 | | | | | | | | | | | | | | | | |
| 37.5 | | | | | | | | | | | | | | | | |
| 40.0 | | | | | | | | | | | | | | | | |
| 42.5 | | | | | | | | | | | | | | | | |
| 45.0 | | | | | | | | | | | | | | | | |
| 47.5 | | | | | | | | | | | | | | | | |
| 50.0 | | | | | | | | | | | | | | | | |

DEPTH OF BORING: 30 FEET
DATE DRILLED: 11/23/16
NOTE:

▽ GROUNDWATER DURING DRILLING: N/ A
▼ GROUNDWATER UPON COMPLETION: N/ A
▼ DELAYED GROUNDWATER: N / A

BORINGLOG_BATONROUGE - PSIHOUSTON.GDT - 1/4/17 10:35 - 0254

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# LOG OF BORING B-3

WEST FELICIANA INDUSTRIAL PARK
ST. FRANCISVILLE, LOUISIANA

TYPE OF BORING: Hollow Stem Auger | LOCATION: Site Characterization | PSI Project No.: 02591115

| DEPTH, FT. | SOIL TYPE | USCS SYMBOL | SAMPLES | SOIL DESCRIPTION | N-BLOWS/FT. | MOISTURE CONTENT (%) | LIQUID LIMIT (LL) | PLASTIC LIMIT (PL) | PLASTICITY INDEX (PI) | % PASSING No. 200 SIEVE | SHEAR STRENGTH (tsf) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 | SHEAR STRENGTH (tsf) HAND PEN (tsf) | SHEAR STRENGTH (tsf) UC (tsf) | SHEAR STRENGTH (tsf) TORVANE (tsf) | SHEAR STRENGTH (tsf) UU (tsf) | UNIT DRY WEIGHT (pcf) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | No recovery | | | | | | | | | | | | |
| 2.5 | | CL-ML | | Brown **SILTY CLAY** with trace sand | | 19 | 26 | 21 | 5 | | | | | | | |
| 5.0 | | | | | | 17 | | | | 96 | | | | | | |
| | | CL | | Stiff brown **LEAN CLAY** with trace sand | | | | | | | | | | | | |
| 7.5 | | | | | | 21 | 30 | 13 | 17 | | △▲ | | | 0.35 | 0.55 | 110 |
| 10.0 | | | | | | | | | | | | | | | | |
| 12.5 | | SC | | Tan **CLAYEY SAND** | | | | | | | | | | | | |
| 15.0 | | | | | | 12 | | | | 34 | | | | | | |
| 17.5 | | CL | | Firm light brown and tan **LEAN CLAY** with ferrous stains ▽ | | | | | | | | | | | | |
| 20.0 | | | | | | 23 | | | | | △ | | | 0.45 | | |
| 22.5 | | CL | | Firm red and gray **LEAN CLAY** with ferrous stains | | | | | | | | | | | | |
| 25.0 | | | | | | 25 | | | | | ○ | 0.33 | | | | |
| 27.5 | | | | | | | | | | | | | | | | |
| 30.0 | | | | | | 29 | 31 | 16 | 15 | | ▲○ | 0.50 | | | 0.33 | 102 |
| | | | | Boring terminated at 30 feet | | | | | | | | | | | | |
| 32.5 | | | | | | | | | | | | | | | | |
| 35.0 | | | | | | | | | | | | | | | | |
| 37.5 | | | | | | | | | | | | | | | | |
| 40.0 | | | | | | | | | | | | | | | | |
| 42.5 | | | | | | | | | | | | | | | | |
| 45.0 | | | | | | | | | | | | | | | | |
| 47.5 | | | | | | | | | | | | | | | | |
| 50.0 | | | | | | | | | | | | | | | | |

DEPTH OF BORING: 30 FEET
DATE DRILLED: 11/23/16
NOTE:

▽ GROUNDWATER DURING DRILLING: 20 feet
▼ GROUNDWATER UPON COMPLETION: N/ A
▼ DELAYED GROUNDWATER: N / A

BORINGLOG_BATONROUGE - PSIHOUSTON.GDT - 1/4/17 10:35 - 0254

psi Information To Build On
Engineering • Consulting • Testing
*Professional Service Industries, Inc.*
*11950 Industriplex Blvd*
*Baton Rouge, Louisiana 70809*
*(225) 293-8378*

**CPT: CPT-1-2**

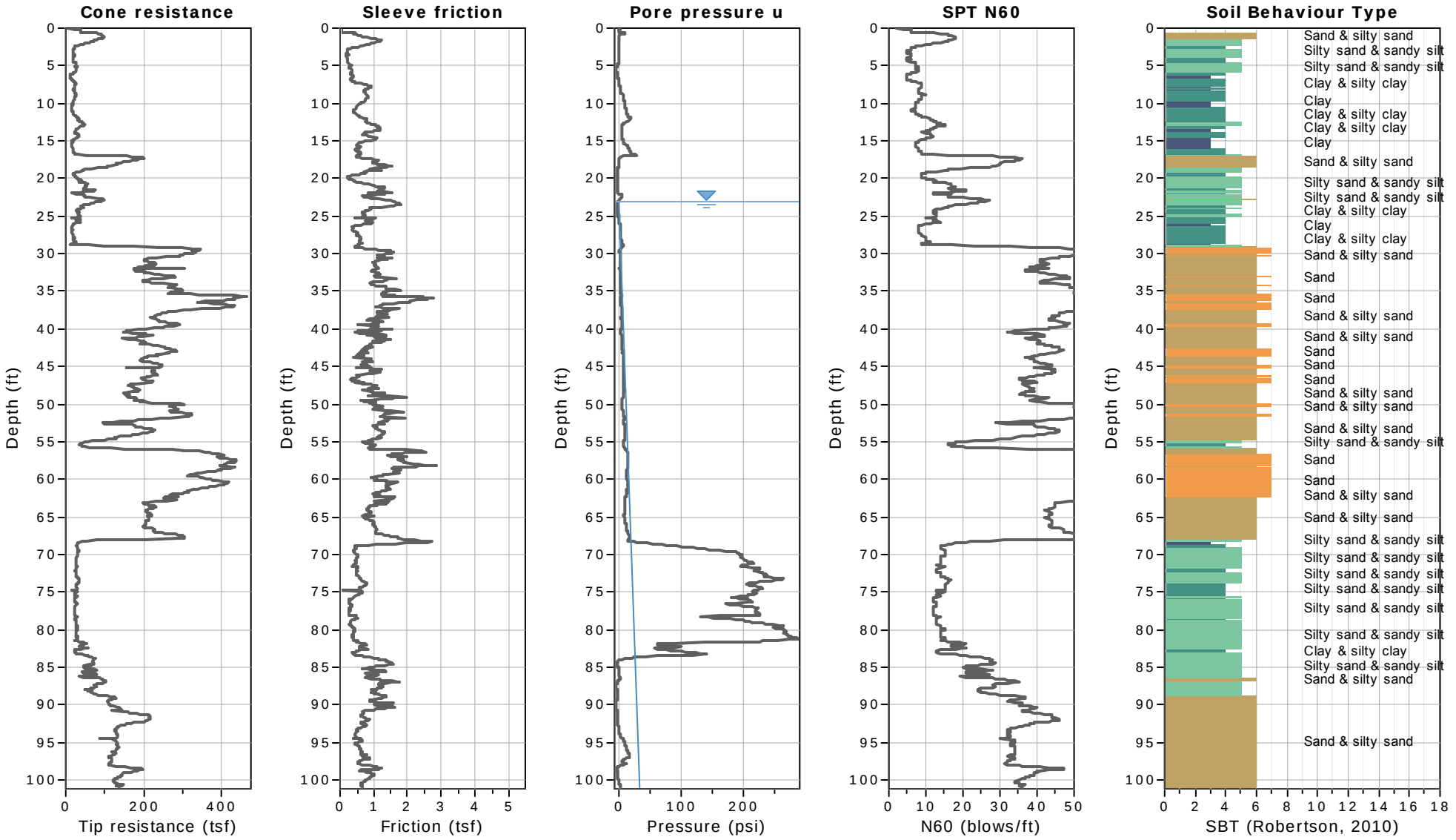
Total depth: 100.98 ft, Date: 11/21/2016

Cone Type: 60° 1.4" Diam. Type 2 Electric Cone Penetrometer

Cone Operator: Bill Penick

**Project:** 02591115 - West Feliciana Industrial Park

**Location:** St. Francisville, Louisiana



**CPT: CPT-2**

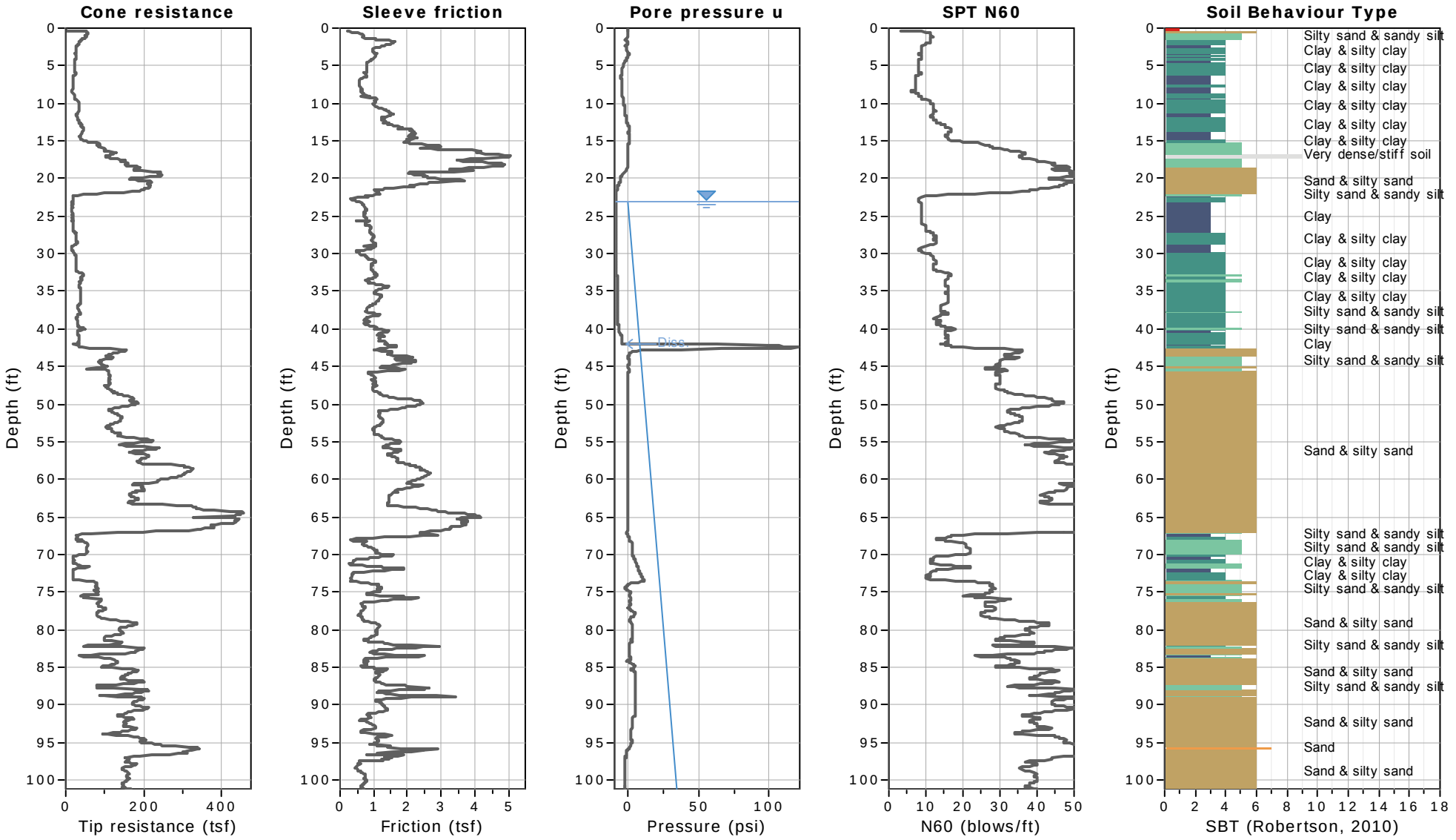
Total depth: 101.18 ft, Date: 11/21/2016

Cone Type: 60° 1.4" Diam. Type 2 Electric Cone Penetrometer

Cone Operator: Bill Penick

**Project:** 02591115 - West Feliciana Industrial Park

**Location:** St. Francisville, Louisiana



# Dissipation Tests Results

## Dissipation tests

Dissipation tests consists of stopping the piezocone penetration and observing porepressures (u) with elapsed time (t). The data are automatic recorded by the field computer and should take place until a minimum of 50% dissipation.

The porepressures are plotted as a function of square root of (t). The graphical technique suggested by Robertson and Campanella (1989), yields a value for $t_{50}$, which corresponds to the time for 50% consolidation.

The value of the coefficient of consolidation in the radial or horizontal direction $c_h$ was then calculated by Houlsby and Teh's (1988) theory using the following equation:

$$c_h = \frac{T \times r^2 \times I_r^{0.5}}{t_{50}}$$

where:

T: time factor given by Houlsby and Teh's (1988) theory corresponding to the porepressure position
r: piezocone radius
$I_r$: stiffness index, equal to shear modulus G divided by the undrained strength of clay ($S_u$).
$t_{50}$: time corresponding to 50% consolidation

## Permeability estimates based on dissipation test

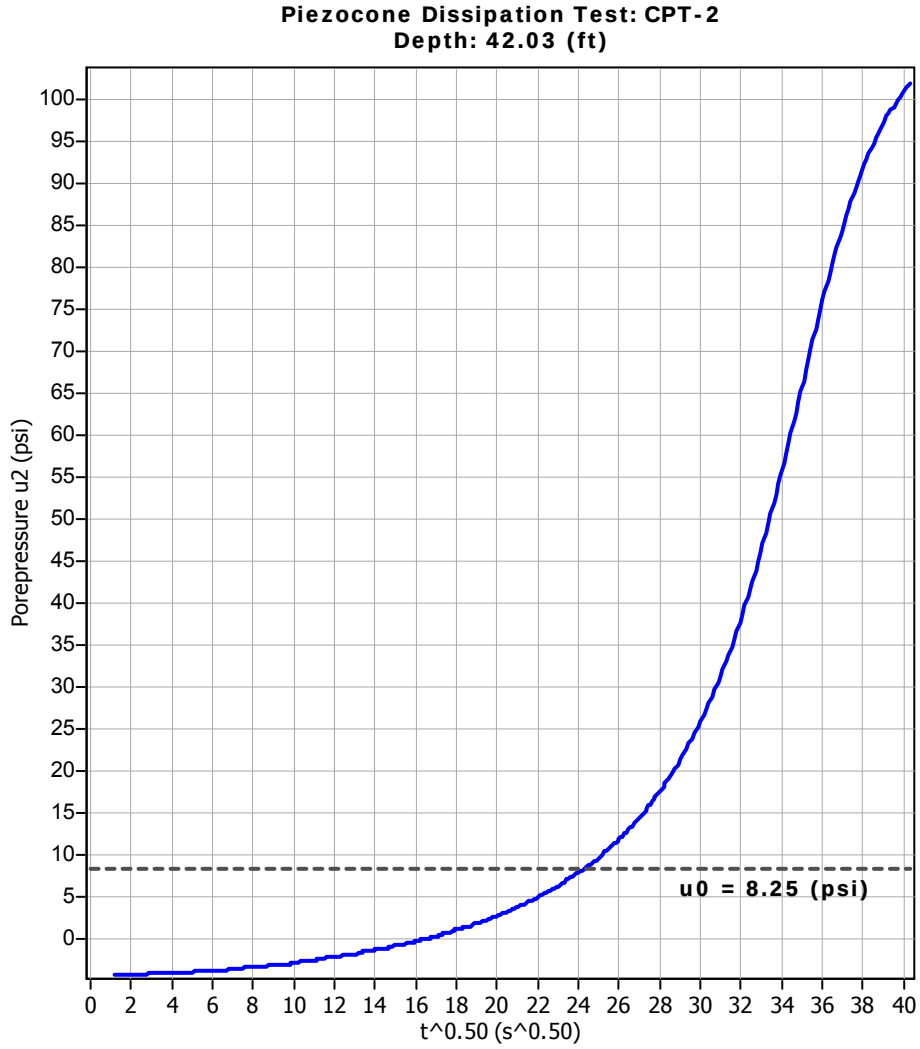
The dissipation of pore pressures during a CPTu dissipation test is controlled by the coefficient of consolidation in the horizontal direction ($c_h$) which is influenced by a combination of the soil permeability ($k_h$) and compressibility (M), as defined by the following:

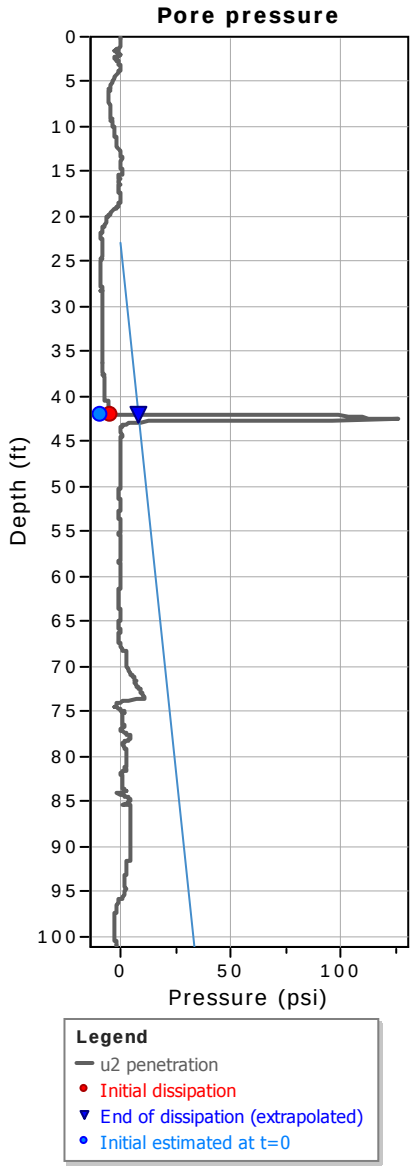
$$k_h = c_h \times \gamma_w / M$$

where: M is the 1-D constrained modulus and $\gamma_w$ is the unit weight of water, in compatible units.

**Tabular results**

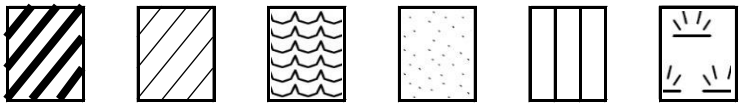
| CPTU Borehole | Depth (ft) | $(t_{50})^{0.50}$ | $t_{50}$ (s) | $t_{50}$ (years) | $G/S_u$ | $c_h$ ($ft^2/s$) | $c_h$ ($ft^2$/year) | M (tsf) | $k_h$ (ft/s) |
|---|---|---|---|---|---|---|---|---|---|
| CPT-2 | 42.03 | 14.7 | 215 | 6.81E-006 | 664869.69 | 3.16E-003 | 99726 | 341.77 | 2.89E-007 |


Piezocone Dissipation Test: CPT-2
Depth: 42.03 (ft)
Porepressure u2 (psi)
t^0.50 (s^0.50)
u0 = 8.25 (psi)


Pore pressure
Depth (ft)
Pressure (psi)
Legend
u2 penetration
Initial dissipation
End of dissipation (extrapolated)
Initial estimated at t=0

# KEY TO TERMS AND SYMBOLS USED ON LOGS

## SOIL TYPE

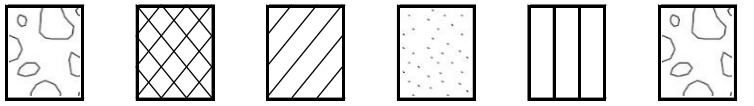


FAT CLAY | LEAN CLAY | ORGANIC CLAY | SAND | SILT | PEAT

## SAMPLER TYPE

NO RECOVERY | AUGER SAMPLE | SHELBY TUBE | SPLIT SPOON

## SOIL TYPE / MODIFIERS



GRAVEL | FILL | CLAYEY | SANDY | SILTY | GRAVELY

GROUNDWATER DURING DRILLING

GROUNDWATER UPON COMPLETION

## UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D 2487 (1980)

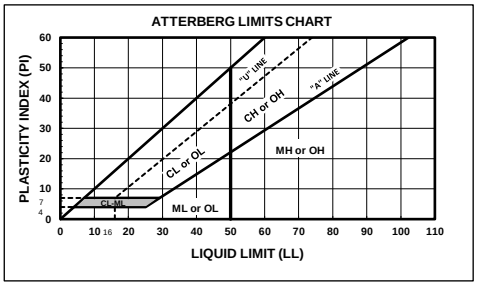
| MAJOR DIVISIONS | | | LETTER SYMBOL | TYPICAL DESCRIPTIONS |
|---|---|---|---|---|
| COARSE-GRAINED SOILS LESS THAN 50% PASSING NO. 200 SIEVE | GRAVEL & GRAVELLY SOILS LESS THAN 50% PASSING NO. 4 SIEVE | CLEAN GRAVEL (LITTLE OR NO FINES) | GW | WELL-GRADED GRAVEL, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES |
| | | | GP | POORLY GRADED GRAVEL, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES |
| | | WITH APPRECIABLE FINES | GM | SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURES |
| | | | GC | CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES |
| | SANDS MORE THAN 50% PASSING NO. 4 SIEVE | CLEAN SANDS (LITTLE OR NO FINES) | SW | WELL-GRADED SAND |
| | | | SP | POORLY-GRADED SANDS |
| | | WITH APPRECIABLE FINES | SM | SILTY SANDS |
| | | | SC | CLAYEY SANDS |
| FINE-GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE | SILTS AND CLAYS LIQUID LIMIT < 50 | | ML | INORGANIC SILTS & VERY FINE SANDS, CLAYEY SILT W/ LOW PLASTICITY INDEX |
| | | | CL | INORGANIC LEAN CLAYS GRAVELLY, SANDY, OR SILTY LEAN CLAYS |
| | | | OL | ORGANIC SILTS & ORGANIC SILTY CLAYS W/LOW PLASTICITY INDEX |
| | SILTS AND CLAYS LIQUID LIMIT ≥ 50 | | MH | INORGANIC SILTS W/ HIGH PLASTICITY INDEX, ELASTIC SILTS |
| | | | CH | INORGANIC FAT CLAYS GRAVELLY, SANDY, OR SILTY FAT CLAYS |
| | | | OH | ORGANIC CLAYS OF MED TO HIGH PLASTICITY, ORGANIC SILTS |
| HIGHLY ORGANIC SOIL | | | PT | PEAT AND OTHER HIGHLY ORGANIC SOILS |
| UNCLASSIFIED FILL MATERIALS | | | | ARTIFICIALLY DEPOSITED AND OTHER UNCLASSIFIED SOILS AND MAN-MADE SOIL MIXTURES |

## CONSISTENCY OF COHESIVE SOILS

| CONSISTENCY | SHEAR STRENGTH IN TONS/FT$^2$ |
|---|---|
| VERY SOFT | 0 TO 0.125 |
| SOFT | 0.125 TO 0.25 |
| FIRM | 0.25 TO .50 |
| STIFF | 0.50 TO 1.00 |
| VERY STIFF | 1.00 TO 2.00 |
| HARD | > 2.00 OR 2.00+ |

## RELATIVE DENSITY - GRANULAR SOILS

| CONSISTENCY | N-VALUE (BLOWS/FOOT) |
|---|---|
| VERY LOOSE | 0-4 |
| LOOSE | 4-9 |
| MEDIUM DENSE | 10-29 |
| DENSE | 30-49 |
| VERY DENSE | > 50 OR 50+ |




## ABBREVIATIONS

HP - HAND PENETROMETER

TV - MINIATURE TORVANE

FV - FIELD TORVANE

UC - UNCONFINED COMPRESSION TEST

UU - UNCONSOLIDATED UNDRAINED TRAIXIAL

CU - CONSOLIDATED UNDRAINED

NOTE: BORING LOGS INDICATE SHEAR STRENGTH AS OBTAINED BY ABOVE TESTS

## CLASSIFICATION OF GRANULAR SOILS

U.S. STANDARD SIEVE SIZE(S)

| 6" | 3" | 3/4" | 4 | 10 | 40 | 200 |
|---|---|---|---|---|---|---|

| BOULDERS | COBBLES | GRAVEL | | SAND | | | SILT OR CLAY | CLAY |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | | |

| 152 | 76.2 | 19.1 | 4.76 | 2.0 | 0.42 | 0.074 | 0.002 |
|---|---|---|---|---|---|---|---|

GRAIN SIZE IN MM