Professional Service Industries, Inc.
11950 Industriplex Blvd.
Baton Rouge, Louisiana 70809
Phone: (225) 293-8378

September 14, 2018

Dequincy Industrial Park Preliminary Geotechnical Engineering Report

SWLA Economic Development Alliance
4310 Ryan Street
Lake Charles, LA 70605

Attn: Mr. Gus Fontenot
Phone: 337.433.3632
Email: gfontenot@allianceswla.org

Re: **General Geotechnical Site Characterization Report**
LED Dequincy Industrial Park Site
Calcasieu Parish, Louisiana
PSI Project No. 02591645

Dear Mr. Fontenot:

Professional Service Industries, Inc. (PSI) is pleased to submit our General Geotechnical Site Characterization Report for the above-referenced project. This report presents the results of our field exploration 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 industrial manufacturing facility and depth of groundwater.

If you have any questions pertaining to this report, please contact our office at (225) 293-8378. PSI would be pleased to continue providing geotechnical and construction material testing services throughout the construction of the project, and we look forward to working with you and your organization on this and future projects.

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Sarah F. Berman, E.I.
Geotechnical Project Manager

9.14.2018

STATE OF LOUISIANA
NABIL S. MIKHAIL
License No. 35300
PROFESSIONAL ENGINEER

Nabil Mikhail, PE, D.GE.
Chief Engineer

GENERAL GEOTECHNICAL SITE CHARACTERIZATION REPORT

LED Dequincy Industrial Park Site
Dequincy, Calcasieu Parish, Louisiana
PSI Project No. 02591645

PREPARED FOR

SWLA ECONOMIC DEVELOPMENT ALLIANCE
4310 RYAN STREET
LAKE CHARLES, LA 70605

September 12, 2018

BY
PROFESSIONAL SERVICE INDUSTRIES, INC.
11950 INDUSTRIPLEX BLVD.
PHONE: 225-293-8378

Name: Nabil Mikhail, P.E., D.GE.
Date: September 14, 2018
License No.: 35300
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PROJECT INFORMATION

PROJECT AUTHORIZATION

Professional Service Industries, Inc. (PSI) has completed a General Geotechnical Site Characterization Study at the Dequincy Industrial Park LED Site located in Calcasieu Parish, Louisiana. Our services were performed in general accordance with PSI Proposal No. 247925, dated June 15, 2018. Authorization was provided by Mr. Lawrence Henagan, Mayor of the City of Dequincy, by signing PSI's proposal on August 14, 2018.

PROJECT DESCRIPTION

The primary objective of this preliminary investigation is to provide general information regarding the compatibility of this site with industrial development:

- Sustainability of the naturally occurring soils for building foundations;
- Requirements of soil augmentation, if any, for construction of a petrochemical plant or other industrial manufacturing facility; and
- Depth of free groundwater table at the exploration locations during our field operations.

This general geotechnical site characterization report will provide an initial baseline of the site's subsurface conditions that will likely be encountered during future site development. However, as with any geotechnical investigation, 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 at the site that were not encountered within the scope of this preliminary investigation.

The opinions and information to be presented in this preliminary report are general estimates for use by others in feasibility studies and cost-estimating purposes. Thus, the estimates are based on a 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 purpose of this site characterization was to explore the subsurface conditions at the site and present preliminary geotechnical related observations for the proposed construction. PSI's contracted scope of services is:

- Perform one (1) Cone Penetrometer Test (CPTu) sounding and one (1) conventional soil boring at the subject site as outlined by 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 geotechnical laboratory testing on selected soil samples recovered from the boring; and,
- Provide a general discussion regarding compatibility of this site for industrial development, suitability of the subgrade soils for building and other industrial structure foundations, and requirements of soil augmentation, if needed, for construction of the proposed industrial manufacturing facility.

The scope of services did not include an environmental assessment for determining the presence or absence of wetland, or hazardous or toxic materials in the soil, surface water, groundwater, or air on, 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. Additionally, PSI's scope of services did not include environmental sampling or performing analytical testing of soil or groundwater samples.

PSI did not provide any service to investigate or detect the presence of moisture, mold, or other biological contaminants within the project area, or any service that was designed or intended to prevent or lower the risk of the occurrence or amplification of the same. The Client should be aware that mold is ubiquitous to the environment, with mold amplification occurring when building materials are impacted by moisture. The Client should also be aware 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.

FIELD AND LABORATORY PROCEDURES

In accordance to the LED standard SOW, the subsurface conditions at the subject site were explored by drilling and recovering soil samples from one (1) soil boring, and through one (1) Cone Penetrometer Test (CPTu) sounding. Soil boring B-1 extended to a depth of approximately 30 feet below the existing ground surface. CPTu sounding 'CPT-1' extended to a depth of approximately 54 feet below the existing ground surface. The number and depths of the boring and sounding were selected in accordance with the exploration guidelines provided by the Client. Refer to the Boring Location Plan in the Appendix for the approximate exploration locations based on the most recent Google Earth aerial imagery, dated December 1, 2017.

The exploration locations were selected and located in the field by PSI personnel using a furnished site plan and a handheld GPS unit. The soil boring was performed using the Geoprobe 7822DT track-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 then at five (5) foot intervals thereafter to the boring termination depth. Drilling and sampling were both performed in general accordance with ASTM Standard Procedures.

The boring was sampled using the Shelby Tube (ASTM D1587) samplers. The samples were identified according to boring number and depth, placed in polyethylene plastic wrapping to reduce moisture loss, and transported to PSI's laboratory in Baton Rouge, Louisiana. The CPT soundings were performed in general accordance with ASTM D5778. The CPTu sounding was performed using the same Geoprobe 7822DT track-mounted drilling rig and was performed in general accordance with ASTM D5778.

All samples obtained during the field exploration were visually classified and evaluated by experienced geotechnical personnel upon arrival at the laboratory. Selected samples were tested in the laboratory to determine material properties for our evaluation. The geotechnical laboratory testing program included moisture content, Atterberg limits, percent passing the US Standard No. 200 sieve, and unconfined compressive and unconsolidated undrained strength testing. Additional estimates of unconfined compressive strength were obtained through the use of a hand penetrometer.

The geotechnical laboratory testing was conducted in general accordance with applicable ASTM procedures. The results of the laboratory tests are presented in the Boring Logs in the Appendix. The samples which were

not altered by laboratory testing will be retained for 60 days from the date of this report and will then be discarded.

SITE AND SUBSURFACE CONDITIONS

SITE LOCATION AND DESCRIPTION

The Dequincy Industrial Park LED site is located off of Louisiana Highway 12 in Calcasieu Parish outside of Dequincy, Louisiana. The Latitude and Longitude near the center of the approximately 47.4-acre site are approximately N 30.43568° and W 93.46628°, respectively. At the time of PSI's field exploration, the subject site area was an undeveloped tract of land with grass and tree groundcover. An existing road runs north-south on the eastern side of the site. Based on limited information obtained from Google Earth, across the site, the elevation ranges from approximately 76 feet to 85 feet.

Based on a review of historical Google Earth aerial imagery, the existing road has been on site since the earliest available aerial imagery, dated December 30, 1997. Also, since that time, the site has not been cleared or developed. Around 2003, historic imagery shows that near the location of PSI's boring B-1, an area of the site started to be used as an equipment storage area. It should be noted that the available Google Earth aerial imagery for the subject site is of low quality and includes some gaps in coverage; therefore, it may not necessarily be sufficient to reach a conclusion regarding former uses, if any, of the site.

SUBSURFACE CONDITIONS

Based on the field observations and results of the laboratory testing, the soils were classified, and the boring and CPTu logs were developed. The boring and CPTu logs are presented in the Appendix along with a key to the terms and symbols used on the logs. The soil boring generally encountered stiff lean clay stratum from the ground surface to 2 feet below the existing ground surface (bgs) underlain by a soft to firm lean clay strata from 2-6 feet bgs. From 6 to 18 feet bgs, stiff to very stiff lean clay stratum was encountered. From 18 feet bgs to the maximum explored depth of approximately 30 feet, soft sandy silt stratum was identified.

The CPTu sounding was relatively consistent with the boring stratification. The CPTu encountered silty material extending from the ground surface to about 2 feet below the existing ground surface. These soils were underlain with fat clay stratum to a depth of approximately 8 feet bgs. From 8 to 14 feet bgs, the CPT sounding showed sandy silt and silty sand strata. This was underlain with alternating layers of sand, silty sand, and sandy silt to a depth of approximately 22 feet bgs. From 22 to 32 feet below the existing ground surface, sand and silty sand strata was encountered. This sandy stratum was underlain by predominately lean and fat clay material to the depth of approximately 50 feet bgs. These clay soils were underlain by fat clay material to the maximum CPTu exploration depth of 54 feet below the existing ground surface.

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. 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, and locations of the samples and laboratory test data. The stratifications shown on the logs represent the conditions only at the actual exploration locations. Variations may occur and should be expected between and away from the sample locations.

The stratifications represent the approximate boundary between subsurface materials, but the actual transition may be more gradual. This is particularly important considering the site size and the limited number of explorations made at random and accessible locations.

WATER LEVEL MEASUREMENTS

Free groundwater was encountered at a depth of approximately 25 feet below the existing ground surface in soil boring 'B-1' and at a depth of approximately 12 feet below the existing ground surface in sounding 'CPT-1' at the time of our field exploration. However, it should be noted that the groundwater information presented in this report is based on observations made at the time of our field exploration and may not have become fully static at the time of measurement. Groundwater levels at the site can fluctuate based on variations in rainfall, evaporation, surface runoff, and other hydro-geologic factors. Therefore, it is recommended that the Contractor determine the groundwater depth at the time of construction.

EVALUATION AND DISCUSSION

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 structural loading information for industrial manufacturing facility were not provided at the time of this study. Grading plans are also not available at this time.

The choice of the type of a deep foundation system should be based on the tolerance criteria for the performance of the structures and economics of the 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 considered to carry the structural loads anticipating that settlement will occur as a result of the self-weight of new fill, and building, and floor loads. Lightly loaded equipment pads may be able to be supported on shallow spread footings, or mat foundations, as long as potential for movement is considered in the design. Prior to new fill placement, site preparation should include stripping and removal of surficial topsoil, organic materials, and soft soil or de-mucking of wet areas or drainage conveyances. Proof-rolling should be performed in the presence of the Geotechnical Engineer to assess general stability and firmness prior to fill placement. It should also be noted that the presence of silty material encountered in the upper two feet of the CPT sounding can be very susceptible to disturbance created during construction and can lead to a significant loss of strength in the material. Therefore, precautions should be taken to limit the amount of disturbance induced to these soils.

Notwithstanding the limited number of soil borings and CPTu soundings with associated 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 following proper preparation. The requested estimated allowable bearing capacities for both deep and shallow foundations systems are presented below.

Provided that the site is properly prepared, the proposed industrial structures (tanks, pipe racks, etc.) could be supported on shallow foundation systems using spread footings bearing at least 24 inches below final grade in properly compacted structural fill or stiff to very stiff natural in-situ lean clay. For preliminary analyses

purposes only, spread footings bearing in these materials can be designed for a net allowable soil bearing capacities between 800 and 1,300 psf for a footing size up to five (5) feet by five (5) feet based on the assumed settlement tolerances of one (1) inch. This allowable bearing capacity value is in consideration of dead loads plus sustained live loads and may be increased by one third (1/3) when accounting for transient live loads, such as wind. To minimize the potential for localized bearing failure, minimum dimensions of 24 inches for spread footings are recommended.

Based on the CPT soundings and the laboratory testing, the static method of analysis was used to compute the estimated allowable pile capacities for a precast concrete pile and an open-ended pipe pile for possible use in support of the proposed industrial facility. In Table 1 below, allowable axial capacities are shown for both 14-inch precast concrete piles and 14-inch open-ended pipe piles with an applied design factor if safety of 2.0 in compression and 3.0 in tension.

Table 1: Preliminary Estimated Allowable Pile Capacities

Estimated Allowable Single Pile Capacity (tons)* FS=2.0 in compression; FS= 3.0 in tension				
Pile Length (ft)**	Precast Concrete Pile (PCC)		Open-Ended Pipe Pile (OPP)	
	14-inch Square		14-inch Diameter	
	Compression	Tension	Compression	Tension
30	49	20	37	16
35	45	26	35	20
40	53	31	41	24
45	60	36	48	28

(*) These are soil-pile related capacities and consideration should be given to the structural integrity of the pile member.

(**) Pile lengths are referenced from the existing ground surface in borings B-1 and CPT-1 at the time of drilling, and additional length should be added to account for fill thickness or a raised floor.

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

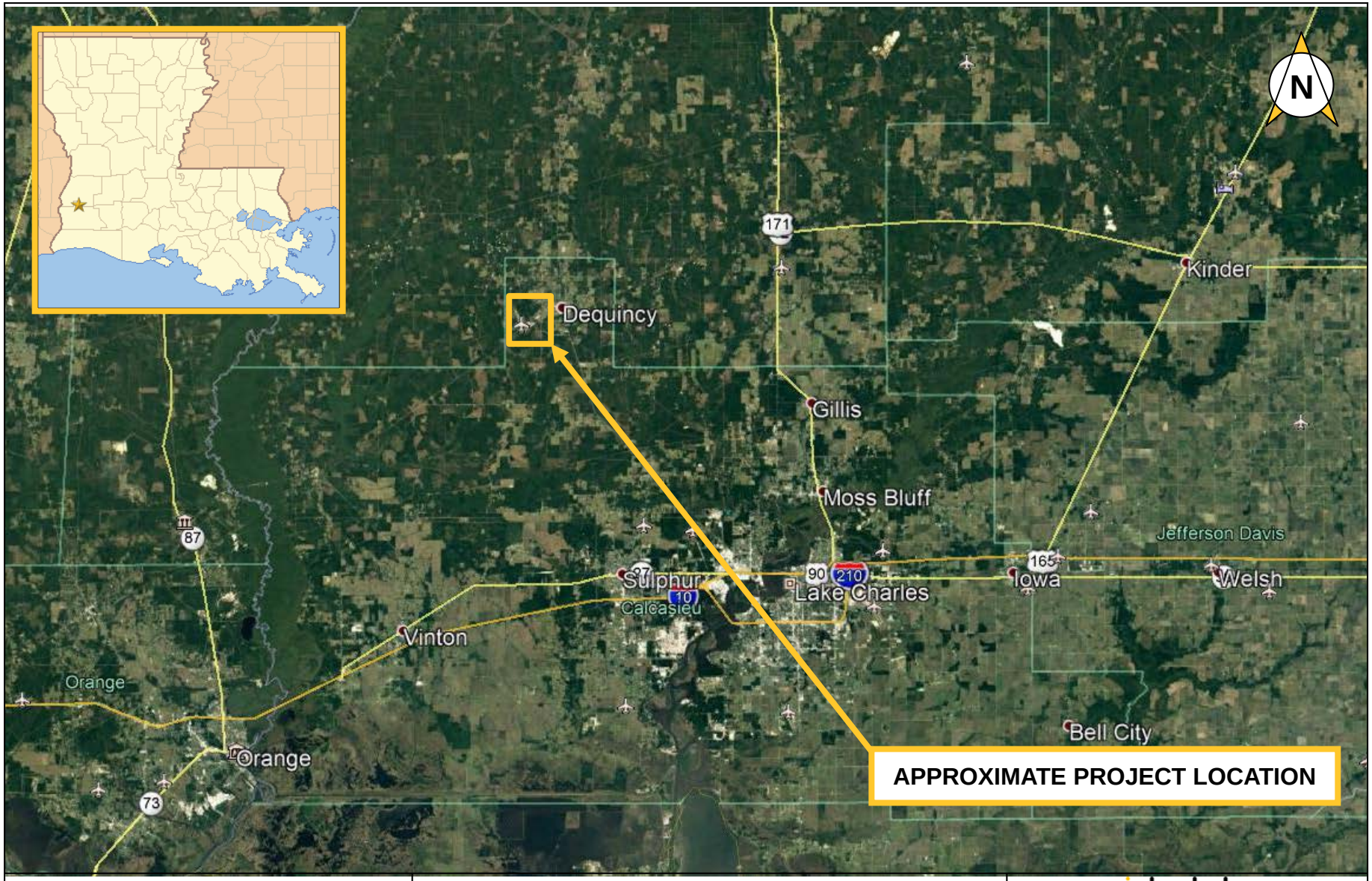
REPORT LIMITATIONS

The preliminary recommendations provided in this site characterization report are based on the available subsurface information obtained by PSI and design details furnished by the Client for the proposed project. If there are any revisions to the plans for this project, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in our recommendations are required. If PSI is not notified of such changes, we will not be responsible for the impact of those changes on the project.

PSI warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

This report has been prepared for the exclusive use SWLA Economic Development Alliance for the specific purpose of determining general site characterization information at the LED Dequincy Industrial Park site located in Calcasieu Parish, Louisiana.

APPENDIX



GEOTECHNICAL ENGINEERING SERVICES
DEQUINCY INDUSTRIAL PARK
LED SITE CHARACTERIZATION
CALCASIEU PARISH, LOUISIANA

SITE VICINITY MAP

PSI PROJECT NO.: 02591645
GOOGLE EARTH IMAGERY DATE: 01/05/2018

intertek psi

GEOTECHNICAL ENGINEERING SERVICES
DEQUINCY INDUSTRIAL PARK
LED SITE CHARACTERIZATION
CALCASIEU PARISH, LOUISIANA

BORING LOCATION PLAN

PSI PROJECT NO.: 02591645
GOOGLE EARTH IMAGERY DATE: 12/01/2017

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CPT: CPT-1

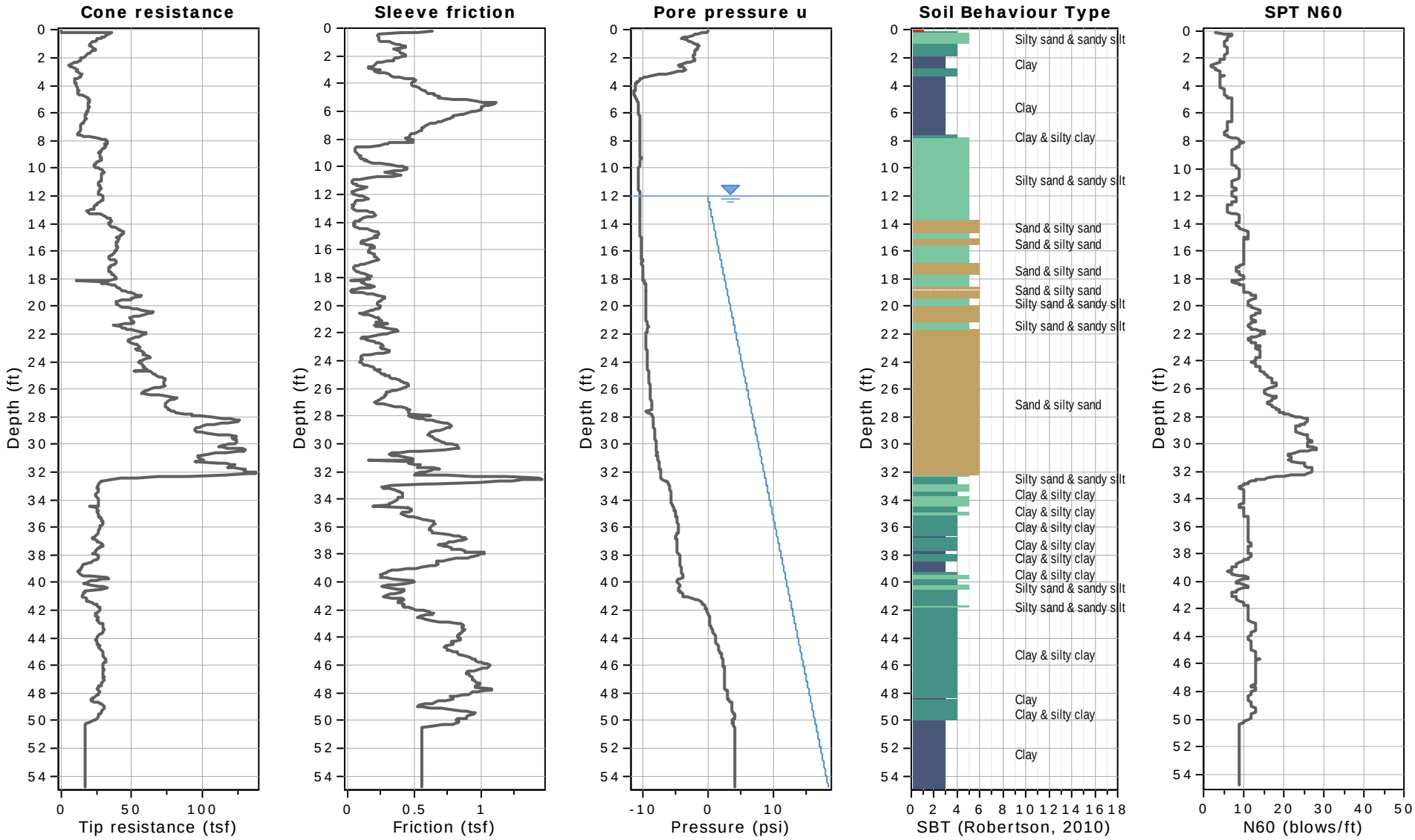
Total depth: 54.79 ft, Date: 8/20/2018

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

Cone Operator: Jeremiah Garms

Project: 02591645 - Dequincy Industrial Park - LED

Location: Calcasieu Parish, Louisiana



LOG OF BORING B-1

LED DEQUINCY INDUSTRIAL PARK
SITE CHARACTERIZATION
CALCESIEU PARISH, LOUISIANA

TYPE OF BORING: Hollow Stem Auger | LOCATION: Louisiana Highway 12 | PSI Project No.: 02591645

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)	DRY UNIT WEIGHT (pcf)
		CL		Stiff brown and gray **LEAN CLAY** with roots and organics		25						0.50				
2.5		CL		Soft to firm tan and gray **LEAN CLAY** with ferrous stains and silt pockets		24	38	16	22			0.21				
5.0						23						0.25				
		CL		Stiff to very stiff gray **LEAN CLAY** with ferrous stains and silt pockets		20						0.75	1.28			103
7.5																
10.0						19	47	14	33			0.75				
12.5																
15.0						28						0.67	1.16			96
17.5																
		ML		Soft tan and gray **SANDY SILT** with clay		27						0.29				
20.0																
22.5																
25.0				▽		34						0.17			0.22	
27.5																
						30				55		0.13				
30.0				Boring completed 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: 8/20/18
NOTE:

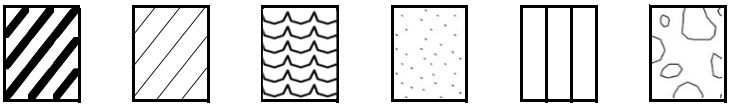
▽ GROUNDWATER DURING DRILLING: 25 feet
▼ GROUNDWATER UPON COMPLETION:
▼ DELAYED GROUNDWATER:

BORINGLOG_BATONROUGE - PSIHOUSTON.GDT - 9/12/18 15:48 - 0254

intertek psi
Professional Service Industries, Inc.
11950 Industriplex Boulevard
Baton Rouge, Louisiana 70809
(225) 293-8378

KEY TO TERMS AND SYMBOLS USED ON LOGS

SOIL TYPE



FAT CLAY | LEAN CLAY | ORGANIC CLAY | SAND | SILT | GRAVEL

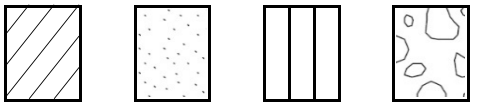
SAMPLER TYPE

NO RECOVERY | AUGER SAMPLE | SHELBY TUBE | SPLIT SPOON

SOIL TYPE

TOPSOIL | FILL

MODIFIERS



CLAYEY | SANDY | SILTY | GRAVELY

GROUNDWATER DURING DRILLING

GROUNDWATER UPON COMPLETION

UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D 2487 (1980)

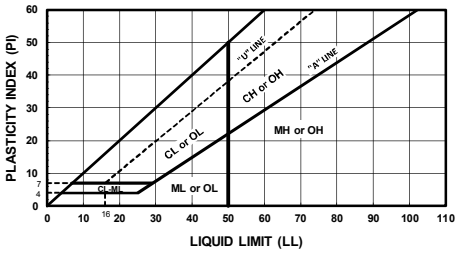
MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS LESS THAN 50% PASSING NO. 200 SIEVE	GRAVEL & GRAVELLY SOILS LESS THAN 50% PASSING NO. 4 SIEVE	CLEAN GRAVEL (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVEL, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			GP	POORLY GRADED GRAVEL, GRAVEL-SAND 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 - 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

DENSITY	N-VALUE (BLOWS/FT)
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

UC - UNCONFINED COMPRESSION TEST

UU - UNCONSOLIDATED UNDRAINED TRAIXIAL

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

CLASSIFICATION OF GRANULAR SOILS

U.S. STANDARD SIEVE SIZE(S)

12"	3"	3/4"	4	10	40	200

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

300	75	19	4.75	2.0	0.42	0.075	0.005

GRAIN SIZE IN MM

intertek psi

Professional Service Industries, Inc.
11950 Industriplex Boulevard
Baton Rouge, Louisiana 70809
Phone: (225) 293-8378