Report
Geotechnical Investigation

PROPOSED RESIDENCE
11901 PINE BELT DRIVE
CYPRESS, TEXAS 77429

RAM Project No.: RT22-173

RAM Testing & Drilling, LLC
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March 4, 2022

REPORT
GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENCE
11901 PINE BELT DRIVE
CYPRESS, TEXAS 77429

PREPARED FOR:

Elements Design & Construction, LLC
Houston, Texas

PREPARED BY:

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1.0 INTRODUCTION AND SUMMARY

1.1 Introduction

This report presents the results of a geotechnical investigation pertaining to the design of foundations for the proposed residential building that will be constructed at 11901 Pine Belt Drive in Cypress, Texas. The area for the proposed development project is an open lot that has a relatively flat terrain and currently covered with short grasses. The project site location is shown on Plate 1 in the Appendix.

The purpose of this geotechnical investigation was to provide data and parameters that could be used for the design and construction of foundations for the proposed residential building.

This geotechnical investigation was performed by RAM Testing and Drilling, LLC (RAM Testing) for Elements Design & Construction, LLC in accordance with an email request by Mr. Munir Tager on February 25, 2022.

The scope of work for this geotechnical investigation consisted of:

- drilling and sampling 2 geotechnical borings to depths of 15 and 20 feet below the existing ground surface within the area of the proposed development as shown on Plate 2 in the Appendix,

- performing field tests and recovering relatively undisturbed soil samples,

- measuring depth to groundwater in the geotechnical borings during drilling and after the completion of drilling,

- backfilling the bore holes with soil cuttings after the completion of the drilling operations,

- visually classifying samples obtained and conducting laboratory tests to determine the physical and mechanical properties of the soils,

- analyzing the field and laboratory test data,

- preparing boring logs based on visual soil classifications and the results of the laboratory tests,

- performing potential vertical rise of the site soils within the project area as well as bearing capacity and settlement analyses for foundations which may be used to support the loads of the proposed residential building,

- performing engineering analyses as necessary to determine the design parameters for post-tensioned slab-on-grade in accordance with the Post Tensioning Institute (PTI) requirements as contained in PTI's 2004 (Third Edition) publication titled "Design and Construction of Post-Tensioned Slabs-On-Ground",

- developing and presenting guidelines concerning subgrade preparation for the area of the proposed building, and

- submitting 1 copy and a pdf of a report of the geotechnical investigation.

1.2 Summary of Findings

The pertinent findings of this geotechnical investigation are provided in the following sections.

1.2.1 Subsurface Soil Strata

The subsurface soil strata at the location of the proposed development are described by the boring logs for Boring Nos. B-1 and B-2 as provided in the Appendix.

Data from the 2 geotechnical borings drilled suggest that the upper 20 feet of the overburden soils are generally composed of one (1) soil layer as described below.

LAYER	DEPTH BELOW GROUND SURFACE (FT)	SOIL DESCRIPTION
I	0 – 20	Dark gray, light gray, and tan SANDY LEAN CLAY (CL), very stiff to hard w/ claystones.

Laboratory testing was performed on s
elected samples of the subsurface materials obtained to classify the soils in accordance with ASTM D 2487 and to define the engineering properties of the soils. Portions of the test results

indicating the high and low values of specific testing are provided in the table below:

LAYER	DEPTH (FT)	LIQUID LIMIT (%)		PLASTICITY INDEX (%)		MOISTURE CONTENT (%)		PASSING NO. 200 SIEVE (%)	
		HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW
I	0 - 20	36	23	19	8	14	11	67.7	54.0

1.2.2 Groundwater Condition

Groundwater was not encountered during the drilling of the geotechnical borings. The bore holes were immediately backfilled with soil cuttings after the completion of the drilling activities.

1.2.3 Soil Swell Potential

The results of laboratory plasticity tests indicated that the site soils within the development area exhibited slight to medium plasticity with low to moderate shrink/swell potential. A maximum Potential Vertical Rise (PVR) value less than **1.00 inch** was calculated for the upper 8 feet of the site soils using the Texas Department of Transportation (TxDOT) Method (TEX-124-E). This method uses the maximum percent swell through the entire active depth.

1.3 Summary of Recommendations

Recommendations are provided below pertaining to the design and construction of the foundations for the proposed residential building.

1.3.1 Site and Subgrade Preparation

It is recommended that site preparation within the area of the proposed building when a slab-on-grade floor will be used consists of the stripping/removal of existing vegetation, organics, topsoil, wet, soft, loose, or unstable/pumping soils. The depth of stripping/removal, typically to a depth of about 6 inches, may vary across the site and could be as much as 2 feet especially in areas where wet, loose, soft, or unstable soils are encountered. The actual depth of removal should be determined by a representative of the geotechnical engineer or a qualified/experienced personnel at the time of construction.

After stripping and excavating as discussed above, the exposed soil should be proof-rolled to locate any wet, soft, loose, or unstable areas. Soils which are observed to rut or deflect excessively under the moving load should be undercut and replaced with properly compacted structural fill, or these soils may be dried by discing/aerating/remixing/recompacting, if time allows, or these soils may be mixed with a stabilizing/drying agent (lime or fly ash). The proof-rolling and undercutting activities should be witnessed by a RAM Testing representative or the engineer's/owner's representative, properly documented, and should be performed during a period of dry weather.

After subgrade preparation and observation have been completed as stated above, any necessary structural fill material that is required to achieve the desired grade may be placed over the foundation area and to a distance of at least five (5) feet beyond the perimeters of the foundation. The first layer of fill should be placed in a relatively uniform horizontal lift and be adequately keyed into the subgrade soils. Structural fill materials should consist of a clayey sand or inactive lean clay free of organic or other deleterious materials, have a liquid limit not greater than 35, and a plasticity index between 8 and 20. Structural fill should be placed in maximum loose lifts of 8 inches and should be compacted to at least 95% of maximum dry density at moisture content within ± 2% of the optimum moisture content as determined by ASTM D-698. If water must be added, it should be uniformly applied and thoroughly mixed into the soil by discing or scarifying. Each lift of structural fill should be tested by a representative of the geotechnical engineer or a qualified personnel for compliance with density requirement prior to placement of subsequent lifts. Care should be taken in the application of compactive effort throughout the fill and fill scope areas.

Depending on weather conditions, difficulty may be encountered in adequately densifying/compacting the surficial soils. If the surficial soils are unsuitably wet, excess pore pressures ("pumping") may develop and excess displacement of the subgrade soils may occur during site preparation. If the site subgrade soils become unsuitably wet, the construction contractor should:

- dry the soils to within ± 2% of the optimum moisture content by discing these materials,
- dry the soils by blending a stabilizing agent such as lime or fly ash with the unsuitably wet soils, or
- remove the unsuitably wet soils and replace with properly compacted structural fill having an acceptable moisture content.

1.3.2 Foundation Recommendations

The loads of the proposed residential building may be supported on foundation systems as provided below.

Post-Tensioned Slab – The loads of the proposed residential building may be supported on a post-tensioned slab founded on at least **1.0 foot** of properly compacted structural fill soil prepared in accordance with Section 1.3.1 of this report. The structural fill should be placed over the foundation area and to a distance of at least five (5) feet beyond the perimeters of the foundation. Provided below are the parameters for the design of post-tensioned slab-on-grade in accordance with the Post Tensioning Institute (PTI) requirements and guidelines as contained in the Third Edition of the PTI's 2004 publication entitled "Design and Construction of Post-Tensioned Slabs-on-Ground".

DESIGN PARAMETERS	
Allowable Net Bearing Pressure (Total Load)	1,800 psf *
Percent Fine Clay	30 %**
Thornwaite Moisture Index (I_m)	+ 15
Depth of Constant Soil Suction	9 feet
Constant Soil Suction	3.50 pF
Edge Moisture Variation Distance (e_m) Center Lift Edge Lift	 9.0 feet 4.9 feet
Differential Soil Movement (y_m) Center Lift Edge Lift	 0.43 inch 0.35 inch
Slab-Subgrade Coefficient of Friction (μ)	0.6 to 0.7
Effective Plasticity Index	16

* Provided the recommendations in Section 1.3.1 of this report are followed and grade beams are founded at least 1.5 feet beneath finished grade. ** Estimated value

The PTI methods for design of slab-on-grade foundations are essentially empirical design techniques and the parameters provided above are based on our interpretation of the soil borings, laboratory test results, and the criteria published in the PTI design manuals.

We recommend that the grade beams extend to a depth based on structural design. The grade beam width and depth should be properly evaluated by the structural engineer. Grade beams may be thickened and widened to serve as spread footings at concentrated load areas.

Drilled and Underreamed Pier Foundation – The loads of the proposed residential building may also be supported on drilled and underreamed pier foundation system. The drilled piers (maximum bell diameter of 4 feet) may be founded at a depth of at least 8.0 feet below the existing grade or at least 8.0 feet beneath final grade. The drilled piers may be designed for maximum allowable net bearing pressures of 4,000 psf for dead loads plus sustained live loads and 6,000 psf for dead loads plus sustained and transient live loads, whichever results in a larger bearing area. These values consider a safety factor of at least 3 and 2, respectively, against a bearing capacity failure.

Allowable shaft friction in compression and tension for the portions of the drilled pier shafts below a depth of 5 feet beneath the finished grade surface is 450 psf.

For a slab-on-grade floor system, wall loads can be transmitted to the drilled piers by grade beams. The grade beam should be at least 12 inches wide, extend at least 1.5 feet below finished grade, and be founded on drilled piers. The grade beams may be founded directly over the prepared subgrade.

A single isolated pier designed as discussed should experience a settlement of less than 1 inch. However, if a cluster of closely spaced piers is planned, RAM Testing should be contacted to calculate the amount of settlement or to determine the appropriate reduction values in the allowable bearing pressures.

The edge-to-edge spacing of the drilled piers should be equal to a minimum of 1.2 times the average drilled pier bell diameter of adjacent drilled piers. Should piers be located closer than 1.2 bell diameters, measured edge-to-edge, reduction in the allowable net bearing pressures will be required. RAM Testing should be notified for further evaluation in order to determine the appropriate reduction values.

We recommend that the drilled pier excavations be observed by a representative of the geotechnical engineer or a qualified personnel to verify that the strength properties of the foundation materials are consistent with the properties of the materials discussed and used as basis for the provided bearing capacity recommendations in this report, to ensure that the piers are installed in accordance with the specifications, and to verify that the excavation is free from excess water and loose cuttings. Placement of concrete in the excavations should commence immediately after the excavation is completed. A bell shaft ratio of 3 to 1 is recommended.

In the event that caving of pier bell excavations occur during the construction of the drilled piers, where drilled pier side wall or bell excavations cave so rapidly that concrete cannot be placed quickly enough to allow construction of the piers, it will be necessary that casing be used to maintain an open pier excavation or consider the use of drilled straight shafts.

The floor for the proposed building may consist of a slab-on-grade floor placed over at least **1.00 foot** of properly compacted structural fill prepared in accordance with site preparation as described in Section 1.3.1 of this report. The structural fill soils should be placed and extend at least five (5) feet beyond the perimeters of the foundation. An allowable net bearing pressure of 600 psf can be used for slab-on-grade bearing on properly compacted structural fill.

Shallow Spread Footing Foundation - Provided the site and subgrade preparation recommendations provided in Section 1.3.1 of this report are followed and at least **1.00 foot** of properly compacted structural fill is placed over the foundation area and to a distance of at least five (5) feet beyond the perimeters of the foundation, it is our opinion that the planned building construction can also be supported by shallow spread footings. The shallow spread footings should have a maximum width of 5 feet, be founded at a depth of at least three (3) feet below the desired finished grade, and be designed for maximum allowable net bearing pressures of 2,400 psf for axial compression dead loads plus sustained loads and 3,600 psf for axial compression dead loads plus sustained and transient live loads.

If a cluster of closely spaced footings (i.e., if the center to center spacing of the footings is less than two times the width of the footing) are planned, RAM Testing should be contacted to calculate the amount of settlement.

Footing foundations should be prepared by excavating the overburden soils to the final foundation grade elevation, compacting the foundation subgrade soils to an in-place dry density equal to at least 95% of the maximum dry density at a moisture content within ± 2% of the optimum moisture content as determined by ASTM D 698. A tamping plate hand compactor or other suitable impact compactor should be used to perform the compaction. Without proper compaction of the spread footing/grade beam foundation soils, settlement of the shallow spread/grade beam footings could exceed 1 inch.

The foundation excavations should be observed by a representative of RAM Testing or qualified personnel prior to steel or concrete placement to assess that the foundation materials are capable of supporting the design loads and are consistent with the materials discussed in this report. Soft, loose, or unstable soil zones encountered at the bottom of the footing excavations should be removed and replaced with properly compacted structural fill as directed by the geotechnical engineer.

After opening, footing excavations should be observed and concrete placed as quickly as possible to avoid exposure of the footing bottoms to wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond. The foundation concrete should be placed during the same day the excavation is made. If it is required that footing excavations be left open for more than one day, they should be protected to minimize evaporation or entry of moisture.

For a slab-on-grade floor system, wall loads can be transmitted to the spread footings by grade beams. The grade beam should be at least 12 inches wide, extend at least 1.5 feet below finished grade, and be founded on spread footings. The grade beams may be founded directly over the prepared subgrade.

The floor for the proposed residential building may consist of a slab-on-grade floor placed over properly compacted structural fill prepared in accordance with site preparation as described in Section 1.3.1 of this report. An allowable net bearing pressure of 600 psf can be used for slab-on-grade bearing on properly compacted structural fill.

2.0 FIELD INVESTIGATION

For the current geotechnical study, 2 geotechnical borings (Boring Nos. B-1 and B-2) were drilled and sampled on February 26, 2022 by RAM Testing. The boring locations, as shown on Plate 2 in the Appendix, were selected and staked in the field by a representative of RAM Testing, measuring from existing points of reference. Drilling, sampling, and testing were performed in accordance with applicable ASTM procedures.

Soil sampling during the drilling of the geotechnical boring consisted of continuous sampling to 10 feet and intermittent sampling thereafter, with relatively undisturbed samples being obtained.

Relatively undisturbed samples were obtained by hydraulically forcing sections of 2-inch outside diameter (O.D.) tubing (Shelby tube) into the subsoils. The tube samples were extruded in the field, sealed with foil, visually classified, and placed into airtight plastic bags. Estimates of the unconfined compressive strengths and undrained shear strengths of the cohesive soils were obtained with pocket penetrometer readings being taken on the tube samples.

All samples were transported to RAM Testing laboratory for purposes of performing laboratory tests on selected samples.

3.0 LABORATORY TESTING

A laboratory testing program was conducted to obtain engineering properties for use in performing engineering analyses and to adjust field soil classifications. The following laboratory tests were performed:

LABORATORY TEST	TEST STANDARD
Moisture Content of Soils	ASTM D 2216
Percent Soil Particles Passing a No. 200 Sieve	ASTM D 1140
Liquid Limit, Plastic Limit, and Plasticity Index of Soils	ASTM D 4318

The numbers of tests and the test results are presented in the boring logs provided in the Appendix. All tests were performed in accordance with applicable ASTM procedures and methods and soils classifications were completed in accordance with the guidelines of ASTM D 2487 and ASTM D 2488.

4.0 SUBSURFACE CONDITIONS

4.1 Subsoils

The subsurface soil conditions as determined from the drilling of the geotechnical borings are described in Section 1.2.1 of this report and provided on the boring logs in the Appendix.

The boring logs were prepared by using both field visual classifications and the results of laboratory testing. The stratification lines, shown on the boring logs, represent the approximate boundaries between soil types and the transitions between soil types may be gradual.

4.2 Groundwater

Groundwater conditions are described in Section 1.2.2 of this report and on the boring logs provided in the Appendix. The depth to groundwater was obtained by observing the drilling operations and the free moisture contained in the samples recovered during drilling and determining presence or absence of water in the borings during drilling and after the completion of drilling.

Groundwater was not encountered during the drilling of the geotechnical borings. However, it is possible that seasonal variations may cause fluctuations in the water level data obtained during our field investigation. If necessary, we recommend that the contractor determine the actual groundwater level at the time of construction in order to determine the impact, if any, of the groundwater on the construction procedures. It should be noted that the recommendations contained in this report are based on groundwater information at the time of this geotechnical investigation and that an accurate determination of the true groundwater level may require several days or even months of observations.

5.0 CONSTRUCTION CONSIDERATIONS

The following recommendations should be followed with regard to construction of the proposed residential building.

5.1 Moisture Sensitive Soils/Weather Related Concerns

Soils at the site are extremely sensitive to moisture changes, the subgrade soils should be protected and adequate drainage should be maintained at the time of the construction. During inclement weather, the subgrade soils may get disturbed due to construction traffic. It is extremely important to provide good site drainage during construction.

During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils which become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. It will, therefore, be advantageous to perform earthwork and foundation construction activities during dry weather.

5.2 Drainage and Groundwater Concerns

Water should not be allowed to collect in the foundation excavation or on prepared subgrades of the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater, or surface runoff. Positive site surface drainage should be provided to reduce infiltration of surface water around the perimeter of the foundation. The grades should be sloped away from the foundation and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and foundation area. Trees and other vegetation capable of withdrawing significant amounts of moisture from the subsoils should be located a distance from the nearest foundation equal to at least the expected ultimate extent of the root system of the vegetation, or appropriate moisture barriers should be provided.

Groundwater was not encountered during the drilling of the geotechnical borings. It is not anticipated that groundwater will be present nor will the groundwater pose a problem with the construction activities associated with the proposed project. However, if groundwater is encountered during the construction activities, it is expected that the use of sumps and sump pumps will be effective for groundwater dewatering where the exposed soils consist of the site clays. Should excessive and uncontrolled amounts of seepage occur, the geotechnical engineer should be consulted.

5.3 Drilled and Underreamed Piers

The successful completion of drilled and underreamed excavations will depend, to a large extent, on the suitability of the drilling and underreaming equipment together with the skill of the operator. The sequence of operations should be scheduled so that each underream can be completed, reinforcing steel placed, and the concrete poured in a continuous, rapid and orderly manner to reduce the time that the excavation is open.

Shafts and underreams should be clear and be free of all loose materials prior to placement of concrete. Concrete placed for drilled piers should have a 4 to 6-inch slump and be placed continuously in the shaft. Concrete may be allowed to drop freely in dry drilled pier excavations containing 1 inch or less of water, provided that the concrete does not fall against the steel reinforcing or the shaft sides. Drilled piers with more than 1 inch of water in the bottom should be filled with concrete by the tremie method of concrete placement. If casing is required, the casing should be removed as concrete is being placed. The casing should be removed in a manner that precludes the surrounding soil from invading the fresh concrete. This will require a vertical, smooth removal of the casing while maintaining the bottom of the casing below the top of the concrete a distance sufficient enough to offset the surrounding material pressure.

A qualified representative of the geotechnical engineer should verify that the underream installation procedures meet specifications.

5.4 Federal Excavation Safety Regulations

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better insure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

6.0 CLOSING REMARKS

RAM Testing has performed a geotechnical investigation and provided soils data and parameters that may be used for the design and construction of foundations for the proposed residential building that will be constructed at 11901 Pine Belt Drive in Cypress, Texas. This report has been prepared for the exclusive use of Elements Design & Construction, LLC and its authorized representatives in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

In the event that changes are made in the nature, design, or location of the proposed development, the conclusions, parameters, and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the findings and guidelines included in this report are modified or verified in writing. The analyses and guidelines presented in this report are based upon data obtained from 2 geotechnical borings drilled on February 26, 2022. The nature and extent of variations within the subsurface materials may not become evident until after construction is initiated. If significant variations in the subsurface materials are encountered during construction, it may be necessary to re-evaluate the parameters and recommendations provided in this report.

We appreciate the opportunity to be of service to you on this project. If we can answer any questions concerning the contents of this report or be of further service, please do not hesitate to contact us.

Sincerely,

RAM Testing
Firm Reg. No.: 11970

STATE OF TEXAS
BONIFACIO F. MUSNGI, JR.
90666
LICENSED
PROFESSIONAL ENGINEER
03/04/2022

Bonifacio F. Musngi, Jr., P.E.
Project Engineer

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APPENDIX

Site Location,

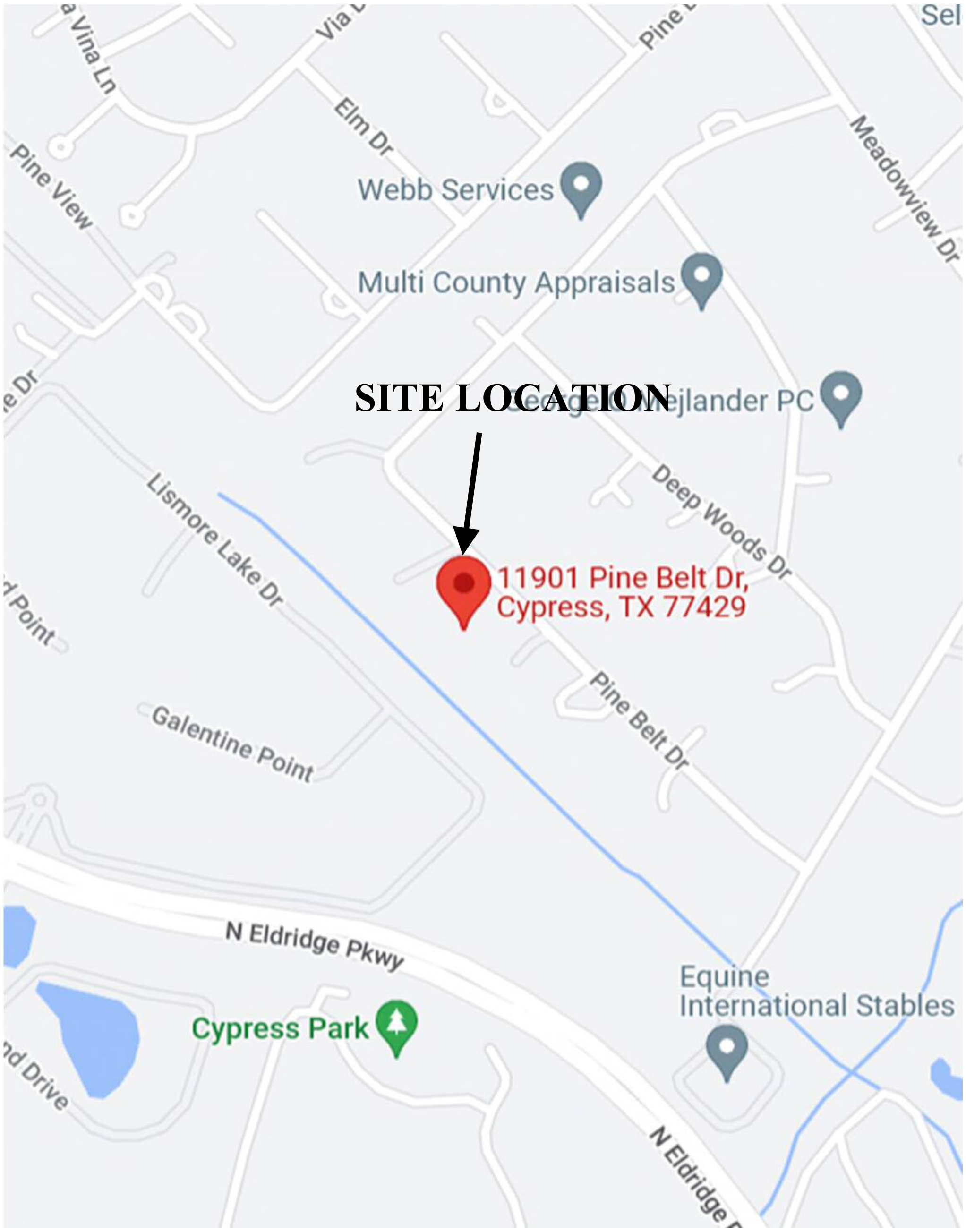
Locations of Borings,

Boring Logs (Boring Nos. B-1 and B-2),

and

Key to Terms and Symbols
Used on Boring Logs

RAM Testing



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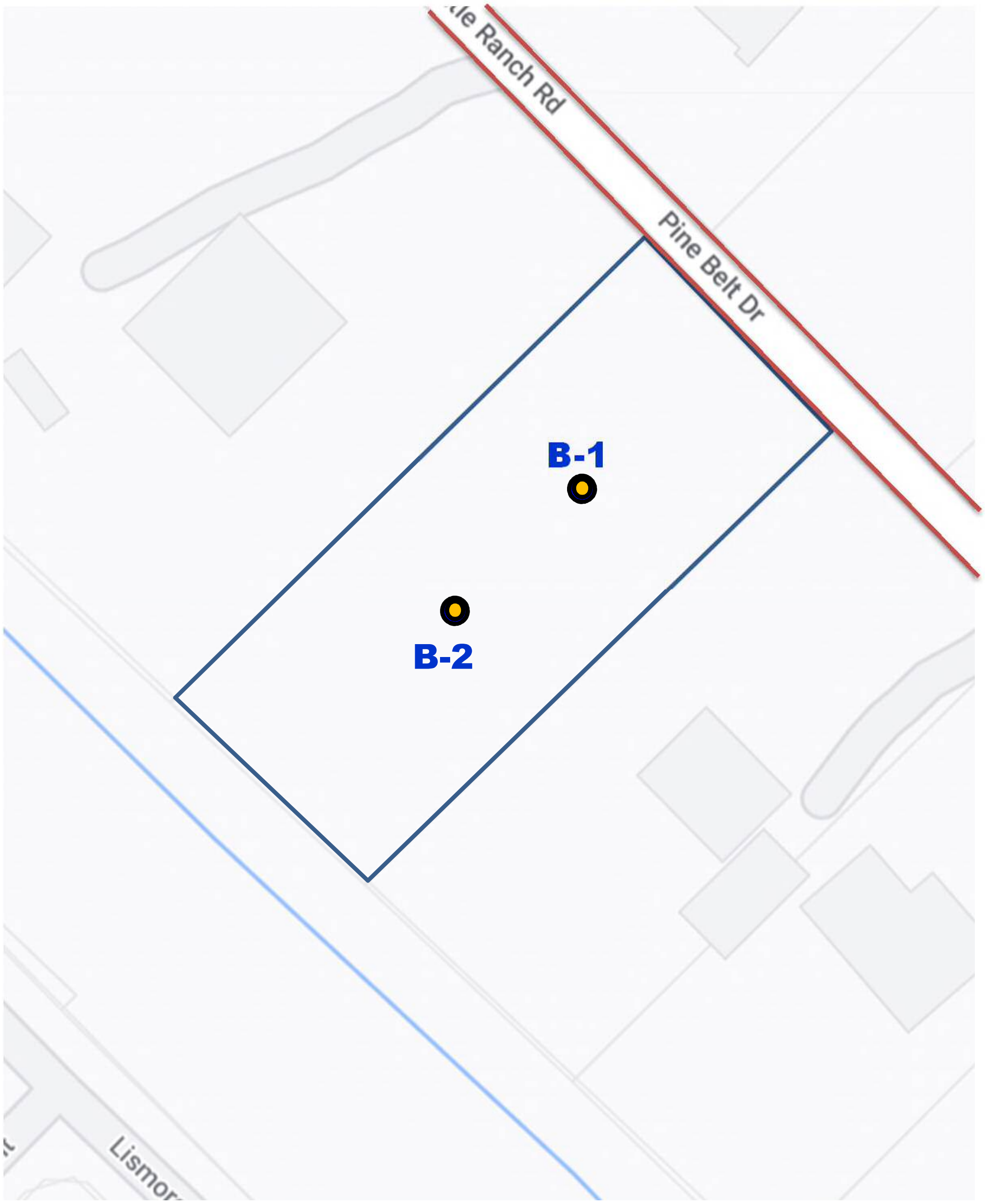
PROPOSED RESIDENCE
11901 PINE BELT DRIVE
CYPRESS, TEXAS 77429

SITE LOCATION

Date: 03/04/22	Project No: RT22-173	Plate 1



- Geotechnical borings included in the study

PROPOSED RESIDENCE
11901 PINE BELT DRIVE
CYPRESS, TEXAS 77429

LOCATIONS OF BORINGS

Date: 03/04/22	Project No: RT22-173	Plate 2

LOG OF BORING NO. B-1

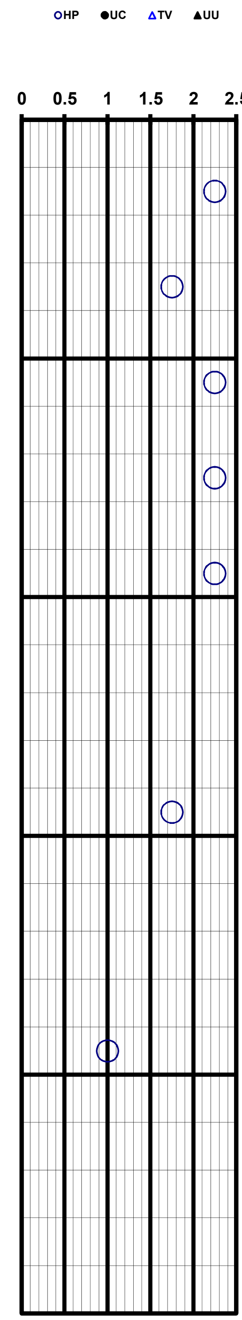
PROPOSED RESIDENCE
11901 PINE BELT DRIVE
CYPRESS, TEXAS 77429

TYPE OF BORING: **FLIGHT AUGER** CLIENT: **Elements Design & Construction, LLC** PROJECT NO.: **RT22-173**

SURFACE ELEVATION: **N/A** LOCATION: **See Plate 2** DATE DRILLED: **02/26/22**

DEPTH, FT.	DESCRIPTION	HAND PEN. RDG. (TSF)	MOISTURE CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	PASS #200 SIEVE, %	DRY DENSITY (PCF)
	SANDY LEAN CLAY (CL), very stiff to hard, dark gray and tan	4.50	13	29	16	13	62.1	
	- light gray and tan w/ calcareous nodules at 2'	3.50	11					
5		4.50	13					
		4.50	13	23	15	8	67.7	
10		4.50	12					
15		3.50	13					
20	20'	2.00	14					
	(Boring terminated at 20')							
25								

SHEAR STRENGTH (tons/sq.ft)



Groundwater was not encountered during the drilling of the boring. The boring was backfilled with soil cuttings after the completion of the drilling activities.

RAM Testing

Plate 3

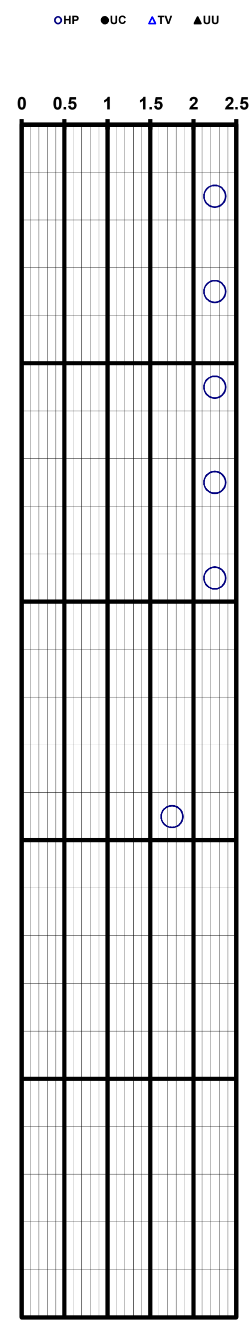
LOG OF BORING NO. B-2

PROPOSED RESIDENCE
11901 PINE BELT DRIVE
CYPRESS, TEXAS 77429

TYPE OF BORING: **FLIGHT AUGER** CLIENT: **Elements Design & Construction, LLC** PROJECT NO.: **RT22-173**
SURFACE ELEVATION: **N/A** LOCATION: **See Plate 2** DATE DRILLED: **02/26/22**

DEPTH, FT.	DESCRIPTION	HAND PEN. RDG. (TSF)	MOISTURE CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	PASS #200 SIEVE, %	DRY DENSITY (PCF)
	SANDY LEAN CLAY (CL), very stiff to hard, dark gray and tan	4.50	13					
	- light gray and tan w/ claystones at 2'	4.50	11	27	15	12	54.0	
5		4.50	13					
		4.50	13					
10		4.50	13	36	17	19	66.9	
15	15'	3.50	13					
	(Boring terminated at 15')							
20								
25								

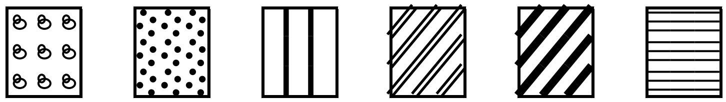
SHEAR STRENGTH (tons/sq.ft)



Groundwater was not encountered during the drilling of the boring. The boring was backfilled with soil cuttings after the completion of the drilling activities.

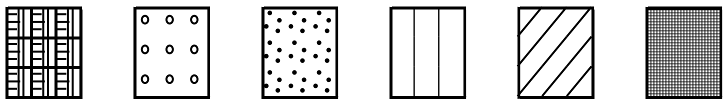
KEY TO TERMS AND SYMBOLS USED ON BORING LOGS

SOIL TYPE



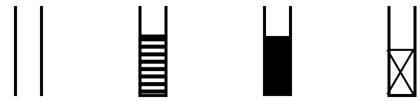
GRAVEL | SAND | SILT | LEAN CLAY | FAT CLAY | PEAT

MODIFIERS

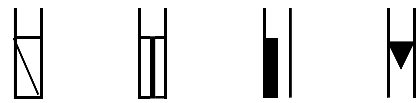


STONE | GRAVELY | SANDY | SILTY | CLAYEY | MISC. (SEE TEXT ON LOG)

SAMPLER TYPE

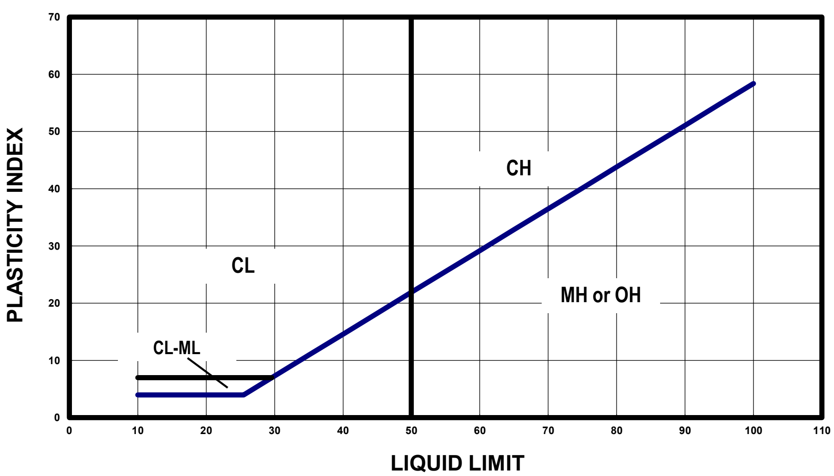


NO SAMPLE | AUGER SAMPLE | SHELBY TUBE | SPLIT SPOON



NO RECOVERY | ROCK CORE | 1.8" SHELBY TUBE | TXDOT CONE

UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D 2487



CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	SHEAR STRENGTH (Tons/ft^2)
Very Soft	0 - 0.125
Soft	0.125 - 0.25
Firm	0.25 - 0.5
Stiff	0.5 - 1.0
Very Stiff	1.0 - 2.0
Hard	> 2.0 or 2.0+

RELATIVE DENSITY - GRANULAR SOILS

CONSISTENCY	N-VALUE*	PP (tsf)
Very Loose	0 - 4	0 - 0.5
Loose	5 - 10	0.5 - 1.5
Medium Dense	11 - 30	1.5 - 3.0
Dense	31 - 50	3.0 - 4.5
Very Dense	> 50	> 4.5

* blows/foot

DEGREE OF PLASTICITY OF FINE-GRAINED SOILS

DEGREE OF PLASTICITY	PLASTICITY INDEX	SWELL POTENTIAL
None	0 - 4	Very Low
Slight	5 - 10	Low
Medium	11 - 20	Moderate
High	21 - 40	High
Very High	> 40	Very High

MOISTURE CONDITION COHESIVE SOILS

DESCRIPTION	CONDITION
Absence of moisture, dusty, dry to touch	DRY
Damp but no visible water	MOIST
Visible free water	WET

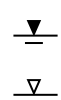
CONSISTENCY OF COHESIVE SOILS AFTER TERZAGHI (1948)

CONSISTENCY	N-VALUE (Blows/Foot)
Very Soft	< 2
Soft	2 - 4
Firm	4 - 8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	> 30

ABBREVIATIONS

HP - Hand Penetrometer
TV - Torvane
MV - Miniature Vane
UC - Unconfined Compression Test
UU - Unconsolidated Undrained Triaxial Test
CU - Consolidated Undrained Triaxial Test

NOTE: Plot indicates shear strength as obtained by above tests.



Final Groundwater Level

Initial Groundwater Level

CLASSIFICATION OF GRANULAR SOILS

U.S. STANDARD SIEVE SIZE(S)

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

BOUL--DERS	COBBLES	GRAVEL		SAND			SILT	CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE		

152 | 76.2 | 19.1 | 4.76 | 2.0 | 0.42 | 0.074 | 0.005 | 0.001

GRAIN SIZE IN MM

RAM Testing

Plate 5