PRELIMINARY
GEOTECHNICAL EVALUATION

105 ACRE SOUTH TRACT
LINDALE, TEXAS
APEX PROJECT NO. 107-260

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66267

The seal appearing on this document was authorized by Timothy L. McDaniel, P.E. 66267 on January 7, 2008.

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APPENDIX

1.0 INTRODUCTION

1.1 Project Authorization and Progress

Apex has completed a subsurface exploration and preliminary evaluation of the soil conditions at the proposed 105 acre south industrial park site, in Lindale, Texas. Authorization to perform the work was provided by Mr. Rick Martindale, Project Manager, Adams Engineering, Inc. (client), by accepting Apex Proposal No. P0701-727 dated October 5, 2007. Formal authorization was provided on October 23, 2007 and received on October 25, 2007. Field procedures were conducted on November 29, 2007.

1.2 Purpose and Scope of Services

The purpose of this report is to provide the architect with preliminary findings for appropriate, general foundation types, subgrade remediation options, and typical design and construction parameters and considerations for foundations, slabs, and site work at the proposed site of the referenced project.

The scope of services for this project included:

1. Determine the soil profile components at the boring locations;
2. Define the engineering characteristics of the major subsurface materials identified and encountered;
3. Observe the seepage and groundwater conditions at the site as related to the depth of borings; and
4. Summarize typical foundation types, design parameters, and general considerations in a geotechnical evaluation report.

This report also briefly outlines the testing procedures and describes the site and subsurface conditions.

1.3 Report Limitation

As limited in the scope of services, this report is preliminary and is not intended to be used for the final project design. This report may be used to produce design concepts and does provide various earthwork and foundation guidelines, considerations, and/or typical values for design parameters. This report should not be used by the contractor in lieu of project specifications. The findings and recommendations in this report are preliminary, and are intended to be interpreted by professional architectural, structural engineering, and civil engineering consultants for comparative project planning and/or site selection criteria.

2.0 PROJECT DESCRIPTION

2.1 Project Description

Apex understands the current scope for this project includes exploring the subsurface conditions of the proposed site, and to provide preliminary construction information based on the findings of the subsurface investigation.

2.2 Loading Criteria

For the purpose of this report, the following loading criteria have been assumed:

- Maximum column loads will not exceed approximately 30 kips;
- Maximum continuous wall loads will be approximately one (1) to two (2) kips per linear foot;
- Maximum uniform floor loads are expected to be about 125 psf; and
- Maximum isolated concentrated floor loads are expected to be about five (5) kips.

2.3 Design Grade Changes

Specific grading information was unknown at the time of this report. Grade changes are expected to be a nominal two (2) to three (3) feet maximum. If larger grade changes are anticipated, these should be discussed with our geotechnical engineer prior to finalizing design.

2.4 Information Note

Other than as assumed and stated above, detailed information on structural systems and finalized planned grading was not available to us at the time this report was prepared. If any of this information should change significantly or be in error, it should be brought to our attention so that we may review recommendations made in this report.

3.0 DRILLING AND TESTING PROCEDURES

3.1 Field Operations

Subsurface conditions at the site of the proposed campus were explored by drilling six (6) exploratory borings to a depth of approximately 20 feet each. The borings were located in the field by the drilling crew, by measuring approximate distances from existing features as shown on the Plan of Borings included in the Appendix of this report.

Drilling Equipment. The borings were advanced using a diesel-powered drill rig equipped with a rotary head and continuous flight augers. Drilling and sampling activities were performed in general accordance with referenced ASTM procedures or other accepted methods.

Disturbed and Undisturbed Soil Sampling. Undisturbed samples were obtained using thin wall sampling procedures, generally in accordance with ASTM D 1587. The samples obtained by this procedure were extruded by a hydraulic ram and visually classified in the field. A calibrated hand penetrometer was used as an aid in evaluating the shear strength of the cohesive soils encountered during drilling. The hand penetrometer readings are recorded on the boring logs at the corresponding sample depths.

Disturbed soil samples were collected by employing split-spoon sampling procedures (Standard Penetration Test) in general accordance with ASTM Standard Method D 1586. Samples were obtained at selected depths in the test boring by driving a standard two (2) inch OD split-spoon sampler 18 inches (where possible) into the subsurface materials using an automatic falling hammer. The penetration resistance or "N-Value" is related to the number of hammer blows required to drive the sampler the final 12 inches, and when properly evaluated, can be used as an index for cohesion for clays, and relative density for sands.

Soil Sampling Interval. Generally, four (4) soil samples were obtained from each of the borings from just below the ground surface to a depth of about 10 feet, and additional soil samples were obtained at about five (5) foot intervals thereafter. See the boring logs for specific information regarding the depth of samples obtained for this investigation.

Water Level and Borehole Information. Water level information was obtained during drilling and after completion of drilling activities.

Boring Logs. Boring logs which include soil descriptions, water level information, laboratory test data, stratifications, penetration resistance, classifications based on the Unified Soil Classification System (USCS) and sample types and depths are included in the Appendix. A key to descriptive terms and symbols used on the boring logs is also presented in the Appendix.

3.2 Laboratory Testing

The soil samples obtained during the field exploration were transported to the laboratory and examined by qualified geotechnical personnel. Representative soil samples were selected and tested to determine classification properties and particular engineering characteristics. Laboratory tests were performed in general accordance with referenced ASTM procedures or with other accepted laboratory methods. The results of these tests at the corresponding sample depths are presented on the report boring logs included in the Appendix. Laboratory tests performed for this study are tabulated as follows:

LABORATORY TESTING PROGRAM	
Laboratory Test	**ASTM Designation**
Atterberg Liquid Limit and Plastic Limit Determination	D 4318
Soils Finer than a No. 200 Mesh Sieve	D 1140
Moisture Content Determination	D 2216

3.3 Sample Retention

Soil samples not altered by laboratory testing will be retained for 60 days from the date of this report and then discarded unless Apex is otherwise instructed by the client in writing.

4.0 SITE AND SUBSURFACE CONDITIONS

4.1 Site Description

The site for the proposed industrial park is located south/west of the intersection of I-20 and Harvey Road near Lindale, Texas. The location of Boring No. 1 was determined using a handheld GPS unit which indicated the following coordinates N 32° 27’ 59” and W -95° 25’ 36”. The degree of accuracy of the GPS unit is typically within an approximate distance of 50 feet.

At the time of field operations surficial vegetation consisted predominantly of grass. The drilling crew reported that the track-mounted drilling rig did not have any difficulty maneuvering about the site.

4.2 Subsurface Conditions

The stratification of the soils encountered during field drilling operations is presented on the boring logs in the Appendix. The stratification of the subsurface materials shown on the boring logs represents the subsurface conditions encountered at the actual boring locations and variations may occur across the site. The lines of demarcation represent the approximate boundary between the soil types, but the actual transition may be gradual. The following subsurface descriptions are of a generalized nature to highlight the major stratification features. The borings encountered the following soil strata beneath the ground surface:

- **Sandy Lean Clay (CL);**
- **Well-Graded Sand with Silt (SW-SM)**
- **Clayey Sand (SC);**
- **Silty Clayey Sand (SC-SM);** and
- **Silty Sand (SM).**

The boring logs should be reviewed for more detailed information concerning occurrences, descriptions, and physical properties.

4.3 Groundwater Conditions

Water level observations were made during and after the completion of drilling activities. Based upon the available information, it appears that the groundwater level at the time of the field exploration was as shallow as eight (8) feet below existing grade. Groundwater levels are expected to vary across the site. If more detailed water level information is required, observation wells or piezometers could be installed at the site, and water levels could be monitored over time.

GROUNDWATER OBSERVATIONS		
Boring No.	**Seepage Condition**	**Post Drilling Borehole Condition**
1	None	No seepage noted during drilling. Dry upon completion.
2	18 ft	Water level at 18 feet upon completion, and at final check.
3	10 ft	Water level at 10 feet upon completion. Water level at 8 feet at final check.
4	18 ft	Water level at 18 feet upon completion and at final check. Boring caved to 19 feet.
5	13 ft	Water level at 13 feet upon completion. Water level at 11 feet. and caved to 14 feet. at final check.
6	13 ft	Water level at 14 feet. upon completion. Water level at 14 feet. and caved to 14 feet. at final check.

It should be noted that groundwater level fluctuations may occur due to seasonal and climatic variations, alteration of drainage patterns, leaking utilities, land usage, and ground cover.

5.0 FINDINGS

5.1 General

The analyses for the foundation type(s) appropriate for proposed structures are based upon observations and test data obtained from, and inferred by the soils identified at the individual exploratory boring locations as well as overall site conditions. As previously stated, the following recommendations should be considered preliminary. Furthermore, additional borings, laboratory testing, and analyses may alter these recommendations, although substantial changes are not anticipated.

Expansive Soil Conditions. Potential Vertical Rise (PVR) values of approximately <u>one (1) inch to less than one (1) inch</u> were estimated for this site based on the Texas Department of Transportation method (Test Procedure TEX-124-E). One (1) inch of PVR is generally accepted as the maximum allowable value for design and construction in the geographical area. Soils encountered in the borings possess low to moderate expansive characteristics. Depending on the final placement and grading, subgrade modification and/or foundation design provisions may be needed to accommodate these soil conditions.

Bearing Capacity. The bearing capacity of the naturally occurring soil was evaluated from the results of the field penetration tests, including Standard Penetration Tests (SPT) and portable penetration tests, laboratory compression tests, and soil properties inferred by soil characteristics as classified by the USCS. These test results indicate that the characteristics of the surficial coarse grained material ranges from very loose to loose. Subgrade preparations can be implemented to mitigate loose and/or soft soil conditions.

Based on the scope of this preliminary investigation, it is probable that fine grained or clayey surficial soils (possibly with expansive characteristics) exist on site; however, this preliminary investigation did not encounter widespread clayey surficial soils.

Settlement. Based the observed loose soil conditions, excessive foundation movements from settlement are possible. However, if foundations are designed and constructed in accordance with final recommendations, excessive foundation movement as a result of settlement is not expected. Total settlement can be limited to on the order of one (1) inch or less for foundation units designed in accordance with typical recommendations as outlined herein. Differential settlements can be limited to on the order of ½ inch or less by appropriate foundation design and subgrade preparation.

Customary measures should be taken to minimize moisture variations beneath the structure to preclude loss of shear strength of foundation soils.

Drainage Considerations. Due to the nature of subgrade soils, it is imperative that positive surface drainage away from the foundation be provided. If moisture from surficial runoff or irrigation is allowed to collect and permeate into subgrade soils underneath foundation elements, shear strength losses, as well as excessive total and differential settlement may occur.

5.2 Feasible Foundation Systems.

Based on the findings of this evaluation, including the known or assumed planned grading and structural systems as outlined previously, the following foundation systems may be considered:

1. Shallow Footings. A shallow foundation system using individual and/or continuous footings appears to be the most economical foundation based on the information available. To mitigate the loose soil conditions encountered across the site will require the overexcavation of a minimum of three (3) feet of the native soils and replacement with moisture and density controlled select fill. Dependent on final configuration of facilities planned for the site, additional overexcavation and replacement exceeding three (3) feet may be necessary to remediate loose and/or expansive subgrade soils. For conditions typical of those found at the boring locations, footings should bear on a minimum of one (1) foot of select fill and may be founded typically at a nominal depth of 18 inches below the final surrounding grade. At interior locations, footings may be founded at the minimum depth required to accommodate the structural detailing and design. All footings should bear within the zone of select fill required for the subgrade remediation. Net allowable soil bearing pressures on the order of 2,200 and 1,800 pounds per square foot (psf), respectively, may be used to proportion individual and continuous footings. Large loads or large footings may necessitate the use of lower bearing capacities and the provision of additional fill beneath the footings.

2. Drilled shaft foundations. As an additional foundation option, structural loads such as columns and uniform wall loads may be supported on straight-sided drilled shafts. The construction of drilled shaft underreams or belled shafts are not recommended due to the sandy nature of the soils encountered not being susceptible to underreams without caving. Drilled shafts could bear at a minimum depth of 15 feet, within sandy lean clay (CL) or clayey sand (SC). The use of straight sided shafts should be anticipated due to the occurrence of granular materials at this depth. Also, casing will be required to prevent the intrusion of

groundwater and caving of the pier excavation. A slab on grade floor system may be used with the subgrade preparations limiting the potential vertical movement to one (1) inch or less.

Planned facilities with large column loads (overhead cranes, tanks, large superstructure loads, etc.) may require the exploration of soils at a greater depth than advanced during this preliminary investigation.

5.3 Walls Below Grade

It is unknown whether or not the proposed development will utilize retaining structures or walls above or below grade. However the following information is provided for reference and planning purposes.

General. Walls above or below grade, including retaining and stem walls, are subject to lateral pressures from soil and water. Active soils (those with plasticity sufficient to allow shrinkage and expansion, and having access to a source of varying moisture) and surcharge loading also influence lateral earth pressures.

Backfill. Generally, a free-draining backfill is preferable to one that is relatively impervious, as the free-draining material will allow a less rigid wall design. Surface water should be precluded from entering the free-draining backfill, to preclude backfill erosion, piping, and development of “undrained” conditions. Stem walls should be designed for “at-rest” conditions, as these features will be restrained at the top and bottom. Retaining walls should be designed for “active” conditions.

Washed, granular backfill (with lower lateral pressures) should certainly be considered. This decision should be based upon a cost comparison of combinations of backfill and structural rigidity of walls, which should require evaluation by the structural engineer. The following table provides equivalent fluid pressure values for several soil types and loading cases. Lean clay (CL) and fat clay (CH) soils should not be placed and compacted for backfill, unless the wall is designed to accommodate the lateral pressures that will result from these soils.

Regardless of whether on-site soils are used, the active zone behind the wall should be backfilled with a free-draining material, and designed for that condition. In this case, backfill should be protected from entry of runoff through aggressive, positive grading design, and with back-wall drainage. Positive drainage of walls is recommended to prevent development of the “undrained” condition. Special handling of irrigation runoff to avoid “water-logging” the backfill is also advised.

Loading Considerations. For walls subjected entirely to soil loading (no water in the backfill), the normal earth pressure diagram is triangular. Surcharge loads such as vehicular traffic, construction equipment, or other anticipated requirements should be added to the pressure diagram. Surface footings near the basement walls will increase lateral forces against the walls. These forces should be accounted for in the design of the walls.

Walls constructed below grade should be water-proofed with commercial products available specifically for this purpose. Additionally, it is recommended that components be installed to remove water away from the wall. Several geosynthetics are available that would function to provide a conduit along the wall that allows the water to follow the geosynthetics down alongside the wall to be removed via gravel lined trenches away from the building at a minimum gradient of one percent (1%).

EQUIVALENT FLUID PRESSURES FOR RETAINING WALLS [1,2]

Backfill	Unit Weight (pcf)	Ø	At Rest [6]		Active [6]	
			Drained	Undrained	Drained	Undrained
Clayey Soils (SC) [3]	120	20°	80	100	60	90
Silty Sand (SM) [4]	115	25°	67	93	47	84
Washed, free-draining concrete Sand (ASTM C 33) (SW or SP)	115	30°	58*	89	38	80
Compacted low swell potential select fill (SC or CL) [3,5]	120	See Notes 3 and 5	96	110	80	100

NOTES:

1. Applies only to smooth vertical walls with horizontal backfill. Specific design of other retaining walls can be provided once exact wall configuration is known.
2. Lateral earth pressure formulas are as follows:
   $K_a = \tan^2 (45 - Ø/2)$ $K_o = 1 - \sin Ø$ $K_p = \tan^2 (45 + Ø/2)$
   * Example Calculation: (115) (1 - sin 30) = (115) (0.5) = 57.5 = 58
3. Amount passing No. 200 sieve shall be less than 50% for Clayey Sand (SC) soils and from 50% to 65% for Sandy Lean Clay (CL) soils.
4. Amount passing No. 200 sieve shall be less than 20% for Silty Sand (SM) soils.
5. K_a and K_o are based upon published test data, where Ø may be taken as 12°.
6. Values are given in the following units: Pounds per Square Foot per Foot of Wall Height (psf / ft of wall height)

Sliding Resistance. Frictional sliding resistance for lateral loading conditions may be determined using a coefficient of friction estimated from values provided in the following table.

COEFFICIENT OF FRICTION AT BASE OF WALL	
Material at Concrete Interface	**Coefficient**
Coarse Grained Soil w/o Silt (SC, SW, or SP)	0.45
Coarse Grained Soil w/ Silt (SM, SC-SM)	0.35
Silt (ML, MH)	0.30

If the base of the retaining wall rests on clay, the shearing resistance against sliding should be based on the cohesion of the clay, which can be estimated as one-half the unconfined compression strength value. If the clay is stiff or hard, its surface should be roughened before the concrete base is placed.

5.4 Paving

The soils are conducive for construction of either concrete or asphaltic pavement sections. For light duty auto drives and parking, concrete paving a minimum of five (5) inches thick may be considered for planning purposes, placed on properly prepared subgrade. For light duty asphaltic sections, a minimum of two (2) inches asphaltic surface on nine (9) inches of crushed limestone flexible base, on properly prepared subgrade may be used for estimating purposes. Heavy duty pavement sections will require additional thicknesses of paving materials and will be dependent upon the traffic loading (ESALs) and the results of CBR tests along the pavement route.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 General

This section provides general guidance considered to be good practice for most construction projects. However, the information listed below may need to be modified to apply to certain specific conditions if addressed previously herein, or if in conflict with other recommendations made specifically for certain soil conditions, project features, or other elements.

6.2 Site Preparation

This section offers general comments and guidelines. To prepare for foundation and soil supported floor slab construction, we recommend that all topsoil, vegetation, roots, and any soft soils in the building area be stripped from the site and either properly disposed or stockpiled for later use in landscaping. Utilities should be located and rerouted as necessary.

Proof Roll Verification. After stripping and undercutting, as required by the grading plan and overexcavation as required herein, the building area should be proof rolled with a heavy, loaded pneumatic-tired vehicle such as a 20 to 25 ton loaded dump truck or scraper. It is recommended that all areas beneath the floor slab be proof rolled to identify loose or soft soils. All proof rolling and undercutting activities should be witnessed by Apex and should be performed during a period of dry weather. Any weak areas which yield under the proof roll, or any areas with a tendency to pump should be mitigated. Such mitigation may include:

- Overexcavation and backfilling,
- Reprocessing to remove moisture,
- Chemical modification with lime or cementitious admixtures, or
- Installation of geosynthetics.

In the event such mitigation is required, the geotechnical engineer should be contacted to design an appropriate procedure.

Scarification. After stripping, excavating where required, and proof rolling but prior to placing fill, the exposed soils should be scarified and then processed to a moisture content between two percentage points below (-2%) and two percentage points above (+2%) the Standard Proctor optimum. The subgrade soils should be recompacted to a dry density of at least 95% of the Standard Proctor (ASTM D 698) maximum dry density for a depth of at least eight (8) inches below the surface.

6.3 Select Fill

After the subgrade has been prepared and inspected, select fill placement may begin. Select fill material should be:

- Free of organic or other deleterious materials,
- Homogeneous mixture,
- Maximum particle size of three (3) inches,
- Liquid limit less than 38,
- Plasticity index between 7 and 18, and
- Consist of Silty Clayey Sand (SC-SM), low plasticity Sandy Lean Clay (CL), or Clayey Sand (SC) soils as defined by the Unified Soil Classification System.

If a fine-grained material is used for fill, very close moisture content control will be required to achieve the recommended degree of compaction.

Use of On Site Material as Fill. Based on the results of the laboratory analysis, the onsite surficial silty clayey sand (SC-SM) and clayey sands (SC) materials encountered during the preliminary investigation do generally comply with the select fill criteria and may be reused in select fill applications. Based on the relatively small sample size compared to the overall breadth of the project, there may be areas where surficial soils do not comply with the select criteria outlined herein. All onsite material to be used as select fill should be approved prior to use. Moderate to highly plastic soils should not be allowed for use in select fill applications.

Silty sand mixtures (SM) were determined to be the prevalent surface soil in the vicinity of the majority of the borings, excluding Boring No. 2 where clayey sands (SC) were encountered. Our experience shows that many contractors encounter difficulty in working with silty soils such as silty sands (SM), depending on the seasonal moisture and groundwater conditions. These materials are usually non-plastic and tend to draw lower moisture upward during progressive construction of fills, precluding attainment of stability in successive lifts. For this reason, this material will <u>not</u> satisfy the recommended requirements listed herein for select fill. Apex excludes these materials as select fill because they are difficult to work with, and difficult to <u>maintain</u> moisture and density objectives after compaction and testing, rather than any detrimental engineering properties. Customary “protection of completed work” provisions under typical construction contracts may become problematic when using these materials. Although these materials may satisfy moisture and compaction test requirements at the time of placement, they typically require re-working prior to further construction due to subsequent moisture variations, surficial degradation, and loss of structure, especially under construction traffic, which affects the density of the material. Further, silty sand soils do not usually allow “formless” utility and foundation trenches to remain stable. *However, if very stringent moisture control is maintained, these materials may be allowable in certain instances, if the risks are understood by the affected parties.* It is recommended that contract documents include separate bid items and unit prices for both imported select fill and the use of the on-site silty sand materials, which do not satisfy the select fill requirements herein.

Select Fill Placement. Fill should be placed in maximum lifts of eight (8) inches of loose materials. Select fill thicknesses less than four (4) feet should be compacted within the range of two percentage point below (-2%) to two percentage points above (+2%) the optimum moisture content value and a minimum of 95% of the maximum density as determined by the Standard Proctor (ASTM D 698) test. If water must be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying.

Select fill thicknesses greater than four (4) feet should be compacted at a minimum of 98% of the maximum density as determined by the Standard Proctor (ASTM D 698) test, under similar moisture conditions as listed in the preceding paragraph. It is not recommended that portions of the site with fill thicknesses less than four (4) feet be compacted to a lesser compaction level than other portions of the site with thicknesses greater than four (4) feet which are compacted to a greater compaction level. If any portion of the fill beneath the building exceeds four (4) feet then the entire select fill pad should be compacted to the 98% compaction level.

Select Fill Testing Frequency. Each lift of compacted soil should be tested and inspected by the soils engineer or his representative prior to placement of subsequent lifts. As a guideline, it is recommended that field density tests be taken at a frequency of not less than one (1) test per 2,500 square feet of surface area per lift or a minimum of four (4) tests per lift for each tested area for the building area, and not less than one (1) test per 5,000 square feet of surface area per lift or a minimum of four (4) per lift for each tested area for the pavement area.

6.4 Safety Considerations

Prior to the commencement of construction, the owner and the contractor should make themselves aware of and become familiar with applicable local, state, and federal safety regulations, including the current Occupational Safety and Health Association (OSHA) Excavation and Trench Safety Standards. Construction site safety generally is the sole responsibility of the contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations.

We are providing this information solely as a service to our client. Under no circumstances should the information provided herein be construed that Apex is assuming responsibility for construction site safety of the contractor's activities. Such responsibility is not being implied and should not be inferred.

6.5 Worker Safety - Slopes

The contractor should be aware that slope height, slope inclination, or excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, or federal safety regulations, e.g., OSHA Standards Title 29 CFR Part 1926, Subpart P - Excavations, Sections 1926.650 to 1926.652, successor regulations as well as other building code requirements. Such regulations are strictly enforced and, if not followed, the owner, contractor, and earthwork and utility subcontractors could be liable for substantial penalties.

If any excavations (including utility trench excavations) are extended to a depth of more than 20 feet (including the spoil height if the spoil pile is placed in close proximity to the edge of the excavation), it will be required to have the side slopes, or retaining walls, designed by a professional engineer registered in the State of Texas.

6.6 Drainage Considerations

Water should not be allowed to collect near the foundations or floor slab area of the project either during or after construction. Undercut or excavated areas should be sloped toward a sump area to facilitate removal of any collected groundwater or surface runoff.

Excessive foundation or slab movement should not occur if customary measures are taken to reduce and control moisture variations beneath the structure to preclude loss of shear strength of foundation soils.

- Proper surface drainage should be maintained, and landscape irrigation systems should be located and operated in a manner to completely avoid wetting of building foundations.
- After installation, the irrigation system should be pressure tested, any leaks repaired, and water spray systems directed away from the building(s).
- Positive drainage away from the building(s) should be provided at all times, including during construction.

If positive drainage is not provided, water will pond around or below the structure and excessive total and differential movements may occur.

6.7 Landscaping and Trees

The effects of evapotranspiration from nearby trees can adversely affect the foundation soils by removing moisture during dry periods through their extensive root systems, resulting in shrinkage or subsidence of the subgrade in the tree-structure proximity. Therefore, Apex recommends the following:

- Trees around the structures be no closer than 50 percent (50%) of the mature height of the tree;
- Structure should not be positioned within the vertical projection of mature tree canopies or drip lines; and
- If trees and large bushes are placed within closer proximity of the structures, vertical root barriers to a depth of at least four (4) feet below ground should be installed to inhibit the movement of the tree’s roots systems under the floor slab and/or foundations.

6.8 Weather Considerations

The soils encountered in the surficial zone at this site are expected to be relatively sensitive to disturbances caused by construction traffic when wet. The contractor should be aware of the importance of proper maintenance of surface drainage. Depending on weather-related ground conditions, contractor’s maintenance of drainage during construction, and other factors, some difficulty may be encountered by the contractor in achieving compaction on initial lifts of fill placed on loose or soft subgrade. This will be exacerbated by wet weather, particularly if the contractor allows surface drainage to enter and pond in the excavations.

Fine-Grained Soil. Fine-grained soils (including silty sands [SM] and silty clayey sands [SM-SC]) are expected to be relatively sensitive to disturbances caused by construction traffic and to changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support characteristics. In addition, soil which becomes 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. Earthwork activities performed during cooler, wetter months may certainly offer more difficulties than if performed during warmer, drier periods.

Wet Conditions. If construction is performed during wet conditions, work platforms can be created for earthwork by mixing fly ash, hydrated lime, cement, cement kiln dust (CKD), or commercial combination of these additives. Quick lime may also be used in areas where dusting is of concern, if proper worker safety considerations are observed. Pumping subgrades are possible at the site and it is recommended that bid documents incorporate this possibility into the bid schedule.

Geosynthetics. The use of geotextiles and geogrids may be warranted in situations where the subgrade is very wet and highly unstable, if such use is necessary to maintain a mandatory construction schedule during wet weather. Use of these products should be considered in conjunction with evaluation by the geotechnical engineer and product engineering applications representative.

6.9 Groundwater Control

Due to potential variations in groundwater levels, difficulty during excavation and construction of the proposed foundation is possible. <u>Groundwater was encountered at this site, and it is reasonable to anticipate that groundwater conditions may vary as noted previously.</u> It is suggested that contract documents address the need for maintaining controls to preclude water from draining into excavations.

Some dewatering through shaping of work areas to shed water, and construction of temporary ditches with sumps and pumping may be necessary to remove the loose soils and allow placement of imported select fill in a dry manner. Excavated soils intended for re-use as select fill may require special methods in order to dry the soil to a suitable moisture content prior to re-placing the soil as select fill.

6.10 General Slope Stability

Analysis and evaluation of the stability of slopes is beyond the scope of this investigation. Such analyses typically involve more extensive field investigation and sampling, specialized testing, and advanced analysis using computational techniques in combination with experienced engineering judgment.

For general information, earth slopes higher than about six (6) feet can be of concern due to steepness, water accumulation in the slope, presence of seeps and springs, and surcharge loadings at or near the top of the slope. In general, earth slopes should be no steeper than 1 (vertical) on 3 (horizontal) and may require further flattening depending upon site conditions. Foundations near the top of slopes should be placed a minimum distance from the top of slope equivalent to the greater of five (5) feet or the height of the slope. Otherwise, properly designed and constructed retaining structures are advised. Apex will be pleased to conduct any required slope stability analysis under a supplemental agreement.

6.11 Protection of Work

Subgrade areas, base courses, and lifts of fill that have been successfully moisture conditioned, processed, and compacted in lifts to the required density, successfully proof rolled, and approved must be protected from changes in moisture and other influences.

Satisfactorily completed areas may be adversely affected by prolonged exposure to dry weather, precipitation, equipment traffic, or by excavations and uncontrolled backfilling for utilities, and other disturbances rendering such areas unsatisfactory. Such areas should be reworked prior to continuing with subsequent construction.

7.0 GENERAL COMMENTS

The exploration and analysis of the site conditions reported herein are considered preliminary in detail and scope and are not intended to form a basis for foundation design. The information submitted is based on the available soil information only and not on design details for the intended projects.

The findings, recommendations or professional advice contained herein have been made after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics, and engineering geology. No other warranties are implied or expressed.

The scope of services did not include any environmental assessment for 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, or unusual or suspicious items or conditions are strictly for the information of the client. Prior to purchase or development of this site, an environmental assessment is advisable.

The scope of services did not include a geologic investigation to address any faults, large scale subsidence, or other macro geologic features not specifically addressed in this report or the agreement between Apex and the client.

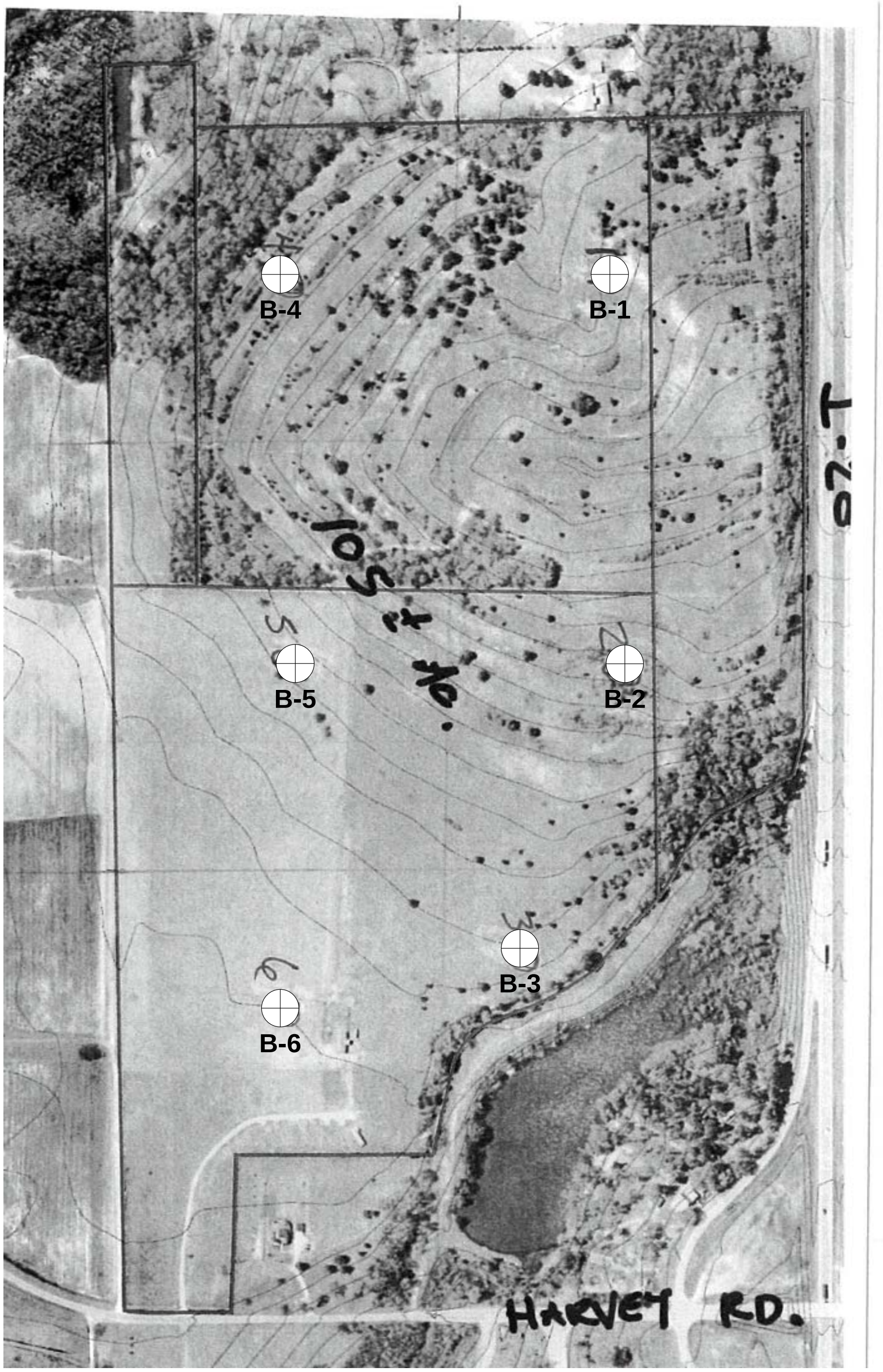
After plans are more complete, it is recommended that the soils and foundation engineer be retained to provided a subsurface investigation tailored to meet the specific needs of the project.

This report has been prepared for the exclusive use of our client for the general application for the referenced project. Apex cannot be responsible for interpretations, opinions, or recommendations made by others based on the data contained in this report.

This report was prepared for general purposes only and should not be considered sufficient for purposes of preparing accurate plans for construction. Contractors reviewing this report are advised that the discussions and recommendations contained herein were provided exclusively to and for use by the project owner.

APPENDIX

NORTH



This drawing is generalized in nature and is only intended to show boring locations relative to the general site plan.

PLAN OF BORINGS

Apex geoscience inc.

APEX PROJECT NO.: 107-260

DATE DRILLED: November 28, 2007

SCALE: Not to Scale

Adams Engineering, Inc.
105 Acre South Tract
Lindale, Texas

LOG OF BORING NO. 1

Apex geoscience inc.

Project Description: **Preliminary - South Industrial Trac**
Lindale, Texas

Surface El.:

Location: **Lat 32° 27' 59"**
Long. -95° 25' 36"

Depth, feet	Samples	Graphic Log	MATERIAL DESCRIPTION	Penetration Blows / Foot	Pocket Penetrometer, TSF	Unconfined Compression, TSF	% Passing No. 200 Sieve	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Other
	☒		Loose, brown and red, SILTY SAND (SM) 3.0	5			24		7	NP	NP	NP	
	☒		Medium dense, brown, red and gray, CLAYEY SAND (SC) 5.0	11			48		12				
5	☒		Medium dense, brown and red, CLAYEY SAND (SC) 8.0	14									
	☒		Medium dense, brown, red and gray, CLAYEY SAND (SC)	16			43		13	37	18	19	
10													
	☒		18.0	19									
15													
	☒		Medium dense, brown and red, CLAYEY SAND (SC) 20.0	21			22		12	24	13	11	
20			**Boring terminated at 20 ft.**										
25													

Completion Depth:	**20.0**
Date Boring Started:	**11/28/07**
Date Boring Completed:	**11/28/07**
Logger:	**R. Kyles**
Project No.:	**107-260**

Remarks: **No seepage noted during drilling. Dry upon completion.**

The stratification lines represent approximate strata boundaries.

LOG OF BORING NO. 2

Project Description: **Preliminary - South Industrial Trac**
Lindale, Texas

Apex geoscience inc.

Surface El.:
Location: **See Plan of Borings**

Depth, feet	Samples	Graphic Log	MATERIAL DESCRIPTION	Penetration Blows / Foot	Pocket Penetro-meter, TSF	Unconfined Compression, TSF	% Passing No. 200 Sieve	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Other
		▨	Very loose, brown and red, CLAYEY SAND (SC)										
	☒	▨		2			36		14	27	15	12	
	☒	▨		2									
5			5.0										
	☒	▨	Soft, brown and red, SANDY LEAN CLAY (CL)	3			51		13	30	16	14	
	☒	▨	-medium stiff below 8 ft.	5									
10		▨											
	☒	▨		6					11				
15		▨											
		▼	18.0										
	☒	▨	Medium dense, red, SILTY CLAYEY SAND (SC-SM)	16			14		16	NP	NP	NP	
20			20.0										
			Boring terminated at 20 ft.										
25													

Completion Depth: **20.0**
Date Boring Started: **11/28/07**
Date Boring Completed: **11/28/07**
Logger: **R. Kyles**
Project No.: **107-260**

Remarks: **Seepage noted at 18 ft. during drilling. Water level at 18 ft. upon completion, and at final check.**

The stratification lines represent approximate strata boundaries.

LOG OF BORING NO. 3

Project Description: **Preliminary - South Industrial Trac**
Lindale, Texas

Apex geoscience inc.

Surface El.:

Location: **See Plan of Borings**

Depth, feet	Samples	Graphic Log	MATERIAL DESCRIPTION	Penetration Blows / Foot	Pocket Penetrometer, TSF	Unconfined Compression, TSF	% Passing No. 200 Sieve	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Other
			Very loose, brown, SILTY SAND (SM)										
	☒			2					8				
	☒			2									
5	☒		-loose at 5 ft.	7			16		17	NP	NP	NP	
			8.0										
	☒		Loose, red and brown, WELL-GRADED SAND WITH SILT (SW-SM)	5									
10			▼										
			13.0										
	☒		Medium dense, red, brown and tan, WELL-GRADED SAND WITH SILT (SW-SM)	11			10		21	NP	NP	NP	
15													
			18.0										
			Loose, red and tan, SILTY SAND (SM)										
	☒			6			36		23				
20			20.0										
			Boring terminated at 20 ft.										
25													

Completion Depth: **20.0**
Date Boring Started: **11/28/07**
Date Boring Completed: **11/28/07**
Logger: **R. Kyles**
Project No.: **107-260**

Remarks: **Seepage noted at 10 ft. during drilling. Water level at 10 ft. upon completion. Water level at 8 ft. at final check.**

The stratification lines represent approximate strata boundaries.

LOG OF BORING NO. 4

Project Description: **Preliminary - South Industrial Trac**
Lindale, Texas

Apex geoscience inc.

Surface El.:
Location: **See Plan of Borings**

Depth, feet	MATERIAL DESCRIPTION		Penetration Blows / Foot	Pocket Penetrometer, TSF	Unconfined Compression, TSF	% Passing No. 200 Sieve	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Other
	Very loose, brown and tan, SILTY SAND (SM)		3			22		5	NP	NP	NP	
	-medium dense at 3 ft.		10									
5		5.0										
	Medium dense, red, brown and tan, CLAYEY SAND (SC)		23									
		8.0										
	Medium dense, gray, red, and brown, CLAYEY SAND (SC)		23			31		13	29	17	12	
10												
		13.0										
	Dense, gray, tan and brown, CLAYEY SAND (SC)		43									
15												
	▼	18.0										
	Very dense, red, SILTY CLAYEY SAND (SC-SM)		57			15		20	NP	NP	NP	
20		20.0										
	Boring terminated at 20 ft.											
25												

Completion Depth:	**20.0**
Date Boring Started:	**11/28/07**
Date Boring Completed:	**11/28/07**
Logger:	**R. Kyles**
Project No.:	**107-260**

Remarks: **Seepage noted at 18 ft. during drilling. Water level at 18 ft. upon completion, at final check. Caved to 19 ft.**

The stratification lines represent approximate strata boundaries.

LOG OF BORING NO. 5

Project Description: **Preliminary - South Industrial Trac**
Lindale, Texas

Apex geoscience inc.

Surface El.:
Location: **See Plan of Borings**

Depth, feet	Samples	Graphic Log	MATERIAL DESCRIPTION	Penetration Blows / Foot	Pocket Penetrometer, TSF	Unconfined Compression, TSF	% Passing No. 200 Sieve	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Other
			Very loose, brown and red, SILTY CLAYEY SAND (SC-SM), with root fibers										
				1									
				2			26		6	NP	NP	NP	
5				3									
			8.0										
			Very loose, brown and red, CLAYEY SAND (SC), with root fibers	3			23		9				
10													
			▼ 13.0										
			Medium dense, brown and red, SILTY CLAYEY SAND (SC-SM)	11			19		17	NP	NP	NP	
15													
				16									
20			20.0										
			Boring terminated at 20 ft.										
25													

Completion Depth:	**20.0**
Date Boring Started:	**11/28/07**
Date Boring Completed:	**11/28/07**
Logger:	**R. Kyles**
Project No.:	**107-260**

Remarks: **Seepage noted at 13 ft. during drilling. Water level at 13 ft. upon completion. Water level at 11 ft. and caved 14 ft. at final check.**

The stratification lines represent approximate strata boundaries.

LOG OF BORING NO. 6

Project Description: **Preliminary - South Industrial Trac**
Lindale, Texas

Apex geoscience inc.

Surface El.:
Location: **See Plan of Borings**

Depth, feet	Samples	Graphic Log	MATERIAL DESCRIPTION	Penetration Blows / Foot	Pocket Penetrometer, TSF	Unconfined Compression, TSF	% Passing No. 200 Sieve	Unit Dry Weight, lb/cu ft.	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Other
			Very loose, brown and red, SILTY SAND (SM)										
	☒			3			16		6	NP	NP	NP	
	☒			3									
5	☒			3			17		6				
	☒		-loose at 8 ft.	4									
10													
			▽ 13.0										
	☒		Loose, tan and red, WELL-GRADED SAND WITH SILT (SW-SM) ▼	6					18				
15													
	☒			8			6		21	NP	NP	NP	
			20.0										
20			**Boring terminated at 20 ft.**										
25													

Completion Depth:	**20.0**
Date Boring Started:	**11/28/07**
Date Boring Completed:	**11/28/07**
Logger:	**R. Kyles**
Project No.:	**107-260**

Remarks: **Seepage noted at 13 ft. during drilling. Water level at 14 ft. upon completion. Water level at 14 ft. and caved to 14 ft. at final check.**

LB 107-260.GPJ 01/09/08

The stratification lines represent approximate strata boundaries.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)	▨	GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
			▨	GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	▨	GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
			▨	GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)	▨	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			▨	SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	▨	SM	SILTY SANDS, SAND - SILT MIXTURES
			▨	SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	▨	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			▨	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			▨	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50	▨	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			▨	CH	INORGANIC CLAYS OF HIGH PLASTICITY
			▨	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			▨	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

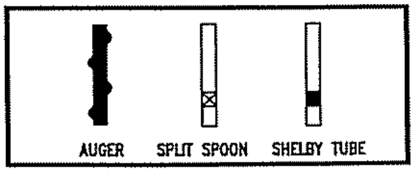
RELATIVE DENSITY - GRANULAR SOILS

CONSISTENCY	N-VALUE (BLOWS/FOOT)
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	SHEAR STRENGTH (TSF)
VERY SOFT	0 - 0.25
SOFT	0.25 - 0.50
MEDIUM STIFF	0.50 - 1.00
STIFF	1.00 - 2.00
VERY STIFF	2.00 - 4.00
HARD	4.00 +

SAMPLER TYPES



▽ SEEPAGE
▼ GROUND WATER LEVEL

TERMS AND SYMBOLS

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Symbols13.dwg