Earthtec Engineering, Inc.

133 North 1330 West
Orem, Utah - 84057
Phone (801) 225-5711
Fax (801) 225-3363

1596 W. 2650 S. #108
Ogden, Utah - 84401
Phone (801) 399-9516
Fax (801) 399-9842

GEOTECHNICAL STUDY
LOT 1813 EAGLEPOINTE ESTATES PHASE 18
NEAR THE INTERSECTION OF
PACE LANE AND SILVERTREE LANE
NORTH SALT LAKE, UTAH

Project No. 12-1586G

April 5, 2013

Prepared For:

Sky Properties
Attention: Mr. Brad Holgate
585 West 500 South, Suite 110
Bountiful, UT 84010

Prepared By:

EARTHTEC ENGINEERING, INC.
Ogden Office

Shawn A. Stuart, E.I.T.
Staff Geotechnical Engineer

LICENSED PROFESSIONAL ENGINEER
ANDREW MICHAEL HARRIS
No. 7420456
STATE OF UTAH
4/5/13

Andrew M. Harris, P.E.
Engineering Manager

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1.0 EXECUTIVE SUMMARY

This report presents the results of our geotechnical study for the proposed single-family residence to be constructed on Lot 1813 of the Eaglepointe Estates Phase 18, located near the intersection of Pace Lane and Silvertree Lane in North Salt Lake, Utah. We understand the proposed building, as currently planned, will consist of a one to two-story structure founded on spread footings with the possibility of a full basement.

For the field exploration, we excavated a total of four test pits and one test hole to a depth of approximately 4½ to 11 feet below the existing ground surface. Groundwater was encountered only in Test Hole 4 (TP-4), where groundwater was observed seeping into the test pit at approximately 4½ below the adjacent ground surface at the contact point between the fill material and the native clay soils. The subsurface soils encountered generally consisted of fill material and topsoil overlying layers of Silty Sand (SM), Lean Clays (CL), Silty Gravel with sand (GM), and Poorly Graded Gravel with silt and sand (GP-GM). The fill material and topsoil should be removed beneath the entire building footprint and beneath exterior flatwork. The native clay soils have a varying potential for moisture-related movement with some soils exhibiting a moderate potential for collapse under increased moisture and anticipated load conditions.

Based on the results of our field exploration, laboratory testing and engineering analyses, it is our opinion that the subject site is suitable for the proposed development, provided the recommendations presented herein are followed and implemented during design and construction. Conventional strip and spread footings may be used to support the structures. Due to the varying potential for moisture-related movement in the native soils, footings, foundations, and floor slabs should be constructed entirely on a minimum of 24 inches of properly placed and compacted structural fill extending to native soils.

The global stability of the existing slope at the property was analyzed as part of our study. Our analyses indicate that the existing slope as currently graded does not meet the required minimum factors of safety. The proposed home should be setback a minimum of 20 feet from the crest of the slope as discussed further in Section 9.0.

This executive summary provides a general synopsis of our recommendations. Details of our findings, conclusions and recommendations are provided within the body of this report. Failure to consult with Earthtec regarding any changes made during design and/or construction of the project from those discussed above in Section 3.0 relieves Earthtec Engineering, Inc. from any liability arising from changed conditions at the site. We also strongly recommend that Earthtec Engineering, Inc. observe the building excavations to verify the adequacy of our recommendations presented herein, and that Earthtec Engineering, Inc. perform materials testing and special inspections for this project to provide consistency during construction.

2.0 INTRODUCTION

This report presents the results of our geotechnical study for the proposed single-family residence to be constructed on Lot 1813 of the Eaglepointe Estates Phase 18, located near the intersection of Pace Lane and Silvertree Lane in North Salt Lake, Utah. The general location of the site is shown on Figure 1, *Vicinity Map*, at the end of this report.

The purposes of this study were to

- Evaluate the subsurface soil conditions at the site,
- Assess the engineering characteristics of the subsurface soils, and
- Provide geotechnical recommendations for general site grading and the design and construction of foundations, concrete floor slabs, and miscellaneous concrete flatwork.

The scope of work completed for this study included field reconnaissance, subsurface exploration, field and laboratory soil testing, geotechnical engineering analysis, and the preparation of this report.

3.0 PROPOSED CONSTRUCTION

We understand that a single-family residence will be constructed on Lot 1813 of the Eaglepointe Estates Phase 18 subdivision located near the intersection of Pace Lane and Silvertree Lane in North Salt Lake, Utah. The proposed home will be conventionally framed, one to two stories in height, and will likely be founded on spread footings with the possibility of a full basement. We have based our recommendations in this report on the assumption that foundation loads for the proposed home will not exceed 3,000 pounds per linear foot for bearing walls, 20,000 pounds for column loads, and 100 pounds per square foot for floor slabs. If structural loads will be greater our office should be notified so that we may review our recommendations and, if necessary, make modifications.

In addition to the construction described above, we anticipate that

- Utilities will be installed to service the proposed building,
- Exterior concrete flatwork will be placed in the form of curb, gutter, and sidewalks.

4.0 GENERAL SITE DESCRIPTION

Lot 1813 of the Eaglepointe Estates Phase 18 is located near the intersection of Pace Lane and Silvertree Lane in North Salt Lake, Utah. At the time of our subsurface investigation, the subject property consisted of an undeveloped lot that was vegetated with weeds, grasses, and oak brush. Previous grading and fill placement to accommodate site improvements was observed in the northeast corner of the subject property. The subject property is relatively flat within the proposed building pad near the southeast corner of the property. The subject property then gradually slopes downward to the north-northwest at approximately 10 to 50 percent grades with an approximate change in elevation of 190 feet across the property. The subject property is irregular in shape and is bounded on the north and east by undeveloped residential property, on the south by the Kern River Corridor pipeline, and on the west by residential development.

5.0 SUBSURFACE EXPLORATION

Under the direction of a qualified member of our geotechnical staff, subsurface explorations were conducted at the site on November 29, 2012 and on March 25, 2013, by excavating four exploratory test pits using a track-mounted excavator and hand-auguring one exploratory test hole to depths of about 4½ to 11 feet below the existing ground surface. The approximate locations of the test pits and test hole are shown on Figure 2, *Aerial Photograph Showing Location of Test Pits and Test Hole*. Graphical representations and detailed descriptions of the soils encountered are shown on Figures Nos. 3 through 6, *Test Pit Log,* and on Figure No. 7, *Test Hole Log*, at the end of this report. The stratification lines shown on the logs represent the approximate boundary between soil units; the actual transition may be gradual. Due to potential natural variations inherent in soil deposits, care should be taken in interpolating between and extrapolating beyond exploration points. A key to the symbols and terms on the logs is presented on Figure 8, *Legend*.

The subsurface soils exposed in the test pits and test hole were classified by visual examination using the guidelines of the Unified Soil Classification System (USCS). Disturbed bag samples and relatively undisturbed thin-walled "Shelby" tube and block samples were collected at various depths in each test pit and test hole. Samples were transported to our Ogden, Utah laboratory for further analysis. Samples will be retained in our laboratory for 30 days following the date of this report and then discarded unless a written request for additional holding time is received prior to the disposal date.

6.0 LABORATORY TESTING

Representative soil samples collected during our field exploration were tested in the laboratory to assess pertinent engineering properties and to aid in refining field classifications, if needed. Tests performed included natural moisture content and dry density tests, liquid and plastic limit determinations, full and mechanical (partial) gradation analyses, direct shear tests, and one-dimensional consolidation tests. The following table summarizes the laboratory test results, which are also included on the attached test pit and test hole logs at the respective sample depths, on Figure Nos. 9 through 10, *Consolidation-Swell Test,* on Figure No. 11, *Grain Size Distribution*, and on Figure Nos. 12 through 13, *Direct Shear Test*.

Table 1: Laboratory Test Results

Test Pit No.	Depth (ft.)	Natural Moisture (%)	Natural Dry Density (pcf)	Atterberg Limits		Grain Size Distribution (%)			*Soil Type
				Liquid Limit	Plasticity Index	Gravel (+ #4)	Sand	Silt/Clay (- #200)	
TP-1	1	7	---	22	*NP	7	78	15	SM
TP-1	4	11	79	37	15	0	6	94	CL
TP-2	7	9	76	23	3	0	45	55	CL
TP-4	8½	23	---	43	19	0	20	80	CL
TH-1	1	6	---	21	NP	64	22	14	GM
TH-1	4	4	---	16	NP	67	24	9	GP-GM

* NP = Non-Plastic
**Detailed descriptions of the soils encountered are presented on the test pit and test hole logs

As part of the consolidation test procedure, water was added to the samples of the native clay soils to assess moisture sensitivity when the samples were loaded to an equivalent pressure of approximately 1,000 psf. This part of the consolidation test indicated that the near surface Lean Clay (CL) soils observed to about 5 feet below existing grades exhibited a moderate potential (approximately 3 percent) for collapse (settlement) under increased moisture contents and anticipated load conditions. A consolidation test was also performed on the underlying Sandy Lean Clay (CL) soils observed below 5 feet, which indicated that the Sandy Lean Clay (CL) soils exhibited a negligible potential (less than 0.1 percent) for moisture-related movement under increased moisture contents and anticipated load conditions.

7.0 SUBSURFACE CONDITIONS

7.1 Soil Types

On the surface of the site, we encountered fill material and topsoil which we estimated to extend about 6 inches to 4½ feet in depth at the test pit and test hole locations. Below the fill material and topsoil we encountered layers of Silty Sand (SM), Lean Clay (CL), Lean Clay with sand (CL), Sandy Lean Clay (CL), Silty Gravel with sand (GM), and Poorly Graded Gravel with silt and sand (GP-GM) extending to the maximum depths explored of about 4½ to 11 feet below the existing ground surface. Based on our experience and observations during the field exploration, the clay soils visually appeared to be stiff in consistency while the sand and gravel soils appeared to be medium dense to dense in consistency. Consolidation test results indicate the clay soils are moderately compressible and have a negligible to moderate potential for moisture-related movement.

7.2 Groundwater Conditions

Groundwater was not encountered at the test pit locations at the time of our field investigation except in TP-4 where we observed groundwater seeping into the excavation at approximaley 4½ feet below the adjacent ground surface. In addition, we observed oxidation in the soils, a possible indicator of past water or seepage levels, at a depth of about 4 feet below the existing ground surface in Test Pit-1 and in Test Pit-2. Groundwater levels will fluctuate in response to the season, precipitation and snow melt, irrigation, and other on and off-site influences. Precisely quantifying these fluctuations would require long term monitoring. The contractor should be prepared to dewater excavations as needed.

8.0 SITE GRADING

8.1 General Site Grading

Unsuitable soils and vegetation should be removed from below foundation, floor slab, and exterior concrete flatwork areas. Unsuitable soils consist of topsoil, organic soils, undocumented fill, soft, loose, or disturbed native soils, and any other inapt materials. We encountered fill material and topsoil on the surface extending to approximately 6 inches to 4½ feet in depth at the test pit and test hole locations. The fill material we encountered at the site is considered undocumented (untested). The fill material and topsoil (including soil with roots larger than about ¼ inch in diameter) should be completely removed beneath all structures and pavement, even if found to extend deeper, along with any other unsuitable soils that may be encountered. Over-excavating below footings, foundations, and flatwork will also be required, as discussed in Sections 11.0 and 12.0.

Fill placed over large areas, even if only a few feet in depth, can cause consolidation in the underlying native soils resulting in settlement of the fill. If more than 5 feet of grading fill will be placed above the existing surface (to raise site grades), Earthtec should be notified so that we may assess potential settlement and make additional recommendations if needed. Such recommendations may include placing the fill several weeks prior to construction to allow settlement to occur.

8.2 Temporary Excavations

Temporary excavations that are less than 4 feet in depth and above groundwater should have side slopes no steeper than ½H:1V (Horizontal:Vertical). Temporary excavations where water is encountered in the upper 4 feet or that extend deeper than 4 feet below site grades should be sloped or braced in accordance with OSHA[1] requirements for Type C soils.

8.3 Fill Material Composition

The native clay soils, sand soils, and existing fill materials observed during our field investigation are not suitable for use as structural fill; however the native gravel soils observed during our field investigation appear to be suitable for use as structural fill. Some of the native gravels contain more oversized gravel then we generally recommend for structural fill thus making the material more difficult to compact and test. Excavated existing fill material, topsoil, sand soils, and clay soils may be stockpiled for use as fill in landscape areas. We recommend that a professional engineer or geologist verify that the structural fill to be used on this project meets our requirements, given below.

Structural fill is defined as fill material that will ultimately be subjected to any kind of structural loading, such as those imposed by footings, floor slabs, pavement, etc. We

[1] OSHA Health And Safety Standards, Final Rule, CFR 29, part 1926.

recommend that structural fill consist of native or imported sandy/gravelly soils meeting the following requirements:

Table 2: Structural Fill Recommendations

Sieve Size/Other	Percent Passing (by weight)
4 inches	100
3/4 inches	70 – 100
No. 4	40 – 80
No. 40	15 – 50
No. 200	0 – 20
Liquid Limit	35 maximum
Plasticity Index	15 maximum

In some situations, particles larger than 4 inches and/or more than 30 percent coarse gravel may be acceptable, but would likely make compaction more difficult and/or significantly reduce the possibility of successful compaction testing. Consequently, more strict quality control measures than normally used may be required, such as using thinner lifts and increased or full time observation of fill placement.

We recommend that utility trenches below any structural load be backfilled using structural fill. Note that most local governments and utility companies require Type A-1-a or A-1-b (AASHTO classification) soils (which overall is stricter than our recommendation for structural fill) be used as backfill above utilities in certain areas. In other areas or situations, utility trenches may be backfilled with the native soil, but the contractor should be aware that native clay soils (as observed in the explorations) may be time consuming to compact due to potential difficulties in controlling the moisture content needed to obtain optimum compaction. All backfill soil should have a maximum particle size of 4 inches, a maximum Liquid Limit of 35 and a maximum Plasticity Index of 15.

Where needed (submerged areas), we recommend that free draining granular material (clean sand and/or gravel) meet the following requirements:

Table 3: Free-Draining Fill Recommendations

Sieve Size/Other	Percent Passing (by weight)
3 inches	100
No. 10	0 – 25
No. 40	0 – 15
No. 200	0 – 5
Plasticity Index	Non-plastic

Three inch minus washed rock (sometimes called river rock or drain rock) and pea gravel materials usually meet these requirements and may be used as free draining fill. If free draining fill will be placed adjacent to soil containing a significant amount of sand or silt/clay, precautions should be taken to prevent the migration of fine soil into the free draining fill. Such precautions should include either placing a filter fabric, such as a Mirafi 140N or equivalent, between the free draining fill and the adjacent material, or using a well graded, clean filtering material approved by the geotechnical engineer.

8.4 Fill Placement and Compaction

The thickness of each lift should be appropriate for the compaction equipment that is used. We recommend a maximum lift thickness of 4 inches for hand operated equipment, 6 inches for most "trench compactors", and 8 inches for larger rollers, unless it can be demonstrated by in-place density tests that the required compaction can be obtained throughout a thicker lift. The full thickness of each lift of structural fill placed should be compacted to at least the following percentages of the maximum dry density, as determined by ASTM D-1557:

In landscape areas not supporting structural loads:	90%
Less than 5 feet of fill below foundations, flatwork and pavements:	95%
Five or more feet of fill below foundations, flatwork and pavements:	98%

Generally, placing and compacting fill at a moisture content within 2% of the optimum moisture content, as determined by ASTM D-1557, will facilitate compaction. Typically, the further the moisture content is from optimum the more difficult it will be to achieve the required compaction.

Fill should be tested frequently during placement and early testing is recommended to demonstrate that placement and compaction methods are achieving the required compaction. It is the contractor's responsibility to ensure that fill materials and compaction efforts are consistent so that tested areas are representative of the entire fill.

8.5 Stabilization Recommendations

Near surface layers of clay soils were encountered during our field exploration. These soils may rut and pump during grading and construction. The likelihood of rutting and/or pumping, and the depth of disturbance, is proportional to the moisture content in the soil, the load applied to the ground surface, and the frequency of the load. Consequently, rutting and pumping can be minimized by avoiding concentrated traffic, minimizing the load applied to the ground surface by using lighter equipment and/or partial loads, by working in dry times of the year, or by providing a working surface for equipment.

During grading the soil in any obvious soft spots should be removed and replaced with granular material. If rutting or pumping occurs traffic should be stopped in the area of concern. The soil in rutted areas should be removed and replaced with granular material. In areas where pumping occurs the soil should either be allowed to sit until pore pressures dissipate (several hours to several days) and the soil firms up, or be removed and replaced with granular material. Typically, we recommend removal to a minimum depth of 24 inches.

For granular material, we recommend using angular well-graded gravel, such as pit run, or crushed rock with a maximum particle size of four inches. We suggest that the initial lift be approximately 12 inches thick and be compacted with a static roller-type compactor. A finer granular material such as sand, gravelly sand, sandy gravel or road base may also be used. The more angular and coarse the material, the thinner the lift that will be required. We recommend that the fines content (percent passing the No. 200 sieve) be less than 15%, the liquid limit be less than 35, and the plasticity index be less than 15.

Using a geosynthetic fabric, such as Mirafi 600X or equivalent, may also reduce the amount of material required and avoid mixing of the granular material and the subgrade. If a fabric is used, following removal of disturbed soils and water, the fabric should be placed over the bottom and up the sides of the excavation a minimum of 24 inches. The fabric should be placed in accordance with the manufacturer's recommendations, including proper overlaps. The granular material should then be placed over the fabric in compacted lifts. Again, we suggest that the initial lift be approximately 12 inches thick and be compacted with a static roller-type compactor.

9.0 SLOPE STABILITY

We evaluated the overall stability of the existing slope at the subject property. The properties of the native soils at the site were estimated using direct shear testing on samples recovered during our field investigation. Our direct shear testing on the native soils encountered during our field investigation indicated the gravel soils have an internal friction angle of about 35 degrees and the native clays have a friction angle of 32 degrees and a cohesion of 205 psf. Accordingly, we used an internal friction angle of 32 degrees, an apparent cohesion of 205 psf and a moist unit weight of 107 pcf for the clays in our analyses. An internal friction angle of 35 degrees and a moist unit weight of 130 pcf was utilized for the gravels in our analyses

For the seismic (pseudostatic) analysis, a peak horizontal ground acceleration of 0.76g for the 2% probability of exceedance in 50 years was obtained for site (grid) locations of 40.826 degrees north latitude and -111.903 degrees west longitude. Typically, one-third to one-half this value is utilized in analysis. Accordingly, a value of 0.254 was used as the pseudostatic coefficient for the stability analysis.

We evaluated the global stability of the site using the computer program XSTABLE. This program uses a limit equilibrium (Bishop's modified) method for calculating factors of safety against sliding on an assumed failure surface and evaluates numerous potential failure surfaces, with the most critical failure surface identified as the one yielding the lowest factor of safety of those evaluated. The slope configurations analyzed were taken from the grading plan and topographical cross-section provided by Bingham Engineering for the subject property and consisted of a 10 foot tall slope inclined at 4H:1V (Horizontal to Vertical) followed by an approximately 74-foot high slope inclined at approximately 4H:1V followed by an approximately 18-foot wide bench followed by an approximately 70-foot high slope inclined at approximately 2H:1V followed by an approximately 28-foot high slope inclined at approximately 5H:1V followed by an approximately 10-foot high slope inclined at approximately 2H:1V followed by a relatively flat building pad. Typically, the required minimum factors of safety are 1.5 for static conditions and 1.0 for seismic (pseudostatic) conditions. The results of our analyses indicate that the slope configuration described above meets the minimum factor of safety requirement for the static condition but does not meet the required minimum factor of safety for the seismic (pseudostatic) condition. Given the height of the slope and surrounding development, regrading of the slope may not be feasible. As an alternative, the proposed home location should be planned to facilitate a minimum setback of 20 feet from the crest of the slope. The slope stability data are attached as Figures 14 through 16.

It should be clearly understood that slope movements or even failure can occur if the slope is undermined or the slope soils become saturated. The property owner and the owner's representatives should be made aware of the risks should these or other conditions occur that could saturate or erode/undermine the soils. Surface water should be directed away from the top and bottom of the slope, the slope should be vegetated with drought resistant plants, and sprinklers should not be placed on the face of the slope. Any modifications to the slope, including the construction of retaining walls, should be properly designed and engineered.

10.0 SEISMIC CONSIDERATIONS

10.1 Seismic Design

The residential structures should be designed in accordance with the International Residential Code (IRC). The IRC designates this area as a seismic design class E.

The site is located at approximately 40.826 degrees latitude and -111.903 degrees longitude from the approximate center of the site. The IRC site value for this property is 1.18g. The design spectral response acceleration parameters are given below in Table 4.

Table No. 4: Design Acceleration for Short Period

S_S	F_a	Site Value (S_{DS})
		2/3 S_S*F_a
1.77g	1.00	1.18g

S_S = Mapped spectral acceleration for short periods
F_a = Site coefficient from Table 1613.5.3(1)
$S_{DS} = \frac{2}{3}S_{MS} = \frac{2}{3}(F_a \cdot S_s)$ = 5% damped design spectral response acceleration for short periods

10.2 Faulting

Based upon published geologic maps[2], no active faults traverse through or immediately adjacent to the site and the site is not located within local fault study zones. The nearest mapped fault trace is the Wasatch Fault Zone, Salt Lake City Section, located about 0.58 miles (0.93 kilometers) west of the project site.

10.3 Liquefaction Potential

Liquefaction is a phenomenon where soils lose their intergranular strength due to an increase of pore pressures during a dynamic event such as an earthquake. The potential for liquefaction is based on several factors, including 1) the grain size distribution of the soil, 2) the plasticity of the fine fraction of the soil (material passing the No. 200 sieve), 3) relative density of the soil, 4) earthquake strength (magnitude) and duration, and 5) overburden pressures. In addition, the soils must be near saturation for liquefaction to occur. The site

[2] U.S. Geological Survey, Quaternary Fault and Fold Database of the United States, November 3, 2010

appears to be located within an area which has been mapped by the Utah Geological Survey[3] as having very low liquefaction potential.

Loose, saturated sands are most susceptible to liquefaction, but some loose, saturated gravels and relatively sensitive silt to low-plasticity silty clay soils can also liquefy during a seismic event. Subsurface soils were composed of predominately unsaturated, medium dense to dense sands and gravels and stiff clays. The soils encountered do not appear liquefiable, but the liquefaction susceptibility of underlying soils (deeper than our explorations) is not known and would require deeper explorations to quantify.

11.0 FOUNDATIONS

11.1 General

The foundation recommendations presented in this report are based on the soil conditions encountered during our field exploration, the results of laboratory testing of samples of the native soils, the site grading recommendations presented in this report, and the foundation loading conditions presented in Section 3.0, *Proposed Construction*, of this report. If loading conditions are significantly different, Earthtec should be notified so that we can re-evaluate our design parameters and estimates (higher loads may cause more settlement), and to provide additional recommendations if necessary.

Conventional strip and spread footings constructed on properly placed and compacted structural fill extending to native soils may be used to support the proposed residence after the appropriate removals as outlined in Section 8.1. Foundations should not be installed directly on native clay soils, on topsoil, undocumented fill, debris, combination soils, organic soils, frozen soil, or in ponded water. If foundation soils become disturbed during construction they should be removed or recompacted.

[3] Liquefaction Potential Map, Utah Geological Survey, Public Information Series 28. 1994.

11.2 Strip/Spread Footings

We recommend that conventional strip and spread foundations be constructed entirely on a minimum 24 inches of properly placed and compacted structural fill extending to undisturbed native soils. For foundation design we recommend the following:

- Footings founded on a minimum 24 inches of structural fill may be designed using a maximum allowable bearing capacity of 1,500 pounds per square foot. The values for vertical foundation pressure can be increased by one-third for wind and seismic conditions per Section 1806.1 when used with the Alternative Basic Load Combinations found in Section 1605.3.2 of the 2009 International Building Code.
- Continuous and spot footings should be uniformly loaded and should have a minimum width of 20 and 30 inches, respectively.
- Exterior footings should be placed below frost depth which is determined by local building codes. In general 30 inches of cover is adequate for most sites; however local code should be verified by the end design professional. Interior footings, not subject to frost (heated structures), should extend at least 18 inches below the lowest adjacent grade.
- Foundation walls and footings should be properly reinforced to resist all vertical and lateral loads and differential settlement.
- The bottom of footing excavations should be compacted to a minimum of 95% of the Modified Proctor value for the material. If soft areas are encountered, they should be stabilized as recommended in Section 8.5.
- Footing excavations should be observed by the geotechnical engineer prior to beginning footing construction to evaluate whether suitable bearing soils have been exposed and whether excavation bottoms are free of loose or disturbed soils.
- Structural fill used below foundations should extend laterally a minimum of 6 inches for every 12 vertical inches of structural fill placed. For example, if 18 inches of structural fill are required to bring the excavation to footing grade, the structural fill should extend laterally a minimum of 9 inches beyond the edge of the footings on both sides.

11.3 Estimated Settlements

If the proposed foundations are properly designed and constructed using the parameters provided above, we estimate that total settlements should not exceed one inch and differential settlements should be one-half of the total settlement over a 25-foot length of continuous foundation, for non-earthquake conditions. Additional settlement could occur during an earthquake due to ground shaking, if more than 3 feet of grading fill is placed above the existing ground surface, and/or if foundation soils are allowed to become wetted.

11.4 Lateral Earth Pressures

Below grade walls act as soil retaining structures and should be designed to resist pressures induced by the backfill soils. The lateral pressures imposed on a retaining structure are dependant on the rigidity of the structure and its ability to resist rotation. Most retaining walls that can rotate or move slightly will develop an active lateral earth pressure condition. Structures that are not allowed to rotate or move laterally, such as subgrade basement walls, will develop an at-rest lateral earth pressure condition. Lateral pressures applied to structures may be computed by multiplying the vertical depth of backfill material by the appropriate equivalent fluid density. Any surcharge loads in excess of the soil weight applied to the backfill should be multiplied by the appropriate lateral pressure coefficient and added to the soil pressure. For static conditions the resultant forces is applied at about one-third the wall height (measured from bottom of wall). For seismic conditions, the resultant forces are applied at about two-third times the height of the wall both measured from the bottom of the wall. The lateral pressures presented in the table below are based on drained, horizontally placed structural fill (as outlined in this report) soils as backfill material using a 32° friction angle and a dry unit weight of 120 pcf.

Table No. 5: Lateral Earth Pressures (Static and Dynamic)

Condition	Case	Lateral Pressure Coefficient	Equivalent Fluid Pressure (pcf)
Active	Static	0.31	37
	Seismic	0.65	78
At-Rest	Static	0.47	56
	Seismic	0.82	99
Passive	Static	3.25	391
	Seismic	3.83	459

*Seismic values combine the static and dynamic values

These pressure values do not include any surcharge, and are based on a relatively level ground surface at the top of the wall and drained conditions behind the wall. It is important that water is not allowed to build up (hydrostatic pressures) behind retaining structures. Retaining walls should incorporate drainage behind the walls as appropriate, and surface water should be directed away from the top and bottom of the walls.

Lateral loads are typically resisted by friction between the underlying soil and footing bottoms. Resistance to sliding may incorporate the friction acting along the base of foundations, which may be computed using a coefficient of friction of soils against concrete of 0.55 for structural fill meeting the recommendations presented herein. For allowable stress design, the lateral resistance may be computed using section 1806 of the 2009 International Building Code and all sections referenced therein. Retaining wall lateral resistance design should further reference Section 1807.2 for reference of Safety Factors. Retaining systems are assumed to be founded upon and backfilled with granular structural fill. Resistances can be calculated assuming Class 3 material in Table 1806.2, which is sandy gravel and/or gravel, provided clay or silt is not used immediately below the foundation, or as backfill material. If backfilling with clay or silt, it is required to contact Earthtec Engineering prior to construction for further review and recommendations. The values for lateral foundation pressure can be increased by one-third for wind and seismic conditions per

Section 1806.1 when used with the Alternative Basic Load Combinations found in Section 1605.3.2 of the 2009 International Building Code.

The pressure and coefficient values presented above are ultimate; therefore an appropriate factor of safety may need to be applied to these values for design purposes. The appropriate factor of safety will depend on the design condition and should be determined by the project structural engineer.

12.0 FLOOR SLABS AND FLATWORK

Concrete floor slabs and exterior flatwork may be supported on native soils after appropriate removals and grading as outlined in Section 8.1 are completed. We recommend placing a minimum 6 inches of free-draining fill material (see Section 8.3) beneath floor slabs to facilitate construction, act as a capillary break, and aid in distributing floor loads. For flatwork, we recommend placing a minimum 4 inches of roadbase material or free-draining fill. Prior to placing the free-draining fill or roadbase materials, the native subgrade should be proof-rolled to identify soft spots, which should be stabilized as discussed above in Section 8.5.

For slab design, we recommend using a modulus of subgrade reaction of 100 pounds per cubic inch. To help control normal shrinkage and stress cracking, we recommend that floor slabs have adequate reinforcement for the anticipated floor loads with the reinforcement continuous through interior floor joints, frequent crack control joints, and non-rigid attachment of the slabs to foundation and bearing walls. Special precautions should be taken during placement and curing of all concrete slabs and flatwork. Excessive slump (high water-cement ratios) of the concrete and/or improper finishing and curing procedures used during hot or cold weather conditions may lead to excessive shrinkage, cracking, spalling, or curling of slabs. We recommend all concrete placement and curing operations be performed in accordance with American Concrete Institute (ACI) codes and practices.

13.0 DRAINAGE

13.1 Surface Drainage

As part of good construction practice, precautions should be taken during and after construction to reduce the potential for water to collect near foundation walls. Accordingly, we recommend the following:

- Adequate compaction of foundation backfill should be provided i.e. a minimum of 90% of ASTM D-1557. **Water consolidation methods should not be used.**

- The ground surface should be graded to drain away from the building in all directions. We recommend a minimum fall of 8 inches in the first 10 feet.

- Roof runoff should be collected in rain gutters with downspouts designed to discharge well outside of the backfill limits, or at least 10 feet from foundations, whichever is greater.

- Sprinklers should be aimed away, and all sprinkler components (valves, lines, sprinkler heads) should be placed at least 5 feet from foundation walls. Sprinkler systems should be well maintained, checked for leaks frequently, and repaired promptly. Over-watering at any time should be avoided.

- The contractor should take precautions to prevent significant wetting of the soil at the base of the excavation during construction. Such precautions may include: grading to prevent runoff from entering the excavation, excavating during normally dry times of the year, covering the base of the excavation if significant rain or snow is forecast, backfill at the earliest possible date, frame floors and/or the roof at the earliest possible date, other precautions that might become evident during construction.

13.2 Subsurface Drainage

Section R405.1 of the 2009 International Residential Code states, "Drains shall be provided around all concrete and masonry foundations that retain earth and enclose habitable or usable spaces located below grade." An exception is allowed when the foundation is installed on well drained ground consisting of Group 1 soils, which include those defined by the Unified Soil Classification System as GW, GP, SW, SP, GM, and SM. A variety of soils were encountered during our field investigation. The majority of the native soils encountered in the explorations (CL) were not Group 1 soils. The recommendations presented below should be followed during design and construction of the foundation drains:

- A perforated 4-inch minimum diameter pipe should be enveloped in at least 12 inches of free-draining gravel and placed adjacent to the perimeter footings. The perforations should be oriented such that they are not located on the bottom side of the pipe, as much as possible. The free-draining gravel should consist of primarily ¾- to 2-inch size gravel having less than 5 percent passing the No. 4 sieve, and should be wrapped with a separation fabric such as Mirafi 140N or equivalent.

- The highest point of the perforated pipe bottom should be equal to the bottom elevation of the footings. The pipe should be uniformly graded to drain to an appropriate outlet (storm drain, land drain, other gravity outlet, etc.) or to one or more sumps where water can be removed by pumping.

- To facilitate drainage beneath basement floor slabs we recommend that the minimum thickness of free-draining fill beneath the slabs be increased to at least 10 inches (approximately equal to the bottom of footing elevations). A separation fabric such as Mirafi 140N or equivalent should be placed beneath the free-draining gravel. Connections should be made to allow any water beneath the slabs to reach the perimeter foundation drain (i.e. placing at least 10 inches of free-draining fill beneath footings).

- The drain system should be periodically inspected and clean-outs should be installed for the foundation drain to allow occasional cleaning/purging, as needed. Proper drain operation depends on proper construction and maintenance.

14.0 GENERAL CONDITIONS

The exploratory data presented in this report was collected to provide geotechnical design recommendations for this project. The test pits may not be indicative of subsurface conditions outside the study area or between points explored and thus have a limited value in depicting subsurface conditions for contractor bidding. Variations from the conditions portrayed in the test pits may occur and which may be sufficient to require modifications in the design. If during construction, conditions are different than presented in this report, please advise us so that the appropriate modifications can be made.

The findings and recommendations presented in this geotechnical report were prepared in accordance with generally accepted geotechnical engineering principles and practice in this area of Utah at this time. No other warranty or representation, either expressed or implied, is intended in our proposals, contracts or reports.

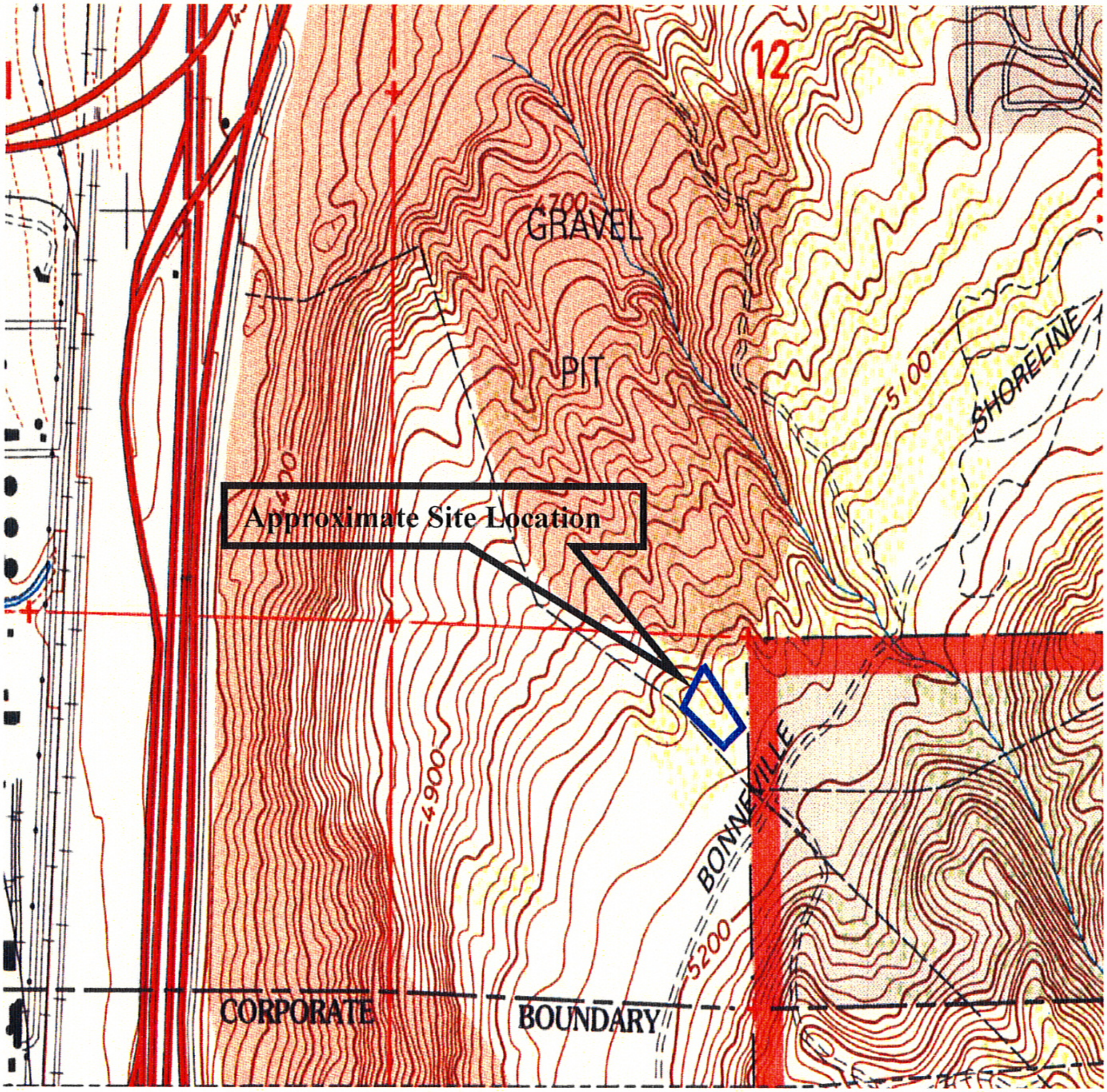
This geotechnical report is based on relatively limited subsurface explorations and laboratory testing. Subsurface conditions may differ in some locations of the site from those described herein, which may require additional analyses and possibly modified recommendations. Thus we strongly recommend consulting with Earthtec Engineering, Inc. regarding any changes made during design and construction of the project from those discussed above in Section 3.0. Failure to consult with Earthtec regarding any such changes relieves Earthtec from any liability arising from changed conditions at the site.

For consistency, Earthtec Engineering Inc. should also perform materials testing and special inspections for this project. The recommendations presented herein are based on the assumption that an adequate program of tests and observations will be followed during construction to verify compliance with our recommendations. We also assume that we will review the project plans and specifications to verify that our conclusions and recommendations are incorporated and remain appropriate (based on the actual design). Earthtec Engineering, Inc. should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Earthtec Engineering, Inc. also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please contact Earthtec at your convenience.

VICINITY MAP

LOT 1813 EAGLEPOINTE ESTATES PHASE 18, NORTH SALT LAKE, UT

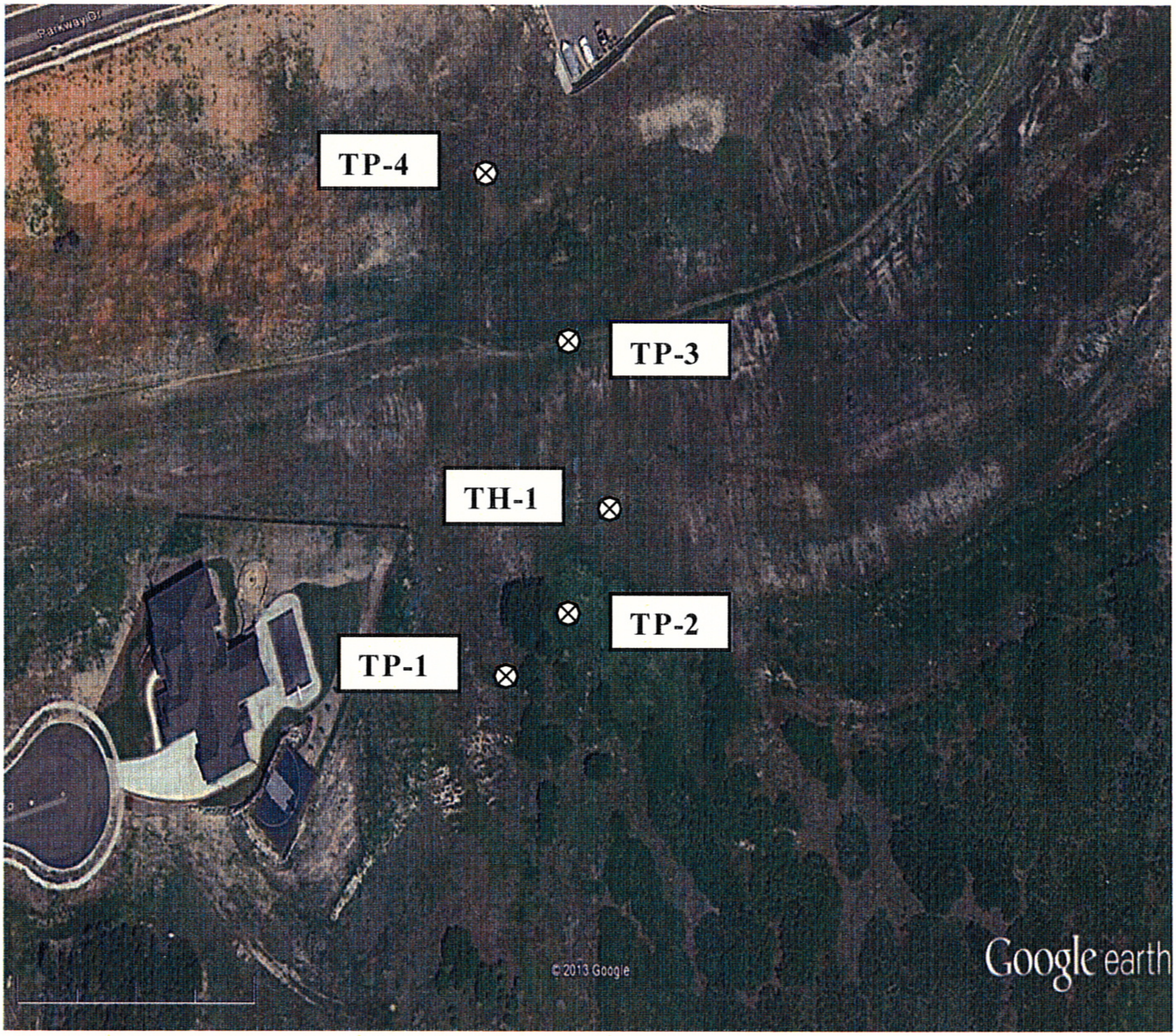


(cida.usgs.gov)

Not to Scale

PROJECT NO.: 12-1586G	Earthtec Engineering Inc.	FIGURE NO.: 1

AERIAL PHOTOGRAPH SHOWING LOCATION OF TEST PITS AND TEST HOLE
LOT 1813 EAGLEPOINTE ESTATES PHASE 18, NORTH SALT LAKE, UT



⊗ **Approximate Location of Test Pits and Test Hole**
(Aerial photograph provided by Google earth)

N
Not to Scale

PROJECT NO.: 12-1586G	Earthtec Engineering Inc.	**FIGURE NO.:** 2

TEST PIT LOG
NO.: TP-1

PROJECT: Lot 1813 Eaglepointe Estates Phase 18
PROJECT NO.: 12-1586G
CLIENT: Sky Properties
DATE: 11/29/12 - 11/29/12
LOCATION: See Figure 2
ELEVATION: Not Measured
OPERATOR: Client
LOGGED BY: SAS
EQUIPMENT: Excavator
DEPTH TO WATER; INITIAL ▽ :
AT COMPLETION ▼ :

Depth (Ft.)	Graphic Log	USCS	Description	Samples	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0		TOPSOIL	Topsoil, slightly moist, black, organic rich, sandy									
1–2		SM	Silty Sand, medium dense (estimated), slightly moist, dark brown to brown, moderate thin organics	X	7		22	NP	7	78	15	
2–5		CL	Lean Clay, stiff (estimated), dry, brown, moderate salt staining, minor iron oxide staining at 4 feet, minor root material (1/4 inches and smaller)	‖	11	79	37	15	0	6	94	C
5–11		CL	Sandy Lean Clay, stiff (estimated), slightly moist, light brown, moderate iron oxide staining	‖								
11–12			MAXIMUM DEPTH EXPLORED APPROXIMATELY 11 FEET									

Notes: No groundwater encountered.

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

LOG OF TESTPIT 12-1586G-PITS.GPJ EARTHTEC.GDT 4/5/13

TEST PIT LOG

NO.: TP-2

PROJECT: Lot 1813 Eaglepointe Estates Phase 18
CLIENT: Sky Properties
LOCATION: See Figure 2
OPERATOR: Client
EQUIPMENT: Excavator
DEPTH TO WATER; INITIAL ▽ :

PROJECT NO.: 12-1586G
DATE: 11/29/12 - 11/29/12
ELEVATION: Not Measured
LOGGED BY: SAS
AT COMPLETION ▼ :

Depth (Ft.)	Graphic Log	USCS	Description	Samples	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0–1		FILL	Fill: consisting of clay, slightly moist, brown									
1–4		CL	Lean Clay, stiff (estimated), slightly moist, brown	■ (at ~3.5–4)								
4–10.5		CL	Sandy Lean Clay, stiff (estimated), dry to slightly moist, light brown, minor iron oxide staining, minor to moderate root material (1/8 inches and smaller)	■ (at ~7–7.5)	9	76	23	3	0	45	55	C
10			boulders at 10 feet (approximately 12 inches in diameter or larger), red									
10.5			MAXIMUM DEPTH EXPLOREDAPPROXIMATELY 10.5 FEET									

Notes: No groundwater encountered.

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 12-1586G

Earthtec Engineering Inc.

FIGURE NO.: 4

LOG OF TESTPIT 12-1586G-PITS.GPJ EARTHTEC.GDT 4/5/13

TEST PIT LOG
NO.: TP-3

PROJECT: Lot 1813 Eaglepointe Estates Phase 18
CLIENT: Sky Properties
LOCATION: See Figure 2
OPERATOR: Client
EQUIPMENT: Mini-excavator
DEPTH TO WATER; INITIAL ▽ :

PROJECT NO.: 12-1586G
DATE: 03/25/13 - 03/25/13
ELEVATION: Not Measured
LOGGED BY: SAS
AT COMPLETION ▼ :

Depth (Ft.)	Graphic Log	USCS	Description	Samples	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0–1		TOPSOIL	Topsoil, moist, black, organic rich									
1–2		GP-GM	Poorly Graded Gravel with silt and sand, medium dense (estimated), slightly moist, light brown									
2–6.5		CL	Lean Clay, medium stiff (estimated), moist, olive gray	■ (≈5–5.5)								
6.5–9		GP-GM	Poorly Graded Gravel with silt and sand, medium dense (estimated), moist, light brown	☒ (≈8–8.5)								
9			MAXIMUM DEPTH EXPLORED APPROXIMATELY 9 FEET									

Notes: No groundwater encountered.

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

TEST PIT LOG
NO.: TP-4

PROJECT: Lot 1813 Eaglepointe Estates Phase 18
CLIENT: Sky Properties
LOCATION: See Figure 2
OPERATOR: Client
EQUIPMENT: Mini-excavator
DEPTH TO WATER; INITIAL ▽ :

PROJECT NO.: 12-1586G
DATE: 03/25/13 - 03/25/13
ELEVATION: Not Measured
LOGGED BY: SAS
AT COMPLETION ▼ :

Depth (Ft.)	Graphic Log	USCS	Description	Samples	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0–4.5		FILL	Fill: consisting of clay, moist, red-gray, organic rich to 1 foot									
4.5–9		CL	Lean Clay with sand, stiff (estimated), slightly moist, red-brown									
9				■	23		43	19	0	20	80	DS
9			MAXIMUM DEPTH EXPLORED APPROXIMATELY 9 FEET									

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

Notes: Groundwater encountered at 4.5 feet below existing site grades during our initial site investigation.

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 12-1586G

Earthtec Engineering Inc.

FIGURE NO.: 6

TEST HOLE LOG

NO.: TH-1

PROJECT: Lot 1813 Eaglepointe Estates Phase 18
PROJECT NO.: 12-1586G
CLIENT: Sky Properties
DATE: 11/26/12 - 11/26/12
LOCATION: See Figure 2
ELEVATION: Not Measured
OPERATOR: Earthtec Engineering, Inc.
LOGGED BY: SAS
EQUIPMENT: Hand Auger
DEPTH TO WATER; INITIAL ∇ :
AT COMPLETION ▼ :

Depth (Ft.)	Graphic Log	USCS	Description	Samples	Blows per foot	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0		TOPSOIL	Topsoil, slightly moist, brown, organic rich, gravelly, sandy										
		GM	Silty Gravel with sand, dense (estimated), slightly moist, red, moderate to minor thin root material	X		6		21	NP	64	22	14	
3		GP-GM	Poorly Graded Gravel with silt and sand, dense (estimated), slightly moist, red	X									
				X		4		16	NP	67	24	9	
6			MAXIMUM DEPTH EXPLORED APPROXIMATELY 4.5 FEET										

Notes: No groundwater encountered. Equipment refusal at 4.5 feet below existing site grades.

Tests Key

CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 12-1586G

Earthtec Engineering, Inc.

FIGURE NO.: 7

LEGEND

PROJECT: Lot 1813 Eaglepointe Estates Phase 18 **DATE:** 11/29/12 - 11/29/12
CLIENT: Sky Properties **LOGGED BY:** SAS

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR SOIL DIVISIONS			USCS SYMBOL	TYPICAL SOIL DESCRIPTIONS
COARSE GRAINED SOILS (More than 50% retaining on No. 200 Sieve)	GRAVELS (More than 50% of coarse fraction retained on No. 4 Sieve)	CLEAN GRAVELS (Less than 5% fines)	GW	Well Graded Gravel, May Contain Sand, Very Little Fines
			GP	Poorly Graded Gravel, May Contain Sand, Very Little Fines
		GRAVELS WITH FINES (More than 12% fines)	GM	Silty Gravel, May Contain Sand
			GC	Clayey Gravel, May Contain Sand
	SANDS (50% or more of coarse fraction passes No. 4 Sieve)	CLEAN SANDS (Less than 5% fines)	SW	Well Graded Sand, May Contain Gravel, Very Little Fines
			SP	Poorly Graded Sand, May Contain Gravel, Very Little Fines
		SANDS WITH FINES (More than 12% fines)	SM	Silty Sand, May Contain Gravel
			SC	Clayey Sand, May Contain Gravel
FINE GRAINED SOILS (More than 50% passing No. 200 Sieve)	SILTS AND CLAYS (Liquid Limit less than 50)		CL	Lean Clay, Inorganic, May Contain Gravel and/or Sand
			ML	Silt, Inorganic, May Contain Gravel and/or Sand
			OL	Organic Silt or Clay, May Contain Gravel and/or Sand
	SILTS AND CLAYS (Liquid Limit Greater than 50)		CH	Fat Clay, Inorganic, May Contain Gravel and/or Sand
			MH	Elastic Silt, Inorganic, May Contain Gravel and/or Sand
			OH	Organic Clay or Silt, May Contain Gravel and/or Sand
HIGHLY ORGANIC SOILS			PT	Peat, Primarily Organic Matter

SAMPLER DESCRIPTIONS

- SPLIT SPOON SAMPLER (1 3/8 inch inside diameter)
- MODIFIED CALIFORNIA SAMPLER (2 inch outside diameter)
- SHELBY TUBE (3 inch outside diameter)
- BLOCK SAMPLE
- BAG/BULK SAMPLE

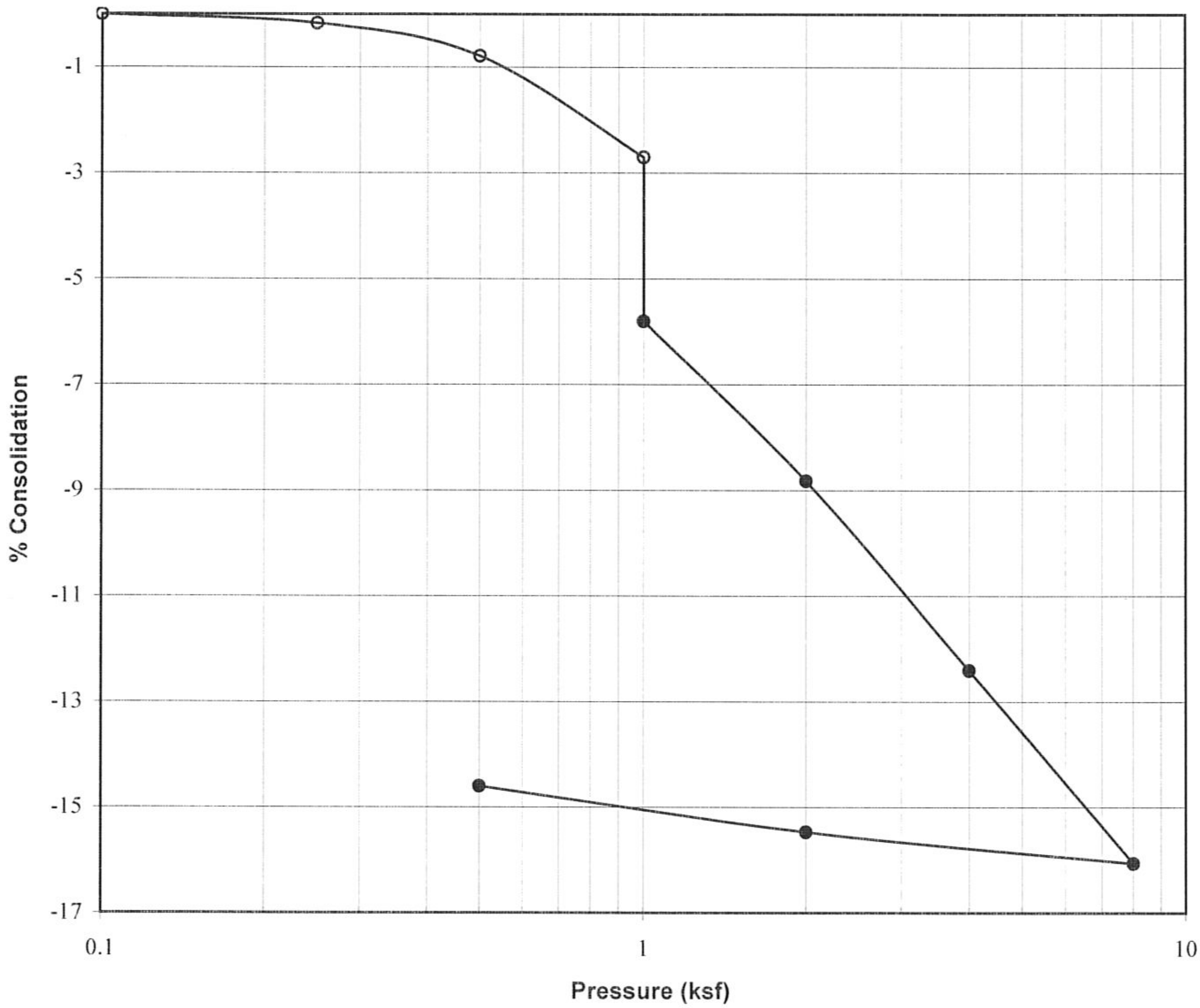
WATER SYMBOLS

- ∇ Water level encountered during field exploration
- ▼ Water level encountered at completion of field exploration

NOTES:
1. The logs are subject to the limitations, conclusions, and recommendations in this report.
2. Results of tests conducted on samples recovered are reported on the logs and any applicable graphs.
3. Strata lines on the logs represent approximate boundaries only. Actual transitions may be gradual.
4. In general, USCS symbols shown on the logs are based on visual methods only: actual designations (based on laboratory tests) may vary.

PROJECT NO.: 12-1586G Earthtec Engineering Inc. **FIGURE NO.:** 8

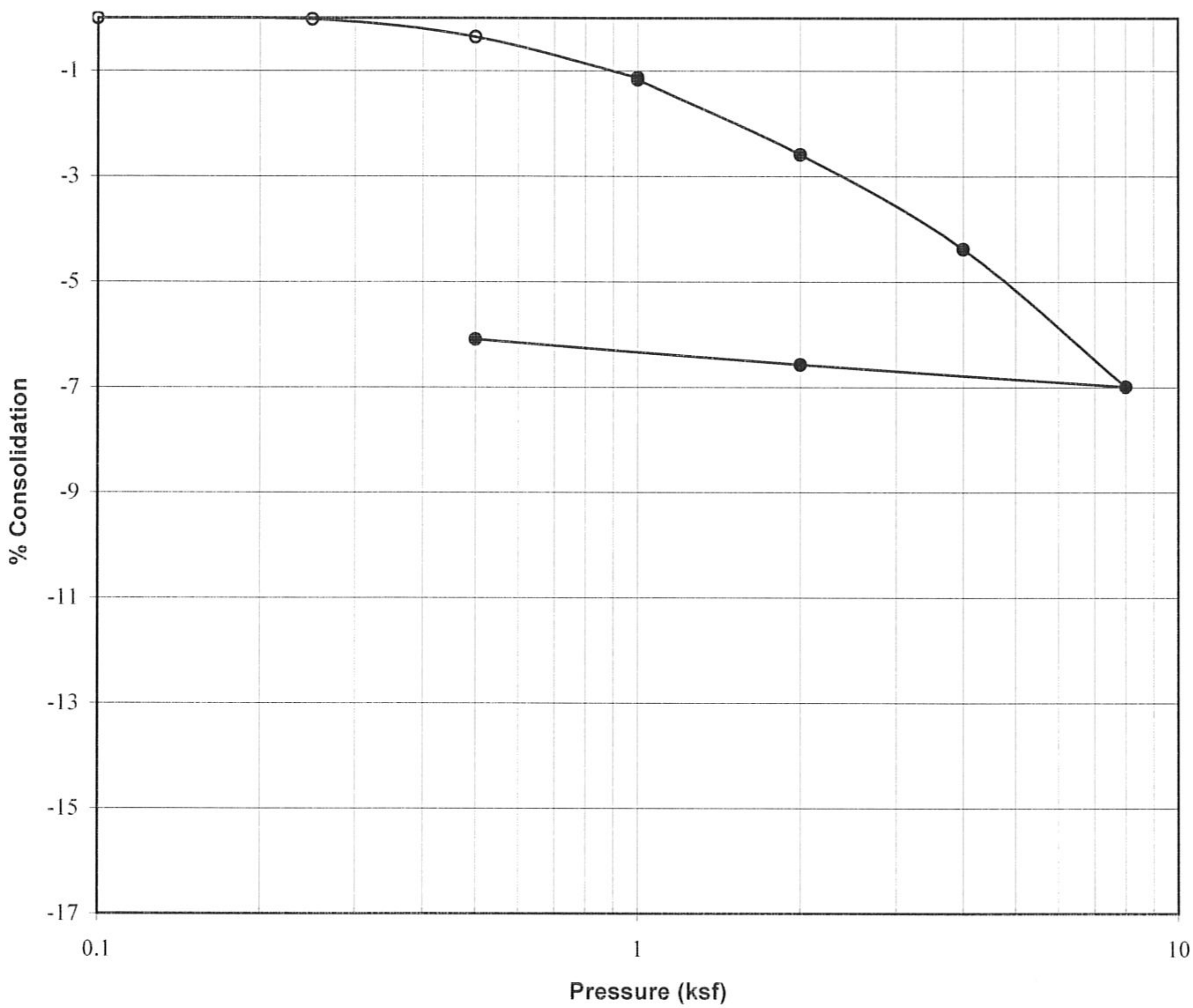
CONSOLIDATION - SWELL TEST



Project:	Lot 1813 Eaglepoint Estates Phase 18
Location:	TP-1
Sample Depth, ft:	4
Description:	Shelby Tube
Soil Type:	Lean Clay (CL)
Natural Moisture, %:	7
Dry Density, pcf:	79
Liquid Limit:	37
Plasticity Index:	15
Water Added at:	1 ksf
Percent Collapse:	3.1

PROJECT NO.: 12-1586G	Earthtec Engineering Inc.	**FIGURE NO.:** 9

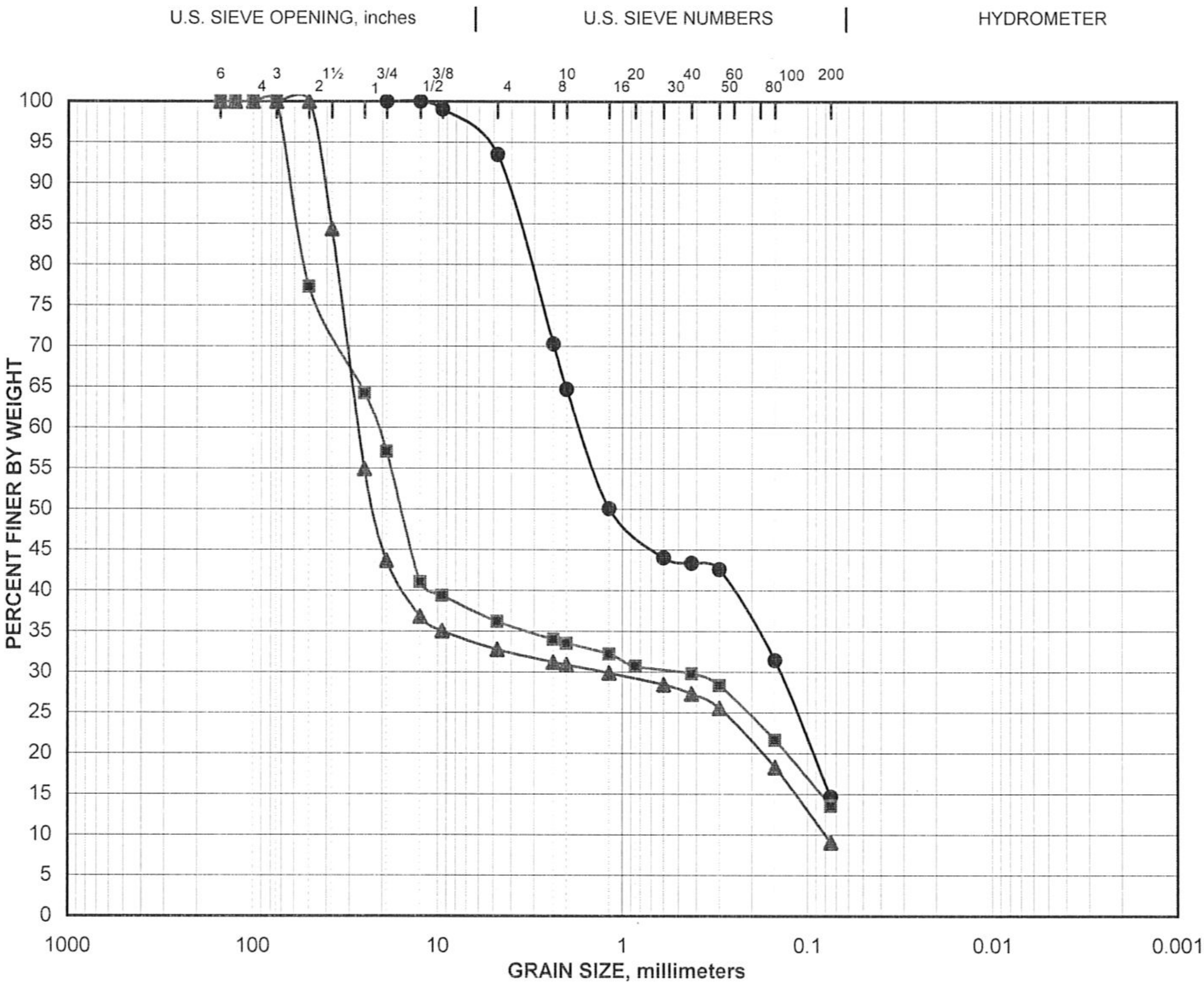
CONSOLIDATION - SWELL TEST



Project:	Lot 1813 Eaglepoint Estates Phase 18
Location:	TP-2
Sample Depth, ft:	7
Description:	Block
Soil Type:	Sandy Lean Clay (CL)
Natural Moisture, %:	9
Dry Density, pcf:	76
Liquid Limit:	23
Plasticity Index:	3
Water Added at:	1 ksf
Percent Collapse:	0.0

PROJECT NO.: 12-1586G	Earthtec Engineering Inc.	**FIGURE NO.:** 10

GRAIN SIZE DISTRIBUTION



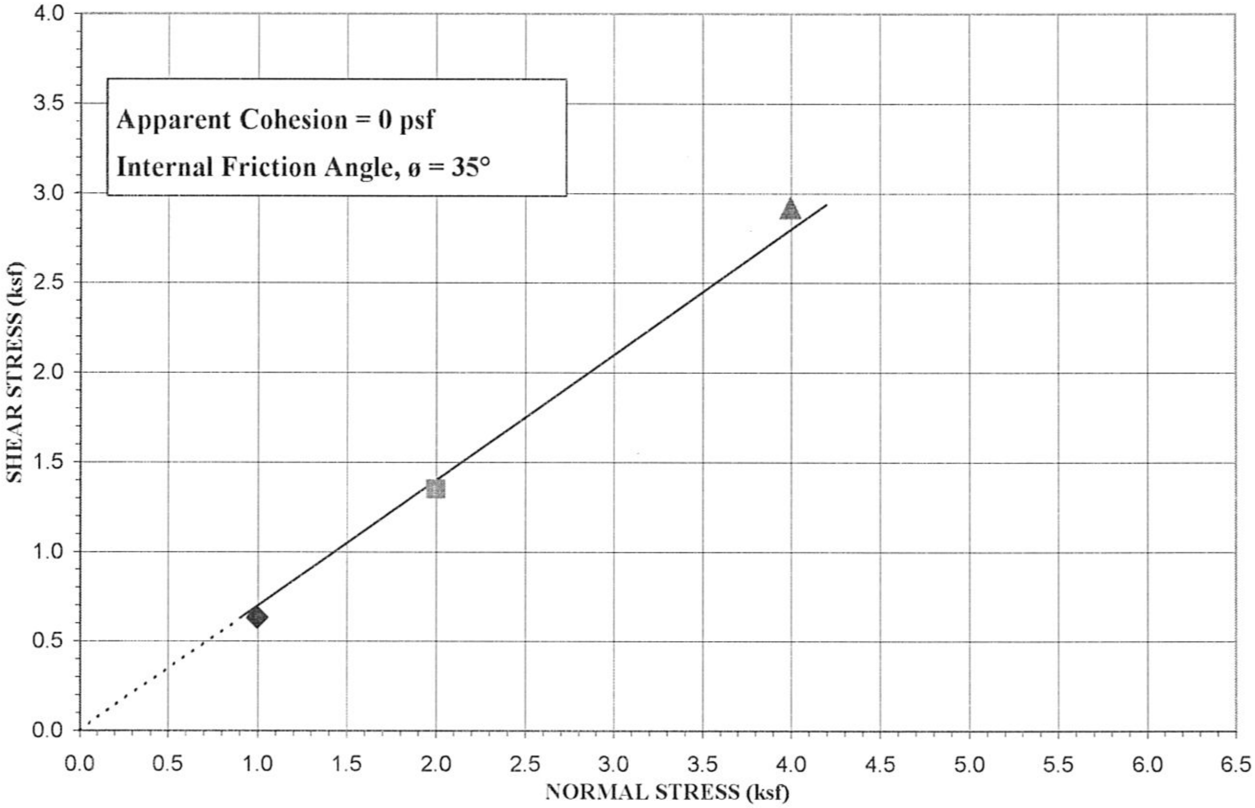
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

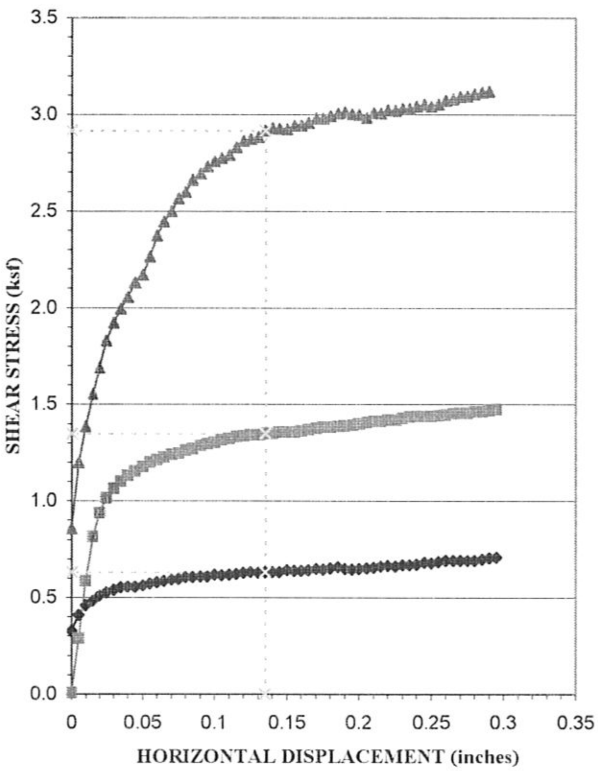
Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● TP-1 @ 1'	Silty SAND (SM)	7	22	NP	NP	0.2	27
■ TH-1 @ 1'	Silty GRAVEL with sand (GM)	6	21	NP	NP	0.2	385
▲ TH-1 @ 4'	Poorly Graded GRAVEL with silt and sand (GP-GM)	4	16	NP	NP	0.7	334
◆							
X							

Specimen Identification	D100	D85	D60	D30	D15	D10	%Gravel	%Sand	%Silt	%Clay
● TP-1 @ 1'	19.0	3.68	1.69	0.138	0.054		7	78	15	
■ TH-1 @ 1'	150	57.4	21.3	0.495	0.075		64	22	14	
▲ TH-1 @ 4'	150	38.0	26.8	1.26	0.110	0.068	67	24	9	
◆										
X										

PROJECT NO.: 12-1586G	Earthtec Engineering Inc.	FIGURE NO.: 11

DIRECT SHEAR TEST





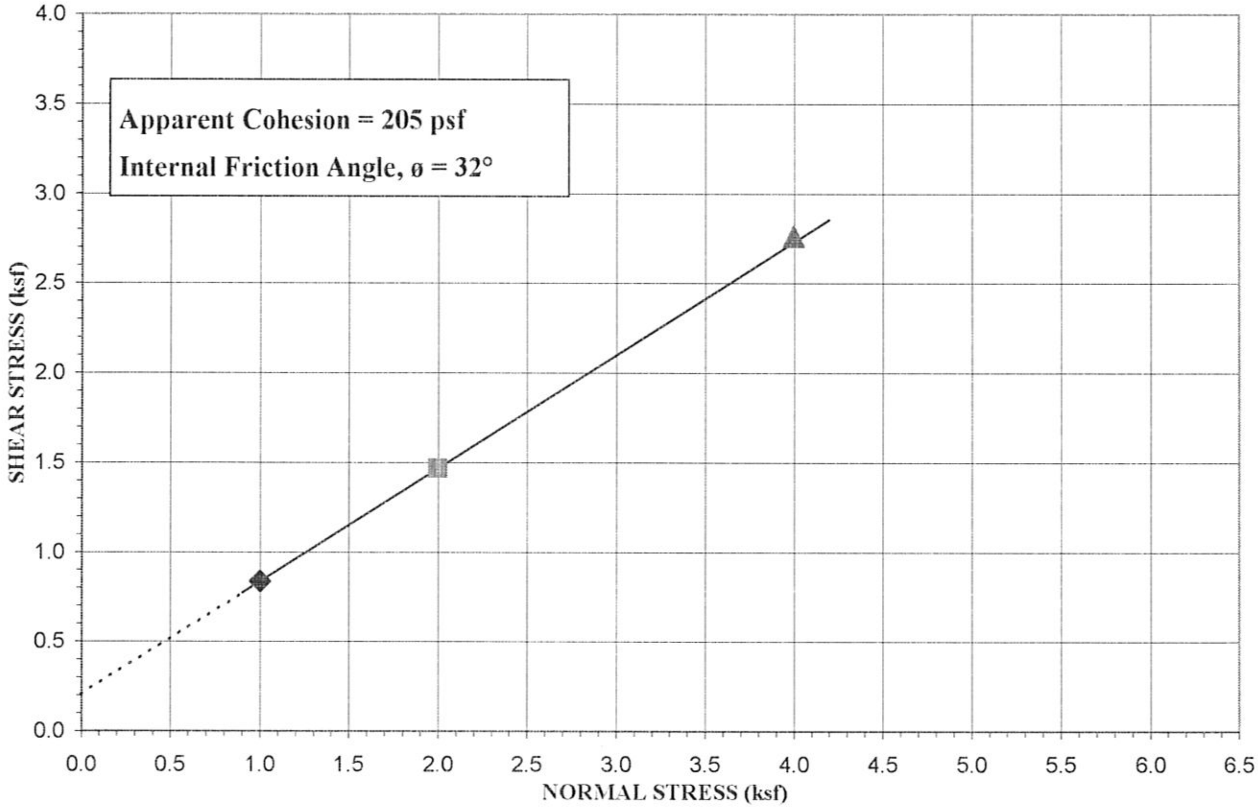
Source: 1	Depth: 4.0 ft		
Type of Test:	Consolidated Drained/Saturated		
Test No. (Symbol)	1 (◆)	2 (■)	3 (▲)
Sample Type	Remolded		
Initial Height, in.	1	1	1
Diameter, in.	2.4	2.4	2.4
Dry Density Before, pcf	120.2	119.5	120.0
Dry Density After, pcf	121.3	122.3	123.0
Moisture % Before	4.3	4.3	4.3
Moisture % After	21.6	20.7	20.1
Normal Load, ksf	1.0	2.0	4.0
Shear Stress, ksf	0.63	1.35	2.92
Strain Rate	.00009316 IN/SEC		

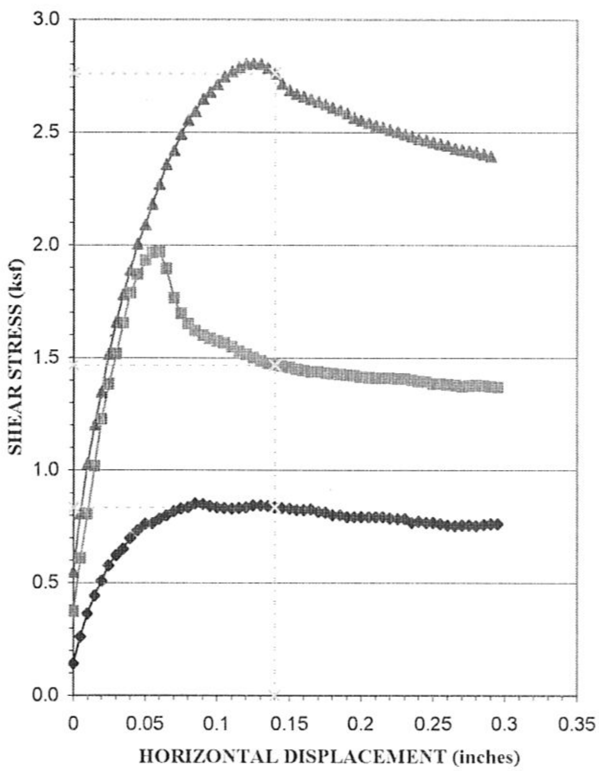
Sample Properties	
Cohesion, psf	0
Friction Angle, ϕ	35
Liquid Limit, %	16
Plasticity Index, %	NP
Percent Gravel	67
Percent Sand	24
Percent Passing No. 200 sieve	9
Classification	Poorly Graded Gravel with silt and sand (GP-GM)

PROJECT: Lot 1813 Eaglepoint Estates Phase 18

PROJECT NO.: 12-1586G	Earthtec Engineering, Inc.	FIGURE NO.: 12

DIRECT SHEAR TEST





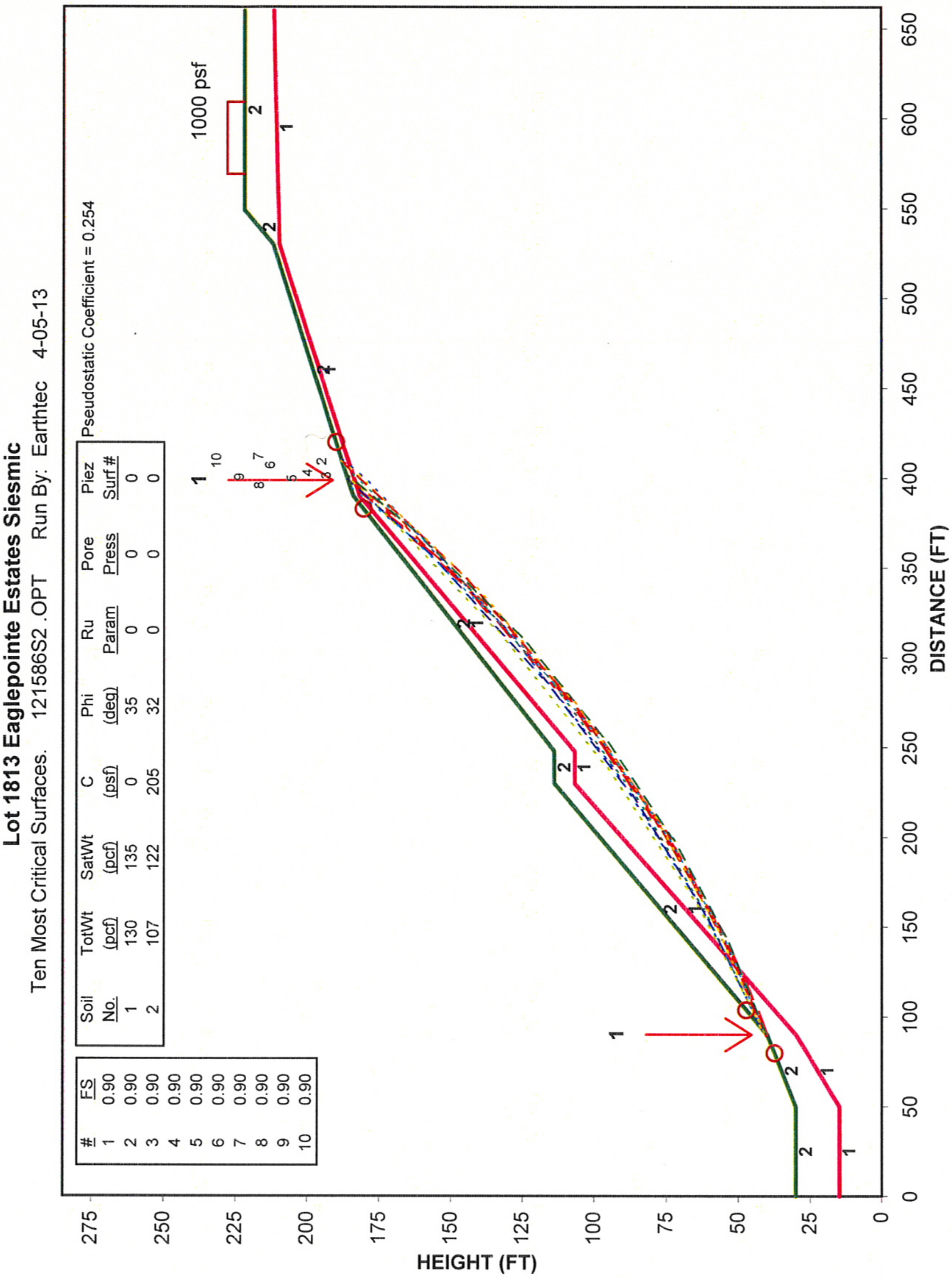
Source: 4	Depth: 8.5 ft		
Type of Test:	Consolidated Drained/Saturated		
Test No. (Symbol)	1 (◆)	2 (■)	3 (▲)
Sample Type	Undisturbed		
Initial Height, in.	1	1	1
Diameter, in.	2.4	2.4	2.4
Dry Density Before, pcf	97.8	98.7	98.5
Dry Density After, pcf	102.5	102.8	103.2
Moisture % Before	23.3	23.3	23.3
Moisture % After	25.6	28.3	25.7
Normal Load, ksf	1.0	2.0	4.0
Shear Stress, ksf	0.84	1.47	2.76
Strain Rate	.00005403 IN/SEC		

Sample Properties	
Cohesion, psf	205
Friction Angle, ϕ	32
Liquid Limit, %	43
Plasticity Index, %	19
Percent Gravel	0
Percent Sand	20
Percent Passing No. 200 sieve	80
Classification	Lean CLAY (CL) with sand

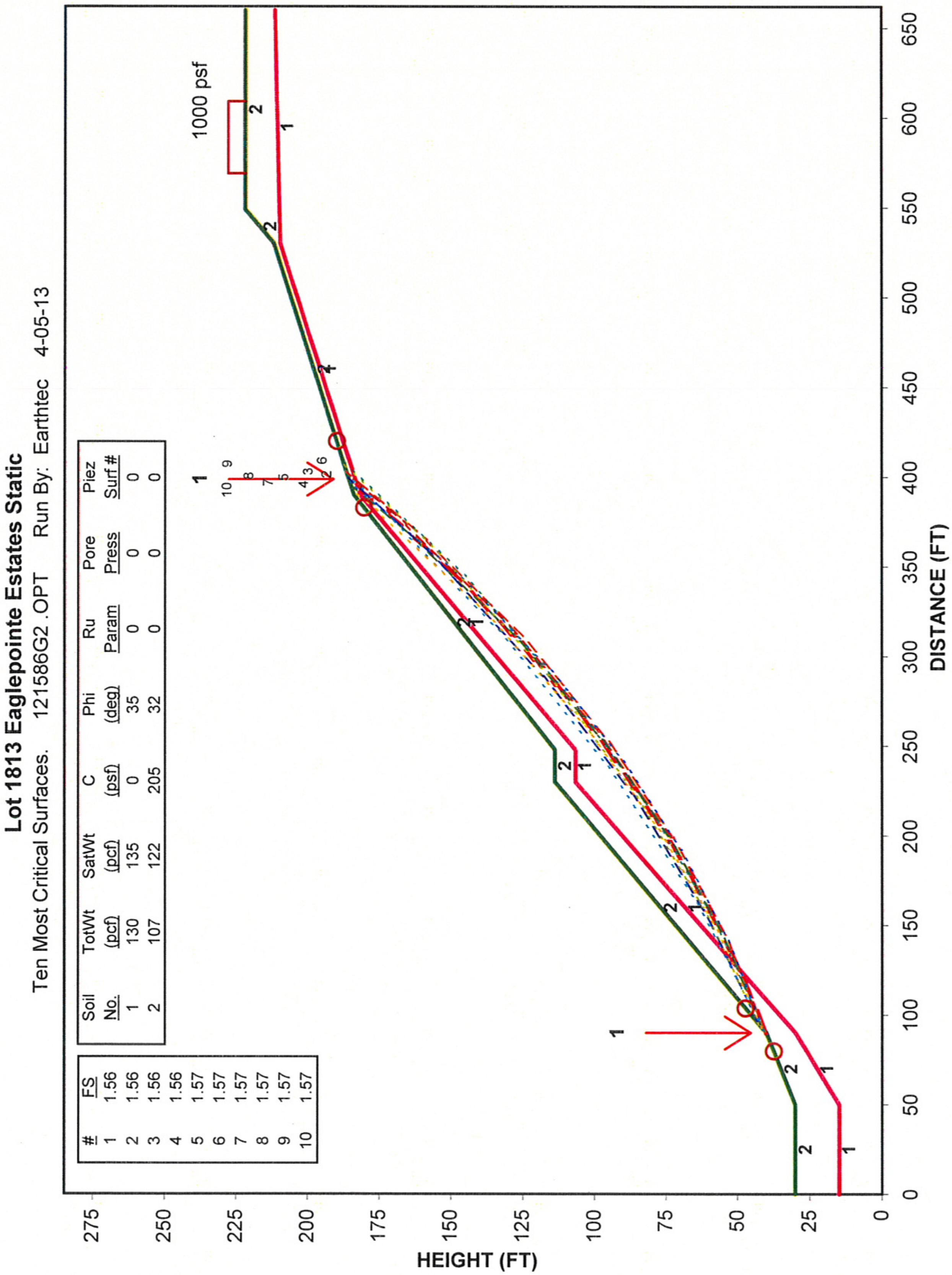
PROJECT: Lot 1813 Eaglepoint Estates Phase 18

PROJECT NO.: 12-1586G	Earthtec Engineering Inc.	FIGURE NO.: 13

STABILITY RESULTS

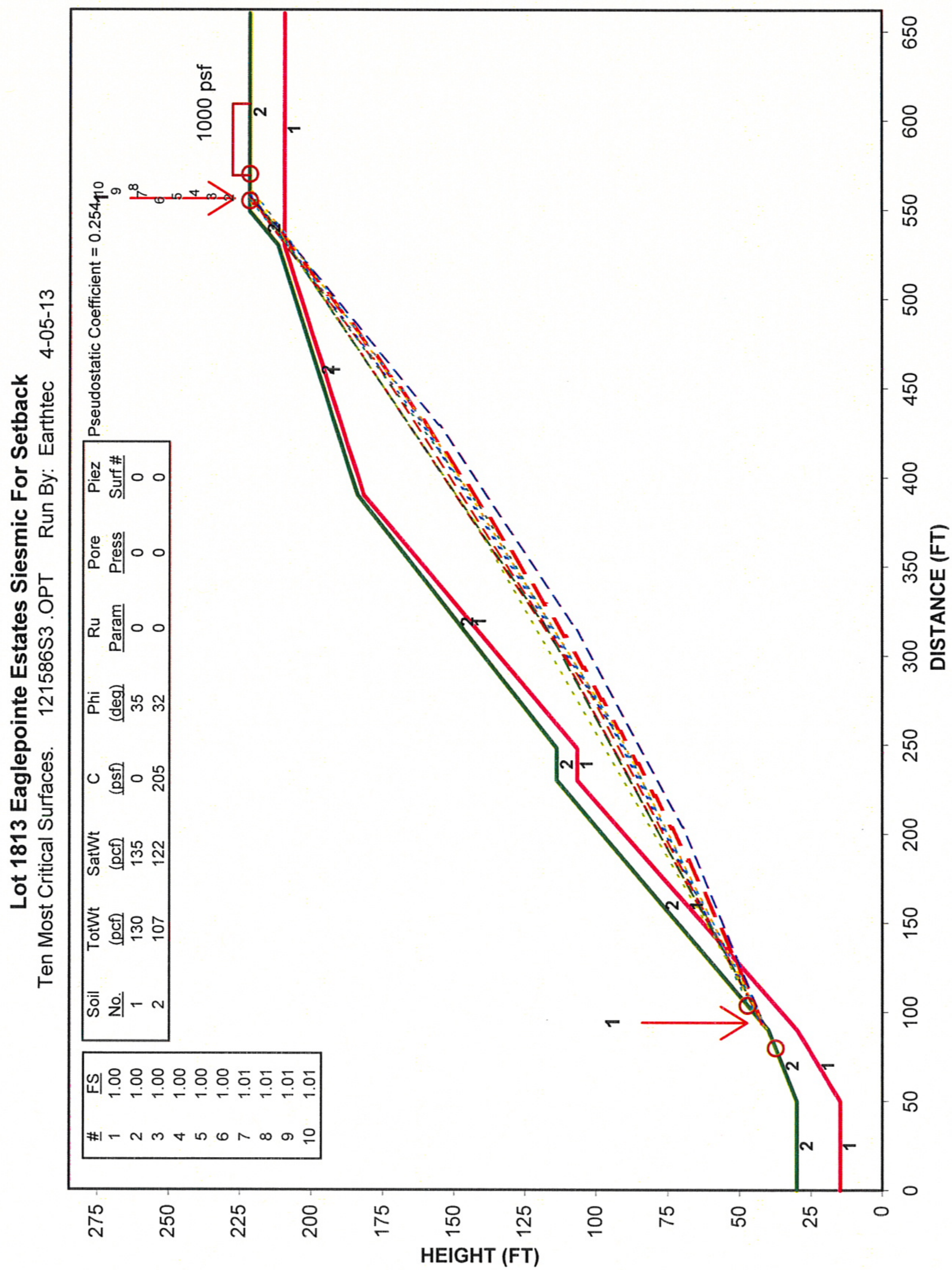


STABILITY RESULTS



PROJECT NO.: 121586	Earthtec Engineering Inc.	FIGURE NO.: 15

STABILITY RESULTS



PROJECT NO.: 121586

FIGURE NO.: 16