J

When Recorded Mail To:
American Fork City
51 East Main
American Fork UT 84003

ENT 8993:2023 PG 1 of 181
ANDREA ALLEN
UTAH COUNTY RECORDER
2023 Feb 14 1:41 pm FEE 40.00 BY AR
RECORDED FOR AMERICAN FORK CITY

NOTICE OF INTEREST, BUILDING REQUIREMENTS, AND ESTABLISHMENT OF RESTRICTIVE COVENANTS

This Notice is recorded to bind the attached Geotechnical Study dated 9.26.17 & 5.25.18 along with the site grading plan to the property generally located at 1000 S. 400 W (address), American Fork, UT 84003 and therefore mandating that all construction be in compliance with said Geotechnical Study and site grading plan per the requirements of American Fork City ordinances and standards and specification including specifically Ordinance 07-10-47, Section 6-5, Restrictive Covenant Required and 6-2-4, Liquefiable Soils. Said Sections require establishment of a restrictive covenant and notice to property owners of liquefiable soils or other unique soil conditions and construction methods associated with the property.

Exhibit A – Legal Description of Property
Exhibit B – Geotechnical Study
Exhibit C – Site Grading Plan

Dated this 8 day of September, 20 22.

OWNER(S):

(Signature)	(Signature)
Matthew Loveland	
(Printed Name)	(Printed Name)
VP of Land	
(Title)	(Title)

STATE OF UTAH)
§
COUNTY OF Salt Lake)

On the 8th day of September, 20 22 personally appeared before me Matthew Loveland and —, Owner(s) of said Property, as (individuals and/or authorized representatives of a company), and acknowledged to me that such individuals or company executed the within instrument freely of their own volition and pursuant to the articles of organization where applicable.

CLAIRE DREW
Notary Public State of Utah
My Commission Expires on:
September 24, 2025
Comm. Number: 720611

Notary Public
My Commission Expires: 9/24/25

Approved as to form: American Fork City Attorney

Rev. 12/4/18

Exhibit A – Legal Description of Property

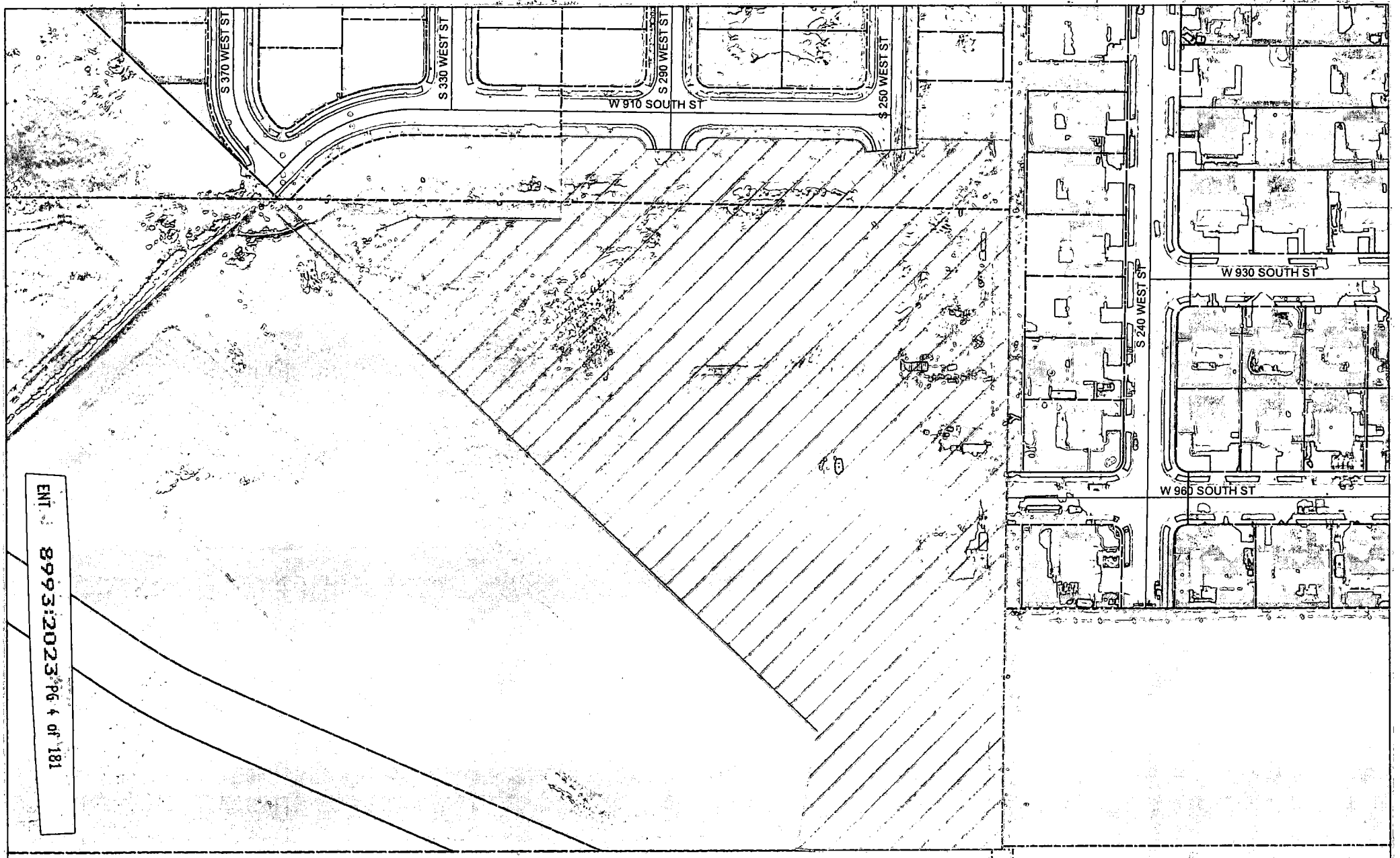
STONECREEK PLAT J
LEGAL DESCRIPTION

BEGINNING AT A POINT WHICH IS N89°48'57"E 822.46 FEET AND SOUTH 1506.09 FEET FROM THE NORTHWEST CORNER OF SECTION 26, TOWNSHIP 5 SOUTH, RANGE 1 EAST, SALT LAKE BASE & MERIDIAN,

THENCE ALONG THE SOUTH BOUNDARY OF STONECREEK PLAT H THE FOLLOWING FIVE (5) COURSES: 1) SOUTH 45°44'08" EAST 101.00 FEET, 2) NORTH 44°37'49" EAST 54.16 FEET, 3) NORTH 68°48'04" EAST 44.00 FEET, 4) SOUTH 89°12'04" EAST 180.00 FEET, AND 5) NORTH 00°49'19" EAST 101.00 FEET TO A POINT ALONG THE SOUTH BOUNDARY OF STONECREEK PLAT G; THENCE ALONG SAID PLAT THE FOLLOWING EIGHT (8) COURSES: 1) SOUTH 89°12'04" EAST 85.99 FEET, 2) ALONG THE ARC OF A 15.00 FOOT RADIUS CURVE TO THE RIGHT A DISTANCE OF 23.57 FEET (CURVE HAVING A CENTRAL ANGLE OF 90°01'23" AND A LONG CHORD BEARS S44°11'22"E 21.22 FEET), 3) SOUTH 89°12'44" EAST 62.00 FEET; 4) ALONG THE ARC OF A 15.00 FOOT RADIUS CURVE TO THE RIGHT A DISTANCE OF 23.56 FEET (CURVE HAVING A CENTRAL ANGLE OF 89°58'37" AND A LONG CHORD BEARS N45°48'38"E 21.21 FEET), 5) SOUTH 89°12'04" EAST 173.00 FEET, 6) ALONG THE ARC OF A 15.00 FOOT RADIUS CURVE TO THE RIGHT A DISTANCE OF 23.57 FEET (CURVE HAVING A CENTRAL ANGLE OF 90°01'23" AND A LONG CHORD BEARS S44°11'22"E 21.22 FEET), 7) NORTH 85°52'36" EAST 62.23 FEET, AND 8) NORTH 00°49'19" EAST 11.09 FEET; THENCE SOUTH 89°10'41" EAST 112.96 FEET; THENCE SOUTH 00°51'25" WEST 85.23 FEET; THENCE SOUTH 00°25'56" WEST 170.20 FEET; THENCE SOUTH 00°54'29" WEST 608.92 FEET; THENCE NORTH 89°59'52" WEST 207.88 FEET; THENCE ALONG THE ARC OF A 331.00 FOOT RADIUS CURVE TO THE RIGHT A DISTANCE OF 40.72 FEET (CURVE HAVING A CENTRAL ANGLE OF 07°02'53" AND A LONG CHORD BEARS N86°28'26"W 40.69 FEET); THENCE NORTH 10°00'05" EAST 134.43 FEET; THENCE ALONG THE ARC OF A 306.00 FOOT RADIUS CURVE TO THE RIGHT A DISTANCE OF 10.15 FEET (CURVE HAVING A CENTRAL ANGLE OF 01°54'04" AND A LONG CHORD BEARS N10°57'08"E 10.15 FEET); THENCE NORTH 45°44'08" WEST 906.00 FEET; THENCE NORTH 44°15'54" EAST 15.02 FEET TO THE POINT OF BEGINNING.

CONTAINS: 426,862 SF OR 9.80 AC

BASIS OF BEARING IS NORTH 89°48'57" EAST ALONG SECTION LINE FROM THE NORTHWEST CORNER TO THE NORTH QUARTER CORNER OF SECTION 26, TOWNSHIP 5 SOUTH, RANGE 1 EAST, SALT LAKE AND MERIDIAN (NAD 83)



STONECREEK PLAT J - LEGAL DESCRIPTION EXHIBIT

Exhibit B – Geotechnical Study

EARTHTEC ENGINEERING

1497 West 40 South
Lindon, Utah - 84042
Phone (801) 225-5711

3662 West 2100 South
Salt Lake City, Utah - 84120
Phone (801) 787-9138

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

Geotechnical Study
26 Acre Property
1000 South 400 West
American Fork, Utah

Project No. 178750

August 16, 2017

Prepared For:

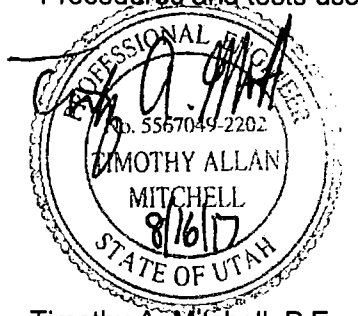
Woodside Homes
Attention: Mr. Garrett Seely
460 West 50 North, Suite 200
American Fork, UT 84101

Prepared By:

EARTHTEC ENGINEERING
Lindon Office

CERTIFICATE

I hereby certify that I am a licensed professional engineer, as defined in the "Sensitive Lands Ordinance" Section of American Fork City Ordinances. I have examined this report to which this certificate is attached and the information and conclusions contained therein are, without any reasonable reservation not stated therein, accurate and complete. Procedures and tests used in this report meet minimum applicable professional standards.



Timothy A. Mitchell, P.E.
Geotechnical Engineer

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APPENDIX A

1.0 EXECUTIVE SUMMARY

This entire report presents the results of Earthtec Engineering's completed geotechnical study for the 26 Acre Property in American Fork, Utah. This executive summary provides a general synopsis of our recommendations and findings. Details of our findings, conclusions, and recommendations are provided within the body of this report.

- The subject property is approximately 26 acres and is proposed to be developed with a new residential subdivision. The proposed structures will consist of conventionally framed, one- to two-story, structures with the possibility of basements. We anticipate foundation loads for the proposed structures will not exceed 5,000 pounds per linear foot for bearing wall, 30,000 pounds for column loads, and 100 pounds per square foot for floor slabs. (see Section 3)
- Our field exploration included the boring of one (1) boring and the excavation of eight (8) test pits to depths of 7 to 31½ feet below the existing ground surface. Groundwater was encountered at depths of approximately 4 to 6½ feet below the existing ground surface. (see Section 5)
- The native soils have a slight to high potential for collapse (settlement) and a slight to high potential for compressibility under increased moisture contents and anticipated load conditions. (see Section 6)
- The subsurface soils encountered generally consisted of topsoil overlying very soft to stiff clay and silt, and loose to dense sand and gravel. All topsoil should be removed beneath the entire building footprints, exterior flatwork, and pavements prior to construction. (see Section 7)
- The silt and sand layers encountered have a "High" potential for liquefaction during a moderate to large earthquake event; should these layers liquefy, we estimate that up to 3 inches of liquefaction-induced settlement and up to ½ foot of liquefaction-induced lateral movements could occur. (see Section 9)
- Conventional strip and spread footings may be used to support the structure, with foundations placed entirely on firm, undisturbed, uniform non-porous, non-organic soils (i.e. completely on clay soils, or completely on sand soils, etc.), or entirely on a minimum 18 inches of properly placed, compacted, and tested structural fill extending to undisturbed native soils. (see Section 10)
- Minimum roadway section consists of 3-inches of asphalt over 10 inches of road-base. Areas that are soft or deflect under construction traffic should be removed and replaced with granular material or structural fill. (see Section 13)

Based on the results of our field exploration, laboratory testing, and engineering analyses, it is our opinion that the subject site may be suitable for the proposed development, provided the recommendations presented in this report are followed and implemented during design and construction.

Failure to consult with Earthtec Engineering (Earthtec) regarding any changes made during design and/or construction of the project from those discussed herein relieves Earthtec from any liability arising from changed conditions at the site. We also strongly recommend that Earthtec observes the building excavations to verify the adequacy of our recommendations presented herein, and that Earthtec performs materials testing and special inspections for this project to provide continuity during construction.

2.0 INTRODUCTION

The project is located at approximately 1000 South 400 West in American Fork, Utah. The general location of the site is shown on Figure No. 1, *Vicinity Map* and Figure No. 2, *Aerial Photograph Showing Location of Boring and Test Pits*, at the end of this report. The purposes of this study are 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, miscellaneous concrete flatwork, and asphalt paved residential streets.

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 the proposed project, as described to us by Mr. Garrett Seely with Woodside Homes, consists of developing the approximately 26-acre existing parcel with a new residential subdivision. The proposed structures will consist of conventionally framed, one- to two-story, structures with the possibility of basements. We have based our recommendations in this report on the assumption that or anticipated foundation loads for the proposed structures will not exceed 5,000 pounds per linear foot for bearing wall, 30,000 pounds for column loads, and 100 pounds per square foot for floor slabs. If structural loads will be greater Earthtec should be notified so that we may review our recommendations and make modifications, if necessary.

In addition to the construction described above, we anticipate that

- Utilities will be installed to service the proposed buildings,
- Exterior concrete flatwork will be placed in the form of curb, gutter, and sidewalks, and
- Asphalt paved residential streets will be constructed.

4.0 GENERAL SITE DESCRIPTION

4.1 Site Description

At the time of our subsurface exploration the site was an undeveloped agricultural field. The ground surface appears to be relatively flat, we anticipate less than 3 feet of cut and fill may be required for site grading. The lot was bounded on all sides by undeveloped agricultural fields.

4.2 Geologic Setting

The subject property is located in the central portion of Utah Valley near the northern shore of Utah Lake. Utah Valley is a deep, sediment-filled basin that is part of the Basin and Range Physiographic Province. The valley was formed by extensional tectonic processes during the Tertiary and Quaternary geologic time periods. The valley is bordered by the Wasatch Mountain Range on the east and the Lake Mountains on the west. Much of northwestern Utah, including Utah Valley, was previously covered by the Pleistocene age Lake Bonneville. Utah Lake, which currently covers much of the western portion of the valley, is a remnant of this ancient fresh water lake. The surficial geology of much of the eastern margin of the valley has been mapped by Constenius, 2011[1]. The surficial geology at the location of the subject site and adjacent properties is mapped as:

- "Fine-grained lacustrine deposits" (Map Unit Qlf) dated to be upper Pleistocene. These soil or deposits are generally described in the referenced mapping as "silt and clay with some fine grained sand."
- "Younger alluvial-fan deposits" (Map Unit Qafy) dated to be Holocene and upper Pleistocene. These soil or deposits are generally described in the referenced mapping as "mostly sand, silt, and gravel that is poorly stratified and poorly sorted."

5.0 SUBSURFACE EXPLORATION

5.1 Soil Exploration

Under the direction of a qualified member of our geotechnical staff, subsurface explorations were conducted at the site on July 3 and 21, 2017 by the boring of one (1) boring and the excavation of eight (8) test pits to depths of 7 to 31½ feet below the existing ground surface using a an all-terrain hydraulic drill rig and a track mounted mini-excavator. The approximate locations of the boring and test pits are shown on Figure No. 2, *Aerial Photograph Showing Location of Boring and Test Pits*. Graphical representations and detailed descriptions of the soils encountered are shown on Figure Nos. 3 through 11, *Boring and Test Pit 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

[1] Constenius, K.N., Clark, D.L., King, J.K., Ehler, J.B., 2011, Interim Geologic Map of the Provo Quadrangle, *Utah, Wasatch and Salt Lake Counties, Utah*; U.S. Geological Survey, Open-File 586DM, Scale 1: 62,500.

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 No. 12, *Legend.*

As required by the American Fork Sensitive Lands Ordinance a 70-foot boring is required to have been performed within 2,000 feet of the site. The boring labeled AF-06-4 is within 2,000 feet of the site.

Samples of the subsurface soils were collected in the borings at depth intervals of approximately 2½ to 5 feet. Relatively undisturbed samples were collected by pushing thin-walled "Shelby" tubes into undisturbed soils below the augers. Disturbed samples were collected with a 1⅜ inch inside diameter split spoon sampler. The split spoon sampler was driven 18 inches into undisturbed soil with a 140-pound hammer free-falling through a distance of 30 inches. The blows required to drive the sampler through the final 12 inches of penetration is called the "N-value" or "blow count," and is recorded as "blows per foot" on the attached boring logs at the respective sample depths. The blow count provides a reasonable indication of the in-place relative density of sandy soils, but provides only a limited indication of the relative stiffness of cohesive (clayey) materials, since the penetration resistance for these soils is a function of the moisture content. In gravelly soils, the blow count may be higher than it otherwise would be, particularly when one or more gravel particles are larger than the sampler diameter. Disturbed bag samples and relatively undisturbed block samples were collected at various depths in each test pit.

The soil samples collected were classified by visual examination in the field following the guidelines of the Unified Soil Classification System (USCS). The samples were transported to our Lindon, Utah laboratory where they will be retained 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 30-day limit.

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, dry density tests, liquid and plastic limits determinations, mechanical (partial) gradation analyses, one-dimensional consolidation tests, organic content burnoff, and a water-soluble sulfate test. The table below summarizes the laboratory test results, which are also included on the attached *Boring and Test Pit Logs* at the respective sample depths, and on Figure Nos. 13 through 18, *Consolidation-Swell Test.*

Table 1: Laboratory Test Results

Boring and Test Pit No.	Depth (ft.)	Natural Moisture (%)	Natural Dry Density (pcf)	Atterberg Limits		Grain Size Distribution (%)			Organic Content (%)	Soil Type
				Liquid Limit	Plasticity Index	Gravel (+ #4)	Sand	Silt/Clay (- #200)		
B-1	7½	28	85	26	4	1	5	94	---	ML
B-1	10	29	---	---	---	0	46	54	---	ML
B-1	15	---	---	30	8	---	---	---	---	CL
B-1	20	---	---	37	16	---	---	---	---	CL
B-1	30	---	---	30	9	---	---	---	---	CL
TP-1	3	34	77	41	22	1	32	67	4.9	CL
TP-2	3	26	88	24	4	3	30	67	---	CL-ML
TP-3	2½	8	---	---	---	51	28	21	---	GM
TP-4	5	4	---	---	---	74	25	1	---	GP
TP-5	2½	24	86	28	7	0	30	70	---	CL-ML
TP-5	4	26	---	20	NP*	4	59	37	---	SM
TP-5	10	---	---	27	4	---	---	---	3.0	ML
TP-6	3	9	87	---	---	2	24	74	---	ML
TP-7	2½	23	74	31	5	1	3	96	---	ML
TP-8	3	---	---	27	6	---	---	---	---	CL-ML

NP* = Non-Plastic

As part of the consolidation test procedure, water was added to the samples to assess moisture sensitivity when the samples were loaded to an equivalent pressure of approximately 1,000 psf. The native soils have a slight to high potential for collapse (settlement) and a slight to high potential for compressibility under increased moisture contents and anticipated load conditions.

A water-soluble sulfate test was performed on a representative sample obtained during our field exploration. Testing indicated a value of 107 parts per million. Based on this result, the risk of sulfate attack to concrete appears to be "negligible" according to American Concrete Institute standards. Therefore, we any type of Portland cement can be used for concrete in contact with on-site soils. The results can be found in Appendix A.

7.0 SUBSURFACE CONDITIONS

7.1 Soil Types

On the surface of the site, we encountered topsoil which is estimated to extend about up to 1½ feet in depth at the boring and test pit locations. Below the topsoil we encountered layers of clay, silt, sand, and gravel extending to depths of 7 to 31½ feet below the existing ground surface. Graphical representations and detailed descriptions of the soils encountered are shown on Figure Nos. 3 through 11, *Boring and Test Pit Log* at the end of this report. Based on the blow counts obtained and our experience and observations during field exploration, the clay

and silt soils visually ranged from very soft to stiff in consistency and the sand and gravel soils visually had a relative density varying from loose to dense.

7.2 Groundwater Conditions

Groundwater was encountered at depths of approximately 4 to 6½ feet below the existing ground surface. Note that groundwater levels will fluctuate in response to the season, precipitation, snow melt, irrigation, and other on and off-site influences. Quantifying these fluctuations would require long term monitoring, which is beyond the scope of this study. The contractor should be prepared to dewater excavations as needed.

8.0 SITE GRADING

8.1 General Site Grading

All surface vegetation and unsuitable soils (such as topsoil, organic soils, undocumented fill, soft, loose, or disturbed native soils, and any other inapt materials) should be removed from below foundations, floor slabs, exterior concrete flatwork, and pavement areas. We encountered topsoil on the surface of the site. The topsoil (including soil with roots larger than about ¼ inch in diameter) should be completely removed, even if found to extend deeper, along with any other unsuitable soils that may be encountered. Over-excavations below footings and slabs also may be needed, as discussed in Section 10.0.

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. Because the site is relatively flat, we anticipate that less than 3 feet of grading fill will be placed. If more than 3 feet of grading fill will be placed above the existing surface (to raise site grades), Earthtec should be notified so that we may provide additional recommendations, if required. Such recommendations will likely include placing the fill several weeks (or possibly more) 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[2] requirements for Type C soils.

8.3 Fill Material Composition

The native soils are not suitable for use as placed and compacted structural fill. Excavated soils, including clay and silt, may be stockpiled for use as fill in landscape areas.

[2] OSHA Health and Safety Standards, Final Rule, CFR 29, part 1926.

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, pavements, etc. We recommend that a professional engineer or geologist verify that the structural fill to be used on this project meets the requirements, stated below. We recommend that structural fill consist of imported sandy/gravelly soils meeting the following requirements in the table below:

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, stricter 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 recommendations 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 and silt 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.

If required (i.e. fill in submerged areas), we recommend that free draining granular material (clean sand and/or gravel) meet the following requirements in the table below:

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 between the free draining fill and the adjacent soil 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 prior to compaction 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 and other areas not below structurally loaded areas: 90%
- Less than 5 feet of fill below structurally loaded areas: 95%
- Greater than 5 feet of fill below structurally loaded areas: 98%

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

Fill should be tested frequently during placement and we recommend early testing to demonstrate that placement and compaction methods are achieving the required compaction. The contractor is responsible 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 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, partially loaded equipment, tracked equipment, by working in dry times of the year, and/or by providing a working surface for equipment. However, because of the relatively shallow depth of groundwater, it is likely that rutting and pumping may not be avoidable.

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. Materials which are more angular and coarse may require thinner lifts in order to achieve compaction. 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 SEISMIC AND GEOLOGIC CONSIDERATIONS

9.1 Seismic Design

The residential structures should be designed in accordance with the 2015 International Residential Code (IRC). The IRC designates this area as a seismic design class D_1.

The site is located at approximately 40.357 degrees latitude and -111.808 degrees longitude from the approximate center of the site. The IRC site value for this property is 0.801g. The design spectral response acceleration parameters are given below.

Table 4: Design Acceleration for Short Period

S_S	F_a	Site Value (S_{DS})
		2/3 S_S*F_a
1.158g	1.037	0.801g

S_S = Mapped spectral acceleration for short periods
F_a = Site coefficient from Table 1613.3.3(1)
S_{DS} = ⅔S_{MS}= ⅔ (F_a·S_S) = 5% damped design spectral response acceleration for short periods

9.2 Faulting

The subject property is located within the Intermountain Seismic Belt where the potential for active faulting and related earthquakes is present. Based upon published geologic maps[3], no active faults traverse through or immediately adjacent to the site and the site is not located

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

within local fault study zones. The nearest mapped fault trace is part of a group of fault beneath Utah Lake located about 1¼ miles south of the site.

9.3 Liquefaction Potential

According to current liquefaction maps[4] for Utah County, the site is located within an area designated as "High" in liquefaction potential. Liquefaction can occur when saturated subsurface soils below groundwater lose their inter-granular strength due to an increase in soil pore water pressures during a dynamic event such as an earthquake. As part of this study, the potential for liquefaction to occur in the soils we encountered was assessed using Youd *et al*[5] and Boulanger & Idriss[6]. Potential liquefaction-induced movements were evaluated using Tokimatsu & Seed[7] and Youd, Hansen & Bartlett[8].

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 clay, silt, sand and gravel soils. Our analysis indicates that approximately up to 3 inches of liquefaction-induced settlement and possibly up to ½ feet of lateral spreading could occur in the vicinity of B-1 during a moderate to large earthquake event. The liquefaction potential at the site can be mitigated using one of the following alternatives:

- Install earthquake drains, such as Nilex drains, to relieve increases in pore water pressure during a seismic event.
- Connect/tie all footings together using reinforced grade beams and connect reinforced slabs to the footings so that the building will react as a cohesive unit. This may result in some tilting of the building due to differential liquefaction-induced movements. The building may also move laterally due to lateral spreading.

10.0 FOUNDATIONS

10.1 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

[4] Utah Geological Survey, Liquefaction-Potential Map for a Part of Utah County, Utah, Public Information Series 28, August 1994
[5] Youd, T.L. (Chair), Idriss, I.M. (Co-Chair), and 20 other authors, 2001, Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, October 2001, p. 817-833.
[6] Boulanger, R.W. and Idriss, I.M., 2006, Liquefaction Susceptibility Criteria for Silts and Clays, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, November 2006, p. 1413-1426.
[7] Tokimatsu, K. and Seed, H.B., 1987, Evaluation of Settlements in Sands due to Earthquake Shaking, Journal of Geotechnical Engineering, ASCE, p. 861-878.
[8] Youd, T.L., Hansen, C.M. and Bartlett, S.F., 2002, Revised Multilinear Regression Equations for Prediction of Lateral Spread Displacement, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, December 2002, p. 1007-1017.

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 and assumptions related to foundations 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 may be used to support the proposed structures after appropriate removals as outlined in Section 8.1. Foundations should not be installed 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 compacted.

10.2 Strip/Spread Footings

We recommend that conventional strip and spread foundations be constructed entirely on firm, undisturbed, uniform non-porous, non-organic soils (i.e. completely on clay soils, or completely on sand soils, etc.), or entirely on a minimum 18 inches of properly placed, compacted, and tested structural fill extending to undisturbed native soils For foundation design we recommend the following:

- Footings founded on native soils may be designed using a maximum allowable bearing capacity of 1,500 pounds per square foot. Footings founded on a minimum 18 inches of structural fill may be designed using a maximum allowable bearing capacity of 2,000 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 2015 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 with at least 4 passes of an approved non-vibratory roller prior to erection of forms or placement of structural fill to densify soils that may have been loosened during excavation and to identify soft spots. 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.
- Because of shallow groundwater conditions encountered at the site, we anticipate that 24

inches of structural fill will be required below the proposed structure to provide a firm surface upon which to construct the proposed structure. In lieu of traditional structural fill, clean 1- to 2-inch clean gravel may be used in conjunction with a stabilization fabric, such as Mirafi 600X or equivalent, which should be placed between the native soils and the clean gravel (additional recommendations for placing clean gravel and stabilization fabric are given in Section 8.5 of this report).

- Due to shallow groundwater encountered at the site, lowest floor slab depths should be limited to 1 foot below existing site grades. This is intended to provide a minimum of 3 feet of separation between the observed groundwater condition and the bottom of the floor slab.
- 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 is 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.

10.3 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 a seismic event due to ground shaking, if more than 3 feet of grading fill is placed above the existing ground surface, if loading conditions are greater than anticipated in Section 3, and/or if foundation soils are allowed to become wetted.

10.4 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 dependent 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 are 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 native soils as backfill material using a 30° friction angle and a dry unit weight of 110 pcf.

Table 5: Lateral Earth Pressures (Static and Dynamic)

Condition	Case	Lateral Pressure Coefficient	Equivalent Fluid Pressure (pcf)
Active	Static	0.33	37
	Seismic	0.50	55
At-Rest	Static	0.50	55
	Seismic	0.71	78
Passive	Static	3.00	330
	Seismic	3.92	431

*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 0.30 for native clays and silts, 0.40 for native sands, and 0.55 for native gravels or structural fill meeting the recommendations presented herein. Concrete or masonry walls shall be selected and constructed in accordance to the provision of Section R404 of the 2015 International Residential Code or sections referenced therein. Retaining wall lateral resistance design should further reference Section R404.4 for reference of Safety Factors.

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.

11.0 FLOOR SLABS AND FLATWORK

Due to shallow groundwater encountered at the site, lowest floor slab depths should be limited to 1 foot below existing site grades. This is intended to provide a minimum of 3 feet of separation between the observed groundwater condition and the bottom of the floor slab.

Concrete floor slabs and exterior flatwork may be supported on native non-porous soils or 12 inches of properly placed and compacted structural fill after appropriate removals and grading as outlined in Section 8.1 are completed. We recommend placing a minimum 4 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 exterior flatwork, we recommend placing a minimum 4 inches of road-base material. Prior to placing the free-draining fill or road-base materials, the native sub-grade 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 sub-grade reaction of 120 pounds per cubic inch. The thickness of slabs supported directly on the ground shall not be less than 3½ inches. A 6-mil polyethylene vapor retarder with joints lapped not less than 6 inches shall be placed between the ground surface and the concrete, as per Section R506 of the 2015 International Residential Code.

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.

12.0 DRAINAGE

12.1 Surface Drainage

Due to the collapse potential of native soils within the upper 4½ feet, wetting of subsurface soils (including those below foundations) could result in adverse settlement. Accordingly, we recommend the following:

- The contractor should take precautions to prevent significant wetting of the soil at the base of the excavation. 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.
- Adequate compaction of foundation wall 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 10 inches in the first 10 feet.
- Roof runoff should be collected in rain gutters with down spouts designed to discharge well outside of the backfill limits, or at least 10 feet from foundations, whichever is greater.
- Sprinkler nozzles should be aimed away, and all sprinkler components kept at least 10 feet, from foundation walls. Also, sprinklers should not be placed at the top or on the face of slopes. Sprinkler systems should be designed with proper drainage and well maintained.

Over-watering should be avoided.

- Any additional precautions which may become evident during construction.

12.2 Subsurface Drainage

Section R405.1 of the 2015 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." Section R310.2.3.2 of the 2015 International Residential Code states, "Window wells shall be designed for proper drainage by connecting to the building's foundation drainage system." 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. The soils observed in the explorations at the depth of foundation consisted primarily of silt (ML) and clay (CL) which are 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.
- A perforated 4-inch minimum diameter pipe should be installed in all window wells and connected to the foundation drain.
- 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.
- 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.

13.0 PAVEMENT RECOMMENDATIONS

We understand that asphalt paved residential streets will be constructed as part of the project. The native soils encountered beneath the topsoil during our field exploration were predominantly composed of clays. We estimate that a California Bearing Ratio (CBR) value of 3 is appropriate for these soils. Also, the near-surface native soils are potentially collapsible, and over-excavation may be needed to minimize the potential settlement of pavements. If the topsoil is left beneath concrete flatwork and pavement areas, increased maintenance costs over time should be anticipated.

We anticipate that the traffic volume will be about 1,000 vehicles a day (27.3 ESAL/day) or less for the residential streets, consisting of mostly cars and pickup trucks, with a daily delivery truck and a weekly garbage truck. Based on these traffic parameters, the estimated CBR given above, and the procedures and typical design inputs outlined in the UDOT Pavement Design Manual (1998), we recommend the minimum asphalt pavement section presented below.

Table 6: Pavement Section Recommendations

Asphalt Thickness (in)	Compacted Roadbase Thickness (in)	Compacted Subbase Thickness (in)
3	10*	0

* Stabilization may be required

If the pavement will be required to support construction traffic, more than an occasional semi-tractor or fire truck, or more traffic than listed above, our office should be notified so that we can re-evaluate the pavement section recommendations. The following also apply:

- The subgrade should be prepared by proof rolling to a firm, non-yielding surface, with any identified soft areas stabilized as discussed above in Section 8.5.
- Site grading fills below the pavements should meet structural fill composition and placement recommendations per Sections 8.3 and 8.4 herein.
- Asphaltic concrete, aggregate base and sub-base material composition should meet local, APWA or UDOT requirements.
- Aggregate base and sub-base is compacted to local, APWA, or UDOT requirements, or to at least 95 percent of maximum dry density (ASTM D 1557).
- Asphaltic concrete is compacted to local or UDOT requirements, or to at least 96 percent of the laboratory Marshall density (ASTM D 6927).

14.0 GENERAL CONDITIONS

The exploratory data presented in this report was collected to provide geotechnical design recommendations for this project. The explorations 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 explorations may occur and which may be sufficient to require modifications in the design. If during construction, conditions are different than presented in this report, Earthtec should be advised immediately 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 warranty or representation is intended in our proposals, contracts, letters, 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 regarding any changes made during design and construction of the project from those discussed herein. Failure to consult with Earthtec regarding any such changes relieves Earthtec from any liability arising from changed conditions at the site.

To maintain continuity, Earthtec 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 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 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.

Respectfully;

EARTHTEC ENGINEERING

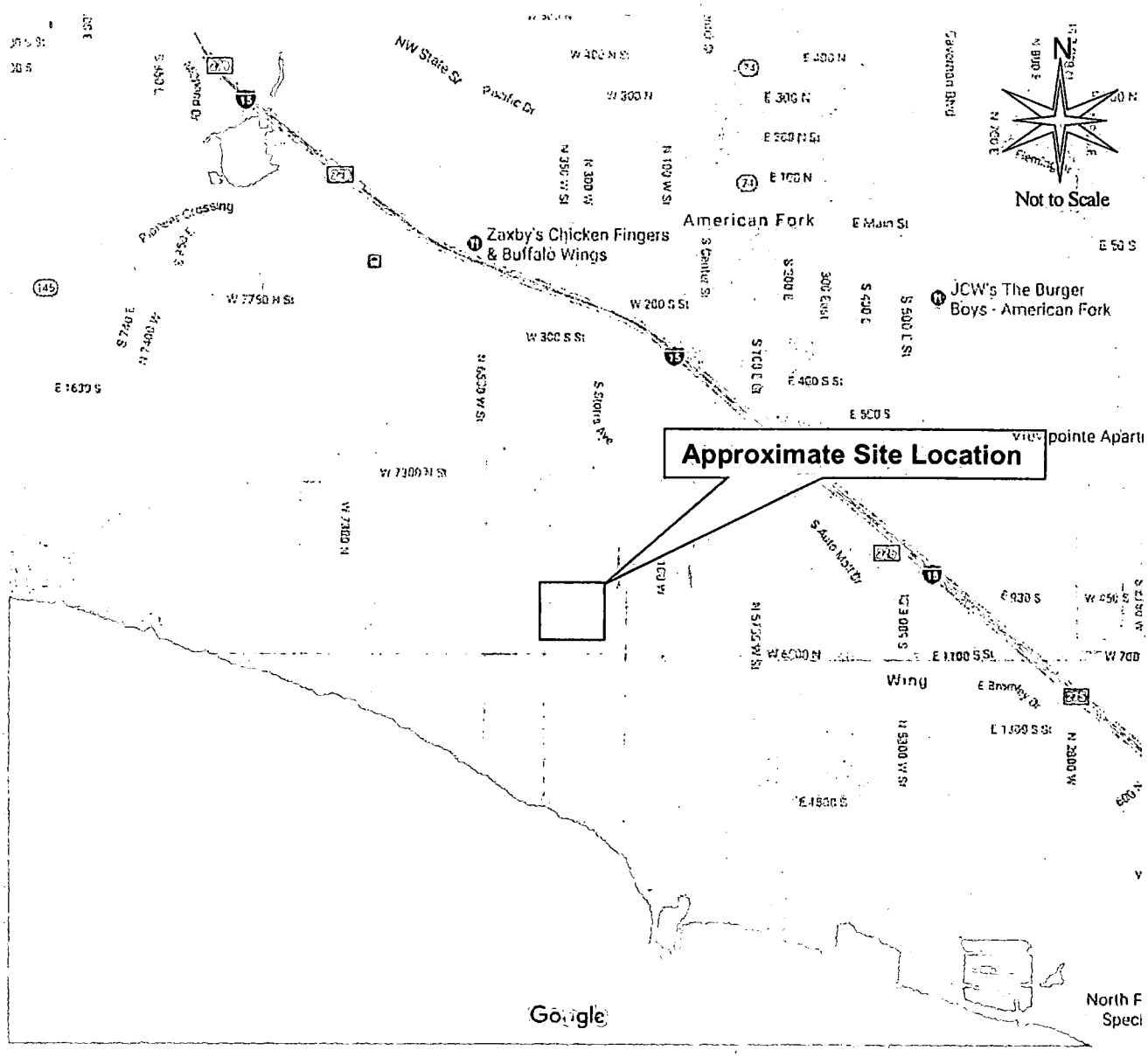
Jeremy A. Balleck, E.I.T.
Staff Engineer

PROFESSIONAL ENGINEER
No. 5567049-2202
TIMOTHY ALLAN MITCHELL
8/6/17
STATE OF UTAH

Timothy A. Mitchell, P.E.
Geotechnical Engineer

VICINITY MAP

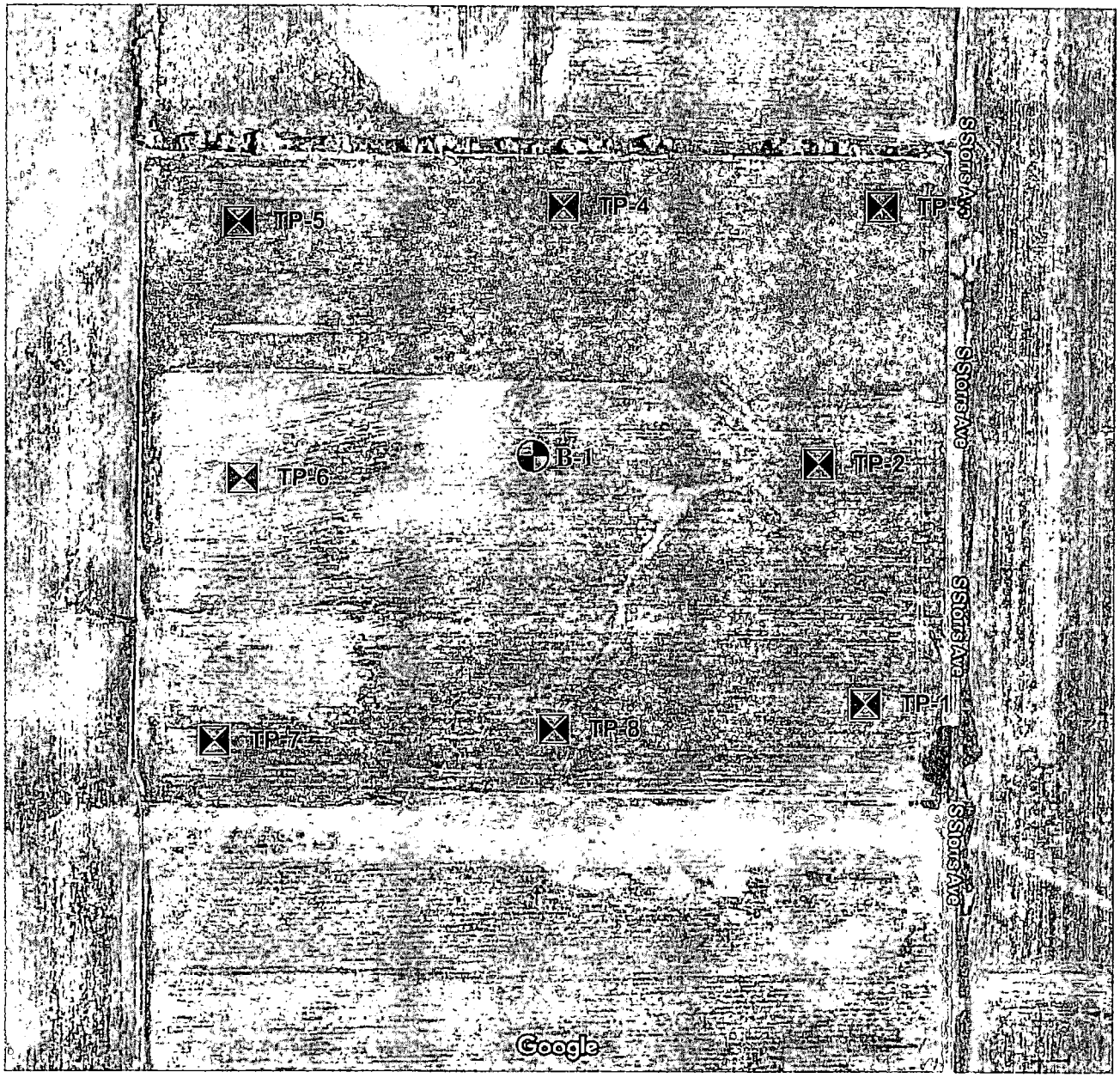
26 Acre Property
1000 South 400 West
American Fork, Utah



PROJECT NO.: 178750	EARTHTEC ENGINEERING	FIGURE NO.: 1

AERIAL PHOTOGRAPH SHOWING LOCATION OF BORING AND TEST PITS

26 Acre Property
1000 South 400 West
American Fork, UTAH



Approximate Boring Locations

Approximate Test Pit Locations

N

Not to Scale

PROJECT NO.: 178750		FIGURE NO.: 2

BORING LOG

NO.: B-1

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Great Basin
EQUIPMENT: ATV Drill Rig
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/03/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼: 6.5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Blows per foot	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL, sandy lean clay, dry to moist, brown										
		SM	Silty SAND with gravel, loose, moist, gray to brown										
3					5								SS
		CL	Lean CLAY, soft, moist to wet, brown										
6					3								
		ML	SILT, soft (estimated), wet, brown			28	85	26	4	1	5	94	C
9													
		ML	Sandy SILT, very soft, wet, brown		1	29				0	46	54	
12													
15		CL	Lean CLAY, soft to stiff, wet, brown		3			30	8				

Notes: Groundwater encountered at approximatly 6½ feet

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

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 3a

LOG OF TESTHOLE 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

BORING LOG

NO.: B-1

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Great Basin
EQUIPMENT: ATV Drill Rig
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/03/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼: 6.5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Blows per foot	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
18			Lean CLAY, soft to stiff, wet, brown										
21					12			37	16				
24		CL											
27					13								
30					7			30	9				
33			Maximum depth explored approximately 31½ feet										

Notes: Groundwater encountered at approximatly 6½ feet

Tests Key

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

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 3b

LOG OF TESTHOLE 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-1

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▽: 5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL, sandy lean clay, dry to moist, brown									
1												
2			Sandy Lean CLAY, medium stiff (estimated), moist to wet, brown, some interbedded sand layers, roots to 3'									
3					34	77	41	22	1	32	67	C, B
4												
5		CL	▽									
6												
7												
8												
9			Maximum depth explored approximately 8 feet									
10												
11												
12												
13												
14												
15												
16												
17												

Notes: Groundwater encountered at approximatly 5 feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 4

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-2

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼: 5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0												
1			TOPSOIL, sandy lean clay, dry to moist, brown, roots									
2			Sandy Silty CLAY, medium stiff (estimated), moist to wet, brown, roots to 3½'									
3												
4					26	88	24	4	3	30	67	C
5		CL-ML										
6			... cemented nodules									
7												
8		SM	Silty SAND, loose to medium dense (estimated), wet, brown									
9			Maximum depth explored approximately 8½ feet									
10												
11												
12												
13												
14												
15												
16												
17												

Notes: Groundwater encountered at approximatly 5 feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 5

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-3

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼: 4.5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL, lean clay, dry to moist, brown, roots									
1												
2		CL	Lean CLAY, medium stiff (estimated), moist, brown, roots									
3			Silty GRAVEL with sand, medium dense to dense (estimated), moist to wet, gray	X	8				51	28	21	
4		GM										
5												
6												
7		SP	Poorly Graded SAND, medium dense (estimated), wet, brown	X								
8												
9		CL	Lean CLAY, stiff (estimated), wet, brown, interbedded sand layers									
10			Maximum depth explored approximately 8½ feet due to test pit cave in									
11												
12												
13												
14												
15												
16												
17												

Notes: Groundwater encountered at approximatly 4½ feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 6

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-4

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck

DEPTH TO WATER; INITIAL ▽:
AT COMPLETION ▽: 5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL, lean clay, moist, brown									
2			Poorly Graded GRAVEL with sand, medium dense to dense (estimated), moist to wet, gray, cobbles									
5		GP ▽		X	4				74	25	1	
8			Maximum depth explored approximately 8 feet									

Notes: Groundwater encountered at approximatly 5 feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 7

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-5

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▽: 5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0												
1			TOPSOIL, silty clay, moist, brown									
2		CL-ML	Sandy Silty CLAY, medium stiff (estimated), moist, brown									
3					24	86	28	7	0	30	70	C
4			Silty SAND, medium dense (estimated), moist to wet, brown									
5		SM	▽		26		20	NP	4	59	37	
6												
7			SILT, medium stiff (estimated), wet, red-brown									
8												
9		ML										
10												
11			... gray, organic material				27	4				B
12			Maximum depth explored approximately 11 feet									
13												
14												
15												
16												
17												

Notes: Groundwater encountered at approximatly 5 feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 8

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-6

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▽: 6.5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL, silty sand, dry, gray									
1												
2		ML	SILT with sand, medium stiff (estimated), dry, brown, roots, pinholes									
3					9	87			2	24	74	C
4		CL	Lean CLAY, medium stiff (estiamted) moist, gray, oxide stains, cemented nodules									
5												
6			▽									
7		SM	Silty SAND, medium dense (estimated) wet, gray									
8												
9		CL-ML	Silty CLAY, medium stiff (estimated), wet, brown									
10												
11			Maximum depth explored approximately 10½ feet									
12												
13												
14												
15												
16												
17												

Notes: Groundwater encountered at approximatly 6½ feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 9

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-7

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▽: 5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0												
1			TOPSOIL, silty sand; moist, brown									
2			SILT, medium stiff (estimated), moist, gray, roots, pinholes									
3		ML			23	74	31	5	1	3	96	C
4												
5			▽Lean CLAY, medium stiff to stiff (estimated), wet, brown to gray									
6												
7		CL	... mottled, some cemented nodules									
8												
9												
10		SP	Poorly Graded SAND, medium dense (estimated), wet, gray									
11			Maximum depth explored approximately 10 feet									
12												
13												
14												
15												
16												
17												

Notes: Groundwater encountered at approximatly 5 feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 10

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-8

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼: 4 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL, sandy lean clay, dry, brown									
1												
2			Silty CLAY, medium stiff to stiff (estimated), moist to wet, dark brown to gray									
3												
4		CL-ML ▼					27	6				
5												
6												
7			Maximum depth explored approximately 7 feet due to test pit cave in									
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												

Notes: Groundwater encountered at approximatly 4 feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

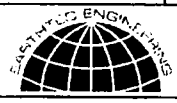


FIGURE NO.: 11

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

LEGEND

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
DATE: 07/03/17 - 07/21/17
LOGGED BY: J. Balleck

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.

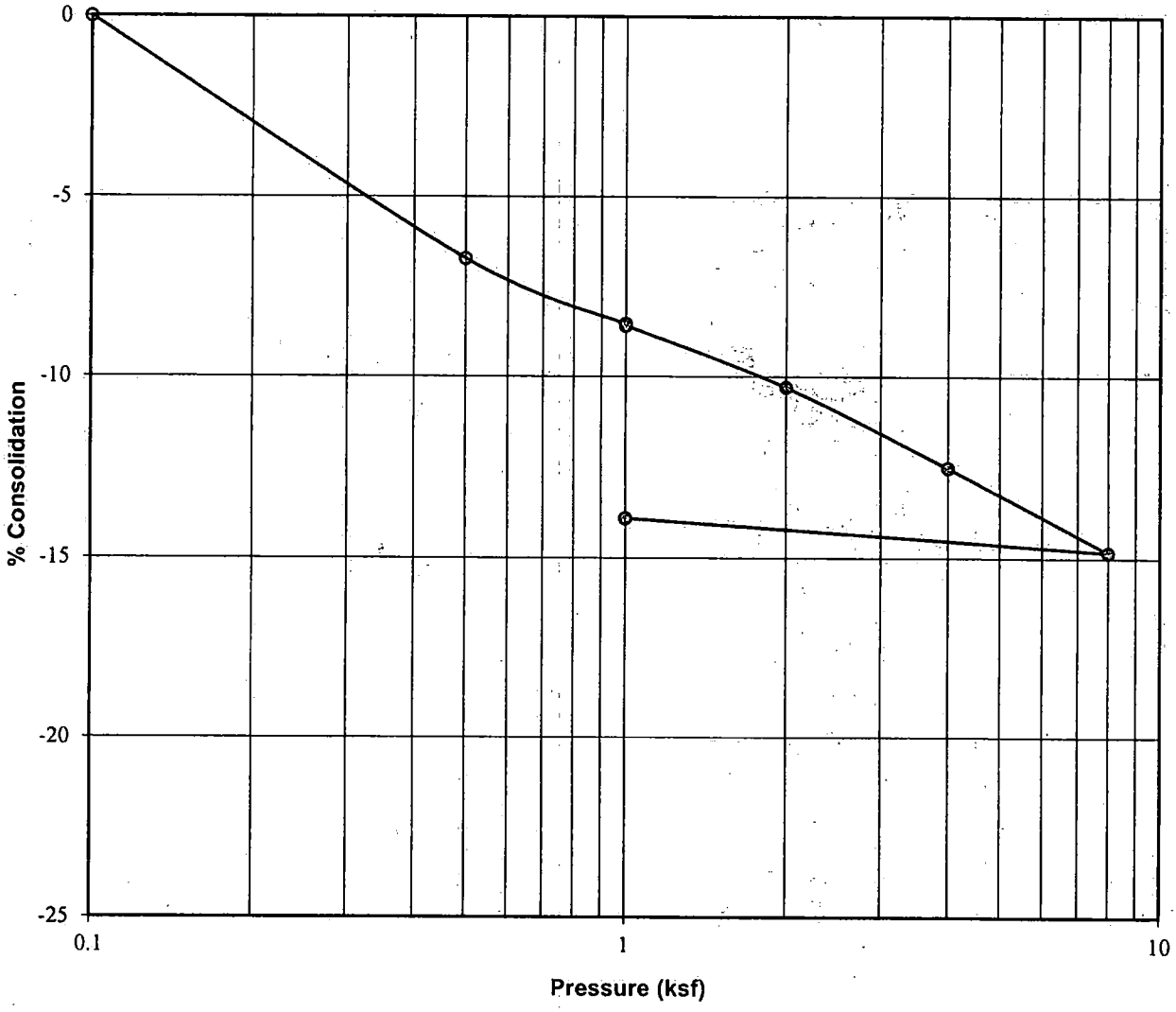
PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 12

LEGEND 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

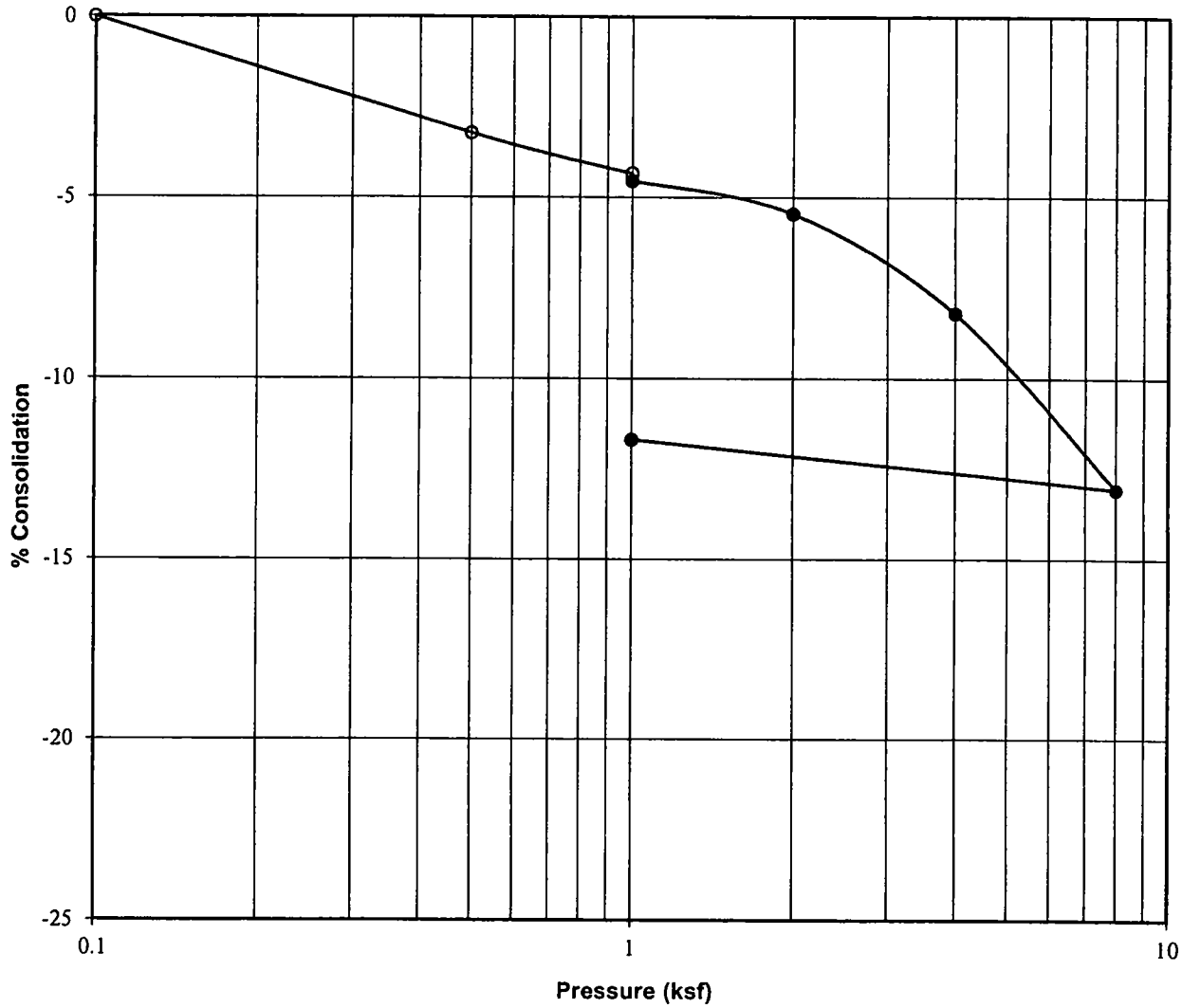
CONSOLIDATION - SWELL TEST



Project:	26 Acre Property
Location:	B-1
Sample Depth, ft:	7½
Description:	Shelby
Soil Type:	SILT (ML)
Natural Moisture, %:	28
Dry Density, pcf:	85
Liquid Limit:	26
Plasticity Index:	4
Water Added at:	1 ksf
Percent Collapse:	0.1

PROJECT NO.: 178750	EARTHTEC ENGINEERING	**FIGURE NO.:** 13

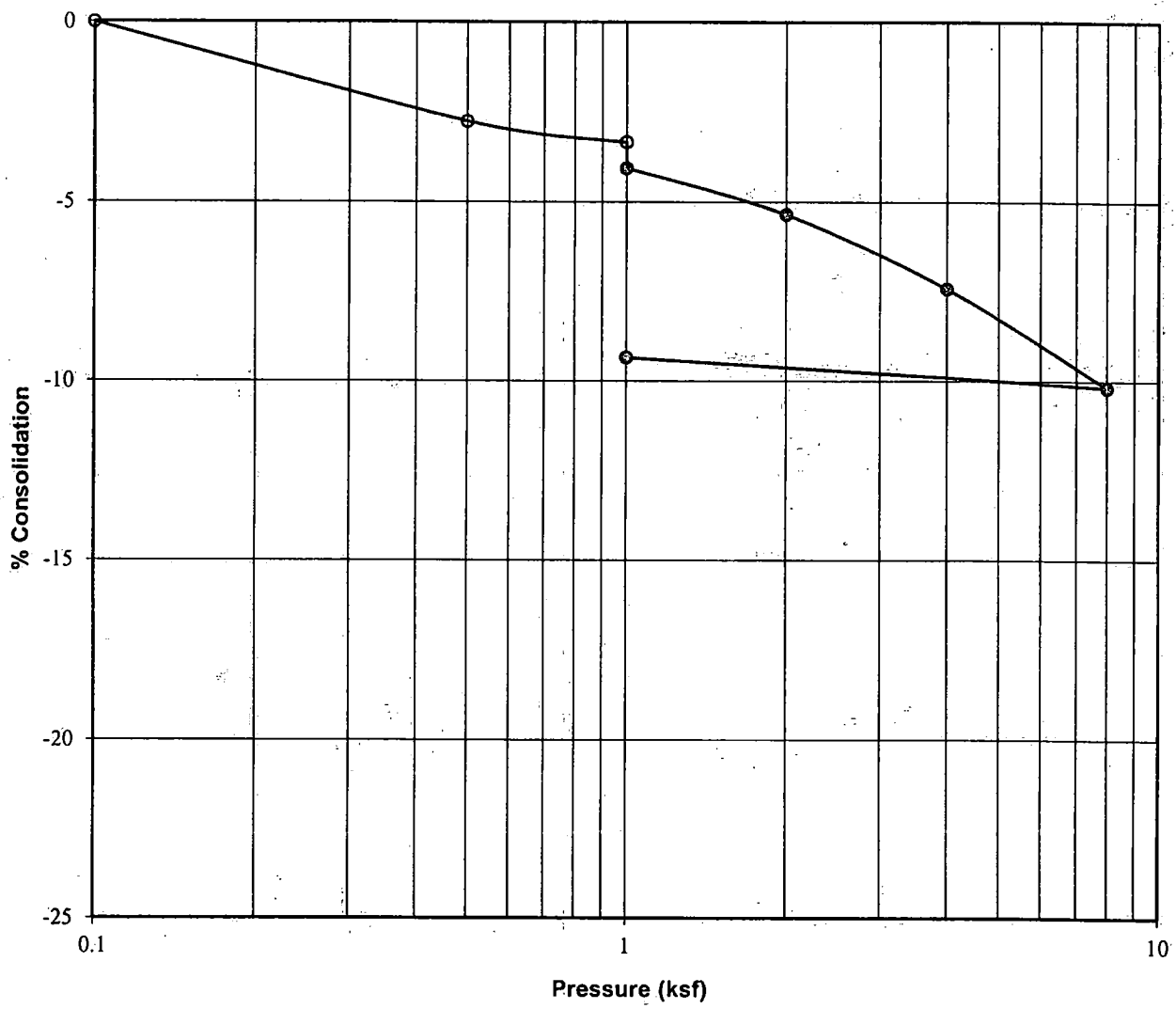
CONSOLIDATION - SWELL TEST



Project:	26 Acre Property
Location:	TP-1
Sample Depth, ft:	3
Description:	Block
Soil Type:	Sandy Lean CLAY (CL)
Natural Moisture, %:	34
Dry Density, pcf:	77
Liquid Limit:	41
Plasticity Index:	22
Water Added at:	1 ksf
Percent Collapse:	0.2

PROJECT NO.: 178750		**FIGURE NO.:** 14

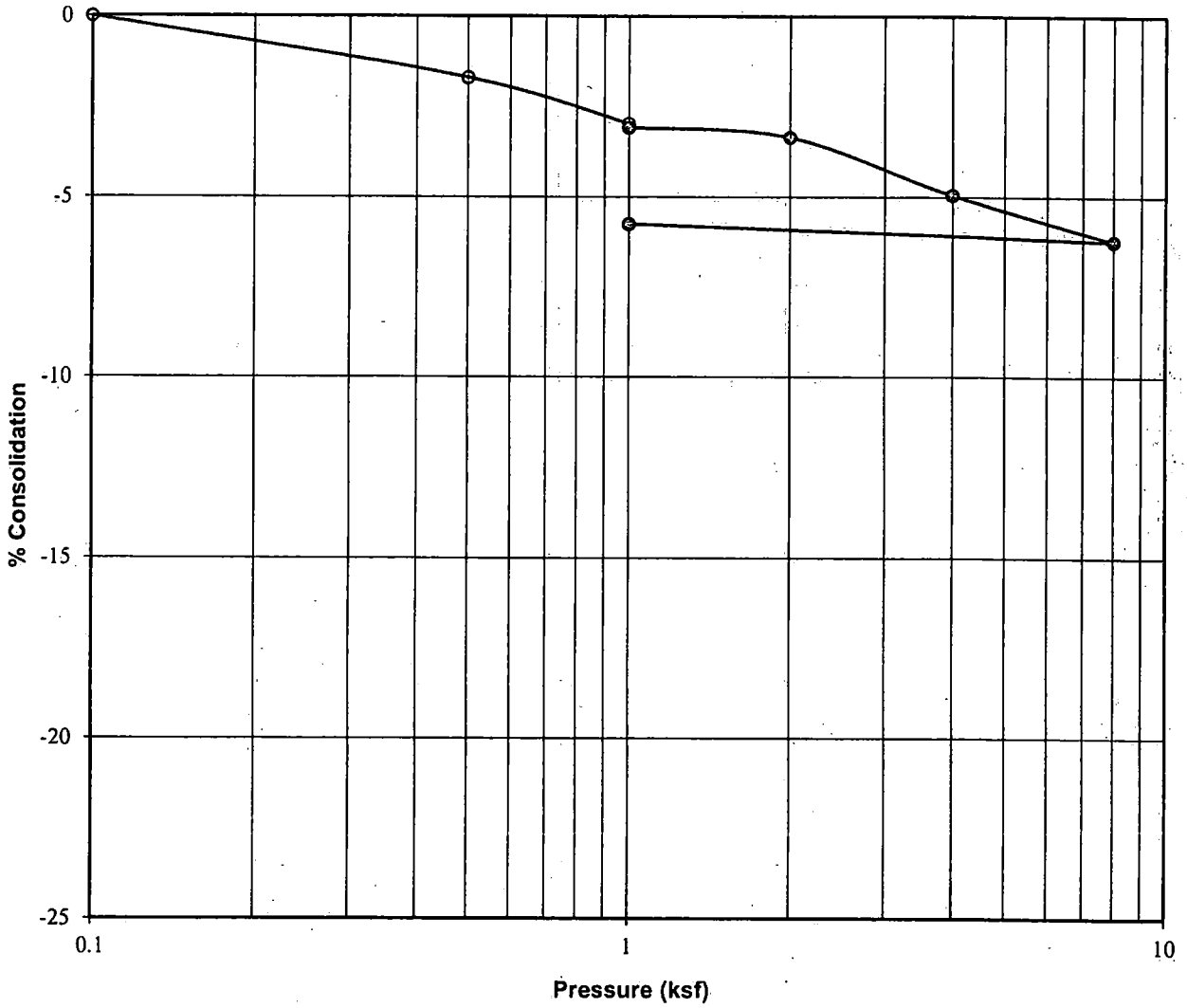
CONSOLIDATION - SWELL TEST



Project:	26 Acre Property
Location:	TP-2
Sample Depth, ft:	3
Description:	Block
Soil Type:	Sandy Silty CLAY (CL-ML)
Natural Moisture, %:	26
Dry Density, pcf:	88
Liquid Limit:	24
Plasticity Index:	4
Water Added at:	1 ksf
Percent Collapse:	0.7

PROJECT NO.: 178750	EARTHTEC ENGINEERING	**FIGURE NO.:** 15

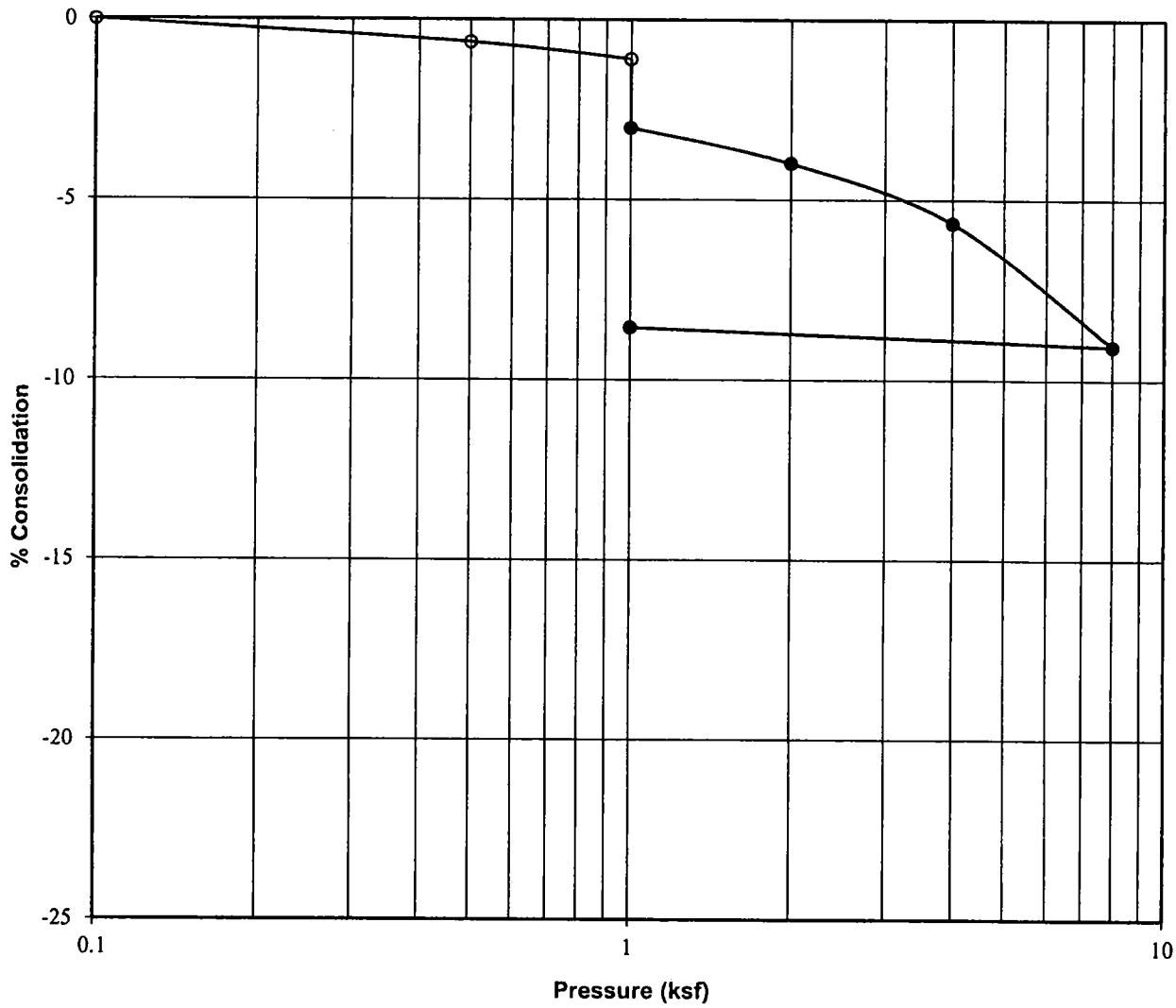
CONSOLIDATION - SWELL TEST



Project:	26 Acre Property
Location:	TP-5
Sample Depth, ft:	2½
Description:	Block
Soil Type:	Sandy Silty CLAY (CL-ML)
Natural Moisture, %:	24
Dry Density, pcf:	86
Liquid Limit:	28
Plasticity Index:	7
Water Added at:	1 ksf
Percent Collapse:	0.1

PROJECT NO.: 178750		**FIGURE NO.:** 16

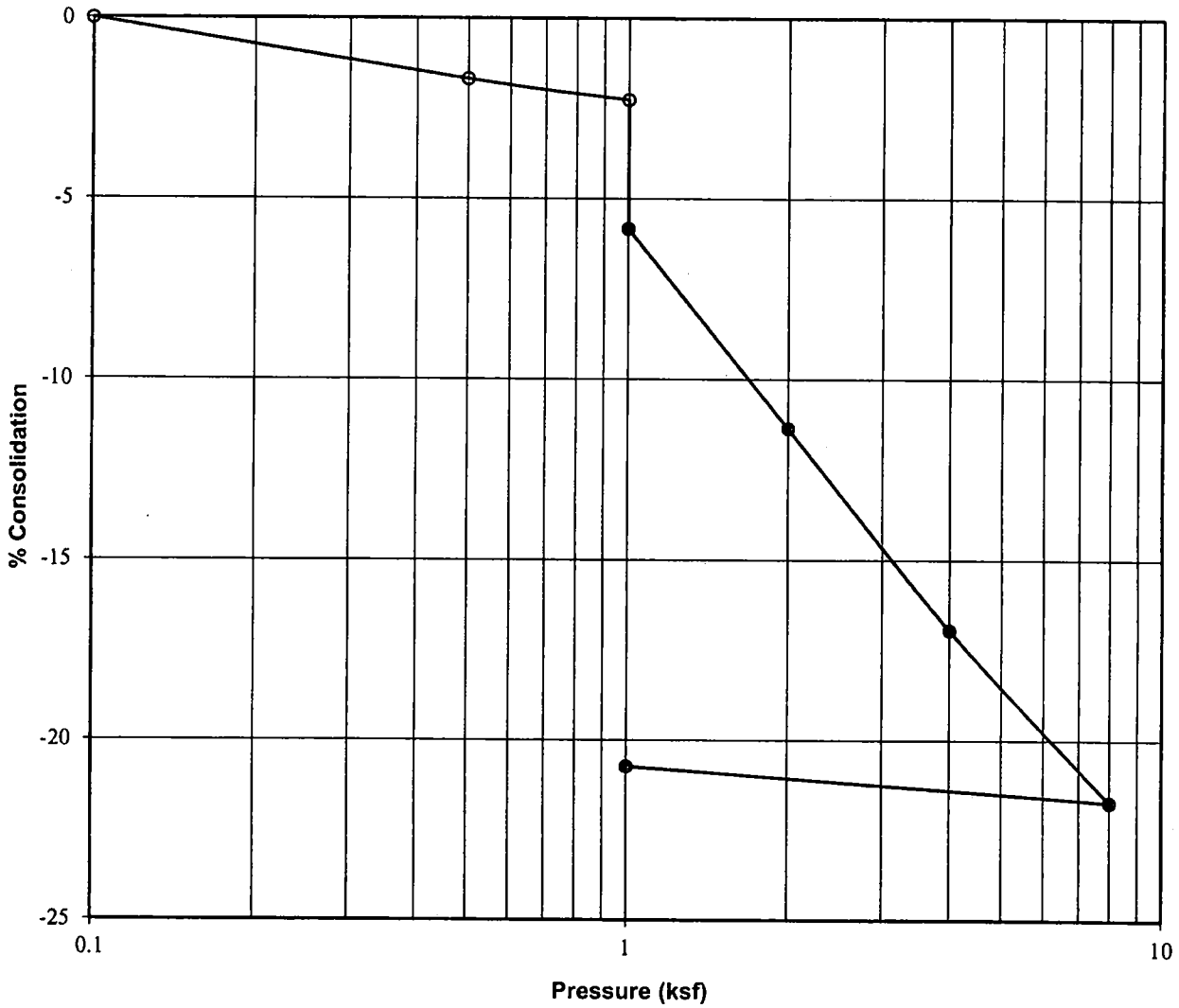
CONSOLIDATION - SWELL TEST



Project:	26 Acre Property
Location:	TP-6
Sample Depth, ft:	3
Description:	Block
Soil Type:	SILT with sand (ML)
Natural Moisture, %:	9
Dry Density, pcf:	87
Liquid Limit:	-
Plasticity Index:	-
Water Added at:	1 ksf
Percent Collapse:	1.9

PROJECT NO.: 178750		**FIGURE NO.:** 17

CONSOLIDATION - SWELL TEST



Project:	26 Acre Property
Location:	TP-7
Sample Depth, ft:	2½
Description:	Block
Soil Type:	SILT (ML)
Natural Moisture, %:	23
Dry Density, pcf:	74
Liquid Limit:	31
Plasticity Index:	5
Water Added at:	1 ksf
Percent Collapse:	3.6

PROJECT NO.: 178750	EARTHTEC ENGINEERING	**FIGURE NO.:** 18

APPENDIX A

Timpview Analytical Laboratories
A Chemtech-Ford, Inc. Affiliate
1384 West 130 South Orem, UT 84058 (801) 229-2282

Certificate of Analysis

Earthtec Testing & Engineering
Caleb Allred
1497 W 40 S
Lindon, UT 84042
DW System # :

Work Order #: 17G1276
PO# / Project Name: 178750
Receipt: 7/26/17 14:50
Batch Temp °C: 25.0
Date Reported: 8/1/2017

Sample Name: B-1 @ 2.5
Collected: 7/3/17 10:00 **Matrix:** Solid **Collected By:** Client

Parameter	Lab ID #	Method	Analysis Date / Time	Result	Units	MRL	Flags
Sulfate, Soluble (IC)	17G1276-01	EPA 300.0	7/28/17	107	mg/kg dry	12	
Total Solids	17G1276-01	SM 2540G	7/28/17	80.8	%	0.1	SPH

Comment:

Reviewed by: Joyce Applegate

Joyce Applegate, Project Manager

Flag Legend
SPH = Sample submitted past method specified holding time.

Analyses presented in this report were performed in accordance with the National Environmental Laboratory Accreditation Program by a Chemtech-Ford affiliate company, except where otherwise noted.

1497 West 40 South
Lindon, Utah - 84042
Phone (801) 225-5711

3662 West 2100 South
Salt Lake City, Utah - 84120
Phone (801) 787-9138

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

Geotechnical Study – Revised
26 Acre Property
1000 South 400 West
American Fork, Utah

Project No. 178750

September 26, 2017

Prepared For:

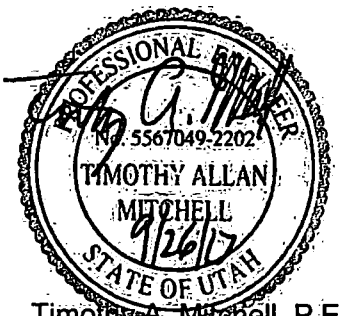
Woodside Homes
Attention: Mr. Garrett Seely
460 West 50 North, Suite 200
American Fork, UT 84101

Prepared By:

EARTHTEC ENGINEERING
Lindon Office

CERTIFICATE

I hereby certify that I am a licensed professional engineer, as defined in the "Sensitive Lands Ordinance" Section of American Fork City Ordinances. I have examined this report to which this certificate is attached and the information and conclusions contained therein are, without any reasonable reservation not stated therein, accurate and complete. Procedures and tests used in this report meet minimum applicable professional standards.



Timothy A. Mitchell, P.E.
Geotechnical Engineer

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APPENDIX A

1.0 EXECUTIVE SUMMARY

This entire report presents the results of Earthtec Engineering's completed geotechnical study for the 26 Acre Property in American Fork, Utah. This executive summary provides a general synopsis of our recommendations and findings. Details of our findings, conclusions, and recommendations are provided within the body of this report.

- The subject property is approximately 26 acres and is proposed to be developed with a new residential subdivision. The proposed structures will consist of conventionally framed, one- to two-story, structures with the possibility of basements. We anticipate foundation loads for the proposed structures will not exceed 5,000 pounds per linear foot for bearing wall, 30,000 pounds for column loads, and 100 pounds per square foot for floor slabs. (see Section 3)
- Our field exploration included the boring of one (1) boring and the excavation of eight (8) test pits to depths of 7 to 31½ feet below the existing ground surface. Groundwater was encountered at depths of approximately 4 to 6½ feet below the existing ground surface. (see Section 5)
- The native soils have a slight to high potential for collapse (settlement) and a slight to high potential for compressibility under increased moisture contents and anticipated load conditions. (see Section 6)
- The subsurface soils encountered generally consisted of topsoil overlying very soft to stiff clay and silt, and loose to dense sand and gravel. All topsoil should be removed beneath the entire building footprints, exterior flatwork, and pavements prior to construction. (see Section 7)
- The silt and sand layers encountered have a "High" potential for liquefaction during a moderate to large earthquake event; should these layers liquefy, we estimate that up to 3 inches of liquefaction-induced settlement and up to ½ foot of liquefaction-induced lateral movements could occur. (see Section 9)
- Conventional strip and spread footings may be used to support the structure, with foundations placed entirely on firm, undisturbed, uniform non-porous, non-organic soils (i.e. completely on clay soils, or completely on sand soils, etc.), or entirely on a minimum 18 inches of properly placed, compacted, and tested structural fill extending to undisturbed native soils. (see Section 10)
- Minimum roadway section consists of 3-inches of asphalt over 10 inches of road-base. Areas that are soft or deflect under construction traffic should be removed and replaced with granular material or structural fill. (see Section 13)

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 in this report are followed and implemented during design and construction.

Failure to consult with Earthtec Engineering (Earthtec) regarding any changes made during design and/or construction of the project from those discussed herein relieves Earthtec from any liability arising from changed conditions at the site. We also strongly recommend that Earthtec observes the building excavations to verify the adequacy of our recommendations presented herein, and that Earthtec performs materials testing and special inspections for this project to provide continuity during construction.

2.0 INTRODUCTION

The project is located at approximately 1000 South 400 West in American Fork, Utah. The general location of the site is shown on Figure No. 1, *Vicinity Map* and Figure No. 2, *Aerial Photograph Showing Location of Boring and Test Pits*, at the end of this report. The purposes of this study are 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, miscellaneous concrete flatwork, and asphalt paved residential streets.

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 the proposed project, as described to us by Mr. Garrett Seely with Woodside Homes, consists of developing the approximately 26-acre existing parcel with a new residential subdivision. The proposed structures will consist of conventionally framed, one- to two-story, structures with the possibility of basements. We have based our recommendations in this report on the assumption that or anticipated foundation loads for the proposed structures will not exceed 5,000 pounds per linear foot for bearing wall, 30,000 pounds for column loads, and 100 pounds per square foot for floor slabs. If structural loads will be greater Earthtec should be notified so that we may review our recommendations and make modifications, if necessary.

In addition to the construction described above, we anticipate that

- Utilities will be installed to service the proposed buildings,
- Exterior concrete flatwork will be placed in the form of curb, gutter, and sidewalks, and
- Asphalt paved residential streets will be constructed.

4.0 GENERAL SITE DESCRIPTION

4.1 Site Description

At the time of our subsurface exploration the site was an undeveloped agricultural field. The ground surface appears to be relatively flat, we anticipate less than 3 feet of cut and fill may be required for site grading. The lot was bounded on all sides by undeveloped agricultural fields.

4.2 Geologic Setting

The subject property is located in the central portion of Utah Valley near the northern shore of Utah Lake. Utah Valley is a deep, sediment-filled basin that is part of the Basin and Range Physiographic Province. The valley was formed by extensional tectonic processes during the Tertiary and Quaternary geologic time periods. The valley is bordered by the Wasatch Mountain Range on the east and the Lake Mountains on the west. Much of northwestern Utah, including Utah Valley, was previously covered by the Pleistocene age Lake Bonneville. Utah Lake, which currently covers much of the western portion of the valley, is a remnant of this ancient fresh water lake. The surficial geology of much of the eastern margin of the valley has been mapped by Constenius, 2011[1]. The surficial geology at the location of the subject site and adjacent properties is mapped as:

- "Fine-grained lacustrine deposits" (Map Unit Qlf) dated to be upper Pleistocene. These soil or deposits are generally described in the referenced mapping as "silt and clay with some fine grained sand."
- "Younger alluvial-fan deposits" (Map Unit Qafy) dated to be Holocene and upper Pleistocene. These soil or deposits are generally described in the referenced mapping as "mostly sand, silt, and gravel that is poorly stratified and poorly sorted."

5.0 SUBSURFACE EXPLORATION

5.1 Soil Exploration

Under the direction of a qualified member of our geotechnical staff, subsurface explorations were conducted at the site on July 3 and 21, 2017 by the boring of one (1) boring and the excavation of eight (8) test pits to depths of 7 to 31½ feet below the existing ground surface using a an all-terrain hydraulic drill rig and a track mounted mini-excavator. The approximate locations of the boring and test pits are shown on Figure No. 2, *Aerial Photograph Showing Location of Boring and Test Pits*. Graphical representations and detailed descriptions of the soils encountered are shown on Figure Nos. 3 through 11, *Boring and Test Pit 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

[1] Constenius, K.N., Clark, D.L., King, J.K., Ehler, J.B., 2011, Interim Geologic Map of the Provo Quadrangle, *Utah, Wasatch and Salt Lake Counties, Utah*; U.S. Geological Survey, Open-File 586DM, Scale 1: 62,500.

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 No. 12, *Legend*.

As required by the American Fork Sensitive Lands Ordinance a 70-foot boring is required to have been performed within 2,000 feet of the site. The boring labeled AF-06-4 is within 2,000 feet of the site.

Samples of the subsurface soils were collected in the borings at depth intervals of approximately 2½ to 5 feet. Relatively undisturbed samples were collected by pushing thin-walled "Shelby" tubes into undisturbed soils below the augers. Disturbed samples were collected with a 1⅜ inch inside diameter split spoon sampler. The split spoon sampler was driven 18 inches into undisturbed soil with a 140-pound hammer free-falling through a distance of 30 inches. The blows required to drive the sampler through the final 12 inches of penetration is called the "N-value" or "blow count," and is recorded as "blows per foot" on the attached boring logs at the respective sample depths. The blow count provides a reasonable indication of the in-place relative density of sandy soils, but provides only a limited indication of the relative stiffness of cohesive (clayey) materials, since the penetration resistance for these soils is a function of the moisture content. In gravelly soils, the blow count may be higher than it otherwise would be, particularly when one or more gravel particles are larger than the sampler diameter. Disturbed bag samples and relatively undisturbed block samples were collected at various depths in each test pit.

The soil samples collected were classified by visual examination in the field following the guidelines of the Unified Soil Classification System (USCS). The samples were transported to our Lindon, Utah laboratory where they will be retained 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 30-day limit.

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, dry density tests, liquid and plastic limits determinations, mechanical (partial) gradation analyses, one-dimensional consolidation tests, organic content burnoff, and a water-soluble sulfate test. The table below summarizes the laboratory test results, which are also included on the attached *Boring and Test Pit Logs* at the respective sample depths, and on Figure Nos. 13 through 18, *Consolidation-Swell Test*.

Table 1: Laboratory Test Results

Boring and Test Pit No.	Depth (ft.)	Natural Moisture (%)	Natural Dry Density (pcf)	Atterberg Limits		Grain Size Distribution (%)			Organic Content (%)	Soil Type
				Liquid Limit	Plasticity Index	Gravel (+ #4)	Sand	Silt/Clay (- #200)		
B-1	7½	28	85	26	4	1	5	94	---	ML
B-1	10	29	---	---	---	0	46	54	---	ML
B-1	15	---	---	30	8	---	---	---	---	CL
B-1	20	---	---	37	16	---	---	---	---	CL
B-1	30	---	---	30	9	---	---	---	---	CL
TP-1	3	34	77	41	22	1	32	67	4.9	CL
TP-2	3	26	88	24	4	3	30	67	---	CL-ML
TP-3	2½	8	---	---	---	51	28	21	---	GM
TP-4	5	4	---	---	---	74	25	1	---	GP
TP-5	2½	24	86	28	7	0	30	70	---	CL-ML
TP-5	4	26	---	20	NP*	4	59	37	---	SM
TP-5	10	---	---	27	4	---	---	---	3.0	ML
TP-6	3	9	87	---	---	2	24	74	---	ML
TP-7	2½	23	74	31	5	1	3	96	---	ML
TP-8	3	---	---	27	6	---	---	---	---	CL-ML

NP* = Non-Plastic

As part of the consolidation test procedure, water was added to the samples to assess moisture sensitivity when the samples were loaded to an equivalent pressure of approximately 1,000 psf. The native soils have a slight to high potential for collapse (settlement) and a slight to high potential for compressibility under increased moisture contents and anticipated load conditions.

A water-soluble sulfate test was performed on a representative sample obtained during our field exploration. Testing indicated a value of 107 parts per million. Based on this result, the risk of sulfate attack to concrete appears to be "negligible" according to American Concrete Institute standards. Therefore, we any type of Portland cement can be used for concrete in contact with on-site soils. The results can be found in Appendix A.

7.0 SUBSURFACE CONDITIONS

7.1 Soil Types

On the surface of the site, we encountered topsoil which is estimated to extend about up to 1½ feet in depth at the boring and test pit locations. Below the topsoil we encountered layers of clay, silt, sand, and gravel extending to depths of 7 to 31½ feet below the existing ground surface. Graphical representations and detailed descriptions of the soils encountered are shown on Figure Nos. 3 through 11, *Boring and Test Pit Log* at the end of this report. Based on the blow counts obtained and our experience and observations during field exploration, the clay

and silt soils visually ranged from very soft to stiff in consistency and the sand and gravel soils visually had a relative density varying from loose to dense.

7.2 Groundwater Conditions

Groundwater was encountered at depths of approximately 4 to 6½ feet below the existing ground surface. Note that groundwater levels will fluctuate in response to the season, precipitation, snow melt, irrigation, and other on and off-site influences. Quantifying these fluctuations would require long term monitoring, which is beyond the scope of this study. The contractor should be prepared to dewater excavations as needed.

8.0 SITE GRADING

8.1 General Site Grading

All surface vegetation and unsuitable soils (such as topsoil, organic soils, undocumented fill, soft, loose, or disturbed native soils, and any other inapt materials) should be removed from below foundations, floor slabs, exterior concrete flatwork, and pavement areas. We encountered topsoil on the surface of the site. The topsoil (including soil with roots larger than about ¼ inch in diameter) should be completely removed, even if found to extend deeper, along with any other unsuitable soils that may be encountered. Over-excavations below footings and slabs also may be needed, as discussed in Section 10.0.

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. Because the site is relatively flat, we anticipate that less than 3 feet of grading fill will be placed. If more than 3 feet of grading fill will be placed above the existing surface (to raise site grades), Earthtec should be notified so that we may provide additional recommendations, if required. Such recommendations will likely include placing the fill several weeks (or possibly more) 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[2] requirements for Type C soils.

8.3 Fill Material Composition

The native soils are not suitable for use as placed and compacted structural fill. Excavated soils, including clay and silt, may be stockpiled for use as fill in landscape areas.

[2] OSHA Health and Safety Standards, Final Rule, CFR 29, part 1926.

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, pavements, etc. We recommend that a professional engineer or geologist verify that the structural fill to be used on this project meets the requirements, stated below. We recommend that structural fill consist of imported sandy/gravelly soils meeting the following requirements in the table below:

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, stricter 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 recommendations 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 and silt 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.

If required (i.e. fill in submerged areas), we recommend that free draining granular material (clean sand and/or gravel) meet the following requirements in the table below:

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 between the free draining fill and the adjacent soil 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 prior to compaction 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 and other areas not below structurally loaded areas: 90%
- Less than 5 feet of fill below structurally loaded areas: 95%
- Greater than 5 feet of fill below structurally loaded areas: 98%

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

Fill should be tested frequently during placement and we recommend early testing to demonstrate that placement and compaction methods are achieving the required compaction. The contractor is responsible 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 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, partially loaded equipment, tracked equipment, by working in dry times of the year, and/or by providing a working surface for equipment. However, because of the relatively shallow depth of groundwater, it is likely that rutting and pumping may not be avoidable.

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. Materials which are more angular and coarse may require thinner lifts in order to achieve compaction. 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 SEISMIC AND GEOLOGIC CONSIDERATIONS

9.1 Seismic Design

The residential structures should be designed in accordance with the 2015 International Residential Code (IRC). The IRC designates this area as a seismic design class D_1.

The site is located at approximately 40.357 degrees latitude and -111.808 degrees longitude from the approximate center of the site. The IRC site value for this property is 0.801g. The design spectral response acceleration parameters are given below.

Table 4: Design Acceleration for Short Period

S_S	F_a	Site Value (S_{DS})
		2/3 S_S*F_a
1.158g	1.037	0.801g

S_S = Mapped spectral acceleration for short periods
F_a = Site coefficient from Table 1613.3.3(1)
S_{DS} = ⅔S_{MS}= ⅔ (F_a·S_s) = 5% damped design spectral response acceleration for short periods

9.2 Faulting

The subject property is located within the Intermountain Seismic Belt where the potential for active faulting and related earthquakes is present. Based upon published geologic maps[3], no active faults traverse through or immediately adjacent to the site and the site is not located

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

within local fault study zones. The nearest mapped fault trace is part of a group of fault beneath Utah Lake located about 1¼ miles south of the site.

9.3 Liquefaction Potential

According to current liquefaction maps[4] for Utah County, the site is located within an area designated as "High" in liquefaction potential. Liquefaction can occur when saturated subsurface soils below groundwater lose their inter-granular strength due to an increase in soil pore water pressures during a dynamic event such as an earthquake. As part of this study, the potential for liquefaction to occur in the soils we encountered was assessed using Youd *et al*[5] and Boulanger & Idriss[6]. Potential liquefaction-induced movements were evaluated using Tokimatsu & Seed[7] and Youd, Hansen & Bartlett[8].

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 clay, silt, sand and gravel soils. Our analysis indicates that approximately up to 3 inches of liquefaction-induced settlement and possibly up to ½ feet of lateral spreading could occur in the vicinity of B-1 during a moderate to large earthquake event. The liquefaction potential at the site can be mitigated by using the following alternative:

- Connect/tie all footings together using reinforced grade beams and connect reinforced slabs to the footings so that the building will react as a cohesive unit. This may result in some tilting of the building due to differential liquefaction-induced movements. The building may also move laterally due to lateral spreading.

10.0 FOUNDATIONS

10.1 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

[4] Utah Geological Survey, Liquefaction-Potential Map for a Part of Utah County, Utah, Public Information Series 28, August 1994
[5] Youd, T.L. (Chair), Idriss, I.M. (Co-Chair), and 20 other authors, 2001, Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, October 2001, p. 817-833.
[6] Boulanger, R.W. and Idriss, I.M., 2006, Liquefaction Susceptibility Criteria for Silts and Clays, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, November 2006, p. 1413-1426.
[7] Tokimatsu, K. and Seed, H.B., 1987, Evaluation of Settlements in Sands due to Earthquake Shaking, Journal of Geotechnical Engineering, ASCE, p. 861-878.
[8] Youd, T.L., Hansen, C.M. and Bartlett, S.F., 2002, Revised Multilinear Regression Equations for Prediction of Lateral Spread Displacement, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, December 2002, p. 1007-1017.

conditions and assumptions related to foundations 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 may be used to support the proposed structures after appropriate removals as outlined in Section 8.1. Foundations should not be installed 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 compacted.

10.2 Strip/Spread Footings

We recommend that conventional strip and spread foundations be constructed entirely on firm, undisturbed, uniform non-porous, non-organic soils (i.e. completely on clay soils, or completely on sand soils, etc.), or entirely on a minimum 18 inches of properly placed, compacted, and tested structural fill extending to undisturbed native soils For foundation design we recommend the following:

- Footings founded on native soils may be designed using a maximum allowable bearing capacity of 1,500 pounds per square foot. Footings founded on a minimum 18 inches of structural fill may be designed using a maximum allowable bearing capacity of 2,000 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 2015 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 with at least 4 passes of an approved non-vibratory roller prior to erection of forms or placement of structural fill to densify soils that may have been loosened during excavation and to identify soft spots. 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.
- Because of shallow groundwater conditions encountered at the site, we anticipate that 24 inches of structural fill will be required below the proposed structure to provide a firm surface upon which to construct the proposed structure. In lieu of traditional structural fill, clean 1- to

2-inch clean gravel may be used in conjunction with a stabilization fabric, such as Mirafi 600X or equivalent, which should be placed between the native soils and the clean gravel (additional recommendations for placing clean gravel and stabilization fabric are given in Section 8.5 of this report).

- Due to shallow groundwater encountered at the site, lowest floor slab depths should be limited to 1 foot below existing site grades. This is intended to provide a minimum of 3 feet of separation between the observed groundwater condition and the bottom of the floor slab.
- 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 is 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.

10.3 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 a seismic event due to ground shaking, if more than 3 feet of grading fill is placed above the existing ground surface, if loading conditions are greater than anticipated in Section 3, and/or if foundation soils are allowed to become wetted.

10.4 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 dependent 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 are 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 native soils as backfill material using a 30° friction angle and a dry unit weight of 110 pcf.

Table 5: Lateral Earth Pressures (Static and Dynamic)

Condition	Case	Lateral Pressure Coefficient	Equivalent Fluid Pressure (pcf)
Active	Static	0.33	37
	Seismic	0.50	55
At-Rest	Static	0.50	55
	Seismic	0.71	78
Passive	Static	3.00	330
	Seismic	3.92	431

*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 0.30 for native clays and silts, 0.40 for native sands, and 0.55 for native gravels or structural fill meeting the recommendations presented herein. Concrete or masonry walls shall be selected and constructed in accordance to the provision of Section R404 of the 2015 International Residential Code or sections referenced therein. Retaining wall lateral resistance design should further reference Section R404.4 for reference of Safety Factors.

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.

11.0 FLOOR SLABS AND FLATWORK

Due to shallow groundwater encountered at the site, lowest floor slab depths should be limited to 1 foot below existing site grades. This is intended to provide a minimum of 3 feet of separation between the observed groundwater condition and the bottom of the floor slab.

Concrete floor slabs and exterior flatwork may be supported on native non-porous soils or 12 inches of properly placed and compacted structural fill after appropriate removals and grading as outlined in Section 8.1 are completed. We recommend placing a minimum 4 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 exterior flatwork, we recommend placing a minimum 4 inches of road-base material. Prior to placing the free-draining fill or road-base materials, the native sub-grade 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 sub-grade reaction of 120 pounds per cubic inch. The thickness of slabs supported directly on the ground shall not be less than 3½ inches. A 6-mil polyethylene vapor retarder with joints lapped not less than 6 inches shall be placed between the ground surface and the concrete, as per Section R506 of the 2015 International Residential Code.

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.

12.0 DRAINAGE

12.1 Surface Drainage

Due to the collapse potential of native soils within the upper 4½ feet, wetting of subsurface soils (including those below foundations) could result in adverse settlement. Accordingly, we recommend the following:

- The contractor should take precautions to prevent significant wetting of the soil at the base of the excavation. 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.
- Adequate compaction of foundation wall 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 10 inches in the first 10 feet.
- Roof runoff should be collected in rain gutters with down spouts designed to discharge well outside of the backfill limits, or at least 10 feet from foundations, whichever is greater.
- Sprinkler nozzles should be aimed away, and all sprinkler components kept at least 10 feet, from foundation walls. Also, sprinklers should not be placed at the top or on the face of slopes. Sprinkler systems should be designed with proper drainage and well maintained.

Over-watering should be avoided.

- Any additional precautions which may become evident during construction.

12.2 Subsurface Drainage

Section R405.1 of the 2015 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." Section R310.2.3.2 of the 2015 International Residential Code states, "Window wells shall be designed for proper drainage by connecting to the building's foundation drainage system." 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. The soils observed in the explorations at the depth of foundation consisted primarily of silt (ML) and clay (CL) which are not Group 1 soils. If basements are built, 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.
- A perforated 4-inch minimum diameter pipe should be installed in all window wells and connected to the foundation drain.
- 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.
- 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.

13.0 PAVEMENT RECOMMENDATIONS

We understand that asphalt paved residential streets will be constructed as part of the project. The native soils encountered beneath the topsoil during our field exploration were predominantly composed of clays. We estimate that a California Bearing Ratio (CBR) value of 3 is appropriate for these soils. Also, the near-surface native soils are potentially collapsible, and over-excavation may be needed to minimize the potential settlement of pavements. If the topsoil is left beneath concrete flatwork and pavement areas, increased maintenance costs over time should be anticipated.

We anticipate that the traffic volume will be about 1,000 vehicles a day (27.3 ESAL/day) or less for the residential streets, consisting of mostly cars and pickup trucks, with a daily delivery truck and a weekly garbage truck. Based on these traffic parameters, the estimated CBR given above, and the procedures and typical design inputs outlined in the UDOT Pavement Design Manual (1998), we recommend the minimum asphalt pavement section presented below.

Table 6: Pavement Section Recommendations

Asphalt Thickness (in)	Compacted Roadbase Thickness (in)	Compacted Subbase Thickness (in)
3	10*	0

* Stabilization may be required

If the pavement will be required to support construction traffic, more than an occasional semi-tractor or fire truck, or more traffic than listed above, our office should be notified so that we can re-evaluate the pavement section recommendations. The following also apply:

- The subgrade should be prepared by proof rolling to a firm, non-yielding surface, with any identified soft areas stabilized as discussed above in Section 8.5.
- Site grading fills below the pavements should meet structural fill composition and placement recommendations per Sections 8.3 and 8.4 herein.
- Asphaltic concrete, aggregate base and sub-base material composition should meet local, APWA or UDOT requirements.
- Aggregate base and sub-base is compacted to local, APWA, or UDOT requirements, or to at least 95 percent of maximum dry density (ASTM D 1557).
- Asphaltic concrete is compacted to local or UDOT requirements, or to at least 96 percent of the laboratory Marshall density (ASTM D 6927).

14.0 GENERAL CONDITIONS

The exploratory data presented in this report was collected to provide geotechnical design recommendations for this project. The explorations 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 explorations may occur and which may be sufficient to require modifications in the design. If during construction, conditions are different than presented in this report, Earthtec should be advised immediately 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 warranty or representation is intended in our proposals, contracts, letters, 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 regarding any changes made during design and construction of the project from those discussed herein. Failure to consult with Earthtec regarding any such changes relieves Earthtec from any liability arising from changed conditions at the site.

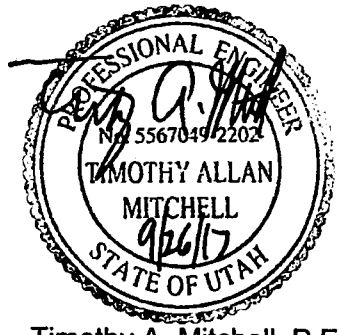
To maintain continuity, Earthtec should also perform materials testing and special inspections for this project. The recommendations presented herein are based on the assumption that an adequate program of tests and observations will be followed during construction to verify compliance with our recommendations. 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 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 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.

Respectfully;

EARTHTEC ENGINEERING

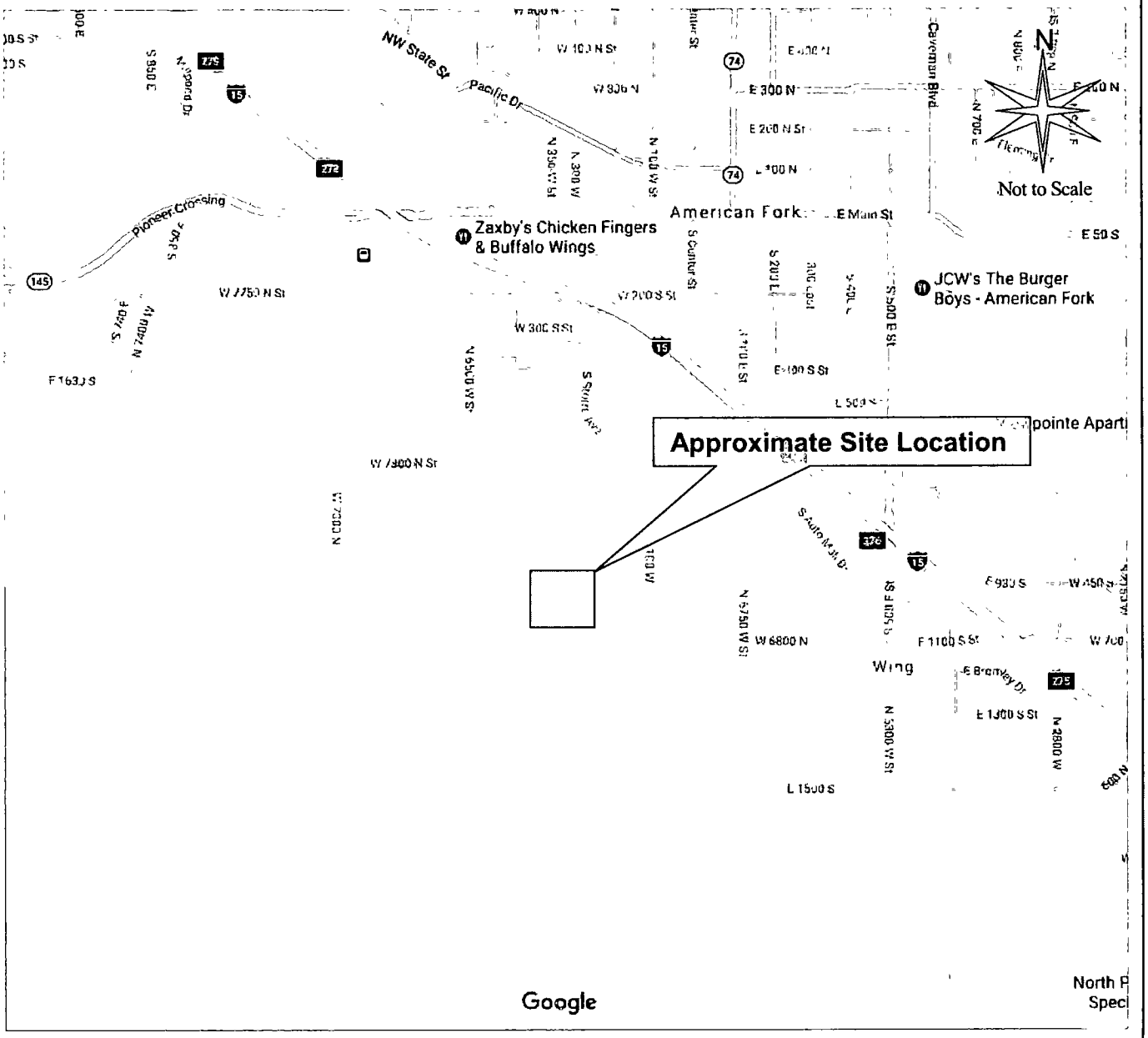
Jeremy A. Balleck, E.I.T.
Staff Engineer



Timothy A. Mitchell, P.E.
Geotechnical Engineer

VICINITY MAP

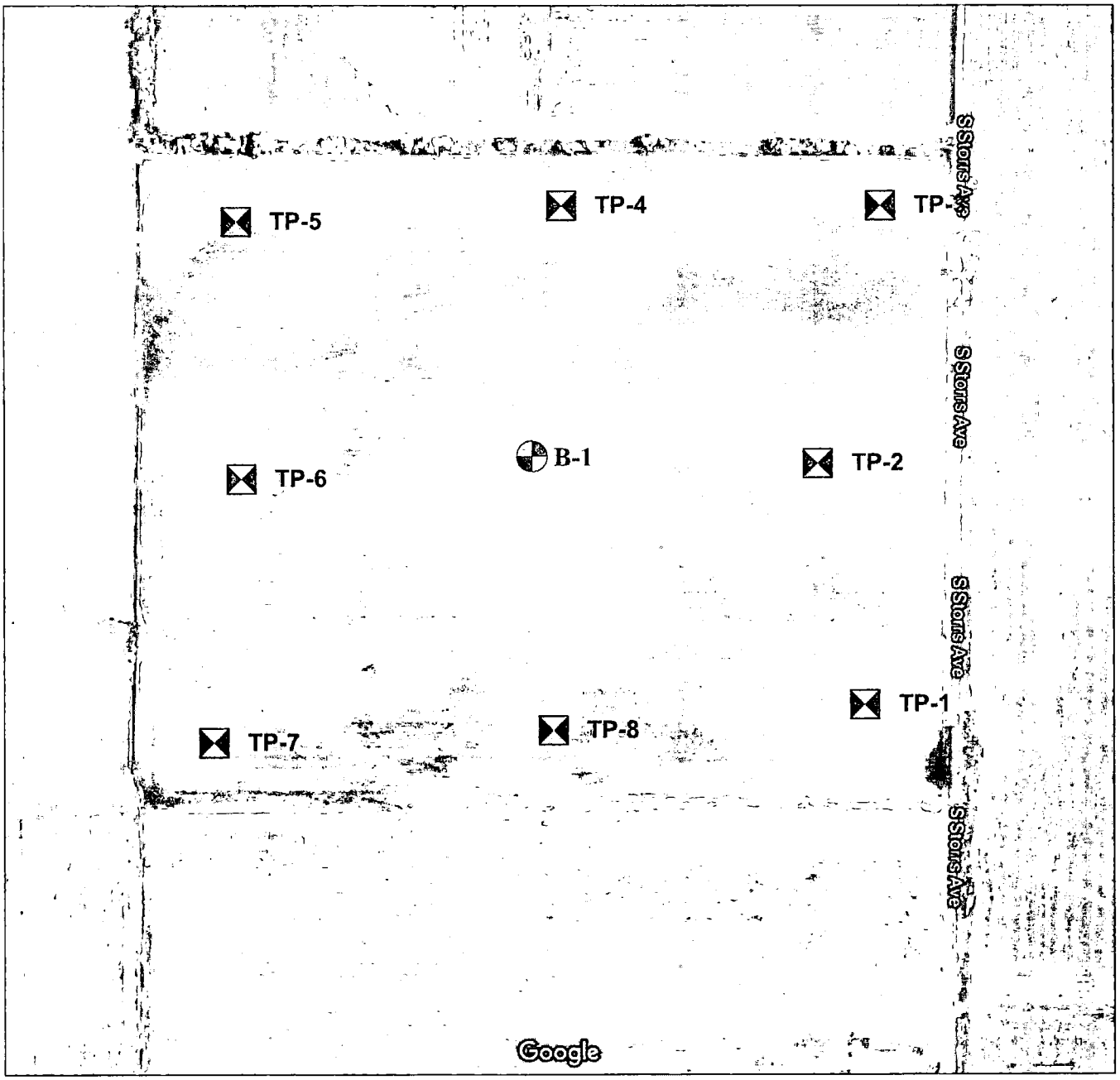
26 Acre Property
1000 South 400 West
American Fork, Utah



PROJECT NO.: 178750	EARTHTEC ENGINEERING	FIGURE NO.: 1

AERIAL PHOTOGRAPH SHOWING LOCATION OF BORING AND TEST PITS

26 Acre Property
1000 South 400 West
American Fork, UTAH



Approximate Boring Locations

Approximate Test Pit Locations

N

Not to Scale

PROJECT NO.: 178750	EARTHTEC ENGINEERING	FIGURE NO.: 2

BORING LOG

NO.: B-1

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Great Basin
EQUIPMENT: ATV Drill Rig
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/03/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼: 6.5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Blows per foot	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL, sandy lean clay, dry to moist, brown										
		SM	Silty SAND with gravel, loose, moist, gray to brown										
3					5								SS
		CL	Lean CLAY, soft, moist to wet, brown										
6					3								
		ML	SILT, soft (estimated), wet, brown			28	85	26	4	1	5	94	C
9													
		ML	Sandy SILT, very soft, wet, brown		1	29				0	46	54	
12													
15		CL	Lean CLAY, soft to stiff, wet, brown		3			30	8				

Notes: Groundwater encountered at approximatly 6½ feet

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

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 3a

LOG OF TESTHOLE 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

BORING LOG

NO.: B-1

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Great Basin
EQUIPMENT: ATV Drill Rig
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/03/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼: 6.5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Blows per foot	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
18		CL	Lean CLAY, soft to stiff, wet, brown										
21					12			37	16				
24													
27					13								
30					7			30	9				
33			Maximum depth explored approximately 31½ feet										

Notes: Groundwater encountered at approximatly 6½ feet

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

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 3b

LOG OF TESTHOLE 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-1

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼: 5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0												
1			TOPSOIL, sandy lean clay, dry to moist, brown									
2		CL	Sandy Lean CLAY, medium stiff (estimated), moist to wet, brown, some interbedded sand layers, roots to 3'									
3					34	77	41	22	1	32	67	C, B
4												
5												
6												
7												
8												
9			Maximum depth explored approximately 8 feet									
10												
11												
12												
13												
14												
15												
16												
17												

Notes: Groundwater encountered at approximatly 5 feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 4

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-2

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼: 5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0												
1			TOPSOIL, sandy lean clay, dry to moist, brown, roots									
2			Sandy Silty CLAY, medium stiff (estimated), moist to wet, brown, roots to 3½'									
3												
4					26	88	24	4	3	30	67	C
5		CL-ML										
6												
7			... cemented nodules									
8		SM	Silty SAND, loose to medium dense (estimated), wet, brown									
9			Maximum depth explored approximately 8½ feet									
10												
11												
12												
13												
14												
15												
16												
17												

Notes: Groundwater encountered at approximatly 5 feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 5

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-3

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼: 4.5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL, lean clay, dry to moist, brown, roots									
1												
2		CL	Lean CLAY, medium stiff (estimated), moist, brown, roots									
3		GM	Silty GRAVEL with sand, medium dense to dense (estimated), moist to wet, gray	X	8				51	28	21	
4												
5												
6												
7		SP	Poorly Graded SAND, medium dense (estimated), wet, brown	X								
8												
9		CL	Lean CLAY, stiff (estimated), wet, brown, interbedded sand layers									
10			Maximum depth explored approximately 8½ feet due to test pit cave in									
11												
12												
13												
14												
15												
16												
17												

Notes: Groundwater encountered at approximatly 4½ feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 6

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-4

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼: 5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL, lean clay, moist, brown									
1												
2			Poorly Graded GRAVEL with sand, medium dense to dense (estimated), moist to wet, gray, cobbles									
3												
4												
5		GP ▼										
				X	4				74	25	1	
6												
7												
8			Maximum depth explored approximately 8 feet									
9												
10												
11												
12												
13												
14												
15												
16												
17												

Notes: Groundwater encountered at approximatly 5 feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 7

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-5

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼: 5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0					TEST RESULTS							
1			TOPSOIL, silty clay, moist, brown									
2		CL-ML	Sandy Silty CLAY, medium stiff (estimated), moist, brown									
3				■	24	86	28	7	0	30	70	C
4			Silty SAND, medium dense (estimated), moist to wet, brown									
5		SM		☒	26		20	NP	4	59	37	
6												
7			SILT, medium stiff (estimated), wet, red-brown	☒								
8												
9		ML										
10			... gray, organic material	■			27	4				B
11												
12			Maximum depth explored approximately 11 feet									
13												
14												
15												
16												
17												

Notes: Groundwater encountered at approximatly 5 feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 8

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-6

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼: 6.5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL, silty sand, dry, gray									
1												
2		ML	SILT with sand, medium stiff (estimated), dry, brown, roots, pinholes									
3				■	9	87			2	24	74	C
4		CL	Lean CLAY, medium stiff (estiamted) moist, gray, oxide stains, cemented nodules									
5												
6												
7		SM	Silty SAND, medium dense (estimated) wet, gray									
8												
9		CL-ML	Silty CLAY, medium stiff (estimated), wet, brown	■								
10												
11			Maximum depth explored approximately 10½ feet									
12												
13												
14												
15												
16												
17												

Notes: Groundwater encountered at approximatly 6½ feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 9

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-7

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼: 5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0												
1			TOPSOIL, silty sand, moist, brown									
2			SILT, medium stiff (estimated), moist, gray, roots, pinholes									
3		ML		■	23	74	31	5	1	3	96	C
4												
5			▼Lean CLAY, medium stiff to stiff (estimated), wet, brown to gray									
6												
7		CL	... mottled, some cemented nodules	■								
8												
9												
10		SP	Poorly Graded SAND, medium dense (estimated), wet, gray									
11			Maximum depth explored approximately 10 feet									
12												
13												
14												
15												
16												
17												

Notes: Groundwater encountered at approximatly 5 feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 10

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

TEST PIT LOG
NO.: TP-8

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
LOCATION: See Figure 2
OPERATOR: Blaine Hone Excavation
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽:

PROJECT NO.: 178750
DATE: 07/21/17
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼: 4 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL, sandy lean clay, dry, brown									
1												
2			Silty CLAY, medium stiff to stiff (estimated), moist to wet, dark brown to gray									
3												
4		CL-ML ▼					27	6				
5												
6												
7												
8			Maximum depth explored approximately 7 feet due to test pit cave in									
9												
10												
11												
12												
13												
14												
15												
16												
17												

Notes: Groundwater encountered at approximatly 4 feet

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 11

LOG OF TESTPIT 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

LEGEND

PROJECT: 26 Acre Property
CLIENT: Woodside Homes
DATE: 07/03/17 - 07/21/17
LOGGED BY: J. Balleck

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.

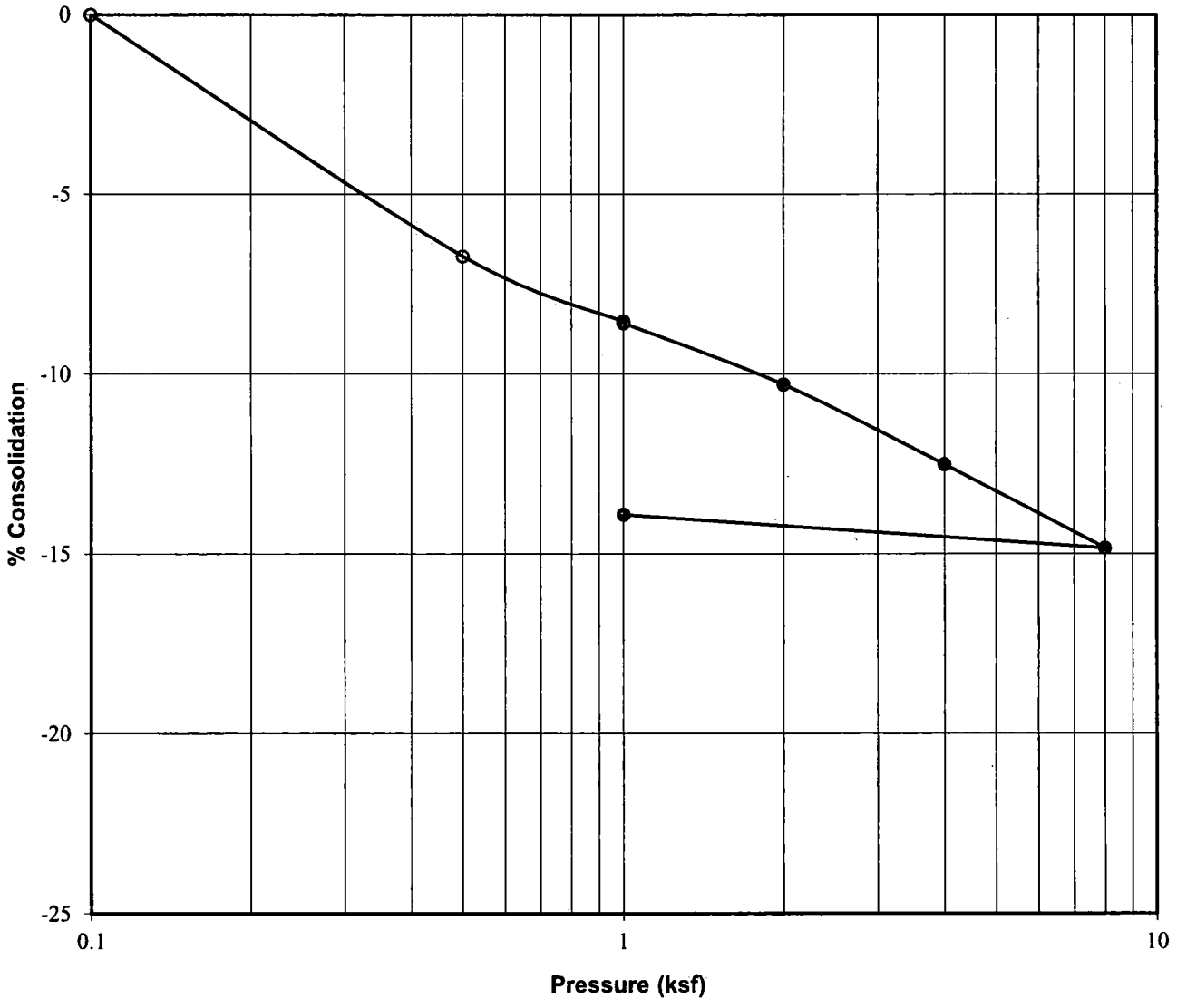
PROJECT NO.: 178750

EARTHTEC ENGINEERING

FIGURE NO.: 12

LEGEND 178750 LOGS.GPJ EARTHTEC.GDT 8/16/17

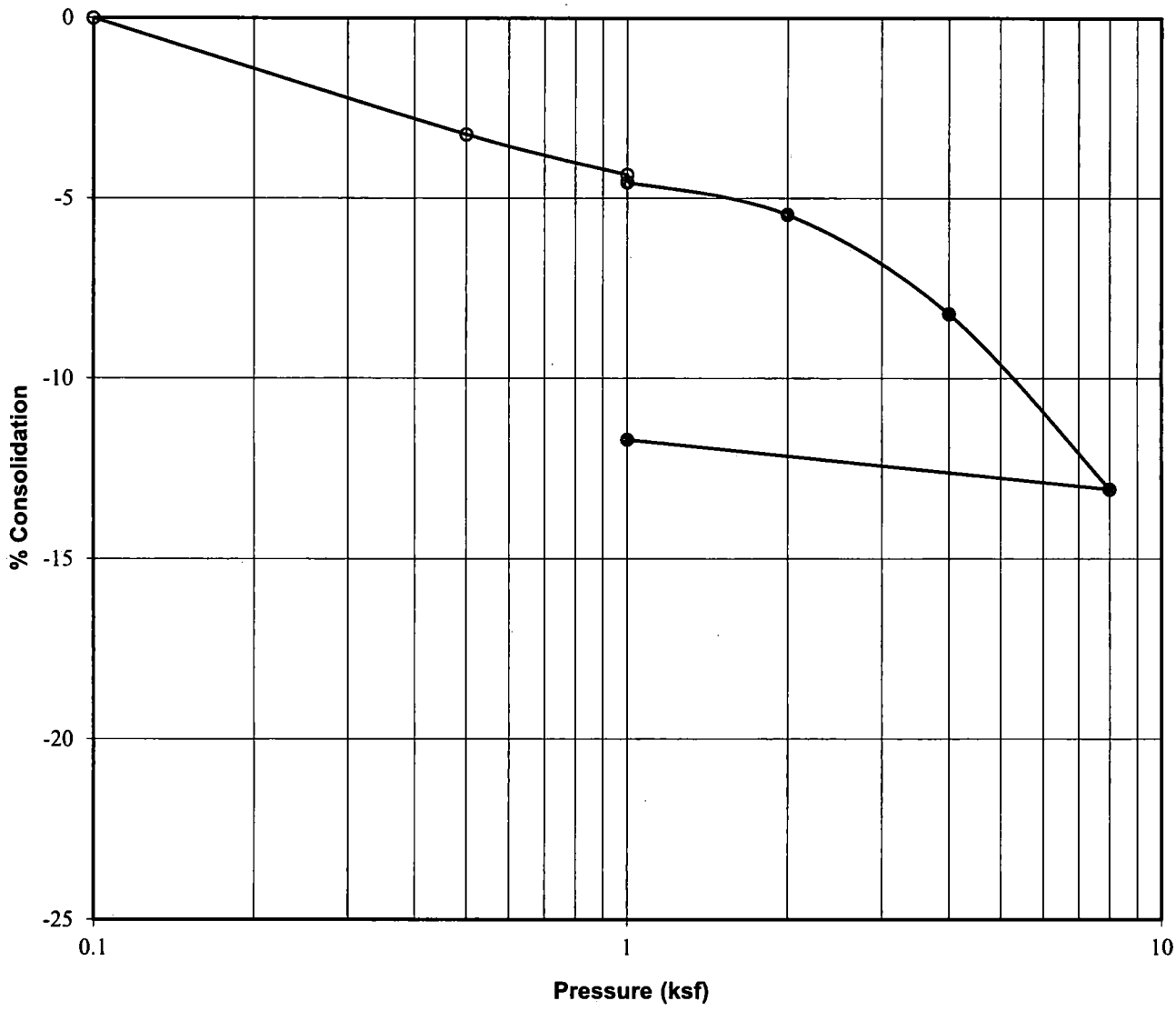
CONSOLIDATION - SWELL TEST



Project:	26 Acre Property
Location:	B-1
Sample Depth, ft:	7½
Description:	Shelby
Soil Type:	SILT (ML)
Natural Moisture, %:	28
Dry Density, pcf:	85
Liquid Limit:	26
Plasticity Index:	4
Water Added at:	1 ksf
Percent Collapse:	0.1

PROJECT NO.: 178750	EARTHTEC ENGINEERING	**FIGURE NO.:** 13

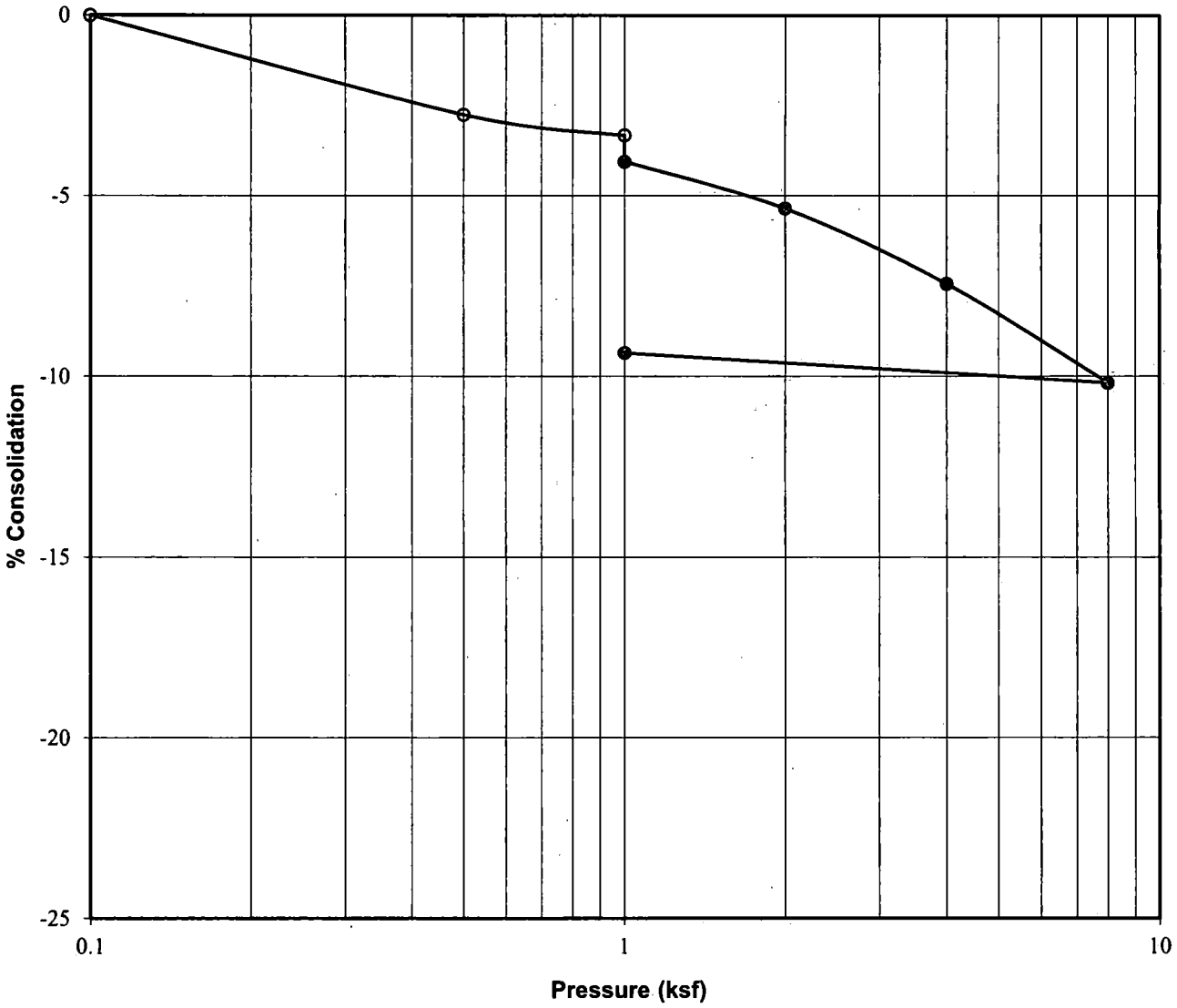
CONSOLIDATION - SWELL TEST



Project:	26 Acre Property
Location:	TP-1
Sample Depth, ft:	3
Description:	Block
Soil Type:	Sandy Lean CLAY (CL)
Natural Moisture, %:	34
Dry Density, pcf:	77
Liquid Limit:	41
Plasticity Index:	22
Water Added at:	1 ksf
Percent Collapse:	0.2

PROJECT NO.: 178750	EARTHTEC ENGINEERING	**FIGURE NO.:** 14

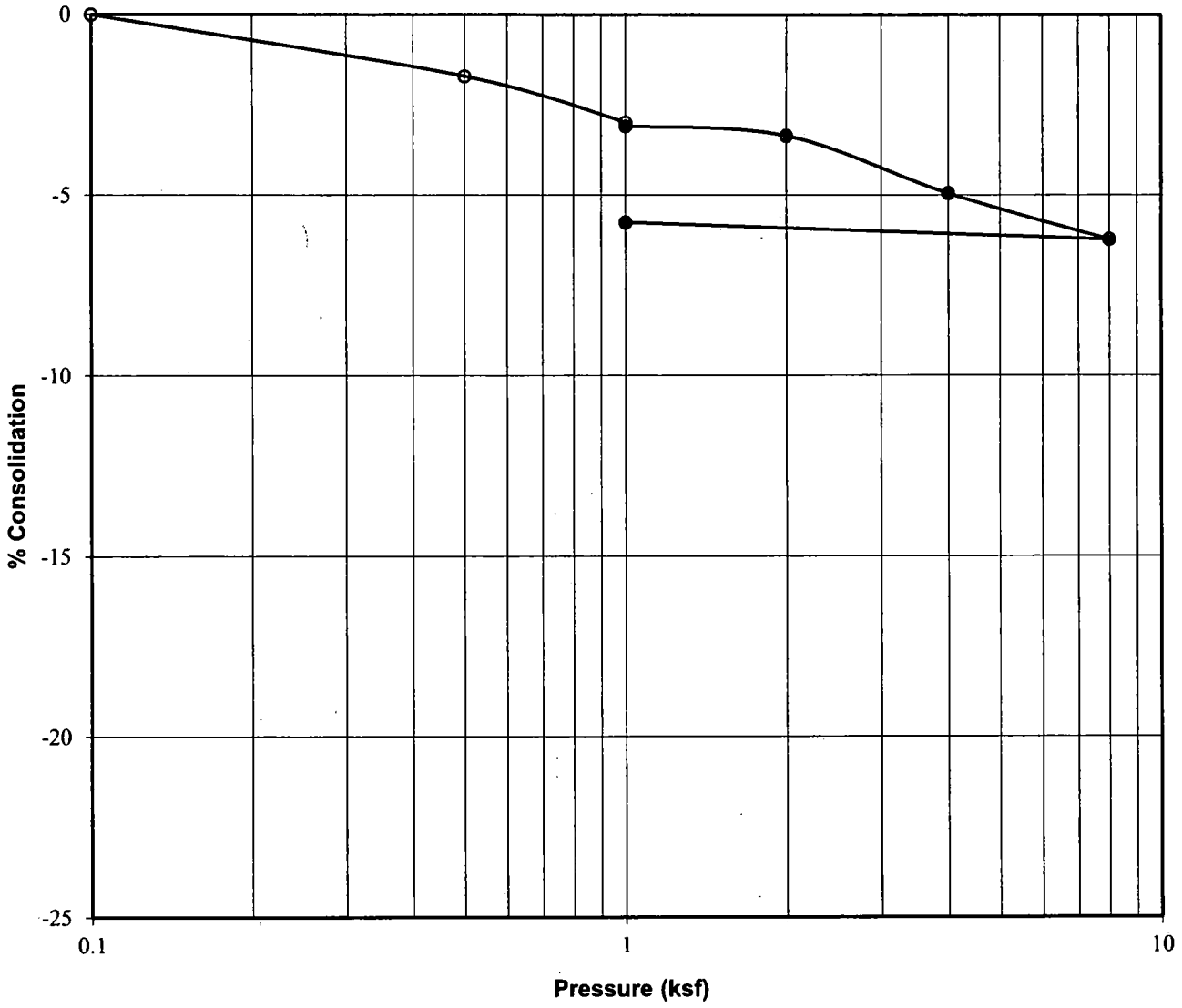
CONSOLIDATION - SWELL TEST



Project:	26 Acre Property
Location:	TP-2
Sample Depth, ft:	3
Description:	Block
Soil Type:	Sandy Silty CLAY (CL-ML)
Natural Moisture, %:	26
Dry Density, pcf:	88
Liquid Limit:	24
Plasticity Index:	4
Water Added at:	1 ksf
Percent Collapse:	0.7

PROJECT NO.: 178750	EARTHTEC ENGINEERING	**FIGURE NO.:** 15

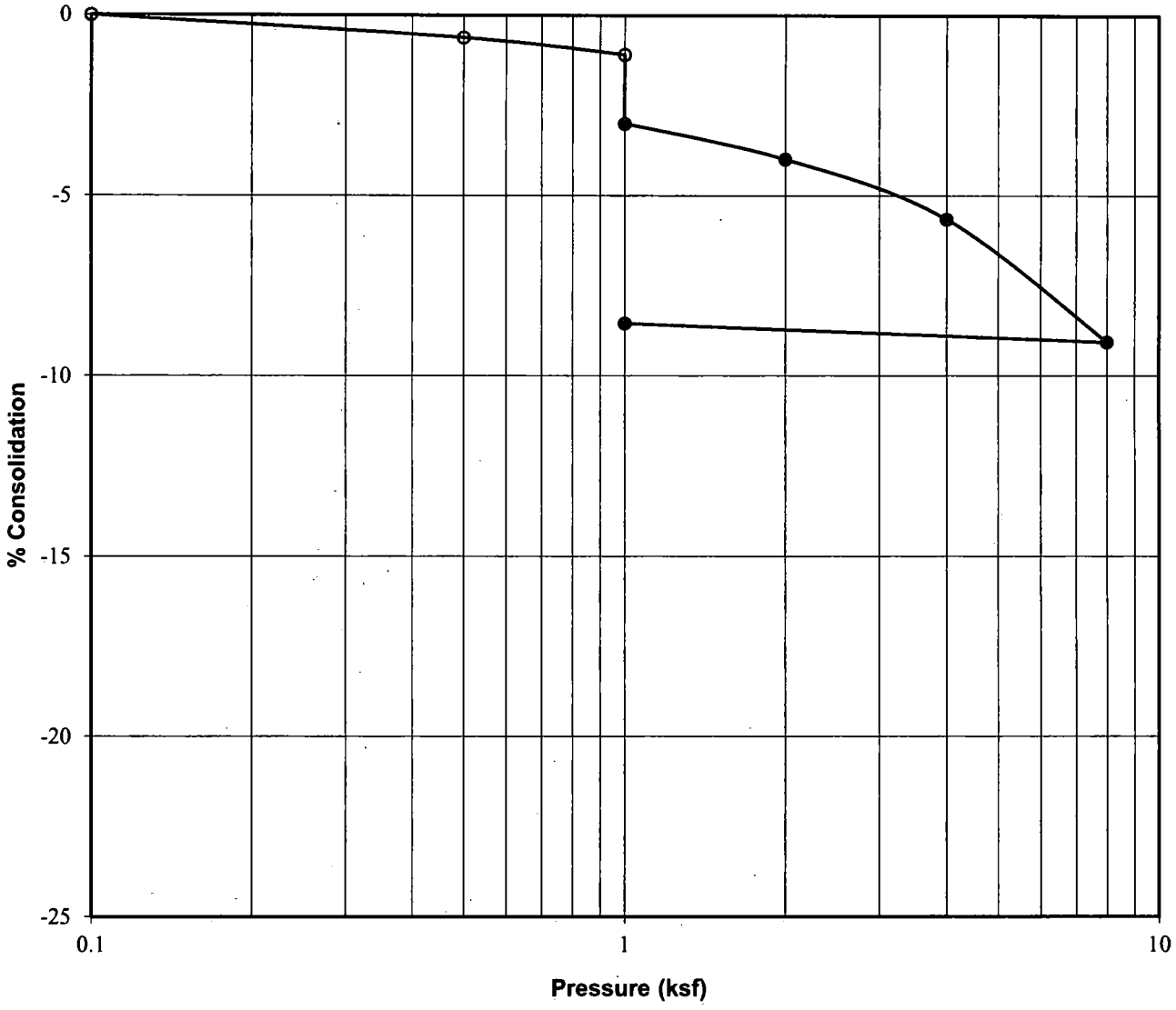
CONSOLIDATION - SWELL TEST



Project:	26 Acre Property
Location:	TP-5
Sample Depth, ft:	2½
Description:	Block
Soil Type:	Sandy Silty CLAY (CL-ML)
Natural Moisture, %:	24
Dry Density, pcf:	86
Liquid Limit:	28
Plasticity Index:	7
Water Added at:	1 ksf
Percent Collapse:	0.1

PROJECT NO.: 178750	EARTHTEC ENGINEERING	**FIGURE NO.:** 16

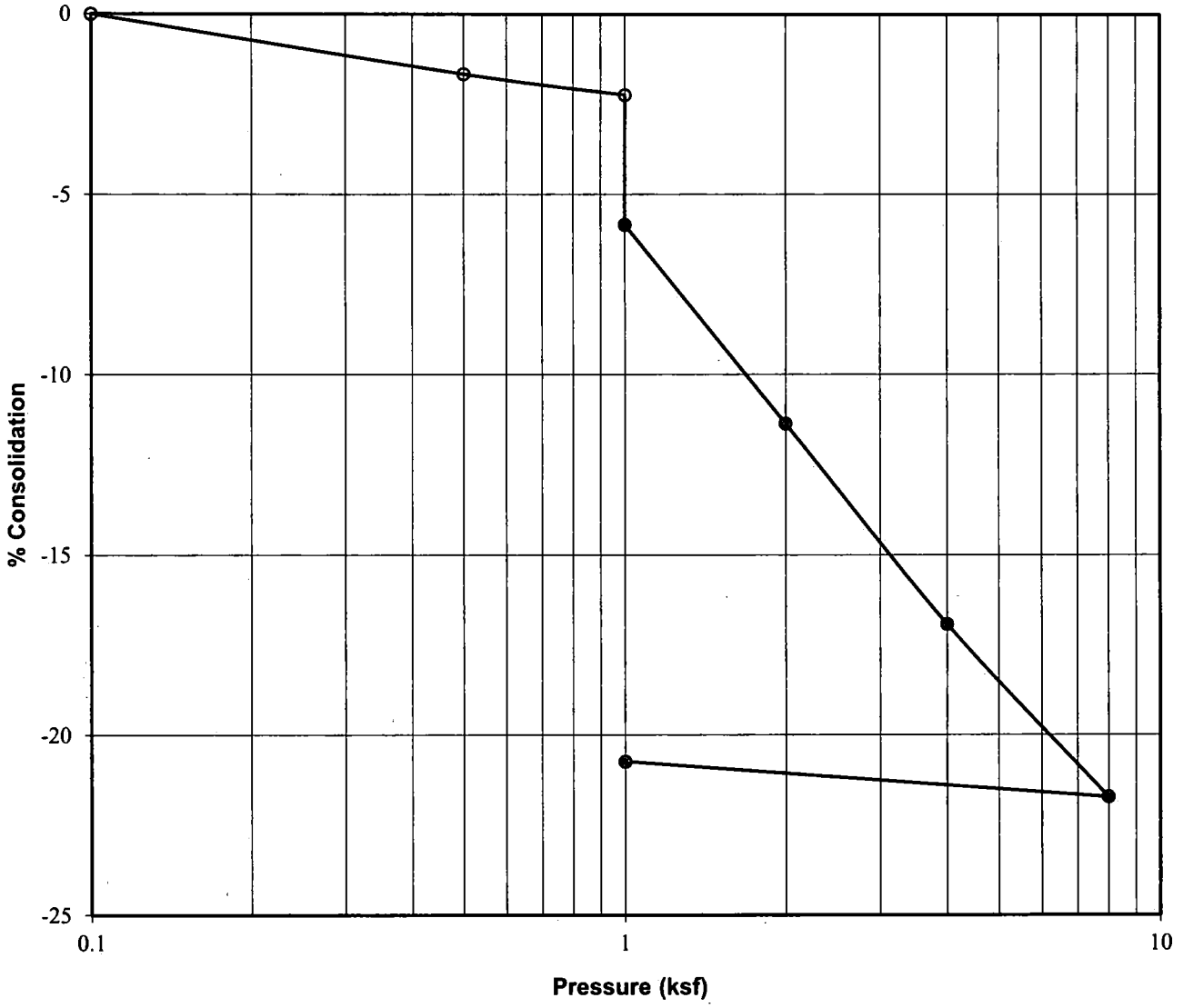
CONSOLIDATION - SWELL TEST



Project:	26 Acre Property
Location:	TP-6
Sample Depth, ft:	3
Description:	Block
Soil Type:	SILT with sand (ML)
Natural Moisture, %:	9
Dry Density, pcf:	87
Liquid Limit:	-
Plasticity Index:	-
Water Added at:	1 ksf
Percent Collapse:	1.9

PROJECT NO.: 178750	EARTHTEC ENGINEERING	**FIGURE NO.:** 17

CONSOLIDATION - SWELL TEST



Project:	26 Acre Property
Location:	TP-7
Sample Depth, ft:	2½
Description:	Block
Soil Type:	SILT (ML)
Natural Moisture, %:	23
Dry Density, pcf:	74
Liquid Limit:	31
Plasticity Index:	5
Water Added at:	1 ksf
Percent Collapse:	3.6

PROJECT NO.: 178750	EARTHTEC ENGINEERING	**FIGURE NO.:** 18

APPENDIX A

Timpview Analytical Laboratories

A Chemtech-Ford, Inc. Affiliate
1384 West 130 South Orem, UT 84058 (801) 229-2282

Certificate of Analysis

Earthtec Testing & Engineering
Caleb Allred
1497 W 40 S
Lindon, UT 84042
DW System # :

Work Order #: 17G1276
PO# / Project Name: 178750
Receipt: 7/26/17 14:50
Batch Temp °C: 25.0
Date Reported: 8/1/2017

Sample Name: B-1 @ 2.5

Collected: 7/3/17 10:00 **Matrix:** Solid **Collected By:** Client

Parameter	Lab ID #	Method	Analysis Date / Time	Result	Units	MRL	Flags
Sulfate, Soluble (IC)	17G1276-01	EPA 300.0	7/28/17	107	mg/kg dry	12	
Total Solids	17G1276-01	SM 2540G	7/28/17	80.8	%	0.1	SPH

Comment:

Reviewed by: Joyce Applegate

Joyce Applegate, Project Manager

Flag Legend

SPH = Sample submitted past method specified holding time.

EARTHTEC ENGINEERING

1497 West 40 South
Lindon, Utah - 84042
Phone (801) 225-5711

3662 West 2100 South
Salt Lake City, Utah - 84120
Phone (801) 787-9138

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

May 25, 2018

Woodside Homes
Attention: Mr. Garrett Seely
460 West 50 North, Suite 200
Salt Lake, UT 84101

Re: **Addendum 1**
26 Acre Property
1000 South 400 West
American Fork, Utah
Job No: 178750

Mr. Seely:

This letter is an addendum to Section **10.2 Strip/Spread Footings** recommendations in the geotechnical study[1]. The study was completed on September 26, 2017 on the 26 Acre Property located in American Fork, Utah.

Based upon updated structural loads provided to us in a memo by Mr. Jacob Ballard with Acute Engineering, Inc. on May 22, 2018, we understand that the structural loads will have a maximum bearing wall load of 2,600 lbs/ft, a maximum column load of 23,000 lbs, and a maximum floor slab load of 50 psf. Based upon the updated structural loads, we recommend that conventional strip and spread foundations be constructed entirely on firm, undisturbed, uniform, non-porous, non-organic, native soils (ie. completely on clay soils, or completely on sand soils, etc.), or entirely on a minimum of 12 inches of properly placed, compacted, and tested structural fill extending to firm, undisturbed, uniform, non-porous, non-organic, native soils. All other recommendations presented in the referenced report remains valid and shall be followed.

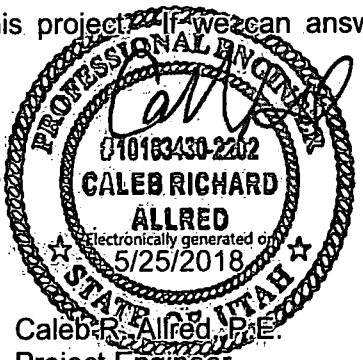
The information presented in this addendum applies to the same general conditions in the geotechnical report. The information and recommendations presented in this letter were conducted within the limits prescribed by our client, with the usual thoroughness and competence of the engineering profession in this area at this time. No warranty or representation is intended in our proposals, contracts, reports, or letters.

[1] Geotechnical Study - Revised, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Engineering Project No. 178750, September 26, 2017.

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please call.

Respectfully;
EARTHTEC ENGINEERING

Timothy A. Mitchell, P.E.
Senior Geotechnical Engineer



Caleb R. Allred, P.E.
Project Engineer

TM/ca

EARTHTEC ENGINEERING

1497 West 40 South
Lindon, Utah - 84042
Phone (801) 225-5711

840 West 1700 South #10
Salt Lake City, Utah - 84104
Phone (801) 787-9138

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

August 25, 2020

Woodside Homes of Utah
460 West 50 South, Suite 300
Salt Lake City, UT 84101

Re: Response to Review
American Fork Property and 26 Acre Property
700 South 400 West and 1000 South 400 West
American Fork, Utah
Job No: 169273 and 178750

Gentlemen:

This letter is a response to the review by CMT, dated July 31, 2020, of our geotechnical reports[1,2] completed in 2017. In addition, an addendum[3] to 178750 was completed on May 25, 2018.

2. The strength of existing soils, bearing capacity of supporting soils, soil settlement estimates, and lateral resistance/pressures were addressed, but were not substantiated; we request that calculations for settlement, bearing capacity (including any graphs used in determining consolidation coefficients) and lateral pressures/lateral resistance be provided for review. CMT previously provided a review (and recommended approval – see letter dated July 19, 2019) of the pavement sections presented in the first referenced report. A pavement section was also provided for residential/local streets in the second referenced report, which does not meet the minimum values required in Sensitive Lands Ordinance areas (see Section 13.1 of the city's Standards and Specifications).

The calculations used for the settlement and bearing capacity, are included at the end of this letter. The structures on this project will be slab-on-grade, therefore; lateral pressures are not required. Consolidation graphs can be found in the referenced reports.

Pavement sections should meet the minimum values as required by the city or the referenced report, whichever is greater.

3. Groundwater levels that may affect the development were addressed, including potential groundwater fluctuations and installing subdrain systems if floor slabs will be placed below the ground surface. However, an estimated depth of high groundwater level (or similar discussion) was not provided, per item 3 of Section 4-2-2 of the Ordinance.

Groundwater was encountered at 6 to 9 feet below the existing ground surface in the explorations in Earthtec Job No. 169273 and 4 to 6½ feet below the existing ground

[1] Geotechnical Study, American Fork Property, 700 South 400 West, American Fork, Utah, Earthtec Engineering, Project No.169273, January 11, 2017.
[2] Geotechnical Study-Revised, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Engineering, Project No.178750, September 26, 2017.
[3] Addendum 1, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Engineering, Project No.178750, May 25, 2018.

surface in the explorations in Earthtec Job No. 178750. No evidence of higher groundwater levels was observed in the soils. In Earthtec Job No. 178750, oxide stains were observed in TP-6 at 3½ feet below the existing ground surface. We understand that the structures will be slab-on-grade. Therefore, floor slabs will not be placed below the ground surface.

General Conditions

The information presented in this letter applies only to the soils encountered during the field investigation on the subject site. It should be noted that Earthtec Engineering was not involved with the selection of the foundation system being used, surface drainage control, floor slab design and construction, backfill compaction requirements against foundation walls, mass grading of the site, or any other aspect of the building construction. Site grading activities completed in other areas such as driveways, sidewalks, or detached structures, were not observed during this site visit, are outside of the scope of our work and are not addressed in this letter. The observations and recommendations presented in this letter were conducted within the limits prescribed by our client, with the usual thoroughness and competence of the engineering profession in this area at this time. No warranty or representation is intended in our proposals, contracts, reports, or letters.

Closure

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please call.

Respectfully;
EARTHTEC ENGINEERING

Jeremy A. Balleck, E.I.T.
Staff Engineer

PROFESSIONAL ENGINEER
No. 5567049-2202
TIMOTHY ALLAN MITCHELL
Electronically generated on 8/25/2020
STATE OF UTAH

Timothy A. Mitchell, P.E.
Senior Geotechnical Engineer

JB/tm

Attachments:
Settlement Calculations
Bearing Capacity Calculations

169273 Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	American Fork Property			TP-2				
B:	3.33333	feet (width or diameter)			b =	1.666667	ft (1/2 width/dia)	
L:	25	feet (length)			l =	12.5	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	30
unit weight:	110.08	pcf (above footing depth)					Strip Load,k:	5
allowable q:	1500	psf						
footing type:	1	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	12	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
CL-ML	0.074	0.001	1300		110.08	0.7	0.5	3.56
GP-GM	0.02	0.0025			130		2.8	1.00
CL-ML	0.074	0.001	1300		110.08	0.7	4.0	1.72
CL	0.076	0.008	2000		117.5	0.1	17.5	1.30

STRIP FOOTINGS...								
	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	0	0.000	0.0	275.2	0.000	0.000	0.00	
CL-ML	0.5	0.990	1484.5	330.2	0.068	0.042	0.11	
GP-GM	1.5	0.850	1275.0	460.2	0.138	0.000	0.25	
GP-GM	2.5	0.668	1002.2	590.2	0.103	0.000	0.35	
GP-GM	2.75	0.629	943.6	622.7	0.024	0.000	0.38	
CL-ML	3.75	0.503	753.8	732.8	0.055	0.084	0.51	
CL-ML	4	0.477	716.0	760.3	0.013	0.021	0.55	
CL	5	0.396	593.7	877.8	0.022	0.012	0.58	
CL	6	0.337	505.0	995.3	0.017	0.012	0.61	
CL	7	0.292	438.4	1112.8	0.014	0.012	0.64	<---2B
CL	8	0.258	386.8	1230.3	0.011	0.012	0.66	
CL	9	0.231	345.8	1347.8	0.010	0.012	0.68	
CL	10	0.208	312.6	1434.1	0.008	0.012	0.70	
CL	11	0.190	285.0	1489.2	0.007	0.012	0.72	
CL	12	0.175	261.9	1544.3	0.007	0.012	0.74	
CL	13	0.161	242.2	1599.4	0.006	0.012	0.76	
CL	14	0.150	225.2	1654.5	0.005	0.012	0.78	
CL	15	0.140	210.5	1709.6	0.005	0.012	0.79	
CL	16	0.132	197.5	1764.7	0.004	0.012	0.81	
CL	17	0.124	186.1	1819.8	0.039	0.012	0.86	
CL	17.5	0.121	180.8	1847.4	0.018	0.006	0.88	

169273 Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	American Fork Property			TP-3				
B:	4.47214	feet (width or diameter)			b =	2.236068	ft (1/2 width/dia)	
L:	4.47214	feet (length)			l =	2.236068	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	30
unit weight:	95.14	pcf (above footing depth)					Strip Load,k:	5
allowable q:	1500	psf						
footing type:	2	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	8	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		1.5	1.00
CL-ML	0.172	0.017	1500		95.14	0.7	2.5	2.55
SM	0.02	0.0025			91	0.2	12.5	1.00

SQUARE/RECTANGULAR FOOTINGS (Boussinesq Method)...

	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	1	0.947	1420.6	372.9	0.008	0.000	0.01	
Fill	1.5	0.861	1291.2	440.4	0.004	0.000	0.01	
CL-ML	2.5	0.644	966.2	535.5	0.092	0.084	0.19	
SM	3.5	0.461	691.6	626.5	0.078	0.024	0.29	
SM	4.5	0.333	499.8	717.5	0.055	0.024	0.37	
SM	5.5	0.247	370.8	808.5	0.039	0.024	0.43	
SM	6.5	0.189	283.0	837.1	0.030	0.024	0.49	
SM	7.5	0.148	221.7	865.7	0.024	0.024	0.53	
SM	8.5	0.118	177.7	894.3	0.019	0.024	0.58	
SM	9.5	0.097	145.3	922.9	0.015	0.024	0.62	<---2B
SM	10.5	0.081	120.8	951.5	0.012	0.024	0.65	
SM	11.5	0.068	101.9	980.1	0.010	0.024	0.69	
SM	12.5	0.058	87.0	1008.7	0.009	0.024	0.72	

178750 Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property							
B:	3.91578	feet (width or diameter)			b =	1.95789	ft (1/2 width/dia)	
L:	3.91578	feet (length)			l =	1.95789	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	23
unit weight:	115	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	2	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	6.5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		1.5	1.00
SM	0.02	0.0025			115		1.0	1.00
CL	0.162	0.015	2500		103.18	0.2	4.0	3.92
ML	0.096	0.01	900		108.8	0.1	12.5	0.91

SQUARE/RECTANGULAR FOOTINGS (Boussinesq Method)...

	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	1	0.926	1389.1	422.5	0.008	0.000	0.01	
SM	1	0.000	0.0	422.5	0.000	0.000	0.01	
CL	2	0.690	1035.6	525.7	0.085	0.024	0.12	
CL	3	0.473	708.9	628.9	0.059	0.024	0.20	
CL	4	0.326	489.2	732.0	0.040	0.024	0.26	
ML	5	0.233	349.5	778.4	0.120	0.012	0.40	
ML	6	0.173	258.9	824.8	0.137	0.012	0.54	
ML	7	0.132	198.2	871.2	0.103	0.012	0.66	
ML	8	0.104	156.0	917.6	0.079	0.012	0.75	<---2B
ML	9	0.084	125.6	964.0	0.061	0.012	0.82	
ML	10	0.069	103.2	1010.4	0.049	0.012	0.88	
ML	11	0.057	86.2	1056.8	0.039	0.012	0.94	
ML	12	0.049	73.0	1103.2	0.032	0.012	0.98	
ML	12.5	0.045	67.5	1126.4	0.015	0.006	1.00	

178750 Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property							
B:	3.91578	feet (width or diameter)			b =	1.95789	ft (1/2 width/dia)	
L:	3.91578	feet (length)			l =	1.95789	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	23
unit weight:	103.18	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	3	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
CL	0.162	0.015	2500		103.18	0.2	9.5	3.64

SQUARE/RECTANGULAR FOOTINGS (Westergard Method)..

	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	0	0.000	0.0	258.0	0.000	0.000	0.00	
CL	1	0.816	1223.4	361.1	0.116	0.024	0.14	
CL	2	0.649	973.6	464.3	0.088	0.024	0.25	
CL	3	0.511	765.9	536.3	0.069	0.024	0.35	
CL	4	0.402	602.3	577.1	0.056	0.024	0.43	
CL	5	0.318	477.2	617.9	0.045	0.024	0.49	
CL	6	0.255	382.4	658.6	0.036	0.024	0.55	
CL	7	0.207	310.5	699.4	0.029	0.024	0.61	
CL	8	0.170	255.5	740.2	0.023	0.024	0.65	<---2B
CL	9	0.142	212.9	781.0	0.019	0.024	0.70	
CL	9.5	0.130	195.3	801.4	0.009	0.012	0.72	

178750 Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property							
B:	3.91578	feet (width or diameter)			b =	1.95789	ft (1/2 width/dia)	
L:	3.91578	feet (length)			l =	1.95789	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	23
unit weight:	111	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	3	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
CL-ML	0.091	0.009	2000		111	0.7	9.5	2.76

SQUARE/RECTANGULAR FOOTINGS (Westergard Method)...

	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	0	0.000	0.0	277.5	0.000	0.000	0.00	
CL-ML	1	0.816	1223.4	388.5	0.067	0.084	0.15	
CL-ML	2	0.649	973.6	499.5	0.051	0.084	0.29	
CL-ML	3	0.511	765.9	579.3	0.040	0.084	0.41	
CL-ML	4	0.402	602.3	627.9	0.032	0.084	0.52	
CL-ML	5	0.318	477.2	676.5	0.025	0.084	0.63	
CL-ML	6	0.255	382.4	725.1	0.020	0.084	0.74	
CL-ML	7	0.207	310.5	773.7	0.016	0.084	0.84	
CL-ML	8	0.170	255.5	822.3	0.013	0.084	0.93	<---2B
CL-ML	9	0.142	212.9	870.9	0.010	0.084	1.03	
CL-ML	9.5	0.130	195.3	895.2	0.005	0.042	1.07	

178750 Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property							
B:	3.91578	feet (width or diameter)			b =	1.95789	ft (1/2 width/dia)	
L:	3.91578	feet (length)			l =	1.95789	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	23
unit weight:	106.64	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	2	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		1.5	1.00
CL-ML	0.053	0.005	2000		106.64	0.1	0.5	4.11
SM	0.02	0.0025			110		3.5	1.00
ML	0.096	0.01	900		110	0.1	12.5	0.98

SQUARE/RECTANGULAR FOOTINGS (Boussinesq Method)...

Soil Type	Below ftg. depth (ft)	Influence	Increased Stress (psf)	avg. ovrbn. press.(psf)	Incremnt. Sett. (in.)	Collapse Sett. (in.)	Total Set. (in.)	
Fill	1	0.926	1389.1	401.6	0.008	0.000	0.01	
Fill	1.5	0.816	1224.3	469.1	0.003	0.000	0.01	
CL-ML	1.5	0.000	0.0	469.1	0.000	0.000	0.01	
SM	2.5	0.573	859.0	579.1	0.095	0.000	0.11	
SM	3.5	0.391	586.8	626.7	0.069	0.000	0.17	
ML	4.5	0.274	411.6	674.3	0.109	0.012	0.30	
ML	5.5	0.200	299.5	721.9	0.075	0.012	0.38	
ML	6.5	0.150	225.7	769.5	0.058	0.012	0.45	
ML	7.5	0.117	175.3	817.1	0.054	0.012	0.52	
ML	8.5	0.093	139.6	864.7	0.075	0.012	0.61	<---2B
ML	9.5	0.076	113.6	912.3	0.059	0.012	0.68	
ML	10.5	0.063	94.1	959.9	0.047	0.012	0.74	
ML	11.5	0.053	79.2	1007.5	0.038	0.012	0.79	
ML	12.5	0.045	67.5	1055.1	0.031	0.012	0.83	

178750 Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property							
B:	3.91578	feet (width or diameter)			b =	1.95789	ft (1/2 width/dia)	
L:	3.91578	feet (length)			l =	1.95789	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	23
unit weight:	94.3	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	3	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	6.5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
ML	0.113	0.006	2300		94.3	1.9	1.0	5.98
CL	0.162	0.015	2500		103.5	0.2	4.0	4.26
SM	0.02	0.0025			115		5.5	1.00
CL-ML	0.053	0.005	2000		107	0.1	12.5	2.05

SQUARE/RECTANGULAR FOOTINGS (Westergard Method)...

	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	0	0.000	0.0	235.8	0.000	0.000	0.00	
ML	1	0.744	1115.4	330.1	0.046	0.228	0.27	
CL	2	0.649	973.6	433.6	0.092	0.024	0.39	
CL	3	0.511	765.9	537.1	0.069	0.024	0.48	
CL	4	0.402	602.3	640.6	0.052	0.024	0.56	
SM	5	0.204	306.1	693.2	0.038	0.000	0.60	
SM	5.5	0.178	266.5	719.5	0.016	0.000	0.61	
CL-ML	6.5	0.229	344.0	764.1	0.010	0.012	0.64	
CL-ML	7.5	0.187	281.2	808.7	0.008	0.012	0.66	
CL-ML	8.5	0.155	232.9	853.3	0.006	0.012	0.67	<---2B
CL-ML	9.5	0.130	195.3	897.9	0.005	0.012	0.69	
CL-ML	10.5	0.110	165.7	942.5	0.004	0.012	0.71	
CL-ML	11.5	0.095	142.0	987.1	0.004	0.012	0.72	
CL-ML	12.5	0.082	122.9	1031.7	0.003	0.012	0.74	

178750 Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property							
B:	3.91578	feet (width or diameter)			b =	1.95789	ft (1/2 width/dia)	
L:	3.91578	feet (length)			l =	1.95789	ft (1/2 length)	
foot. depth:	4.5	feet					Spread Load,k:	23
unit weight:	91.02	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	2	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	4.5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
ML	0.185	0.011	1000		91.02	3.6	0.0	2.33
CL	0.162	0.015	2500		103.5	0.2	4.5	4.08
SP	0.02	0.0025			115		10.5	1.00

SQUARE/RECTANGULAR FOOTINGS (Boussinesq Method)...

Soil Type	Below ftg. depth (ft)	Influence	Increased Stress (psf)	avg. ovrbn. press.(psf)	Incremnt. Sett. (in.)	Collapse Sett. (in.)	Total Set. (in.)	
Fill	0	0.000	0.0	409.6	0.000	0.000	0.00	
ML	0	0.000	0.0	409.6	0.000	0.000	0.00	
CL	1	0.926	1389.1	450.7	0.110	0.024	0.13	
CL	2	0.690	1035.6	491.8	0.089	0.024	0.25	
CL	3	0.473	708.9	532.9	0.066	0.024	0.34	
CL	4	0.326	489.2	574.0	0.048	0.024	0.41	
CL	4.5	0.274	411.6	594.5	0.021	0.012	0.44	
SP	5.5	0.200	299.5	647.1	0.040	0.000	0.48	
SP	6.5	0.150	225.7	699.7	0.029	0.000	0.51	
SP	7.5	0.117	175.3	752.3	0.022	0.000	0.53	
SP	8.5	0.093	139.6	804.9	0.017	0.000	0.55	<---2B
SP	9.5	0.076	113.6	857.5	0.013	0.000	0.56	
SP	10.5	0.063	94.1	910.1	0.010	0.000	0.57	

Project: American Fork Property
Job No. 169273

8/21/2020

Bearing Capacity after Meyerhoff[1]

Allowable Bearing Pressure, $q_{all} = (cN_cs_cd_c + \gamma DN_qs_qd_q + 0.5\gamma BN_\gamma s_\gamma d_\gamma r_\gamma)/(F.S.) \leq q_l$

Friction Angle, ϕ =	28	degrees				N_q =	14.7	$= e^{(\pi \tan\phi)}\tan^2(45+\phi/2)$
Cohesion, c =	0	psf				N_c =	25.8	$= (N_q - 1)\cot\phi$
Effective Unit Weight, γ =	110	pcf	=	17.3	kN/m2	N_g =	11.2	$= (N_q - 1)\tan(1.4\phi)$
Longest Wall Footing Length, L =	25	ft	=	7.6	m	K_p =	2.8	$= \tan^2(45+\phi/2)$
Bearing Pressure Limit, q_l =	2	ksf	=	0.1	mPa			
F.S. =	3.0							shaded areas indicate input values

SUMMARY TABLES

Allowable Wall Footing Bearing Capacity, q_{all} - ksf

Footing	Structural Fill	Width - ft									
Depth, D - ft	Depth, D_f - ft	1.50	1.67	1.83	2.00	2.50	3.00	3.50	4.00	4.50	5.00
1.00	0.00	0.96	0.99	1.02	1.05	1.15	1.26	1.37	1.48	1.59	1.71
2.50	0.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
1.00	2.00	2.41	2.35	2.30	2.27	2.24	2.27	2.32	2.40	2.48	2.58
2.50	2.00	5.04	4.75	4.52	4.32	3.89	3.60	3.39	3.24	3.12	3.02

Allowable Square Column Footing Bearing Capacity, q_{all} - ksf

Footing	Structural Fill	Width - ft									
Depth, D - ft	Depth, D_f - ft	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00
1.00	0.00	1.43	1.56	1.68	1.81	1.94	2.00	2.00	2.00	2.00	2.00
2.50	0.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
1.00	2.00	4.64	4.32	4.15	4.07	4.04	3.92	3.72	3.56	3.42	3.31
2.50	2.00	6.48	5.56	4.94	4.50	4.17	3.92	3.72	3.56	3.42	3.31

1Bowles, Joseph E.; Foundation Analyses and Design; McGraw-Hill; 1988; pgs: 187-196

using Bowles bearing capacity reduction method (r_γ = 1- 0.25 log (B/6), B ≥ 6 ft.).

Wall (Strip) Footing

Width, B =	1.50	1.67	1.83	2.00	2.50	3.00	3.50	4.00	4.50	5.00
s_c =	1.03	1.04	1.04	1.04	1.06	1.07	1.08	1.09	1.10	1.11
$s_q = s_\gamma$ =	1.02	1.02	1.02	1.02	1.03	1.03	1.04	1.04	1.05	1.06
Depth, D =	1									
d_c =	1.22	1.20	1.18	1.17	1.13	1.11	1.10	1.08	1.07	1.07
$d_q = d_\gamma$ =	1.11	1.10	1.09	1.08	1.07	1.06	1.05	1.04	1.04	1.03
r_γ =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
q_{ult} =	2.9	3.0	3.1	3.2	3.5	3.8	4.1	4.4	4.8	5.1
q_{all} =	1.0	1.0	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7
Depth, D =	2.5									
d_c =	1.55	1.50	1.45	1.42	1.33	1.28	1.24	1.21	1.18	1.17
$d_q = d_\gamma$ =	1.28	1.25	1.23	1.21	1.17	1.14	1.12	1.10	1.09	1.08
r_γ =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
q_{ult} =	6.5	6.5	6.5	6.5	6.7	6.9	7.2	7.5	7.8	8.1
q_{all} =	2.2	2.2	2.2	2.2	2.2	2.3	2.4	2.5	2.6	2.7

Square Column Footing

Width, B =	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00
Depth, D =	1.00									
d_c =	1.13	1.11	1.10	1.08	1.07	1.07	1.06	1.06	1.05	1.05
$d_q = d_\gamma$ =	1.07	1.06	1.05	1.04	1.04	1.03	1.03	1.03	1.03	1.02
r_γ =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.98
q_{ult} =	4.3	4.7	5.0	5.4	5.8	6.2	6.6	7.0	7.3	7.7
q_{all} =	1.4	1.6	1.7	1.8	1.9	2.1	2.2	2.3	2.4	2.6
Depth, D =	2.5									
d_c =	1.33	1.28	1.24	1.21	1.18	1.17	1.15	1.14	1.13	1.12
$d_q = d_\gamma$ =	1.17	1.14	1.12	1.10	1.09	1.08	1.08	1.07	1.06	1.06
r_γ =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.98
q_{ult} =	8.3	8.6	8.9	9.2	9.5	9.9	10.2	10.6	10.9	11.2
q_{all} =	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7

Project: 26 Acre Property
Job No. 178750

8/21/2020

Bearing Capacity after Meyerhoff[1]

Allowable Bearing Pressure, $q_{all} = (cN_cs_cd_c + \gamma DN_qs_qd_q + 0.5\gamma BN_\gamma s_\gamma d_\gamma r_\gamma)/(F.S.) \le q_l$

Friction Angle, ϕ =	30	degrees			N_q =	18.4	$= e^{(\pi\tan\phi)}\tan^2(45+\phi/2)$
Cohesion, c =	0	psf			N_c =	30.1	$= (N_q - 1)\cot\phi$
Effective Unit Weight, γ =	110	pcf	=	17.3 kN/m2	N_g =	15.7	$= (N_q - 1)\tan(1.4\phi)$
Longest Wall Footing Length, L =	25	ft	=	7.6 m	K_p =	3.0	$= \tan^2(45+\phi/2)$
Bearing Pressure Limit, q_l =	2	ksf	=	0.1 mPa			
F.S. =	3.0						shaded areas indicate input values

SUMMARY TABLES

Allowable Wall Footing Bearing Capacity, q_{all} - ksf

Footing	Structural Fill	Width - ft									
Depth, D - ft	Depth, D_f - ft	1.50	1.67	1.83	2.00	2.50	3.00	3.50	4.00	4.50	5.00
1.00	0.00	1.26	1.30	1.34	1.39	1.53	1.68	1.84	1.99	2.00	2.00
2.50	0.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
1.00	2.00	3.16	3.08	3.04	3.00	2.98	3.03	3.12	3.23	3.12	3.02
2.50	2.00	5.04	4.75	4.52	4.32	3.89	3.60	3.39	3.24	3.12	3.02

Allowable Square Column Footing Bearing Capacity, q_{all} - ksf

Footing	Structural Fill	Width - ft									
Depth, D - ft	Depth, D_f - ft	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00
1.00	0.00	1.94	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
2.50	0.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
1.00	2.00	6.27	5.56	4.94	4.50	4.17	3.92	3.72	3.56	3.42	3.31
2.50	2.00	6.48	5.56	4.94	4.50	4.17	3.92	3.72	3.56	3.42	3.31

1Bowles, Joseph E.; Foundation Analyses and Design; McGraw-Hill; 1988; pgs: 187-196

using Bowles bearing capacity reduction method (r_γ = 1- 0.25 log (B/6), B ≥ 6 ft.).

Wall (Strip) Footing

Width, B =	1.50	1.67	1.83	2.00	2.50	3.00	3.50	4.00	4.50	5.00
s_c =	1.04	1.04	1.04	1.05	1.06	1.07	1.08	1.10	1.11	1.12
$s_n = s_v$ =	1.02	1.02	1.02	1.02	1.03	1.04	1.04	1.05	1.05	1.06
Depth, D =	1									
d_c =	1.23	1.21	1.19	1.17	1.14	1.12	1.10	1.09	1.08	1.07
$d_n = d_v$ =	1.12	1.10	1.09	1.09	1.07	1.06	1.05	1.04	1.04	1.03
r_v =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
q_{ult} =	3.8	3.9	4.0	4.2	4.6	5.1	5.5	6.0	6.5	6.9
q_{all} =	1.3	1.3	1.3	1.4	1.5	1.7	1.8	2.0	2.2	2.3
Depth, D =	2.5									
d_c =	1.58	1.52	1.47	1.43	1.35	1.29	1.25	1.22	1.19	1.17
$d_n = d_v$ =	1.29	1.26	1.24	1.22	1.17	1.14	1.12	1.11	1.10	1.09
r_v =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
q_{ult} =	8.3	8.3	8.4	8.5	8.7	9.1	9.5	9.9	10.3	10.8
q_{all} =	2.8	2.8	2.8	2.8	2.9	3.0	3.2	3.3	3.4	3.6

Square Column Footing

Width, B =	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00
Depth, D =	1.00									
d_c =	1.14	1.12	1.10	1.09	1.08	1.07	1.06	1.06	1.05	1.05
$d_n = d_v$ =	1.07	1.06	1.05	1.04	1.04	1.03	1.03	1.03	1.03	1.02
r_v =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.98
q_{ult} =	5.8	6.3	6.9	7.4	8.0	8.5	9.1	9.6	10.1	10.6
q_{all} =	1.9	2.1	2.3	2.5	2.7	2.8	3.0	3.2	3.4	3.5
Depth, D =	2.5									
d_c =	1.35	1.29	1.25	1.22	1.19	1.17	1.16	1.14	1.13	1.12
$d_n = d_v$ =	1.17	1.14	1.12	1.11	1.10	1.09	1.08	1.07	1.07	1.06
r_v =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.98
q_{ult} =	11.0	11.4	11.8	12.3	12.7	13.2	13.7	14.3	14.7	15.2
q_{all} =	3.7	3.8	3.9	4.1	4.2	4.4	4.6	4.8	4.9	5.1

TAYLOR GEOTECHNICAL

2650 North 180 East
Lehi, Utah 84043
P. 801-766-3246

December 17, 2021

Mr. Ben Hunter
Project Engineer
American Fork City
51 East Main Street
American Fork, Utah 84003

Subject: **Geotechnical Review No. 1**
Stonecreek Subdivision, Plats H & I
1000 South 400 West
American Fork Utah
TG Project No. 21160

Subject Documents: Earthtec Engineering, Geotechnical Study - Revised, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Mr. Garrett Seely, Woodside Homes, 460 West 50 South, Suite 200, American Fork [sic], UT 84101, September 26, 2017.

Earthtec Engineering, Addendum 1, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Mr. Garrett Seely, Woodside Homes, 460 West 50 South, Suite 200, Salt Lake [sic], UT 84101, May 25, 2018.

Earthtec Engineering, Response to Review, American Fork Property and 26 Acre Property, 700 South 400 West and 1000 South 400 West, American Fork, Utah, Earthtec Project No. 169273 and 178750, prepared for Woodside Homes of Utah, 460 West 50 South, Suite 300, Salt Lake City, UT 84101, August 25, 2020.

Submittal Status: **GEOTECHNICAL SUBMITTAL INCOMPLETE**

Dear Mr. Hunter:

At your request, Taylor Geotechnical (TG) reviewed the above subject documents. The purpose of TG's review is to evaluate whether or not Earthtec Engineering (Earthtec) adequately addresses geotechnical engineering parameters at the site, consistent with concerns for public health, safety, welfare, reasonable professional standards-of-care and the American Fork City Sensitive Lands Ordinance 07-10-47. Section 4-2-2 of the of the American Fork City Sensitive Land Ordinance sub-item (10), states the report must be in accordance with the guidelines and recommendations of the "American Fork Sensitive Lands Geologic Hazards Study," Chapter 5

titled "Conclusions and Recommendations" prepared by RB&G Engineering, Inc., dated December 2006.

TG Conclusion

Based substantially in and on reliance of the technical documentation and assurances provided by Earthtec, including their opinions and conclusions, it is TG's opinion the September 26, 2017, report combined with the May 25, 2018 and August 25, 2020, Earthtec report does not fulfill the requirements of the American Fork City Sensitive Lands Ordinance 07-10-47.

TG Recommendations

Based on the requirements of the American Fork City Sensitive Land Ordinance and the technical documentation provided by Earthtec, TG recommends the City of American Fork not consider the Earthtec submittals complete from a geotechnical perspective until the following items are adequately addressed.

1. The subject site is below elevation 4593 feet. For sites below elevation 4593 feet, the Sensitive Land Ordinance requires the geotechnical report address current groundwater conditions by means of taking measurements at least 24 hours after drill and artesian conditions at the site (see page 17, RBG 2006). The September 26, 2017, Earthtec report did not address artesian conditions at the property in accordance with the American Fork Sensitive Lands Ordinance.

   TG recommends American Fork City request Earthtec address artesian conditions for the proposed development.

2. The RB&G, 2006, report specifies for facilities designed according to the IBC seismic provisions and located within the moderate or high liquefaction hazard zones identified on Figure 6 of the RB&G report, that the recommended Site Class be based on a site-specific subsurface investigation to a depth of at least 30 feet, supplemented by at least one investigation to a depth of at least 70 feet and located within 2,000 feet of the site (see page 17, RGB 2006). The liquefaction hazard of the site should be analyzed with a boring to at least 40 feet within the subject site (see page 18, RBG 2006).

   The September 26, 2017, Earthtec report states on page 4, section 5.1 Soil Exploration, the following: "As required by the American Fork Sensitive Lands Ordinance a 70-foot boring is required to have been performed within 2,000 feet of the site. The boring labeled AF-06-4 is within 2,000 feet of the site."

   The 70-foot deep boring referred to by Earthtec is required for determining the recommended Site Class. A minimum 40 foot deep boring is required for the liquefaction hazard assessment.

TG recommends American Fork City request Earthtec to:

a) *Provide a copy of the boring log AF-06-4;*

b) *Provide a site plan depicting the location of boring AF-06-4 relative to the subject site;*

c) *Substantiate the Site Class based on the referenced AF-06-4 boring and Boring B-1 from the September 26, 2012 report;*

3. The September 26, 2017, Earthtec report states on page 10, section 9.3 Liquefaction Potential, the following: "Our analysis indicates that approximately up to 3 inches of liquefaction-induced settlement and possibly up to ½ feet of lateral spreading could occur in the vicinity of B-1 during a moderate to large earthquake event."

   The September 26, 2017, May 25, 2018 or the August 25, 2020, Earthtec documents provided to TG for review did not contain the calculations of their liquefaction analysis. *TG recommends American Fork request Earthtec provide their calculations to substantiate their conclusions including the output file that substantiates the peak ground acceleration.*

4. In a July 31, 2020, CMT review letter of the September 26, 2017, Earthtec document, CMT requested Earthtec provide " . . . calculations for settlement, bearing capacity (including any graphs used in determining consolidation coefficients) and lateral pressures/lateral resistance be provided for review."

   In response the request, the August 25, 2020, Earthtec document states the following, "The calculations used for the settlement and bearing capacity are included at the end of the this letter. The structures on this project will be slab-on-grade, therefore; lateral pressures are not required. Consolidation graphs can be found in the referenced reports."

   The settlement calculations as provided in the August 25, 2020, Earthtec document used different consolidation coefficients for the same soil type and did not identify from which consolidation graphs the consolidation coefficients were derived. *Therefore, TG recommends American Fork City request Earthtec to:*

   a) *Label on their settlement calculations which consolidation curves go with each of the listed consolidation coefficients;*

   b) *Clarify which settlement calculations substantiate the allowable bearing recommendation presented in the September 26, 2012 report and the May 25, 2018, Addendum report, especially where soft and highly compressible soils were documented.*

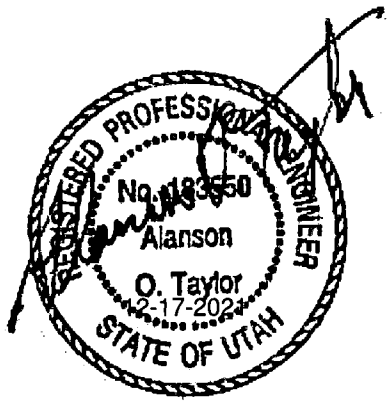
c) *Clarify the potential depth of over-excavation that will be required across the site based the presence of pinhole structured soils, especially in the area of Test Pits 6 through 8.*

CLOSURE

All services performed by Taylor Geotechnical for this review were provided for the exclusive use and benefit of American Fork City. No other person or entity is entitled to use or rely upon any of the information or reports generated by Taylor Geotechnical as a result of this review.

If you have any questions, please feel free to contact the undersigned. The opportunity to be of continued service to American Fork City is appreciated.

Respectfully submitted,
Taylor Geotechnical



Alanson O. Taylor, P.E.
Principal

EARTHTEC ENGINEERING

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May 9, 2022

Woodside Homes of Utah
460 West 50 South, Suite 300
Salt Lake City, UT 84101

Re: Response to Review
26 Acre Property, Stonecreek Subdivision Plats H & I
1000 South 400 West
American Fork, Utah
Job No: 178750

Gentlemen:

This letter is a response to the review by Taylor Geotechnical, dated December 17, 2021, of our geotechnical report[1] completed in 2017. In addition, an addendum[2] was completed on May 25, 2018.

1. The subject site is below elevation 4593 feet. For sites below elevation 4593 feet, the Sensitive Land Ordinance requires the geotechnical report address current groundwater conditions by means of taking measurements at least 24 hours after drill and artesian conditions at the site (see page 17, RBG 2006). The September 26, 2017, Earthtec report did not address artesian conditions at the property in accordance with the American Fork Sensitive Lands Ordinance.

   TG recommends American Fork City request Earthtec address artesian conditions for the proposed development.

   Groundwater was encountered in the explorations at depths of 4 to 6½ feet below the ground surface. No evidence of artesian conditions were encountered in the explorations.

2. The RB&G, 2006, report specifies for facilities designed according to the IBC seismic provisions and located within the moderate or high liquefaction hazard zones identified on Figure 6 of the RB&G report, that the recommended Site Class be based on a site specific subsurface investigation to a depth of at least 30 feet, supplemented by at least one investigation to a depth of at least 70 feet and located within 2,000 feet of the site (see page 17, RGB 2006). The liquefaction hazard of the site should be analyzed with a boring to at least 40 feet within the subject site (see page 18, RBG 2006).

   The September 26, 2017, Earthtec report states on page 4, section 5.1 Soil Exploration, the following: "As required by the American Fork Sensitive Lands Ordinance a 70-foot

[1] Geotechnical Study-Revised, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Engineering, Project No.178750, September 26, 2017.
[2] Addendum 1, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Engineering, Project No.178750, May 25, 2018.

boring is required to have been performed within 2,000 feet of the site. The boring labeled AF-06-4 is within 2,000 feet of the site."

The 70-foot deep boring referred to by Earthtec is required for determining the recommended Site Class. A minimum 40-foot deep boring is required for the liquefaction hazard assessment.

TG recommends American Fork City request Earthtec to:

a) Provide a copy of the boring log AF-06-4;

The boring information from the sensitive lands ordinance is provided at the end of this letter.

b) Provide a site plan depicting the location of boring AF-06-4 relative to the subject site;

An aerial photograph is provided at the end of this letter.

c) Substantiate the Site Class based on the referenced AF-06-4 boring and Boring B-1 from the September 26, 2017 report;

Based on the two borings, we recommend Site Class E based on the thick Fat Clay layer encountered in Boring AF-06-4.

3. The September 26, 2017, Earthtec report states on page 10, section 9.3 Liquefaction Potential, the following: "Our analysis indicates that approximately up to 3 inches of liquefaction-induced settlement and possibly up to ½ feet of lateral spreading could occur in the vicinity of B-1 during a moderate to large earthquake event."

   The September 26, 2017, May 25, 2018 or the August 25, 2020, Earthtec documents provided to TG for review did not contain the calculations of their liquefaction analysis. *TG recommends American Fork request Earthtec provide their calculations to substantiate their conclusions including the output file that substantiates the peak ground acceleration.*

   Liquefaction calculations and seismic design maps are provided at the end of the report.

4. In a July 31, 2020, CMT review letter of the September 26, 2017, Earthtec document, CMT requested Earthtec provide "... calculations for settlement, bearing capacity (including any graphs used in determining consolidation coefficients) and lateral pressures/lateral resistance be provided for review."

   In response the request, the August 25, 2020, Earthtec document states the following, "The calculations used for the settlement and bearing capacity are included at the end of this letter. The structures on this project will be slab-on-grade, therefore; lateral pressures are not required. Consolidation graphs can be found in the referenced reports."

   The settlement calculations as provided in the August 25, 2020, Earthtec document used different consolidation coefficients for the same soil type and did not identify from which consolidation graphs the consolidation coefficients were derived. *Therefore, TG recommends American Fork City request Earthtec to:*

a) Label on their settlement calculations which consolidation curves go with each of the listed consolidation coefficients;

Updated settlement calculations are provided at the end of the letter with the Figure number of the consolidation tests used.

b) Clarify which settlement calculations substantiate the allowable bearing recommendation presented in the September 26, 2017 report and the May 25, 2018, Addendum report, especially where soft and highly compressible soils were documented.

Each of the settlement calculations use an allowable bearing capacity of 1,500 psf.

c) Clarify the potential depth of over-excavation that will be required across the site based the presence of pinhole structured soils, especially in the area of Test Pits 6 through 8.

Pinhole structured soils were encountered in test pits 6 and 7. At test pit 6, the porous soils were observed from 1 to 3½ below the existing ground surface and in test pit 7, the porous soils were observed from 1 to 4½ feet below the existing ground surface.

General Conditions

The information presented in this letter applies only to the soils encountered during the field investigation on the subject site. It should be noted that Earthtec Engineering was not involved with the selection of the foundation system being used, surface drainage control, floor slab design and construction, backfill compaction requirements against foundation walls, mass grading of the site, or any other aspect of the building construction. Site grading activities completed in other areas such as driveways, sidewalks, or detached structures, were not observed during this site visit, are outside of the scope of our work and are not addressed in this letter. The observations and recommendations presented in this letter were conducted within the limits prescribed by our client, with the usual thoroughness and competence of the engineering profession in this area at this time. No warranty or representation is intended in our proposals, contracts, reports, or letters.

Closure

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please call.

Respectfully;
EARTHTEC ENGINEERING

Jeremy A. Balleck, E.I.T.
Staff Engineer

Timothy A. Mitchell, P.E.
Senior Geotechnical Engineer

JB/tm

Attachments:
Log Information for AF-06-4

Aerial Photograph Showing Location of Boring AF-06-4 in relation to subject site
Liquefication Calculations
Seismic Design Maps
Settlement Calculations

DRILL HOLE LOG

BORING NO. 06-04

SHEET 1 OF 2

PROJECT: AMERICAN FORK SENSITIVE LAND STUDY
CLIENT: HORROCKS ENGINEERS
LOCATION: SOUTH END OF 6500 WEST
DRILLING METHOD: CME-55 NO. 1 / N.W. CASING
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ▽ ARTESIAN' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200601.022
DATE STARTED: 8/22/06
DATE COMPLETED: 8/23/06
GROUND ELEVATION: NOT MEASURED
LOGGED BY: M.H., D.S., J.H.B.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
				12	9,16,20,(73)	SM	2.5" ASPHALT 8" ROAD BASE brown, moist, very dense SILTY SAND								
	5			8	0,1/12",(2) *0.15*	CL	dk. gray, very moist, soft								
	10			10	Pushed *0.31*	CL-1	gray to black, moist, firm		37.7	32	13	0	2	98	UC
	15			18	3,4,8,(22) *0.68*	CL	lt. brown, moist, stiff								
	20			16	Pushed *0.70*	CL	gray-brown, moist, stiff LEAN CLAY								
	25			18	0,2,1,(4) *0.60*	CL	gray-brown, moist, stiff								
	30			12	Pushed *0.39*	CL-2	gray-brown, moist, firm		41.8	48	27	0	0	100	UC
	35			18	0/18",(0) *0.26*	CL	gray-brown, moist, soft								
	40			18	Pushed *0.36*	CL	gray-brown, moist, firm								
	45			18	0/18",(0) *0.28*	CH	gray-brown, moist, soft FAT CLAY								

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LEGEND:

DISTURBED SAMPLE — 2,3,2,(6) ← Blow Count per 6" / $(N_1)_{60}$ Value; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE — PUSHED; 0.45 ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear

= Potential Liquefaction
= Potential Liquefaction & Lateral Spread

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DRILL HOLE LOG

BORING NO. 06-04

PROJECT: AMERICAN FORK SENSITIVE LAND STUDY
CLIENT: HORROCKS ENGINEERS
LOCATION: SOUTH END OF 6500 WEST
DRILLING METHOD: CME-55 NO. 1 / N.W. CASING
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ▽ ARTESIAN' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200601.022
DATE STARTED: 8/22/06
DATE COMPLETED: 8/23/06
GROUND ELEVATION: NOT MEASURED
LOGGED BY: M.H., D.S., J.H.B.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
				18	0/18",(0) 0.25	CH	gray-brown, moist, soft								
	55			18	Pushed 0.29	CH	gray-brown, moist, soft to firm		51.5	61	40	0	0	100	UC
							FAT CLAY								
	60			18	0/18",(0) 0.38	CH	gray, moist, firm								
	65			18	Pushed 0.45	CH	black, moist, firm								
	70			18	1,6,6,(11)	ML	black, wet, med. dense		26.2		NP	0	18	82	
							SANDY SILT W/CLAY LAYERS TO 4" THICK								
				18	2,8,6,(12)	SM	gray, wet, med. dense		27.8		NP	0	60	40	
	75						SILTY SAND								
				8	-	SM	gray, wet								
	80					SM	gray, wet								
				18	6,7,20,(22)	ML	gray, wet, med. dense		24.9		NP	0	19	81	
	85						SANDY SILT W/SAND & CLAY LENSES & LAYERS								
				13	Pushed 0.54	CL	gray, moist, stiff								
							LEAN CLAY W/SAND LAYERS								
	90														
				18	4,6,11,(13)	SM	gray, wet, med. dense		19.9		NP	0	63	37	
	95						SILTY SAND								
				12	12,37,38,(56)	GP-GM	gray, wet, dense								
							GRAVEL W/SAND & SILT								

LEGEND:

DISTURBED SAMPLE — 2,3,2,(6) ← Blow Count per 6" / $(N_1)_{60}$ Value; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE — PUSHED 0.45 ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear

= Potential Liquefaction
= Potential Liquefaction & Lateral Spread

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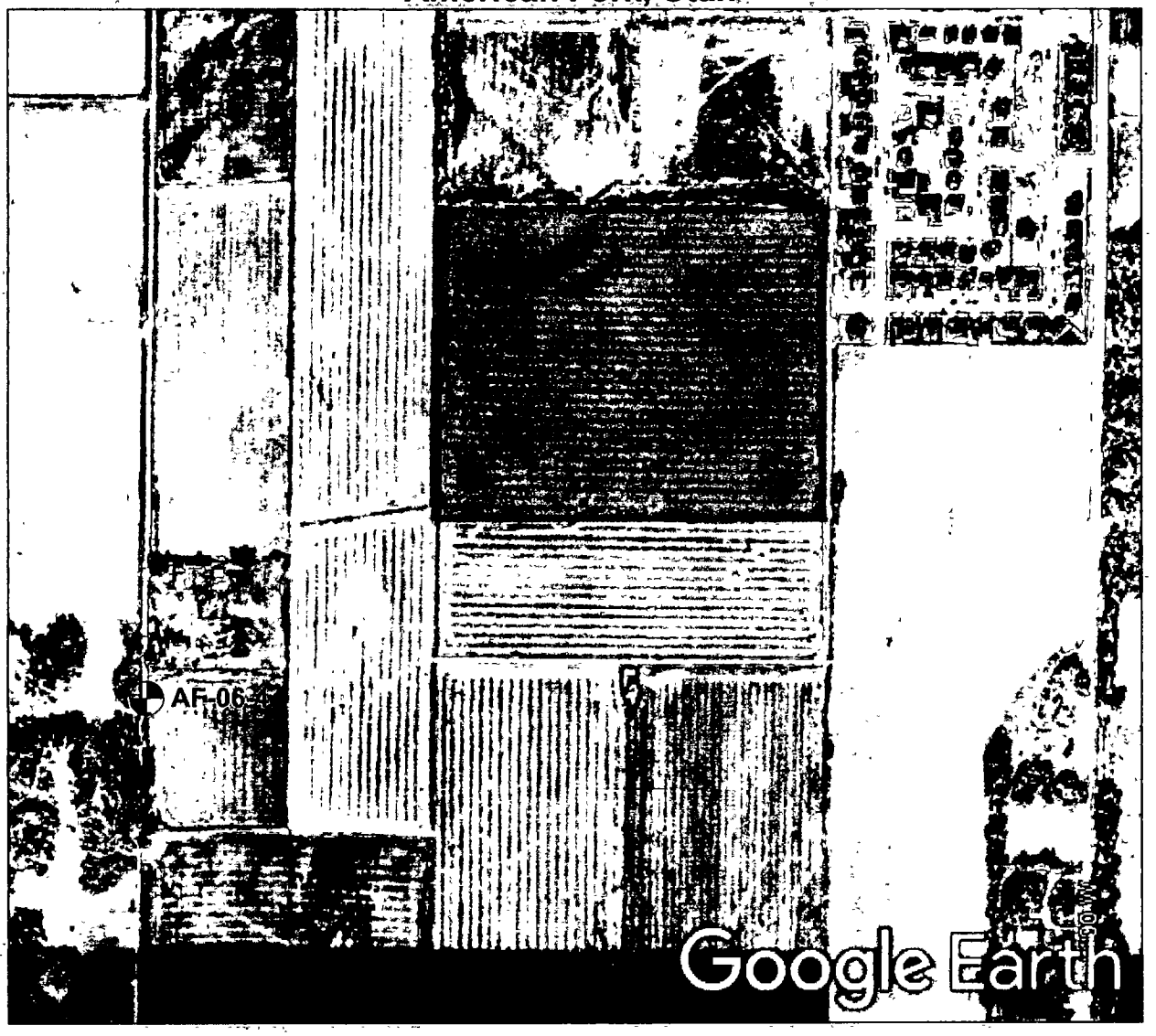
AERIAL PHOTOGRAPH SHOWING LOCATION OF BORING AF-06-4 IN RELATION TO SITE

26-ACRE PROPERTY
1000 South 400 West
American Fork, Utah



Approximate Boring Locations

N

Not to Scale

PROJECT NO.: 178750	EARTHTEC ENGINEERING	

Project	26 Acre Property		
Location	See Figure 2, Utah	Calcs By	WGT
Project No	178750	References / Reviewed By	
Date.	5/5/22	1 Youd, et al, 2001 — C_E =	1 02
Drill Rig Code	L3	2 Boulanger & Idriss 2006 — C_B =	1 05
Borehole Diameter, inches:	7	3 Bray & Sancio, 2006 — C_S =	1.20
Sampler without liners?	yes	Magnitude Scaling Factor, MSF =	1 00
Fill Height, feet.	0	$R^* = R + 10^{(0\ 89M_w - 5\ 64)}$ =	12 9
Magnitude, Mw	7 5	ModCal Sampler Conver Factor (*) =	0 77
Peak Horiz. Acceleration, amax.	0 491	Use representative tests for layers?	yes
Distance from site to fault, km.	2 1	Enter Ground Slope %	0.01
Reference atmosphere value,tsf	1.05811	Enter W=Ht/Distance to free face,%:	

LATERAL SPREADING VALUES

Boring	F_{15},T_{15}	$D50_{15}$	D_H, ft	Boring	F_{15},T_{15}	$D50_{15}$	D_H, ft	Boring	F_{15},T_{15}	$D50_{15}$	D_H, ft
B-1	74,2 29	0 039	0.2								

TOTAL SETTLEMENT VALUES

Boring	Sett., in	Boring	Sett., in	Boring	Sett., in
B-1	2.7				

Boring No	Water Depth, feet	Sample Depth, feet	USC	% Fines	Unit Weight, pcf	Pore Press., tsf	Total Stress tsf	Effective Stress tsf	Rod Length, feet	Meas N-value N_m	Rod Correct. C_R	Ovrbrdn Correct. C_N	$(N_1)_{60}$	$(N_1)_{60cs}$	r_d	$CRR_{7.5}$	CSR	(>1) F.S	F S = ($CRR_{7.5}$ / CSR) MSF (<=1) F S	Moisture Content %	Liquid Limit	Plast Index	Will It Liquefy By: Boul/Idriss Criteria?	Will It Liquefy By: Bray/Sancio Criteria?	Volum. Strain %	Layer Thick. feet	Layer Settlmnt, inches
B-1	6.5	3 5	CL	85	113	0 000	0 198	0 198	5	5	0 75	1 59	7.6	14 1	0 99	0.15	0.32	(Clay)					NO				
	6 5	6	CL	85	112	0 000	0 336	0 336	10	3	0 80	1.45	4.5	10 4	0 99	0.12	0 31	(Clay)					NO				
	6.5	8 5	ML	94	99	0 062	0 421	0 358	10	3	0.80	1 43	4.4	10.3	0 98	0.12	0 37		0.31	28	26	4	YES	YES	2 5	2 5	0 8
	6 5	11	ML	54	112	0 140	0 616	0 476	15	1	0 85	1 33	1.5	6 8	0.97	0.09	0 40		0.21	29					3.3	5	2 0
	6.5	16	CL	85	112	0 296	0 896	0 600	20	3	0.85	1.25	4.1	9 9	0 96	0 11	0.46	(Clay)			30	8	NO				
	6 5	21	CL	85	116	0 452	1.218	0 766	25	12	0 95	1.14	16 7	25.0	0.95	0 29	0.48	(Clay)			37	16	NO				
	6 5	26	CL	85	117	0 608	1.521	0 913	30	13	0 95	1.07	16 9	25 3	0.94	0.30	0.50	(Clay)			37	16	NO				
	6 5	31	CL	85	114	0 764	1.767	1 003	35	7	1 00	1 02	9 2	16 0	0.92	0.17	0.52	(Clay)			30	9	NO				
													#N/A														
													#N/A														
													#N/A														

USGS Design Maps Detailed Report

ASCE 7-10 Standard (40.35681°N, 111.80767°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1] $S_S = 1.158$ g

From Figure 22-2 [2] $S_1 = 0.391$ g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index PI > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4-1: Site Coefficient F_a

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at Short Period				
	$S_S \leq 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_S

For Site Class = D and S_S = 1.158 g, F_a = 1.037

Table 11.4-2: Site Coefficient F_v

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at 1-s Period				
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.391 g, F_v = 1.618

Equation (11.4-1): $S_{MS} = F_a S_S = 1.037 \times 1.158 = 1.201$ g

Equation (11.4-2): $S_{M1} = F_v S_1 = 1.618 \times 0.391 = 0.632$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

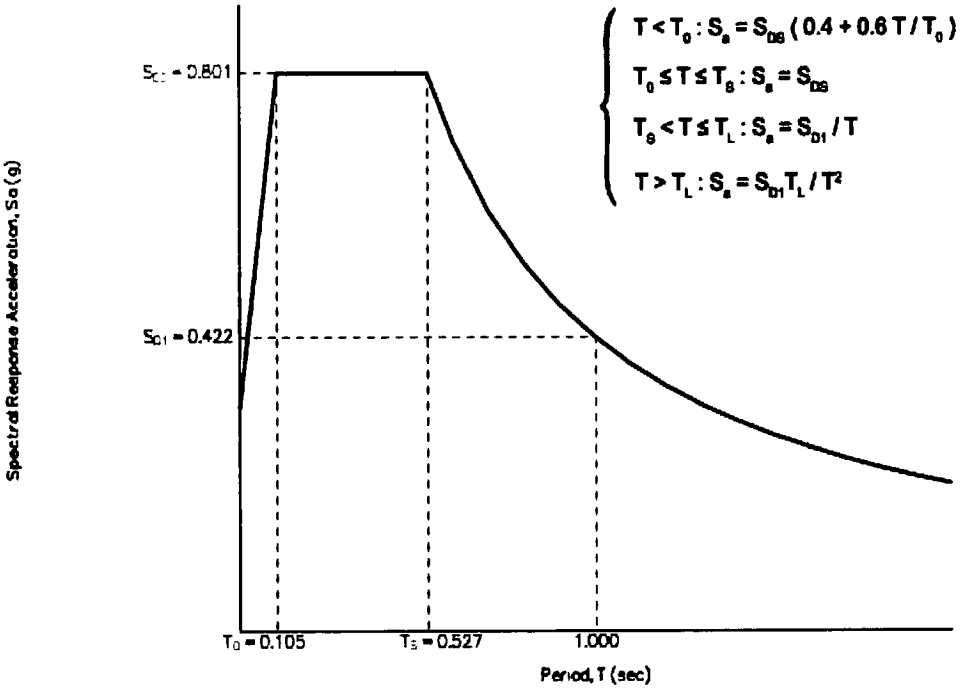
Equation (11.4-3): $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 1.201 = 0.801$ g

Equation (11.4-4): $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 0.632 = 0.422$ g

Section 11.4.5 — Design Response Spectrum

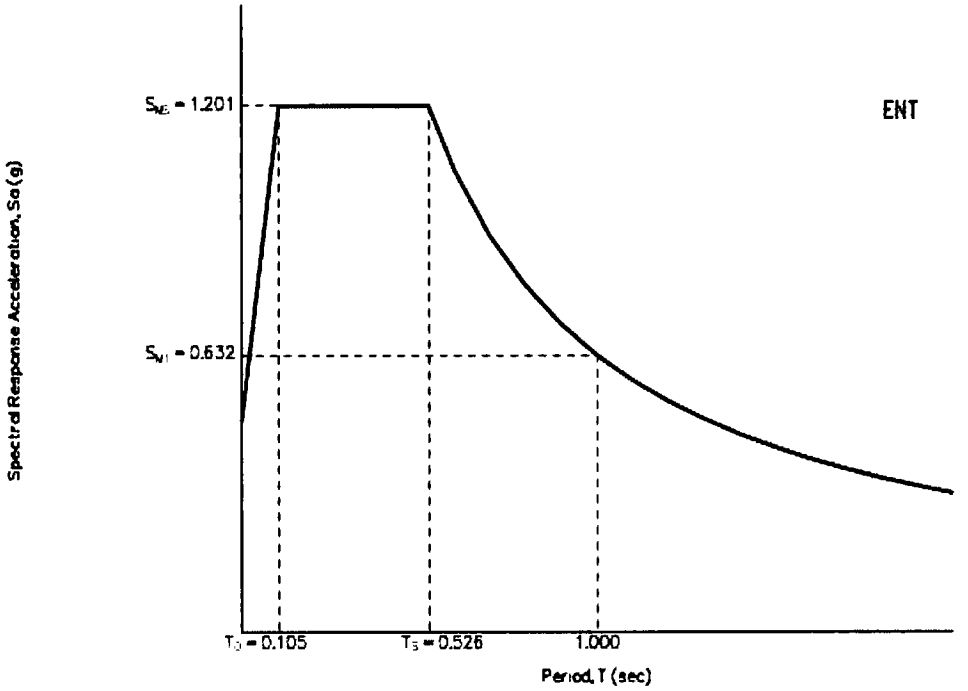
From Figure 22-12 [3] $T_L = 8$ seconds

Figure 11.4-1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 0.493

Equation (11.8-1): $PGA_M = F_{PGA}PGA = 1.007 \times 0.493 = 0.496$ g

Table 11.8-1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of PGA

For Site Class = D and PGA = 0.493 g, F_{PGA} = 1.007

Section 21.2.1.1 — Method 1 (from Chapter 21 - Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 0.827

From Figure 22-18 [6] C_{R1} = 0.836

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 0.801 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.422 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = D

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

USGS Design Maps Summary Report

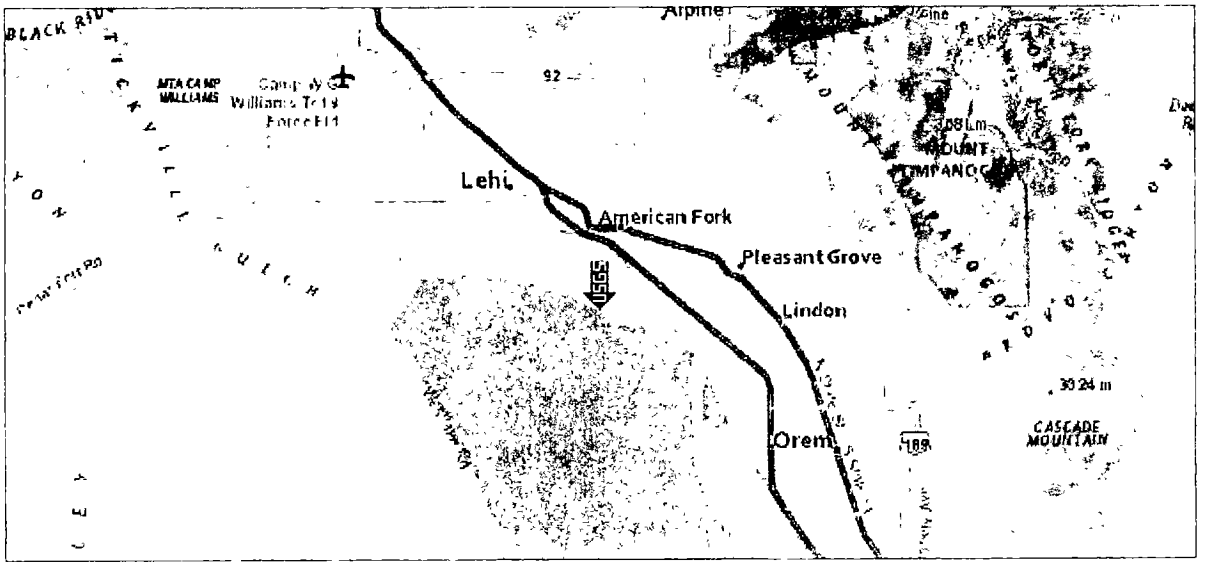
User-Specified Input

Building Code Reference Document ASCE 7-10 Standard
(which utilizes USGS hazard data available in 2008)

Site Coordinates 40.35681°N, 111.80767°W

Site Soil Classification Site Class D – "Stiff Soil"

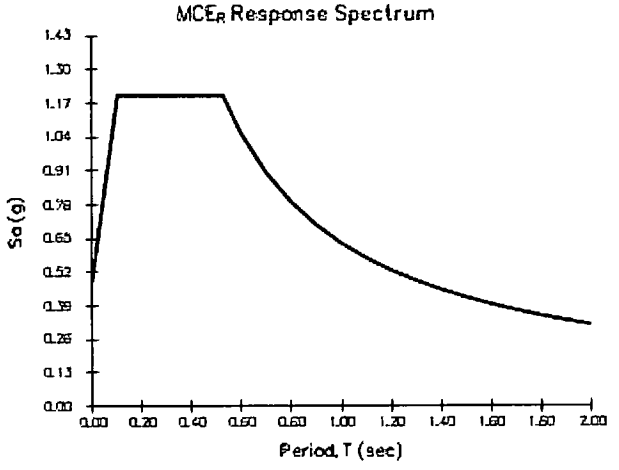
Risk Category I/II/III

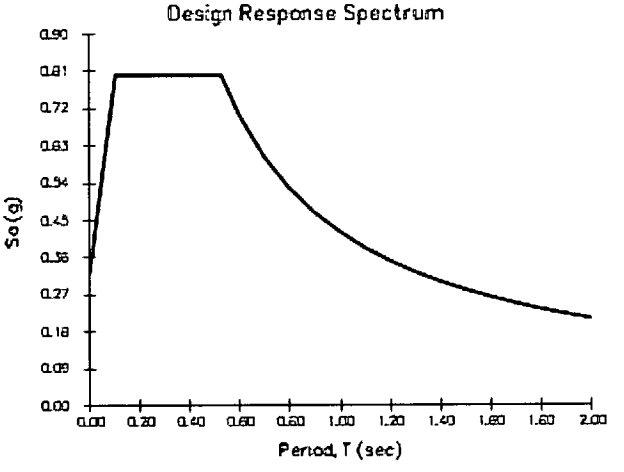


USGS-Provided Output

S_S =	1.158 g	S_{MS} =	1.201 g	S_{DS} =	0.801 g
S_1 =	0.391 g	S_{M1} =	0.632 g	S_{D1} =	0.422 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property		B1					
B:	1.73333	feet (width or diameter)			b =	0.866667	ft (1/2 width/dia)	
L:	25	feet (length)			l =	12.5	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	23
unit weight:	115	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	1	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	6.5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
SM	0.02	0.0025			115		1.0	1.00
CL - Fig 14	0.162	0.015	2500		103.18	0.2	4.0	4.12
ML - Fig 13	0.096	0.01	900		108.8	0.1	12.5	0.94

STRIP FOOTINGS...

Soil Type	Below ftg. depth (ft)	Influence	Increased Stress (psf)	avg. ovrbn. press.(psf)	Incremnt. Sett. (in.)	Collapse Sett. (in.)	Total Set. (in.)	
Fill	0	0.000	0.0	287.5	0.000	0.000	0.00	
SM	1	0.770	1154.5	402.5	0.141	0.000	0.14	
CL - Fig 14	2	0.493	738.9	505.7	0.070	0.024	0.24	
CL - Fig 14	3	0.349	523.2	608.9	0.048	0.024	0.31	
CL - Fig 14	4	0.268	401.4	712.0	0.035	0.024	0.37	<---2B
ML - Fig 13	5	0.216	324.6	758.4	0.102	0.012	0.48	
ML - Fig 13	6	0.181	272.1	804.8	0.096	0.012	0.59	
ML - Fig 13	7	0.156	234.1	851.2	0.122	0.012	0.72	
ML - Fig 13	8	0.137	205.3	897.6	0.103	0.012	0.84	
ML - Fig 13	9	0.122	182.8	944.0	0.089	0.012	0.94	
ML - Fig 13	10	0.110	164.7	990.4	0.077	0.012	1.03	
ML - Fig 13	11	0.100	149.9	1036.8	0.068	0.012	1.11	
ML - Fig 13	12	0.092	137.5	1083.2	0.060	0.012	1.18	
ML - Fig 13	12.5	0.088	132.0	1106.4	0.028	0.006	1.21	

Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property		TP1					
B:	1.73333	feet (width or diameter)			b =	0.866667	ft (1/2 width/dia)	
L:	25	feet (length)			l =	12.5	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	23
unit weight:	103.18	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	1	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
CL - Fig 14	0.162	0.015	2500		103.18	0.2	9.5	3.64

	STRIP FOOTINGS...							
	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	0	0.000	0.0	258.0	0.000	0.000	0.00	
CL - Fig 14	1	0.770	1154.5	361.1	0.112	0.024	0.14	
CL - Fig 14	2	0.493	738.9	464.3	0.074	0.024	0.23	
CL - Fig 14	3	0.349	523.2	536.3	0.053	0.024	0.31	
CL - Fig 14	4	0.268	401.4	577.1	0.041	0.024	0.38	<---2B
CL - Fig 14	5	0.216	324.6	617.9	0.033	0.024	0.43	
CL - Fig 14	6	0.181	272.1	658.6	0.027	0.024	0.49	
CL - Fig 14	7	0.156	234.1	699.4	0.023	0.024	0.53	
CL - Fig 14	8	0.137	205.3	740.2	0.019	0.024	0.57	
CL - Fig 14	9	0.122	182.8	781.0	0.016	0.024	0.62	
CL - Fig 14	9.5	0.116	173.3	801.4	0.008	0.012	0.63	

Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property		TP2					
B:	1.73333	feet (width or diameter)			b =	0.866667	ft (1/2 width/dia)	
L:	25	feet (length)			l =	12.5	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	23
unit weight:	111	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	1	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
CL-ML - Fig 15	0.091	0.009	2000		111	0.7	9.5	2.76

STRIP FOOTINGS...

Soil Type	Below ftg. depth (ft)	Influence	Increased Stress (psf)	avg. ovrbn. press.(psf)	Incremnt. Sett. (in.)	Collapse Sett. (in.)	Total Set. (in.)	
Fill	0	0.000	0.0	277.5	0.000	0.000	0.00	
CL-ML - Fig 15	1	0.770	1154.5	388.5	0.065	0.084	0.15	
CL-ML - Fig 15	2	0.493	738.9	499.5	0.043	0.084	0.28	
CL-ML - Fig 15	3	0.349	523.2	579.3	0.030	0.084	0.39	
CL-ML - Fig 15	4	0.268	401.4	627.9	0.023	0.084	0.50	<---2B
CL-ML - Fig 15	5	0.216	324.6	676.5	0.018	0.084	0.60	
CL-ML - Fig 15	6	0.181	272.1	725.1	0.015	0.084	0.70	
CL-ML - Fig 15	7	0.156	234.1	773.7	0.012	0.084	0.79	
CL-ML - Fig 15	8	0.137	205.3	822.3	0.010	0.084	0.89	
CL-ML - Fig 15	9	0.122	182.8	870.9	0.009	0.084	0.98	
CL-ML - Fig 15	9.5	0.116	173.3	895.2	0.004	0.042	1.03	

Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property		TP5					
B:	1.73333	feet (width or diameter)			b =	0.866667	ft (1/2 width/dia)	
L:	25	feet (length)			l =	12.5	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	23
unit weight:	106.64	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	1	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
CL-ML - Fig 16	0.053	0.005	2000		106.64	0.1	0.5	5.49
SM	0.02	0.0025			110		3.5	1.00
ML - Fig 13	0.096	0.01	900		110	0.1	12.5	1.03

STRIP FOOTINGS...

Soil Type	Below ftg. depth (ft)	Influence	Increased Stress (psf)	avg. ovrbn. press.(psf)	Incremnt. Sett. (in.)	Collapse Sett. (in.)	Total Set. (in.)	
Fill	0	0.000	0.0	266.6	0.000	0.000	0.00	
CL-ML - Fig 16	0.5	0.942	1413.6	319.9	0.022	0.006	0.03	
SM	1.5	0.609	914.0	429.9	0.119	0.000	0.15	
SM	2.5	0.409	614.2	539.9	0.079	0.000	0.23	
SM	3.5	0.303	454.6	587.5	0.060	0.000	0.29	<---2B
ML - Fig 13	4.5	0.239	359.0	635.1	0.068	0.012	0.37	
ML - Fig 13	5.5	0.197	296.1	682.7	0.056	0.012	0.43	
ML - Fig 13	6.5	0.168	251.7	730.3	0.055	0.012	0.50	
ML - Fig 13	7.5	0.146	218.8	777.9	0.059	0.012	0.57	
ML - Fig 13	8.5	0.129	193.4	825.5	0.105	0.012	0.69	
ML - Fig 13	9.5	0.116	173.3	873.1	0.091	0.012	0.79	
ML - Fig 13	10.5	0.105	156.9	920.7	0.079	0.012	0.88	
ML - Fig 13	11.5	0.096	143.4	968.3	0.069	0.012	0.96	
ML - Fig 13	12.5	0.088	132.0	1015.9	0.061	0.012	1.04	

Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property		TP6					
B:	1.73333	feet (width or diameter)			b =	0.866667	ft (1/2 width/dia)	
L:	25	feet (length)			l =	12.5	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	23
unit weight:	94.3	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	1	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	6.5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
ML - Fig 17	0.113	0.006	2300		94.3	1.9	1.0	5.98
CL - Fig 14	0.162	0.015	2500		103.5	0.2	4.0	4.26
SM	0.02	0.0025			115		5.5	1.00
CL-ML - Fig 16	0.053	0.005	2000		107	0.1	12.5	2.05

	STRIP FOOTINGS...							
	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	0	0.000	0.0	235.8	0.000	0.000	0.00	
ML - Fig 17	1	0.770	1154.5	330.1	0.047	0.228	0.28	
CL - Fig 14	2	0.493	738.9	433.6	0.078	0.024	0.38	
CL - Fig 14	3	0.349	523.2	537.1	0.053	0.024	0.45	
CL - Fig 14	4	0.268	401.4	640.6	0.038	0.024	0.52	<---2B
SM	5	0.216	324.6	693.2	0.040	0.000	0.56	
SM	5.5	0.197	296.1	719.5	0.018	0.000	0.57	
CL-ML - Fig 16	6.5	0.168	251.7	764.1	0.007	0.012	0.59	
CL-ML - Fig 16	7.5	0.146	218.8	808.7	0.006	0.012	0.61	
CL-ML - Fig 16	8.5	0.129	193.4	853.3	0.005	0.012	0.63	
CL-ML - Fig 16	9.5	0.116	173.3	897.9	0.005	0.012	0.65	
CL-ML - Fig 16	10.5	0.105	156.9	942.5	0.004	0.012	0.66	
CL-ML - Fig 16	11.5	0.096	143.4	987.1	0.004	0.012	0.68	
CL-ML - Fig 16	12.5	0.088	132.0	1031.7	0.003	0.012	0.69	

Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property		TP7					
B:	1.73333	feet (width or diameter)			b =	0.866667	ft (1/2 width/dia)	
L:	25	feet (length)			l =	12.5	ft (1/2 length)	
foot. depth:	4.5	feet					Spread Load,k:	23
unit weight:	91.02	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	1	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	4.5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
ML - Fig 18	0.185	0.011	1000		91.02	3.6	0.0	2.33
CL - Fig 14	0.162	0.015	2500		103.5	0.2	4.5	4.08
SP	0.02	0.0025			115		10.5	1.00

STRIP FOOTINGS...

Soil Type	Below ftg. depth (ft)	Influence	Increased Stress (psf)	avg. ovrbn. press.(psf)	Incremnt. Sett. (in.)	Collapse Sett. (in.)	Total Set. (in.)	
Fill	0	0.000	0.0	409.6	0.000	0.000	0.00	
ML - Fig 18	0	0.000	0.0	409.6	0.000	0.000	0.00	
CL - Fig 14	1	0.770	1154.5	450.7	0.099	0.024	0.12	
CL - Fig 14	2	0.493	738.9	491.8	0.072	0.024	0.22	
CL - Fig 14	3	0.349	523.2	532.9	0.053	0.024	0.30	
CL - Fig 14	4	0.268	401.4	574.0	0.041	0.024	0.36	<---2B
CL - Fig 14	4.5	0.239	359.0	594.5	0.018	0.012	0.39	
SP	5.5	0.197	296.1	647.1	0.039	0.000	0.43	
SP	6.5	0.168	251.7	699.7	0.032	0.000	0.46	
SP	7.5	0.146	218.8	752.3	0.027	0.000	0.49	
SP	8.5	0.129	193.4	804.9	0.022	0.000	0.51	
SP	9.5	0.116	173.3	857.5	0.019	0.000	0.53	
SP	10.5	0.105	156.9	910.1	0.017	0.000	0.55	

Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property		B1					
B:	3.91578	feet (width or diameter)			b =	1.95789	ft (1/2 width/dia)	
L:	3.91578	feet (length)			l =	1.95789	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	23
unit weight:	115	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	2	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	6.5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
SM	0.02	0.0025			115		1.0	1.00
CL - Fig 14	0.162	0.015	2500		103.18	0.2	4.0	4.12
ML - Fig 13	0.096	0.01	900		108.8	0.1	12.5	0.94

SQUARE/RECTANGULAR FOOTINGS (Boussinesq Method)...

	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	0	0.000	0.0	287.5	0.000	0.000	0.00	
SM	1	0.926	1389.1	402.5	0.156	0.000	0.16	
CL - Fig 14	2	0.690	1035.6	505.7	0.087	0.024	0.27	
CL - Fig 14	3	0.473	708.9	608.9	0.060	0.024	0.35	
CL - Fig 14	4	0.326	489.2	712.0	0.041	0.024	0.42	
ML - Fig 13	5	0.233	349.5	758.4	0.113	0.012	0.54	
ML - Fig 13	6	0.173	258.9	804.8	0.089	0.012	0.64	
ML - Fig 13	7	0.132	198.2	851.2	0.105	0.012	0.76	
ML - Fig 13	8	0.104	156.0	897.6	0.080	0.012	0.85	<---2B
ML - Fig 13	9	0.084	125.6	944.0	0.063	0.012	0.93	
ML - Fig 13	10	0.069	103.2	990.4	0.050	0.012	0.99	
ML - Fig 13	11	0.057	86.2	1036.8	0.040	0.012	1.04	
ML - Fig 13	12	0.049	73.0	1083.2	0.033	0.012	1.08	
ML - Fig 13	12.5	0.045	67.5	1106.4	0.015	0.006	1.10	

Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property		TP1					
B:	3.91578	feet (width or diameter)			b =	1.95789	ft (1/2 width/dia)	
L:	3.91578	feet (length)			l =	1.95789	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	23
unit weight:	103.18	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	3	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
CL - Fig 14	0.162	0.015	2500		103.18	0.2	9.5	3.64

SQUARE/RECTANGULAR FOOTINGS (Westergard Method)...

	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	0	0.000	0.0	258.0	0.000	0.000	0.00	
CL - Fig 14	1	0.816	1223.4	361.1	0.116	0.024	0.14	
CL - Fig 14	2	0.649	973.6	464.3	0.088	0.024	0.25	
CL - Fig 14	3	0.511	765.9	536.3	0.069	0.024	0.35	
CL - Fig 14	4	0.402	602.3	577.1	0.056	0.024	0.43	
CL - Fig 14	5	0.318	477.2	617.9	0.045	0.024	0.49	
CL - Fig 14	6	0.255	382.4	658.6	0.036	0.024	0.55	
CL - Fig 14	7	0.207	310.5	699.4	0.029	0.024	0.61	
CL - Fig 14	8	0.170	255.5	740.2	0.023	0.024	0.65	<---2B
CL - Fig 14	9	0.142	212.9	781.0	0.019	0.024	0.70	
CL - Fig 14	9.5	0.130	195.3	801.4	0.009	0.012	0.72	

Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property		TP2					
B:	3.91578	feet (width or diameter)			b =	1.95789	ft (1/2 width/dia)	
L:	3.91578	feet (length)			l =	1.95789	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	23
unit weight:	111	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	3	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
CL-ML - Fig 15	0.091	0.009	2000		111	0.7	9.5	2.76

SQUARE/RECTANGULAR FOOTINGS (Westergard Method)...

	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	0	0.000	0.0	277.5	0.000	0.000	0.00	
CL-ML - Fig 15	1	0.816	1223.4	388.5	0.067	0.084	0.15	
CL-ML - Fig 15	2	0.649	973.6	499.5	0.051	0.084	0.29	
CL-ML - Fig 15	3	0.511	765.9	579.3	0.040	0.084	0.41	
CL-ML - Fig 15	4	0.402	602.3	627.9	0.032	0.084	0.52	
CL-ML - Fig 15	5	0.318	477.2	676.5	0.025	0.084	0.63	
CL-ML - Fig 15	6	0.255	382.4	725.1	0.020	0.084	0.74	
CL-ML - Fig 15	7	0.207	310.5	773.7	0.016	0.084	0.84	
CL-ML - Fig 15	8	0.170	255.5	822.3	0.013	0.084	0.93	<---2B
CL-ML - Fig 15	9	0.142	212.9	870.9	0.010	0.084	1.03	
CL-ML - Fig 15	9.5	0.130	195.3	895.2	0.005	0.042	1.07	

Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property		TP5					
B:	3.91578	feet (width or diameter)			b =	1.95789	ft (1/2 width/dia)	
L:	3.91578	feet (length)			l =	1.95789	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	23
unit weight:	106.64	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	2	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
CL-ML - Fig 16	0.053	0.005	2000		106.64	0.1	0.5	5.49
SM	0.02	0.0025			110		3.5	1.00
ML - Fig 13	0.096	0.01	900		110	0.1	12.5	1.03

SQUARE/RECTANGULAR FOOTINGS (Boussinesq Method)...

Soil Type	Below ftg. depth (ft)	Influence	Increased Stress (psf)	avg. ovrbn. press.(psf)	Incremnt. Sett. (in.)	Collapse Sett. (in.)	Total Set. (in.)	
Fill	0	0.000	0.0	266.6	0.000	0.000	0.00	
CL-ML - Fig 16	0.5	0.988	1482.7	319.9	0.023	0.006	0.03	
SM	1.5	0.816	1224.3	429.9	0.140	0.000	0.17	
SM	2.5	0.573	859.0	539.9	0.099	0.000	0.27	
SM	3.5	0.391	586.8	587.5	0.072	0.000	0.34	
ML - Fig 13	4.5	0.274	411.6	635.1	0.094	0.012	0.45	
ML - Fig 13	5.5	0.200	299.5	682.7	0.058	0.012	0.52	
ML - Fig 13	6.5	0.150	225.7	730.3	0.041	0.012	0.57	
ML - Fig 13	7.5	0.117	175.3	777.9	0.036	0.012	0.62	
ML - Fig 13	8.5	0.093	139.6	825.5	0.078	0.012	0.71	<---2B
ML - Fig 13	9.5	0.076	113.6	873.1	0.061	0.012	0.78	
ML - Fig 13	10.5	0.063	94.1	920.7	0.049	0.012	0.84	
ML - Fig 13	11.5	0.053	79.2	968.3	0.039	0.012	0.89	
ML - Fig 13	12.5	0.045	67.5	1015.9	0.032	0.012	0.94	

Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property		TP6					
B:	3.91578	feet (width or diameter)			b =	1.95789	ft (1/2 width/dia)	
L:	3.91578	feet (length)			l =	1.95789	ft (1/2 length)	
foot. depth:	2.5	feet					Spread Load,k:	23
unit weight:	94.3	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	2	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	6.5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
ML - Fig 17	0.113	0.006	2300		94.3	1.9	1.0	5.98
CL - Fig 14	0.162	0.015	2500		103.5	0.2	4.0	4.26
SM	0.02	0.0025			115		5.5	1.00
CL-ML - Fig 16	0.053	0.005	2000		107	0.1	12.5	2.05

SQUARE/RECTANGULAR FOOTINGS (Boussinesq Method)...

	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	0	0.000	0.0	235.8	0.000	0.000	0.00	
ML - Fig 17	1	0.926	1389.1	330.1	0.052	0.228	0.28	
CL - Fig 14	2	0.690	1035.6	433.6	0.095	0.024	0.40	
CL - Fig 14	3	0.473	708.9	537.1	0.066	0.024	0.49	
CL - Fig 14	4	0.326	489.2	640.6	0.044	0.024	0.56	
SM	5	0.233	349.5	693.2	0.043	0.000	0.60	
SM	5.5	0.200	299.5	719.5	0.018	0.000	0.62	
CL-ML - Fig 16	6.5	0.150	225.7	764.1	0.007	0.012	0.64	
CL-ML - Fig 16	7.5	0.117	175.3	808.7	0.005	0.012	0.65	
CL-ML - Fig 16	8.5	0.093	139.6	853.3	0.004	0.012	0.67	<---2B
CL-ML - Fig 16	9.5	0.076	113.6	897.9	0.003	0.012	0.68	
CL-ML - Fig 16	10.5	0.063	94.1	942.5	0.002	0.012	0.70	
CL-ML - Fig 16	11.5	0.053	79.2	987.1	0.002	0.012	0.71	
CL-ML - Fig 16	12.5	0.045	67.5	1031.7	0.002	0.012	0.73	

Settlement--Footings

SETTLEMENT OF FOOTINGS								
Project:	26 Acre AF Property		TP7					
B:	3.91578	feet (width or diameter)			b =	1.95789	ft (1/2 width/dia)	
L:	3.91578	feet (length)			l =	1.95789	ft (1/2 length)	
foot. depth:	4.5	feet					Spread Load,k:	23
unit weight:	91.02	pcf (above footing depth)					Strip Load,k:	2.6
allowable q:	1500	psf						
footing type:	2	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	4.5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
ML - Fig 18	0.185	0.011	1000		91.02	3.6	0.0	2.33
CL - Fig 14	0.162	0.015	2500		103.5	0.2	4.5	4.08
SP	0.02	0.0025			115		10.5	1.00

SQUARE/RECTANGULAR FOOTINGS (Boussinesq Method)...

Soil Type	Below ftg. depth (ft)	Influence	Increased Stress (psf)	avg. ovrbn. press.(psf)	Incremnt. Sett. (in.)	Collapse Sett. (in.)	Total Set. (in.)	
Fill	0	0.000	0.0	409.6	0.000	0.000	0.00	
ML - Fig 18	0	0.000	0.0	409.6	0.000	0.000	0.00	
CL - Fig 14	1	0.926	1389.1	450.7	0.110	0.024	0.13	
CL - Fig 14	2	0.690	1035.6	491.8	0.089	0.024	0.25	
CL - Fig 14	3	0.473	708.9	532.9	0.066	0.024	0.34	
CL - Fig 14	4	0.326	489.2	574.0	0.048	0.024	0.41	
CL - Fig 14	4.5	0.274	411.6	594.5	0.021	0.012	0.44	
SP	5.5	0.200	299.5	647.1	0.040	0.000	0.48	
SP	6.5	0.150	225.7	699.7	0.029	0.000	0.51	
SP	7.5	0.117	175.3	752.3	0.022	0.000	0.53	
SP	8.5	0.093	139.6	804.9	0.017	0.000	0.55	<---2B
SP	9.5	0.076	113.6	857.5	0.013	0.000	0.56	
SP	10.5	0.063	94.1	910.1	0.010	0.000	0.57	

TAYLOR GEOTECHNICAL

2650 North 180 East
Lehi, Utah 84043
P. 801-400-9784

July 21, 2022

ENT 8993:2023 PG 135 of 181

Mr. Ben Hunter
Project Engineer
American Fork City
51 East Main Street
American Fork, Utah 84003

Subject: **Geotechnical Engineering Review No. 1**
Stonecreek Subdivision, Plat K
1000 South 400 West
American Fork Utah
TG Project No. 22064

Subject Documents: Earthtec Engineering, Geotechnical Study - Revised, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Mr. Garrett Seely, Woodside Homes, 460 West 50 South, Suite 200, American Fork [sic], UT 84101, September 26, 2017.

Earthtec Engineering, Addendum 1, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Mr. Garrett Seely, Woodside Homes, 460 West 50 South, Suite 200, Salt Lake [sic], UT 84101, May 25, 2018.

Earthtec Engineering, Response to Review, American Fork Property and 26 Acre Property, 700 South 400 West and 1000 South 400 West, American Fork, Utah, Earthtec Project No. 169273 and 178750, prepared for Woodside Homes of Utah, 460 West 50 South, Suite 300, Salt Lake City, UT 84101, August 25, 2020.

Submittal Status: **GEOTECHNICAL ENGINEERING SUBMITTAL INCOMPLETE**

Dear Mr. Hunter:

At your request, Taylor Geotechnical (TG) reviewed the above subject documents. The purpose of TG's review is to evaluate whether or not Earthtec Engineering (Earthtec) adequately addresses geotechnical engineering parameters at the site, consistent with concerns for public health, safety, welfare, reasonable professional standards-of-care, and the American Fork City Sensitive Lands Ordinance 07-10-47. Section 4-2-2 of the American Fork City Sensitive Land Ordinance sub-item (10) states the report must be in accordance with the guidelines and recommendations of the "American Fork Sensitive Lands Geologic Hazards Study," Chapter 5 titled "Conclusions and Recommendations" prepared by RB&G Engineering, Inc., dated December 2006.

TG Conclusion

Based substantially in and on reliance of the technical documentation and assurances provided by Earthtec, including their opinions and conclusions, it is TG's opinion the September 26, 2017, report combined with the May 25, 2018, and August 25, 2020, Earthtec report does not fulfill the requirements of the American Fork City Sensitive Lands Ordinance 07-10-47.

TG Recommendations

Based on the requirements of the American Fork City Sensitive Land Ordinance and the technical documentation provided by Earthtec, TG recommends the City of American Fork not consider the Earthtec submittals complete from a geotechnical perspective until the following items are adequately addressed.

1. The subject site is below elevation 4593 feet. For sites below an elevation of 4593 feet, the Sensitive Land Ordinance requires the geotechnical report to address current groundwater conditions by means of taking measurements at least 24 hours after drilling and address potential artesian conditions at the site (see page 17, RBG 2006). The September 26, 2017, Earthtec report did not address artesian conditions at the property in accordance with the American Fork Sensitive Lands Ordinance.

   TG recommends American Fork City request Earthtec address artesian conditions for the proposed development.

2. The RB&G, 2006, report specifies for facilities designed according to the IBC seismic provisions and located within the moderate or high liquefaction hazard zones identified in Figure 6 of the RB&G report, that the recommended Site Class be based on a site-specific subsurface investigation to a depth of at least 30 feet, supplemented by at least one investigation to a depth of at least 70 feet and located within 2,000 feet of the site (see page 17, RGB 2006). The liquefaction hazard of the site should be analyzed with a boring to at least 40 feet within the subject site (see page 18, RBG 2006).

   The September 26, 2017, Earthtec report states on page 4, section 5.1 Soil Exploration, the following: "As required by the American Fork Sensitive Lands Ordinance a 70-foot boring is required to have been performed within 2,000 feet of the site. The boring labeled AF-06-4 is within 2,000 feet of the site."

   The 70-foot deep boring referred to by Earthtec is required for determining the recommended Site Class. A minimum 40-foot deep boring is required for the liquefaction hazard assessment.

TG recommends American Fork City request Earthtec to:

a) *Provide a copy of the boring log AF-06-4;*

b) *Provide a site plan depicting the location of boring AF-06-4 relative to the subject site;*

c) *Substantiate the Site Class based on the referenced AF-06-4 boring and Boring B-1 from the September 26, 2012 report;*

3. The September 26, 2017, Earthtec report states on page 10, section 9.3 Liquefaction Potential, the following: "Our analysis indicates that approximately up to 3 inches of liquefaction-induced settlement and possibly up to ½ feet of lateral spreading could occur in the vicinity of B-1 during a moderate to large earthquake event."

   The September 26, 2017, May 25, 2018, or the August 25, 2020, Earthtec documents provided to TG for review did not contain the calculations of their liquefaction analysis. *TG recommends American Fork request Earthtec provide their calculations to substantiate their conclusions including the output file that substantiates the peak ground acceleration.*

4. In a July 31, 2020, CMT review letter of the September 26, 2017, Earthtec document, CMT requested Earthtec provide " . . . calculations for settlement, bearing capacity (including any graphs used in determining consolidation coefficients) and lateral pressures/lateral resistance be provided for review."

   In response to the request, the August 25, 2020, Earthtec document states the following, "The calculations used for the settlement and bearing capacity are included at the end of this letter. The structures on this project will be slab-on-grade, therefore; lateral pressures are not required. Consolidation graphs can be found in the referenced reports."

   The settlement calculations as provided in the August 25, 2020, Earthtec document used different consolidation coefficients for the same soil type and did not identify from which consolidation graphs the consolidation coefficients were derived. *Therefore, TG recommends American Fork City request Earthtec to:*

   a) *Label on their settlement calculations which consolidation curves go with each of the listed consolidation coefficients;*

   b) *Clarify which settlement calculations substantiate the allowable bearing recommendation presented in the September 26, 2017 report and the August 25, 2020, Addendum report, especially where soft and highly compressible soils were documented.*

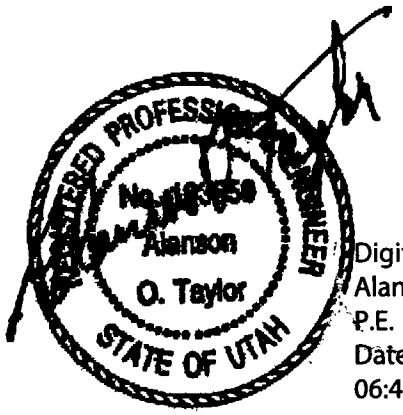
c) *Clarify the potential depth of over-excavation that will be required across the site based on the presence of pinhole structured soils, especially in the area of Test Pits 6 through 8.*

CLOSURE

All services performed by Taylor Geotechnical for this review were provided for the exclusive use and benefit of American Fork City. No other person or entity is entitled to use or rely upon any of the information or reports generated by Taylor Geotechnical as a result of this review.

If you have any questions, please feel free to contact the undersigned. The opportunity to be of continued service to American Fork City is appreciated.

Respectfully submitted,
Taylor Geotechnical



Digitally signed by Alanson O. Taylor, P.E.
Date: 2022.07.21 06:40:44 -06'00'

Alanson O. Taylor, P.E.
Principal

EARTHTEC ENGINEERING

1497 West 40 South **Lindon, Utah - 84042** *Phone (801) 225-5711*
840 West 1700 South #10 **Salt Lake City, Utah - 84104** *Phone (801) 787-9138*
1596 W. 2650 S. #108 **Ogden, Utah - 84401** *Phone (801) 399-9516*

August 12, 2022

ENT 8993:2023 PG 139 of 181

Woodside Homes of Utah, LLC
Attention: Ms. Ginger Romriell
460 West 50 North, Suite 300
Salt Lake City, UT 84101

Re: Response to Review
Meadow Brook
600 South 6600 West
American Fork, Utah
Project No: 228636

Ms. Romriell:

This letter is a response to the review by Taylor Geotechnical of our Geotechnical Report[1] completed in July of 2022. A letter[2] to update structural loads has also been completed by Earthtec Engineering.

Taylor Geotechnical's Review Comment No. 1
Section 9.3 Liquefaction Potential (page 9) of the July 8, 2022, Earthtec document states, "Our analysis indicates that approximately up to 2 inches of liquefaction-induced settlement and possibly up to 1 foot of lateral spreading could occur during a moderate to large earthquake event. Given the small amount of movement, it is our opinion that liquefaction mitigation is not needed at the site."

TG recommends the City request Earthtec to substantiate that public health, safety, and welfare are not impacted. by 2 inches of liquefaction-induced settlement and 1 foot of lateral spreading.

Earthtec Engineering's Response to Comment No. 1
As long as the structural engineer is aware and takes into account these values in their calculations and designs, public health, safety and welfare should not be impacted.

Taylor Geotechnical's Review Comment No. 2
The RB&G, 2006, report specifies for facilities designed according to the IBC seismic provisions and located within the moderate or high liquefaction hazard zones identified on Figure 6 of the RB&G report, that the recommended Site Class be based on a site-specific subsurface investigation to a depth of at least 30 feet, supplemented by at least one investigation to a depth of at least 70 feet and located within 2,000 feet of the site (see page 17, RGB 2006).

The Earthtec report did not supplement their report with at least one investigation to a depth of at least 70 feet within 2,000 feet of the site. TG recommends the City request Earthtec provide the recommended Site Class in accordance the City Sensitive Land Ordinance with:

[1] Geotechnical Study, Meadow Brook, Approximately 600 South 6600 West, American Fork, Utah, Earthtec Engineering, Project No.228636, July 8, 2022.
[2] Addendum 1 – Updated Structural Loads, Meadow Brook, 600 South 6600 West, American Fork, Utah, Earthtec Engineering, Project No.228636, August 9, 2022.

a) The referenced 70 foot boring shown on a site map;
b) The log of the 70 foot boring provided for review; and,
c) Substantiation of their respective site class recommendation.

Earthtec Engineering's Response to Comment No. 2
Boring AF-06-3 is within 2,000 feet of the subject site. A site plan showing the location of the boring in relation to the site is provided at the end of this response. A log of the boring is also provided at the end of this response. Based on this boring the site class is borderline D/E.

Taylor Geotechnical's Review Comment No. 3
Section 11.0 Floor Slabs and Flatwork (page 12) of the July 8, 2022, Earthtec document states, "Due to shallow groundwater encountered at the site, lowest floor slab depths should be limited to 1½ feet below existing site grades."

Section 12.2 Subsurface Drainage (pages 13 & 14) of the July 8, 2022, Earthtec document states, "The depth of the basements will depend greatly on-site [sic] grading and drainage. Based on current site conditions, basements may be constructed no deeper than 2 feet below existing site grades."

TG recommends the City request Earthtec to clarify the discrepancy between the recommended 1½ feet and 2 feet of subsurface construction.

Earthtec Engineering's Response to Comment No. 3
To provide a minimum of 3 feet of separation between the shallowest observed groundwater and the bottom of the floor slab, the lowest floor slab depth should be limited to 1½ feet below the ground surface at the time of our investigation.

Taylor Geotechnical's Review Comment No. 4
The subject site is below elevation 4593 feet. For sites below elevation 4593 feet, the Sensitive Land Ordinance requires the geotechnical report to address artesian conditions at the site. The July 8, 2022, Earthtec report did not address artesian conditions at the property. TG recommends the City request Earthtec address artesian conditions for the proposed development.

Earthtec Engineering's Response to Comment No. 4
Earthtec Engineering did not encounter artesian conditions to the depths explored of approximately 36½ feet.

Taylor Geotechnical's Review Comment No. 5
TG recommends the City request Earthtec provide calculations that substantiate their recommended allowable bearing capacity, estimated settlement, lateral resistance, lateral loading recommendations, and the calculations that substantiate the liquefaction induced settlement and lateral spread analysis. Variables used in the calculations should be substantiated.

Earthtec Engineering's Response to Comment No. 5
Calculations for bearing capacity, settlement, and liquefaction are provided at the end of this response. We understand that all buildings at the subject site will be slab-on-grade, therefore lateral loading will not be required. Consolidation graphs and seismic maps are included in the

original report to substantiate the variables in the calculations.

General Conditions

The information presented in this letter applies only to the soils encountered during the field investigation on the subject site. It should be noted that Earthtec Engineering was not involved with the selection of the foundation system being used, surface drainage control, floor slab design and construction, backfill compaction requirements against foundation walls, mass grading of the site, or any other aspect of the building construction. Site grading activities completed in other areas such as driveways, sidewalks, or detached structures, were not observed during this site visit, are outside of the scope of our work and are not addressed in this letter. The observations and recommendations presented in this letter were conducted within the limits prescribed by our client, with the usual thoroughness and competence of the engineering profession in this area at this time. No warranty or representation is intended in our proposals, contracts, reports, or letters.

Closure

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please call.

Respectfully;
EARTHTEC ENGINEERING

Jeremy A. Balleck, E.I.T.
Staff Engineer

PROFESSIONAL ENGINEER
No. 5567049-2202
TIMOTHY ALLAN MITCHELL
Electronically generated on 08/12/2022
STATE OF UTAH

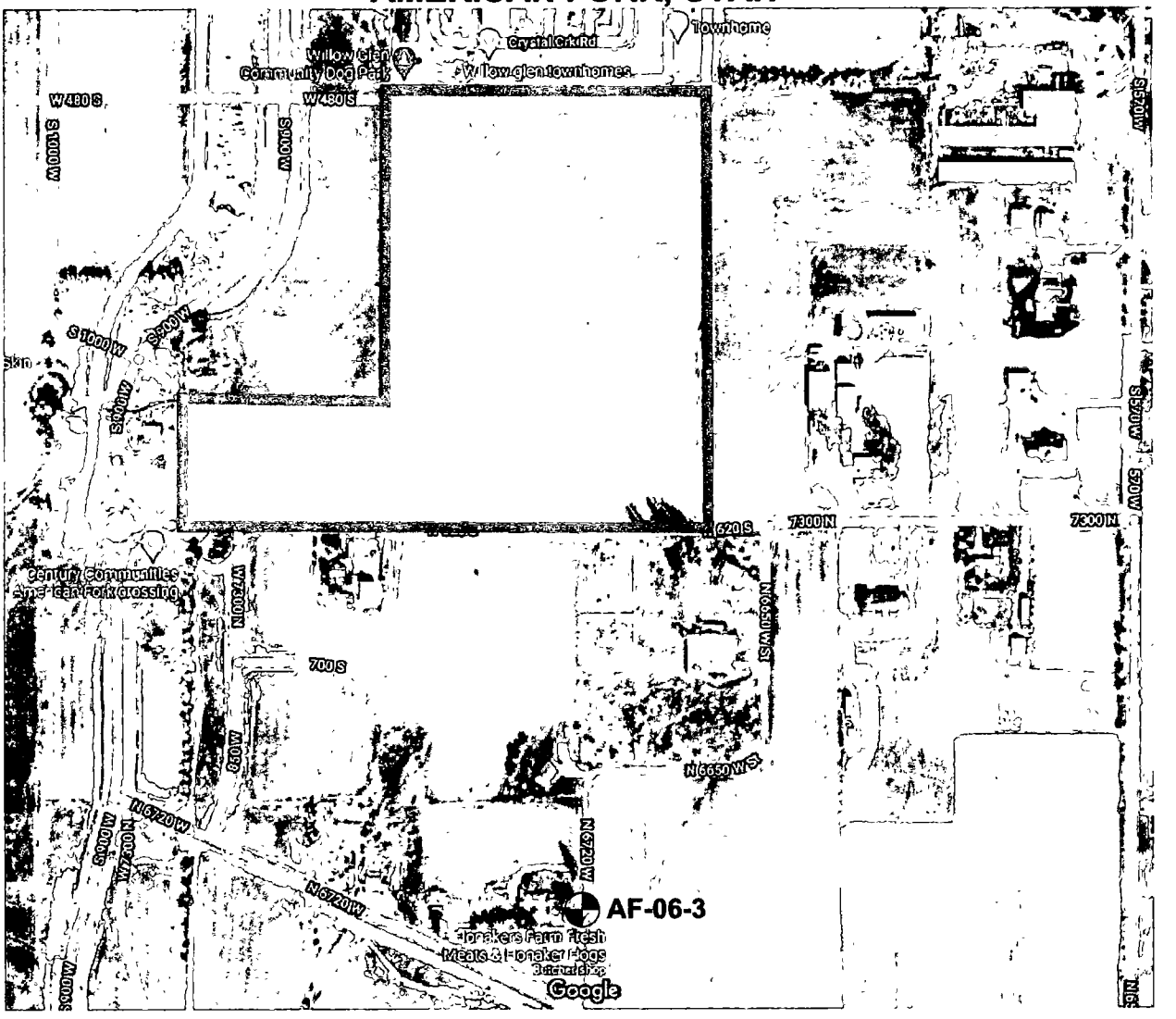
Timothy A. Mitchell, P.E.
Vice President

JB/tm

Attachments:
Aerial Photograph Showing Location of Boring in Relation to Subject Site
Boring AF-06-3 Log
Bearing Capacity Calculations
Settlement Calculations
Liquefaction Calculations

AERIAL PHOTOGRAPH SHOWING LOCATION OF BORING IN RELATION TO SUBJECT SITE

MEADOW BROOK
APPROXIMATELY 600 SOUTH 6600 WEST
AMERICAN FORK, UTAH



*Aerial photograph from Google Maps

Approximate Boring Location

N

Not to Scale

PROJECT NO.: 228636	EARTHTEC ENGINEERING	FIGURE NO.: 2

DRILL HOLE LOG

BORING NO. 06-03

SHEET 1 OF 2

PROJECT: AMERICAN FORK SENSITIVE LAND STUDY
CLIENT: HORROCKS ENGINEERS
LOCATION: SOUTH END OF 6650 WEST
DRILLING METHOD: CME-55 NO. 1 / N.W. CASING
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ▽ N.M. AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200601.022
DATE STARTED: 8/16/06
DATE COMPLETED: 8/17/06
GROUND ELEVATION: NOT MEASURED
LOGGED BY: M. HANSEN, J.H.B.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
				9	3,11,14,(51)	CL	gray-brown, dry, stiff								
	5			12	0,1/12",(2) *0.03*	CL	brown, moist, very soft								
	10			12	Pushed *0.16*	CL	lt. brown, moist, soft — LEAN CLAY W/SAND & SILTY SAND LENSES & LAYERS TO 3" THICK								
	15			18	3,2,3,(8) *0.60*	CL	gray, moist, stiff								
	20			12	Pushed *0.56*	CL-1	gray, moist, stiff		19.1	31	12	0	17	83	UC
	25			18	6,4,6,(13) *0.56*	SM CL-ML	gray, wet, loose — SILTY SAND brown-gray, moist, stiff — SILTY CLAY								
	30			15	Pushed *0.56*	CL-ML	gray, moist, stiff								
	35			18	0/18",(0) *0.55*	CL	gray, moist, stiff								
	40			18	Pushed *0.61*	CL-2	gray, moist, stiff — LEAN CLAY distorted bedding		32.8	42	12	0	1	99	UC
	45			18	0/18",(0) *0.38* *0.21*	CL	gray, moist, soft to firm								
				14	Pushed *0.32*	CL	gray, moist, firm								

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE — 2,3,2,(6) ← Blow Count per 6" (N_1)$_{60}$ Value; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE — PUSHED; 0.45 ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear

= Potential Liquefaction
= Potential Liquefaction & Lateral Spread

DRILL HOLE LOG

BORING NO. 06-03

SHEET 2 OF 2

PROJECT: AMERICAN FORK SENSITIVE LAND STUDY
CLIENT: HORROCKS ENGINEERS
LOCATION: SOUTH END OF 6650 WEST
DRILLING METHOD: CME-55 NO. 1 / N.W. CASING
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ▽ N.M. AFTER 24 HOURS: ▽ N.M.

PROJECT NUMBER: 200601.022
DATE STARTED: 8/16/06
DATE COMPLETED: 8/17/06
GROUND ELEVATION: NOT MEASURED
LOGGED BY: M. HANSEN, J.H.B.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
	55		18	1,3,5,(8) 0.24 0.49	CL	gray, moist, soft to firm LEAN CLAY									
	60		10	Pushed 0.48	CL-1	gray, moist, firm		22.1	32	14	0	2	98	UC
	65		13	3,7,9,(14) 0.30	CL-ML	gray, moist, firm SANDY SILTY CLAY		23.5	25	6	0	20	80	
	70		16	34,38,33,(61)	GP-GM	dk. gray, wet, dense GRAVEL W/SILT & SAND									
	75		14	7,5,6,(9) 0.56	CL	gray, moist, stiff LEAN CLAY W/SILTY SAND LENSES & LAYERS TO 5" THICK									
	80		17	Pushed 0.45	CL-2	gray, moist, stiff		23.4	39	17	0	16	84	UC
	85		8	45,26,48,(58)	GP-GM	gray, wet, dense GRAVEL W/SILT & SAND									
	90		12	Pushed 0.89	CL	brown-gray, moist, stiff LEAN CLAY									
	95		18	30,11,2,(10) 0.40	GC CL	gray, wet, med. dense CLAYEY GRAVEL gray, moist, firm SANDY LEAN CLAY									
			12	Pushed	CL-2	gray, moist		22.6	35	17	0	18	82	UC

..\LOGV1_COLOR AFSENSLAND_COLOR.GPJ US EVAL.GDT 12/11/06

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE — 2,3,2,(6) — Blow Count per 6" / $(N_1)_{60}$ Value; 0.45 — Torvane (tsf)

UNDISTURBED SAMPLE — PUSHED 0.45 — Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear

= Potential Liquefaction
= Potential Liquefaction & Lateral Spread

Project: Meadow Brook
Job No. 228636

8/9/2022

Bearing Capacity after Meyerhoff[1]

Allowable Bearing Pressure, $q_{all} = (cN_cs_cd_c + \gamma DN_qs_qd_q + 0.5\gamma BN_\gamma s_\gamma d_\gamma r_\gamma)/(F.S.) \leq q_l$

Friction Angle, ϕ =	32	degrees				N_q =	23.2	$= e^{(\pi \tan\phi)}\tan^2(45+\phi/2)$
Cohesion, c =	0	psf				N_c =	35.5	$= (N_q - 1)\cot\phi$
Effective Unit Weight, γ =	115	pcf	=	18.1	kN/m2	N_g =	22.0	$= (N_q - 1)\tan(1.4\phi)$
Longest Wall Footing Length, L =	25	ft	=	7.6	m	K_p =	3.3	$= \tan^2(45+\phi/2)$
Bearing Pressure Limit, q_l =	1.5	ksf	=	0.1	mPa			
F.S. =	3.0							shaded areas indicate input values

SUMMARY TABLES

Allowable Wall Footing Bearing Capacity, q_{all} - ksf

Footing	Structural Fill	Width - ft									
Depth, D - ft	Depth, D_f - ft	1.50	1.67	1.83	2.00	2.50	3.00	3.50	4.00	4.50	5.00
1.00	0.00	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
2.50	0.00	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
1.00	2.00	3.78	3.56	3.39	3.24	2.92	2.70	2.55	2.43	2.34	2.27
2.50	2.00	3.78	3.56	3.39	3.24	2.92	2.70	2.55	2.43	2.34	2.27

Allowable Square Column Footing Bearing Capacity, q_{all} - ksf

Footing	Structural Fill	Width - ft									
Depth, D - ft	Depth, D_f - ft	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00
1.00	0.00	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
2.50	0.00	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
1.00	2.00	4.86	4.17	3.70	3.38	3.13	2.94	2.79	2.67	2.57	2.48
2.50	2.00	4.86	4.17	3.70	3.38	3.13	2.94	2.79	2.67	2.57	2.48

1Bowles, Joseph E.; Foundation Analyses and Design; McGraw-Hill; 1988; pgs: 187-196

using Bowles bearing capacity reduction method (r_γ = 1- 0.25 log (B/6), B ≥ 6 ft.).

Wall (Strip) Footing

Width, B =	1.50	1.67	1.83	2.00	2.50	3.00	3.50	4.00	4.50	5.00
s_c =	1.04	1.04	1.05	1.05	1.07	1.08	1.09	1.10	1.12	1.13
$s_q = s_\gamma$ =	1.02	1.02	1.02	1.03	1.03	1.04	1.05	1.05	1.06	1.07
Depth, D =	1									
d_c =	1.24	1.22	1.20	1.18	1.14	1.12	1.10	1.09	1.08	1.07
$d_q = d_\gamma$ =	1.12	1.11	1.10	1.09	1.07	1.06	1.05	1.05	1.04	1.04
r_γ =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
q_{ult} =	5.2	5.4	5.6	5.8	6.5	7.1	7.8	8.5	9.2	9.9
q_{all} =	1.7	1.8	1.9	1.9	2.2	2.4	2.6	2.8	3.1	3.3
Depth, D =	2.5									
d_c =	1.60	1.54	1.49	1.45	1.36	1.30	1.26	1.23	1.20	1.18
$d_q = d_\gamma$ =	1.30	1.27	1.25	1.23	1.18	1.15	1.13	1.11	1.10	1.09
r_γ =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
q_{ult} =	11.4	11.4	11.5	11.6	12.0	12.5	13.1	13.7	14.4	15.1
q_{all} =	3.8	3.8	3.8	3.9	4.0	4.2	4.4	4.6	4.8	5.0

Square Column Footing

Width, B =	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00
Depth, D =	1.00									
d_c =	1.14	1.12	1.10	1.09	1.08	1.07	1.07	1.06	1.06	1.05
$d_q = d_\gamma$ =	1.07	1.06	1.05	1.05	1.04	1.04	1.03	1.03	1.03	1.03
r_γ =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.98
q_{ult} =	8.3	9.1	9.9	10.7	11.5	12.4	13.2	14.0	14.7	15.5
q_{all} =	2.8	3.0	3.3	3.6	3.8	4.1	4.4	4.7	4.9	5.2
Depth, D =	2.5									
d_c =	1.36	1.30	1.26	1.23	1.20	1.18	1.16	1.15	1.14	1.13
$d_q = d_\gamma$ =	1.18	1.15	1.13	1.11	1.10	1.09	1.08	1.08	1.07	1.06
r_γ =	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.98
q_{ult} =	15.4	16.0	16.6	17.3	18.0	18.8	19.5	20.3	21.0	21.7
q_{all} =	5.1	5.3	5.5	5.8	6.0	6.3	6.5	6.8	7.0	7.2

Settlement--Footings New Loads

SETTLEMENT OF FOOTINGS								
Project:	Meadow Brook		B-1					
B:	2.8	feet (width or diameter)			b =	1.4	ft (1/2 width/dia)	
L:	25	feet (length)			l =	12.5	ft (1/2 length)	
foot. depth:	4	feet					Spread Load,k:	22
unit weight:	114.4	pcf (above footing depth)					Strip Load,k:	4.2
allowable q:	1500	psf						
footing type:	1	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	8	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
ML	0.051	0.028	2000		114.4	0.2	14.0	2.07

STRIP FOOTINGS...

Soil Type	Below ftg. depth (ft)	Influence	Increased Stress (psf)	avg. ovrbn. press.(psf)	Incremnt. Sett. (in.)	Collapse Sett. (in.)	Total Set. (in.)	
Fill	0	0.000	0.0	457.6	0.000	0.000	0.00	
ML	1	0.906	1359.4	572.0	0.178	0.024	0.20	
ML	2	0.688	1031.8	686.4	0.134	0.024	0.36	
ML	3	0.522	782.9	800.8	0.100	0.024	0.48	
ML	4	0.413	619.3	915.2	0.075	0.024	0.58	
ML	5	0.339	508.6	967.2	0.062	0.024	0.67	
ML	6	0.287	430.2	1019.2	0.051	0.024	0.74	<---2B
ML	7	0.248	372.1	1071.2	0.044	0.024	0.81	
ML	8	0.218	327.6	1123.2	0.037	0.024	0.87	
ML	9	0.195	292.4	1175.2	0.032	0.024	0.93	
ML	10	0.176	263.9	1227.2	0.028	0.024	0.98	
ML	11	0.160	240.5	1279.2	0.025	0.024	1.03	
ML	12	0.147	220.8	1331.2	0.022	0.024	1.08	
ML	13	0.136	204.1	1383.2	0.020	0.024	1.12	
ML	14	0.126	189.7	1435.2	0.018	0.024	1.16	

Settlement--Footings New Loads

SETTLEMENT OF FOOTINGS								
Project:	Meadow Brook		TP-3					
B:	2.8	feet (width or diameter)			b =	1.4	ft (1/2 width/dia)	
L:	25	feet (length)			l =	12.5	ft (1/2 length)	
foot. depth:	4	feet					Spread Load,k:	22
unit weight:	121.44	pcf (above footing depth)					Strip Load,k:	4.2
allowable q:	1500	psf						
footing type:	1	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	7.5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
SC-SM	0.08	0.011	2700		121.44	0.1	11.0	2.96

STRIP FOOTINGS...

	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	0	0.000	0.0	485.8	0.000	0.000	0.00	
SC-SM	1	0.906	1359.4	607.2	0.067	0.012	0.08	
SC-SM	2	0.688	1031.8	728.6	0.051	0.012	0.14	
SC-SM	3	0.522	782.9	850.1	0.037	0.012	0.19	
SC-SM	4	0.413	619.3	940.3	0.029	0.012	0.23	
SC-SM	5	0.339	508.6	999.4	0.024	0.012	0.27	
SC-SM	6	0.287	430.2	1058.4	0.020	0.012	0.30	<---2B
SC-SM	7	0.248	372.1	1117.4	0.016	0.012	0.33	
SC-SM	8	0.218	327.6	1176.5	0.014	0.012	0.35	
SC-SM	9	0.195	292.4	1235.5	0.012	0.012	0.38	
SC-SM	10	0.176	263.9	1294.6	0.011	0.012	0.40	
SC-SM	11	0.160	240.5	1353.6	0.009	0.012	0.42	

Settlement--Footings New Loads

SETTLEMENT OF FOOTINGS								
Project:	Meadow Brook		TP-4					
B:	2.8	feet (width or diameter)			b =	1.4	ft (1/2 width/dia)	
L:	25	feet (length)			l =	12.5	ft (1/2 length)	
foot. depth:	4	feet					Spread Load,k:	22
unit weight:	101.08	pcf (above footing depth)					Strip Load,k:	4.2
allowable q:	1500	psf						
footing type:	1	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	12	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
CL	0.119	0.012	1400		101.08	0	14.0	1.54

STRIP FOOTINGS...

Soil Type	Below ftg. depth (ft)	Influence	Increased Stress (psf)	avg. ovrbn. press.(psf)	Incremnt. Sett. (in.)	Collapse Sett. (in.)	Total Set. (in.)	
Fill	0	0.000	0.0	404.3	0.000	0.000	0.00	
CL	1	0.906	1359.4	505.4	0.241	0.000	0.24	
CL	2	0.688	1031.8	606.5	0.150	0.000	0.39	
CL	3	0.522	782.9	707.6	0.082	0.000	0.47	
CL	4	0.413	619.3	808.6	0.047	0.000	0.52	
CL	5	0.339	508.6	909.7	0.035	0.000	0.55	
CL	6	0.287	430.2	1010.8	0.038	0.000	0.59	<---2B
CL	7	0.248	372.1	1111.9	0.051	0.000	0.64	
CL	8	0.218	327.6	1213.0	0.068	0.000	0.71	
CL	9	0.195	292.4	1251.6	0.068	0.000	0.78	
CL	10	0.176	263.9	1290.3	0.115	0.000	0.89	
CL	11	0.160	240.5	1329.0	0.103	0.000	1.00	
CL	12	0.147	220.8	1367.7	0.093	0.000	1.09	
CL	13	0.136	204.1	1406.4	0.084	0.000	1.17	
CL	14	0.126	189.7	1445.0	0.077	0.000	1.25	

Settlement--Footings New Loads

SETTLEMENT OF FOOTINGS								
Project:	Meadow Brook		TP-7					
B:	2.8	feet (width or diameter)			b =	1.4	ft (1/2 width/dia)	
L:	25	feet (length)			l =	12.5	ft (1/2 length)	
foot. depth:	4	feet					Spread Load,k:	22
unit weight:	108.8	pcf (above footing depth)					Strip Load,k:	4.2
allowable q:	1500	psf						
footing type:	1	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	10	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
SC	0.182	0.014	2000		108.8	0.7	5.0	4.08
CL	0.092	0.018	2000		126	0.2	14.0	1.51

	STRIP FOOTINGS...							
	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	0	0.000	0.0	435.2	0.000	0.000	0.00	
SC	1	0.906	1359.4	544.0	0.091	0.084	0.18	
SC	2	0.688	1031.8	652.8	0.069	0.084	0.33	
SC	3	0.522	782.9	761.6	0.052	0.084	0.46	
SC	4	0.413	619.3	870.4	0.039	0.084	0.59	
SC	5	0.339	508.6	979.2	0.031	0.084	0.70	
CL	6	0.287	430.2	1105.2	0.031	0.024	0.76	<---2B
CL	7	0.248	372.1	1168.8	0.026	0.024	0.81	
CL	8	0.218	327.6	1232.4	0.022	0.024	0.85	
CL	9	0.195	292.4	1296.0	0.019	0.024	0.90	
CL	10	0.176	263.9	1359.6	0.017	0.024	0.94	
CL	11	0.160	240.5	1423.2	0.015	0.024	0.98	
CL	12	0.147	220.8	1486.8	0.013	0.024	1.01	
CL	13	0.136	204.1	1550.4	0.012	0.024	1.05	
CL	14	0.126	189.7	1614.0	0.010	0.024	1.08	

Settlement--Footings New Loads

SETTLEMENT OF FOOTINGS								
Project:	Meadow Brook		B-1					
B:	3.82971	feet (width or diameter)			b =	1.914854	ft (1/2 width/dia)	
L:	3.82971	feet (length)			l =	1.914854	ft (1/2 length)	
foot. depth:	4	feet					Spread Load,k:	22
unit weight:	114.4	pcf (above footing depth)					Strip Load,k:	4.2
allowable q:	1500	psf						
footing type:	2	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	8	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
ML	0.051	0.028	2000		114.4	0.2	14.0	2.07

SQUARE/RECTANGULAR FOOTINGS (Boussinesq Method)...

Soil Type	Below ftg. depth (ft)	Influence	Increased Stress (psf)	avg. ovrbn. press.(psf)	Incremnt. Sett. (in.)	Collapse Sett. (in.)	Total Set. (in.)	
Fill	0	0.000	0.0	457.6	0.000	0.000	0.00	
ML	1	0.922	1382.9	572.0	0.179	0.024	0.20	
ML	2	0.679	1018.8	686.4	0.133	0.024	0.36	
ML	3	0.461	690.8	800.8	0.091	0.024	0.47	
ML	4	0.316	473.9	915.2	0.061	0.024	0.56	
ML	5	0.225	337.3	967.2	0.044	0.024	0.63	
ML	6	0.166	249.3	1019.2	0.032	0.024	0.68	
ML	7	0.127	190.5	1071.2	0.024	0.024	0.73	
ML	8	0.100	149.8	1123.2	0.018	0.024	0.77	<---2B
ML	9	0.080	120.6	1175.2	0.014	0.024	0.81	
ML	10	0.066	99.0	1227.2	0.011	0.024	0.85	
ML	11	0.055	82.6	1279.2	0.009	0.024	0.88	
ML	12	0.047	70.0	1331.2	0.007	0.024	0.91	
ML	13	0.040	60.0	1383.2	0.006	0.024	0.94	
ML	14	0.035	52.0	1435.2	0.005	0.024	0.97	

Settlement--Footings New Loads

SETTLEMENT OF FOOTINGS								
Project:	Meadow Brook		TP-3					
B:	3.82971	feet (width or diameter)			b =	1.914854	ft (1/2 width/dia)	
L:	3.82971	feet (length)			l =	1.914854	ft (1/2 length)	
foot. depth:	4	feet					Spread Load,k:	22
unit weight:	121.44	pcf (above footing depth)					Strip Load,k:	4.2
allowable q:	1500	psf						
footing type:	3	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	7.5	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
SC-SM	0.08	0.011	2700		121.44	0.1	11.0	2.96

	SQUARE/RECTANGULAR FOOTINGS (Westergard Method)...							
	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	0	0.000	0.0	485.8	0.000	0.000	0.00	
SC-SM	1	0.812	1217.4	607.2	0.063	0.012	0.08	
SC-SM	2	0.642	963.3	728.6	0.048	0.012	0.14	
SC-SM	3	0.502	753.5	850.1	0.036	0.012	0.18	
SC-SM	4	0.393	589.6	940.3	0.028	0.012	0.22	
SC-SM	5	0.310	465.2	999.4	0.022	0.012	0.26	
SC-SM	6	0.248	371.5	1058.4	0.017	0.012	0.29	
SC-SM	7	0.201	300.8	1117.4	0.014	0.012	0.31	
SC-SM	8	0.165	247.0	1176.5	0.011	0.012	0.34	<---2B
SC-SM	9	0.137	205.5	1235.5	0.009	0.012	0.36	
SC-SM	10	0.115	173.1	1294.6	0.007	0.012	0.38	
SC-SM	11	0.098	147.5	1353.6	0.006	0.012	0.39	

Settlement--Footings New Loads

SETTLEMENT OF FOOTINGS								
Project:	Meadow Brook		TP-4					
B:	3.82971	feet (width or diameter)			b =	1.914854	ft (1/2 width/dia)	
L:	3.82971	feet (length)			l =	1.914854	ft (1/2 length)	
foot. depth:	4	feet					Spread Load,k:	22
unit weight:	101.08	pcf (above footing depth)					Strip Load,k:	4.2
allowable q:	1500	psf						
footing type:	3	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	12	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
CL	0.119	0.012	1400		101.08	0	14.0	1.54

SQUARE/RECTANGULAR FOOTINGS (Westergard Method)...

Soil Type	Below ftg. depth (ft)	Influence	Increased Stress (psf)	avg. ovrbn. press.(psf)	Incremnt. Sett. (in.)	Collapse Sett. (in.)	Total Set. (in.)	
Fill	0	0.000	0.0	404.3	0.000	0.000	0.00	
CL	1	0.812	1217.4	505.4	0.192	0.000	0.19	
CL	2	0.642	963.3	606.5	0.123	0.000	0.32	
CL	3	0.502	753.5	707.6	0.069	0.000	0.38	
CL	4	0.393	589.6	808.6	0.034	0.000	0.42	
CL	5	0.310	465.2	909.7	0.026	0.000	0.44	
CL	6	0.248	371.5	1010.8	0.020	0.000	0.46	
CL	7	0.201	300.8	1111.9	0.020	0.000	0.48	
CL	8	0.165	247.0	1213.0	0.035	0.000	0.52	<---2B
CL	9	0.137	205.5	1251.6	0.032	0.000	0.55	
CL	10	0.115	173.1	1290.3	0.078	0.000	0.63	
CL	11	0.098	147.5	1329.0	0.065	0.000	0.69	
CL	12	0.085	126.9	1367.7	0.055	0.000	0.75	
CL	13	0.073	110.2	1406.4	0.047	0.000	0.80	
CL	14	0.064	96.5	1445.0	0.040	0.000	0.84	

Settlement--Footings New Loads

SETTLEMENT OF FOOTINGS								
Project:	Meadow Brook		TP-7					
B:	3.82971	feet (width or diameter)			b =	1.914854	ft (1/2 width/dia)	
L:	3.82971	feet (length)			l =	1.914854	ft (1/2 length)	
foot. depth:	4	feet					Spread Load,k:	22
unit weight:	108.8	pcf (above footing depth)					Strip Load,k:	4.2
allowable q:	1500	psf						
footing type:	3	(1=strip,2&3=square/rect.,4=circular)						
	4	(4 for center, 1 for corner of square/rect.)						
water depth:	10	feet						

DEFINE SOIL PROFILE:			preconsol		Density	Collapse	Below ftg.	Avg.
Soil type	C_c'	C_r'	press.,σ_c'(psf)	OCR	(pcf)	(%)	depth (ft)	OCR
Fill	0.001	0.000125			135		0.0	1.00
SC	0.182	0.014	2000		108.8	0.7	5.0	4.08
CL	0.092	0.018	2000		126	0.2	14.0	1.51

SQUARE/RECTANGULAR FOOTINGS (Westergard Method)...

	Below ftg.		Increased	avg. ovrbn.	Incremnt.	Collapse	Total	
Soil Type	depth (ft)	Influence	Stress (psf)	press.(psf)	Sett. (in.)	Sett. (in.)	Set. (in.)	
Fill	0	0.000	0.0	435.2	0.000	0.000	0.00	
SC	1	0.812	1217.4	544.0	0.086	0.084	0.17	
SC	2	0.642	963.3	652.8	0.066	0.084	0.32	
SC	3	0.502	753.5	761.6	0.050	0.084	0.45	
SC	4	0.393	589.6	870.4	0.038	0.084	0.58	
SC	5	0.310	465.2	979.2	0.028	0.084	0.69	
CL	6	0.248	371.5	1105.2	0.027	0.024	0.74	
CL	7	0.201	300.8	1168.8	0.021	0.024	0.78	
CL	8	0.165	247.0	1232.4	0.017	0.024	0.83	<---2B
CL	9	0.137	205.5	1296.0	0.014	0.024	0.86	
CL	10	0.115	173.1	1359.6	0.011	0.024	0.90	
CL	11	0.098	147.5	1423.2	0.009	0.024	0.93	
CL	12	0.085	126.9	1486.8	0.008	0.024	0.96	
CL	13	0.073	110.2	1550.4	0.006	0.024	0.99	
CL	14	0.064	96.5	1614.0	0.005	0.024	1.02	

Project:	Meadow Brook		
Location:	See Figure No. 2, Utah	Calcs By:	WGT
Project No.	228636	References / Reviewed By:	
Date:	8/9/22	1 Youd, et al, 2001 — C_E =	1 02
Drill Rig Code	L3	2 Boulanger & Idriss, 2008 — C_B =	1.05
Borehole Diameter, inches:	7	3 Bray & Sancio, 2006 — C_S =	1 20
Sampler without liners?.	yes	Magnitude Scaling Factor, MSF =	1 00
Fill Height, feet	0	$R^* = R + 10^{(0.89M_w - 5.64)}$ =	14 5
Magnitude, Mw	7 5	ModCal Sampler Conver Factor (*) =	0 77
Peak Horiz. Acceleration, amax	0.553	Use representative tests for layers?	yes
Distance from site to fault, km	3 65	Enter Ground Slope %	0.001
Reference atmosphere value,tsf	1 05811	Enter W=Ht/Distance to free face,%	

LATERAL SPREADING VALUES

Boring	F_{15}, T_{15}	$D50_{15}$	D_H, ft	Boring	F_{15}, T_{15}	$D50_{15}$	D_H, ft	Boring	F_{15}, T_{15}	$D50_{15}$	D_H, ft
B-1	12,1 22	0 427	1.0								

TOTAL SETTLEMENT VALUES

Boring	Sett., in	Boring	Sett., in	Boring	Sett., in
B-1	1.9				

Boring No	Water Depth, feet	Sample Depth, feet	USC	% Fines	Unit Weight, pcf	Pore Press., tsf	Total Stress tsf	Effective Stress tsf	Rod Length, feet	Meas N-value N_m	Rod Correct. C_R	Ovrbrdn Correct. C_N	$(N_1)_{60}$	$(N_1)_{60cs}$	r_d	$CRR_{7.5}$	CSR	(>1) F S.	F.S = ($CRR_{7.5}$ / CSR) MSF (<=1) F S	Moisture Content %	Liquid Limit	Plast Index	Will It Liquefy By: Boul./Idriss Criteria?	Bray/Sancio Criteria?	Volum. Strain %	Layer Thick. feet	Layer Settlmnt, inches
B-1	8	3 5	ML	68	114	0.000	0 200	0 200	5	7	0 75	1 58	10 7	17.8	0.99	0 19	0 36		AWT	10	26	4	YES	NO			
	8	8 5	CL	70	113	0.016	0 480	0,465	10	4	0 80	1 34	5 5	11 6	0.98	0 13	0 36	(Clay)					NO				
	8	11	SM	12	114	0.094	0.627	0 533	15	6	0 85	1.29	8 4	10.2	0 97	0 12	0 41		0.28						2 5	4	1.2
	8	16	CL	86	115	0.250	0.920	0.670	20	8	0 85	1 20	10 5	17 6	0 96	0 19	0 47	(Clay)		30	43	21	NO				
	8	21	CL	86	116	0 406	1.218	0 812	25	12	0 95	1.12	16 3	24.6	0.95	0.28	0.51	(Clay)		30	43	21	NO				
	8	26	CL	88	116	0 562	1.508	0 946	30	12	0 95	1.05	15 3	23 4	0 94	0 26	0 54	(Clay)		30	43	21	NO				
	8	31	CL	79	114	0 718	1 767	1 049	35	6	1 00	1.00	7 7	14.2	0 92	0 15	0 56	(Clay)		40	39	18	NO	YES			
	8	36	SP-SM	8	118	0 874	2.124	1 250	40	18	1 00	0.92	21 3	21 9	0 88	0 24	0 54		0.45	22					1 4	4 5	0 7
													#N/A														
													#N/A														
													#N/A														

TAYLOR GEOTECHNICAL

2650 North 180 East
Lehi, Utah 84043
P. 801-400-9784

August 31, 2022

Mr. Ben Hunter
Project Engineer
American Fork City
51 East Main Street
American Fork, Utah 84003

Subject: **Geotechnical Engineering Review No. 1**
Stonecreek Subdivision, Plat J
1000 South 400 West
American Fork Utah
TG Project No. 22079

Subject Documents: Earthtec Engineering, Response to Review, 26 Acre Property, Stonecreek Subdivision Plats H & I, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Woodside Homes of Utah, 460 West 50 South, Suite 300, Salt Lake City, UT 84101, May 9, 2022.

Earthtec Engineering, Response to Review, American Fork Property and 26 Acre Property, 700 South 400 West and 1000 South 400 West, American Fork, Utah, Earthtec Project No. 169273 and 178750, prepared for Woodside Homes of Utah, 460 West 50 South, Suite 300, Salt Lake City, UT 84101, August 25, 2020.

Earthtec Engineering, Addendum 1, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Mr. Garrett Seely, Woodside Homes, 460 West 50 South, Suite 200, Salt Lake [sic], UT 84101, May 25, 2018.

Earthtec Engineering, Geotechnical Study - Revised, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Mr. Garrett Seely, Woodside Homes, 460 West 50 South, Suite 200, American Fork [sic], UT 84101, September 26, 2017.

Submittal Status: **GEOTECHNICAL ENGINEERING SUBMITTAL INCOMPLETE**

Dear Mr. Hunter:

At your request, Taylor Geotechnical (TG) reviewed the above-referenced documents prepared by Earthtec Engineering (Earthtec). The purpose of TG's review is to evaluate whether or not the Earthtec submittals adequately address geotechnical engineering parameters at the site, consistent

with concerns for public health, safety, welfare, reasonable professional standards of care, and the American Fork City (the City) Sensitive Lands Ordinance 07-10-47.

It should be noted that the old proposed Plats H & I are now Plats J & K.

TG Conclusion

Based substantially in and on reliance of the technical documentation and assurances provided by Earthtec, including their opinions and conclusions, it is TG's opinion that the Earthtec submittals have not adequately addressed geotechnical engineering parameters at the site, consistent with concerns for public health, safety and welfare; reasonable professional standards of practice and the City Sensitive Lands Ordinance 07-10-47.

TG Recommendations

Based on the requirements of the City Sensitive Land Ordinance and the technical documentation provided by Earthtec, TG recommends the City not consider the Earthtec submittals complete from a geotechnical engineering perspective until the following item is adequately addressed.

The liquefaction analysis provided in the September 26, 2017, Earthtec report with supporting calculations provided in the May 9, 2022, Earthtec response letter was based on Site Class D and ASCE 7-10.

TG recommends the City request Earthtec to:

a) *Update the liquefaction analysis using the modified peak ground acceleration (PGA_M) based on ASCE 7-16 and Site Class E;*

b) *Provide their updated liquefaction analysis calculations;*

c) *Provide the output file that substantiates the PGA_M; and,*

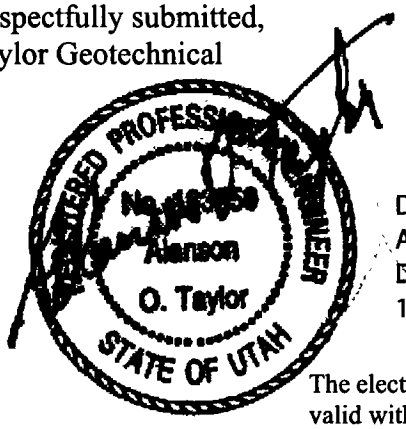
d) *Provide updated seismic design acceleration parameters.*

Closure

All services performed by Taylor Geotechnical for this review were provided for the exclusive use and benefit of the City. No other person or entity is entitled to use or rely upon any of the information or reports generated by Taylor Geotechnical as a result of this review.

If you have any questions, please feel free to contact the undersigned. The opportunity to be of continued service to American Fork City is appreciated.

Respectfully submitted,
Taylor Geotechnical



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Alanson O. Taylor, P.E.
Date: 2022.08.31
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The electronic version of this report is not valid without a digital signature noted.

Alanson O. Taylor, P.E.
Principal

TAYLOR GEOTECHNICAL

2650 North 180 East
Lehi, Utah 84043
P. 801-400-9784

August 31, 2022

Mr. Ben Hunter
Project Engineer
American Fork City
51 East Main Street
American Fork, Utah 84003

Subject: **Geotechnical Engineering Review No. 2**
Stonecreek Subdivision, Plat K
1000 South 400 West
American Fork Utah
TG Project No. 22064

Subject Documents: Earthtec Engineering, Response to Review, 26 Acre Property, Stonecreek Subdivision Plats H & I, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Woodside Homes of Utah, 460 West 50 South, Suite 300, Salt Lake City, UT 84101, May 9, 2022.

Previous Submittals: Earthtec Engineering, Geotechnical Study - Revised, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Mr. Garrett Seely, Woodside Homes, 460 West 50 South, Suite 200, American Fork [sic], UT 84101, September 26, 2017.

Earthtec Engineering, Addendum 1, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Mr. Garrett Seely, Woodside Homes, 460 West 50 South, Suite 200, Salt Lake [sic], UT 84101, May 25, 2018.

Earthtec Engineering, Response to Review, American Fork Property and 26 Acre Property, 700 South 400 West and 1000 South 400 West, American Fork, Utah, Earthtec Project No. 169273 and 178750, prepared for Woodside Homes of Utah, 460 West 50 South, Suite 300, Salt Lake City, UT 84101, August 25, 2020.

Submittal Status: **GEOTECHNICAL ENGINEERING SUBMITTAL INCOMPLETE**

Dear Mr. Hunter:

At your request, Taylor Geotechnical (TG) reviewed the above May 9, 2022, subject document prepared in response to the following review letter by TG:

TG Geotechnical Engineering Review No. 2, Stonecreek Subdivision, Plat K, 1000 South 400 West, American Fork Utah, TG Project No. 22064, prepared for Mr. Ben Hunter, Project Engineer, American Fork City, 51 East Main Street, American Fork, Utah 84003, dated July 21, 2022.

The purpose of TG's review is to evaluate whether or not Earthtec Engineering (Earthtec) adequately addresses geotechnical engineering review comments in the July 21, 2022, TG review letter, consistent with concerns for public health, safety, welfare, reasonable professional standards of care, and the American Fork City (the City) Sensitive Lands Ordinance 07-10-47.

TG Conclusion

Based substantially in and on the reliance of the technical documentation and assurances provided by Earthtec, including their opinions and conclusions, it is TG's opinion the May 9, 2022, Earthtec response report did not adequately respond to the July 21, 2022, TG review letter.

TG Recommendations

Based on the requirements of the City Sensitive Land Ordinance and the technical documentation provided by Earthtec, TG recommends the City not consider the Earthtec submittals complete from a geotechnical perspective until the following items are adequately addressed.

In response to review comment No. 2c of the July 21, 2022, TG review letter, Earthtec recommended Site Class E for seismic analysis of structures within the subject site. The liquefaction analysis provided in response to review comment No. 3 of the July 21, 2022, TG review letter indicated Earthtec used Site Class D and referenced ASCE 7-10.

TG recommends the City request Earthtec to:

a) Update the liquefaction analysis using the PGA_M based on ASCE 7-16 and Site Class E;

b) Provide their updated liquefaction analysis calculations;

c) Provide the output file that substantiates the modified peak ground acceleration; and,

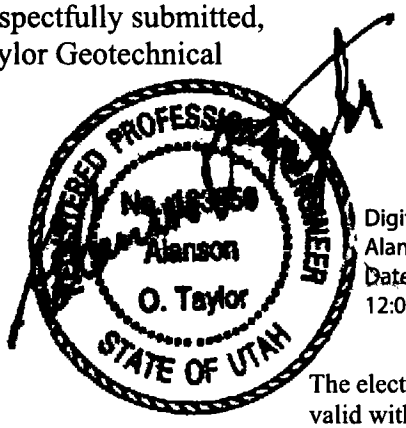
d) Provide updated seismic design acceleration parameters.

CLOSURE

All services performed by Taylor Geotechnical for this review were provided for the exclusive use and benefit of American Fork City. No other person or entity is entitled to use or rely upon any of the information or reports generated by Taylor Geotechnical as a result of this review.

If you have any questions, please feel free to contact the undersigned. The opportunity to be of continued service to American Fork City is appreciated.

Respectfully submitted,
Taylor Geotechnical



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Alanson O. Taylor, P.E.
Date: 2022.08.31
12:03:38 -06'00'

The electronic version of this report is not valid without a digital signature noted.

Alanson O. Taylor, P.E.
Principal

EARTHTEC ENGINEERING

1497 West 40 South
Lindon, Utah - 84042
Phone (801) 225-5711

840 West 1700 South #10
Salt Lake City, Utah - 84104
Phone (801) 787-9138

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

September 8, 2022

Woodside Homes of Utah
460 West 50 South, Suite 300
Salt Lake City, UT 84101

Re: Response to Review
Stonecreek, Plat J
1000 South 400 West
American Fork, Utah
Job No: 178750

Gentlemen:

This letter is a response to the review by Taylor Geotechnical, dated August 31, 2022, of our geotechnical report[1] completed in 2017. In addition, an addendum[2] was completed on May 25, 2018.

TG's Request:

Based on the requirements of the City Sensitive Land Ordinance and the technical documentation provided by Earthtec, TG recommends the City not consider the Earthtec submittals complete from a geotechnical engineering perspective until the following item is adequately addressed.

The liquefaction analysis provided in the September 26, 2017, Earthtec report with supporting calculations provided in the May 9, 2022, Earthtec response letter was based on Site Class D and ASCE 7-10.

TG recommends the City request Earthtec to:

a) Update the liquefaction analysis using the modified peak ground acceleration (PGAM) based on ASCE 7-16 and Site Class E;

Our analysis has been updated with the modified peak ground acceleration of 0.638g.

b) Provide their updated liquefaction analysis calculations;

Our analysis indicates that approximately up to 2.7 inches of liquefaction-induced settlement and possibly up to ½ feet of lateral spreading could occur in the vicinity of B-1 during a moderate to large earthquake event.

c) Provide the output file that substantiates the PGAM; and,

The output file is provided at the end of the letter.

d) Provide updated seismic design acceleration parameters.

[1] Geotechnical Study-Revised, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Engineering, Project No.178750, September 26, 2017.
[2] Addendum 1, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Engineering, Project No.178750, May 25, 2018.

Design Accelerations

S_S	F_a	S_{MS}	S_{DS}
1.248 g	n/a	n/a	n/a
S_1	**F_v**	**S_{M1}**	**S_{D1}**
0.45 g	n/a	n/a	n/a

General Conditions

The information presented in this letter applies only to the soils encountered during the field investigation on the subject site. It should be noted that Earthtec Engineering was not involved with the selection of the foundation system being used, surface drainage control, floor slab design and construction, backfill compaction requirements against foundation walls, mass grading of the site, or any other aspect of the building construction. Site grading activities completed in other areas such as driveways, sidewalks, or detached structures, were not observed during this site visit, are outside of the scope of our work and are not addressed in this letter. The observations and recommendations presented in this letter were conducted within the limits prescribed by our client, with the usual thoroughness and competence of the engineering profession in this area at this time. No warranty or representation is intended in our proposals, contracts, reports, or letters.

Closure

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please call.

Respectfully;
EARTHTEC ENGINEERING

Jeremy A. Balleck, E.I.T.
Staff Engineer

PROFESSIONAL ENGINEER
No. 5567049-2202
TIMOTHY ALLAN MITCHELL
Electronically generated on 9/08/2022
STATE OF UTAH

Timothy A. Mitchell, P.E.
Senior Geotechnical Engineer

JB/tm

Attachments:
Liquefication Calculations
Seismic Design Maps

Project: 28 Acre Property
Location: See Figure 2, Utah
Project No: 178750
Date: 9/8/22
Calcs By: WGT
Reviewed By:

References:
1 Youd, et al, 2001
2 Boulanger & Idriss, 2006
3 Bray & Sancio, 2006

Parameter	Value	Parameter	Value
Drill Rig Code	L3	C_E =	1 02
Borehole Diameter, Inches:	7	C_B =	1 05
Sampler without liners?:	yes	C_S =	1.20
Fill Height, feet:	0	Magnitude Scaling Factor, MSF =	1 00
Magnitude, Mw:	7 5	$R^* = R + 10^{(0.89M_w - 5.64)}$ =	12.9
Peak Horiz. Acceleration, amax:	0.638	ModCal Sampler Conver Factor (*) =	0 77
Distance from site to fault, km.	2 1	Use representative tests for layers?	yes
Reference atmosphere value,tsf:	1.05811	Enter Ground Slope %.	0 01
		Enter W=Ht/Distance to free face,%:	

LATERAL SPREADING VALUES

Boring	F_{15},T_{15}	$D50_{15}$	D_H, ft	Boring	F_{15},T_{15}	$D50_{15}$	D_H, ft	Boring	F_{15},T_{15}	$D50_{15}$	D_H, ft
B-1	74,2 29	0 039	0 2								

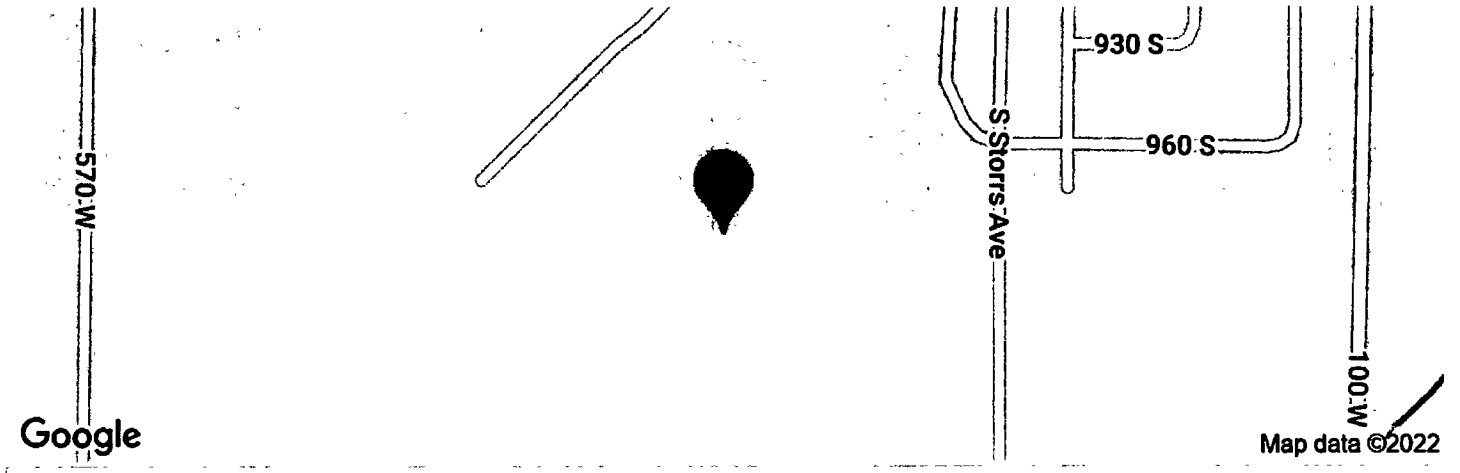
TOTAL SETTLEMENT VALUES

Boring	Sett., in	Boring	Sett., in.	Boring	Sett., in.
B-1	2 7				

Boring No	Water Depth, feet	Sample Depth, feet	USC	% Fines	Unit Weight, pcf	Pore Press., tsf	Total Stress tsf	Effective Stress tsf	Rod Length, feet	Meas N-value N_m	Rod Correct. C_R	Ovrbrdn Correct. C_N	$(N_1)_{60}$	$(N_1)_{60cs}$	r_d	$CRR_{7.5}$	CSR	(>1) F S	F S = ($CRR_{7.5}$ / CSR) MSF (<=1) F.S.	Moisture Content %	Liquid Limit	Plast Index	Will It Liquefy By: Boul/Idriss Criteria?	Will It Liquefy By: Bray/Sancio Criteria?	Volum. Strain %	Layer Thick. feet	Layer Settlmnt, inches
B-1	6 5	3 5	CL	85	113	0 000	0.198	0 198	5	5	0 75	1.59	7.6	14.1	0 99	0 15	0 41	(Clay)					NO				
	6 5	6	CL	85	112	0 000	0 336	0 336	10	3	0 80	1.45	4.5	10.4	0.99	0.12	0.41	(Clay)					NO				
	6 5	8 5	ML	94	99	0 062	0 421	0 358	10	3	0 80	1.43	4 4	10 3	0 98	0.12	0.48		0.24	28	26	4	YES	YES	2 5	2 5	0 8
	6 5	11	ML	54	112	0 140	0 616	0 476	15	1	0 85	1 33	1 5	6.8	0 97	0 09	0 52		0.16	29					3 3	5	2 0
	6 5	16	CL	85	112	0 296	0 896	0.600	20	3	0 85	1.25	4.1	9 9	0.96	0.11	0 60	(Clay)			30	8	NO				
	6 5	21	CL	85	116	0 452	1 218	0 766	25	12	0.95	1 14	16 7	25 0	0 95	0.29	0 63	(Clay)			37	16	NO				
	6.5	26	CL	85	117	0.608	1.521	0 913	30	13	0 95	1.07	16 9	25 3	0 94	0.30	0 65	(Clay)			37	16	NO				
	6.5	31	CL	85	114	0.764	1 767	1 003	35	7	1 00	1.02	9 2	16 0	0 92	0 17	0 67	(Clay)			30	9	NO				
													#N/A														
													#N/A														
													#N/A														

OSHPD

Latitude, Longitude: 40.35681, -111.80767



Date	9/8/2022, 11:19:47 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	E - Soft Clay Soil

Type	Value	Description
S_S	1.248	MCE_R ground motion. (for 0.2 second period)
S_1	0.45	MCE_R ground motion. (for 1.0s period)
S_{MS}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	null -See Section 11.4.8	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	null -See Section 11.4.8	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.56	MCE_G peak ground acceleration
F_{PGA}	1.14	Site amplification factor at PGA
PGA_M	0.638	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.248	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.426	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	3.067	Factored deterministic acceleration value. (0.2 second)
S1RT	0.45	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.507	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	1.196	Factored deterministic acceleration value. (1.0 second)
PGAd	1.191	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.56	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.875	Mapped value of the risk coefficient at short periods
C_{R1}	0.888	Mapped value of the risk coefficient at a period of 1 s
C_V		Vertical coefficient

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TAYLOR GEOTECHNICAL

2650 North 180 East
Lehi, Utah 84043
P. 801-400-9784

September 15, 2022

Mr. Ben Hunter
Project Engineer
American Fork City
51 East Main Street
American Fork, Utah 84003

Subject: **Geotechnical Engineering Review No. 2**
Stonecreek Subdivision, Plat J
1000 South 400 West
American Fork Utah
TG Project No. 22079

Subject Document: Earthtec Engineering, Response to Review, Stonecreek, Plat J, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Woodside Homes of Utah, 460 West 50 South, Suite 300, Salt Lake City, UT 84101, September 8, 2022.

Submittal Status: **GEOTECHNICAL ENGINEERING SUBMITTAL INCOMPLETE**

Dear Mr. Hunter:

At your request, Taylor Geotechnical (TG) reviewed the above-referenced document prepared by Earthtec Engineering (Earthtec) in response to the following review letter by TG to American Fork City (the City):

> TG Geotechnical Engineering Review No. 1, Stonecreek Subdivision, Plat J, 1000 South 400 West, American Fork, Utah, TG Project No. 22079, prepared for Mr. Ben Hunter, Project Engineer, American Fork City, 51 East Main Street, American Fork, Utah 84003, dated August 31, 2022.

The August 31, 2022, TG review letter was prepared for the following September 26, 2017, May 25, 2018, August 25, 2020, and May 9, 2022, Earthtec documents:

> Earthtec Engineering, Response to Review, 26 Acre Property, Stonecreek Subdivision Plats H & I, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Woodside Homes of Utah, 460 West 50 South, Suite 300, Salt Lake City, UT 84101, May 9, 2022.
>
> Earthtec Engineering, Response to Review, American Fork Property and 26 Acre Property, 700 South 400 West and 1000 South 400 West, American Fork, Utah, Earthtec Project No.

169273 and 178750, prepared for Woodside Homes of Utah, 460 West 50 South, Suite 300, Salt Lake City, UT 84101, August 25, 2020.

Earthtec Engineering, Addendum 1, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Mr. Garrett Seely, Woodside Homes, 460 West 50 South, Suite 200, Salt Lake [sic], UT 84101, May 25, 2018.

Earthtec Engineering, Geotechnical Study - Revised, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Mr. Garrett Seely, Woodside Homes, 460 West 50 South, Suite 200, American Fork [sic], UT 84101, September 26, 2017.

The purpose of TG's review is to evaluate whether or not the September 8, 2022, Earthtec response letter adequately addressed review comments in the August 31, 2022, TG review letter and adequately addressed geotechnical engineering parameters at the site, consistent with concerns for public health, safety, welfare, reasonable professional standards of care, and the American Fork City (the City) Sensitive Lands Ordinance 07-10-47.

TG Conclusion

Based substantially in and on reliance of the technical documentation and assurances provided by Earthtec, including their opinions and conclusions, it is TG's opinion that the September 8, 2022, Earthtec response letter did not adequately address review comments in the August 31, 2022, TG review letter consistent with concerns for public health, safety, and welfare; reasonable professional standards of practice and the City Sensitive Lands Ordinance 07-10-47.

TG Recommendations

Based on the requirements of the City Sensitive Land Ordinance and the technical documentation provided by Earthtec, TG recommends the City not consider the Earthtec geotechnical engineering submittal complete from a geotechnical engineering perspective until the following item is adequately addressed.

In the August 31, 2022, TG review letter, TG recommended the City request Earthtec to provide updated seismic design acceleration parameters. The September 8, 2022, Earthtec response letter did not provide updated seismic design accelerations S_{DS} and S_{D1}.

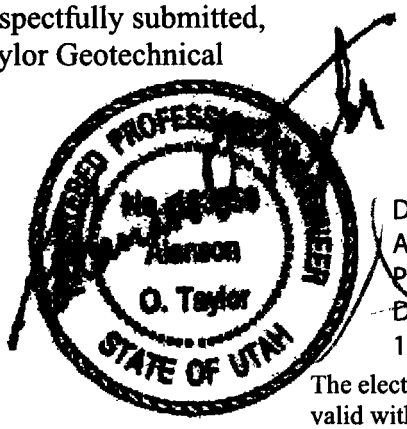
TG recommends the City request Earthtec to provide updated seismic design acceleration parameters S_{DS} and S_{D1}.

Closure

All services performed by Taylor Geotechnical for this review were provided for the exclusive use and benefit of the City. No other person or entity is entitled to use or rely upon any of the information or reports generated by Taylor Geotechnical as a result of this review.

If you have any questions, please feel free to contact the undersigned. The opportunity to be of continued service to American Fork City is appreciated.

Respectfully submitted,
Taylor Geotechnical



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Alanson O. Taylor,
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Date: 2022.09.15
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Alanson O. Taylor, P.E.
Principal

EARTHTEC ENGINEERING

1497 West 40 South
Lindon, Utah - 84042
Phone (801) 225-5711

840 West 1700 South #10
Salt Lake City, Utah - 84104
Phone (801) 787-9138

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

September 16, 2022

Woodside Homes of Utah
460 West 50 South, Suite 300
Salt Lake City, UT 84101

Re: Response to Review
Stonecreek, Plat J
1000 South 400 West
American Fork, Utah
Job No: 178750

Gentlemen:

This letter is a response to the review by Taylor Geotechnical, dated September 15, 2022, of our geotechnical report[1] completed in 2017. In addition, an addendum[2] was completed on May 25, 2018.

TG's Request:

Based on the requirements of the City Sensitive Land Ordinance and the technical documentation provided by Earthtec, TG recommends the City not consider the Earthtec geotechnical engineering submittal complete from a geotechnical engineering perspective until the following item is adequately addressed.

In the August 31, 2022, TG review letter, TG recommended the City request Earthtec to provide updated seismic design acceleration parameters. The September 8, 2022, Earthtec response letter did not provide updated seismic design accelerations S_{DS} and S_{D1}.

TG recommends the City request Earthtec to provide updated seismic design acceleration parameters S_{DS} and S_{D1}.

Earthtec's Response:

ASCE 7-16 Section 11.4.8, Exception 1 allows for an exception to performing a ground motion hazard analysis. The exception states "Structures on Site Class E sites with S_s greater than or equal to 1.0, provided the site coefficient F_a is taken as equal to that of Site Class C." The updated seismic design acceleration parameters are presented below. The section however does not provide any recommendations for obtaining the F_v values. Based upon our telephone conversation with Mr. Taylor, he recommended obtaining the Fv value in the same manner as the Fa value, also Site Class C.

[1] Geotechnical Study-Revised, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Engineering, Project No.178750, September 26, 2017.
[2] Addendum 1, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Engineering, Project No.178750, May 25, 2018.

Design Accelerations

S_S	F_a	S_{MS}	S_{DS}
1.248 g	1.2	1.497 g	0.998 g
S_1	**F_v**	**S_{M1}**	**S_{D1}**
0.45 g	1.5	0.675 g	0.45 g

General Conditions

The information presented in this letter applies only to the soils encountered during the field investigation on the subject site. It should be noted that Earthtec Engineering was not involved with the selection of the foundation system being used, surface drainage control, floor slab design and construction, backfill compaction requirements against foundation walls, mass grading of the site, or any other aspect of the building construction. Site grading activities completed in other areas such as driveways, sidewalks, or detached structures, were not observed during this site visit, are outside of the scope of our work and are not addressed in this letter. The observations and recommendations presented in this letter were conducted within the limits prescribed by our client, with the usual thoroughness and competence of the engineering profession in this area at this time. No warranty or representation is intended in our proposals, contracts, reports, or letters.

Closure

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please call.

Respectfully;
EARTHTEC ENGINEERING

Robert E. Wenzel, P.E.
Vice President

PROFESSIONAL ENGINEER
No. 5567049-2202
TIMOTHY ALLAN MITCHELL
Electronically generated on 9/16/2022
STATE OF UTAH

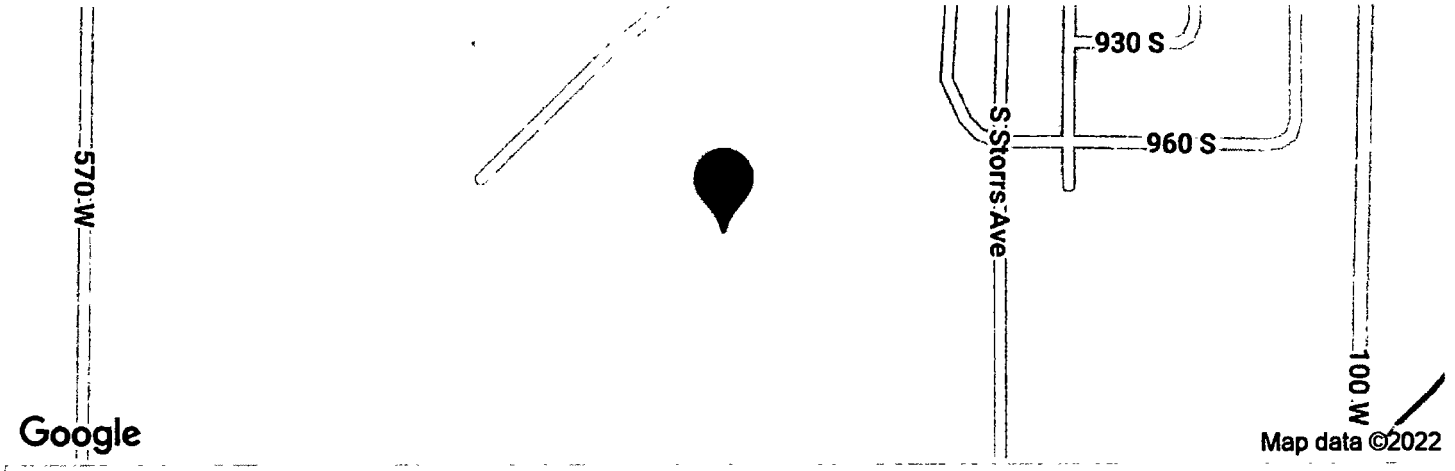
Timothy A. Mitchell, P.E.
Vice President

TM/rew

Attached: OSHPD U.S. Seismic Design Maps

OSHPD

Latitude, Longitude: 40.35681, -111.80767



Date	9/8/2022, 11:19:47 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	E - Soft Clay Soil

Type	Value	Description
S_S	1.248	MCE_R ground motion. (for 0.2 second period)
S_1	0.45	MCE_R ground motion. (for 1.0s period)
S_{MS}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	null -See Section 11.4.8	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	null -See Section 11.4.8	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.56	MCE_G peak ground acceleration
F_{PGA}	1.14	Site amplification factor at PGA
PGA_M	0.638	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.248	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.426	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	3.067	Factored deterministic acceleration value. (0.2 second)
S1RT	0.45	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.507	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	1.196	Factored deterministic acceleration value. (1.0 second)
PGAd	1.191	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.56	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.875	Mapped value of the risk coefficient at short periods
C_{R1}	0.888	Mapped value of the risk coefficient at a period of 1 s
C_V		Vertical coefficient

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TAYLOR GEOTECHNICAL

2650 North 180 East
Lehi, Utah 84043
P. 801-400-9784

ENT 8993:2023 PG 173 of 181

September 17, 2022

Mr. Ben Hunter
Project Engineer
American Fork City
51 East Main Street
American Fork, Utah 84003

Subject: **Geotechnical Engineering Review No. 3**
Stonecreek Subdivision, Plat J
1000 South 400 West
American Fork Utah
TG Project No. 22079

Subject Document: Earthtec Engineering, Response to Review, Stonecreek, Plat J, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Woodside Homes of Utah, 460 West 50 South, Suite 300, Salt Lake City, UT 84101, September 16, 2022.

Review Status: **GEOTECHNICAL ENGINEERING SUBMITTAL COMPLETE**

Dear Mr. Hunter:

At your request, Taylor Geotechnical (TG) reviewed the above-referenced document prepared by Earthtec Engineering (Earthtec) in response to the following review letter by TG to American Fork City (the City):

> TG Geotechnical Engineering Review No. 2, Stonecreek Subdivision, Plat J, 1000 South 400 West, American Fork, Utah, TG Project No. 22079, prepared for Mr. Ben Hunter, Project Engineer, American Fork City, 51 East Main Street, American Fork, Utah 84003, dated September 15, 2022.

The September 15, 2022, TG review letter was prepared for the following September 8, 2022, Earthtec document:

> Earthtec Engineering, Response to Review, Stonecreek, Plat J, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Woodside Homes of Utah, 460 West 50 South, Suite 300, Salt Lake City, UT 84101, September 8, 2022.

The September 8, 2022, Earthtec document was prepared in response to the following review letter by TG to the City:

TG Geotechnical Engineering Review No. 1, Stonecreek Subdivision, Plat J, 1000 South 400 West, American Fork, Utah, TG Project No. 22079, prepared for Mr. Ben Hunter, Project Engineer, American Fork City, 51 East Main Street, American Fork, Utah 84003, dated August 31, 2022.

The August 31, 2022, TG review letter was prepared for the following September 26, 2017, May 25, 2018, August 25, 2020, and May 9, 2022, Earthtec documents:

Earthtec Engineering, Response to Review, 26 Acre Property, Stonecreek Subdivision Plats H & I, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Woodside Homes of Utah, 460 West 50 South, Suite 300, Salt Lake City, UT 84101, May 9, 2022.

Earthtec Engineering, Response to Review, American Fork Property and 26 Acre Property, 700 South 400 West and 1000 South 400 West, American Fork, Utah, Earthtec Project No. 169273 and 178750, prepared for Woodside Homes of Utah, 460 West 50 South, Suite 300, Salt Lake City, UT 84101, August 25, 2020.

Earthtec Engineering, Addendum 1, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Mr. Garrett Seely, Woodside Homes, 460 West 50 South, Suite 200, Salt Lake [sic], UT 84101, May 25, 2018.

Earthtec Engineering, Geotechnical Study - Revised, 26 Acre Property, 1000 South 400 West, American Fork, Utah, Earthtec Project No. 178750, prepared for Mr. Garrett Seely, Woodside Homes, 460 West 50 South, Suite 200, American Fork [sic], UT 84101, September 26, 2017.

The purpose of TG's review is to evaluate whether or not the September 16, 2022, Earthtec response letter adequately addressed review comments in the September 15, 2022, TG review letter and adequately addressed geotechnical engineering parameters at the site, consistent with concerns for public health, safety, welfare, reasonable professional standards of care, and the American Fork City (the City) Sensitive Lands Ordinance 07-10-47.

The proposed construction will consist of roads, sidewalks, utility installation, and conventionally framed, one to two-story structures with slabs on grade due to shallow groundwater. Structural loads for the building are anticipated to consist of column loads up to 23 kips and wall loads up to 2.6 kips per lineal foot.

Liquefaction

A site-specific liquefaction study was completed for the subject property. In the September 8, 2022, Earthtec document, Earthtec concluded that the site is susceptible to 2.7 inches of liquefaction-induced settlement and 0.5 feet of liquefaction-induced lateral spread. The September 26, 2017, Earthtec document (page 10) recommended the following to mitigate liquefaction on proposed structures:

"Connect/tie all footings together using reinforced grade beams and connect reinforced slabs to the footings so that the building will react as a cohesive unit. This may result in some tilting of the building due to differential liquefaction-induced movements. The building may also move laterally due to lateral spreading."

TG Conclusion

Based substantially in and on reliance of the technical documentation and assurances provided by Earthtec, including their opinions and conclusions, it is TG's opinion that the September 16, 2022, Earthtec response letter adequately addressed review comments in the September 15, 2022, TG review letter and combined with the September 26, 2017, May 25, 2018, August 25, 2020, May 9, 2022, and September 8, 2022, Earthtec documents adequately address the geotechnical parameters for the property consistent with concerns for public health, safety, and welfare; reasonable professional standards of practice and the City Sensitive Lands Ordinance 07-10-47.

TG Recommendations

TG recommends the City:

1. Consider the Earthtec submittals acceptable from a geotechnical engineering perspective.

2. Require disclosure in accordance with section 6-2-4(1) of the Sensitive Lands Ordinance. Disclosure of the liquefaction potential and required mitigation shall be recorded as follows:

   A. The existence of a liquefiable soils condition shall be noted on the final plat recorded at the Office of the County Recorder, together with any limitation to development such as extraordinary foundation treatment as recommended by Earthtec, attached as a condition of approval of the project.

   B. In addition, a "Notice of Interest" setting forth any such condition or limitation shall be recorded at the Office of the County Recorder for each lot to which the condition or limitation is applicable.

3. Require, at the time of building permit, each building proposed for construction on land having a high liquefaction potential have a footing and foundation design confirming to liquefaction hazard as certified by a geotechnical and structural engineer to meet or exceed the probable forces. See section 6-2-4(2) of the Sensitive Lands Ordinance.

4. Request certification letters from the geotechnical engineer and structural engineer prior to the placement of concrete for each structure.

Public Right-of-Way

Pavement recommendations provided in the September 26, 2017, Earthtec report are for public streets based on an assumed CBR of 3 and assumed traffic loads. Roads in public right-of-way should be based on project traffic loads provided by the civil engineer for the project or minimum pavement sections as required by the City for roads in the Sensitive Lands Ordinance (see section 13.1 General Description (Asphalt Paving) of the American Fork Standards.

Geotechnical Report Summary for Plan Review

1. All organics, topsoil, existing fill, and other deleterious material should be removed from below proposed building and pavement areas.

2. Footings may be supported on suitable undisturbed native soils or on a minimum of 12 inches of properly placed and compacted structural fill extending to suitable undisturbed native soils.

3. Footings for the structures may be designed using an allowable bearing capacity of 1,500 pounds per square foot for footings bearing on suitable native soils and 2,000 pounds per square foot for footings bearing on a minimum of 18 inches of compacted structural fill.

4. Footings should have a minimum width of 20 inches for strip footings and 30 inches for spot footings.

5. Footings susceptible to frost should be located at a minimum depth of 30 inches. Footings not susceptible to frost should have a minimum embedment of 18 inches.

6. Footing design for each structure should be certified by the structural engineer stating that they have been designed in accordance with the liquefaction mitigation recommendations by Earthtec

7. A perimeter foundation drain is required for below-grade habitable space. However, basement construction is not anticipated due to shallow groundwater.

8. Seismic analysis of proposed structures at the site should be based on a spectral response design acceleration of 0.2 sec (short period) $S_{DS} = 0.998g$.

9. The spectral response design acceleration value was based on factored spectral response accelerations using Site Class E, which should be used for the design of structures.

10. Prior to the placement of concrete for footings, a letter from the geotechnical engineer should be obtained that indicates the subgrade for footing and floor slab support was prepared in accordance with the geotechnical report and ready for the placement of concrete.

11. Floor slabs should not be placed more than 1-foot below the existing grade and should be underlain by at least 4-inches of free draining gravel.

12. No restrictions on the type of cement for concrete placed adjacent to native soils.
13. Gutters should discharge beyond the limits of backfill or at least 10 feet from the buildings, whichever is greater.
14. Surface drainage should slope away from the structure in all directions with an 8 percent grade for the first 10 feet.
15. All import materials should be approved by Geotechnical Engineer.
16. All compaction for interior and exterior backfill adjacent to the building should be verified by the geotechnical engineer.

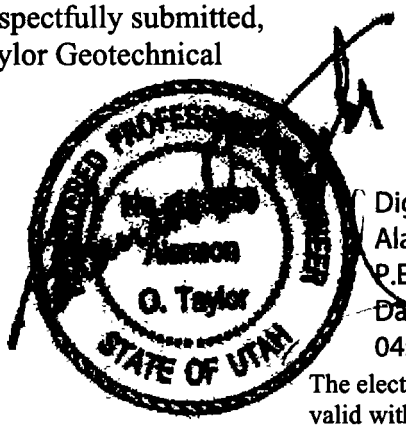
Closure

This letter is issued solely in response to the Consultants' evaluation of the referenced site. Comments and recommendations in this review are based on data presented in the referenced reports. Taylor Geotechnical accordingly provides no warranty that the data in the referenced reports is correct or accurate and has not performed an independent site evaluation. Comments and recommendations presented herein are provided to aid the City in reducing risks from geotechnical hazards and to protect public health and safety.

All services performed by Taylor Geotechnical for this review were provided for the exclusive use and benefit of the City. No other person or entity is entitled to use or rely upon any of the information or reports generated by Taylor Geotechnical as a result of this review.

If you have any questions, please feel free to contact the undersigned. The opportunity to be of continued service to American Fork City is appreciated.

Respectfully submitted,
Taylor Geotechnical



Digitally signed by Alanson O. Taylor, P.E.
Date: 2022.09.17 04:20:34 -06'00'

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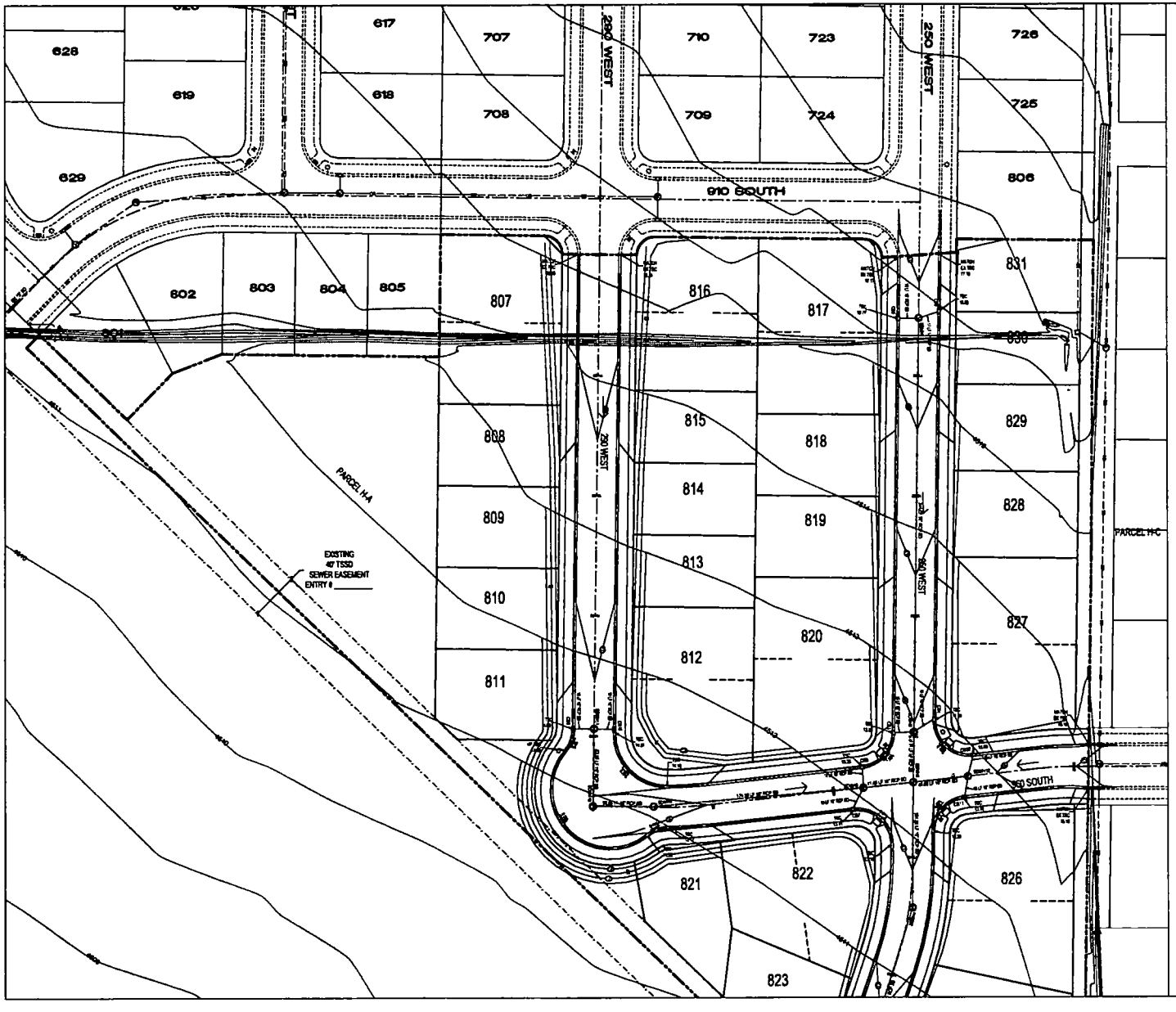
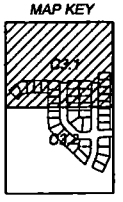
Alanson O. Taylor, P.E.
Principal

Exhibit C – Site Grading Plan



MAP KEY



STORM DRAIN NOTES

1. ALL STORM DRAIN PIPING IS REQUIRED TO HAVE RUBBER GASKETS

Woodside Homes
WOODSIDE HOMES OF UTAH
460 West 50 North, Suite 300
Salt Lake City, UT 84101
801 869 4000

DEVELOPMENT

STONECREEK PLAT J
1000 SOUTH 350 WEST

N

0 20 40 80 120
SCALE: 1"= 40'

Berg
CIVIL ENGINEERING
1078 N DEER CREST LANE
ALPINE, UT, 84004
office: (801) 492-1277
cell: (801) 616-1877

REVISIONS			SEAL
NO.	BY	APP'D	
1			
2			
3			
4			
5			
6			

ACTION	DATE
FINAL	8/10/2022

PROJECT

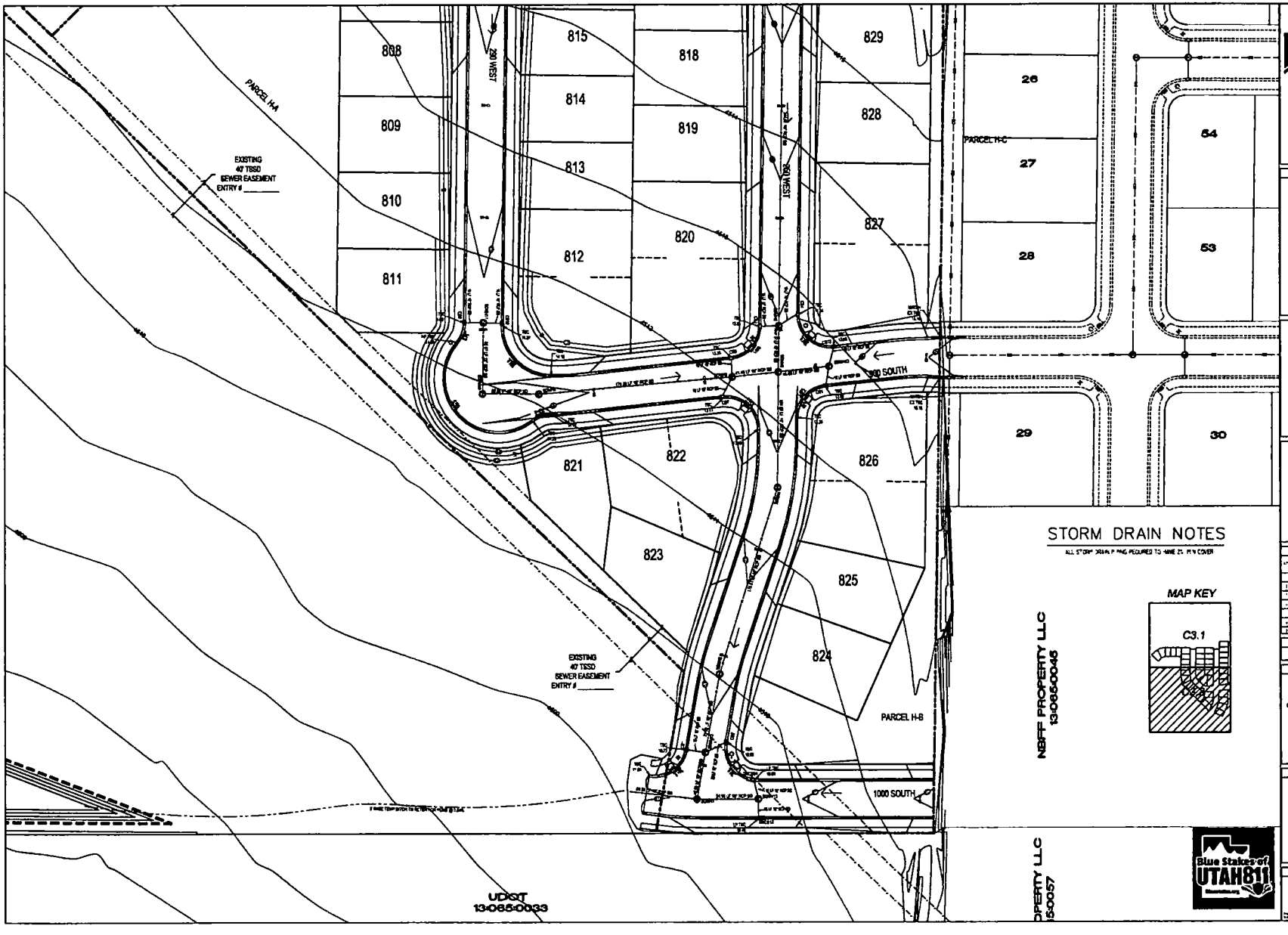
STONECREEK PLAT J

DESCRIPTION

FINAL CONSTRUCTION PLANS

SHEET NAME	SHEET NUMBER
GRADING & DRAINAGE	C3.1

Blue Stakes of UTAH 811



Woodside Homes
WOODSIDE HOMES OF UTAH
460 West 50 North, Suite 300
Salt Lake City, UT 84101
801.869.4000

STONECREEK
PLAT J
1000 SOUTH
350 WEST

SCALE: 1"= 40'

berg
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1018 N DEER CREST LANE
ALPINE, UT 84004
office (801) 492-1277
cell (801) 618-1877

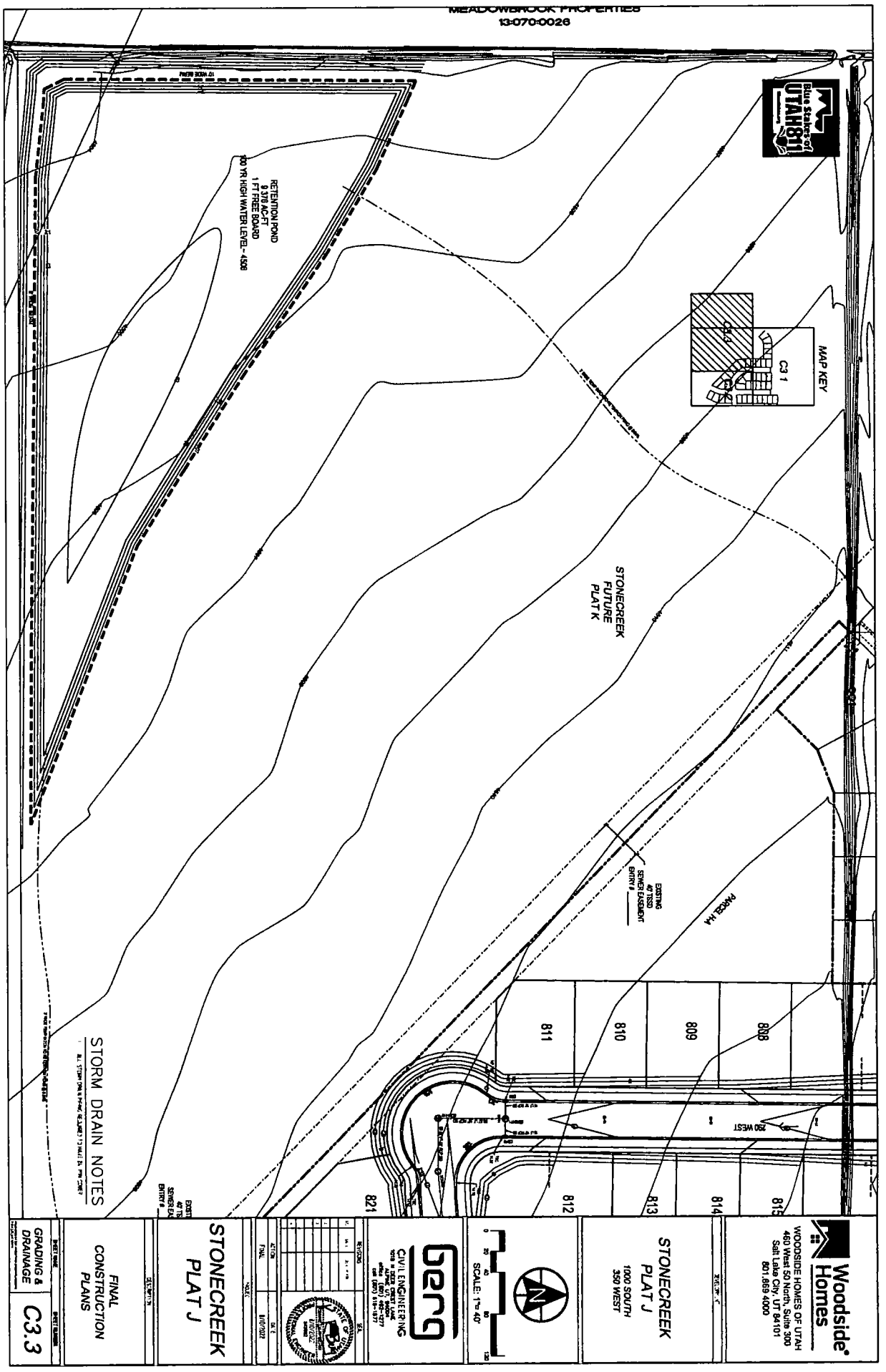
REVISIONS		

ACTION	DATE
FINAL	8/10/2022

STONECREEK
PLAT J

FINAL
CONSTRUCTION
PLANS

SHEET NAME	SHEET NUMBER
GRADING & DRAINAGE	C3.2


MEADOWBROOK PROPERTIES
13-070-0026
MAP KEY
C3.1
C3.4
RETENTION POND
5.0 ACRE-FT
1 FT FREE BOARD
100 YR HIGH WATER LEVEL= 4536
STONECREEK
FUTURE
PLAT K
EXISTING
40' TSSD
SEWER EASEMENT
ENTRY #
PHASE 1H
811
810
809
808
821
812
813
814
815
290 WEST
STORM DRAIN NOTES
Woodside Homes
WOODSIDE HOMES OF UTAH
460 West 50 North, Suite 300
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STONECREEK
PLAT J
1000 SOUTH
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STONECREEK
PLAT J
FINAL
CONSTRUCTION
PLANS
GRADING &
DRAINAGE
C3.3