

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



ENT 84987:2022 PG 1 of 45  
ANDREA ALLEN  
UTAH COUNTY RECORDER  
2022 Jul 28 1:48 pm FEE 0.00 BY CS  
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 10/26/2018 along with the site grading plan to the property generally located at 6205. 900 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 18 day of July, 2022.

OWNER(S):

[Signature]  
(Signature)

\_\_\_\_\_  
(Signature)

JACOB M HORAN  
(Printed Name)

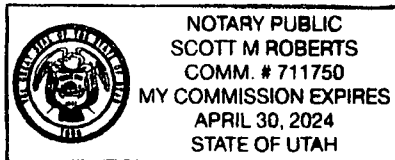
\_\_\_\_\_  
(Printed Name)

MANAGER  
(Title)

\_\_\_\_\_  
(Title)

STATE OF UTAH )  
  )  
  §  
COUNTY OF Utah )

On the 18 day of July, 2022, personally appeared before me Jacob M Horan 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.



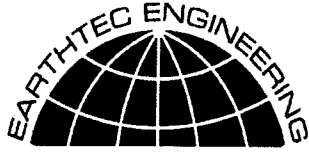
[Signature]  
Notary Public  
My Commission Expires: 4/30/24

**Block 5I**

BEGINNING AT A POINT WHICH IS NORTH 838.47 FEET AND WEST 774.05 FEET FROM THE SOUTH QUARTER CORNER OF SECTION 22, TOWNSHIP 5 SOUTH, RANGE 1 EAST; AND RUNNING: THENCE SOUTH 00°00'09" WEST 93.64 FEET; THENCE ALONG THE ARC OF A 83.00 FOOT RADIUS CURVE TO THE RIGHT A DISTANCE OF 30.20 FEET (CURVE HAVING A CENTRAL ANGLE 20°50'59" AND A LONG CHORD BEARS S10°25'38"W 30.04 FEET); THENCE SOUTH 00°00'09" WEST 99.68 FEET; THENCE NORTH 89°01'53" WEST 140.27 FEET; THENCE NORTH 01°03'29" EAST 630.12 FEET; THENCE SOUTH 89°16'08" EAST 284.53 FEET; THENCE SOUTH 39°27'15" EAST 70.27 FEET; THENCE SOUTH 57°57'04" WEST 0.65 FEET; THENCE ALONG THE ARC OF A 414.50 FOOT RADIUS CURVE TO THE LEFT A DISTANCE OF 419.22 FEET (CURVE HAVING A CENTRAL ANGLE 57°56'55" AND A LONG CHORD BEARS S28°58'36"W 401.58 FEET) TO THE POINT OF BEGINNING. THE ABOVE DESCRIBED PARCEL CONTAINS 117,276 SQUARE FEET IN AREA OR 2.69 ACRES. (NOTE:ALL BEARINGS IN THE ABOVE DESCRIPTION ARE BASED ON THE NAD 27 BEARING OF N 89°52'20" E ALONG THE SECTION LINE FROM THE SOUTH QUARTER CORNER OF SECTION 22, TOWNSHIP 5 SOUTH, RANGE 1 EAST TO THE SOUTHEAST CORNER OF SAID SECTION 22.)

**Block 6J**

BEGINNING AT A POINT WHICH IS NORTH 631.89 FEET AND WEST 550.59 FEET FROM THE SOUTH QUARTER CORNER OF SECTION 22, TOWNSHIP 5 SOUTH, RANGE 1 EAST; AND RUNNING: THENCE WEST 123.38 FEET; THENCE ALONG THE ARC OF A 50.00 FOOT RADIUS CURVE TO THE LEFT A DISTANCE OF 22.75 FEET (CURVE HAVING A CENTRAL ANGLE 26°04'11" AND A LONG CHORD BEARS N47°05'26"W 22.55 FEET); THENCE NORTH 00°00'09" EAST 72.01 FEET; THENCE ALONG THE ARC OF A 90.00 FOOT RADIUS CURVE TO THE RIGHT A DISTANCE OF 28.81 FEET (CURVE HAVING A CENTRAL ANGLE 18°20'34" AND A LONG CHORD BEARS N09°10'08"W 28.69 FEET); THENCE NORTH 00°00'09" EAST 90.88 FEET; THENCE ALONG THE ARC OF A 335.50 FOOT RADIUS CURVE TO THE RIGHT A DISTANCE OF 161.04 FEET (CURVE HAVING A CENTRAL ANGLE 27°30'07" AND A LONG CHORD BEARS N13°45'12"E 159.50 FEET); THENCE SOUTH 54°25'22" EAST 75.79 FEET; THENCE ALONG THE ARC OF A 178.00 FOOT RADIUS CURVE TO THE LEFT A DISTANCE OF 39.75 FEET (CURVE HAVING A CENTRAL ANGLE 12°47'38" AND A LONG CHORD BEARS S60°49'11"E 39.66 FEET); THENCE SOUTH 00°49'10" WEST 279.01 FEET; THENCE SOUTH 36°45'44" EAST 23.83 FEET TO THE POINT OF BEGINNING. THE ABOVE DESCRIBED PARCEL CONTAINS 42,264 SQUARE FEET IN AREA OR 0.97 ACRES. (NOTE:ALL BEARINGS IN THE ABOVE DESCRIPTION ARE BASED ON THE NAD 27 BEARING OF N 89°52'20" E ALONG THE SECTION LINE FROM THE SOUTH QUARTER CORNER OF SECTION 22, TOWNSHIP 5 SOUTH, RANGE 1 EAST TO THE SOUTHEAST CORNER OF SAID SECTION 22.)



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Lindon, Utah - 84042  
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Phone (801) 787-9138

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

**Geotechnical Study  
AF PD  
Penrod Properties  
6820 West 7333 North  
American Fork, Utah**

**Project No. 189047**

October 26, 2018

*Prepared For:*

AFPD, LLC  
Attention: Ms. Ginger Romriell  
555 South State Street, #300  
Orem, UT 84057

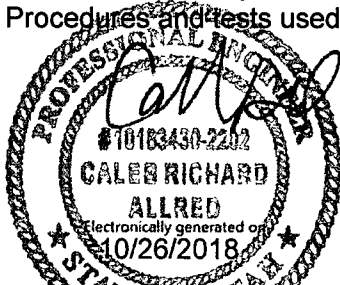
*Prepared By:*

**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.



Caleb R. Allred, P.E.  
Project Engineer



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**ATTACHED FIGURES**

No. 1 VICINITY MAP  
No. 2 AERIAL PHOTOGRAPH SHOWING LOCATION OF BORING AND TEST PITS  
Nos. 3 – 6 BORING AND TEST PIT LOGS  
No. 7 LEGEND  
Nos. 8 – 11 CONSOLIDATION-SWELL TEST

**APPENDIX A**

Timpview Analytical Labs  
USGS Seismic Printouts



## 1.0 EXECUTIVE SUMMARY

This entire report presents the results of Earthtec Engineering's completed geotechnical study for the Penrod Properties 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 10½ acres and is proposed to be developed with the construction of apartment buildings and townhomes. The proposed structures will consist of conventionally framed and two- to three-story, slab-on-grade buildings. We anticipate foundation loads for the proposed structures will not exceed 5,000 pounds per linear foot for bearing walls, 40,000 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 test pits to a depth of 31½ feet below the existing ground surface and the excavation of three (3) test pits to depths of 6 feet below the existing ground surface. Groundwater was encountered at depths of approximately 2 to 3½ feet below the existing ground surface. (see Section 5)
- The native clay and silt soils have a slight to moderate potential for collapse (settlement) and a slight to moderate potential for compressibility under increased moisture contents and anticipated load conditions. (see Section 6)
- The subsurface soils encountered generally consisted of topsoil overlying near-surface very soft to very stiff clay and silt. All topsoil should be removed beneath the entire building footprints, exterior flatwork, and pavements prior to construction. (see Section 7)
- The silt layers between depths of 25 to 25 feet have a "High" potential for liquefaction during a moderate to large earthquake event; should this layer liquefy, we estimate that up to one inch of liquefaction-induced settlement and up to one-half feet 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 a minimum of 24 inches of properly placed, compacted, and tested structural fill extending to undisturbed native soils. (see Section 10)
- Minimum pavement section consists of 3 inches of asphalt over 12 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 6820 West 7333 North 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 Ms. Ginger Romriell with AF PD LLC, consists of developing the approximately 10½ acre existing parcel with apartment buildings and townhomes. The proposed structures will consist of conventionally framed and two- to three-story, slab-on-grade buildings. We have based our recommendations in this report that the anticipated foundation loads for the proposed structures will not exceed 5,000 pounds per linear foot for bearing walls, 40,000 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 a partially developed lot with a single house located near the center of the site and several outbuildings near the north end of the site with empty fields to the north, south, and west. 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 agricultural fields and residential houses.

### 4.2 Geologic Setting

The subject property is located in the central portion of Utah Valley near the eastern 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<sup>1</sup>. 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 upper Pleistocene. These soil or deposits are generally described in the referenced mapping as Silt and clay with some fine-grained sand.

## 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 October 5, 2018 and October 8, 2018 by the boring of one (1) boring to a depth of 31½ feet below the existing ground surface and the excavation of three (3) test pits to depths of 6 feet below the existing ground surface using an all-terrain hydraulic drill rig and a mini-excavator, respectively. 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 6, *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 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. 7, *Legend*.

<sup>1</sup> 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.



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 1¾ 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.

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, and one-dimensional consolidation tests. 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, on Figure Nos. 8 through 11, *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 (%)			Soil Type
				Liquid Limit	Plasticity Index	Gravel (+ #4)	Sand	Silt/Clay (- #200)	
B-1	2½	26	99	33	11	16	10	74	CL
B-1	20	21	---	21	1	0	16	84	ML
B-1	25	44	---	44	20	1	3	96	CL
TP-1	3	32	---	---	---	3	7	90	CL
TP-1	5	30	92	35	11	8	7	85	CL
TP-2	2	52	69	52	20	3	20	77	MH
TP-3	5	33	91	35	13	4	8	88	CL

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 clay and silt soils have a slight to moderate potential for collapse (settlement) and a slight to moderate 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. The water-soluble sulfate testing indicated a value of 277 parts per million. Based on this result, the risk of sulfate attack to concrete appears to be "moderate" according to American Concrete Institute standards. Therefore, we recommend that Type II Portland cement 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 one foot in depth at the boring and test pit locations. Below the fill we encountered layers of clay and silt extending to a depth of 31½ feet below the existing ground surface. Graphical representations and detailed descriptions of the soils encountered are shown on Figure Nos. 3 through 6, *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 ranged from very soft to very stiff in consistency. Variation in topsoil and even fill depths may occur at the site.

### 7.2 Groundwater Conditions

Groundwater was encountered at depths of approximately 2 to 3½ 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, collapsible, 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<sup>2</sup> requirements for Type C soils.

### 8.3 Fill Material Composition

The native soils do not appear to be 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.

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:

<sup>2</sup> OSHA Health and Safety Standards, Final Rule, CFR 29, part 1926.



**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.

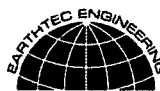
We recommend that utility trenches below any structural load be backfilled using structural fill. Note that most local governments and utility companies require Type A-1-a or A-1-b (AASHTO classification) soils (which overall is stricter than our recommendations for structural fill) be used as backfill above utilities in certain areas. Gradation requirements stated above shall be verified in intervals not exceeding 1,000 tons. 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%
- 5 feet or greater of fill below structurally loaded areas: 98%

Generally, placing and compacting fill at moisture contents within  $\pm 2$  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 layers of clay and silt 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 State of Utah has adopted the 2015 International Building Code (IBC) for seismic design and the structure should be designed in accordance with Chapter 16 of the IBC. The Site Class definitions in the IBC are based upon the soil properties in the upper 100 feet of the soil profile, according to Chapter 20 in ASCE 7. These properties are determined from sampler blow counts, undrained shear strength values, and/or shear velocity measurements. The code states, "When the soil properties are not known in sufficient detail to determine the site class, Site Class D shall be used unless the building official or geotechnical data determines that Site Class E or F soil is likely to be present at the site." Considering our experience in the vicinity of the site and based on the results of our field exploration, we recommend using Site Class D. We encountered some potentially liquefiable soil layers, but given the small amount of possible liquefaction-induced movements, we recommend using Site Class D.

The site is located at approximately 40.364 degrees latitude and -111.823 degrees longitude. Using Site Class D, the design spectral response acceleration parameters are given below.

**Table 4: Design Accelerations**

<b>S<sub>s</sub></b>	<b>F<sub>a</sub></b>	<b>S<sub>MS</sub></b>	<b>S<sub>DS</sub></b>
1.138 g	1.045	1.1898 g	0.793 g
<b>S<sub>1</sub></b>	<b>F<sub>v</sub></b>	<b>S<sub>M1</sub></b>	<b>S<sub>D1</sub></b>
0.3847 g	1.631	0.627 g	0.418 g

S<sub>s</sub> = Mapped spectral acceleration for short periods  
 S<sub>1</sub> = Mapped spectral acceleration for 1-second period  
 S<sub>DS</sub> = 2/3 S<sub>MS</sub> = 2/3 (F<sub>a</sub> · S<sub>s</sub>) = 5% damped design spectral response acceleration for short periods  
 S<sub>D1</sub> = 2/3 S<sub>M1</sub> = 2/3 (F<sub>v</sub> · S<sub>1</sub>) = 5% damped design spectral response acceleration for 1-second period



## 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<sup>3</sup>, no active faults traverse through or immediately adjacent to the site and the site is not located within local fault study zones. The nearest mapped fault trace is part of a group of fault beneath Utah Lake located about 2 miles southwest of the site.

## 9.3 Liquefaction Potential

According to current liquefaction maps<sup>4</sup> 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*<sup>5</sup> and Boulanger & Idriss<sup>6</sup>. Potential liquefaction-induced movements were evaluated using Tokimatsu & Seed<sup>7</sup> and Youd, Hansen & Bartlett<sup>8</sup>.

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 and sand soils. Our analysis indicates that approximately up to one inch of liquefaction-induced settlement and possibly up to one-half feet of lateral spreading could occur in the vicinity of B-1 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.

## 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

<sup>3</sup> U.S. Geological Survey, Quaternary Fault and Fold Database of the United States, November 3, 2010.

<sup>4</sup> Utah Geological Survey, Liquefaction-Potential Map for a Part of Utah County, Utah, Public Information Series 28, August 1994.

<sup>5</sup> 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.

<sup>6</sup> 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.

<sup>7</sup> Tokimatsu, K. and Seed, H.B., 1987, Evaluation of Settlements in Sands due to Earthquake Shaking, Journal of Geotechnical Engineering, ASCE, p. 861-878.

<sup>8</sup> 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 a minimum of 24 inches of properly placed, compacted, and tested structural fill extending to undisturbed native soils. For foundation design we recommend the following:

- Footings founded on a minimum of 24 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 existing site grades. This is intended to provide a minimum of 2 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 Load Resistance

Lateral loads are typically resisted by friction between the underlying soil and footing bottoms. Resistance to sliding may incorporate the friction acting along the base of foundations, which may be computed using a coefficient of friction of soils against concrete of 0.55 for clean gravel or structural fill meeting the recommendations presented herein. The values for lateral resistance 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.

## 11.0 FLOOR SLABS AND FLATWORK

Due to shallow groundwater encountered at the site, lowest floor slab depths should be limited to existing site grades or 3 feet above the observed ground water level. This is intended to provide separation between the observed groundwater condition and the bottom of the floor slab to prevent flooding.

Concrete floor slabs and exterior flatwork may be supported on a minimum of 12 inches of properly placed, compacted, and tested structural fill extending to undisturbed native soils after appropriate removals and grading as outlined in Section 8.1 are completed. We recommend placing a minimum of 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 of 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 130 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 1907.1 of the 2015 International Building 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

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

- 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 must 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 6 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 2 feet, from foundation walls. A drip irrigation system may be utilized in landscaping areas within 10 feet of foundation walls to minimize water intrusion at foundation backfill. 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

Walls or portions thereof that retain earth and enclose interior spaces and floors below grade shall conform to Section 1805 of the 2015 International Building Code for damp proofing and water proofing.

## 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 fill and 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. 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 (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 (2008), we recommend the minimum asphalt pavement section presented below.

**Table 5: Pavement Section Recommendations**

Asphalt Thickness (in)	Compacted Roadbase Thickness (in)	Compacted Subbase Thickness (in)
3	6	6*
3	12*	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. Gradation requirements and frequency shall be followed as required by local, APWA, or UDOT requirements, but not to exceed 500 tons.
- 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).

Due to high static loads imposed by at dumpster locations, we recommend that a rigid pavement section for this area of a minimum of six (6) inches of Portland Cement Concrete (PCC) over a minimum of twelve (12) inches of aggregate base material. The aggregate base material should meet local, APWA or UDOT requirements and should be compacted to local, APWA, or UDOT requirements, or to at least 95 percent of maximum dry density (ASTM D1557).

#### 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



Geotechnical Study  
Penrod Properties  
6820 West 7333 North  
American Fork, Utah  
Project No.: 189047

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.

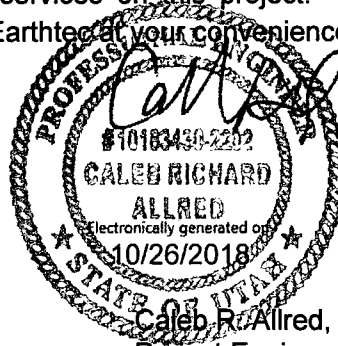
We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please contact Earthtec at your convenience.

Respectfully;

**EARTHTEC ENGINEERING**



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

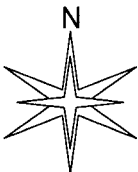
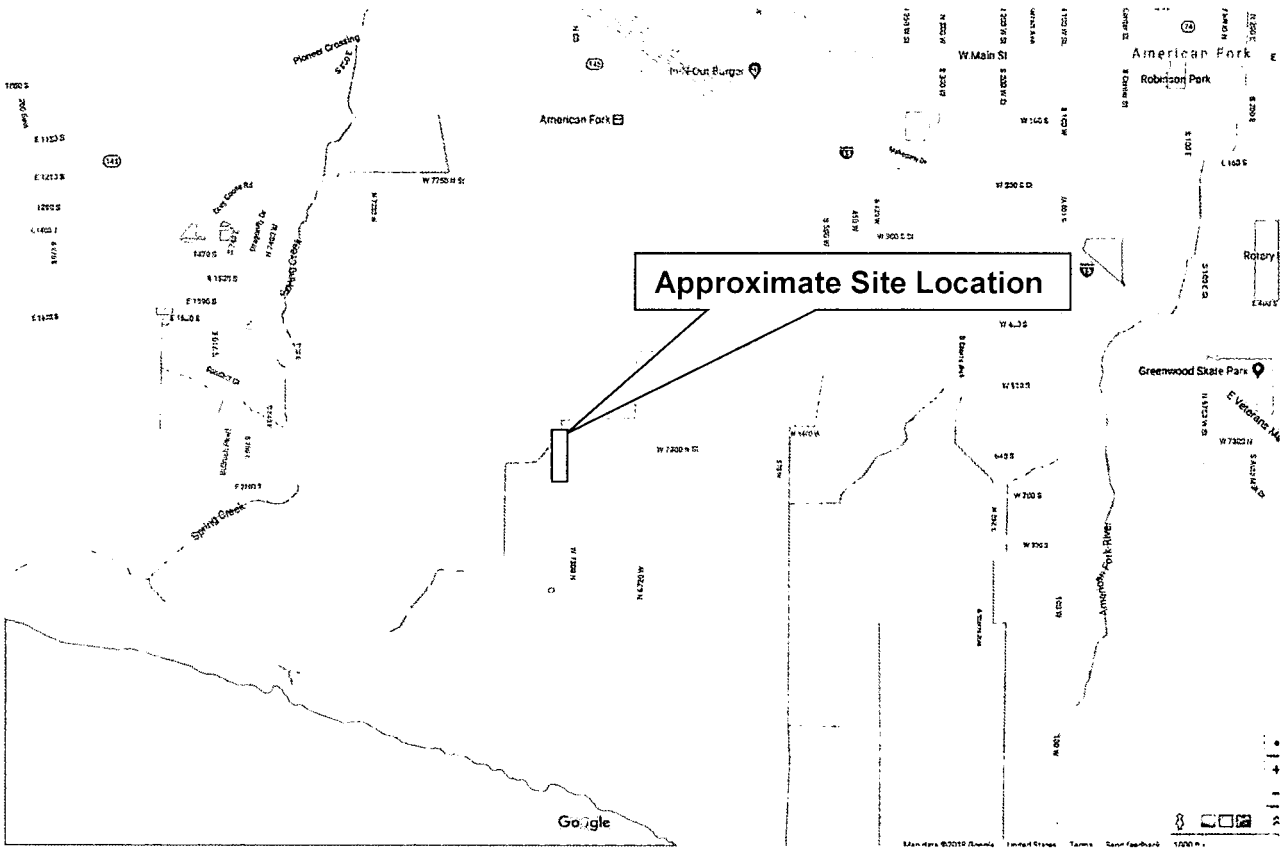


Caleb R. Allred, P.E.  
Project Engineer



# VICINITY MAP

AF PD  
PENROD PROPERTIES  
6820 WEST 7333 NORTH  
AMERICAN FORK, UTAH



Not to Scale

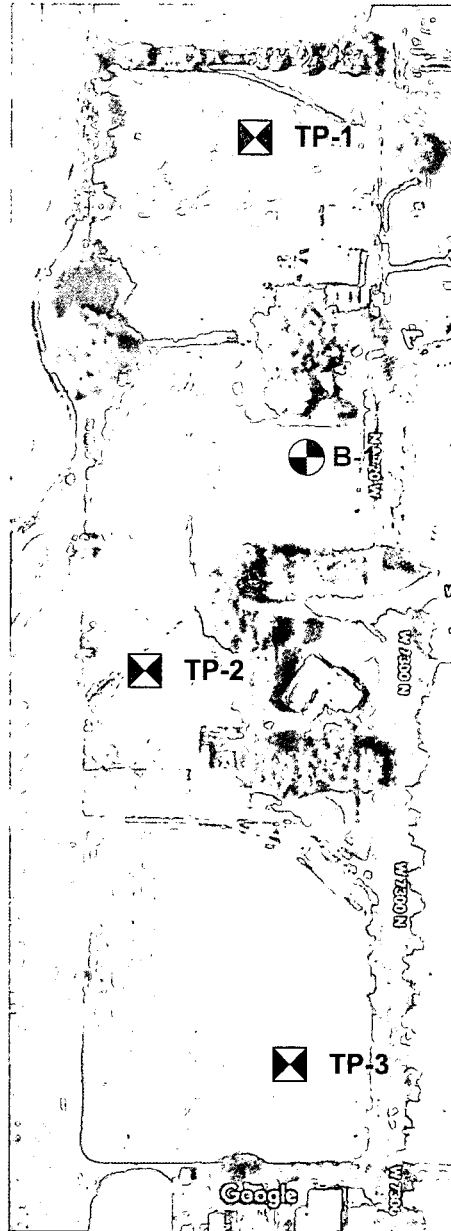
PROJECT NO.: 189047



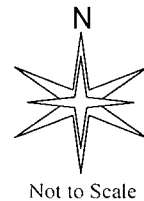
FIGURE NO.: 1

# AERIAL PHOTOGRAPH SHOWING LOCATION OF BORING AND TEST PITS

AF PD  
PENROD PROPERTIES  
6820 WEST 7333 NORTH  
AMERICAN FORK, UTAH



-  Approximate Test Pit Locations
-  Approximate Boring Location



PROJECT NO.: 189047



FIGURE NO.: 2



# BORING LOG

NO.: B-1

**PROJECT:** Penrod Properties

**PROJECT NO.:** 189047

**CLIENT:** AFPD

**DATE:** 10/08/18

**LOCATION:** See Figure 2

**ELEVATION:** Not Measured

**OPERATOR:** Great Basin Drilling

**LOGGED BY:** J. Balleck

**EQUIPMENT:** All Terrain Drill Rig

**DEPTH TO WATER; INITIAL  $\nabla$  :**

**AT COMPLETION  $\nabla$  : 2.5 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 clay, brown, wet, organics											
3		CL	Lean CLAY with sand, soft (estimated), wet, brown			26	99	33	11	16	10	74	C	
6		CL	Lean CLAY, very soft to stiff, wet, brown, calcified nodules, 1/4 silt layers throughout		1									
9	...mottled, some roots			12										
12	...some gravel			12										
15	...3 inch silty sand layer			9										
18														
21		ML	SILT, stiff, wet, gray		11	21		21	1	0	16	84		
24														
27		CL	Lean CLAY, very soft to stiff, wet, gray		1	44		44	20	1	3	96		
30														
33			Maximum depth explored approximately 31½ feet.		15									

**Notes:** Groundwater encountered at approximately 2½ feet.

**Tests Key**

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

LOG OF TEST-HOLE 189047 LOGS.GPJ EARTHTEC.GDT 10/26/18

**PROJECT NO.:** 189047



**FIGURE NO.:** 3

# TEST PIT LOG

## NO.: TP-1

**PROJECT:** Penrod Properties  
**CLIENT:** AFD  
**LOCATION:** See Figure 2  
**OPERATOR:** JSI  
**EQUIPMENT:** Mini Excavator  
**DEPTH TO WATER; INITIAL  $\nabla$  :**

**PROJECT NO.:** 189047  
**DATE:** 10/05/18  
**ELEVATION:** Not Measured  
**LOGGED BY:** J. Balleck  
**AT COMPLETION  $\nabla$  :** 2 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 clay, brown, wet, organics										
1													
2		CL	Lean CLAY, stiff to very stiff (estimated), moist to wet, brown to redish gray brown										SS
3													
4					32				3	7	90		
5													
6					30	92	35	11	8	7	85		C
7			Maximum depth explored approximately 6 feet.										
8													
9													
10													

**Notes:** Groundwater encountered at approximately 2 feet.

**Tests Key**

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

LOG OF TESTPIT\_189047 LOGS.GPJ EARTHTEC.GDT 10/26/18

**PROJECT NO.:** 189047



**FIGURE NO.:** 4

# TEST PIT LOG

## NO.: TP-2

**PROJECT:** Penrod Properties  
**CLIENT:** AFD  
**LOCATION:** See Figure 2  
**OPERATOR:** JSI  
**EQUIPMENT:** Mini Excavator  
**DEPTH TO WATER; INITIAL ∇ :**

**PROJECT NO.:** 189047  
**DATE:** 10/05/18  
**ELEVATION:** Not Measured  
**LOGGED BY:** J. Balleck  
**AT COMPLETION ∇ :** 2 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 clay, brown, wet, organics										
1													
2			Elastic SILT, medium stiff (estimated), moist to wet, brown, roots										
2			▼										
2					52	69	52	20	3	20	77	C	
3		MH											
4													
5													
6			Maximum depth explored approximately 6 feet.										
7													
8													
9													
10													

**Notes:** Groundwater encountered at approximately 2 feet.

**Tests Key**

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

LOG OF TESTPIT\_189047 LOGS.GPJ EARTHTEC.GDT 10/26/18

**PROJECT NO.:** 189047



**FIGURE NO.:** 5

# TEST PIT LOG

## NO.: TP-3

**PROJECT:** Penrod Properties  
**CLIENT:** AFPD  
**LOCATION:** See Figure 2  
**OPERATOR:** JSI  
**EQUIPMENT:** Mini Excavator  
**DEPTH TO WATER; INITIAL ∇ :**

**PROJECT NO.:** 189047  
**DATE:** 10/05/18  
**ELEVATION:** Not Measured  
**LOGGED BY:** J. Balleck  
**AT COMPLETION ▼ :** 3.5 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 clay, brown, wet, organics										
1			Lean CLAY, medium stiff (estimated), moist to wet, brown, roots, calcified nodules										
2													
3													
4		CL ▼ ...no rootholes											
5													
6			Maximum depth explored approximately 6 feet.		33	91	35	13	4	8	88	C	
7													
8													
9													
10													

**Notes:** Groundwater encountered at approximately 3½ feet.

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

LOG OF TESTPIT 189047 LOGS.GPJ EARTHTEC.GDT 10/26/18

**PROJECT NO.:** 189047



**FIGURE NO.:** 6

# LEGEND

**PROJECT:** Penrod Properties  
**CLIENT:** AFPD

**DATE:** 10/05/18  
**LOGGED BY:** J. Balleck

## UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR SOIL DIVISIONS		USCS SYMBOL		TYPICAL SOIL DESCRIPTIONS	
<b>COARSE GRAINED SOILS</b>  (More than 50% retaining on No. 200 Sieve)	<b>GRAVELS</b>  (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	
		GRAVELS WITH FINES (More than 12% fines)		GP Poorly Graded Gravel, May Contain Sand, Very Little Fines	
		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
		SANDS WITH FINES (More than 12% fines)		SP Poorly Graded Sand, May Contain Gravel, Very Little Fines	
	SILTS AND CLAYS (Liquid Limit less than 50)		SM Silty Sand, May Contain Gravel		
	SILTS AND CLAYS (Liquid Limit Greater than 50)		SC Clayey Sand, May Contain Gravel		
	<b>FINE GRAINED SOILS</b>  (More than 50% passing No. 200 Sieve)		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			
		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				
<b>HIGHLY ORGANIC SOILS</b>			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.
  5. In "Blows per foot" column, values in parentheses are corrected (N1)60 values.

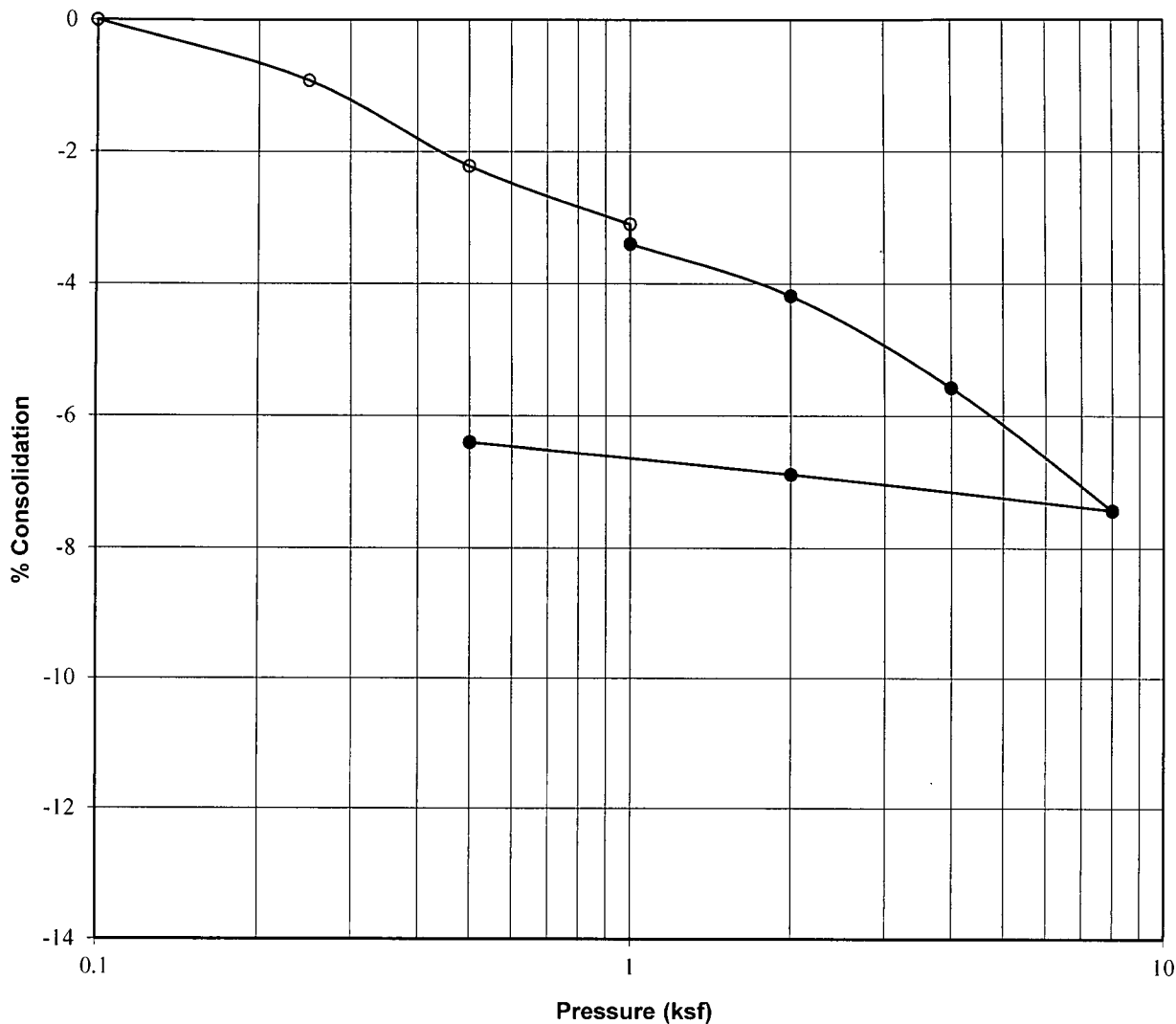
**PROJECT NO.:** 189047



**FIGURE NO.:** 7

LEGEND (UDOT) 189047 LOGS.GPJ EARTHTEC.GDT 10/26/18

## CONSOLIDATION - SWELL TEST



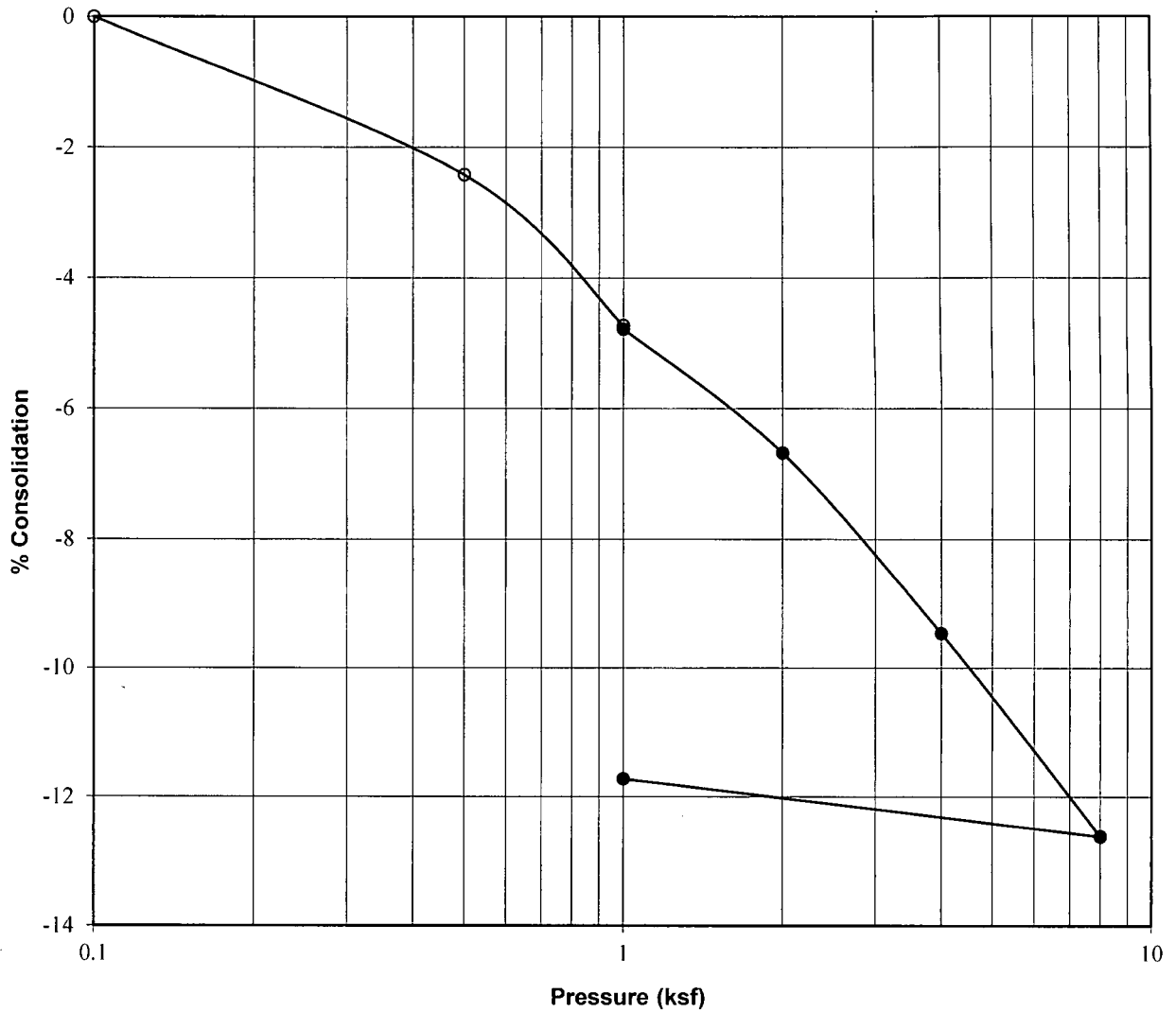
<b>Project:</b>	Penrod Properties
<b>Location:</b>	B-1
<b>Sample Depth, ft:</b>	2½
<b>Description:</b>	Block
<b>Soil Type:</b>	Lean CLAY with gravel (CL)
<b>Natural Moisture, %:</b>	26
<b>Dry Density, pcf:</b>	99
<b>Liquid Limit:</b>	33
<b>Plasticity Index:</b>	11
<b>Water Added at:</b>	1 ksf
<b>Percent Collapse:</b>	0.3

PROJECT NO.: 189047



FIGURE NO.: 8

# CONSOLIDATION - SWELL TEST



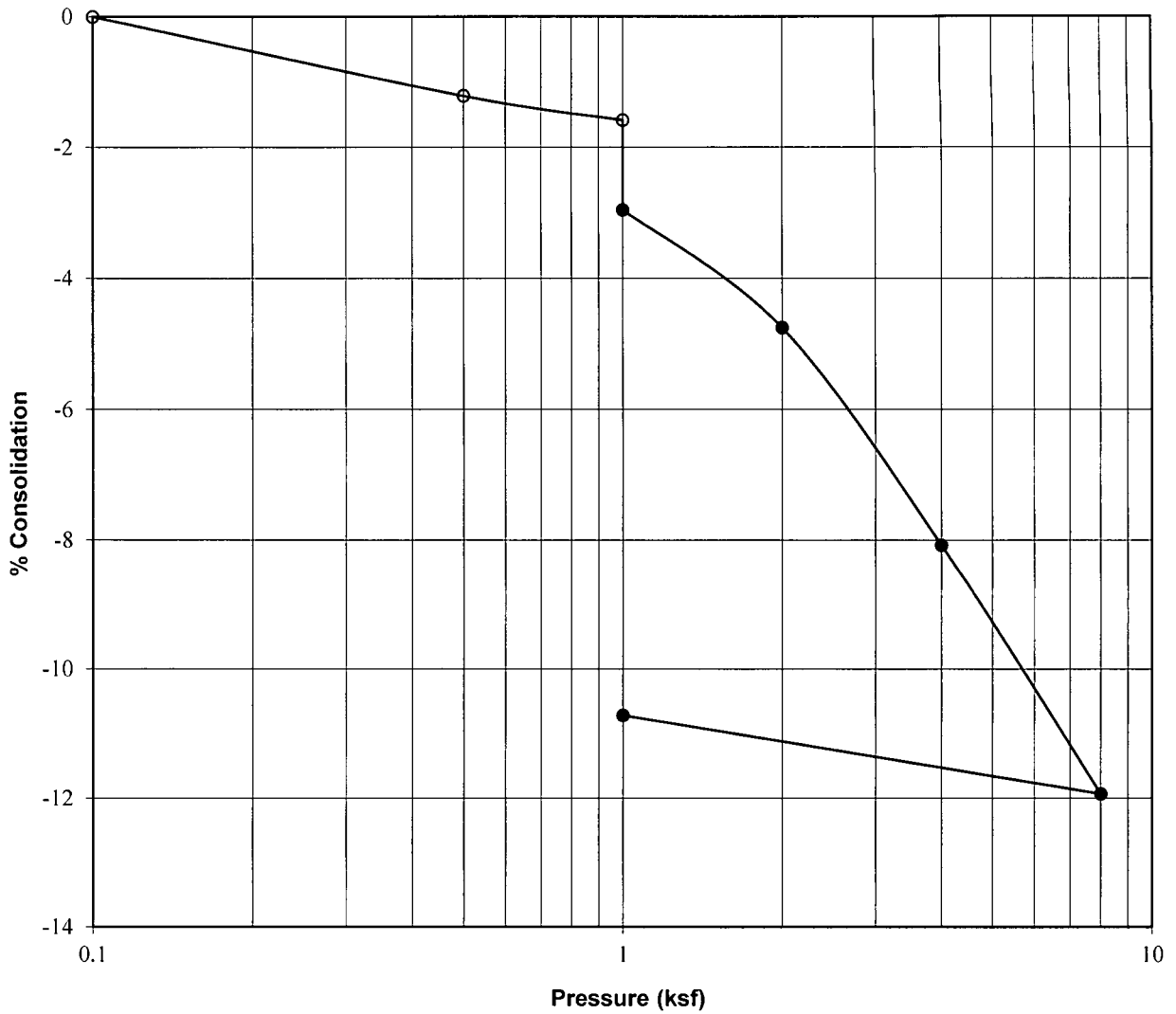
<b>Project:</b>	Penrod Properties
<b>Location:</b>	TP-1
<b>Sample Depth, ft:</b>	5
<b>Description:</b>	Block
<b>Soil Type:</b>	Lean CLAY with gravel (CL)
<b>Natural Moisture, %:</b>	30
<b>Dry Density, pcf:</b>	92
<b>Liquid Limit:</b>	35
<b>Plasticity Index:</b>	11
<b>Water Added at:</b>	1 ksf
<b>Percent Collapse:</b>	0.1

PROJECT NO.: 189047



FIGURE NO.: 9

## CONSOLIDATION - SWELL TEST



<b>Project:</b>	Penrod Properties
<b>Location:</b>	TP-2
<b>Sample Depth, ft:</b>	2
<b>Description:</b>	Block
<b>Soil Type:</b>	Elastic SILT with sand (MH)
<b>Natural Moisture, %:</b>	52
<b>Dry Density, pcf:</b>	69
<b>Liquid Limit:</b>	52
<b>Plasticity Index:</b>	27
<b>Water Added at:</b>	1 ksf
<b>Percent Collapse:</b>	1.4

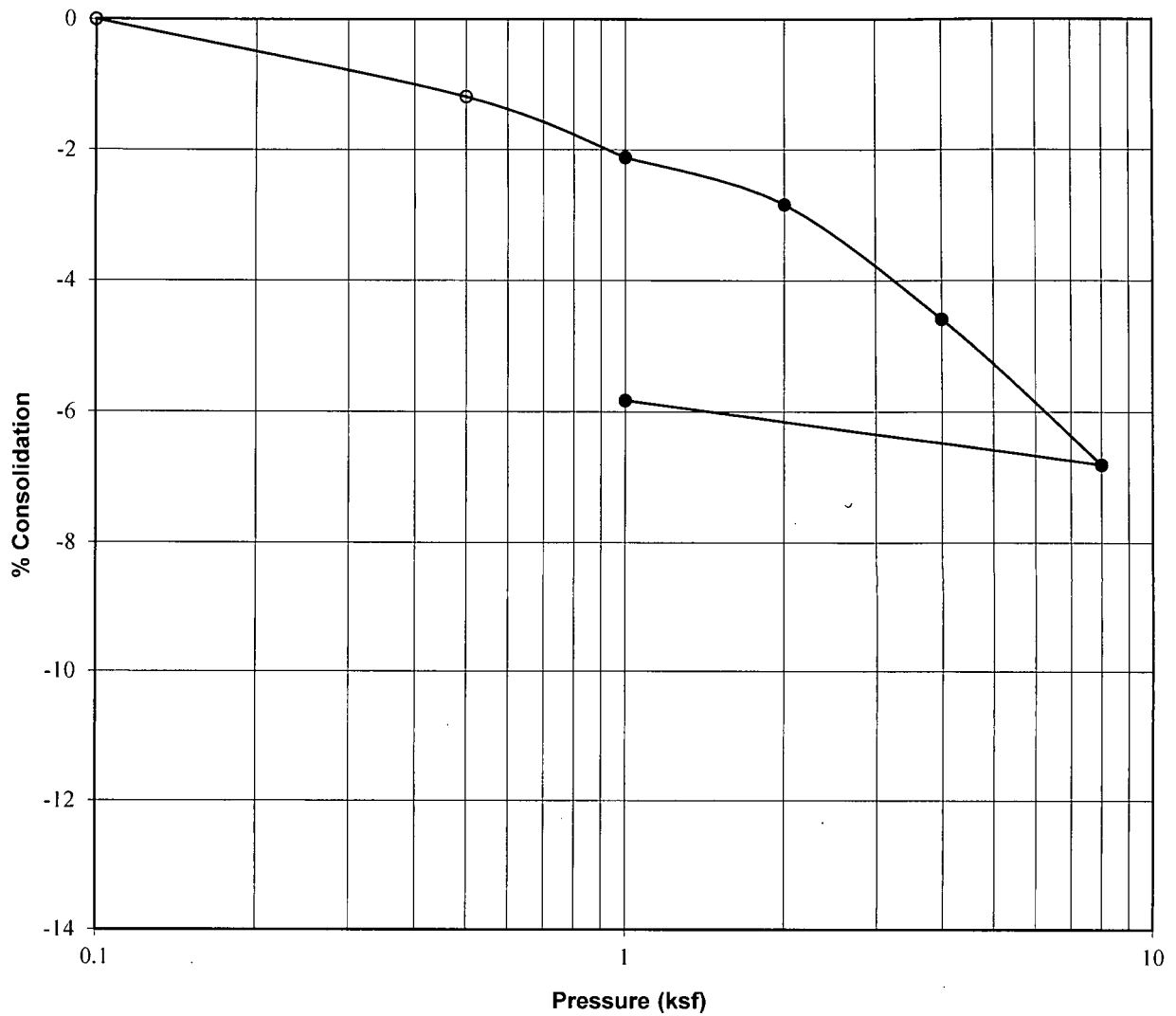
PROJECT NO.: 189047



FIGURE NO.: 10



## CONSOLIDATION - SWELL TEST



<b>Project:</b>	Penrod Properties
<b>Location:</b>	TP-3
<b>Sample Depth, ft:</b>	5
<b>Description:</b>	Block
<b>Soil Type:</b>	Lean CLAY (CL)
<b>Natural Moisture, %:</b>	33
<b>Dry Density, pcf:</b>	91
<b>Liquid Limit:</b>	35
<b>Plasticity Index:</b>	13
<b>Water Added at:</b>	1 ksf

PROJECT NO.: 189047



FIGURE NO.: 11

## **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 #: 18J0479

PO# / Project Name: 189047

Receipt: 10/8/18 16:12

Batch Temp °C: 16.4

Date Reported: 10/15/2018

Sample Name: 189047 TP-1 @ 2

Collected: 10/5/18 13:00

Matrix: Solid

Collected By: Client

Parameter	Lab ID #	Method	Analysis		Units	MRL	Flags
			Date / Time	Result			
Sulfate, Soluble (IC)	18J0479-01	EPA 300.0	10/12/18	277	mg/kg dry	13	
Total Solids	18J0479-01	SM 2540G	10/10/18	74.8	%	0.1	

Comment:

Reviewed by:

*Joyce Applegate*  
Joyce Applegate, Project Manager

# USGS Design Maps Summary Report

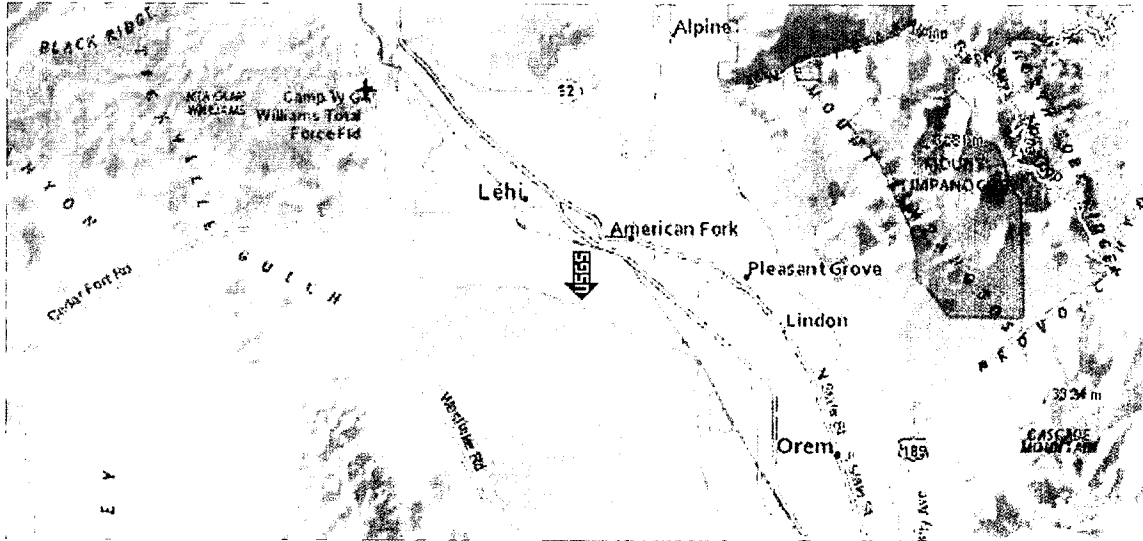
## User-Specified Input

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

**Site Coordinates** 40.364°N, 111.823°W

**Site Soil Classification** Site Class D - "Stiff Soil"

**Risk Category** I/II/III

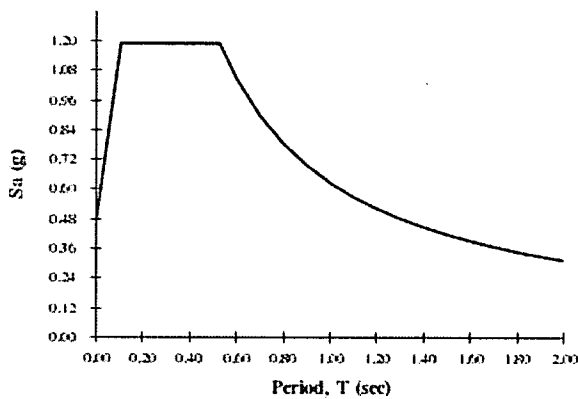


## USGS-Provided Output

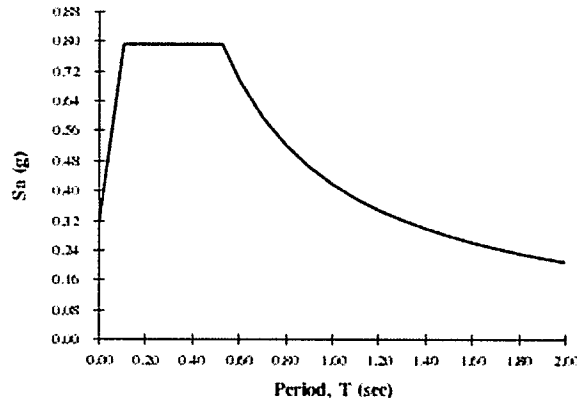
$S_s = 1.138 \text{ g}$	$S_{MS} = 1.189 \text{ g}$	$S_{DS} = 0.793 \text{ g}$
$S_1 = 0.384 \text{ g}$	$S_{M1} = 0.627 \text{ g}$	$S_{D1} = 0.418 \text{ g}$

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.

MCE<sub>R</sub> Response Spectrum



Design Response Spectrum



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

Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.

ASCE 7-10 Standard (40.364°N, 111.823°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** <sup>[1]</sup>

$S_s = 1.138 \text{ g}$

**From Figure 22-2** <sup>[2]</sup>

$S_1 = 0.384 \text{ g}$

## 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:			
<ul style="list-style-type: none"> <li>• Plasticity index <math>PI &gt; 20</math>,</li> <li>• Moisture content <math>w \geq 40\%</math>, and</li> <li>• Undrained shear strength <math>\bar{s}_u &lt; 500</math> psf</li> </ul>			
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/ft<sup>2</sup> = 0.0479 kN/m<sup>2</sup>

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

Table 11.4-1: Site Coefficient  $F_s$ 

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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  $S_s = 1.138$  g,  $F_s = 1.045$**

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  $S_1 = 0.384$  g,  $F_v = 1.631$**

**Equation (11.4-1):**  $S_{MS} = F_a S_s = 1.045 \times 1.138 = 1.189 \text{ g}$

**Equation (11.4-2):**  $S_{M1} = F_v S_1 = 1.631 \times 0.384 = 0.627 \text{ g}$

Section 11.4.4 — Design Spectral Acceleration Parameters

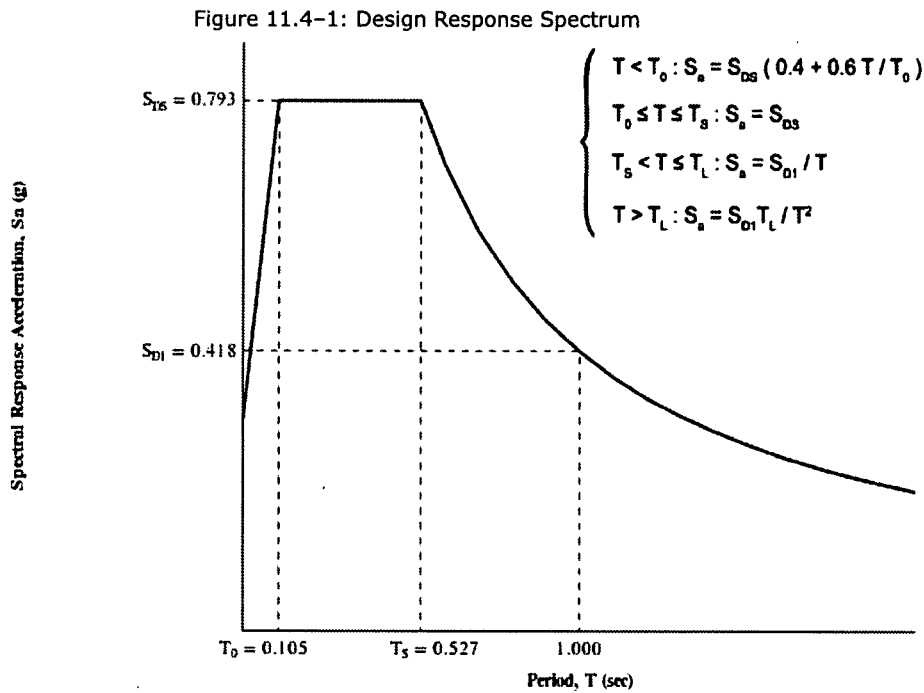
**Equation (11.4-3):**  $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 1.189 = 0.793 \text{ g}$

**Equation (11.4-4):**  $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 0.627 = 0.418 \text{ g}$

Section 11.4.5 — Design Response Spectrum

From **Figure 22-12** <sup>[3]</sup>

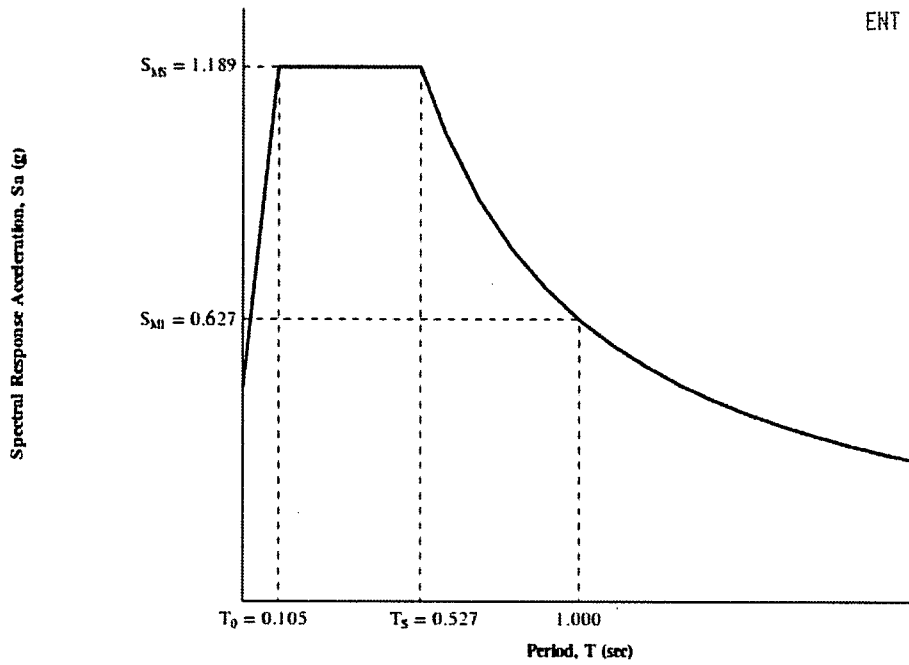
$T_L = 8 \text{ seconds}$



### Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE<sub>R</sub>) Response Spectrum

The MCE<sub>R</sub> Response Spectrum is determined by multiplying the design response spectrum above by 1.5.

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

**From Figure 22-7** <sup>[4]</sup>

PGA = 0.480

**Equation (11.8-1):**

$$PGA_M = F_{PGA} PGA = 1.020 \times 0.480 = 0.49 \text{ g}$$

Table 11.8-1: Site Coefficient  $F_{PGA}$

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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 = 0.480 g,  $F_{PGA} = 1.020$**

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

**From Figure 22-17** <sup>[5]</sup>

$C_{RS} = 0.831$

**From Figure 22-18** <sup>[6]</sup>

$C_{R1} = 0.837$

## Section 11.6 — Seismic Design Category

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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
$0.167g \leq S_{DS} < 0.33g$	B	B	C
$0.33g \leq S_{DS} < 0.50g$	C	C	D
$0.50g \leq S_{DS}$	D	D	D

For Risk Category = I and  $S_{DS} = 0.793 g$ , 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
$0.067g \leq S_{D1} < 0.133g$	B	B	C
$0.133g \leq S_{D1} < 0.20g$	C	C	D
$0.20g \leq S_{D1}$	D	D	D

For Risk Category = I and  $S_{D1} = 0.418 g$ , Seismic Design Category = D

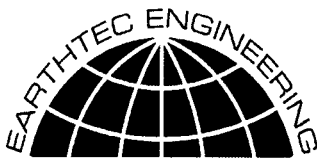
Note: When  $S_1$  is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category  $\equiv$  "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](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](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](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](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](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](https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf)



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

April 20, 2022

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White Horse Developers  
Attn: Mr. Jake Horan  
520 South 850 East, Suite A-4  
Lehi, UT 84043

**Re: Response to Review  
Lakeshore Landing, Penrod Properties (AFPD)  
6820 West 7333 North  
American Fork, Utah  
Job No: 189047**

Mr. Horan:

This letter is a response to the review by CMT of the geotechnical report<sup>1</sup> completed in 2018.

3. *Groundwater levels that may affect the development were addressed, including potential groundwater fluctuations, but an estimated depth of high groundwater levels was not provided.*

**Groundwater was encountered at 2 to 2½ feet in the explorations. The area had been flood irrigated at the time of our study but no evidence of higher groundwater levels were observed in the soils.**

10. *The report is not in accordance with the guidelines and recommendations of the "American Fork Sensitive Lands Geologic Hazards Study" Chapter 5. The recommended depth of borings in Chapter 5 for evaluating liquefaction is 40 feet, and the reviewed report included 1 boring that only extended to a depth of about 31.5 feet.*

In the referenced report by RG&G in Chapter 5 (page 18) dated December 2006 it states:

*"Single lots, residential subdivision of fewer than nine lots, multi-family dwellings with fewer than four units per acre, and single-story commercial buildings of less than 5,000 square feet do not require a sit-specific liquefaction study, even when located with the High and Moderate liquefaction potential areas. Other exceptions also apply, as outlined in Chapter 19.75 of the Salt Lake County Geologic Hazards Ordinance. The definition of "Critical Facilities" is also provided in the ordinance.*

*We recommend that American Fork City's liquefaction study requirements be modeled after the Salt Lake County ordinance. Salt Lake County require a minimum boring depth of 45 feet below final ground surface. Based on a review of boring logs and liquefaction analyses, it is our opinion that a minimum boring depth of 40 feet below existing ground is sufficient for the American Fork area. Deeper investigations should be performed if deemed necessary by the geotechnical engineer preparing the geotechnical report. We recommend that liquefaction investigations include a boring to a depth of at least 40 feet for all critical facilities, as well as for other facilities located within the High or Moderate*

<sup>1</sup> Geotechnical Study, AF PD, Penrod Properties, 6820 West 7333 North, American Fork, Utah, Earthtec Engineering, Project No.189047, October 26, 2018.



*liquefaction zones delineated on Figure 6 and meeting minimum size, occupancy, and/or land use criteria set by the city."*

It should be noted that in the last sentence of the second paragraph, the recommendation is for all critical facilities. This is not considered a critical facility. In addition, in the executive summary it states:

*"We recommend that all developers, owners, and potential owners be advised of the potential seismic hazards, including ground shaking, tectonic subsidence and related flooding, and liquefaction. For facilities designed according to the IBC seismic provisions and located within the "moderated" or "high" liquefaction hazard zones identified on Figure 6, we recommend that the 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."*

Boring AF-06-3 is located within 2,000 feet of the site

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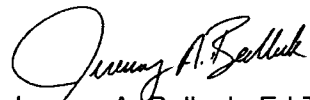
### General Conditions

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

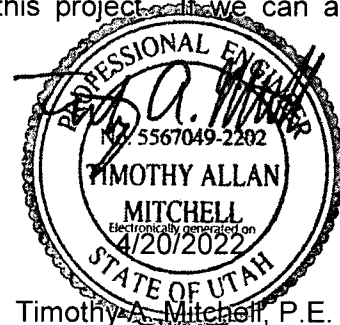
We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please call.

Respectfully;  
**EARTHTEC ENGINEERING**



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

JB/tm

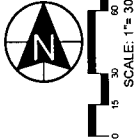


Timothy A. Mitchell, P.E.  
Senior Geotechnical Engineer



**WHITE HORSE DEVELOPERS**  
 530 S. 850 E. Suite A4  
 LEHI, UT 84043

# LAKESHORE LANDING



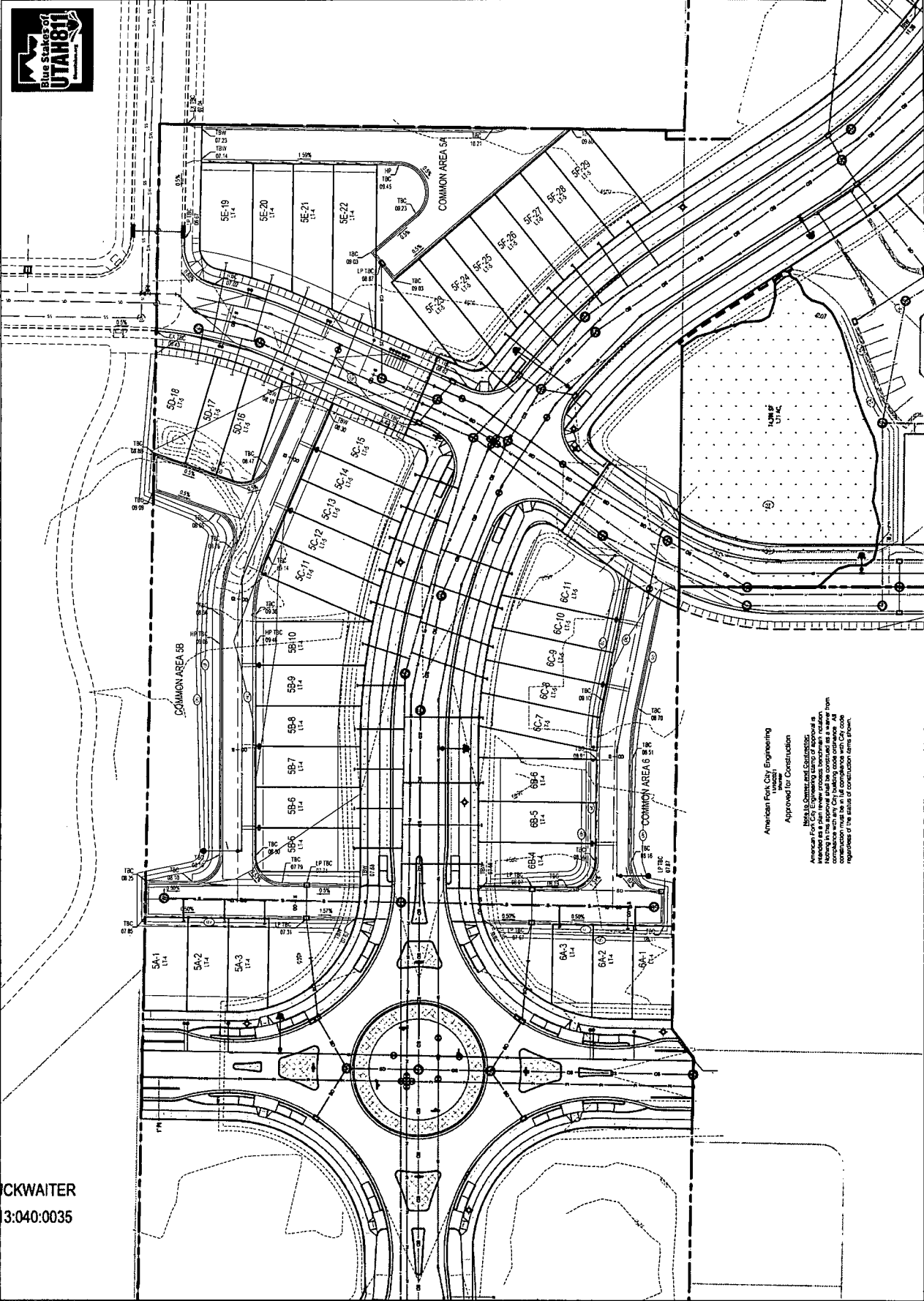
**berg**  
**CIVIL ENGINEERING**  
 11035 Highway 63, Suite 400  
 Lehi, UT 84043  
 Phone: (801) 814-1277  
 Fax: (801) 814-1277

NO.	DATE	DESCRIPTION
1	11/11/21	ISSUED FOR PERMITS
2	11/11/21	ISSUED FOR PERMITS
3	11/11/21	ISSUED FOR PERMITS
4	11/11/21	ISSUED FOR PERMITS
5	11/11/21	ISSUED FOR PERMITS
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98	11/11/21	ISSUED FOR PERMITS
99	11/11/21	ISSUED FOR PERMITS
100	11/11/21	ISSUED FOR PERMITS

# FINAL BLOCK PLAN

**BLOCK 5 & BLOCK 6 CONSTRUCTION DRAWINGS**

**GRADING PLAN**  
**C3.1**



American Fork City Engineering  
 Approved for Construction  
 [Signature]  
 [Stamp]  
 Note to Owner and Contractors:  
 American Fork City Engineering is not responsible for the accuracy of the information provided in this plan. It is the responsibility of the contractor to verify all information on the ground. All construction shall be in accordance with the City of American Fork Code of Ordinances. All construction shall be in accordance with the State of Utah Code of Regulations. All construction shall be in accordance with the City of American Fork Code of Ordinances.

CKWATER  
 3:040:0035