



ENT 34269:2023 PG 1 of 43  
 ANDREA ALLEN  
 UTAH COUNTY RECORDER  
 2023 May 30 11:11 am FEE 0.00 BY MC  
 RECORDED FOR AMERICAN FORK CITY

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

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

This Notice is recorded to bind the attached Geotechnical Study dated February 11, 2019 along with the site grading plan to the property generally located at 1100 W 450 S (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 17 day of November, 2022.

OWNER(S):

[Signature]  
 (Signature)

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

GRANT CHAD CHRISTOFFERSON  
 (Printed Name)

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

MANAGER  
 (Title)

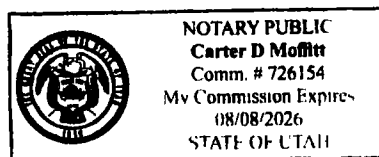
\_\_\_\_\_  
 (Title)

STATE OF UTAH )  
 )  
 COUNTY OF Utah )

On the 17 day of November, 2022, personally appeared before me Grant Chad Christofferson and [Signature], 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: 08/08/26

Approved as to form: American Fork City Attorney



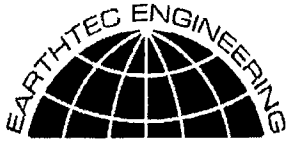
Rev. 12/4/18

**EXHIBIT A**  
**EDGEWATER TOWNHOMES AT AMERICAN**  
**FORK PHASE 2 BOUNDARY**

Beginning at a point which is South 89°53'29" East along the section line 426.31 feet and South 2800.40 feet from the Northwest corner of Section 22, Township 5 South, Range 1 East, Salt Lake Base and Meridian; thence S 89°06'00" E 53.00 feet to a point of curvature; thence along an arc 23.59 feet to the right, having a radius of 15.00 feet, the chord bears N 45°57'19" E 21.23 feet to a point on the southern right of way line of 350 South; thence S 88°56'04" E 570.12 feet to a point of curvature; thence along an arc 31.37 feet to the right, having a radius of 20.00 feet, the chord bears S 43°59'45" E 28.25 feet more or less to the western right of way line of 1100 West; thence along said right of way the following five (5) calls: 1) S 0°56'33" W 140.54 feet; 2) along an arc 114.04 feet to the right, having a radius of 710.50 feet, the chord bears S 5°32'27" W 113.92 feet; 3) S 10°08'21" W 120.25 feet; 4) along an arc 126.73 feet to the left, having a radius of 789.50 feet, the chord bears S 5°32'27" W 126.59 feet; 5) S 0°56'33" W 9.86 feet to a point of curvature; thence along an arc 31.45 feet to the right, having a radius of 20.00 feet, the chord bears S 46°00'15" W 28.31 feet; thence S 0°50'57" W 60.49 feet more or less to the southern right of way line of 450 South; thence N 88°56'04" W 531.16 feet to a point of curvature; thence along an arc 23.61 feet to the left, having a radius of 15.00 feet, the chord bears S 45°58'58" W 21.24 feet; thence N 89°06'00" W 53.00 feet; thence N 0°54'00" E 609.42 feet to the POINT OF BEGINNING.

Area = 8.931 Acres

EXHIBIT B - GEOTECHNICAL STUDY



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

**Geotechnical Study  
Harbor View Development  
7000 West 7750 North  
American Fork, Utah**

**Project No. 198052**

February 11, 2019

*Prepared For:*

Jack William Homes  
Attention: Mr. Greg Bird  
1987 North 1120 West  
Provo, UT 84604

*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.



Electronically generated on  
02/11/2019

Caleb R. Allred, P.E.  
Project Engineer



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**ATTACHED FIGURES**

- No. 1 VICINITY MAP
- No. 2 SITE PLAN SHOWING LOCATION OF TEST PITS AND BORINGS
- Nos. 3 – 13 TEST PITS AND BORING LOGS
- No. 14 LEGEND
- Nos. 15 – 20 CONSOLIDATION-SWELL TEST

**APPENDIX A**

Timpview Analytical Labs



## 1.0 INTRODUCTION

The project is located at approximately 7000 West 7750 North in American Fork, Utah. The general location of the site is shown on Figure No. 1, *Vicinity Map* and Figure No. 2, *Site Plan Showing Location of Test Pits and Borings*, at the end of this report. This entire report presents the results of Earthtec Engineering's completed geotechnical study for the Harbor View Development in American Fork, Utah. 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. Details of our findings, conclusions, and recommendations are provided within the body of this report.

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 PROPOSED CONSTRUCTION

We understand that the proposed project, as described to us by Mr. Greg Bird with Jack William Homes, consists of developing the approximately 35-acre existing parcel with the construction of townhomes and apartment buildings. 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 anticipated foundation loads for the proposed structures will not exceed 5,000 pounds per linear foot for bearing walls, 80,000 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.

## 3.0 GENERAL SITE DESCRIPTION

### 3.1 Site Description

At the time of our subsurface exploration the site was an undeveloped parcel used as an alfalfa



field. The ground surface appears to be relatively flat, and we anticipate less than 3 feet of cut and fill will be required for site grading. The lot was bounded on the north by 7750 North Street and surround by agriculture fields.

### 3.2 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*<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."

## 4.0 SUBSURFACE EXPLORATION

### 4.1 Soil Exploration

Under the direction of a qualified member of our geotechnical staff, subsurface explorations were conducted at the site on January 28, 2019 by the excavation of nine (9) test pits and the boring of two (2) borings to depth of 8 to 31½ feet below the existing ground surface using a track-mounted excavator and a truck-mounted hydraulic drill rig. The approximate locations of the test pits and borings are shown on Figure No. 2, *Site Plan Showing Location of Test Pits and Borings*. Graphical representations and detailed descriptions of the soils encountered are shown on Figure Nos. 3 through 13, *Test Pit and Boring 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. 14, *Legend*.

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

<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.



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. 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.

## 5.0 SUBSURFACE CONDITIONS

### 5.1 Soil Types

On the surface of the site, we encountered topsoil which is estimated to extend about 1 to 1½ feet in depth at the test pit and boring locations. Below the topsoil we encountered layers of clay, silt, and sand extending to depth of 8 to 31½ feet below the existing ground surface. 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. Graphical representations, laboratory testing, and detailed descriptions of the soils encountered are shown on Figure Nos. 3 through 13, *Test Pit and Boring 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 soft to very stiff in consistency and the sand soils visually had a relative density varying loose to medium dense.

It should be considered that small diameter soil borings were used during the course of our subsurface exploration. Fill material composition and contacts are difficult to determine from boring sampling. Variation in topsoil depths may occur at the site.

### 5.2 Groundwater Conditions

Groundwater was encountered at depths of approximately 3 to 9 feet below the existing ground surface. Groundwater was not encountered within the excavations at the depths explored. 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.

### 5.3 Laboratory Testing

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 soils have a negligible to slight potential for collapse (settlement) and a slight to moderate potential for compressibility under increased moisture contents and anticipated load conditions.

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

## 6.0 SITE GRADING

### 6.1 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 8.0.

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.

### 6.2 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.

### 6.3 Fill Material Composition

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. Structural fill may consist of imported sandy/gravelly soils or reworked native soils with a maximum particle size of 4 inches, a maximum Liquid Limit of 35 and a maximum Plasticity Index of 15. The contractor should be aware that native clay and silt

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



soils may be time consuming to compact due to potential difficulties in controlling the moisture content needed to obtain optimum compaction.

Outside of structural loaded areas, 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 as defined above. Note that some local governments and utility companies had different trench backfill requirements and the stricter requirement should be followed. be used as backfill above utilities in certain areas.

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

**Table 1: 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 or a structural 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.

**6.4 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  $\pm 2$  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.

### 6.5 Stabilization Recommendations

Near surface layers of clay 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 or geogrid, 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.



**7.0 SEISMIC AND GEOLOGIC CONSIDERATIONS**

**7.1 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. Considering our experience in the vicinity of the site and based on the results of our field exploration, we recommend using Site Class D.

The site is located at approximately 40.370 degrees latitude and -111.828 degrees longitude. Using Site Class D, the design spectral response acceleration parameters are given below.

**Table 2: Design Accelerations**

<b>S<sub>s</sub></b>	<b>F<sub>a</sub></b>	<b>S<sub>M<sub>s</sub></sub></b>	<b>S<sub>D<sub>s</sub></sub></b>
1.137 g	1.045	1.189 g	0.792 g
<b>S<sub>1</sub></b>	<b>F<sub>v</sub></b>	<b>S<sub>M<sub>1</sub></sub></b>	<b>S<sub>D<sub>1</sub></sub></b>
0.385 g	1.631	0.627 g	0.418 g

**7.2 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 2½ miles south of the site.

**7.3 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>.

<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.



Subsurface soils were composed of clay, silt, and sand soils. Our analysis indicates that approximately up to 2¼ inches of liquefaction-induced settlement and less than ¼ feet 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. The following are mitigation methods to reduce the liquefaction potential at the client's request:

- Densify the liquefiable soils by installing aggregate piers on a grid pattern below the building and extending at least 5 feet beyond the perimeter footings.
- Densify the liquefiable soils by installing grouted columns in a grid pattern below the building and extending at least 5 feet beyond the perimeter footings.
- 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.

## 8.0 FOUNDATIONS

### 8.1 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 2.0, *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.

Prior to placement of footings the appropriate removals as outlined in Section 6.1 should be made. 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.

### 8.2 Strip/Spread Footings

We recommend that conventional strip and spread foundations be constructed entirely on properly placed, compacted, and tested structural fill extending to undisturbed native soils. We recommend the following amount of structural fill for the corresponding loads:

<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.



**Table 3: Structural Fill Depths**

Feet of Structural Fill	Maximum Bearing Capacity	Strip Loads (kips per linear foot)	Spread Loads (kips)
2 feet	1,500 psf	5.0	30
3 feet	1,500 psf	6.0	35
4 feet	1,800 psf	7.0	45

For loads exceed those in the table the native soils should be first improved by installing rammed aggregate piers or other soil improvement options. Rammed aggregate piers or other soil improvement may reduce the amount of structural fill required under strip and spread foundations for loads that are both in and exceed those in the Table 3 and to control total and differential settlements.

For foundation design we recommend the following:

- Footings founded on 24 inches may be designed using a maximum allowable bearing capacity of 1,500 pounds per square foot. Footings founded on a minimum 48 inches of structural fill may be designed using a maximum allowable bearing capacity of 1,800 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 6.5.
- 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.
- 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 Mirafix 600X or equivalent, which should be placed



between the native soils and the clean gravel.

- Due to shallow groundwater encountered at the site, lowest floor slab depths should be limited to 2 feet below 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 2.0, 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 structural fill (as outlined in this report) native soils as backfill material using a 28° friction angle and a dry unit weight of 120 pcf.



**Table 4: Lateral Earth Pressures (Static and Dynamic)**

Condition	Case	Lateral Pressure Coefficient	Equivalent Fluid Pressure (pcf)
Active	Static	0.36	43
	Seismic	0.53	64
At-Rest	Static	0.53	64
	Seismic	0.73	88
Passive	Static	2.77	332
	Seismic	3.38	406

\*Seismic values combine the static and dynamic values

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

Lateral loads are typically resisted by friction between the underlying soil and footing bottoms. Resistance to sliding may incorporate the friction acting along the base of foundations, which may be computed using a coefficient of friction of soils against concrete of 0.55 for clean gravels or structural fill meeting the recommendations presented herein. For allowable stress design, the lateral resistance may be computed using Section 1807 of the 2015 International Building Code and all sections referenced therein. Retaining wall lateral resistance design should further reference Section 1807.2.3 for reference of Safety Factors. Retaining systems are assumed to be founded upon and backfilled with granular structural fill. If backfilling with clay or silt, it is required to contact Earthtec prior to construction for further review and recommendations. The values for lateral foundation pressure can be increased by one-third for wind and seismic conditions per Section 1806.1 when used with the Alternative Basic Load Combinations found in Section 1605.3.2 of the 2015 International Building Code

**9.0 FLOOR SLABS AND FLATWORK**

Concrete floor slabs and exterior flatwork may be supported on 12 inches of properly placed and compacted structural fill after appropriate removals and grading as outlined in Section 6.1 are completed. We recommend placing a minimum 4 inches of free-draining fill material (see Section 6.3) 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 6.5.

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.

## 10.0 DRAINAGE

### 10.1 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 should be provided i.e. a minimum of 90% of ASTM D-1557. Water consolidation methods should not be used.
- The ground surface should be graded to drain away from the building in all directions. We recommend a minimum fall of 8 inches in the first 10 feet.
- Roof runoff should be collected in rain gutters with 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. A drip irrigation system is recommended to be utilized in landscaping areas within 10 feet from 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 and drip irrigation systems should be designed with proper drainage and be well maintained. Over-watering should be avoided.
- Any additional precautions which may become evident during construction.



**10.2 Subsurface Drainage**

Groundwater were encountered and observed at depths of 3 to 9 feet below the existing ground surface. The depth of basements will depend greatly on-site grading and drainage. Based on current site conditions, basements may be constructed no deeper than 2 feet below existing site grades. 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.

**11.0 PAVEMENT RECOMMENDATIONS**

We understand that asphalt paved parking and drive areas 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. 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 5,300 vehicles a day or less for the local collector roadway, the traffic volume will be about 1,500 vehicles a day or less for the parking and drive areas around the apartments, and the traffic volume will be about 700 vehicles a day or less for the parking and drive areas between the townhomes. Traffic will consist 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), and a design life of 20 years, we recommend the minimum asphalt pavement section presented below.

**Table 5: Pavement Section Recommendations - Local Collector**

Asphalt Thickness (in)	Compacted Roadbase Thickness (in)	Compacted Subbase Thickness (in)
4	10	14*
4	8*	16*

\* Stabilization may be required

**Table 6: Pavement Section Recommendations - Apartment Parking and Drive Areas**

Asphalt Thickness (in)	Compacted Roadbase Thickness (in)	Compacted Subbase Thickness (in)
3	8	10*
3½	6	10*

\* Stabilization may be required



**Table 7: Pavement Section Recommendations - Townhomes Parking and Drive Areas**

Asphalt Thickness (in)	Compacted Roadbase Thickness (In)	Compacted Subbase Thickness (in)
3	6	8*

\* 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 6.5.
- Site grading fills below the pavements should meet structural fill composition and placement recommendations per Sections 6.3 and 6.4 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).

Due to high static loads imposed by at dumpster locations, we recommend that a rigid pavement section for these areas of a minimum of six (6) inches of Portland Cement Concrete (PCC) over a minimum of ten (10) 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).

**12.0 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**



Electronically generated on  
 02/11/2019

Caleb R. Allred, P.E.  
 Project Engineer

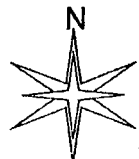
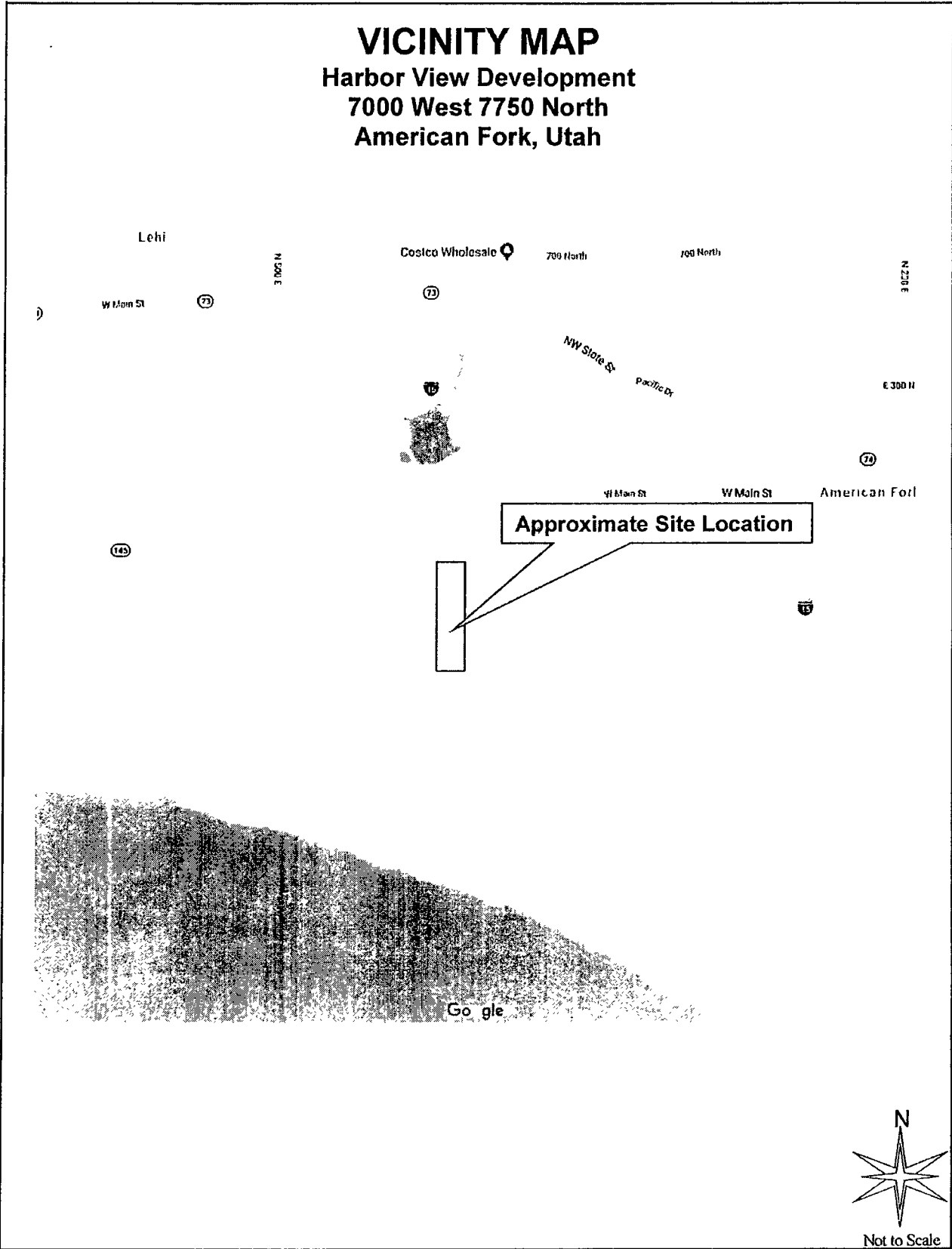


Timothy A. Mitchell, P.E.  
 Geotechnical Engineer



# VICINITY MAP

## Harbor View Development 7000 West 7750 North American Fork, Utah



Not to Scale

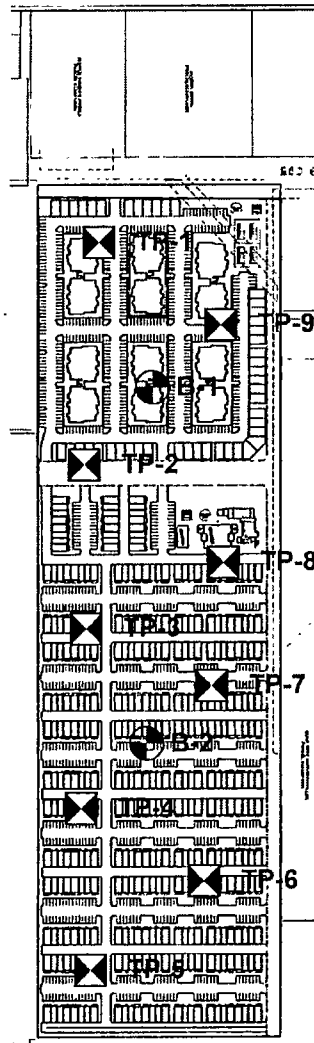
PROJECT NO.: 198052





FIGURE NO.: 1

# SITE PLAN SHOWING LOCATION OF TEST PITS AND BORINGS

Harbor View Development  
7000 West 7750 North  
American Fork, Utah



\*Site Plan provided by Client.

-  Approximate Test Pit Locations
-  Approximate Boring Locations



Not to Scale

PROJECT NO.: 198052



FIGURE NO.: 2

# TEST PIT LOG

## NO.: TP-1

**PROJECT:** Harbor View Development  
**CLIENT:** Jack William Homes  
**LOCATION:** See Figure 2  
**OPERATOR:** Elevate Excavation  
**EQUIPMENT:** Track-mounted excavator  
**DEPTH TO WATER; INITIAL ∇ :**

**PROJECT NO.:** 198052  
**DATE:** 01/28/19  
**ELEVATION:** Not Measured  
**LOGGED BY:** C. Allred

**AT COMPLETION ∇ :** 3 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 with organics, moist, dark brown.										
1			Lean CLAY, medium stiff (estimated), moist to wet, gray to light brown.										
2													
3		CL											
4													
5													
6													
7													
8					27	95	44	24	1	7	92	C	
9			Maximum depth explored approximately 8 feet.										
10													
11													
12													
13													
14													
15													

**Notes:** Groundwater encountered at 3 feet.

**Tests Key**

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

**PROJECT NO.:** 198052



**FIGURE NO.:** 3

LOG OF TESTPIT TEST PITS AND BORINGS.GPJ EARTHTEC.GDT 2/11/19

# TEST PIT LOG

## NO.: TP-2

**PROJECT:** Harbor View Development  
**CLIENT:** Jack William Homes  
**LOCATION:** See Figure 2  
**OPERATOR:** Elevate Excavation  
**EQUIPMENT:** Track-mounted excavator  
**DEPTH TO WATER; INITIAL ∇ :**

**PROJECT NO.:** 198052  
**DATE:** 01/28/19  
**ELEVATION:** Not Measured  
**LOGGED BY:** C. Allred

**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 with organics, moist, dark brown.											
1			Lean CLAY, medium stiff (estimated), moist to wet, gray to light brown.											
2														
3														
4														
5														
6														
7														
8														
9														
10							28		46	26	1	8	91	
11			Maximum depth explored approximately 10 feet.											
12														
13														
14														
15														

**Notes:** Groundwater encountered at 5 feet.

**Tests Key**

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

**PROJECT NO.:** 198052



**FIGURE NO.:** 4

LOG OF TESTPIT TEST PITS AND BORINGS.GPJ EARTHTEC.GDT 2/11/19



# TEST PIT LOG

## NO.: TP-3

**PROJECT:** Harbor View Development  
**CLIENT:** Jack William Homes  
**LOCATION:** See Figure 2  
**OPERATOR:** Elevate Excavation  
**EQUIPMENT:** Track-mounted excavator  
**DEPTH TO WATER; INITIAL ∇ :**

**PROJECT NO.:** 198052  
**DATE:** 01/28/19  
**ELEVATION:** Not Measured  
**LOGGED BY:** C. Allred

**AT COMPLETION ∇ :**

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 with organics, moist, dark brown.										
1			Lean CLAY, medium stiff (estimated), moist to wet, gray to light brown.										
2													
3													
4													
5		CL				10	95	38	19	0	6	94	C
6													
7													
8													
9													
10			Maximum depth explored approximately 9 feet.										
11													
12													
13													
14													
15													

**Notes:** No groundwater encountered.

**Tests Key**

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

**PROJECT NO.:** 198052



**FIGURE NO.:** 5

LOG OF TESTPIT TEST PITS AND BORINGS.GPJ EARTHTEC.GDT 2/11/19

# TEST PIT LOG

## NO.: TP-4

**PROJECT:** Harbor View Development  
**CLIENT:** Jack William Homes  
**LOCATION:** See Figure 2  
**OPERATOR:** Elevate Excavation  
**EQUIPMENT:** Track-mounted excavator  
**DEPTH TO WATER; INITIAL ∇ :**

**PROJECT NO.:** 198052  
**DATE:** 01/28/19  
**ELEVATION:** Not Measured  
**LOGGED BY:** C. Allred

**AT COMPLETION ∇ : 8 ft.**

Depth (Fl.)	Graphic Log	USCS	Description	Samples	TEST RESULTS								
					Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests	
0			TOPSOIL, Lean clay with organics, moist, dark brown.										
1			Silty SAND, medium dense (estimated), slightly moist, brown.										
2		SM											
3				X									
4			Lean CLAY, medium stiff (estimated), moist to wet, gray to light brown.										
5													
6		CL											
7													
8													
9			Maximum depth explored approximately 9 feet.										
10													
11													
12													
13													
14													
15													

**Notes:** Groundwater encountered at 8 feet.

**Tests Key**

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

**PROJECT NO.:** 198052



**FIGURE NO.:** 6

LOG OF TESTPIT TEST PITS AND BORINGS.GPJ EARTHTEC.GDT 2/11/19

# TEST PIT LOG

## NO.: TP-5

**PROJECT:** Harbor View Development  
**CLIENT:** Jack William Homes  
**LOCATION:** See Figure 2  
**OPERATOR:** Elevate Excavation  
**EQUIPMENT:** Track-mounted excavator  
**DEPTH TO WATER; INITIAL ∇ :**

**PROJECT NO.:** 198052  
**DATE:** 01/28/19  
**ELEVATION:** Not Measured  
**LOGGED BY:** C. Allred  
**AT COMPLETION ∇ :** 8 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 with organics, moist, dark brown.											
1														
2			Lean CLAY with gravel, medium stiff (estimated), moist to wet, gray to light brown.											
3														
4														
5														
6		CL				11		38	16	13	10	77		
7														
8														
9														
10														
11				Maximum depth explored approximately 10 feet.										
12														
13														
14														
15														

**Notes:** Groundwater encountered at 8 feet.

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

**PROJECT NO.:** 198052



**FIGURE NO.:** 7

LOG OF TESTPIT TEST PITS AND BORINGS.GPJ: EARTHTEC.GDT 2/11/19

# TEST PIT LOG

## NO.: TP-6

**PROJECT:** Harbor View Development  
**CLIENT:** Jack William Homes  
**LOCATION:** See Figure 2  
**OPERATOR:** Elevate Excavation  
**EQUIPMENT:** Track-mounted excavator  
**DEPTH TO WATER; INITIAL ∇ :**

**PROJECT NO.:** 198052  
**DATE:** 01/28/19  
**ELEVATION:** Not Measured  
**LOGGED BY:** C. Allred

**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, Lean clay with organics, moist, dark brown.										
2			Lean CLAY with sand, medium stiff (estimated), moist to wet, gray to light brown.										
3													
4						23	89	29	11	3	26	71	C
5													
6		CL											
7													
8													
9													
10			Maximum depth explored approximately 9½ feet.										
11													
12													
13													
14													
15													

**Notes:** Groundwater encountered at 5 feet

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

PROJECT NO.: 198052



FIGURE NO.: 8

LOG OF TESTPIT TEST PITS AND BORINGS.GPJ EARTHTEC.GDT 2/11/18

# TEST PIT LOG

## NO.: TP-7

**PROJECT:** Harbor View Development  
**CLIENT:** Jack William Homes  
**LOCATION:** See Figure 2  
**OPERATOR:** Elevate Excavation  
**EQUIPMENT:** Track-mounted excavator  
**DEPTH TO WATER; INITIAL ∇ :**

**PROJECT NO.:** 198052  
**DATE:** 01/28/19  
**ELEVATION:** Not Measured  
**LOGGED BY:** C. Allred

**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 with organics, moist, dark brown.										
1													
2			Lean CLAY, medium stiff (estimated), moist to wet, gray to light brown.										
3													
4													
5		CL			43	76	42	20	1	9	90	C	
6													
7													
8													
9													
10			Maximum depth explored approximately 9½ feet.										
11													
12													
13													
14													
15													

**Notes:** Groundwater encountered at 5 feet.

**Tests Key**

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

PROJECT NO.: 198052



FIGURE NO.: 9

LOG OF TEST PIT, TEST PITS AND BORINGS.GPJ EARTHTEC.GDT 2/11/19

# TEST PIT LOG

## NO.: TP-8

**PROJECT:** Harbor View Development  
**CLIENT:** Jack William Homes  
**LOCATION:** See Figure 2  
**OPERATOR:** Elevate Excavation  
**EQUIPMENT:** Track-mounted excavator  
**DEPTH TO WATER; INITIAL ∇ :**

**PROJECT NO.:** 198052  
**DATE:** 01/28/19  
**ELEVATION:** Not Measured  
**LOGGED BY:** C. Allred  
**AT COMPLETION ∇ :** 6 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, Lean Clay with organic.														
2		CL	Lean CLAY with sand, medium stiff (estimated), moist to wet, gray to light brown.														
3																	
4							13		30	10	5	17	78				
5																	
6																	
7																	
8																	
9																	
10						Maximum depth explored approximately 9½ feet.											
11																	
12																	
13																	
14																	
15																	

**Notes:** Groundwater encountered at 6 feet.

**Tests Key**

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

PROJECT NO.: 198052



FIGURE NO.: 10

LOG OF TESTPIT, TEST PITS AND BORINGS.GPJ EARTHTEC.GDT, 2/1/19

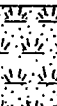

# TEST PIT LOG

## NO.: TP-9

**PROJECT:** Harbor View Development  
**CLIENT:** Jack William Homes  
**LOCATION:** See Figure 2  
**OPERATOR:** Elevate Excavation  
**EQUIPMENT:** Track-mounted excavator  
**DEPTH TO WATER; INITIAL ∇ :**

**PROJECT NO.:** 198052  
**DATE:** 01/28/19  
**ELEVATION:** Not Measured  
**LOGGED BY:** C. Allred

**AT COMPLETION ∇ :** 6 ft.

Depth (Fl.)	Graphic Log	USCS	Description	Samples	TEST RESULTS													
					Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests						
0																		
1			TOPSOIL, Lean clay with organics, moist, dark brown.															
2			Lean CLAY with sand, medium stiff (estimated), moist to wet, gray to light brown.															
3																		
4							17	91	36	17	1	14	85				C	
5																		
6				CL ∇														
7																		
8																		
9																		
10																		
11					Maximum depth explored approximately 10 feet.													
12																		
13																		
14																		
15																		

**Notes:** Groundwater encountered at 6 feet.

**Tests Key**

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

PROJECT NO.: 198052



FIGURE NO.: 11

LOG OF TESTPIT, TEST PITS AND BORINGS.GPJ, EARTHTEC.GDT, 2/11/19

# BORING LOG

NO.: B-1

**PROJECT:** Harbor View Development  
**CLIENT:** Jack William Homes  
**LOCATION:** See Figure 2  
**OPERATOR:** Great Basin Drilling  
**EQUIPMENT:** CME Truck Mounted Drill Rig  
**DEPTH TO WATER; INITIAL ∇ :**

**PROJECT NO.:** 198052  
**DATE:** 01/28/19  
**ELEVATION:** Not Measured  
**LOGGED BY:** J. Balleck

**AT COMPLETION ∇ : 8 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, Lean clay with organics, moist, dark brown.											
3		CL	Lean CLAY, medium stiff, slightly moist to wet, brown to gray.	12										
6														
9		ML	Sandy SILT, very stiff, wet, gray.	17										
12		CL	Lean CLAY, stiff, wet, light brown.	15										
15														
18														
21		ML	Sandy SILT, stiff to very stiff, wet, gray.	12										
24														
27		CL	Lean CLAY, medium stiff, wet, light brown.	6										
30		SM	Silty SAND, medium dense, wet, gray.	11										
33			Maximum depth explored approximately 31½ feet.											

**Notes:** Groundwater encountered at 8 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.: 198052



FIGURE NO.: 12

LOG OF TESTHOLE TEST PITS AND BORINGS.GPJ EARTHTEC.GDT 2/1/19



# BORING LOG

NO.: B-2

**PROJECT:** Harbor View Development  
**CLIENT:** Jack William Homes  
**LOCATION:** See Figure 2  
**OPERATOR:** Great Basin Drilling  
**EQUIPMENT:** CME Truck Mounted Drill Rig  
**DEPTH TO WATER; INITIAL ∇ :**

**PROJECT NO.:** 198052  
**DATE:** 01/28/19  
**ELEVATION:** Not Measured  
**LOGGED BY:** J. Balleck

**AT COMPLETION ∇ : 6 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, Lean clay with organics, moist, dark brown.											
3			Lean CLAY, medium stiff, slightly moist to wet, brown to gray.		8									
6		CL				25	100			3	5	92	C	
9					8									
12			Sandy SILT, stiff, wet, gray.		9									
15		ML												
18			Lean CLAY, soft, wet, gray.		4									
21														
24			Silty SAND, loose to medium dense, wet, gray.		9									
27														
30		SM			12									
33			Maximum depth explored approximately 31½ feet.		18									

**Notes:** Groundwater encountered at 6 feet.

**Tests Key**

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

**PROJECT NO.:** 198052



**FIGURE NO.:** 13

LOG OF TEST-HOLE TEST PITS AND BORINGS.GPJ EARTHTEC.GDT 2/11/19

# LEGEND

**PROJECT:** Harbor View Development  
**CLIENT:** Jack William Homes

**DATE:**  
**LOGGED BY:**

## 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	
		GRAVELS WITH FINES (More than 12% fines)		GM	Silty Gravel, May Contain Sand	
		GRAVELS WITH FINES (More than 12% fines)		GC	Clayey Gravel, May Contain Sand	
	<b>SANDS</b>  (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	
		SANDS WITH FINES (More than 12% fines)		SM	Silty Sand, May Contain Gravel	
		SANDS WITH FINES (More than 12% fines)		SC	Clayey Sand, May Contain Gravel	
					CL	Lean Clay, Inorganic, May Contain Gravel and/or Sand
					ML	Silt, Inorganic, May Contain Gravel and/or Sand
<b>FINE GRAINED SOILS</b>  (More than 50% passing No. 200 Sieve)	SILTS AND CLAYS (Liquid Limit less than 50)			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	
	SILTS AND CLAYS (Liquid Limit Greater than 50)			MH	Elastic Silt, Inorganic, May Contain Gravel and/or Sand	
	SILTS AND CLAYS (Liquid Limit Greater than 50)			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)
- SHEELBY 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.

LEGEND TEST PITS AND BORINGS.GPJ EARTHTEC.GDT 2/11/19

PROJECT NO.: 198052

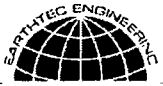
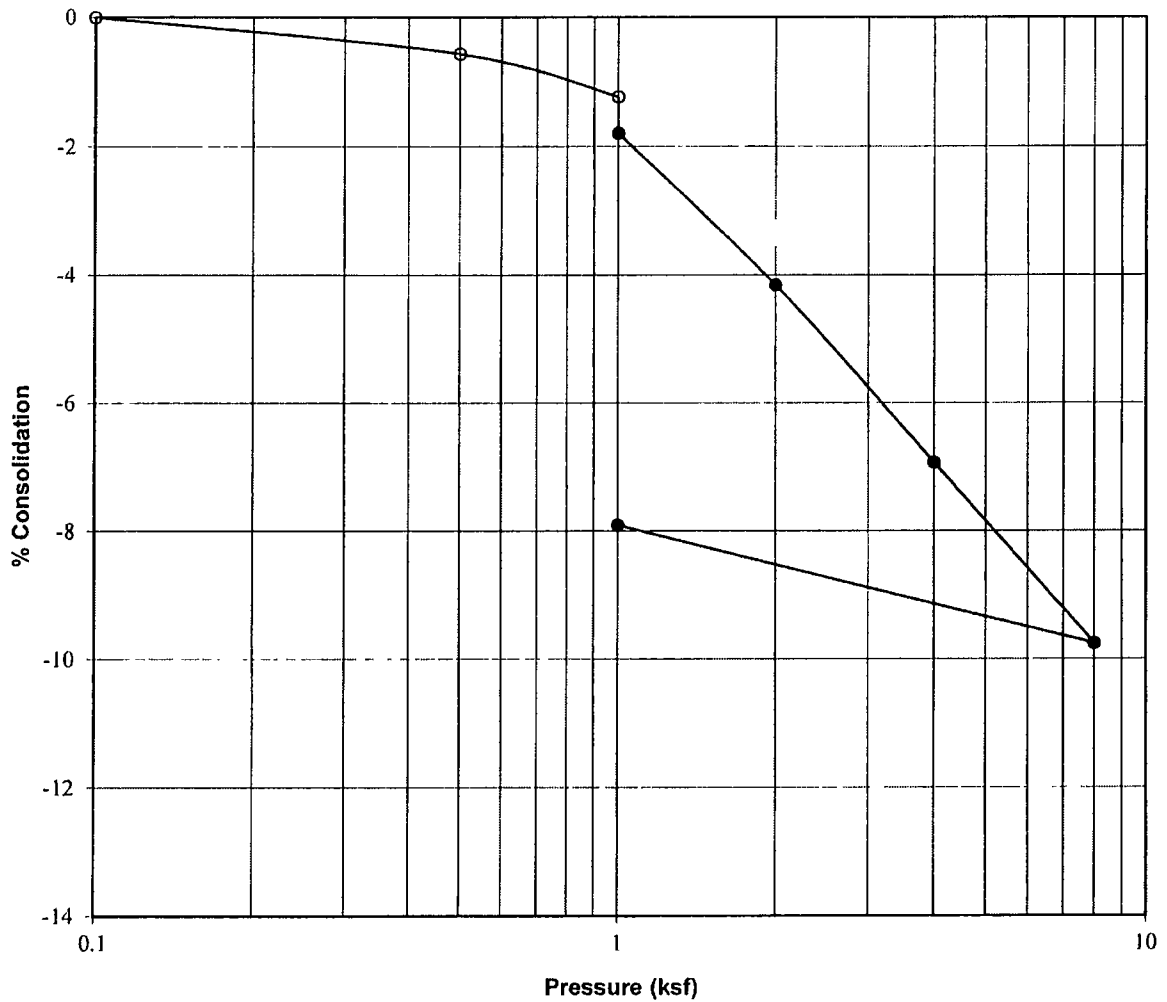


FIGURE NO.: 14

## CONSOLIDATION - SWELL TEST



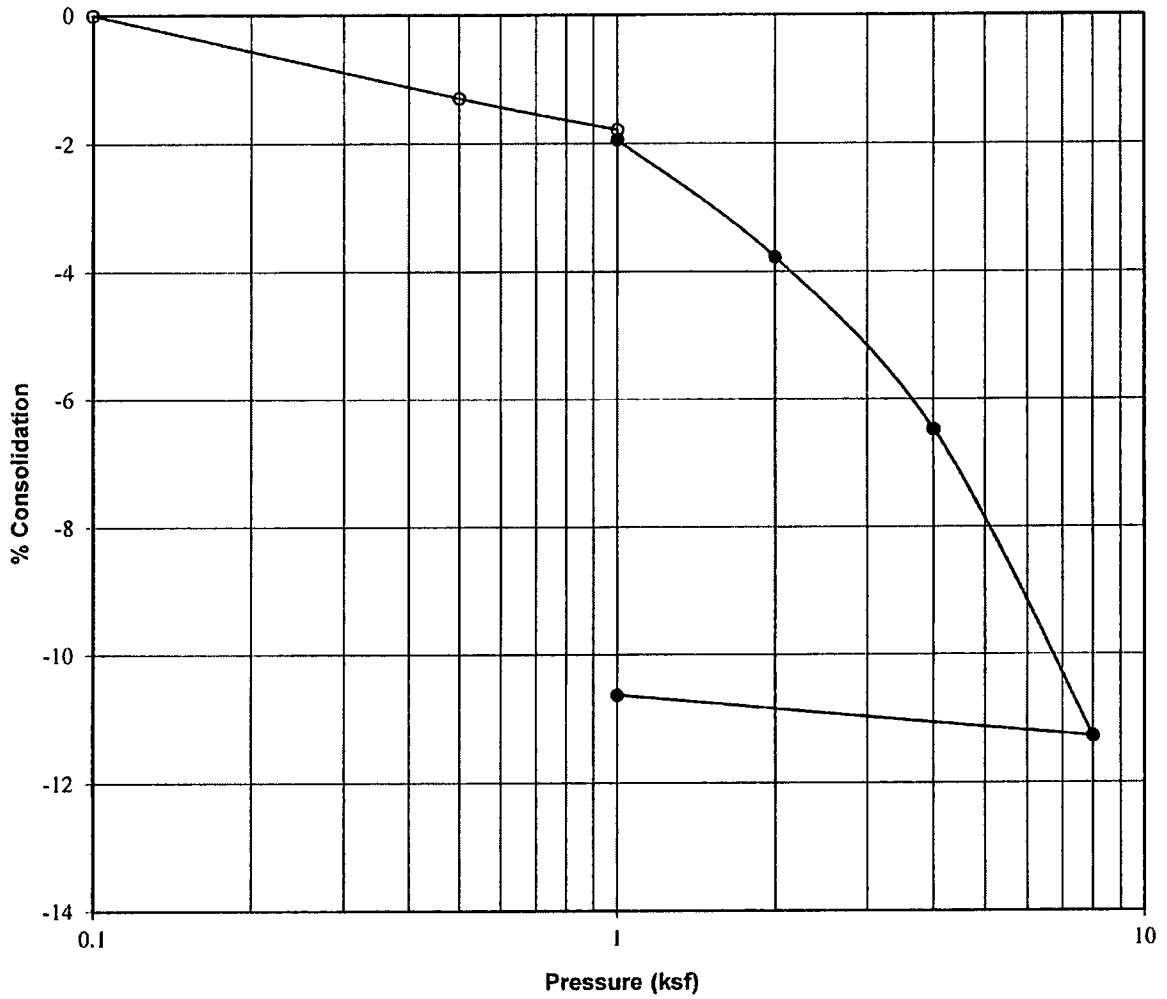
<b>Project:</b>	Harbor View Development
<b>Location:</b>	TP-1
<b>Sample Depth, ft:</b>	7
<b>Description:</b>	Block
<b>Soil Type:</b>	Lean CLAY (CL)
<b>Natural Moisture, %:</b>	27
<b>Dry Density, pcf:</b>	95
<b>Liquid Limit:</b>	44
<b>Plasticity Index:</b>	24
<b>Water Added at:</b>	1 ksf
<b>Percent Collapse:</b>	0.6

PROJECT NO.: 198052



FIGURE NO.: 15

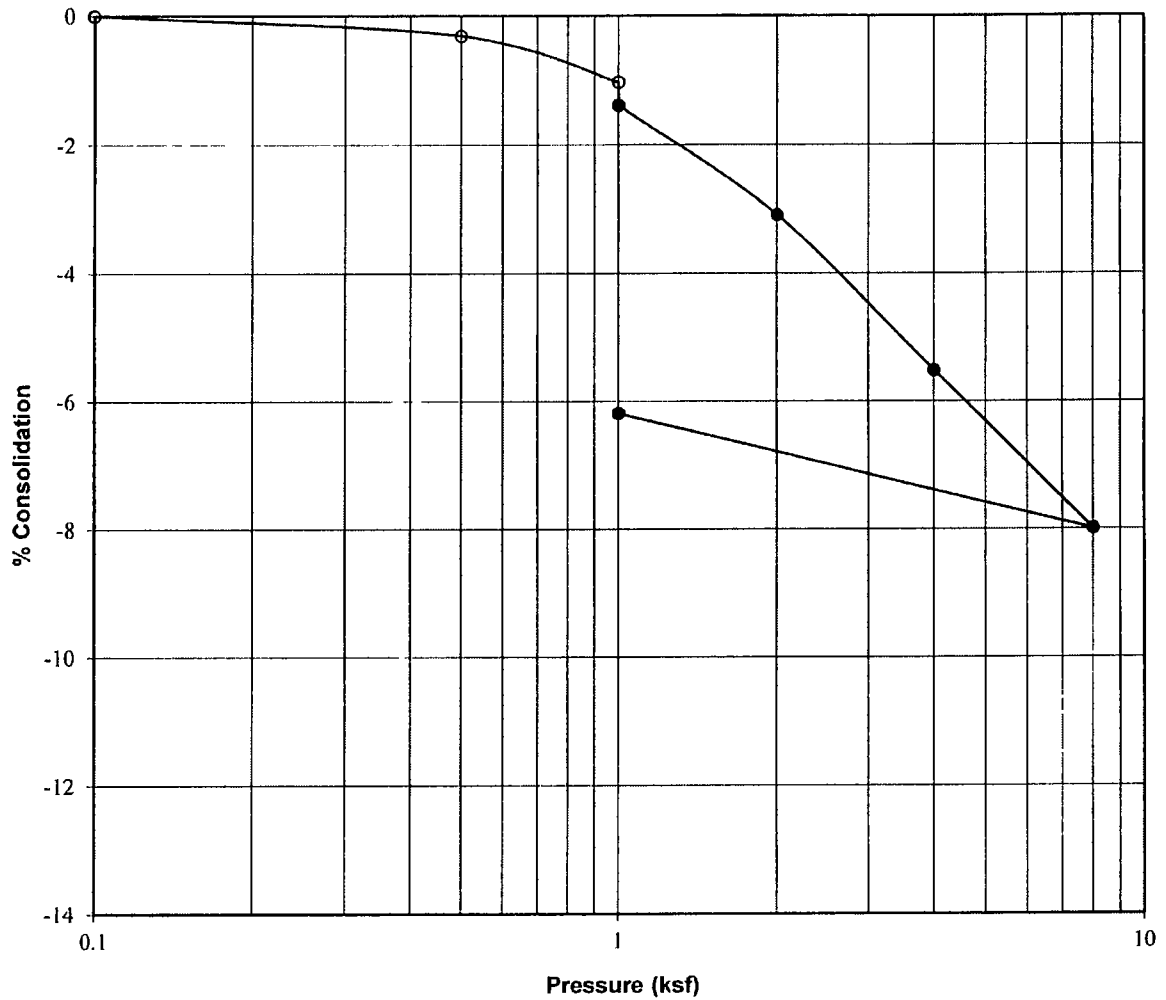
## CONSOLIDATION - SWELL TEST



<b>Project:</b>	Harbor View Development
<b>Location:</b>	TP-3
<b>Sample Depth, ft:</b>	4
<b>Description:</b>	Block
<b>Soil Type:</b>	Lean CLAY (CL)
<b>Natural Moisture, %:</b>	10
<b>Dry Density, pcf:</b>	95
<b>Liquid Limit:</b>	38
<b>Plasticity Index:</b>	19
<b>Water Added at:</b>	1 ksf
<b>Percent Collapse:</b>	0.2



## CONSOLIDATION - SWELL TEST



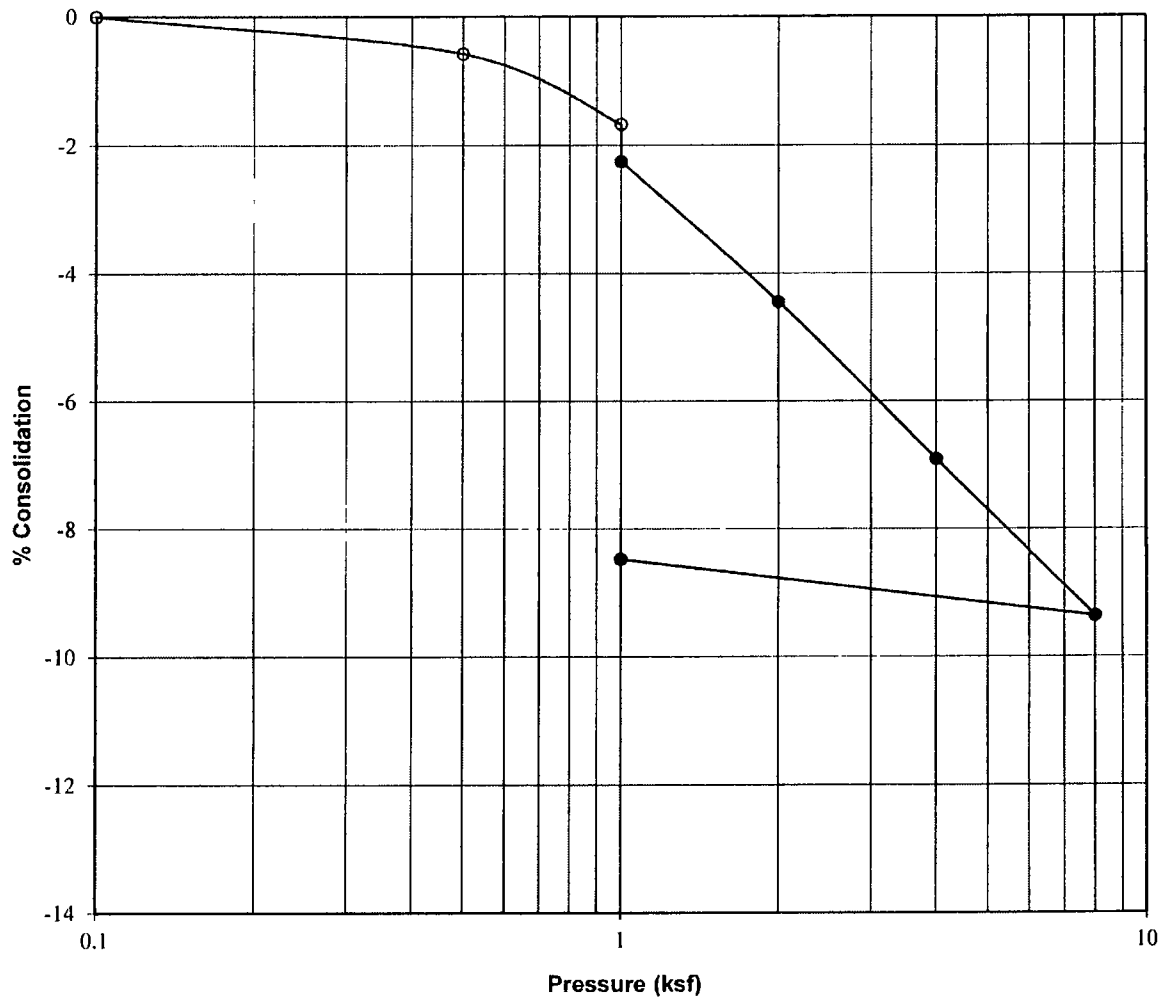
<b>Project:</b>	Harbor View Development
<b>Location:</b>	TP-6
<b>Sample Depth, ft:</b>	3
<b>Description:</b>	Block
<b>Soil Type:</b>	Lean CLAY with sand (CL)
<b>Natural Moisture, %:</b>	23
<b>Dry Density, pcf:</b>	89
<b>Liquid Limit:</b>	29
<b>Plasticity Index:</b>	11
<b>Water Added at:</b>	1 ksf
<b>Percent Collapse:</b>	0.4

PROJECT NO.: 198052



FIGURE NO.: 17

## CONSOLIDATION - SWELL TEST



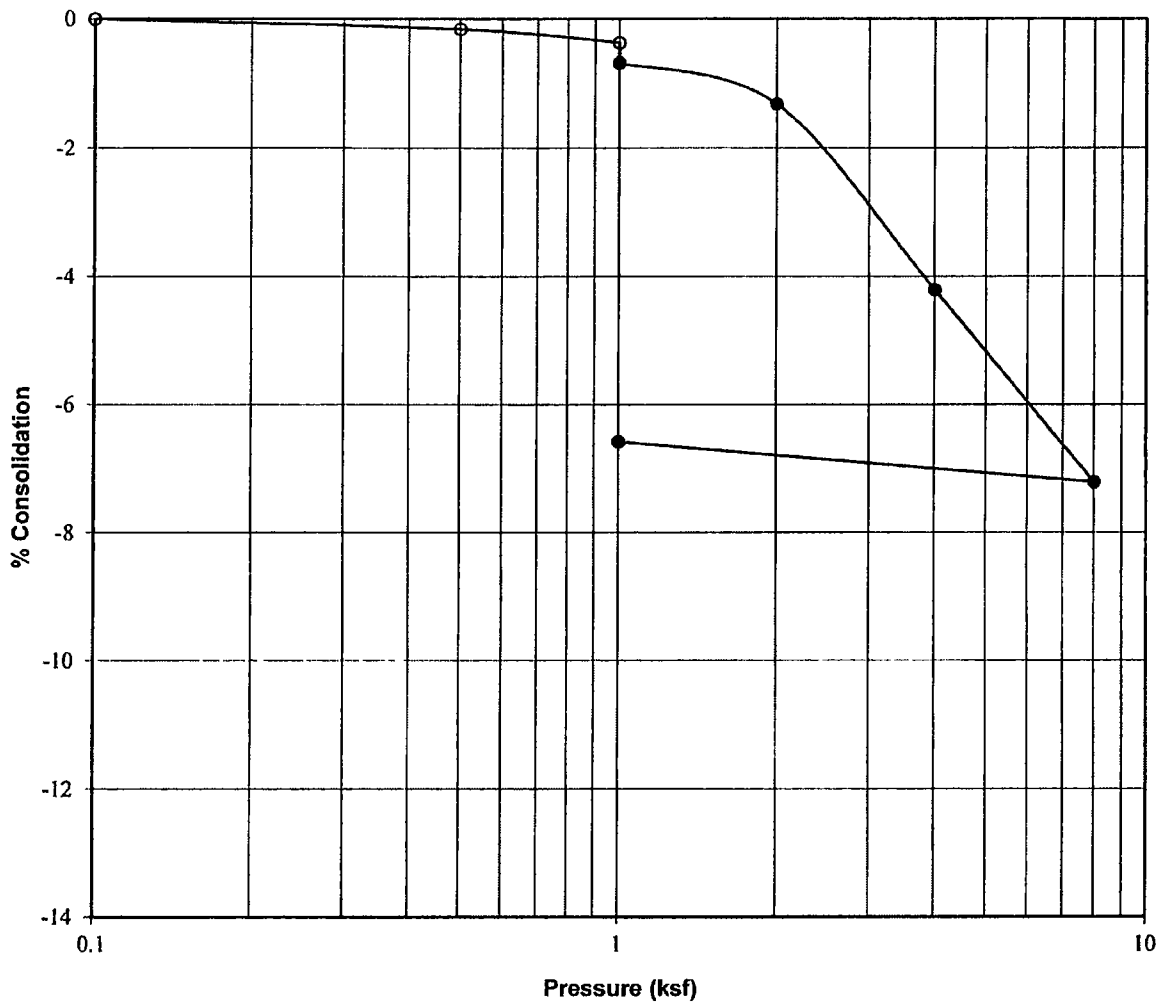
<b>Project:</b>	Harbor View Development
<b>Location:</b>	TP-7
<b>Sample Depth, ft:</b>	5
<b>Description:</b>	Block
<b>Soil Type:</b>	Lean CLAY (CL)
<b>Natural Moisture, %:</b>	43
<b>Dry Density, pcf:</b>	76
<b>Liquid Limit:</b>	42
<b>Plasticity Index:</b>	20
<b>Water Added at:</b>	1 ksf
<b>Percent Collapse:</b>	0.6

PROJECT NO.: 198052



FIGURE NO.: 18

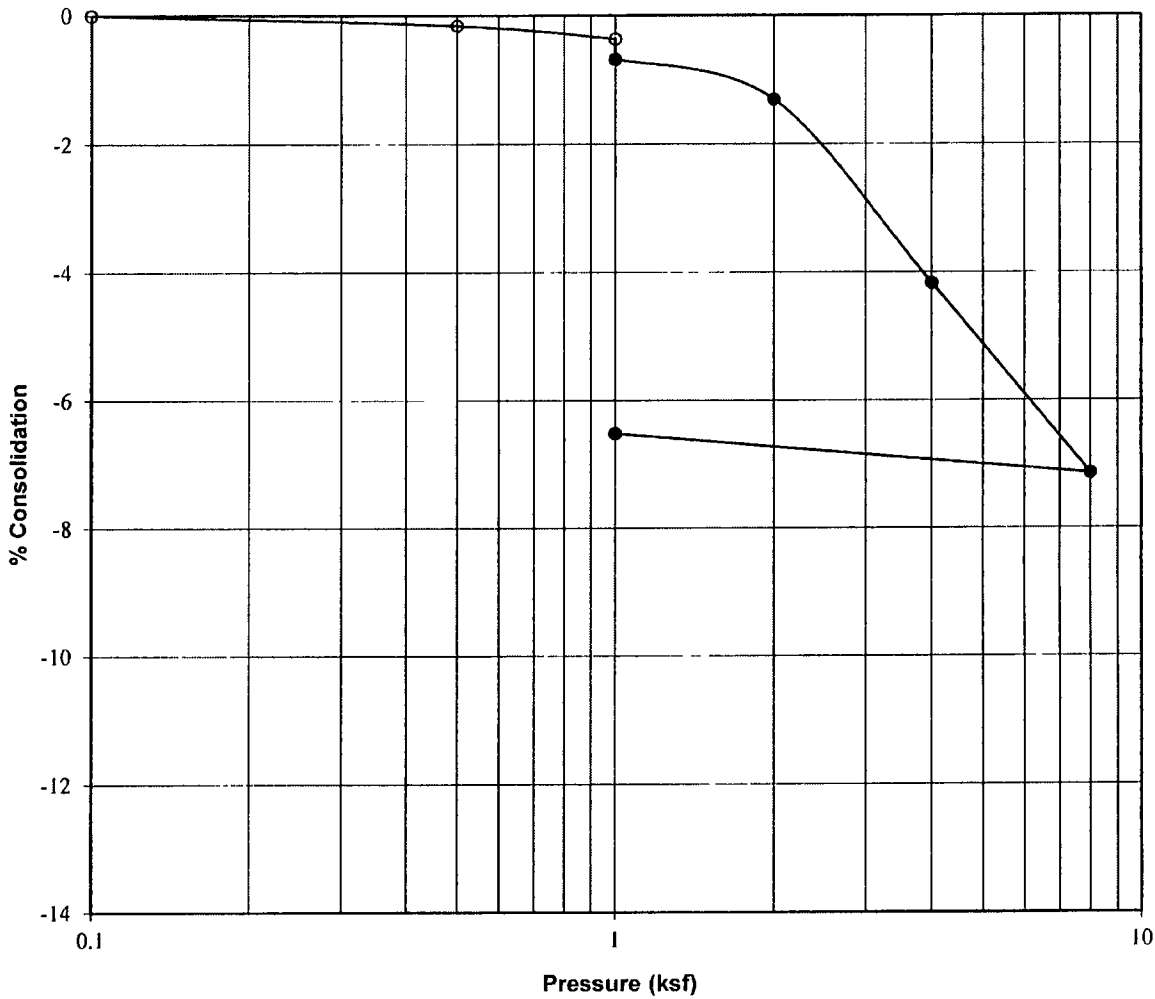
## CONSOLIDATION - SWELL TEST



<b>Project:</b>	Harbor View Development
<b>Location:</b>	TP-9
<b>Sample Depth, ft:</b>	4
<b>Description:</b>	Block
<b>Soil Type:</b>	Lean CLAY with sand (CL)
<b>Natural Moisture, %:</b>	17
<b>Dry Density, pcf:</b>	91
<b>Liquid Limit:</b>	36
<b>Plasticity Index:</b>	17
<b>Water Added at:</b>	1 ksf
<b>Percent Collapse:</b>	0.3



### CONSOLIDATION - SWELL TEST



<b>Project:</b>	Harbor View Development
<b>Location:</b>	B-2
<b>Sample Depth, ft:</b>	5
<b>Description:</b>	Block
<b>Soil Type:</b>	Lean CLAY (CL)
<b>Natural Moisture, %:</b>	25
<b>Dry Density, pcf:</b>	100
<b>Liquid Limit:</b>	-
<b>Plasticity Index:</b>	-
<b>Water Added at:</b>	1 ksf
<b>Percent Collapse:</b>	0.3

PROJECT NO.: 198052



FIGURE NO.: 20



## 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 #: 19A1247  
 PO# / Project Name: 198052  
 Receipt: 1/29/19 13:49  
 Batch Temp °C: 18.4  
 Date Reported: 2/6/2019

Sample Name: TP-3 @ 2 198052

Collected: 1/28/19 15:00

Matrix: Solid

Collected By: Caleb Allred

Parameter	Lab ID #	Method	Analysis		Units	MRL	Flags
			Date / Time	Result			
Sulfate, Soluble (IC)	19A1247-01	EPA 300.0	2/4/19	67	mg/kg dry	12	
Total Solids	19A1247-01	SM 2540G	2/5/19	86.4	%	0.1	

Comment:

Reviewed by:

*Joyce Applegate*  
 \_\_\_\_\_  
 Joyce Applegate, Project Manager

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

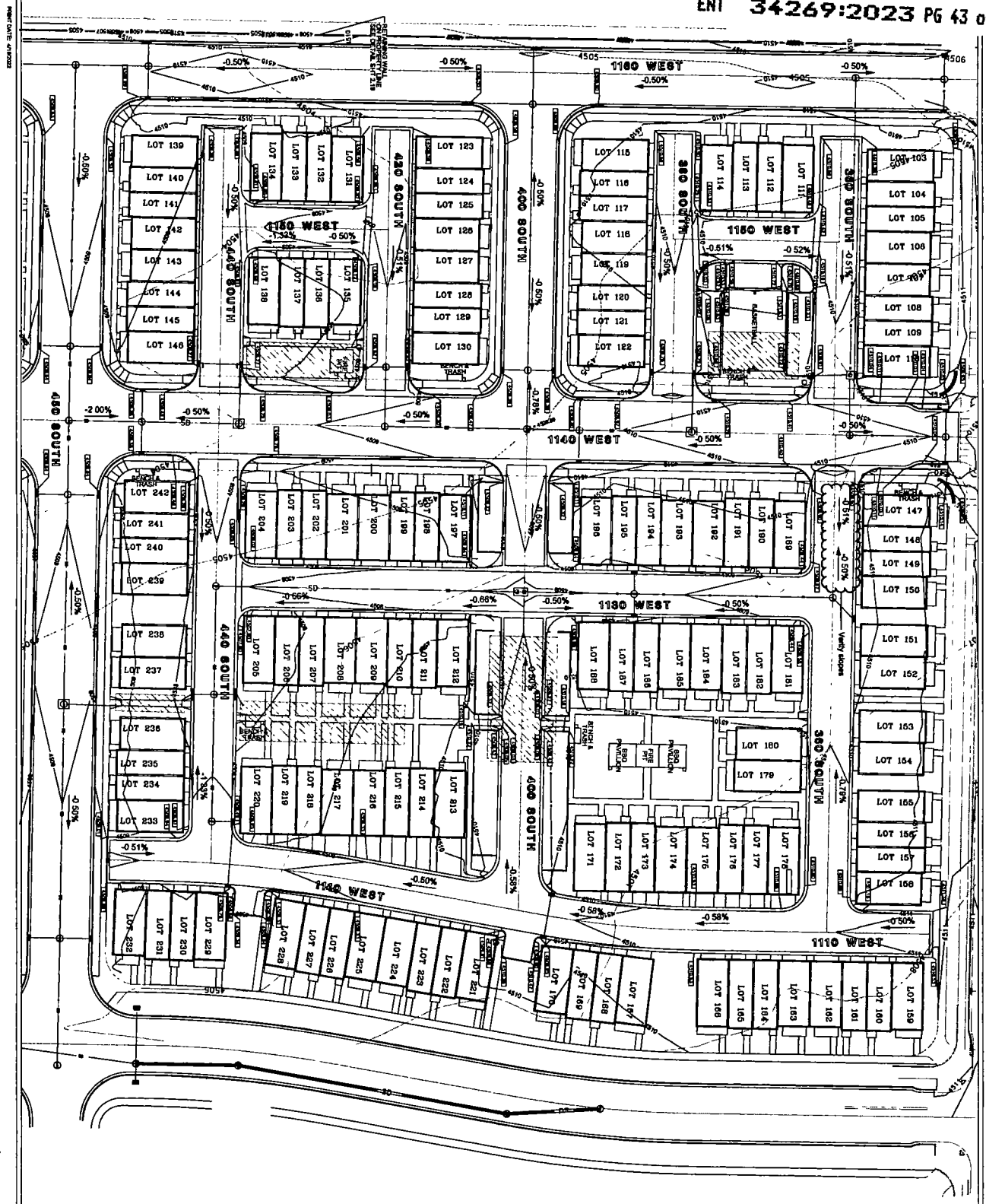


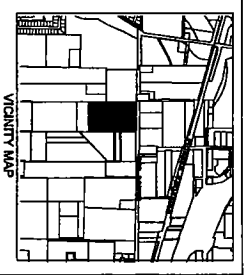
Exhibit C



Project: EDgewater TOWNHOMES PHASE 2  
 Location: AMERICAN FORK, UTAH  
 Drawing Name: GRADING PLAN  
 Revision No: 1.02

EDgewater TOWNHOMES PHASE 2  
 AMERICAN FORK, UTAH  
 GRADING PLAN

No.	Date	By	Revisions



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