July 6, 2022

IMPORTANT NOTICE

REFERENCE: Addendum No. 2 – North Village Special Service District – Coyote Lane Sewer Lift Station

TO: All Plan Holders

Transmitted herewith is Addendum No. 2 to the Plans, Bidding and Contract Documents, and Technical Specifications for the above-referenced project.

Your attention is called to the Contract Documents for the project, which requires that bidders shall signify receipt of all addenda.

ADDENDUM NO. 2

PLANS, BIDDING AND CONTRACT DOCUMENTS, AND TECHNICAL SPECIFICATIONS FOR NORTH VILLAGE SPECIAL SERVICE DISTRICT – COYOTE LANE SEWER LIFT STATION

BID OPENING DATE: JULY 11, 2022, 1:00 PM

July 6, 2022

TO: ALL PLAN HOLDERS

The following clarifications, changes, additions, and/or deletions are hereby made a part of the above-listed project as fully and completely as if the same were set forth therein:

A2.1 PRE-BID ATTENDEE LIST

A list of attendees at the pre-bid meeting on July 6 is included with this Addendum #2.

A2.2 GEOTECHNICAL REPORT

The geotechnical report mentioned in the bidding documents is included for download on the NVSSD website and is also attached to this Addendum #2.

A2.3 XYPEX CONCRETE ADMIXTURE

Xypex admixture per Section 03 10 05 is now required in all concrete located below the finished grade. Previously Sheets S-3 and S-4 only required it in the concrete for the wet well.

A2.4 OWNER-SUPPLIED ELECTRICAL EQUIPMENT

The Owner will provide the following electrical equipment, which is to be installed by the Contractor:

- Natural gas generator and automatic transfer switch
- Utility transformer from Heber Power and Light
- Service Entrance Section (SES)
- PLC Panel
- Both VFD panels (VFD 1 and VFD 2) for the pumps

A2.5 MILESTONE #4 COMPLETION DATE

The starred footnotes shown at the bottom of the Bid Schedules in Addendum #1 incorrectly list June 16, 2030 as the substantial completion date for Milestone #4. The correct date should be June 16, 2023.

A2.6 GENERATOR CONCRETE PAD

The natural gas generator, which will be supplied by Owner, has a footprint dimension of 93" x 40". The Contractor is responsible for installation of the natural gas generator, which includes the concrete pad.

A2.7 UTILITY TRANSFORMER CONCRETE PAD

For the Utility Transformer which is to be provided by Owner, assume a concrete pad dimension of 6' x 6' which will be required to be installed by Contractor.

NVSSD COYOTE LANE SEWER LIFT STATION
PREBID MTG 7/6/22

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GEOTECHNICAL INVESTIGATION
Hutchinson Heber Property – 44 Acres
Highway 40 and Coyote Lane
Heber City, Utah

IGES Project No. 02058-046

May 31, 2018

Prepared for:

Ivory Development

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GEOTECHNICAL INVESTIGATION
HUTCHINSON HEBER PROPERTY – 44 ACRES
HIGHWAY 40 AND COYOTE LANE
HEBER CITY, UTAH

IGES Project No. 02058-046

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May 31, 2018

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APPENDIX

1.0 EXECUTIVE SUMMARY

This report presents the results of a geotechnical investigation conducted for the proposed Hutchinson Heber Property to be located at approximately Highway 40 and Coyote Lane in Heber City, Utah. Based on the subsurface conditions encountered, the subject site is suitable for the proposed construction provided that the recommendations presented in this report are complied with. A brief summary of the critical recommendations is included below:

- Based on our observations the site is overlain by 12 to 30 inches of topsoil comprised of Lean CLAY (CL) and Clayey SAND (SC). The topsoil was underlain by Lean CLAY (CL), Clayey SAND (SC), Poorly Graded SAND (SP-SC) with clay, Poorly Graded GRAVEL (GP-GC) with clay, and Poorly Graded GRAVEL (GP).
- Soils with a pinhole structure (potentially collapsible) were observed in the upper 5 to 6 feet in the Lean CLAY (CL) and Clayey SAND (SC). Test results indicate the soils are moderately collapsible (3.2% to 7%). The collapse potential was not confined to a particular area on the site.
- Groundwater was not encountered in any of the test pits completed for our investigation.
- Shallow spread or continuous wall footings should be established *entirely* on undisturbed native non-collapsible soils (no pinholes) or on a minimum of 24 inches of structural fill if collapsible soils are encountered. The structural fill should have a minimum of 25% fines (such as the native soil) to provide a low permeability barrier against moisture infiltration. Furthermore, the client should closely follow the moisture protection and surface drainage recommendations contained in Section 6.7 of this report to minimize the potential for water to infiltrate into the underlying potentially collapsible soils.
- Concrete slabs-on-grade should be constructed over a minimum of 4 inches of compacted gravel overlying undisturbed suitable native subgrade soils. The slab may be designed with a Modulus of Subgrade Reaction of **150 psi/inch**.
- Flexible pavement section of 3/10 (inches of asphalt/road base) constructed on undisturbed, proof-rolled native soils is recommended for the residential roadways.
- A rigid pavement section of 5/6 (inches of concrete/road base respectively) is recommended for the heavier traffic areas including delivery or dumpster areas.

Recommendations for general site grading, design of foundations, slabs-on-grade, moisture protection and soil corrosivity as well as other aspects of construction are included in this report.

NOTE: The scope of services provided within this report is limited to the assessment of the subsurface conditions at the subject site. The executive summary is provided solely for purposes of overview and is not intended to replace the report of which it is part and should not be used separately from the report.

2.0 INTRODUCTION

2.1 PURPOSE AND SCOPE OF WORK

This report presents the results of a geotechnical investigation conducted for the proposed Hutchinson Heber Property to be located at Highway 40 and Coyote Lane in Heber City, Utah. The purposes of this investigation were to assess the nature and engineering properties of the subsurface soils, and to provide recommendations for general site grading and design and construction of foundations, slabs-on-grade and pavement.

The scope of work completed for this study included a site reconnaissance, subsurface exploration, soil sampling, laboratory testing, engineering analyses, and preparation of this report. Our services were performed in accordance with our proposal and signed authorization.

The recommendations presented in this report are subject to the limitations presented in the **Limitations** section of this report (Section 7.1).

2.2 PROJECT DESCRIPTION

The subject property is located Highway 40 and Coyote Lane in Heber City, Utah (see Figure A-1, *Site Vicinity Map*). Our understanding of the project is based on information provided by the Client. The property has a total area of approximately 44 acres. It is our understanding that the proposed development will consist of a residential development comprised of single-family homes. The construction plans were not available for our review at the time this report was prepared; however, we assume that the new structures will be multi-story wood-framed residences with basements, founded on conventional strip and spread footings.

3.0 METHODS OF STUDY

3.1 FIELD INVESTIGATION

As a part of this investigation, subsurface soil conditions were explored by completing 15 exploratory test pits 9 to 12.5 feet below the existing site grade. The approximate locations of the explorations are shown on Figure A-2 (*Geotechnical Map*) in Appendix A. Exploration points were placed to provide optimum coverage of the site. Logs of the subsurface conditions as encountered in the explorations were recorded at the time of excavation by a member of our technical staff and are presented as Figures A-3 through A-17 in Appendix A. A *Key to Soil Symbols and Terminology* used on the boring and test pit logs is included as Figure A-18.

The test pits were completed using a JCB-4CX rubber-tired backhoe. Soil sampling was completed to collect representative samples of the various layers observed at the site. Disturbed samples were placed in plastic baggies and relatively undisturbed soil samples were collected with the use of a 6-inch long brass tube attached to a hand sampler driven with a 2-lb sledge hammer. All samples were transported to our laboratory to evaluate the engineering properties of the various earth materials observed. The soils were classified in accordance with the *Unified Soil Classification System* (USCS) by our field personnel. Classifications for the individual soil units are shown on the attached boring and test pit logs (Figures A-3 through A-17)

3.2 LABORATORY INVESTIGATION

Geotechnical laboratory tests were conducted on selected relatively undisturbed and bulk soil samples obtained during our field investigation. The laboratory testing program was designed to evaluate the engineering characteristics of onsite earth materials. Laboratory tests conducted during this investigation include:

- Water Content (ASTM D7263)
- Unit Weight (ASTM D2216)
- Atterberg Limits (ASTM D4318)
- No. 200 Sieve Wash (ASTM D1140)
- Maximum dry density and optimum moisture content (ASTM D1557)
- California Bearing Ratio (CBR) (ASTM D1883)
- Collapse/Swell Potential of Soils (ASTM D4546 Method B)
- Direct Shear Test (ASTM D3080)
- Corrosion Testing-sulfate and chloride concentrations, pH and resistivity (ASTM D4972, D4327, D4327, C1580 and EPA 300.0)

The results of the laboratory tests are presented on the boring and test pit logs in Appendix A (Figures A-3 through A-17) and the laboratory test results presented in Appendix B.

3.3 ENGINEERING ANALYSIS

Engineering analyses were performed using soil data obtained from the laboratory test results and empirical correlations from material density, depositional characteristics and classifications. Analyses were performed using formulas, calculations and software that represent methods currently accepted by the geotechnical industry. These methods include settlement, bearing capacity, lateral earth pressures, trench stability and pavement design. Appropriate factors of safety were applied to the results consistent with industry standards and the accepted standard of care.

4.0 GENERALIZED SITE CONDITIONS

4.1 SURFACE CONDITIONS

The subject site is located at an elevation ranging from approximately 5,620 to 5,710 feet above mean sea level. At the time of our subsurface investigation the site existed as open land. The ground surface is covered with grass, weeds, and native soils. The site slopes to the west, having a maximum topographic relief of approximately 90 feet vertical over approximately 2,000 feet horizontally.

4.2 SUBSURFACE CONDITIONS

4.2.1 Earth Materials

Based on our observations the site is overlain by 12 to 30 inches of topsoil comprised of Lean CLAY (CL) and Clayey SAND (SC). The topsoil was underlain by Lean CLAY (CL), Clayey SAND (SC), Poorly Graded SAND (SP-SC) with clay, Poorly Graded GRAVEL (GP-GC) with clay, and Poorly Graded GRAVEL (GP). The sand and gravel were generally dense and dry to moist. The clay was generally stiff and dry to moist that contained fine pinholes.

The stratification lines shown on the enclosed exploratory logs represent the approximate boundary between soil types (Figures A-3 to A-17). The actual in-situ transition may be gradual. Due to the nature and depositional characteristics of the native soils, care should be taken in interpolating subsurface conditions between and beyond the exploration locations. Additional descriptions of these soil units are presented on the exploratory logs (Figures A-3 through A-17 in Appendix A).

4.2.2 Groundwater

Groundwater was not encountered in any of the test pits completed for our investigation. Seasonal fluctuations in precipitation, surface runoff from adjacent properties, or other on or offsite sources may increase moisture conditions. Groundwater conditions can be expected to rise or fall several feet seasonally depending on the time of year. However, based on our field investigation, we anticipate that groundwater will not impact the proposed construction.

4.2.3 Collapsible Soils

Collapse is a phenomenon where undisturbed native soils under increased loading can exhibit volumetric strain and consolidation upon wetting. Collapsible soils can cause differential settling of structures and roadways. Collapsible soils do not necessarily preclude development and can be mitigated by over-excavating porous, potentially collapsible soils and replacing with engineered fill and by controlling surface drainage and runoff. Collapsible soils are typically characterized by a pinhole structure and relatively light in-situ density. Pinholes were observed in the native soil mainly in the upper 5 to 6 feet in the clay and sand soil.

Collapse/swell tests (ASTM D4546 & D5333) were performed on four relatively undisturbed samples of native fine-grained soil during this investigation; the results are summarized in the following table:

Table 4.2.3.1
Summary of Collapse Test Results

Test Specimen	Load at Inundation (psf)	Collapse (%)	Dry Unit Weight (pcf)
TP-2 @ 3 feet	1,600	7	96.4
TP-15 @ 3.5 feet		3.2	84.3

The results of the tests suggest that most of the native soils will, in general, experience moderate volumetric strain under increased moisture conditions. More detailed results of the collapse testing are provided in Appendix B.

5.0 GEOLOGIC CONDITIONS

5.1 GEOLOGIC SETTING

The subject site is located at an elevation of approximately 5,620 to 5,710 feet in the Heber Valley. The Heber Valley is a sediment-filled, erosional valley located on the eastern side of the Wasatch Mountains, in the central portion of Utah (Hintze, 1980; Bryant, 1992; Bryant, 1990). Water from the Uinta Mountains is carried west across the Heber Valley and through the Wasatch Mountains by the Provo River. The elevation of the Wasatch Mountains relative to the elevation of the Heber Valley has caused the impedance of the flow of the Provo River, resulting in a low stream gradient and causing the river to meander (Baker, 1976). Lateral planation of the valley by the meandering river eroded softer Mesozoic rocks and Tertiary volcanic rocks, resulting in the widening evolution of the Heber Valley. The impedance of the flow of the Provo River has also led to the deposition of large quantities of Quaternary fluvial sediments that now fill much of the Heber Valley.

Sediments at the site are mapped as Holocene *Stream gravel and valley fill* (Qal) deposits (alluvium) (Bromfield et al., 1970; Bryant, 1990). They are described as boulder to pebble gravel, sand, silt, and clay deposited in channels and flood plains of streams (Bryant, 1990).

5.2 SEISMICITY AND FAULTING

There are no known active faults that pass under or immediately adjacent to the site (Hecker, 1993; Black et al, 2003). An active fault is defined as a fault displaying evidence of movement during Holocene time (eleven thousand years ago to the present). The site is mapped approximately 6.5 miles north by northeast of the Round Valley Faults, a northwest to southeast trending series of faults that are mapped around Wallsburg. The site is located approximately 18 miles east by northeast of the Provo section of the Wasatch fault zone, which is mapped along the western flank of the Wasatch Mountains. The Provo segment is one of the longest sections of the Wasatch Fault Zone (Hecker, 1993) and is estimated to be approximately 43 miles long with a reported rupture length of 37 miles and a maximum potential to produce earthquakes up to magnitude (Ms) 7.5 to 7.7 (Black et al., 2003). Analyses of ground shaking hazard along the Wasatch Front suggests that the Wasatch fault zone is the single greatest contributor to the seismic hazard in the region.

Following the criteria outlined in the 2015 International Building Code (IBC, 2015), spectral response at the site was evaluated for the *Maximum Considered Earthquake* (MCE) which equates to a probabilistic seismic event having a two percent probability of exceedance in 50 years (2PE50). Spectral accelerations were determined based on the location of the site using the

U.S. Seismic "DesignMaps" Web Application (USGS, 2015); this software incorporates seismic hazard maps depicting probabilistic ground motions and spectral response data developed for the United States by the U. S. Geological Survey as part of NEHRP/NSHMP (Frankel et al., 1996). These maps have been incorporated into both *NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures* (FEMA, 1997) and the *International Building Code* (IBC) (International Code Council, 2015).

Table 5.2
Short- and Long-Period Spectral Accelerations for MCE

Parameter	**Short Period (0.2 sec)**	**Long Period (1.0 sec)**
MCE Spectral Response Acceleration (g)	$S_S = 0.604$	$S_1 = 0.200$
MCE Spectral Response Acceleration Site Class D (g)	$S_{MS} = S_sF_a = 0.795$	$S_{M1} = S_1F_v = 0.400$
Design Spectral Response Acceleration (g)	$S_{DS} = S_{MS}{*}^2/_3 = 0.530$	$S_{D1} = S_{M1}{*}^2/_3 = 0.267$

To account for site effects, site coefficients that vary with the magnitude of spectral acceleration and *Site Class* are used. Site Class is a parameter that accounts for site amplification effects from soils and is based on the average shear wave velocity of the upper 100 feet; based on our field exploration and our understanding of the geology in this area, the subject site is appropriately classified as Site Class D (stiff soil). Based on IBC criteria, the short-period site coefficient (F_a) is 1.317 and long-period site coefficient (F_v) is 2.001. Based on the design spectral response accelerations for a *Building Risk Category* of I, II, III, or IV, the site's *Seismic Design Category* is D. The short- and long-period *Design Spectral Response Accelerations* are presented in Table 5.2; a summary of the *Design Maps* analysis is presented in Appendix C. The *peak ground acceleration* (PGA) may be taken as $0.4{*}S_{MS}$.

5.3 OTHER GEOLOGIC HAZARDS

Geologic hazards and conditions can be defined as naturally occurring geologic conditions or processes that could present a danger to human life and property or result in impacts to conventional construction procedures. These hazards and conditions must be considered before development of the site. There are several hazards and conditions in addition to seismicity and faulting that if present at a site, should be considered in the design of critical and essential facilities. The hazard considered for this site includes liquefaction.

5.3.1 Liquefaction

Certain areas within the Intermountain region possess a potential for liquefaction during seismic events. Liquefaction is a phenomenon whereby loose, saturated, granular soil deposits lose a significant portion of their shear strength due to excess pore water pressure buildup resulting from dynamic loading, such as that caused by an earthquake. Among other effects, liquefaction can result in densification of such deposits causing settlement of overlying layers after an earthquake as excess pore water pressures are dissipated. The primary factors affecting liquefaction potential of a soil deposit are: (1) level and duration of seismic ground motions; (2) soil type and consistency; and (3) depth to groundwater.

Referring to the *Liquefaction-Potential Map for Central Utah* (Anderson et al., 1994) published by the Utah Geological Survey, the site is located within an area currently designated as "very low" for liquefaction potential. The upper 12.5 feet are not considered liquefiable based on our field observations and laboratory testing. Deeper deposits may be more susceptible, but a full liquefaction study is not part of the scope of work and beyond the standard of care for single family residential housing.

6.0 ENGINEERING CONCLUSIONS AND RECOMMENDATIONS

6.1 GENERAL CONCLUSIONS

Based on the subsurface conditions encountered at the site, the subject site is suitable for the proposed development provided that the recommendations presented in this report are incorporated into the design and construction of the project. We recommend that as part of the site grading process any undocumented fill or otherwise unsuitable soils currently present at the site be removed from beneath proposed footings, or footings be deepened to extend below the unsuitable soils. We also recommend that IGES be on site at key points during construction to see that the recommendations in this report are implemented. Shallow spread or continuous wall footings should be established *entirely* on undisturbed native non-collapsible soils (no pinholes) or on a minimum of 24 inches of structural fill if collapsible soils are encountered. The structural fill should have a minimum of 25% fines (such as the native soil) to provide a low permeability barrier against moisture infiltration. Furthermore, the client should closely follow the moisture protection and surface drainage recommendations contained in Section 6.7 of this report to minimize the potential for water to infiltrate underlying potentially collapsible soils.

The following sub-sections present our recommendations for general site grading, pavement design, design of foundations, slabs-on-grade, lateral earth pressures, moisture protection and preliminary soil corrosion.

6.2 EARTHWORK

Prior to the placement of foundations, general site grading is recommended to provide proper support for foundations, exterior concrete flatwork, and concrete slabs-on-grade. Site grading is also recommended to provide proper drainage and moisture control on the subject property.

6.2.1 General Site Preparation

Within the areas to be graded (below proposed structures, fill sections, concrete flatwork, or pavement sections), any existing surface vegetation, debris, asphalt, undocumented fill (if any) should be removed and the upper 8 to 12 inches should be grubbed to remove the majority of the roots and organic matter. Any existing utilities should be re-routed or protected in-place. If tree roots are exposed, they should be grubbed-out and replaced with engineered fill. The exposed native soils should then be proof-rolled with heavy rubber-tired equipment such as a loader. Any soft/loose areas identified during proof-rolling should be removed and replaced with structural fill. An IGES representative should observe the site preparation and grading operations to assess whether the recommendations presented in this report have been complied with.

6.2.2 Excavations

Soft, collapsible, porous, or otherwise unsuitable soils beneath foundations or concrete flatwork may need to be over-excavated and replaced with structural fill. The excavations should extend a minimum of 1-foot laterally for every foot of depth of over-excavation. Excavations should extend laterally at least two feet beyond slabs-on-grade. Structural fill should consist of granular materials and should be placed and compacted in accordance with the recommendations presented in this report.

6.2.3 Excavation Stability

The contractor is responsible for site safety, including all temporary slopes and trenches excavated at the site and design of any required temporary shoring. The contractor is responsible for providing the "competent person" required by OSHA standards to evaluate soil conditions. Soil types are expected to consist of *Type A* soils (cohesive soils with unconfined compressive strength greater than 1.5 tsf) and *Type C* soils (granular soils). Close coordination between the competent person and IGES should be maintained to facilitate construction while providing safe excavations.

Based on Occupational Safety and Health (OSHA) guidelines for excavation safety, trenches with vertical walls up to 5 feet in depth may be occupied. Where very moist soil conditions or groundwater is encountered, or when the trench is deeper than 5 feet, we recommend a trench-shield or shoring be used as a protective system to workers in the trench. Sloping of the sides at 3/4H:1V (53 degrees) in *Type A* soils, and at 1.5H:1V (34 degrees) in *Type C* soils may be used as an alternative to shoring or shielding.

6.2.4 Structural Fill and Compaction

All fill placed for the support of structures, flatwork or pavements, should consist of structural fill. Structural fill may consist of the on-site native soils or an approved imported material. Structural fill should be free of vegetation and debris and contain no rocks larger than 4 inches in nominal size (6 inches in greatest dimension). Topsoil may not be used as structural fill; this material must be kept segregated from other soils intended to be used as structural fill.

All structural fill should be placed in maximum 6-inch loose lifts if compacted by small hand-operated compaction equipment, maximum 8-inch loose lifts if compacted by light-duty rollers, and maximum 12-inch loose lifts if compacted by heavy duty compaction equipment that is capable of efficiently compacting the entire thickness of the lift. These values are *maximums*; the Contractor should be aware that thinner lifts may be necessary to achieve the required compaction criteria. We recommend that all structural fill be compacted on a horizontal plane, unless otherwise approved by IGES. Structural fill placed beneath footings and pavements should be compacted to at least 95 percent of the maximum dry density (MDD) as determined by ASTM D-1557. The moisture content should be at or slightly above the optimum moisture content (OMC) for all structural fill – compacting dry of optimum is discouraged. Any imported fill materials should be approved by IGES prior to importing. Also, prior to placing any fill, the excavations should be observed by IGES to confirm that unsuitable materials have been removed. In addition, proper grading should precede placement of fill, as described in the General Site Preparation and Grading subsection of this report.

All utility trenches backfilled below pavement sections, curb and gutter and concrete flatwork, should be backfilled with structural fill compacted to at least 95 percent of the MDD as determined by ASTM D-1557. All other trenches, including landscape areas, should be backfilled and compacted to a minimum of 90 percent of the MDD (ASTM D-1557).

Backfill around foundation walls should be placed in 10-inch loose lifts or thinner and compacted to 90 percent of the MDD at or slightly above the OMC as determined by ASTM D1557. Failure to properly moisture-condition and compact foundation wall backfill may result in settlements of up to several inches. Only small compaction equipment should be used near basement walls such as jumping jacks and walk-behind/remote controlled compactors. If possible, backfill placement against foundation walls should not be completed until floor joists are in place or the basement walls are braced.

Specifications from governing authorities having their own precedence for backfill and compaction should be followed where applicable.

6.2.5 Soft Soil Stabilization

Due to the presence of shallow fine-grained native soils, soft and/or pumping soils may be encountered locally. If the excavation subgrade soils become problematic, stabilization of soft or pumping subgrade should be accomplished by using a clean, coarse angular material worked into the soft subgrade. We recommend the material be greater than 3 inches in nominal diameter, but less than 6 inches. Alternately, a locally available pit-run gravel may be suitable but should contain a high percentage of particles larger than 3 inches in diameter and have less than 5 percent fines (material passing the No. 200 Sieve). A pit-run gravel may not be as effective as a coarse, angular material in stabilizing the soft soils and will likely require more material be placed. The stabilization material should be worked (pushed) into the soft subgrade soils until a relatively firm and unyielding surface is established. Once a relatively firm and unyielding surface is achieved, the area may be brought to final design grade using structural fill. Other earth materials not meeting aforementioned criteria may also be suitable; however, such material should be evaluated on a case-by-case basis and should be approved by IGES prior to use.

The placement of a woven geotextile and compacted structural fill may be used as an alternative or in conjunction to the procedures previously described to stabilize soft soils. The woven geotextile should consist of Mirafi HP370 or approved equivalent. The geotextile should be placed to cover the entire excavation bottom where structural fill will be placed. The geotextile should be installed in accordance with the manufacturer's recommendations; seams should be overlapped a minimum of 12 inches. Following placement of the geotextile, compacted structural fill may be placed to the required grade.

6.3 FOUNDATIONS

Shallow spread or continuous wall footings should be established *entirely* on undisturbed native non-collapsible soils (no pinholes), such as the native gravel soils and bedrock material, or on a minimum of 24 inches of structural fill if collapsible soils are encountered. The structural fill should have a minimum of 25% fines (such as the native soil) to provide a low permeability barrier against moisture infiltration. Furthermore, the client should closely follow the moisture protection and surface drainage recommendations contained in Section 6.7 of this report to minimize the potential for water to infiltrate into the underlying potentially collapsible soils. All footing excavations should be observed by IGES or other qualified geotechnical engineer prior to constructing footings.

Shallow spread or continuous wall footings constructed as described above may be proportioned utilizing a maximum net allowable bearing pressure of **2,500 pounds per square foot (psf)** for dead load plus live load conditions. A one-third increase may be used for transient wind and seismic loads. If required, all fill beneath the foundations should consist of structural fill/reworked native soils and should be placed and compacted in accordance with our recommendations presented in Section 6.2.3 of this report.

All foundations exposed to the full effects of frost should be established at a minimum depth of 30 inches below the lowest adjacent final grade. Interior footings, not subjected to the full effects of frost (i.e., a continuously heated structure), may be established at higher elevations, however, a minimum depth of embedment of 12 inches is recommended for confinement purposes. The minimum recommended footing width is 20 inches for continuous wall footings and 30 inches for isolated spread footings.

6.4 SETTLEMENT

Static settlement of properly designed and constructed conventional foundations, founded as described above, are anticipated to be on the order of 1 inch or less. Differential settlement is expected to be half of total settlement over a distance of 30 feet.

6.5 EARTH PRESSURES AND LATERAL RESISTANCE

Lateral forces imposed upon conventional foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and friction between the base of the footing and the supporting soils. In determining the frictional resistance against concrete, a coefficient of friction of 0.35 for *native fine-grained soils* should be used, and 0.45 for *native granular soils* should be used.

Ultimate lateral earth pressures from *granular structural fill* backfill acting against retaining walls and buried structures may be computed from the lateral pressure coefficients or equivalent fluid densities presented in Table 6.5. The coefficients and densities presented in Table 6.5 assume no buildup of hydrostatic pressures. The force of the water should be added to the presented values if hydrostatic pressures are anticipated.

Table 6.5 - Recommended Lateral Earth Pressure Coefficients

Condition	Level Backfill	
	Lateral Pressure Coefficient	Equivalent Fluid Density (pcf)
Active (Ka)	0.33	42
At-rest (Ko)	0.50	63
Passive (Kp)	3.0	375

Clayey soils drain poorly and may swell upon wetting, thereby greatly increasing lateral pressures acting on earth retaining structures; therefore, clayey soils should not be used as retaining wall backfill. Backfill should consist of either native granular soil or sandy imported material with an Expansion Index (EI) less than 20.

Walls and structures allowed to rotate slightly should use the active condition. If the element is constrained against rotation, the at-rest condition should be used. These values should be used with an appropriate factor of safety against overturning and sliding. A value of 1.5 is typically used. Additionally, if passive resistance is calculated in conjunction with frictional resistance, the passive resistance should be reduced by ½.

6.6 CONCRETE SLAB-ON-GRADE CONSTRUCTION

To minimize settlement and cracking of slabs, and to aid in drainage beneath the concrete floor slabs, all concrete slabs should be founded on a minimum 4-inch layer of compacted gravel overlying undisturbed suitable native subgrade soils. The gravel should consist of free draining gravel with a 3/4-inch maximum particle size and no more than 5 percent passing the No. 200 mesh sieve. The slab may be designed with a Modulus of Subgrade Reaction of **150 psi/inch**.

All concrete slabs should be designed to minimize cracking as a result of shrinkage. Consideration should be given to reinforcing the slab with a welded wire fabric, re-bar, or fibermesh. Slab reinforcement should be designed by the structural engineer. We recommend that concrete be tested to assess that the slump and/or air content is in compliance with the plans and specifications. If slump and/or air content are measured above the recommendations contained in the plans and specifications, the concrete may not perform as desired. We recommend that concrete be placed in general accordance with the requirements of the American Concrete Institute (ACI).

Our experience indicates that use of reinforcement in slabs and foundations can generally reduce the potential for drying and shrinkage cracking. However, some cracking can be expected as the concrete cures. Minor cracking is considered normal; however, it is often aggravated by a high water/cement ratio, high concrete temperature at the time of placement, small nominal aggregate size, and rapid moisture loss due to hot, dry, and/or windy weather conditions during placement and curing. Cracking due to temperature and moisture fluctuations can also be expected. The use of low slump concrete can reduce the potential for shrinkage cracking; saw cuts in the concrete at strategic locations can help to control and reduce undesirable shrinkage cracks.

6.7 MOISTURE PROTECTION AND SURFACE DRAINAGE

Due to the presence of collapsible soils at the site and as part of good construction practices, moisture should not be allowed to infiltrate into the soils in the vicinity of the foundations. As such, design strategies to minimize ponding and infiltration near the structure should be implemented as follows:

- Hand watering, desert or Xeriscape landscaping should be used within 5 feet of the foundations.
- Rain gutters should be installed around the entire perimeter of the homes and discharge a minimum of 10 feet away from the structure.
- Irrigation valves should be placed a minimum of 5 feet from foundations and must be placed beyond the limits of foundation backfill.
- The ground surface within 10 feet of the structure should be constructed so as to slope a minimum of five percent away.
- Pavement sections should be constructed to divert surface water away from the pavement into storm drains.

6.8 ASPHALT CONCRETE PAVEMENT DESIGN

A laboratory-determined CBR value of 6.0 was obtained from a representative sample of the near-surface soils during our investigation. This value indicates that the subsurface soils will provide relatively good pavement support. No traffic information was available at the time this report was prepared, therefore, we have assumed an equivalent single axle load (ESAL) value of approximately 200,000 for a 30-year design life assuming an annual growth rate of 0%.

Prior to placing the road base, if fine-grained soils are encountered, a minimum of 18 inches of native soils should be reworked to a minimum of 95 percent of the maximum dry density (ASTM D1557). If granular soils are encountered the exposed soils should be moisture conditioned and compacted. After reworking or compacting of the native soils has taken place as recommended, placement and compaction of the road base can then be completed.

Table 6.8.1

Pavement Recommendations

Asphalt (in.)	Roadbase (in.)	Reworked Native Soils – for fine grained subgrade only (in.)
3	10	18

Asphalt has been assumed to be a high stability plant mix and the untreated road base material should be composed of crushed stone with a minimum CBR of 70. The asphalt should be compacted to a minimum density of 96% of the Marshall value and the base course should be compacted to at least 95% of the MDD of the modified proctor at or slightly above the OMC as determined by ASTM D1557.

Pavement in areas where trucks frequently turn around, backup, or load and unload, including service areas, dumpster areas, and entrances/exits to the site, often experience more distress. If the owner wishes to prolong the life of the pavement in these areas, consideration should be given to using a Portland cement concrete (rigid) pavement. For these conditions, the following rigid pavement section is recommended:

Table 6.8.3 - Rigid Pavement Section

Concrete (in.)	Base Course (in.)	Reworked Native Soils – for fine grained subgrade only (in.)
5	6	18

Concrete should consist of a low slump, low water cement ratio mix with a minimum 28-day compressive strength of 4,000 psi. Base course and pit-run should be compacted to at least 95% of the MDD and at or above the OMC as determined by ASTM D-1557.

If traffic conditions vary significantly from our stated assumptions, IGES should be contacted so we can modify our pavement design parameters accordingly. Specifically, if the traffic counts are significantly higher or lower, we should be contacted to revise the pavement section design as necessary. The pavement section thicknesses above assumes that the majority of construction traffic including cement trucks, cranes, loaded haulers, etc. has ceased. If a significant volume of construction traffic occurs after the pavement section has been constructed, the owner should anticipate maintenance or a decrease in the design life of the pavement area.

The pavement section thicknesses above assume that there is no mixing over time between the road base and the clayey subgrade. In order to prevent mixing or fines migration, and thereby prolong the life of the pavement section, we recommend that the owner give consideration to placing a filter fabric between the native soils and the road base, such as Mirafi HP370 or an IGES-approved equivalent.

6.9 PRELIMINARY SOIL CORROSION POTENTIAL

To evaluate the corrosion potential of concrete in contact with onsite native soil, a representative soil sample was tested in our soils laboratory for soluble sulfate content. Laboratory test results indicate that the sample tested had a sulfate content of 58.8 ppm. Based on this result, the onsite native soils are expected to exhibit a *negligible* potential for sulfate attack on concrete. A conventional Type I/II cement should be used for all concrete in contact with site soils.

To evaluate the corrosion potential of ferrous metal in contact with onsite native soil, a representative soil sample was tested in our soils laboratory for soil resistivity (AASHTO T288), chloride content, and pH. The tests indicated that the onsite soil tested has minimum soil resistivity of 3562 OHM-cm, a chloride content of 5.65 ppm, and a pH value of 6.89. Based on these results, the onsite native soil is considered to be *corrosive* when in contact with ferrous metal. Consideration should be given to retaining the services of a qualified corrosion engineer to provide an assessment of any metal such as ancillary water lines, reinforcing steel, valves, and similar improvements in contact with native soils.

7.0 CLOSURE

7.1 LIMITATIONS

The concept of risk is a significant consideration of geotechnical analyses. The analytical means and methods used in performing geotechnical analyses and development of resulting recommendations do not constitute an exact science. Analytical tools used by geotechnical engineers are based on limited data, empirical correlations, engineering judgment and experience. As such the solutions and resulting recommendations presented in this report cannot be considered risk-free and constitute IGES's best professional opinions and recommendations based on the available data and other design information available at the time they were developed. IGES has developed the preceding analyses, recommendations and designs, at a minimum, in accordance with generally accepted professional geotechnical engineering practices and care being exercised in the project area at the time our services were performed. No warrantees, guarantees or other representations are made.

The information contained in this report is based on limited field testing and understanding of the project. The subsurface data used in the preparation of this report were obtained largely from the explorations made for this project. It is very likely that variations in the soil, rock, and groundwater conditions exist between and beyond the points explored. The nature and extent of the variations may not be evident until construction occurs and additional explorations are completed. If any conditions are encountered at this site that are different from those described in this report, IGES must be immediately notified so that we may make any necessary revisions to recommendations contained in this report. In addition, if the scope of the proposed construction or grading changes from those described in this report, our firm must also be notified.

This report was prepared for our client's exclusive use on the project identified in the foregoing. Use of the data, recommendations or design information contained herein for any other project or development of the site not as specifically described in this report is at the user's sole risk and without the approval of IGES, Inc. It is the client's responsibility to see that all parties to the project including the designer, contractor, subcontractors, etc. are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk.

We recommend that IGES be retained to review the final design plans, grading plans and specifications to determine if our engineering recommendations have been properly incorporated in the project development documents. We also recommend that IGES be retained to evaluate, construction performance and other geotechnical aspects of the projects as construction initiates and progresses through its completion.

8.0 REFERENCES CITED

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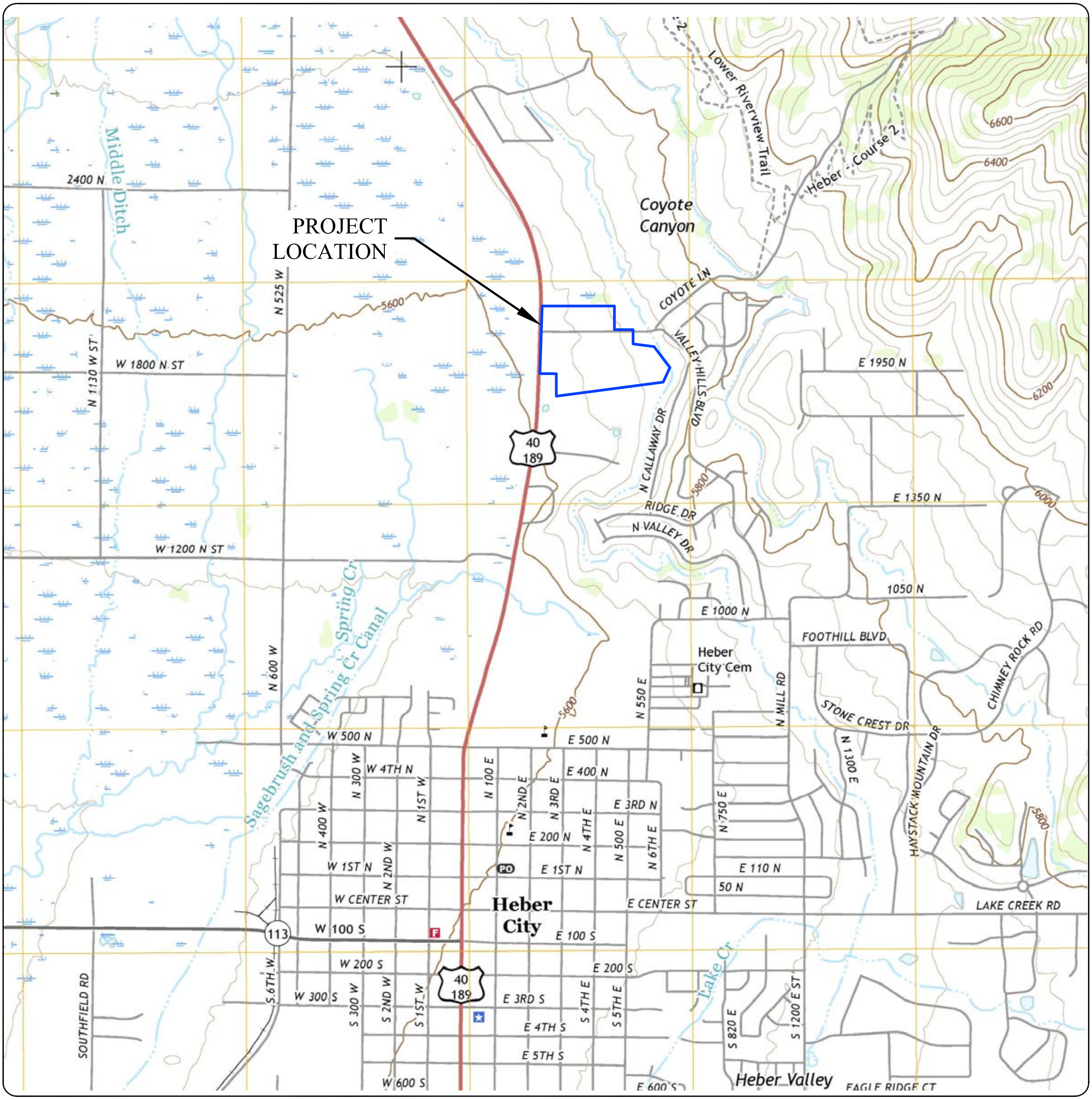
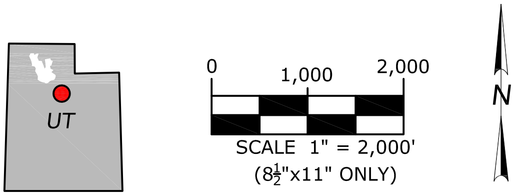
APPENDIX A



BASE MAPS:
USGS HEBER CITY, UTAH
7.5-MINUTE QUADRANGLE TOPOGRAPHIC MAP (2017)



IGES®

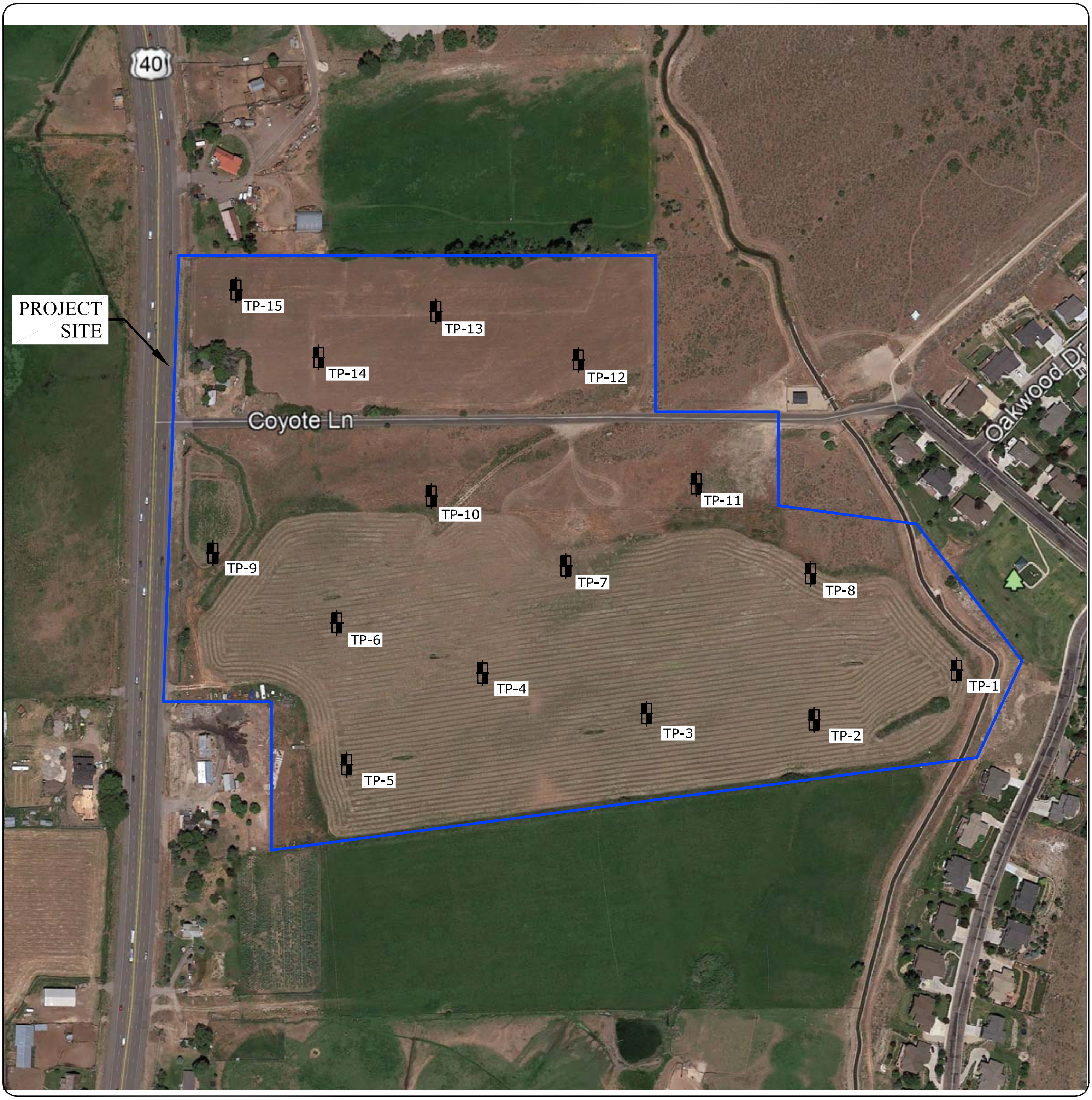
PROJECT NO: 02058-046

GEOTECHNICAL INVESTIGATION
HUTCHINSON HEBER PROPERTY - 44 ACRES
HIGHWAY 40 AND COYOTE LANE
HEBER CITY, UTAH

SITE VICINITY MAP

FIGURE

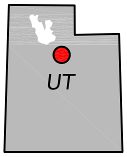
A-1

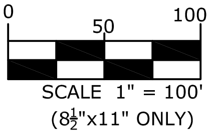


BASE MAP:
GOOGLE EARTH PRO IMAGE, DATED JUNE 22, 2017

LEGEND:

▬ APPROXIMATE TEST PIT LOCATION





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GEOTECHNICAL INVESTIGATION
HUTCHINSON HEBER PROPERTY - 44 ACRES
HIGHWAY 40 AND COYOTE LANE
HEBER CITY, UTAH

GEOTECHNICAL MAP

FIGURE

A-2

DATE	
STARTED:	4/30/18
COMPLETED:	4/30/18
BACKFILLED:	4/30/18

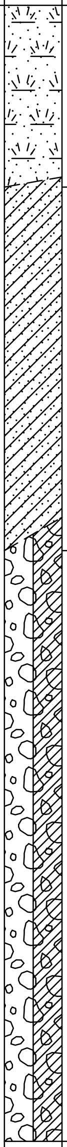
Geotechnical Investigation
Hutchinson Heber Property - 44 Acres
Highway 40 and Coyote Lane
Heber, Utah

Project Number 02058-046

IGES Rep: JGS
Rig Type: JCB-4CX

TEST PIT NO:
TP-01
Sheet 1 of 1

LOCATION
LATITUDE LONGITUDE ELEVATION



DEPTH FEET	SAMPLES	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0			Topsoil - Sandy Lean CLAY grading to Clayey SAND - stiff, moist, dark brown					
2		SC	Clayey SAND - dense, moist, brown with occasional gravel, pinholes present					
4	⧗			100.1	13.9			
6		GP-GC	Poorly Graded GRAVEL with clay and sand - dense, moist, brown with cobbles, no obvious pinholes					
7			- with occasional boulder					
8	▯					11.9		
12.5			No groundwater was encountered					

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content ● — Liquid Limit
10 20 30 40 50 60 70 80 90

SAMPLE TYPE
▯ - GRAB SAMPLE
⧗ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Figure

A-3

DATE	
STARTED:	4/30/18
COMPLETED:	4/30/18
BACKFILLED:	4/30/18

Geotechnical Investigation
Hutchinson Heber Property - 44 Acres
Highway 40 and Coyote Lane
Heber, Utah
Project Number 02058-046

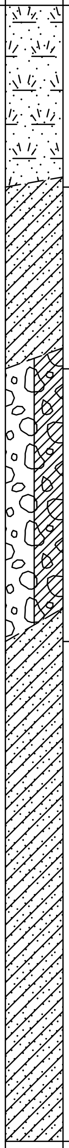
IGES Rep: JGS
Rig Type: JCB-4CX

TEST PIT NO:
TP-02
Sheet 1 of 1

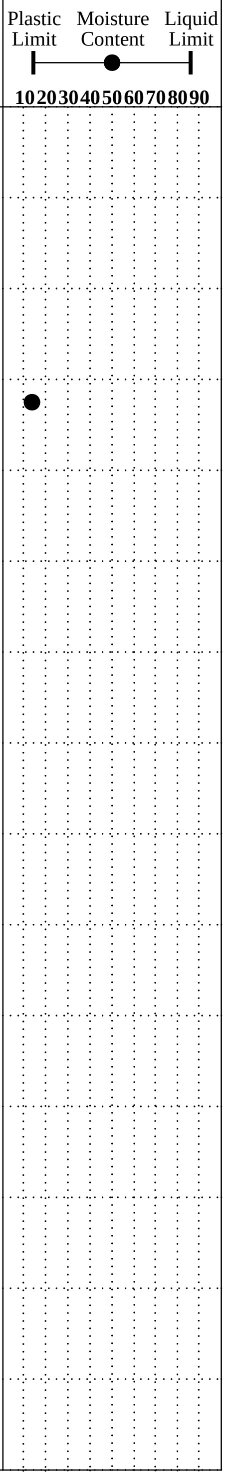
LOCATION
LATITUDE LONGITUDE ELEVATION

DEPTH (FEET)	SAMPLES	WATER LEVEL	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0				Topsoil - Sandy Lean CLAY grading to Clayey SAND - dense, moist, dark brown with cobbles and boulders					
2			SC	Clayey SAND with gravel - dense, moist, brown pinholes present					
3	⧗				96.4	13.3			
4			GP-GC	Poorly Graded GRAVEL with clay and sand - dense, moist, brown with cobbles and occasional boulder, no obvious pinholes					
7			SC	Clayey SAND with gravel - dense, moist, brown with cobbles and occasional boulder, occasional pinholes					
10	▯						29.1		
12.5				No groundwater was encountered					

GRAPHICAL LOG



Moisture Content and Atterberg Limits



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SAMPLE TYPE
▯ - GRAB SAMPLE
⧗ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Figure
A-4

DATE	
STARTED:	4/30/18
COMPLETED:	4/30/18
BACKFILLED:	4/30/18

Geotechnical Investigation
Hutchinson Heber Property - 44 Acres
Highway 40 and Coyote Lane
Heber, Utah

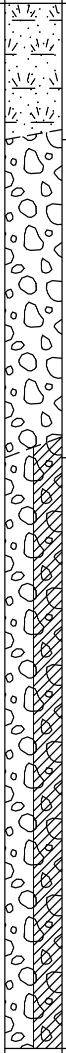
Project Number 02058-046

IGES Rep: JGS
Rig Type: JCB-4CX

TEST PIT NO:
TP-03
Sheet 1 of 1

LOCATION

LATITUDE
LONGITUDE
ELEVATION



DEPTH: FEET	SAMPLES	WATER LEVEL	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0				Topsoil - Clayey SAND with gravel - dense, moist, dark brown with cobbles and boulders					
1.5			GP	Poorly Graded GRAVEL with sand - very dense, slightly moist, brown to gray partially cemented with cobbles and boulders					
5			GP-GC	Poorly Graded GRAVEL with clay and sand - dense, moist, brown not cemented, with cobbles and boulders					
7	▯								
11.5				Groundwater was not encountered					

Depth scale (feet): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

Moisture Content and Atterberg Limits

Plastic Limit ├──●──┤ Liquid Limit
Moisture Content

10 20 30 40 50 60 70 80 90

SAMPLE TYPE
▯ - GRAB SAMPLE
▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Figure

A-5

DATE		
STARTED:	4/30/18	
COMPLETED:	4/30/18	
BACKFILLED:	4/30/18	

Geotechnical Investigation
Hutchinson Heber Property - 44 Acres
Highway 40 and Coyote Lane
Heber, Utah

Project Number 02058-046

IGES Rep: JGS

Rig Type: JCB-4CX

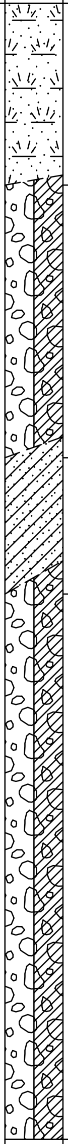
TEST PIT NO:

TP-04

Sheet 1 of 1

LOCATION

LATITUDE LONGITUDE ELEVATION



DEPTH ELEVATION	DEPTH FEET	SAMPLES	WATER LEVEL	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits Plastic Limit — Moisture Content — Liquid Limit 10 20 30 40 50 60 70 80 90
	0				Topsoil - Clayey SAND with gravel - dense, moist, dark brown with cobbles and boulders						
	1										
	2			GP-GC	Poorly Graded GRAVEL with clay and sand - dense, moist, brown with cobbles and boulders						
	3										
	4										
	5	▯		SC	Clayey SAND with gravel - dense, moist, brown with cobbles and boulders			24.7			
	6			GP-GC	Poorly Graded GRAVEL with clay and sand - dense, moist, brown						
	7										
	8										
	9	▯									
	10										
	11										
	12				No groundwater was encountered						
	13										
	14										

SAMPLE TYPE
▯ - GRAB SAMPLE
◧ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Figure

A-6

DATE	
STARTED:	4/30/18
COMPLETED:	4/30/18
BACKFILLED:	4/30/18

Geotechnical Investigation
Hutchinson Heber Property - 44 Acres
Highway 40 and Coyote Lane
Heber, Utah

Project Number 02058-046

IGES Rep: JGS
Rig Type: JCB-4CX

TEST PIT NO:
TP-05
Sheet 1 of 1

LOCATION
LATITUDE LONGITUDE ELEVATION

MATERIAL DESCRIPTION

DEPTH (FEET)	SAMPLES	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0 – 2.5			Topsoil - Sandy Lean CLAY grading to Clayey SAND - stiff, moist, dark brown					
2.5 – 4	3" O.D. thin-walled hand sampler (3 – 3.5)	SC	Clayey SAND - dense, moist, brown with occasional gravel, pinholes present	104.7	13.1			
4 – 4.5		GP-GC	Poorly Graded GRAVEL with clay and sand - dense, moist, brown					
4.5 – 7	Grab sample (6 – 6.5)	SC	Clayey SAND with gravel - dense, moist, brown trace pinholes					
7 – 9		SP-SC	Poorly Graded SAND with clay and gravel - dense, moist, brown with cobbles					
9 – 12.5	Grab sample (12 – 12.5)	SC	Clayey SAND with gravel - dense, moist, brown - with occasional pinholes (11)					

No groundwater was encountered

Moisture Content and Atterberg Limits
Plastic Limit ├ Moisture Content ● Liquid Limit ┤
10 20 30 40 50 60 70 80 90

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SAMPLE TYPE
▯ - GRAB SAMPLE
⧗ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Figure

A-7

DATE	
STARTED:	4/30/18
COMPLETED:	4/30/18
BACKFILLED:	4/30/18

Geotechnical Investigation
Hutchinson Heber Property - 44 Acres
Highway 40 and Coyote Lane
Heber, Utah
Project Number 02058-046

IGES Rep: JGS
Rig Type: JCB-4CX

TEST PIT NO:
TP-06
Sheet 1 of 1

LOCATION
LATITUDE | LONGITUDE | ELEVATION

DEPTH FEET	SAMPLES	WATER LEVEL	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0				Topsoil - Clayey SAND with gravel - dense, moist, dark brown					
2			SC	Clayey SAND with gravel - dense, slightly moist, light brown fine pinholes					
4	▯			- moist to slightly moist, brown					
8	▯			- with cobbles			26.4		
12.5				No groundwater was encountered					

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content ● — Liquid Limit
10 20 30 40 50 60 70 80 90

LOG OF TEST PITS - 4 LINE HEADER W ELEV 02058-046.GPJ IGES.GDT 5/30/18

SAMPLE TYPE
▯ - GRAB SAMPLE
⧗ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Figure

A-8

DATE
STARTED: 4/30/18
COMPLETED: 4/30/18
BACKFILLED: 4/30/18

Geotechnical Investigation
Hutchinson Heber Property - 44 Acres
Highway 40 and Coyote Lane
Heber, Utah

Project Number 02058-046

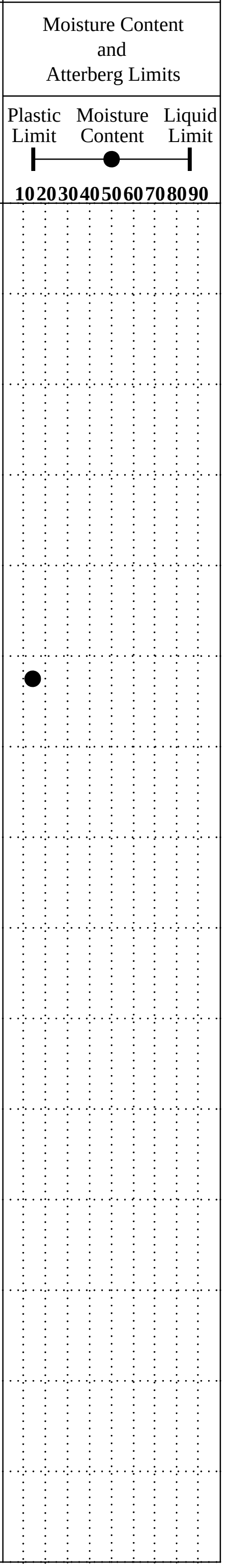
IGES Rep: JGS
Rig Type: JCB-4CX

TEST PIT NO:
TP-07
Sheet 1 of 1

LOCATION
LATITUDE
LONGITUDE
ELEVATION

ELEVATION	DEPTH FEET	SAMPLES	WATER LEVEL	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
	0				Topsoil - Clayey SAND - dense, moist, dark brown with occasional gravel					
	1			GP-GC	Poorly Graded GRAVEL with clay and sand - dense, moist, brown with cobbles					
	2.5			SC	Clayey SAND with gravel - dense, moist, brown pinholes present					
	4			CL	Sandy Lean CLAY with gravel - stiff, moist, brown					
	5	⧗				100.1	13.7			
	7			GP-GC	Poorly Graded GRAVEL with clay and sand - dense, moist, brown with cobbles and occasional boulder					
	9	▯		GP	Poorly Graded GRAVEL with sand - dense, moist, brown no obvious pinholes			8.5		
	10			SC	Clayey SAND with gravel - dense, moist, brown					
	12	▯			- pinholes present					
	12.5				No groundwater was encountered					

Moisture Content and Atterberg Limits



SAMPLE TYPE
▯ - GRAB SAMPLE
⧗ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Figure

A-9

DATE	
STARTED:	4/30/18
COMPLETED:	4/30/18
BACKFILLED:	4/30/18

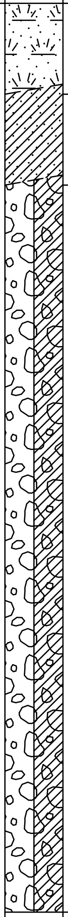
Geotechnical Investigation
Hutchinson Heber Property - 44 Acres
Highway 40 and Coyote Lane
Heber, Utah
Project Number 02058-046

IGES Rep: JGS
Rig Type: JCB-4CX

TEST PIT NO:
TP-08
Sheet 1 of 1

LOCATION

LATITUDE	LONGITUDE	ELEVATION



DEPTH ELEVATION	DEPTH FEET	SAMPLES	WATER LEVEL	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
	0				Topsoil - Sandy Lean CLAY - stiff, moist, dark brown					
	1			CL	Sandy Lean CLAY - stiff, moist, brown					
	2			GP-GC	Poorly Graded GRAVEL with clay and sand - very dense, moist, brown with cobbles and boulders					
	3									
	4	▯								
	5									
	6									
	7									
	8									
	9									
	10				No groundwater was encountered					
	11									
	12									
	13									
	14									

Moisture Content and Atterberg Limits

Plastic Limit — Moisture Content ● — Liquid Limit

10 20 30 40 50 60 70 80 90

SAMPLE TYPE
▯ - GRAB SAMPLE
▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Figure

A-10

DATE	
STARTED:	4/30/18
COMPLETED:	4/30/18
BACKFILLED:	4/30/18

Geotechnical Investigation
Hutchinson Heber Property - 44 Acres
Highway 40 and Coyote Lane
Heber, Utah

Project Number 02058-046

IGES Rep: JGS

Rig Type: JCB-4CX

TEST PIT NO:

TP-09

Sheet 1 of 1

LOCATION

LATITUDE LONGITUDE ELEVATION

DEPTH ELEVATION	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits Plastic Limit / Moisture Content / Liquid Limit 10 20 30 40 50 60 70 80 90
	0					Topsoil - Sandy Lean CLAY - stiff, moist, dark brown						
	1				CL	Sandy Lean CLAY - stiff, moist, brown						
	2				GP-GC	Poorly Graded GRAVEL with clay and sand - very dense, moist, brown with cobbles and boulders						
	3											
	4											
	5											
	6											
	7	▯							17.9			
	8											
	9				GP	Poorly Graded GRAVEL with sand - very dense, moist, brown with cobbles and boulders						
	10											
	11											
	12					No groundwater was encountered						
	13											
	14											

LOG OF TEST PITS - 4 LINE HEADER W ELEV 02058-046.GPJ IGES.GDT 5/30/18

IGES®

SAMPLE TYPE
▯ - GRAB SAMPLE
⧗ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Figure

A-11

DATE	
STARTED:	4/30/18
COMPLETED:	4/30/18
BACKFILLED:	4/30/18

Geotechnical Investigation
Hutchinson Heber Property - 44 Acres
Highway 40 and Coyote Lane
Heber, Utah
Project Number 02058-046

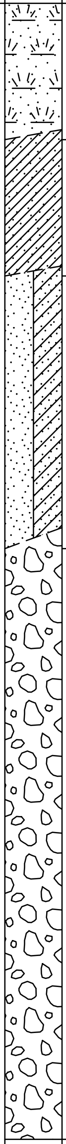
IGES Rep: JGS
Rig Type: JCB-4CX

TEST PIT NO:
TP-10
Sheet 1 of 1

LOCATION
LATITUDE LONGITUDE ELEVATION

MATERIAL DESCRIPTION

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content ● — Liquid Limit
10 20 30 40 50 60 70 80 90



ELEVATION	DEPTH FEET	SAMPLES	WATER LEVEL	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
	0				Topsoil - Sandy Lean CLAY - stiff, slightly moist, dark brown					
	1									
	2	▯		CL	Sandy Lean CLAY - very stiff, dry, light brown partially cemented with occasional gravel					
	3			SP-SC	Poorly Graded SAND with clay and gravel - dense, dry, light brown					
	4									
	5									
	6			GP	Poorly Graded GRAVEL with sand - very dense, slightly moist to dry, light brown with cobbles and boulders					
	7									
	8									
	9									
	10	▯						8.0		
	11				- moist, brown					
	12				No groundwater was encountered					
	13									
	14									

IGES®

SAMPLE TYPE
▯ - GRAB SAMPLE
◧ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Figure
A-12

DATE	
STARTED:	4/30/18
COMPLETED:	4/30/18
BACKFILLED:	4/30/18

Geotechnical Investigation
Hutchinson Heber Property - 44 Acres
Highway 40 and Coyote Lane
Heber, Utah

Project Number 02058-046

IGES Rep: JGS
Rig Type: JCB-4CX

TEST PIT NO:
TP-11
Sheet 1 of 1

LOCATION

LATITUDE	LONGITUDE	ELEVATION

DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0					Topsoil - Sandy Lean CLAY - stiff, moist, dark brown with occasional gravel and cobbles					
2			▨	SC	Clayey SAND - dense, moist, brown with occasional gravel and cobbles - partially cemented, very dense, slightly moist to dry, light brown to brown					
6.5				SP-SC	Poorly Graded SAND with clay - dense, slightly moist, brown no cementation, with occasional gravel and cobbles					
7	▯									
9					No groundwater was encountered					

Moisture Content and Atterberg Limits
Plastic Limit ├ Moisture Content ● Liquid Limit ┤
10 20 30 40 50 60 70 80 90

SAMPLE TYPE
▯ - GRAB SAMPLE
⧗ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Figure
A-13

DATE	
STARTED:	4/30/18
COMPLETED:	4/30/18
BACKFILLED:	4/30/18

Geotechnical Investigation
Hutchinson Heber Property - 44 Acres
Highway 40 and Coyote Lane
Heber, Utah

Project Number 02058-046

IGES Rep: JGS
Rig Type: JCB-4CX

TEST PIT NO:
TP-12
Sheet 1 of 1

LOCATION

LATITUDE	LONGITUDE	ELEVATION

MATERIAL DESCRIPTION

DEPTH (FEET)	SAMPLES	WATER LEVEL	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0 – 1				Topsoil - Clayey SAND with gravel - dense, moist, dark brown with cobbles					
1 – 4.5			SC	Clayey SAND - very dense, dry, light brown partially cemented with occasional gravel					
4.5 – 10.5	▯ (7 – 9) ▯ (10 – 10.5)		SC	Clayey SAND with gravel - dense, slightly moist, brown with cobbles			34.5		
10.5				No groundwater was encountered					

Moisture Content and Atterberg Limits: Plastic Limit, Moisture Content, Liquid Limit — 10 20 30 40 50 60 70 80 90

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SAMPLE TYPE
▯ - GRAB SAMPLE
◪ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Figure
A-14

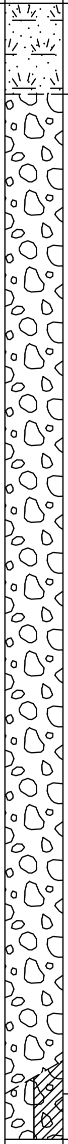
DATE		
STARTED:	4/30/18	
COMPLETED:	4/30/18	
BACKFILLED:	4/30/18	

Geotechnical Investigation
Hutchinson Heber Property - 44 Acres
Highway 40 and Coyote Lane
Heber, Utah
Project Number 02058-046

IGES Rep: JGS
Rig Type: JCB-4CX

TEST PIT NO:
TP-13
Sheet 1 of 1

LOCATION
LATITUDE LONGITUDE ELEVATION



DEPTH FEET	SAMPLES	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0			Topsoil - Clayey SAND - dense, moist, dark brown					
1		GP	Thin layer of cementation then Poorly Graded GRAVEL with sand - very dense, slightly moist, brown with cobbles and boulders					
6			- moist					
8	▯							
12		GP-GC	Poorly Graded GRAVEL with clay and sand - dense, moist, brown					
			No groundwater was encountered					

Depth scale: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
10 20 30 40 50 60 70 80 90

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SAMPLE TYPE
▯ - GRAB SAMPLE
▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Figure

A-15

DATE
STARTED: 4/30/18
COMPLETED: 4/30/18
BACKFILLED: 4/30/18

Geotechnical Investigation
Hutchinson Heber Property - 44 Acres
Highway 40 and Coyote Lane
Heber, Utah
Project Number 02058-046

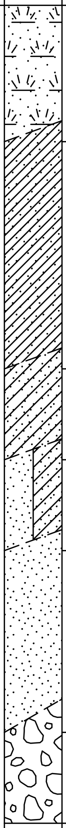
IGES Rep: JGS
Rig Type: JCB-4CX

TEST PIT NO:
TP-14
Sheet 1 of 1

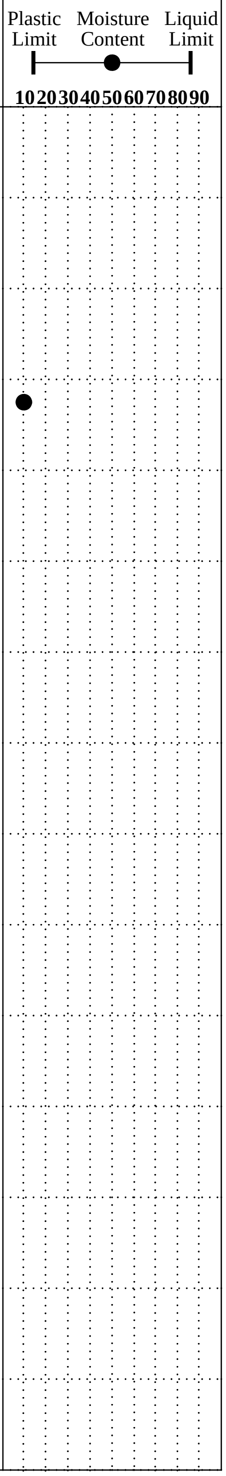
LOCATION
LATITUDE
LONGITUDE
ELEVATION

MATERIAL DESCRIPTION

Depth (feet)	Samples	Unified Soil Classification	Material Description	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0 – 1.5			Topsoil - Clayey SAND with gravel - dense, moist, dark brown with cobbles					
1.5 – 4	2 – 4: GRAB SAMPLE 3 – 3.5: 3" O.D. THIN-WALLED HAND SAMPLER	CL	Sandy Lean CLAY - stiff, moist, brown trace pinholes, with lenses of clayey sand with gravel	102.5	9.6			
4 – 5		SC	Clayey SAND - dense, moist, brown					
5 – 6		SP-SC	Poorly Graded SAND with clay and gravel - dense, moist, brown					
6 – 8		SP	Poorly Graded SAND with gravel - dense, moist, brown with cobbles					
8 – 9		GP	Poorly Graded GRAVEL with sand - very dense, moist, brown with occasional boulder					
9			No groundwater was encountered					


GRAPHICAL LOG

Moisture Content and Atterberg Limits



SAMPLE TYPE
- ▯ - GRAB SAMPLE
- ⧗ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
- ▼- MEASURED
- ▽- ESTIMATED

NOTES:

Figure

A-16

IGES®

DATE	
STARTED:	4/30/18
COMPLETED:	4/30/18
BACKFILLED:	4/30/18

Geotechnical Investigation
Hutchinson Heber Property - 44 Acres
Highway 40 and Coyote Lane
Heber, Utah

Project Number 02058-046

IGES Rep: JGS
Rig Type: JCB-4CX

TEST PIT NO:
TP-15
Sheet 1 of 1

LOCATION

LATITUDE	LONGITUDE	ELEVATION

DEPTH (FEET)	SAMPLES	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0			Topsoil - Clayey SAND - dense, slightly moist, dark brown					
2		CL	Sandy Lean CLAY - stiff, moist, dark brown pinholes present					
3.5–4	⧗			84.3	19.6			
4			- with clayey sand lenses					
5			- trace pinholes to no pinholes					
6–6.5	▯						27	11
10–10.5	▯	SC	Clayey SAND with gravel - dense, moist, dark brown with cobbles					
12			No groundwater was encountered					

Moisture Content and Atterberg Limits: Plastic Limit ├─●─┤ Liquid Limit; scale 10 20 30 40 50 60 70 80 90

SAMPLE TYPE
▯ - GRAB SAMPLE
⧗ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Figure A-17

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			USCS SYMBOL		TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	GRAVELS (More than half coarse fraction is larger than the #4 sieve)	CLEAN GRAVELS WITH LITTLE OR NO FINES	▨	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			▨	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	▨	GM	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
			▨	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS (More than half coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH LITTLE OR NO FINES	▨	SW	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			▨	SP	POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	▨	SM	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
			▨	SC	CLAYEY SANDS SAND-GRAVEL-CLAY MIXTURES
FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid limit less than 50)		▨	ML	INORGANIC SILTS & VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY
			▨	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			▨	OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid limit greater than 50)		▨	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
			▨	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			▨	OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY
HIGHLY ORGANIC SOILS			▨	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

LOG KEY SYMBOLS

⊕ BORING SAMPLE LOCATION

▮ TEST-PIT SAMPLE LOCATION

▼ WATER LEVEL (level after completion)

▽ WATER LEVEL (level where first encountered)

CEMENTATION

DESCRIPTION	DESCRIPTION
WEAKELY	CRUMBLES OR BREAKS WITH HANDLING OR SLIGHT FINGER PRESSURE
MODERATELY	CRUMBLES OR BREAKS WITH CONSIDERABLE FINGER PRESSURE
STRONGLY	WILL NOT CRUMBLE OR BREAK WITH FINGER PRESSURE

OTHER TESTS KEY

C	CONSOLIDATION	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	DS	DIRECT SHEAR
UC	UNCONFINED COMPRESSION	T	TRIAXIAL
S	SOLUBILITY	R	RESISTIVITY
O	ORGANIC CONTENT	RV	R-VALUE
CBR	CALIFORNIA BEARING RATIO	SU	SOLUBLE SULFATES
COMP	MOISTURE/DENSITY RELATIONSHIP	PM	PERMEABILITY
CI	CALIFORNIA IMPACT	-200	% FINER THAN #200
COL	COLLAPSE POTENTIAL	Gs	SPECIFIC GRAVITY
SS	SHRINK SWELL	SL	SWELL LOAD

MODIFIERS

DESCRIPTION	%
TRACE	<5
SOME	5 - 12
WITH	>12

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
DRY	ABSENCE OF MOISTURE, DUSTY, DRY TO THE TOUCH
MOIST	DAMP BUT NO VISIBLE WATER
WET	VISIBLE FREE WATER, USUALLY SOIL BELOW WATER TABLE

STRATIFICATION

DESCRIPTION	THICKNESS
SEAM	1/16–1/2"
LAYER	1/2–12"

DESCRIPTION	THICKNESS
OCCASIONAL	ONE OR LESS PER FOOT OF THICKNESS
FREQUENT	MORE THAN ONE PER FOOT OF THICKNESS

GENERAL NOTES

1. Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual.
2. No warranty is provided as to the continuity of soil conditions between individual sample locations.
3. Logs represent general soil conditions observed at the point of exploration on the date indicated.
4. In general, Unified Soil Classification designations presented on the logs were evaluated by visual methods only. Therefore, actual designations (based on laboratory tests) may vary.

APPARENT / RELATIVE DENSITY – COARSE-GRAINED SOIL

APPARENT DENSITY	SPT (blows/ft)	MODIFIED CA. SAMPLER (blows/ft)	CALIFORNIA SAMPLER (blows/ft)	RELATIVE DENSITY (%)	FIELD TEST
VERY LOOSE	<4	<4	<5	0 – 15	EASILY PENETRATED WITH 1/2-INCH REINFORCING ROD PUSHED BY HAND
LOOSE	4 – 10	5 – 12	5 – 15	15 – 35	DIFFICULT TO PENETRATE WITH 1/2-INCH REINFORCING ROD PUSHED BY HAND
MEDIUM DENSE	10 – 30	12 – 35	15 – 40	35 – 65	EASILY PENETRATED A FOOT WITH 1/2-INCH REINFORCING ROD DRIVEN WITH 5-LB HAMMER
DENSE	30 – 50	35 – 60	40 – 70	65 – 85	DIFFICULT TO PENETRATE 12" WITH 1/2-INCH REINFORCING ROD DRIVEN WITH 5-LB HAMMER
VERY DENSE	>50	>60	>70	85 – 100	PENETRATED ONLY FEW INCHES WITH 1/2-INCH REINFORCING ROD DRIVEN WITH 5-LB HAMMER

CONSISTENCY – FINE-GRAINED SOIL

		TORVANE	POCKET PENETROMETER	FIELD TEST
CONSISTENCY	SPT (blows/ft)	UNTRAINED SHEAR STRENGTH (tsf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	
VERY SOFT	<2	<0.125	<0.25	EASILY PENETRATED SEVERAL INCHES BY THUMB. EXUDES BETWEEN THUMB AND FINGERS WHEN SQUEEZED BY HAND.
SOFT	2 – 4	0.125 – 0.25	0.25 – 0.5	EASILY PENETRATED ONE INCH BY THUMB. MOLDED BY LIGHT FINGER PRESSURE.
MEDIUM STIFF	4 – 8	0.25 – 0.5	0.5 – 1.0	PENETRATED OVER 1/2 INCH BY THUMB WITH MODERATE EFFORT. MOLDED BY STRONG FINGER PRESSURE.
STIFF	8 – 15	0.5 – 1.0	1.0 – 2.0	INDENTED ABOUT 1/2 INCH BY THUMB BUT PENETRATED ONLY WITH GREAT EFFORT.
VERY STIFF	15 – 30	1.0 – 2.0	2.0 – 4.0	READILY INDENTED BY THUMBNAIL.
HARD	>30	>2.0	>4.0	INDENTED WITH DIFFICULTY BY THUMBNAIL.

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KEY TO SOIL SYMBOLS AND TERMINOLOGY

FIGURE

A-18

APPENDIX B

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: **Hutchinson Property**
No: **02058-046**
Location: Heber
Date: 5/14/2018
By: BRR
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.: **TP-15**
Sample:
Depth: **6.0'**
Description: Brown lean clay

Preparation method: Air Dry
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Dry sieved
Approximate maximum grain size: 3/4"
Estimated percent retained on No.40: Not requested
As-received water content (%): Not requested

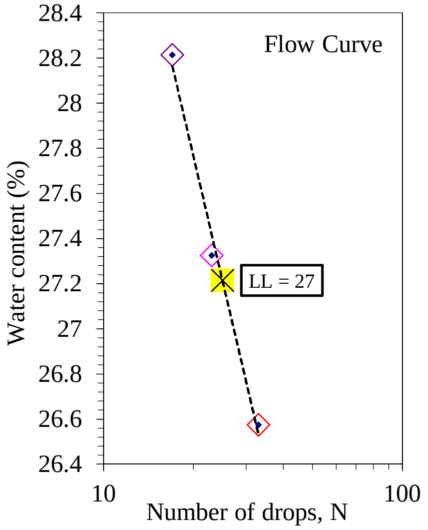
Plastic Limit

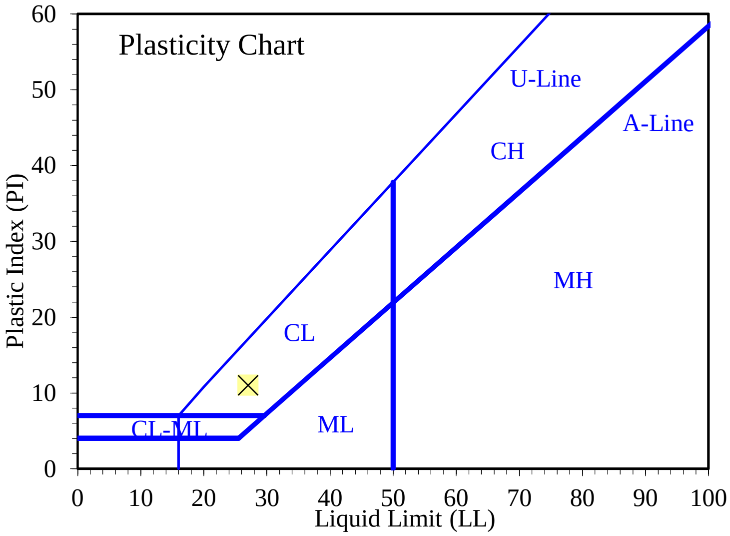
Determination No	1	2			
Wet Soil + Tare (g)	14.53	13.32			
Dry Soil + Tare (g)	13.49	12.45			
Water Loss (g)	1.04	0.87			
Tare (g)	7.06	7.05			
Dry Soil (g)	6.43	5.40			
Water Content, w (%)	16.17	16.11			

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	33	23	17			
Wet Soil + Tare (g)	15.35	15.99	14.80			
Dry Soil + Tare (g)	13.62	14.08	13.11			
Water Loss (g)	1.73	1.91	1.69			
Tare (g)	7.11	7.09	7.12			
Dry Soil (g)	6.51	6.99	5.99			
Water Content, w (%)	26.57	27.32	28.21			
One-Point LL (%)		27				

Liquid Limit, LL (%)	**27**
Plastic Limit, PL (%)	**16**
Plasticity Index, PI (%)	**11**





Entered by:____________
Reviewed:____________

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

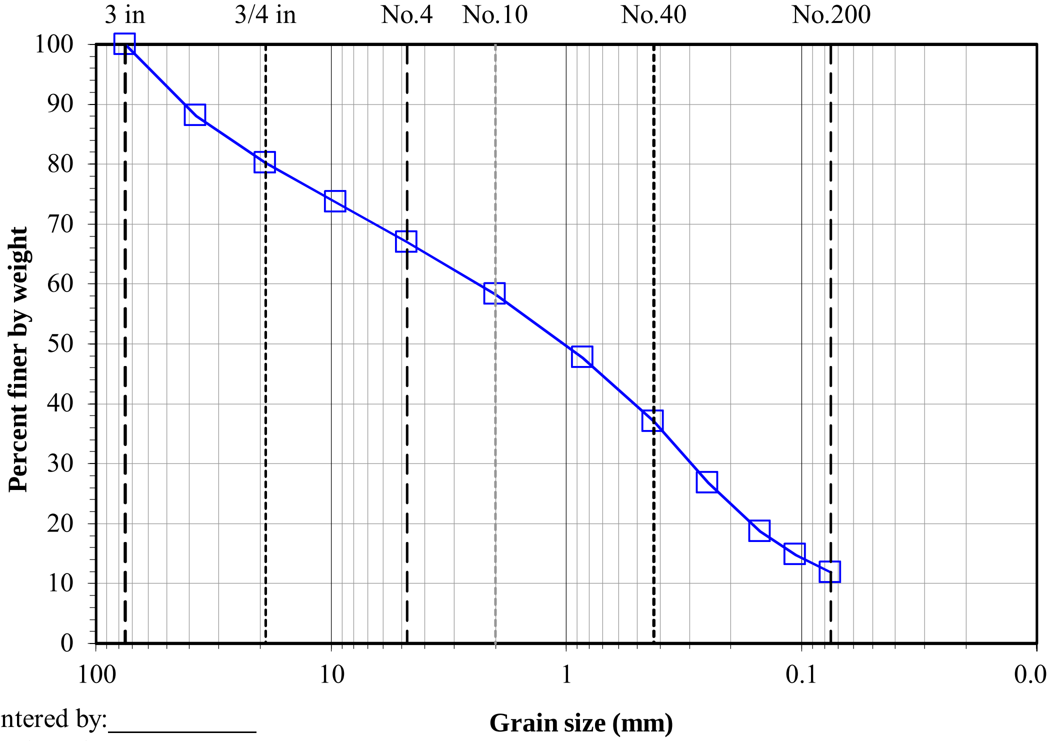
Project: Hutchinson Property
No: 02058-046
Location: Heber
Date: 5/14/2018
By: EH

Boring No.: TP-1
Sample:
Depth: 8.0'
Description: Brown sand with clay and gravel

Split:	Yes	
Split sieve:	3/8"	
	Moist	Dry
Total sample wt. (g):	4640.36	4291.20
+3/8" Coarse fraction (g):	1182.26	1131.24
-3/8" Split fraction (g):	281.74	257.45
Split fraction:	0.736	

Water content data	C.F.(+3/8")	S.F.(-3/8")
Moist soil + tare (g):	1396.40	409.59
Dry soil + tare (g):	1345.38	385.30
Tare (g):	214.14	127.85
Water content (%):	4.5	9.4

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
8"	-	200	-	
6"	-	150	-	
4"	-	100	-	
3"	-	75	100.0	
1.5"	512.05	37.5	88.1	
3/4"	848.35	19	80.2	
3/8"	1131.24	9.5	73.6	←Split
No.4	23.30	4.75	67.0	
No.10	53.84	2	58.2	
No.20	90.85	0.85	47.7	
No.40	128.00	0.425	37.0	
No.60	163.88	0.25	26.8	
No.100	192.10	0.15	18.7	
No.140	205.88	0.106	14.8	
No.200	216.02	0.075	11.9	



Gravel (%): 33.0
Sand (%): 55.1
Fines (%): 11.9

Entered by:___________
Reviewed:___________

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

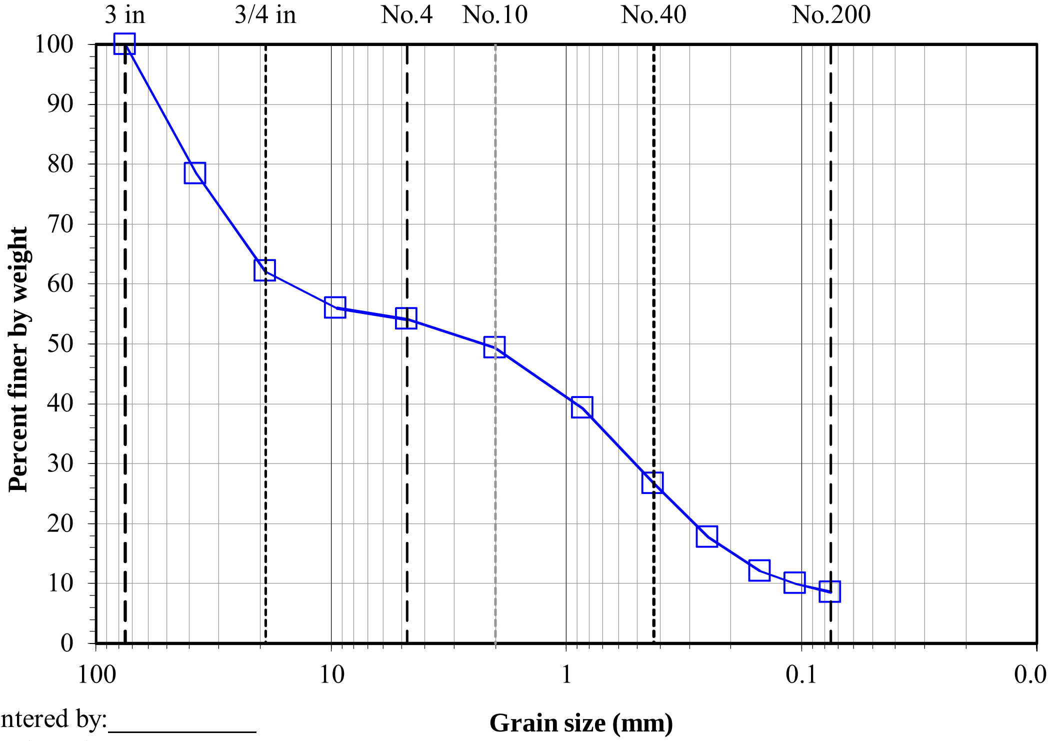
Project: Hutchinson Property
No: 02058-046
Location: Heber
Date: 5/16/2018
By: BRR

Boring No.: TP-7
Sample:
Depth: 9.0'
Description: Brown gravel with silt and sand

Split:	Yes	
Split sieve:	3/8"	
	Moist	Dry
Total sample wt. (g):	4921.43	4586.74
+3/8" Coarse fraction (g):	2123.42	2019.80
-3/8" Split fraction (g):	312.42	286.62
Split fraction:	0.560	

Water content data	C.F.(+3/8")	S.F.(-3/8")
Moist soil + tare (g):	2473.76	434.74
Dry soil + tare (g):	2368.19	408.94
Tare (g):	310.43	122.32
Water content (%):	5.1	9.0

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
8"	-	200	-	
6"	-	150	-	
4"	-	100	-	
3"	-	75	100.0	
1.5"	992.00	37.5	78.4	
3/4"	1738.90	19	62.1	
3/8"	2019.80	9.5	56.0	←Split
No.4	9.63	4.75	54.1	
No.10	34.17	2	49.3	
No.20	85.59	0.85	39.3	
No.40	149.91	0.425	26.7	
No.60	195.98	0.25	17.7	
No.100	225.06	0.15	12.0	
No.140	235.56	0.106	10.0	
No.200	242.87	0.075	8.5	



Gravel (%): 45.9
Sand (%): 45.5
Fines (%): 8.5

Entered by:___________
Reviewed:___________

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

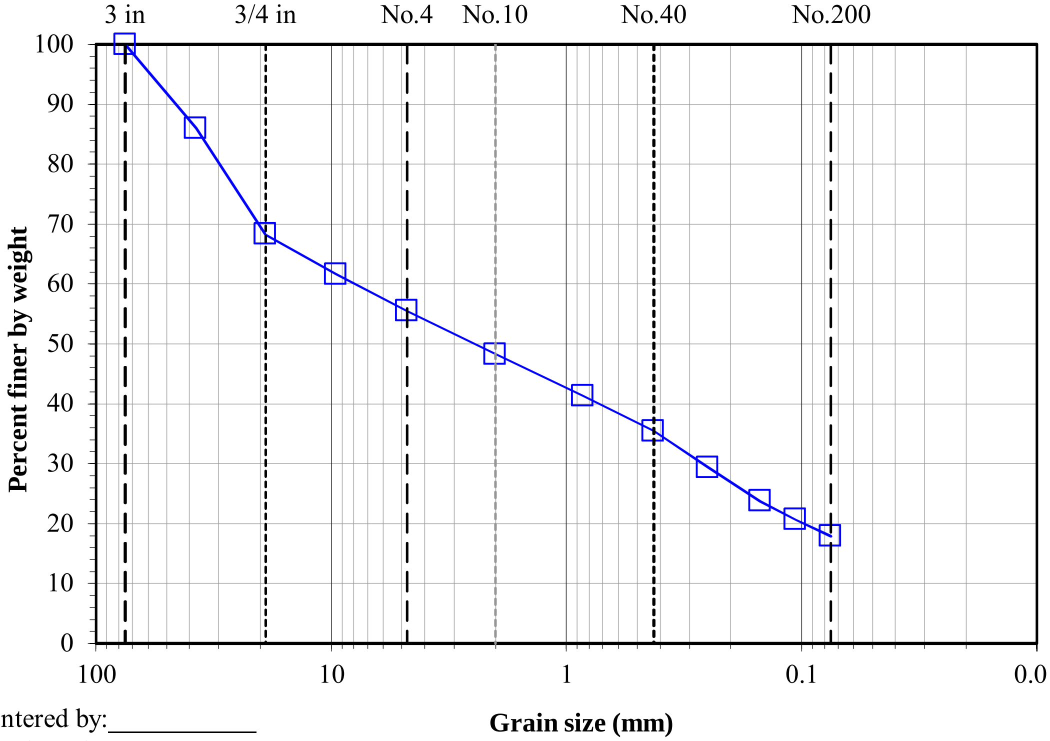
Project: Hutchinson Property
No: 02058-046
Location: Heber
Date: 5/16/2018
By: BRR

Boring No.: TP-9
Sample:
Depth: 7.0'
Description: Brown silty gravel with sand

	Moist	Dry
Split:	Yes	
Split sieve:	3/8"	
Total sample wt. (g):	5125.36	4754.97
+3/8" Coarse fraction (g):	1906.68	1824.00
-3/8" Split fraction (g):	299.82	273.02
Split fraction:	0.616	

Water content data	C.F.(+3/8")	S.F.(-3/8")
Moist soil + tare (g):	2421.73	460.03
Dry soil + tare (g):	2334.43	433.23
Tare (g):	408.49	160.21
Water content (%):	4.5	9.8

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
8"	-	200	-	
6"	-	150	-	
4"	-	100	-	
3"	-	75	100.0	
1.5"	667.60	37.5	86.0	
3/4"	1506.70	19	68.3	
3/8"	1824.00	9.5	61.6	←Split
No.4	27.31	4.75	55.5	
No.10	59.19	2	48.3	
No.20	90.02	0.85	41.3	
No.40	116.10	0.425	35.4	
No.60	143.06	0.25	29.3	
No.100	167.75	0.15	23.8	
No.140	181.69	0.106	20.6	
No.200	193.73	0.075	17.9	



Gravel (%): 44.5
Sand (%): 37.6
Fines (%): 17.9

Entered by:___________
Reviewed:___________

Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

Project: Hutchinson Property
No: 02058-046
Location: Heber
Date: 5/21/2018
By: BRR

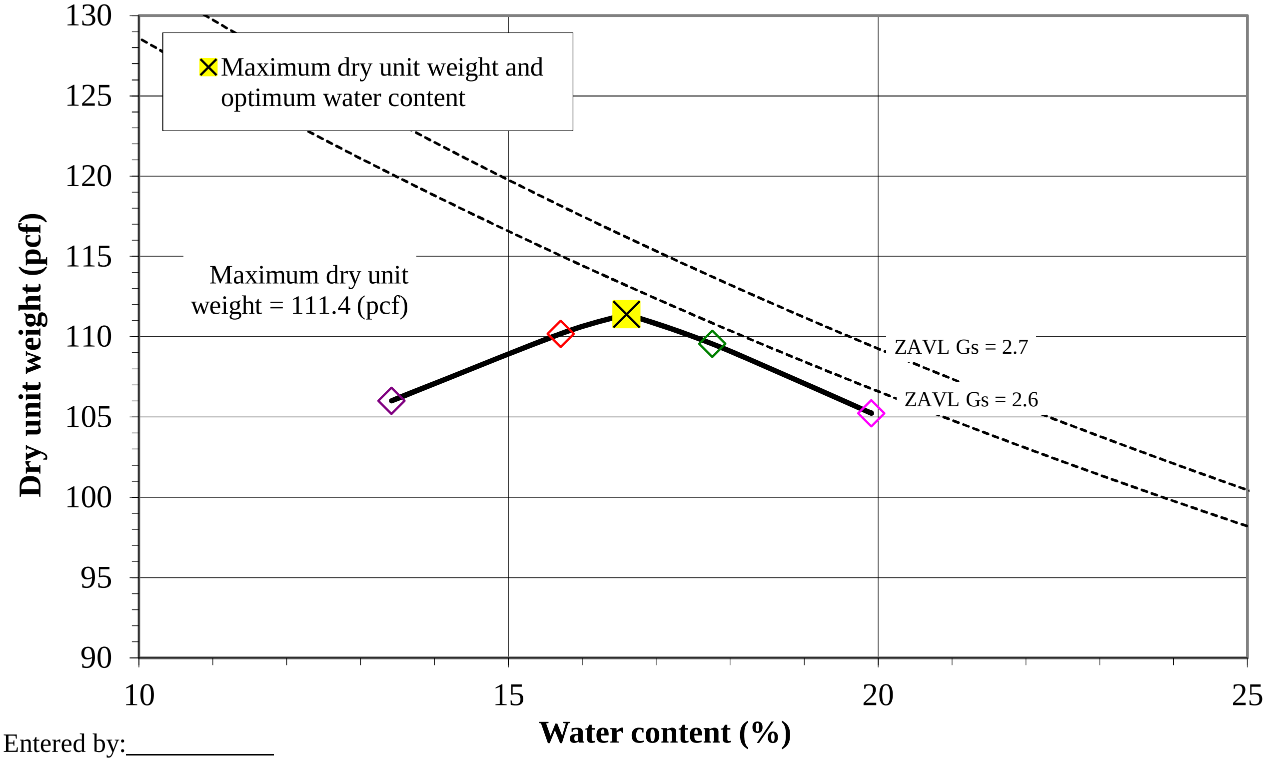
Boring No.: TP-14
Sample:
Depth: 2.0-4.0'
Sample Description: Brown sandy clay
Engineering Classification: Not requested
As-received water content (%): Not requested

Method: ASTM D698 B
Mold Id. Inc 3
Mold volume (ft^3): 0.0332

Preparation method: Moist
Rammer: Mechanical-circular face
Rock Correction: No

Optimum water content (%): 16.6
Maximum dry unit weight (pcf): 111.4

Point Number	As Is	+2%	+4%	+6%				
Wt. Sample + Mold (g)	6037.4	6146.7	6169.6	6127.2				
Wt. of Mold (g)	4224.7	4224.7	4224.7	4224.7				
Wet Unit Wt., γ_m (pcf)	120.2	127.5	129.0	126.2				
Wet Soil + Tare (g)	628.92	700.53	757.19	611.13				
Dry Soil + Tare (g)	569.50	622.01	662.15	531.00				
Tare (g)	126.66	122.11	126.92	128.57				
Water Content, w (%)	**13.4**	**15.7**	**17.8**	**19.9**				
Dry Unit Wt., γ_d (pcf)	**106.0**	**110.2**	**109.6**	**105.2**				



Entered by:___________

Reviewed:___________

California Bearing Ratio

(ASTM D 1883)

Project: Hutchinson Property

Number: 02058-046

Location: Heber

Date: 5/29/2018

By: DKS

Boring No.: TP-14

Sample:

Depth: 2 - 4'

Original Method: ASTM D698 B

Engineering Classification: Not requested

Condition of Sample: Soaked

Scalp and Replace: No

Maximum Dry Unit Weight (pcf): 111.4

Optimum Water Content (%): 16.6

Relative Compaction (%): 100.1

0.1 in. CBR (%): 6.5

0.2 in. CBR (%): 6.0

As Compacted Data			Before	After
Mold Id.	B	Wet Soil + Tare (g)	1562.98	2028.29
Wt. of Mold + Sample (g)	11612.3	Dry Soil + Tare (g)	1388.60	1786.63
Wt. of Mold (g)	7205.8	Tare (g)	328.26	310.50
Dry Unit Weight (pcf)	111.6	Water Content (%)	16.4	16.4

After Soaking Data			Average	Top 1 in.
Wt. of Mold + Sample (g)	11731.1	Wet Soil + Tare (g)	1680.27	540.25
Dry Unit Weight (pcf)	110.2	Dry Soil + Tare (g)	1474.85	497.99
		Tare (g)	408.7	310.48
		Water Content (%)	19.3	22.5

Swell Data

Date	Time	Dial
5/21/2018	16:10	0.684
5/25/2018	15:36	0.739

Surcharge (psf) 50

Swell (%) 1.20

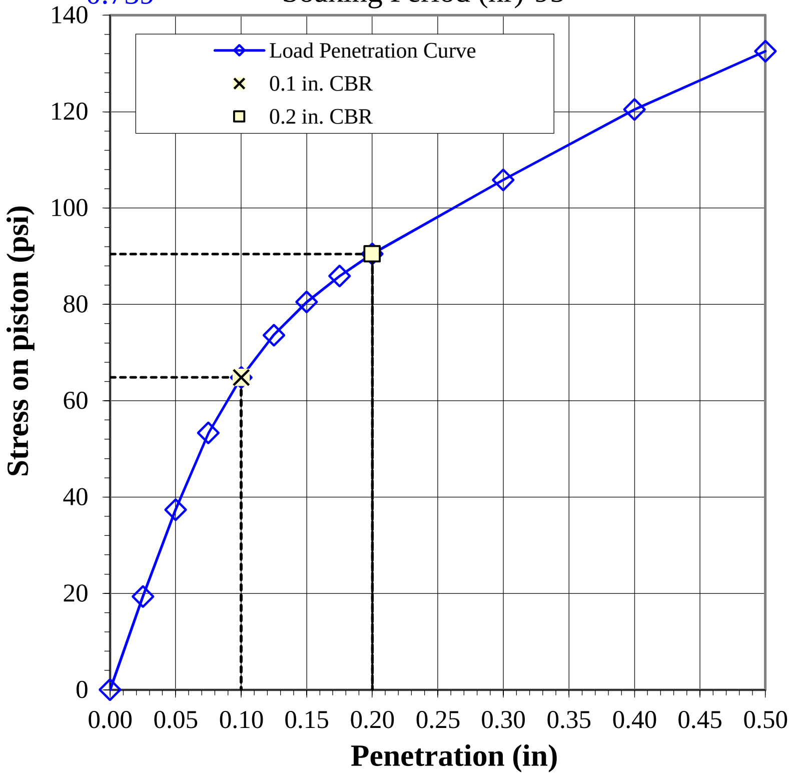
Soaking Period (hr) 95

Penetration Data | Piston ID CBR T1

Zero load (lb) = 0

Area of Piston (in^2) = 3.0

Penetration (in.)	Raw Load (lb)	Piston Stress (psi)	Std. Stress (psi)
0.000	0	0	
0.025	58	19	
0.050	112	37	
0.075	160	53	
0.100	194	65	1000
0.125	221	74	1125
0.150	241	80	1250
0.175	257	86	1375
0.200	271	90	1500
0.300	317	106	1900
0.400	361	120	2300
0.500	397	133	2600



Entered By:___________

Reviewed:___________

Collapse/Swell Potential of Soils

(ASTM D4546 Method B)

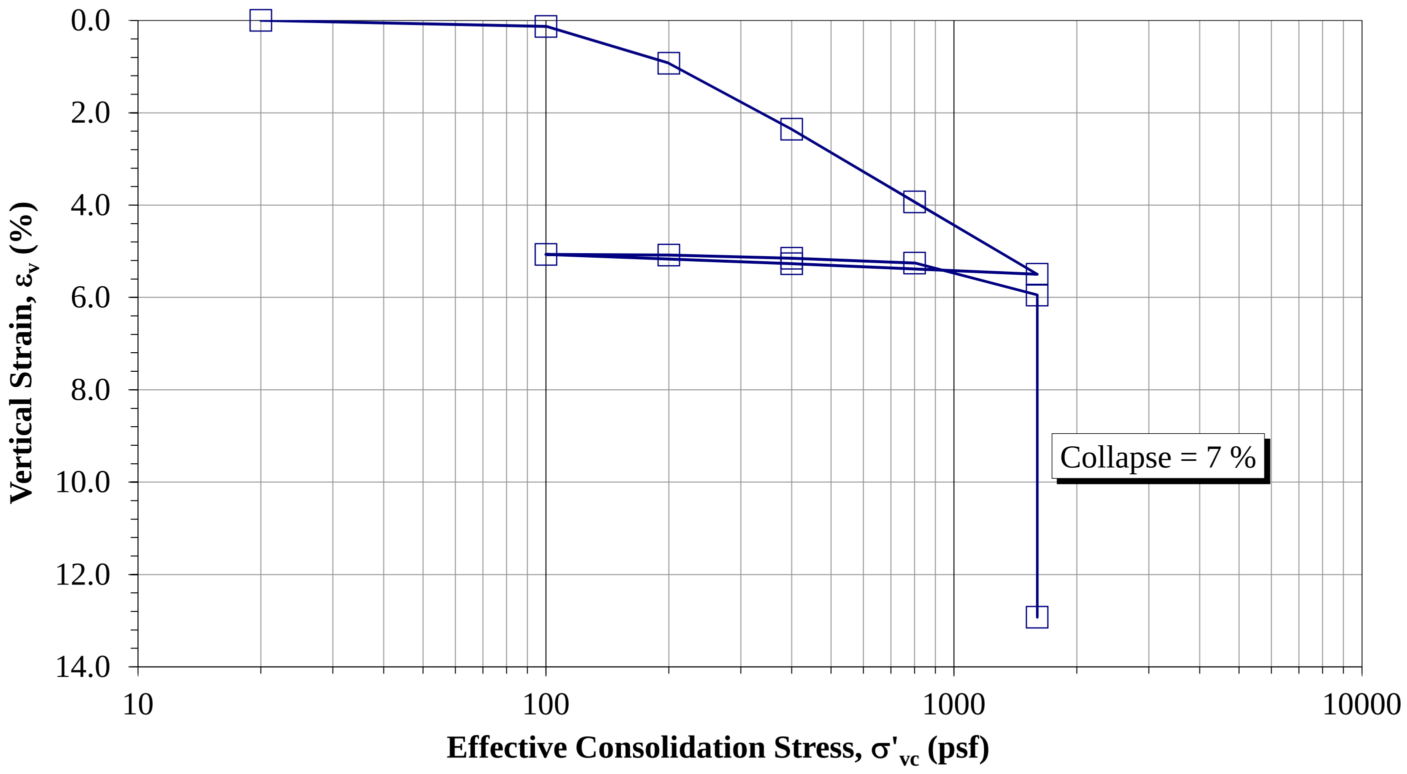
Project: Hutchinson Property
No: 02058-046
Location: Heber
Date: 5/18/2018
By: EH

Boring No.: TP-2
Sample:
Depth: 3.0'
Sample Description: Brown silt
Engineering Classification: Not requested
Sample type: Undisturbed-trimmed from thin-wall

Consolidometer No.: 1
Specific gravity, G_s: 2.70 Assumed
Collapse (%): 7.0
Collapse stress (psf): 1600
Water type used for inundation: Tap

	Initial (o)	Final (f)
Sample height, H (in.)	0.913	0.7950
Sample diameter, D (in.)	2.411	2.411
Mass rings + wet soil (g)	163.92	171.43
Mass rings/tare (g)	44.48	44.48
Moist unit wt., γ_m (pcf)	109.16	133.24
Wet soil + tare (g)	270.59	250.66
Dry soil + tare (g)	253.76	229.10
Tare (g)	126.90	123.34
Water content, w (%)	13.3	20.4
Dry unit wt., γ_d (pcf)	96.37	110.68
Saturation	47.83	100.00

Stress (psf)	Dial (in.)	1-D ε_v (%)	H_c (in.)	e
Seating	0.1304	0.00	0.9130	0.749
20	0.1304	0.00	0.9130	0.749
100	0.1316	0.13	0.9118	0.747
200	0.1389	0.93	0.9045	0.733
400	0.1519	2.35	0.8915	0.708
800	0.1663	3.93	0.8771	0.680
1600	0.1806	5.50	0.8628	0.653
400	0.1785	5.27	0.8649	0.657
100	0.1767	5.07	0.8667	0.660
200	0.1768	5.08	0.8666	0.660
400	0.1774	5.15	0.8660	0.659
800	0.1784	5.26	0.8650	0.657
1600	0.1847	5.95	0.8587	0.645
1600	0.2484	12.92	0.7950	0.523



Comments: Specimen contains some oversized gravel (+ #4).

Entered: ________
Reviewed: ________

Collapse/Swell Potential of Soils
(ASTM D4546 Method B)

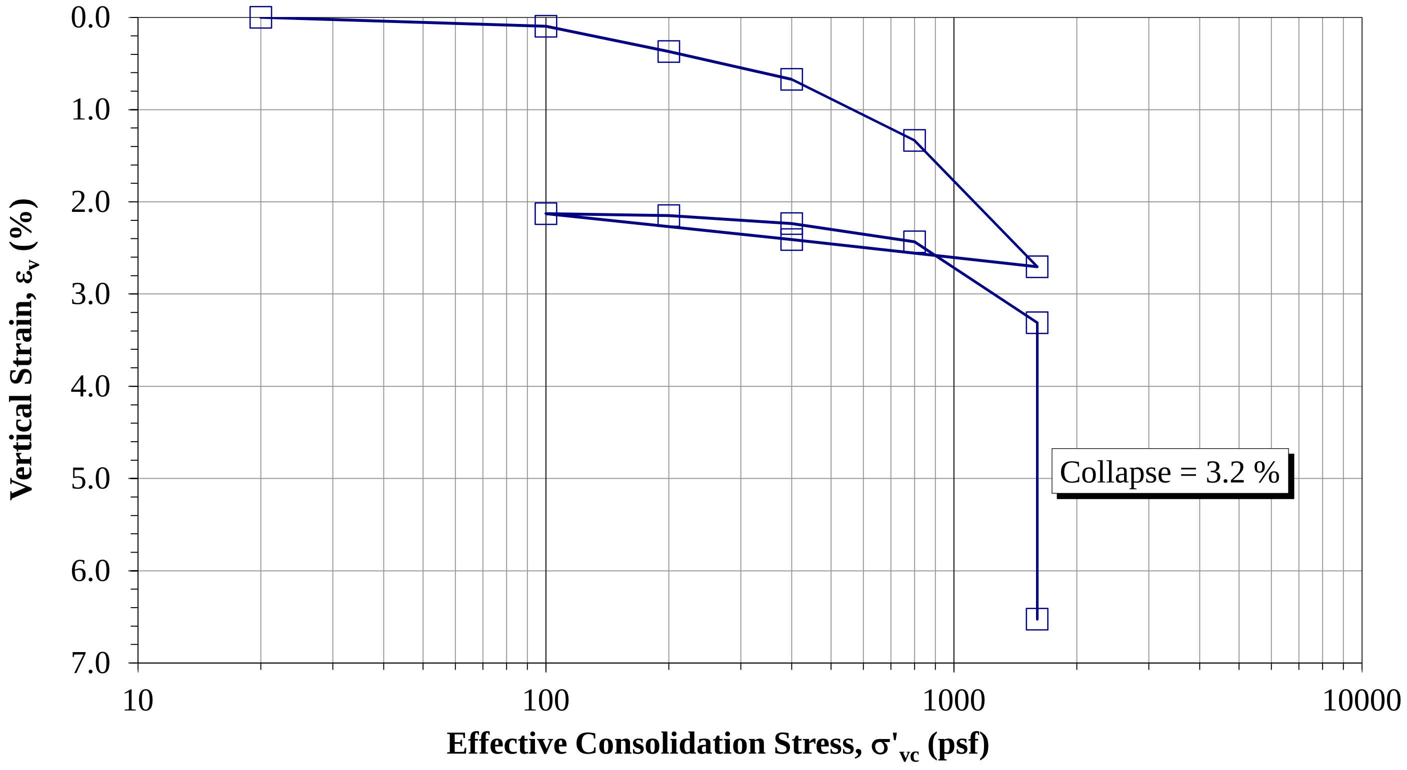
Project: Hutchinson Property
No: 02058-046
Location: Heber
Date: 5/18/2018
By: EH

Boring No.: TP-15
Sample:
Depth: 3.5'
Sample Description: Dark brown clay
Engineering Classification: Not requested
Sample type: Undisturbed-trimmed from thin-wall

Consolidometer No.: 2
Specific gravity, G_s: 2.70 Assumed
Collapse (%): 3.2
Collapse stress (psf): 1600
Water type used for inundation: Tap

	Initial (o)	Final (f)
Sample height, H (in.)	0.921	0.8609
Sample diameter, D (in.)	2.413	2.413
Mass rings + wet soil (g)	156.94	166.85
Mass rings/tare (g)	45.47	45.47
Moist unit wt., γ_m (pcf)	100.82	117.45
Wet soil + tare (g)	251.20	241.38
Dry soil + tare (g)	231.02	214.24
Tare (g)	127.94	124.40
Water content, w (%)	19.6	30.2
Dry unit wt., γ_d (pcf)	84.32	90.20
Saturation	52.91	93.91

Stress (psf)	Dial (in.)	1-D ε_v (%)	H_c (in.)	e
Seating	0.2012	0.00	0.9210	0.999
20	0.2012	0.00	0.9210	0.999
100	0.2021	0.10	0.9201	0.997
200	0.2046	0.37	0.9176	0.992
400	0.2074	0.67	0.9148	0.986
800	0.2135	1.34	0.9087	0.972
1600	0.2261	2.70	0.8961	0.945
400	0.2234	2.41	0.8988	0.951
100	0.2208	2.13	0.9014	0.956
200	0.2210	2.15	0.9012	0.956
400	0.2218	2.24	0.9004	0.954
800	0.2236	2.43	0.8986	0.950
1600	0.2317	3.31	0.8905	0.933
1600	0.2613	6.53	0.8609	0.869



Entered: ________
Reviewed: ________

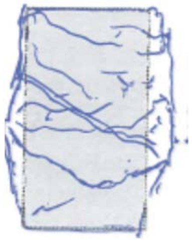
Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

(ASTM D2850)

Project: Hutchinson Property
No: 02058-046
Location: Heber
Date: 5/16/2018
By: BRR

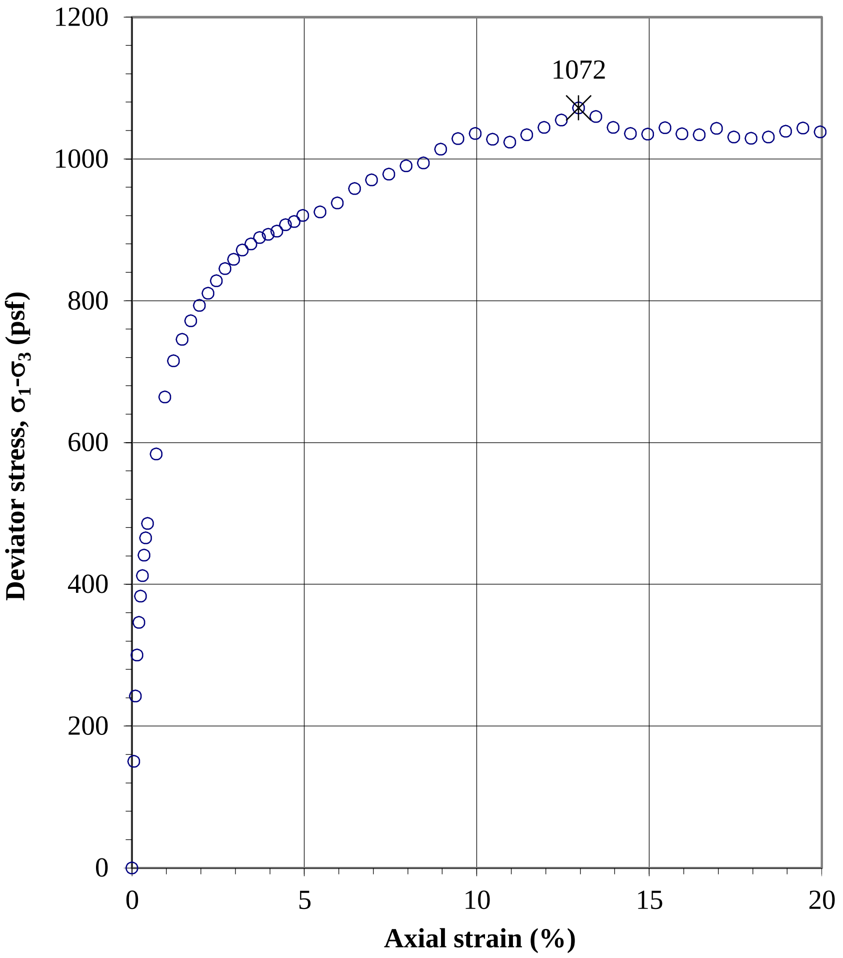
Boring No.: TP-1
Sample:
Depth: 4.0'
Sample Description: Brown clay with sand
Sample type: Undisturbed

Specific gravity, Gs	2.65	Assumed
Sample height, H (in.)	5.492	
Sample diameter, D (in.)	2.417	
Sample volume, V (ft^3)	0.0146	
Wt. rings + wet soil (g)	754.05	
Wt. rings/tare (g)	0.00	
Moist soil, Ws (g)	754.05	
Moist unit wt., γ_m (pcf)	114.0	
Dry unit wt., γ_d (pcf)	**100.1**	
Saturation (%)	56.2	
Void ratio, *e*	0.66	



Wet soil + tare (g)	1083.87
Dry soil + tare (g)	992.25
Tare (g)	333.17
Water content, w (%)	**13.9**
Confining stress, σ_3 (psf)	200
Shear rate (in/min)	0.0165
Strain at failure, ε_f (%)	12.95
Deviator stress at failure, $(\sigma_1-\sigma_3)_f$ (psf)	1072
Shear stress at failure, $q_f = (\sigma_1-\sigma_3)_f/2$ (psf)	536

Axial Strain (%)	σ_d $\sigma_1-\sigma_3$ (psf)	Q 1/2 σ_d (psf)
0.00	0.0	0.0
0.05	150.5	75.3
0.10	242.3	121.2
0.15	300.6	150.3
0.20	346.2	173.1
0.25	383.4	191.7
0.30	412.3	206.1
0.35	441.1	220.5
0.40	465.7	232.8
0.45	486.1	243.1
0.70	583.7	291.9
0.95	664.3	332.1
1.20	715.4	357.7
1.45	745.7	372.8
1.70	771.6	385.8
1.95	793.3	396.6
2.20	810.7	405.3
2.45	828.1	414.0
2.70	845.3	422.6
2.95	858.4	429.2
3.20	871.4	435.7
3.45	880.3	440.1
3.70	889.1	444.5
3.95	893.8	446.9
4.20	898.4	449.2
4.45	907.1	453.5
4.70	911.7	455.8
4.95	920.2	460.1
5.45	925.1	462.5
5.95	937.9	468.9
6.45	958.2	479.1
6.95	970.5	485.2
7.45	978.7	489.3
7.95	990.5	495.2
8.45	994.5	497.2
8.95	1013.6	506.8
9.45	1028.7	514.3
9.95	1035.9	517.9
10.45	1028.0	514.0
10.95	1023.8	511.9
11.45	1034.3	517.1
11.95	1044.7	522.3
12.45	1054.9	527.4
12.95	1072.1	536.0
13.45	1060.1	530.0
13.95	1044.5	522.2
14.45	1036.1	518.0
14.95	1034.9	517.4
15.45	1044.2	522.1
15.95	1035.7	517.8
16.45	1034.2	517.1
16.95	1043.1	521.5
17.45	1030.9	515.4
17.95	1029.2	514.6
18.45	1030.8	515.4
18.95	1039.0	519.5
19.45	1043.7	521.8
19.95	1038.1	519.0



Entered by:___________

Reviewed:___________

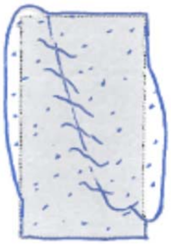
Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

(ASTM D2850)

IGES

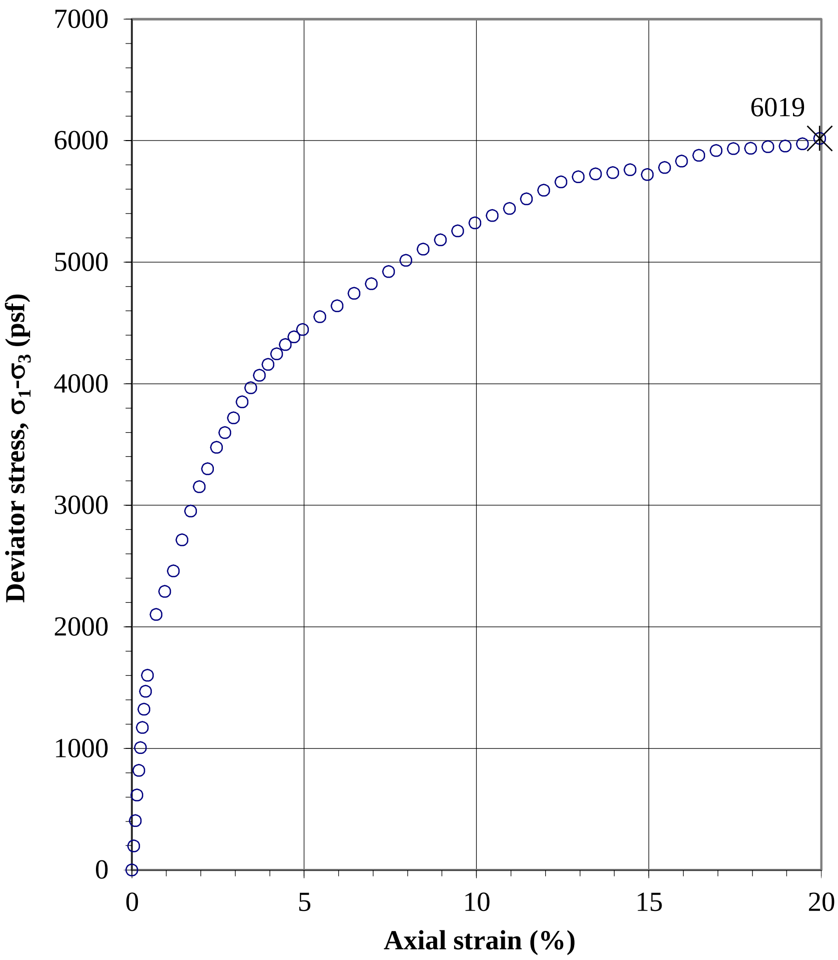
Project:	**Hutchinson Property**	**Boring No.:**	**TP-7**
No:	**02058-046**	**Sample:**	
Location:	Heber	**Depth:**	**5.0'**
Date:	5/17/2018	Sample Description:	Reddish brown clay with sand
By:	EH	Sample type:	Undisturbed

Specific gravity, Gs	2.70	Assumed
Sample height, H (in.)	4.842	
Sample diameter, D (in.)	2.405	
Sample volume, V (ft^3)	0.0127	
Wt. rings + wet soil (g)	657.49	
Wt. rings/tare (g)	0.00	
Moist soil, Ws (g)	657.49	
Moist unit wt., γ_m (pcf)	113.9	
Dry unit wt., γ_d (pcf)	**100.1**	
Saturation (%)	54.0	
Void ratio, *e*	0.69	



Wet soil + tare (g)	779.34
Dry soil + tare (g)	700.22
Tare (g)	123.62
Water content, w (%)	**13.7**
Confining stress, σ_3 (psf)	200
Shear rate (in/min)	0.0145
Strain at failure, ε_f (%)	19.95
Deviator stress at failure, $(\sigma_1\text{-}\sigma_3)_f$ (psf)	6019
Shear stress at failure, $q_f = (\sigma_1\text{-}\sigma_3)_f/2$ (psf)	3009

Axial Strain (%)	σ_d σ_1-σ_3 (psf)	Q 1/2 σ_d (psf)
0.00	0.0	0.0
0.05	198.5	99.3
0.10	405.3	202.7
0.15	616.1	308.1
0.20	818.2	409.1
0.25	1007.5	503.8
0.30	1171.3	585.7
0.35	1322.3	661.2
0.40	1468.9	734.5
0.45	1602.7	801.4
0.70	2101.7	1050.9
0.95	2292.2	1146.1
1.20	2460.9	1230.5
1.45	2716.2	1358.1
1.70	2953.6	1476.8
1.95	3152.4	1576.2
2.20	3300.5	1650.3
2.45	3476.6	1738.3
2.70	3598.3	1799.2
2.95	3719.3	1859.7
3.20	3852.0	1926.0
3.45	3967.5	1983.8
3.70	4070.1	2035.1
3.95	4160.0	2080.0
4.20	4245.3	2122.7
4.45	4322.1	2161.1
4.70	4386.2	2193.1
4.95	4445.8	2222.9
5.45	4552.2	2276.1
5.95	4641.2	2320.6
6.45	4744.8	2372.4
6.95	4823.3	2411.7
7.45	4924.2	2462.1
7.95	5016.1	2508.1
8.45	5106.5	2553.3
8.95	5184.0	2592.0
9.45	5256.6	2628.3
9.95	5324.2	2662.1
10.45	5383.1	2691.6
10.95	5441.0	2720.5
11.45	5520.4	2760.2
11.95	5591.0	2795.5
12.45	5660.5	2830.3
12.95	5703.0	2851.5
13.45	5726.3	2863.2
13.95	5738.0	2869.0
14.45	5760.0	2880.0
14.95	5720.1	2860.1
15.45	5780.6	2890.3
15.95	5832.7	2916.4
16.45	5880.2	2940.1
16.95	5919.7	2959.9
17.45	5933.7	2966.9
17.95	5936.8	2968.4
18.45	5949.7	2974.9
18.95	5955.1	2977.6
19.45	5973.5	2986.8
19.95	6018.5	3009.3



Entered by:___________

Reviewed:___________

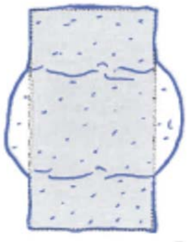
Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

(ASTM D2850)

Project: Hutchinson Property
No: 02058-046
Location: Heber
Date: 5/18/2018
By: BRR

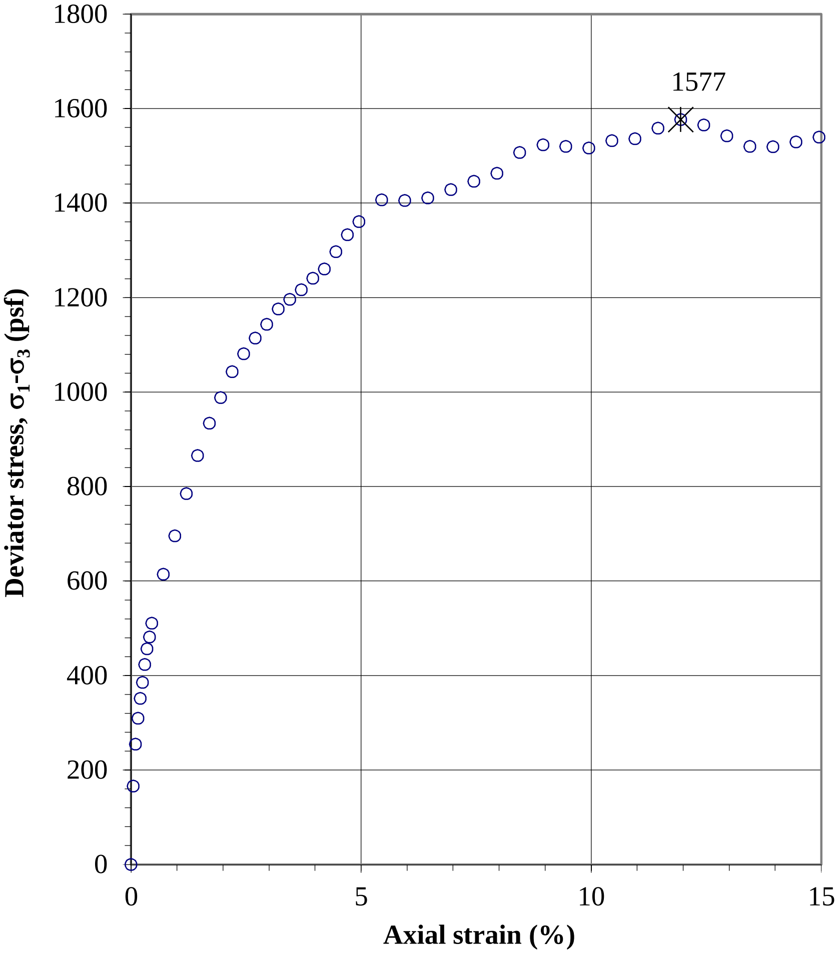
Boring No.: TP-14
Sample:
Depth: 3.0'
Sample Description: Brown clayey sand
Sample type: Undisturbed

Specific gravity, Gs 2.65 Assumed
Sample height, H (in.) 5.743
Sample diameter, D (in.) 2.397
Sample volume, V (ft^3) 0.0150
Wt. rings + wet soil (g) 764.04
Wt. rings/tare (g) 0.00
Moist soil, Ws (g) 764.04
Moist unit wt., γ_m (pcf) 112.3
Dry unit wt., γ_d (pcf) **102.5**
Saturation (%) 41.1
Void ratio, *e* 0.62



Wet soil + tare (g) 900.20
Dry soil + tare (g) 833.82
Tare (g) 139.73
Water content, w (%) **9.6**
Confining stress, σ_3 (psf) 200
Shear rate (in/min) 0.0172
Strain at failure, ε_f (%) 11.95
Deviator stress at failure, $(\sigma_1\text{-}\sigma_3)_f$ (psf) 1577
Shear stress at failure, $q_f = (\sigma_1\text{-}\sigma_3)_f/2$ (psf) 789

Axial Strain (%)	σ_d σ_1-σ_3 (psf)	Q 1/2 σ_d (psf)
0.00	0.0	0.0
0.05	165.8	82.9
0.10	254.8	127.4
0.15	309.7	154.9
0.20	351.8	175.9
0.25	385.4	192.7
0.30	423.2	211.6
0.35	456.7	228.3
0.40	481.7	240.8
0.45	510.8	255.4
0.70	614.1	307.0
0.95	695.7	347.8
1.20	785.3	392.6
1.45	866.0	433.0
1.70	933.8	466.9
1.95	988.6	494.3
2.20	1043.2	521.6
2.45	1080.8	540.4
2.70	1114.1	557.0
2.95	1143.1	571.5
3.20	1176.0	588.0
3.45	1196.4	598.2
3.70	1216.6	608.3
3.95	1240.8	620.4
4.20	1260.8	630.4
4.45	1297.0	648.5
4.70	1332.9	666.4
4.95	1360.5	680.2
5.45	1407.2	703.6
5.95	1405.2	702.6
6.45	1411.1	705.5
6.95	1428.7	714.3
7.45	1446.0	723.0
7.95	1463.0	731.5
8.45	1507.0	753.5
8.95	1523.2	761.6
9.45	1519.9	759.9
9.95	1516.5	758.2
10.45	1532.1	766.0
10.95	1536.0	768.0
11.45	1558.6	779.3
11.95	1577.1	788.5
12.45	1565.4	782.7
12.95	1542.5	771.2
13.45	1519.8	759.9
13.95	1519.2	759.6
14.45	1529.4	764.7
14.95	1539.4	769.7



Entered by:___________

Reviewed:___________

Minimum Laboratory Soil Resistivity, pH of Soil for Use in Corrosion Testing, and Ions in Water by Chemically Suppressed Ion Chromatography *(AASHTO T 288, T 289, ASTM D4327, and C1580)*

Project: **Hutchinson Property**
No: **02058-046**
Location: Heaber
Date: 5/23/2018
By: DKS

Sample info.	Boring No.	TP-15							
	Sample								
	Depth	6.0'							
Water content data	Wet soil + tare (g)	104.66							
	Dry soil + tare (g)	97.99							
	Tare (g)	37.29							
	Water content (%)	11.0							
Chem. data	pH	6.89							
	Soluble chloride* (ppm)	<5.65							
	Soluble sulfate** (ppm)	58.8							
Resistivity data	Pin method	2							
	Soil box	Miller Small							
		Approximate Soil condition (%)	Resistance Reading (Ω)	Soil Box Multiplier (cm)	Resistivity (Ω-cm)	Approximate Soil condition (%)	Resistance Reading (Ω)	Soil Box Multiplier (cm)	Resistivity (Ω-cm)
		As Is	22460	0.67	15048				
		+3	8101	0.67	5428				
		+6	5576	0.67	3736				
		+9	5316	0.67	3562				
		+12	5383	0.67	3607				
	Minimum resistivity (Ω-cm)	**3562**							

* Performed by AWAL using EPA 300.0

** Performed by AWAL using ASTM C1580

Entered by:___________

Reviewed:___________

APPENDIX C

USGS Design Maps Summary Report

User–Specified Input

Report Title Hutchinson Heber Property
Wed May 30, 2018 18:42:11 UTC

Building Code Reference Document 2012/2015 International Building Code
(which utilizes USGS hazard data available in 2008)

Site Coordinates 40.52966°N, 111.40593°W

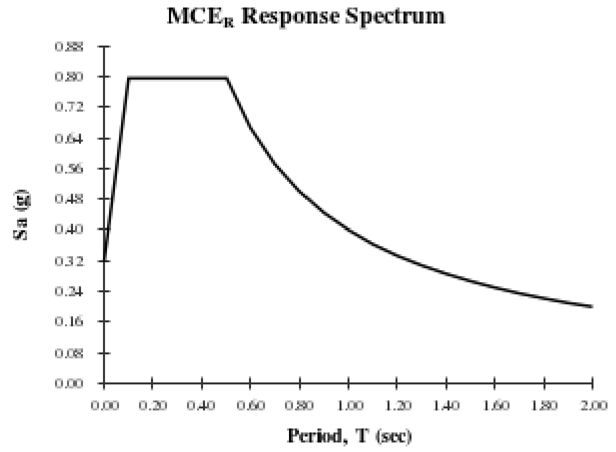
Site Soil Classification Site Class D – "Stiff Soil"

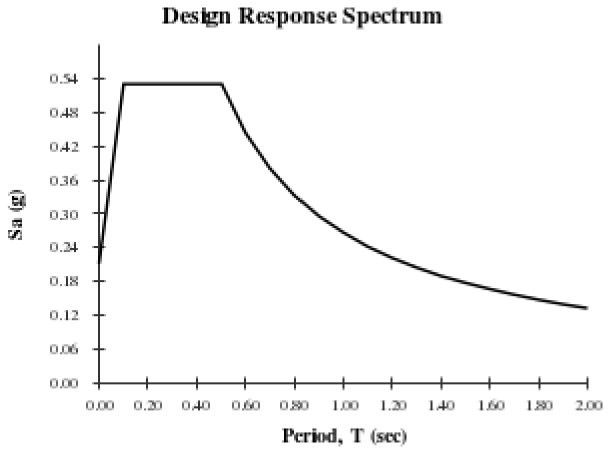
Risk Category I/II/III

USGS–Provided Output

S_S = 0.604 g S_{MS} = 0.795 g S_{DS} = 0.530 g
S_1 = 0.200 g S_{M1} = 0.400 g S_{D1} = 0.267 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.





USGS Design Maps Detailed Report

2012/2015 International Building Code (40.52966°N, 111.40593°W)

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

Section 1613.3.1 — 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 2012/2015 International Building Code are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 1613.3.3.

From Figure 1613.3.1(1) [1]	$S_S = 0.604$ g
From Figure 1613.3.1(2) [2]	$S_1 = 0.200$ g

Section 1613.3.2 — Site class definitions

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 Section 1613.

2010 ASCE-7 Standard – Table 20.3-1
SITE CLASS DEFINITIONS

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

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

Section 1613.3.3 — Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters

TABLE 1613.3.3(1)
VALUES OF SITE COEFFICIENT F_a

Site Class	Mapped Spectral Response Acceleration at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
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 = 0.604 g, F_a = 1.317

TABLE 1613.3.3(2)
VALUES OF SITE COEFFICIENT F_v

Site Class	Mapped Spectral Response Acceleration at 1–s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
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 = 0.200 g, F_v = 2.001

Equation (16-37): $S_{MS} = F_aS_S = 1.317 \text{ x } 0.604 = 0.795 \text{ g}$

Equation (16-38): $S_{M1} = F_vS_1 = 2.001 \text{ x } 0.200 = 0.400 \text{ g}$

Section 1613.3.4 — Design spectral response acceleration parameters

Equation (16-39): $S_{DS} = ⅔\ S_{MS} = ⅔ \text{ x } 0.795 = 0.530 \text{ g}$

Equation (16-40): $S_{D1} = ⅔\ S_{M1} = ⅔ \text{ x } 0.400 = 0.267 \text{ g}$

Section 1613.3.5 — Determination of seismic design category

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION

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

For Risk Category = I and S_{DS} = 0.530 g, Seismic Design Category = D

TABLE 1613.3.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

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

For Risk Category = I and S_{D1} = 0.267 g, Seismic Design Category = D

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

Seismic Design Category ≡ "the more severe design category in accordance with
Table 1613.3.5(1) or 1613.3.5(2)" = D

Note: See Section 1613.3.5.1 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 1613.3.1(1)*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(1).pdf
2. *Figure 1613.3.1(2)*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(2).pdf