CMT ENGINEERING LABORATORIES

ENGINEERING • GEOTECHNICAL • ENVIRONMENTAL (ESA I & II) •
MATERIALS TESTING • SPECIAL INSPECTIONS •
ORGANIC CHEMISTRY • PAVEMENT
DESIGN • GEOLOGY

GEOTECHNICAL ENGINEERING STUDY

West Weber Development

About 800 South 3600 West
West Weber, Utah
CMT PROJECT NO. 16394

FOR:
Blue Highland Group, LLC
11992 South Catania Drive
Draper, Utah 84020

June 3, 2021

CMT ENGINEERING LABORATORIES

June 3, 2021

Mr. Ed Grampp
Blue Highland Group, LLC
11992 South Catania Drive
Draper, Utah 84020

Subject: Geotechnical Engineering Study
West Weber Development
About 800 South 3600 West
West Weber, Utah
CMT Project No. 16394

Mr. Grampp:

Submitted herewith is the report of our geotechnical engineering study for the subject site. This report contains the results of our findings and an engineering interpretation of the results with respect to the available project characteristics. It also contains recommendations to aid in the design and construction of the earth related phases of this project.

On April 23, 2021 and May 7, 2021, a CMT Engineering Laboratories (CMT) staff professional was on-site and supervised the excavation of 13 test pits extending to depths of about 8.5 to 12.0 feet below the existing ground surface. Soil samples were obtained during the field operations and subsequently transported to our laboratory for further testing and observation.

Conventional spread and/or continuous footings may be utilized to support the proposed structures, provided the recommendations in this report are followed. A detailed discussion of design and construction criteria is presented in this report.

We appreciate the opportunity to work with you at this stage of the project. CMT offers a full range of Geotechnical Engineering, Geological, Material Testing, Special Inspection services, and Phase I and II Environmental Site Assessments. With offices throughout Utah, Idaho and Arizona, our staff is capable of efficiently serving your project needs. If we can be of further assistance or if you have any questions regarding this project, please do not hesitate to contact us at 801-590-0394.

Sincerely,
CMT Engineering Laboratories

Bryan N Roberts

276478
BRYAN N.
ROBERTS
6/3/2021

Bryan N. Roberts, P.E.
Senior Geotechnical Engineer

Reviewed by:

Andrew M. Harris, P.E.
Geotechnical Division Manager

ENGINEERING • GEOTECHNICAL • ENVIRONMENTAL (ESA I & II) • MATERIALS TESTING • SPECIAL INSPECTIONS
ORGANIC CHEMISTRY • PAVEMENT DESIGN • GEOLOGY
www.cmtlaboratories.com

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 General

CMT Engineering Laboratories (CMT) was retained to conduct a geotechnical subsurface study for the proposed West Weber Development. The site is located near 800 South 3600 West in West Weber, Utah, as shown in the **Vicinity Map** below.

VICINITY MAP

1.2 Objectives, Scope and Authorization

The objectives and scope of our study were planned in discussions between Mr. Ed Grampp of Blue Highland Group, LLC., and Mr. Andrew Harris of CMT Engineering Laboratories (CMT). In general, the objectives of this study were to define and evaluate the subsurface soil and groundwater conditions at the site, and provide appropriate foundation, earthwork, pavement and seismic recommendations to be utilized in the design and construction of the proposed development.

In accomplishing these objectives, our scope of work has included performing field exploration, which consisted of the excavating/logging/sampling of 13 test pits, performing laboratory testing on representative samples of the subsurface soils collected in the test pits, and conducting an office program, which consisted of correlating available data, performing engineering analyses, and preparing this summary report. This scope of work was authorized by returning a signed copy of our proposal dated and executed on April 12, 2021.

1.3 Description of Proposed Construction

We understand that development of a 32.59-acres portion of the 69.14-acre parcel is to be completed for single-family residential housing. Structures are likely to be 1 to 3 levels above grade with basements. We anticipate structures will likely be constructed using conventional wood-framing, founded on spread footing. Maximum continuous wall and column loads are anticipated to be 1 to 3 kips per lineal foot and 15 to 25 kips, respectively. If the loading conditions are different than we have projected, please notify us so that any appropriate modifications to our conclusions and recommendations contained herein can be made.

Exterior pavements at the site will likely include asphalt paved public roadways. Traffic is projected to consist of a light volume of automobiles and pickup trucks, three to four medium-weight delivery trucks, several school busses, a weekly garbage truck, and an occasional fire truck.

Site development will require some earthwork in the form of minor cutting and filling. A site grading plan was not available at the time of this report, but we project that maximum cuts and fills may be on the order of 2 to 3 feet. If deeper cuts or fills are planned, CMT should be notified to provide additional recommendations, if needed.

1.4 Executive Summary

Our evaluation indicates that proposed structures can be supported upon conventional spread and continuous wall foundations established upon suitable, undisturbed, natural soils and/or upon structural fill extending to suitable natural soils. The most significant geotechnical aspects regarding site development include the following:

1. Surface vegetation and potential loose/disturbed soils from agricultural use must be removed/properly prepared.
2. Groundwater was observed at the time of the field investigation between depths of about 5 feet to as deep as 9 feet below the ground surface. Higher, localized water levels may occur along existing

irrigation ditch. Groundwater as shallow as about 5 feet may affect utility and possible foundation installation.

4. Sidewall caving/slumping within excavations extending into natural sand soils and near or below the groundwater must be anticipated.

It is recommended that the top of the lowest habitable slab be kept a minimum of 3.0 feet above the measured groundwater level. Otherwise, a land drain with individual foundations drains must be installed.

During construction CMT must observe that topsoil, any loose soil or undocumented fills, and any other or unsuitable soils have been removed and that suitable, stable, soils have been encountered prior to placing site grading fills, footings, slabs, and pavements. Where surface soil has been previously disturbed from agricultural activities they must be properly prepared prior to subsequent overlying construction.

In the following sections, detailed discussions pertaining to the site and subsurface descriptions, geologic/seismic setting, earthwork, foundations, lateral resistance, lateral pressure, floor slabs, and pavements are provided.

2.0 FIELD EXPLORATION

2.1 General

In order to define and evaluate the subsurface soil and groundwater conditions, 13 test pits were excavated with a backhoe at the site to depths of approximately 8.5 to 12.0 feet below the existing ground surface. Locations of the test pits are shown on **Figure 1, Site Plan**, included in the Appendix. The field exploration was performed under the supervision of an experienced member of our geotechnical staff.

Representative soil samples were collected by obtaining disturbed "grab" samples and undisturbed thin wall ring and block samples from within the test pits. The samples were placed in sealed plastic bags and containers prior to transport to the laboratory.

The subsurface soils encountered in the test pits were classified in the field based upon visual and textural examination, logged and described in general accordance with ASTM[1] D-2488. These field classifications were supplemented by subsequent examination and testing of select samples in our laboratory. Graphical representations of the subsurface conditions encountered are presented on each individual Test Pit Log, **Figures 2 through 14**, included in the Appendix. A Key to Symbols defining the terms and symbols used on the logs, is provided as **Figure 15** in the Appendix.

Following completion of excavating operations, 1.25-inch diameter slotted PVC pipe was installed in test pits TP-5, TP-7 and TP-8 to allow subsequent water level measurements.

---

[1] American Society for Testing and Materials

Upon completion of logging and sampling, the test pits were backfilled with the excavated soils. When backfilling, minimal to no effort was made to compact the backfill and no compaction testing was performed. Thus, the test pit backfill is considered undocumented fill and settlement of the backfill in the test pits over time should be anticipated.

3.0 LABORATORY TESTING

3.1 General

Selected samples of the subsurface soils were subjected to various laboratory tests to assess pertinent engineering properties, as follows:

1. Moisture Content, ASTM D-2216, Percent moisture representative of field conditions
2. Dry Density, ASTM D-2937, Dry unit weight representing field conditions
3. Atterberg Limits, ASTM D-4318, Plasticity and workability
4. Gradation Analysis, ASTM D-1140/C-117, Grain Size Analysis
5. One Dimension Consolidation, ASTM D-2435, Consolidation properties

3.2 Lab Summary

Laboratory test results are presented on the test pit logs (**Figures 2 through 14**) and in the following Lab Summary table:

LAB SUMMARY TABLE

TEST PIT	DEPTH (feet)	SOIL CLASS	SAMPLE TYPE	MOISTURE CONTENT(%)	DRY DENSITY (pcf)	GRADATION			ATTERBERG LIMITS		
						GRAV.	SAND	FINES	LL	PL	PI
TP-1	4	CL	block	23.6	98						
TP-2	10	CL	block	26.9	97						
TP-3	3	CL	block	24.2	95			98.7	38	18	20
TP-4	5	SM	TW	28.2	93			40.5			NP
TP-5	2	SM	bag	9.4				30.3			NP
	6	CL	TW	27	91			43			
TP-6	2	SM	bag	9				33			NP
TP-7	3	CL	block	13.2	106				43	18	25
TP-9	3	CL	block	14.7	91						
TP-10	3	CL	block	17.5	99						
	6	ML	block	14.7	104			87			NP
TP-11	3	SM	bag	11.8				36.8			
TP-12	3	CL	block	26.6	92						

3.3 One-Dimensional Consolidation Tests

To provide data necessary for our settlement analyses, a consolidation test was performed on each of 4 representative samples of the fine-grained clay soils encountered within the upper about 10 feet. Based upon data obtained from the consolidation tests, the clay soils tested are moderately over-consolidated and will exhibit moderate strength and moderately high compressibility characteristics under the anticipated loadings. Detailed results of the tests are maintained within our files and can be transmitted to you, upon your request.

4.0 GEOLOGIC & SEISMIC CONDITIONS

4.1 Geologic Setting

The subject site is located in the west-central portion of Weber County in north-central Utah. The site sits at an elevation of approximately 4,232 feet above sea level. The site is located in the north-central portion of a valley bound by the Wasatch Mountains on the east and Antelope Island (Great Salt Lake) and the Promontory Mountains to the west. The Valley is a deep, sediment-filled basin that is part of the Basin and Range Physiographic Province. The valley was formed by extensional tectonic processes during the Tertiary and Quaternary geologic time periods. The Valley is located within the Intermountain Seismic Belt, a zone of ongoing tectonism and seismic activity extending from southwestern Montana to southwestern Utah. The active (evidence of movement in the last 10,000 years) Wasatch Fault Zone is part of the Intermountain Seismic Belt and extends from southeastern Idaho to central Utah along the western base of the Wasatch Mountain Range.

Much of northwestern Utah, including the valley in which the subject site is located, was also previously covered by the Pleistocene age Lake Bonneville. The Great Salt Lake, located along the western margin of the valley and beyond, is a remnant of this ancient fresh water lake. Lake Bonneville reached a high-stand elevation of approximately 5,092 feet above sea level at between 18,500 and 17,400 years ago. Approximately 17,400 years ago, the lake breached its basin in southeastern Idaho and dropped relatively fast, by almost 300 feet, as water drained into the Snake River. Following this catastrophic release, the lake level continued to drop slowly over time, primarily driven by drier climatic conditions, until reaching the current level of the Great Salt Lake. Shoreline terraces formed at the high-stand elevation of the lake and several subsequent lower lake levels are visible in places on the mountain slopes surrounding the valley. Much of the sediment within the Valley was deposited as lacustrine sediments during both the transgressive (rise) and regressive (fall) phases of Lake Bonneville.

A geologic map that includes the location of the subject site has been completed by Harty and others[2]. The surficial geology at the location of the subject site and adjacent properties is mapped as “Delta deposits” (Map Unit Qd2) dated to be lower Holocene; “Older stream alluvium” (Map Unit Qal2) dated Holocene; and “Marsh deposits” (Map Unit Qsm) dated Holocene. No fill has been mapped at the location of the site on the geologic map.

Unit Qd2 is described on the referenced map as “Silt, fine sand, and clay deposited in a platform-like topographic form with an upper-surface elevation of about 1292 meters (4240 ft) (about 8 meters [25 feet] above modern

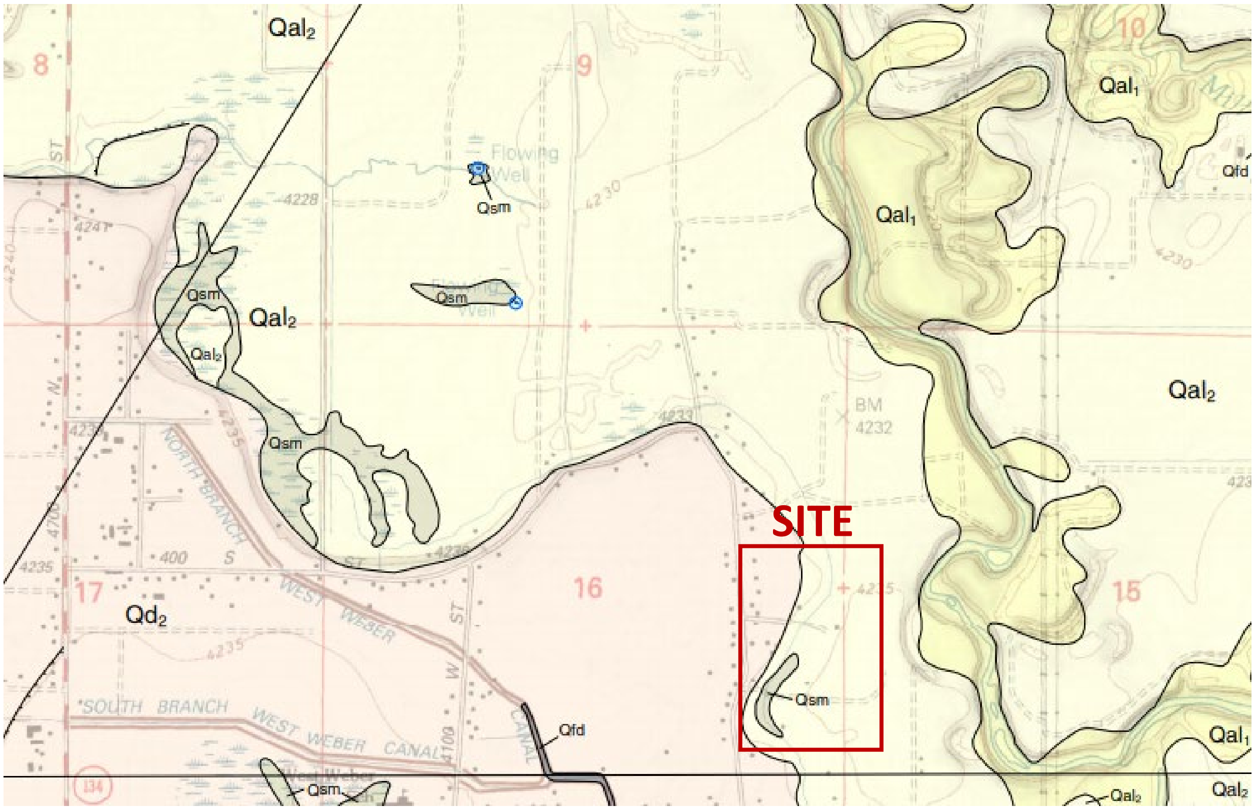
---

[2] Harty, K.M., Lowe, M., and Kirby, S.M., 2012, Geologic Map of the Plain City Quadrangle, Weber and Box Elder Counties, Utah; Utah Geological Survey Map 253DM, Scale 1:24,000.

Weber River flood plain); scattered pebble gravel covers the surface of the platform in some areas; deposited during transgression of the post-Gilbert Great Salt Lake shoreline between about 9.7 and 9.4 ka (Murchison, 1989; Sack, 2005); relates to the lower Holocene high water level; northwestern boundary of Qd2 at Plain City is cut by a well-defined, sublinear upper Holocene shoreline at 1287 meters (4221 ft), and traceable for about 4.8 kilometers (3.0 mi) along the ground surface; formed between 2.5 and 2.0 ka, remnants of this shoreline are exposed elsewhere in the Lake Bonneville basin and are considered to mark Great Salt Lake's upper Holocene high water level (Sack, 2005); Qd2 is dissected by and thus predates Qal2 deposits; total thickness about 3 to 6 meters (10–20 ft)."

Unit Qal2 is described as "Well to poorly sorted silt, sand, and gravel deposited along inactive flood plains 1 to 3 meters (3–10 ft) above modern stream level; mapped where fluvial processes are generally no longer active; thickness generally less than 3 meters (10 ft)."

Unit Qsm is described as "Wet, fine-grained, organic-rich sediment associated with springs and seeps; thickness probably less than 1 meter (3 ft) in most areas." Refer to the **Geologic Map**, shown below.



GEOLOGIC MAP

4.2 Faulting

No surface fault traces are shown on the referenced geologic map crossing, adjacent to, or projecting toward the subject site. The nearest active fault is the Weber Segment of the Wasatch Fault Zone 6.5 miles to the east. Seismic design issues are addressed in **Section 4.3** below.

4.3 Seismicity

4.3.1 Site Class

Utah has adopted the International Building Code (IBC) 2018, which determines the seismic hazard for a site based upon 2014 mapping of bedrock accelerations prepared by the United States Geologic Survey (USGS) and the soil site class. The USGS values are presented on maps incorporated into the IBC code and are also available based on latitude and longitude coordinates (grid points). For site class definitions, IBC 2018 Section 1613.2.2 refers to Chapter 20, Site Classification Procedure for Seismic Design, of ASCE[3] 7-16, which stipulates that the average values of shear wave velocity, blow count and/or shear strength within the upper 100 feet (30 meters) be utilized to determine seismic site class.

Considering our explorations only extended to a depth of about 12 feet, it is our opinion the site best fits Site Class E – Soft Clay profile based on average shear wave velocity data within the upper 30 meters ($V_{S,30}$) published by McDonald and Ashland[4]. This study places the subject site well within unit description Q01WDe, which has a log-mean $V_{S,30}$ of 166 meters per second (544 feet per second). Site Class E has a shear velocity less than 600 ft/second. Considering our explorations only extended to a depth of about 8.5 feet, it is our opinion the site best fits Site Class E – Soft Clay Profile, which we recommend for seismic structural design.

4.3.2 Ground Motions

The 2014 USGS mapping utilized by the IBC provides values of peak ground, short period and long period spectral accelerations for the Site Class B/C boundary and the Risk-Targeted Maximum Considered Earthquake (MCE_R). This Site Class B/C boundary represents average bedrock values for the Western United States and must be corrected for local soil conditions at site grid coordinates of 41.252848 degrees north latitude and -112.064731 degrees west longitude. The following table and response spectra summarizes the peak ground, short period and long period accelerations for the MCE_R event, and incorporates appropriate soil correction factors for a Site Class E soil profile:

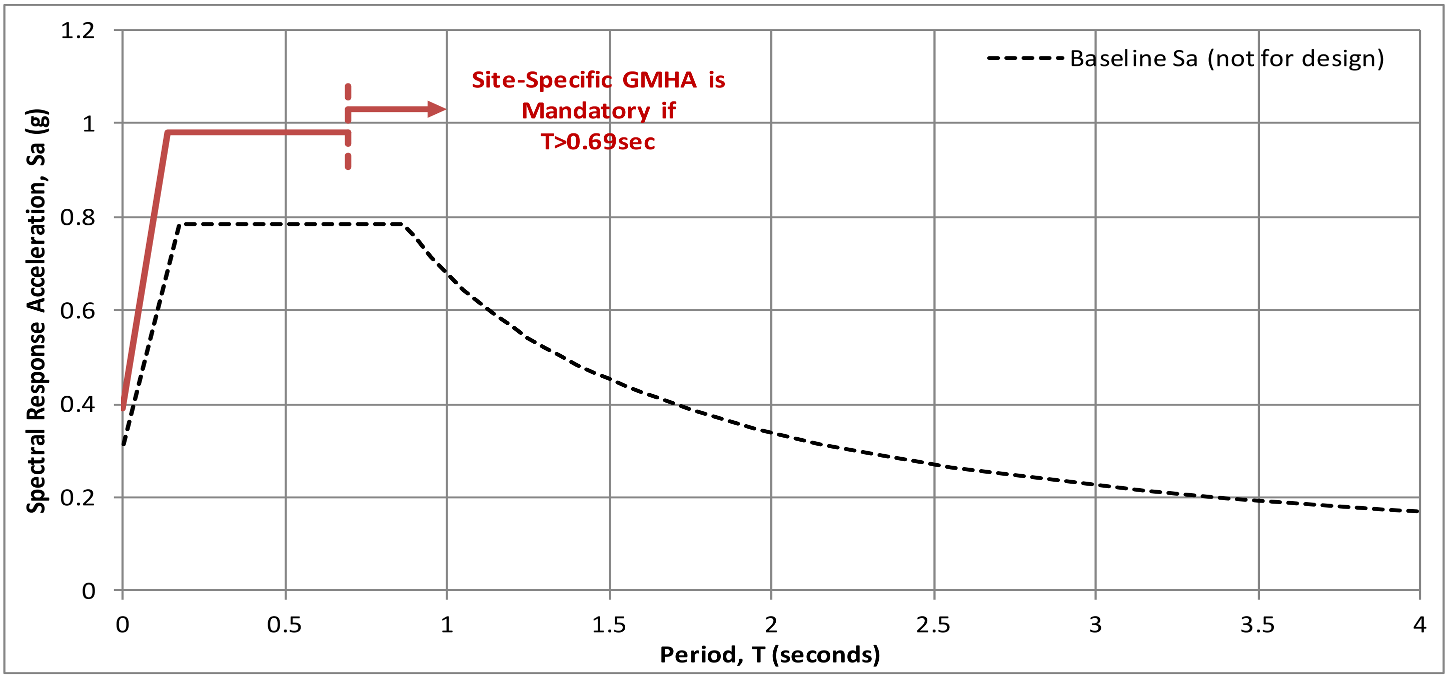
---

[3] American Society of Civil Engineers

[4] McDonald, G.N. and Ashland, F.X., 2008, "Earthquake Site-Conditions Map for the Wasatch Front Urban Corridor, Utah," Utah Geological Survey Special Study 125, 41 pp.

SPECTRAL ACCELERATION PERIOD, T	SITE CLASS B/C BOUNDARY [mapped values] (g)	SITE COEFFICIENT	SITE CLASS E [adjusted for site class effects] (g)	MULTI-PLIER	DESIGN VALUES (g)
Peak Ground Acceleration	PGA = **0.543**	F_{pga} = 1.157	PGA_M = 0.628	1.000	PGA_M = 0.628
0.2 Seconds (Long Period Acceleration)	S_S = **1.225**	F_a = N/A	S_{MS} = N/A	0.667	S_{DS} = N/A
	(Exception 1:)	F_a = (1.200)	S_{MS} = (1.470)	0.667	S_{DS} = (0.980)
1.0 Second (Long Period Acceleration)	S_1 = **0.438**	F_v = N/A	S_{M1} = N/A	0.667	S_{D1} = N/A
	(Exception 3:)	F_v = (2.324)	S_{M1} = (1.018)	0.667	S_{D1} = (0.679)

NOTES: 1. TL (seconds): **8**
2. Site Class: **E**
3. Have data to verify?
4. ASCE 7-16 Requires Site-Specific Ground Motion Hazard Analysis (Since Ss ≥ 1.0 & S1 ≥ 0.2 sec) - OR Can Use Exceptions 1 & 3 up to T=0.69sec (per §11.4.8)



As shown in the response spectrum above, if the period of the proposed building is greater than 0.69 seconds, a site-specific ground motion hazard analysis (GMHA) is required. If this situation applies, please contact CMT for a proposal to perform the GMHA.

4.3.3 Liquefaction

The site is located in an area that has been identified by the Utah Earthquake Preparedness Information Center Utah Division of Comprehensive Emergency Management for Weber County as having "high" liquefaction potential. Liquefaction is defined as the condition when saturated, loose, granular soils lose their support capabilities because of excessive pore water pressure which develops during a seismic event. Clayey soils, even if saturated, will not liquefy during a major seismic event.

A special liquefaction study was not performed for this site which would require further exploration such as drilling and SPT sampling to a minimum depth of about 30 to 40 feet or pushing a CPT cone to similar depth. Saturated sand soils were encountered within the test pits which may be affected by liquefaction during a design seismic event.

4.4 Other Geologic Hazards

No landslide deposits or features, including lateral spread deposits, are mapped at the site. The site is not located within a known or mapped potential debris flow, stream flooding[5], or rock-fall hazard area.

5.0 SITE CONDITIONS

5.1 Surface Conditions

At the time the test pits were excavated the site consisted multiple vacant, undeveloped fields. Overall, the site is relatively flat, with a very slight slope downward to the west. Based upon aerial photos readily available online dating back to 1993, the site has not changed significantly. The site is bounded on the north and east by vacant, undeveloped field, on the south by a vacant, undeveloped field and a single-family home and on the west by single-family homes, 3600 West street followed by single-family homes and vacant, undeveloped fields. (see **Vicinity Map** in **Section 1.1** above).

5.2 Subsurface Soils

The subsurface soils encountered varied primarily between clay and fine sand soils across the site within the depths penetrated, about 8.5 to 12.0 feet. The surface was blanketed at each test pit with topsoil ranging from about 3 inches up to about 10 inches thick. Surficial clay soil were encountered predominately within the upper northwest quarter to one third of the site grading thinner with underlying fine sand soils to the south and east.

The clay soils were moist to wet, brown and gray in color, and estimated to be medium stiff to soft in consistency. They also exhibited moderate over consolidation and strength characteristics with moderately high compressibility characteristics.

The natural fine sand soils were moist to wet, brown to gray in color, and estimated to be loose to medium dense. They will also exhibit moderate strength and moderately low compressibility characteristics under static loading.

For a more descriptive interpretation of subsurface conditions, please refer to the test pit logs, **Figures 2 through 14**, which graphically represent the subsurface conditions encountered. The lines designating the interface between soil types on the logs generally represent approximate boundaries - in situ, the transition between soil types may be gradual.

5.3 Groundwater

Groundwater was encountered in the test pits at depths of about 5 to 9 feet below existing grade at the time of our field exploration.

---

[5] https://msc.fema.gov/portal/search?AddressQuery=800%20South%203600%20West%2C%20West%20Weber%2C%20Utah#searchresultsanchor

On June 2, 2021, CMT personnel returned to the site to measure groundwater levels within pipes installed at test pits TP- 5, TP-7, and TP-8. However, these pipes had been damaged. The pipe at test pit TP-5 was open to about 4 feet below the ground surface and did not have water within this depth. The pipe at test pit TP-7 was damaged at the surface and we were unable to insert a tape within the pipe. At test pit TP-8 the pipe was pinched at about 7.5 feet below the ground surface. No water was observed within this depth.

Groundwater levels can fluctuate seasonally. Numerous other factors such as heavy precipitation, irrigation of neighboring land, and other unforeseen factors, may also influence ground water elevations at the site. The detailed evaluation of these and other factors, which may be responsible for ground water fluctuations, is beyond the scope of this study.

5.4 Site Subsurface Variations

Based on the results of the subsurface explorations and our experience, variations in the continuity and nature of subsurface conditions should be anticipated. Due to the heterogeneous characteristics of natural soils, care should be taken in interpolating or extrapolating subsurface conditions between or beyond the exploratory locations.

Also, when logging and sampling of the test pits was completed, the test pits were backfilled with the excavated soils but minimal to no effort was made to compact these soils. Thus, the test pit backfill is considered undocumented fill and settlement of the backfill in the test pits over time should be anticipated.

6.0 SITE PREPARATION AND GRADING

6.1 General

It is anticipated that site preparation will consist of the removal of surface vegetation, topsoil, any other deleterious materials, loose/disturbed soils and any non-engineered fills, if encountered, from beneath an area extending out at least 3 feet beyond new structures and 2 feet beyond pavements. Loose surficial soils free of deleterious materials may be recompacted in place to the requirements outlined later in this report.

We estimate that the earthwork contractor must be prepared to dewater excavations deeper than about 5 feet below the ground surface. Localized higher water levels may be encountered in excavations next to an irrigation ditch when the ditch has water running. Foundation and other excavations extending to less than about 2 feet of groundwater may require some stabilization as well as dewatering.

If basements are to be implemented without an area land drain and individual foundation drains, we recommend that a test hole be completed just outside the home footprint and allowed to sit open for a minimum 1 day to allow for the measurement of static groundwater conditions. The top of all habitable floor slabs must be established a minimum of 3 feet above the measured static water level.

Subsequent to stripping and prior to the placement of structural site grading fill, pavements, floor slabs, or footings, the exposed subgrade shall be proofrolled by running moderate-weight rubber tire-mounted construction equipment uniformly over the surface at least three times. An exception to this would be where the exposed subgrade is within 2 feet of groundwater. If excessively soft or otherwise unsuitable soils are encountered beneath footings, they must be totally removed and/or stabilized. If removal depth required is more than 2 feet or at groundwater level, CMT must be notified to provide additional recommendations. In pavement, floor slab, and outside flatwork areas, unsuitable natural soils shall be removed to a maximum depth of 2 feet and replaced with compacted granular structural fill.

Surface vegetation and other deleterious materials should generally be removed from the site. Topsoil, although unsuitable for utilization as structural fill, may be stockpiled for subsequent landscaping purposes.

Fill placed over large areas to raise overall site grades can induce settlements in the underlying natural soils. If more than 4 feet of additional site grading fill (above existing grade) is anticipated over the natural ground surface, we should be notified to assess potential settlements and provide additional recommendations as needed. These recommendations may include placement of the site grading fill far in advance to allow potential settlements to occur prior to construction.

The site should be observed by a CMT geotechnical engineer to assess that suitable natural soils have been exposed and any deleterious materials, loose and/or disturbed soils have been removed, prior to placing site grading fills, footings, slabs, and pavements.

6.2 Temporary Excavations

For granular (cohesionless) soils, construction excavations above the water table, not exceeding 3 feet, should be no steeper than one-half horizontal to one vertical (0.5H:1V). For excavations up to 8 feet, in granular soils and above the water table, the slopes should be no steeper than one horizontal to one vertical (1H:1V). Excavations deeper than about 8 feet are not anticipated at the site.

Excavations encountering saturated cohesionless soils will be very difficult and will require very flat sideslopes and/or shoring, bracing and dewatering as these soils will tend to flow into the excavation. Where excavations are known to extend below groundwater it is recommended that dewatering begin as far in advance as reasonably possible to help facilitate the excavation process. Even with dewatering, adjacent saturated clean sand soils may flow into the excavation. Temporary shoring of excavations must be anticipated.

Temporary construction excavations in cohesive soil, not exceeding 4 feet in depth and above or below the groundwater table, may be constructed with near-vertical sideslopes. Temporary excavations up to 8 feet deep in fine-grained cohesive soils, above or below the water table, may be constructed with sideslopes no steeper than one-half horizontal to one vertical (0.5H:1V).

To reduce disturbance of the natural soils during excavation, it is recommended that smooth edge buckets/blades be utilized.

All excavations must be inspected periodically by qualified personnel. If any signs of instability or excessive sloughing are noted, immediate remedial action must be initiated. All excavations should be made following OSHA safety guidelines.

6.3 Fill Material

Structural fill is defined as all fill which will ultimately be subjected to structural loadings, such as imposed by footings, floor slabs, pavements, etc. Structural fill will be required as backfill over foundations and utilities, as site grading fill, and possibly as replacement fill below footings. All structural fill must be free of sod, rubbish, topsoil, frozen soil, and other deleterious materials.

Following are our recommendations for the various fill types we anticipate will be used at this site:

Fill Material Type	Description/Recommended Specification
Structural Fill/Foundation Replacement Fill	Placed below structures, flatwork and pavement. Imported structural fill is recommended to consist of well-graded sand/gravel mixture, with maximum particle size of 4 inches, a minimum 70% passing 3/4-inch sieve, a maximum 20% passing the No. 200 sieve, and a maximum Plasticity Index of 10.
Site Grading Fill	Placed over larger areas to raise the site grade. Sandy to gravelly soil, with a maximum particle size of 6 inches, a minimum 70% passing 3/4-inch sieve, and a maximum 40% passing No. 200 sieve.
Non-Structural Fill	Placed below non-structural areas, such as landscaping. On-site soils or imported soils, with a maximum particle size of 8 inches, including silt/clay soils not containing excessive amounts of degradable/organic material.
Stabilization Fill	Placed to stabilize soft areas prior to placing structural fill and/or site grading fill. Coarse angular gravels and cobbles 1 inch to 8 inches in size. May also use 1.5- to 2.0-inch gravel placed on stabilization fabric, such as Mirafi RS280i, or equivalent (see **Section 6.6**).

On-site sand soils free of debris and deleterious materials may be suitable for use as structural site grading fill, if processed to meet the requirements given above, and may also be used in non-structural fill situations. However, with shallow groundwater, these onsite soils may be above optimum moisture content and would therefore require drying prior to re-utilization. This will be difficult to near impossible to do during wet and cold periods of the year.

All fill material should be approved by a CMT geotechnical engineer prior to placement.

6.4 Fill Placement and Compaction

The various types of compaction equipment available have their limitations as to the maximum lift thickness that can be compacted. For example, hand operated equipment is limited to lifts of about 4 inches and most “trench compactors” have a maximum, consistent compaction depth of about 6 inches. Large rollers, depending on soil and moisture conditions, can achieve compaction at 8 to 12 inches. The full thickness of each lift should be compacted to at least the following percentages of the maximum dry density as determined by ASTM D-1557 (or AASHTO[6] T-180) in accordance with the following recommendations:

LOCATION	TOTAL FILL THICKNESS (FEET)	MINIMUM PERCENTAGE OF MAXIMUM DRY DENSITY
Beneath an area extending at least 3 feet beyond the perimeter of structures, and 2 feet beyond flatwork and pavement (applies to structural fill and site grading fill)	0 to 5 5 to 8	95 98
Site grading fill outside area defined above	0 to 5 5 to 8	92 95
Utility trenches within structural areas	--	96
Roadbase and subbase	-	96
Non-structural fill	0 to 5 5 to 8	90 92

Structural fills greater than 8 feet thick are not anticipated at the site. For best compaction results, we recommend that the moisture content for structural fill/backfill be within 2% of optimum. Field density tests should be performed on each lift as necessary to verify that proper compaction is being achieved.

6.5 Utility Trenches

Deeper utility excavations may require dewatering and or some stabilization. For the bedding zone around the utility, we recommend utilizing sand bedding fill material that meets current APWA[7] requirements.

Most utility companies and local governments are requiring Type A-1a or A-1b (AASHTO Designation) soils (sand/gravel soils with limited fines) be used as backfill over utilities within public rights of way, and the backfill be compacted over the full depth above the bedding zone to at least 96% of the maximum dry density as determined by AASHTO T-180 (ASTM D-1557). Existing sand and gravel soils at this site may meet these specifications with some processing.

Where the utility does not underlie structurally loaded facilities and public rights of way, on-site soils free of debris may be utilized as trench backfill above the bedding layer, provided they are properly moisture conditioned and compacted to the minimum requirements stated above in **Section 6.4**.

6.6 Stabilization

To stabilize soft subgrade conditions (if encountered), a mixture of coarse, clean, angular gravels and cobbles and/or 1.5- to 2.0-inch clean gravel should be utilized, as indicated above in **Section 6.3**. Often the amount of gravelly material can be reduced with the use of a geotextile fabric such as Mirafi RS280i or equivalent. Its use

---

[6] American Association of State Highway and Transportation Officials
[7] American Public Works Association

will also help avoid mixing of the subgrade soils with the gravelly material. After excavating the soft/disturbed soils, the fabric should be spread across the bottom of the excavation and up the sides a minimum of 18 inches. Otherwise, it should be placed in accordance with the manufacturer's recommendation, including proper overlaps. The gravel material can then be placed over the fabric in compacted lifts as described above.

7.0 FOUNDATION RECOMMENDATIONS

The following recommendations have been developed on the basis of the previously described project characteristics, including the maximum loads discussed in **Section 1.3**, the subsurface conditions observed in the field and the laboratory test data, and standard geotechnical engineering practice.

7.1 Foundation Recommendations

Based on our geotechnical engineering analyses, the proposed structures may be supported upon conventional spread and/or continuous wall foundations placed on suitable, undisturbed natural soils and/or on structural fill extending to suitable natural soils. Footings may be designed using a net bearing pressure of 1,500 psf may be utilized.

The term "net bearing pressure" refers to the pressure imposed by the portion of the structure located above lowest adjacent final grade, thus the weight of the footing and backfill to lowest adjacent final grade need not be considered. The allowable bearing pressure may be increased by 1/2 for temporary loads such as wind and seismic forces.

We also recommend the following:

1. Exterior footings subject to frost should be placed at least 30 inches below final grade.
2. Interior footings not subject to frost should be placed at least 16 inches below grade.
3. Continuous footing widths should be maintained at a minimum of 18 inches.
4. Spot footings should be a minimum of 24 inches wide.

7.2 Installation

Under no circumstances shall the footings be established upon non-engineered fills, loose or disturbed soils, topsoil, sod, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water. If unsuitable soils are encountered, they must be completely removed and replaced with compacted structural fill. Excavation bottoms shall be examined by a qualified geotechnical engineer to confirm that suitable bearing materials soils have been exposed.

All structural fill shall meet the requirements for such, and be placed and compacted in accordance with **Section 6** above. The width of structural replacement fill below footings should be equal to the width of the footing plus 1 foot for each foot of fill thickness. For instance, if the footing width is 2 feet and the structural fill depth beneath the footing is 2 feet, the fill replacement width should be 4 feet, centered beneath the footing.

7.3 Estimated Settlement

Settlements of foundations designed and installed in accordance with the above criteria and recommendations supporting the loads, as discussed in Section 1.3, Description of Proposed Construction, can be controlled to within 1 inch or less.

Approximately 50 percent of the quoted settlement should occur during construction.

7.4 Lateral Resistance

Lateral loads imposed upon foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and friction between the base of the footings and the supporting soils. In determining frictional resistance, a coefficient of 0.30 for natural silt/clay soils or 0.40 for natural sand/gravel soils and structural fill, may be utilized for design. Passive resistance provided by properly placed and compacted structural fill above the water table may be considered equivalent to a fluid with a density of 250 pcf. A combination of passive earth resistance and friction may be utilized if the passive component of the total is divided by 1.5.

8.0 LATERAL EARTH PRESSURES

Parameters, as presented within this section, are for backfills which will consist of drained soil placed and compacted in accordance with the recommendations presented herein.

The lateral pressures imposed upon subgrade facilities will, therefore, be basically dependent upon the relative rigidity and movement of the backfilled structure. For active walls, such as retaining walls which can move outward (away from the backfill), backfill may be considered equivalent to a fluid with a density of 40 pounds per cubic foot in computing lateral pressures. For more rigid walls (moderately yielding), backfill may be considered equivalent to a fluid with a density of 50 pounds per cubic foot. For very rigid non-yielding walls, granular backfill should be considered equivalent to a fluid with a density of at least 60 pounds per cubic foot. The above values assume that the surface of the soils slope behind the wall is horizontal and that the fill within 3 feet of the wall will be compacted with hand-operated compacting equipment.

For seismic loading of retaining/below-grade walls, the following uniform lateral pressures, in pounds per square foot (psf), should be added based on wall depth and wall case.

Uniform Lateral Pressures			
Wall Height (Feet)	**Active Pressure Case (psf)**	**Moderately Yielding Case (psf)**	**At Rest/Non-Yielding Case (psf)**
4	46	87	128
6	68	130	192

9.0 FLOOR SLABS

Floor slabs may be established upon suitable, undisturbed, natural soils and/or on structural fill extending to suitable natural soils (same as for foundations). Under no circumstances shall floor slabs be established directly on any topsoil, non-engineered fills, loose or disturbed soils, sod, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water.

In order to facilitate curing of the concrete, we recommend that floor slabs be directly underlain by at least 4 inches of “free-draining” fill, such as “pea” gravel or 3/4-inch quarters to 1-inch minus, clean, gap-graded gravel. To help control normal shrinkage and stress cracking, the floor slabs may include the following features:

1. Adequate reinforcement for the anticipated floor loads with the reinforcement continuous through interior floor joints;
2. Frequent crack control joints; and
3. Non-rigid attachment of the slabs to foundation walls.

It is recommended that the top of the lowest habitable slab be kept a minimum of 3.0 feet above the measured groundwater level. Otherwise, a land drain with individual foundations drains must be installed.

10.0 DRAINAGE RECOMMENDATIONS

10.1 Surface Drainage

It is important to the long-term performance of foundations and floor slabs that water not be allowed to collect near the foundation walls and infiltrate into the underlying soils. We recommend the following:

1. All areas around structures should be sloped to provide drainage away from the foundations. Where possible we recommend a minimum slope of 6 inches in the first 10 feet away from the structure.

2. All roof drainage should be collected in rain gutters with downspouts designed to discharge at least 10 feet from the foundation walls or well beyond the backfill limits, whichever is greater.

3. Adequate compaction of the foundation backfill should be provided. We suggest a minimum of 90% of the maximum laboratory density as determined by ASTM D-1557. Water consolidation methods should not be used under any circumstances.

4. Sprinklers should be aimed away from the foundation walls. The sprinkling systems should be designed with proper drainage and be well-maintained. Over watering should be avoided.

5. Other precautions may become evident during construction.

10.2 Foundation Subdrains

If floor slabs will be placed deeper than approximately 3 feet below the existing ground surface, we recommend that perimeter foundation subdrains be installed and be tied to an area land drain or other appropriate down-gradient discharge point.

Foundation subdrains shall at a minimum consist of a 4-inch diameter perforated or slotted plastic or PVC pipe enclosed in clean gravel surrounding the home foundation. The invert of the subdrain should be at least 18 inches below the top of the lowest adjacent floor slab. The gravel portion of the drain should extend 2 inches laterally and below the perforated pipe and at least 1 foot above the top of the lowest adjacent floor slab. The gravel zone must be installed immediately adjacent to the perimeter footings and the foundation walls. To reduce the possibility of plugging, the gravel with drain pipe must be wrapped with a geotextile, such as Mirafi 140N or equivalent.

Above the subdrain, a minimum 12-inch-wide zone of “free-draining” sand/gravel should be placed adjacent to the foundation walls and extend to within 2.0 feet of final grade and similarly separated from adjacent soils with a geotextile such as Mirafi 140N or equivalent. The upper 2.0 foot of soils should consist of a compacted low permeable soil where possible to reduce surface water infiltration into the drain. As an alternative to the zone of permeable sand/gravel, a prefabricated “drainage board,” such as Miradrain or equivalent, may be placed adjacent to the exterior below-grade walls. Prior to the installation of the footing subdrain, the below-grade walls should be heavily dampproofed/waterproofed. The slope of the subdrain should be at least 0.3 percent. The gravel placed around the drain pipe should be clean 0.75-inch to 1.0-inch minus gap-graded gravel and/or “pea” gravel. The foundation subdrains can be discharged into the area subdrains, storm drains, or other suitable down-gradient location. Further it is recommended that a minimum 8 inches of gravel be placed below the floor slab which is hydraulically tied to the perimeter foundation drain through either drain pipes or a minimum 4-inch gravel layer extending out and below the foundation and connecting to the perimeter drain.

11.0 PAVEMENTS

We anticipate the natural fine-grained clay soils will exhibit poor pavement support characteristics when saturated or nearly saturated. Based on our laboratory testing experience with similar soils, our pavement design utilized a California Bearing Ratio (CBR) of 3 for the natural clay soils and an average daily equivalent single axle load over a 20-year period (ESAL) of up to 9.0. The sections provided also assume that proper on-going maintenance be completed over the pavement lifetime.

Given the projected traffic as discussed above in **Section 1.3**, the following pavement sections are recommended for approximately 9 ESAL's (18-kip equivalent single-axle loads) per day:

MATERIAL	PAVEMENT SECTION THICKNESS (inches)	
Asphalt	**3.5**	**3.5**
Road-Base	**13.0**	**8**
Subbase	**0**	**6**
Total Thickness	**16.5**	**17.5**

Untreated base course (UTBC) should conform to city specifications, or to 1-inch-minus UDOT specifications for A–1-a/NP, and have a minimum CBR value of 70%. Subbase shall consist of a granular soil with a minimum CBR of 30 percent. Roadbase and subbase material should be compacted as recommended above in **Section 6.4**. Asphalt material generally should conform to APWA requirements, having a ½-inch maximum aggregate size, a 75-gyration Superpave mix containing no more than 15% of recycled asphalt (RAP) and a PG58-28 binder.

Site concrete should typically have a minimum 28-day unconfined compressive strength of 4,000 pounds per square inch and contain 6 percent ±1 percent air-entrainment.

12.0 QUALITY CONTROL

We recommend that CMT be retained as part of a comprehensive quality control testing and observation program. With CMT on-site we can help facilitate implementation of our recommendations and address, in a timely manner, any subsurface conditions encountered which vary from those described in this report. Without such a program CMT cannot be responsible for application of our recommendations to subsurface conditions which may vary from those described herein. This program may include, but not necessarily be limited to, the following:

12.1 Field Observations

Observations should be completed during all phases of construction such as site preparation, foundation excavation, structural fill placement and concrete placement.

12.2 Fill Compaction

Compaction testing by CMT is required for all structural supporting fill materials. Maximum Dry Density (Modified Proctor, ASTM D-1557) tests should be requested by the contractor immediately after delivery of any fill materials. The maximum density information should then be used for field density tests on each lift as necessary to ensure that the required compaction is being achieved.

12.3 Excavations

All excavation procedures and processes should be observed by a geotechnical engineer from CMT or their representative. In addition, for the recommendations in this report to be valid, all backfill and structural fill placed in trenches and all pavements should be density tested by CMT. We recommend that freshly mixed concrete be tested by CMT in accordance with ASTM designations.

13.0 LIMITATIONS

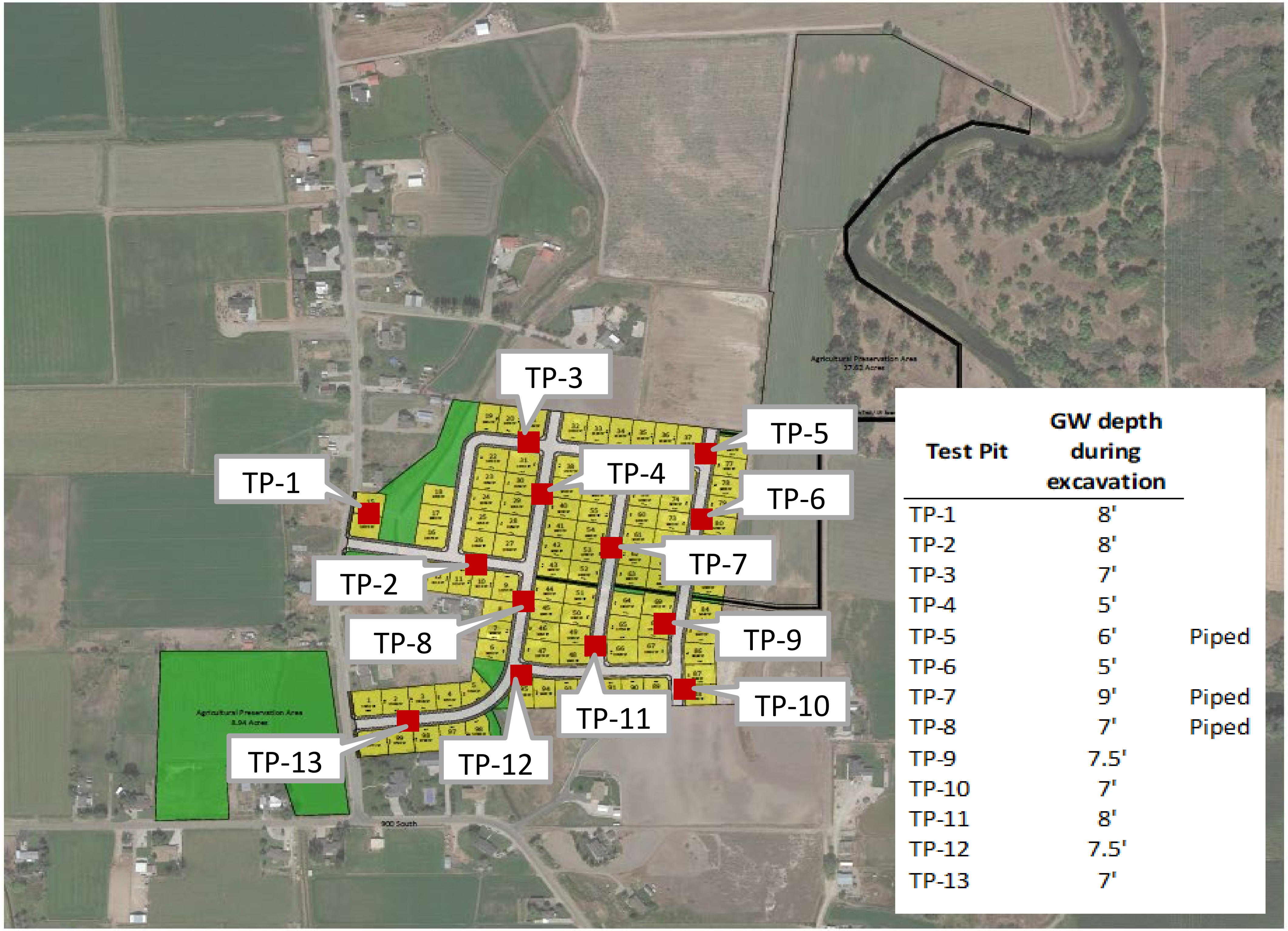
The recommendations provided herein were developed by evaluating the information obtained from the subsurface explorations and soils encountered therein. The exploration logs reflect the subsurface conditions only at the specific location at the particular time designated on the logs. Soil and ground water conditions may differ from conditions encountered at the actual exploration locations. The nature and extent of any variation in the explorations may not become evident until during the course of construction. If variations do appear, it may become necessary to re-evaluate the recommendations of this report after we have observed the variation.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

We appreciate the opportunity to be of service to you on this project. If we can be of further assistance or if you have any questions regarding this project, please do not hesitate to contact us at (801) 590-0394. To schedule materials testing, please call (801) 381-5141.

APPENDIX

SUPPORTING DOCUMENTATION



Test Pit	GW depth during excavation	
TP-1	8'	
TP-2	8'	
TP-3	7'	
TP-4	5'	
TP-5	6'	Piped
TP-6	5'	
TP-7	9'	Piped
TP-8	7'	Piped
TP-9	7.5'	
TP-10	7'	
TP-11	8'	
TP-12	7.5'	
TP-13	7'	

Acres:	69.14
Agricultural Acres:	36.56
Development Acres:	32.58
Net Development Acres:	61.55
No. of Lots Permitted:	67
Density Bonus Requested:	50%
No. of Density Bonus Lots:	33
Total No. of Lots Proposed:	100

Ed Grampp
(801) 633-9605
edgrampp@gmail.com
April 9, 2021

North
0 400

Stephen G. McCutchon
Land Developer / Land Planner
PO Box 382
Draper, UT 84020
(801) 557-6945
stevemplan@gmail.com
www.stevemplandevelopment.com

CMT ENGINEERING LABORATORIES

West Weber Development
About 800 South 3600 West, West Weber, Utah

SITE PLAN

Date:	28-Apr-2021
CMT No.:	16394

Figure:
1

West Weber Development

About 800 South 3600 West, West Weber, Utah

Test Pit Log

TP-1

Total Depth: 12'
Water Depth: 8'

Date: 4/23/21
Job #: 16394

Depth (ft)	GRAPHIC LOG	Soil Description		Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation			Atterberg		
								Gravel %	Sand %	Fines %	LL	PL	PI
0	⁖⁖⁖	Topsoil											
	▨	Brown to Grayish-Brown Lean CLAY (CL)											
	▨		moist, medium stiff										
2	▨			■	1								
4	▨			■	2	24	98						
6	▨												
	▨	grades blue-ish gray	soft to medium stiff	■	3								
▽ 8	▨		wet										
	▨	grades light brown											
10	▨			■	4								
12		END AT 12'											
14													
16													
18													
20													
22													
24													
26													
28													

Remarks: Groundwater encountered during excavation at depth of 8 feet.

Coordinates: °, °
Surface Elev. (approx): Not Given

Equipment: Rubber Tire Backhoe
Excavated By: Rockwell
Logged By: Sterling Howell

Figure:
2

CMT ENGINEERING LABORATORIES

Page: 1 of 1

West Weber Development

About 800 South 3600 West, West Weber, Utah

Test Pit Log

TP-2

Total Depth: 12'
Water Depth: 8'

Date: 4/23/21
Job #: 16394

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation Gravel %	Sand %	Fines %	Atterberg LL	PL	PI
0	░	Topsoil										
	▨	Light Reddish-Brown Lean CLAY (CL) moist, stiff										
2	▨		■	5								
4	▨											
	▨		■	6								
6	▨											
▽ 8	▨	grades light grayish-brown wet soft										
10	▨		▯	7	27	97						
	▨	grades blue-ish brown										
	▨		■	8								
12		END AT 12'										
14												
16												
18												
20												
22												
24												
26												
28												

Remarks: Groundwater encountered during excavation at depth of 8 feet.

Coordinates: °, °
Surface Elev. (approx): Not Given

Equipment: Rubber Tire Backhoe
Excavated By: Rockwell
Logged By: Sterling Howell

Figure:
3

CMT ENGINEERING LABORATORIES

West Weber Development

About 800 South 3600 West, West Weber, Utah

Test Pit Log

TP-3

Total Depth: 11.5'
Water Depth: 7'

Date: 4/23/21
Job #: 16394

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation Gravel %	Sand %	Fines %	Atterberg LL	PL	PI
0		Topsoil										
		Reddish-Brown Lean CLAY (CL) moist to very moist, stiff										
2												
			■	9	24	95			99	38	18	20
4												
			■	10								
6												
▽		wet										
8			‖	11								
		Blue-ish Gray Sandy CLAY (CL) soft										
10												
		Blue-ish Gray Silty SAND (SM) wet, medium dense	◢	12								
		END AT 11.5'										
12												
14												
16												
18												
20												
22												
24												
26												
28												

Remarks: Groundwater encountered during excavation at depth of 7 feet.

Coordinates: °, °
Surface Elev. (approx): Not Given

Equipment: Rubber Tire Backhoe
Excavated By: Rockwell
Logged By: Sterling Howell

Figure:
4

CMT ENGINEERING LABORATORIES

West Weber Development

About 800 South 3600 West, West Weber, Utah

Test Pit Log

TP-4

Total Depth: 12'
Water Depth: 5'

Date: 4/23/21
Job #: 16394

Depth (ft)	GRAPHIC LOG	Soil Description		Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation			Atterberg		
								Gravel %	Sand %	Fines %	LL	PL	PI
0	⁘	Topsoil											
	▨	Reddish-Brown to Brown Lean CLAY (CL)											
2	▨		slightly moist to moist, stiff	■	13								
4	▨												
▽													
	⁘	Light Brown Silty Fine SAND (SM)	wet loose										
6	⁘			▯	14	28	93			41			NP
	▨	Blue-ish Gray Lean CLAY (CL)											
8	▨		moist, medium stiff to stiff										
	▨			■	15								
10	⁘	Dark Gray Poorly Graded Coarse SAND (SP)	wet medium dense										
	⁘			◢	16								
12		END AT 12'											
14													
16													
18													
20													
22													
24													
26													
28													

Remarks: Groundwater encountered during excavation at depth of 5 feet.

Coordinates: °, °
Surface Elev. (approx): Not Given

Equipment: Rubber Tire Backhoe
Excavated By: Rockwell
Logged By: Sterling Howell

CMT ENGINEERING LABORATORIES

Page: 1 of 1

Figure: 5

West Weber Development

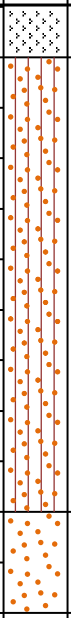
About 800 South 3600 West, West Weber, Utah

Test Pit Log

TP-5

Total Depth: 12'
Water Depth: 6'

Date: 4/23/21
Job #: 16394



Depth (ft)	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation Gravel %	Gradation Sand %	Gradation Fines %	Atterberg LL	Atterberg PL	Atterberg PI
0	Topsoil										
1	Light Orange Brown Silty Fine SAND (SM) with some cementation slightly moist, medium dense										
2		◢	17	9				30			NP
	grades light brown moist										
4		◢	18								
6 ▽	wet loose	‖	19	27	91			43			
	grades light olive brown										
8		◢	20								
10	Dark Blue-ish Gray Poorly Graded Coarse SAND (SP) wet, medium dense										
11		◢	21								
12	END AT 12'										
14											
16											
18											
20											
22											
24											
26											
28											

Remarks: Groundwater encountered during excavation at depth of 6 feet.

Coordinates: °, °
Surface Elev. (approx): Not Given

Equipment: Rubber Tire Backhoe
Excavated By: Rockwell
Logged By: Sterling Howell

CMT ENGINEERING LABORATORIES

Page: 1 of 1

Figure:
6

West Weber Development

About 800 South 3600 West, West Weber, Utah

Test Pit Log TP-6

Total Depth: 12'
Water Depth: 5'

Date: 4/23/21
Job #: 16394

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation Gravel %	Sand %	Fines %	Atterberg LL	PL	PI
0		Topsoil										
		Light Orange Brown Sandy Silt to Silty Fine Sand (ML-SM) slightly moist to moist, loose to medium dense										
2			◢	22	9				33			NP
		Light Reddish-Brown Silty SAND (SM) moist to very moist, loose to medium dense										
4			◢	23								
▽		wet										
6												
8		Blue-ish Gray Silty to Poorly Graded SAND (SM-SP) medium dense										
			◢	24								
10												
			◢	25								
12		END AT 12'										
14												
16												
18												
20												
22												
24												
26												
28												

Remarks: Groundwater encountered during excavation at depth of 5 feet.

Coordinates: °, °
Surface Elev. (approx): Not Given

Equipment: Rubber Tire Backhoe
Excavated By: Rockwell
Logged By: Sterling Howell

CMT ENGINEERING LABORATORIES

Page: 1 of 1

Figure: 7

West Weber Development

About 800 South 3600 West, West Weber, Utah

Test Pit Log

TP-7

Total Depth: 11'
Water Depth: 9'

Date: 4/23/21
Job #: 16394

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		Topsoil										
		Brown to Dark Brown Lean (CL) slightly moist, very stiff to hard										
2			■	26	13	106				43	18	25
		Light Brown Silty SAND (SM) moist to very moist, medium dense										
4			◢	27								
8			◢	28								
▽		wet										
		Blue-ish Gray Silty to Poorly Graded SAND (SM-SP) wet, medium dense										
10			◢	29								
		END AT 11'										

Remarks: Groundwater encountered during excavation at depth of 9 feet.

Coordinates: °, °
Surface Elev. (approx): Not Given

Equipment: Rubber Tire Backhoe
Excavated By: Rockwell
Logged By: Sterling Howell

CMT ENGINEERING LABORATORIES

Figure:
8

West Weber Development

About 800 South 3600 West, West Weber, Utah

Test Pit Log

TP-8

Total Depth: 11.5'
Water Depth: 7'

Date: 4/23/21
Job #: 16394

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		Topsoil										
		Reddish Light Brown Lean CLAY (CL) slightly moist to moist, stiff										
2												
			■	30								
4												
			■	31								
6												
▽		Light Brown Silty Fine SAND (SM) wet loose										
8			‖	32								
		Light Brown to Gray Lean CLAY (CL) wet, soft to very soft										
10												
			‖	33								
		END AT 11.5'										
12												
14												
16												
18												
20												
22												
24												
26												
28												

Remarks: Groundwater encountered during excavation at depth of 7 feet.

Coordinates: °, °
Surface Elev. (approx): Not Given

Equipment: Rubber Tire Backhoe
Excavated By: Rockwell
Logged By: Sterling Howell

CMT ENGINEERING LABORATORIES

Page: 1 of 1

Figure:
9

West Weber Development

About 800 South 3600 West, West Weber, Utah

Test Pit Log

TP-9

Total Depth: 8.5'
Water Depth: 7.5'

Date: 5/7/21
Job #: 16394

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		3" Topsoil										
	▨	Brown CLAY (CL) with silt										
2	▨											
	▨		■	34	15	91						
4		Brown to Brown/Gray SAND (SP-SM) with silt										
6												
▽			◣	35								
8		wet										
		END AT 8.5'										
10												
12												
14												
16												
18												
20												
22												
24												
26												
28												

Remarks: Groundwater encountered during excavation at depth of 7.5 feet.

Coordinates: °, °
Surface Elev. (approx): Not Given

Equipment: Rubber Tire Backhoe
Excavated By: CMT Engineering
Logged By: Nate Pack

Figure:
10

CMT ENGINEERING LABORATORIES

West Weber Development

About 800 South 3600 West, West Weber, Utah

Test Pit Log

TP-10

Total Depth: 8.5'
Water Depth: 7'

Date: 5/7/21
Job #: 16394

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		3" Topsoil										
2		Brown CLAY (CL)										
			■	36	18	99						
4		Brown SAND (SP-SM) with silt										
6		Gray Sandy SILT (ML)	■	37	15	104			87			NP
▽		wet										
8			◣	38								
		END AT 8.5'										
10												
12												
14												
16												
18												
20												
22												
24												
26												
28												

Remarks: Groundwater encountered during excavation at depth of 7 feet.

Coordinates: °, °
Surface Elev. (approx): Not Given

Equipment: Rubber Tire Backhoe
Excavated By: CMT Engineering
Logged By: Nate Pack

CMT ENGINEERING LABORATORIES

Figure:

11

West Weber Development

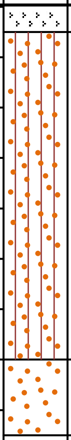
About 800 South 3600 West, West Weber, Utah

Test Pit Log

TP-11

Total Depth: 8.5'
Water Depth: 8'

Date: 5/7/21
Job #: 16394



Depth (ft)	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation Gravel %	Sand %	Fines %	Atterberg LL	PL	PI
0	3" Topsoil										
	Brown to Dark Brown Silty SAND (SM) moist, medium dense										
2	grades brown to light brown										
		◣	39	12				37			
4											
6		◣	40								
	Brown SAND (SP) with trace silt										
▽ 8	wet	◣	41								
	END AT 8.5'										
10											
12											
14											
16											
18											
20											
22											
24											
26											
28											

Remarks: Groundwater encountered during excavation at depth of 8 feet.

Coordinates: °, °
Surface Elev. (approx): Not Given

Equipment: Rubber Tire Backhoe
Excavated By: CMT Engineering
Logged By: Nate Pack

Figure:
12

CMT ENGINEERING LABORATORIES

West Weber Development

About 800 South 3600 West, West Weber, Utah

Test Pit Log

TP-12

Total Depth: 8.5'
Water Depth: 7.5'

Date: 5/7/21
Job #: 16394

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation Gravel %	 Sand %	 Fines %	Atterberg LL	 PL	 PI
0	⁘	6" Topsoil										
	▨	Dark Brown CLAY (CL) with trace silt moist, very stiff										
2	▨											
	▨		■	42	27	92						
4	▨											
	⁙	Brown SAND (SP) moist, medium dense										
6	⁙		■	43								
∇	⁙	wet										
8	⁙		◣	0.5								
		END AT 8.5'										
10												
12												
14												
16												
18												
20												
22												
24												
26												
28												

Remarks: Groundwater encountered during excavation at depth of 7.5 feet.

Coordinates: °, °
Surface Elev. (approx): Not Given

Equipment: Rubber Tire Backhoe
Excavated By: CMT Engineering
Logged By: Nate Pack

CMT ENGINEERING LABORATORIES

Figure:
13

West Weber Development

About 800 South 3600 West, West Weber, Utah

Test Pit Log TP-13

Total Depth: 8.5'
Water Depth: 7'
Date: 5/7/21
Job #: 16394

Depth (ft)	GRAPHIC LOG	Soil Description		Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation Gravel %	Sand %	Fines %	Atterberg LL	PL	PI
0		6" Topsoil	disturbed										
		Brown to Dark Brown Silty SAND (SM)	moist, medium dense										
2		grades brown to light brown											
				◣	1.5								
4													
		Brown SAND (SP) with trace silt		◣	2.5								
6													
▽			wet										
8													
		END AT 8.5'											
10													
12													
14													
16													
18													
20													
22													
24													
26													
28													

Remarks: Groundwater encountered during excavation at depth of 7 feet.

Coordinates: °, °
Surface Elev. (approx): Not Given

Equipment: Rubber Tire Backhoe
Excavated By: CMT Engineering
Logged By: Nate Pack

Figure: 14

CMT ENGINEERING LABORATORIES

West Weber Development

Key to Symbols

About 800 South 3600 West, West Weber, Utah

Date: 4/23/21

Job #: 16394

①	②	③	④	⑤	⑥	⑦	⑧ Gradation			Atterberg		
Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI

COLUMN DESCRIPTIONS

Depth (ft.): Depth (feet) below the ground surface (including groundwater depth - see water symbol below).

Graphic Log: Graphic depicting type of soil encountered (see below).

Soil Description: Description of soils encountered, including Unified Soil Classification Symbol (see below).

Sample Type: Type of soil sample collected at depth interval shown; sampler symbols are explained below-right.

Sample #: Consecutive numbering of soil samples collected during field exploration.

Moisture (%): Water content of soil sample measured in laboratory (percentage of dry weight of sample).

Dry Density (pcf): The dry density of a soil measured in laboratory (pounds per cubic foot).

Gradation: Percentages of Gravel, Sand and Fines (Silt/Clay), obtained from lab test results of soil passing the No. 4 and No. 200 sieves.

Atterberg: Individual descriptions of Atterberg Tests are as follows:

LL = Liquid Limit (%): Water content at which a soil changes from plastic to liquid behavior.

PL = Plastic Limit (%): Water content at which a soil changes from liquid to plastic behavior.

PI = Plasticity Index (%): Range of water content at which a soil exhibits plastic properties (= Liquid Limit - Plastic Limit).

STRATIFICATION	
Description	**Thickness**
Seam	Up to ½ inch
Lense	Up to 12 inches
Layer	Greater than 12 in.
Occasional	1 or less per foot
Frequent	More than 1 per foot

MODIFIERS
Trace
<5%
Some
5-12%
With
> 12%

MOISTURE CONTENT
Dry: Absence of moisture, dusty, dry to the touch.
Moist: Damp / moist to the touch, but no visible water.
Wet: Visible water, usually soil below groundwater.

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			USCS SYMBOLS		TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS More than 50% of material is larger than No. 200 sieve size.	**GRAVELS** The coarse fraction retained on No. 4 sieve.	**CLEAN GRAVELS** (< 5% fines)	GW		Well-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines
			GP		Poorly-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines
		GRAVELS WITH FINES (≥ 12% fines)	GM		Silty Gravels, Gravel-Sand-Silt Mixtures
			GC		Clayey Gravels, Gravel-Sand-Clay Mixtures
	SANDS The coarse fraction passing through No. 4 sieve.	**CLEAN SANDS** (< 5% fines)	SW		Well-Graded Sands, Gravelly Sands, Little or No Fines
			SP		Poorly-Graded Sands, Gravelly Sands, Little or No Fines
		SANDS WITH FINES (≥ 12% fines)	SM		Silty Sands, Sand-Silt Mixtures
			SC		Clayey Sands, Sand-Clay Mixtures
FINE-GRAINED SOILS More than 50% of material is smaller than No. 200 sieve size.	**SILTS AND CLAYS** Liquid Limit less than 50%		ML		Inorganic Silts and Sandy Silts with No Plasticity or Clayey Silts with Slight Plasticity
			CL		Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
			OL		Organic Silts and Organic Silty Clays of Low Plasticity
	SILTS AND CLAYS Liquid Limit greater than 50%		MH		Inorganic Silts, Micacious or Diatomacious Fine Sand or Silty Soils
			CH		Inorganic Clays of High Plasticity, Fat Clays
			OH		Organic Silts and Organic Clays of Medium to High Plasticity
HIGHLY ORGANIC SOILS			PT		Peat, Soils with High Organic Contents

Note: Dual Symbols are used to indicate borderline soil classifications (i.e. GP-GM, SC-SM, etc.).

SAMPLER SYMBOLS

- Block Sample
- Bulk/Bag Sample
- Modified California Sampler 3.5" OD, 2.42" ID
- D&M Sampler
- Rock Core
- Standard Penetration Split Spoon Sampler
- Thin Wall (Shelby Tube)

WATER SYMBOL

- ▽ Encountered Water Level
- ▼ Measured Water Level

(see Remarks on Logs)

1. The results of laboratory tests on the samples collected are shown on the logs at the respective sample depths.
2. The subsurface conditions represented on the logs are for the locations specified. Caution should be exercised if interpolating between or extrapolating beyond the exploration locations.
3. The information presented on each log is subject to the limitations, conclusions, and recommendations presented in this report.

CMT ENGINEERING LABORATORIES

Figure:

15