CMT TECHNICAL SERVICES

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

PRELIMINARY GEOTECHNICAL ENGINEERING STUDY

Proposed Crimson Flats Development

About 1500 South Main Street
Nephi, Utah
CMT PROJECT NO. 21343

FOR:
Wall Consultant Group
2139 South 1260 West
Salt Lake City, Utah 84119

January 24, 2024

January 24, 2024

Mr. Isaac Riches, PE
Wall Consultant Group
2139 South 1260 West
Salt Lake City, Utah 84119

Subject: Geotechnical Engineering Study
Proposed Crimson Flats Development
About 1500 South Main Street
Nephi, Utah
CMT Project Number: 1484621343

Mr. Riches:

Submitted herewith is the report of our preliminary 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 December 18 and 19, 2023, a CMT Technical Services (CMT) staff professional was on-site and observed the drilling of 13 bore holes extending to depths of about 11.5 to 40.0 feet below the existing ground surface and the excavation of 12 test pits extending to depths of about 8.0 to 11.0 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.

Potentially collapsible soils were encountered within the upper, about 8 feet of surficial soils often visually containing rootholes and pinholes as well as low in place density. The depth and lateral extent of these potentially collapsible soils vary across the site. Conventional spread and/or continuous footings may be utilized to support the proposed structure, provided the recommendations in this report are followed. This report presents detailed discussions of design and construction criteria for this site.

Sincerely,
CMT Technical Services

LICENSED PROFESSIONAL ENGINEER
276478
BRYAN N. ROBERTS
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Bryan N. Roberts, P.E.
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Reviewed by:

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Geotechnical Division Manager

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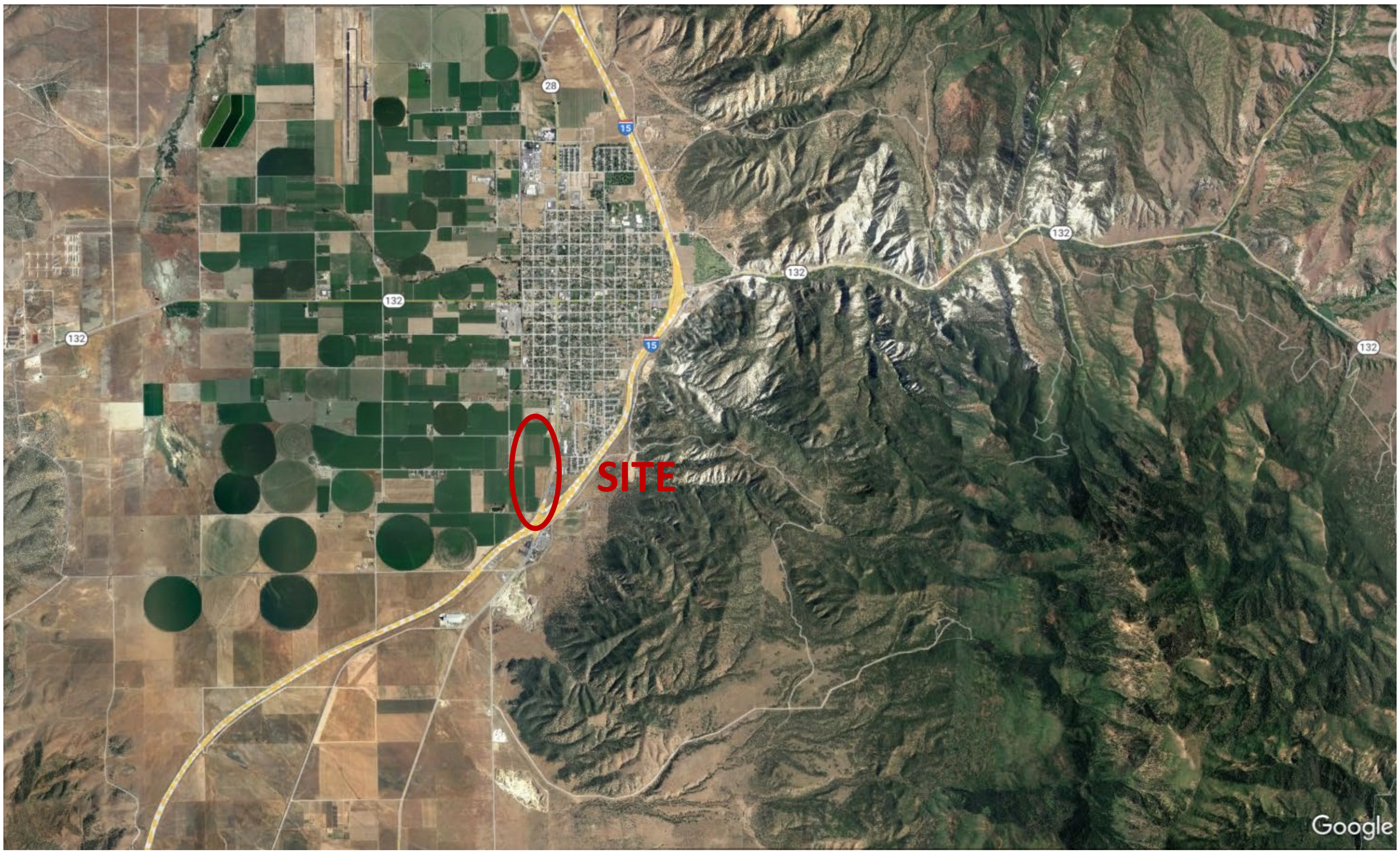
APPENDIX

1.0 INTRODUCTION

1.1 General

CMT Technical Services (CMT) was retained to conduct a preliminary geotechnical subsurface study for the proposed Crimson Flats Development located about 1500 South Main Street in Nephi, 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. Isaac Riches of Wall Consultant Group, and Mr. Andrew Harris of CMT. In general, the objectives of this study were to generally define and evaluate the subsurface soil and groundwater conditions at the site, and provide preliminary 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 drilling/logging/sampling of 13 bore holes, excavating/logging/sampling of 12 test pits, performing laboratory testing on representative samples of the subsurface soils collected in the bore hole and 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 September 29, 2023.

1.3 Description of Proposed Construction

We understand that a commercial development is currently being planned for the parcels totaling approximately 70-acres. The development will likely consist of commercial and retail structures, baseball diamonds, a hotel, and Nephi City Police Station. Though the exact configuration of the development has not yet been determined, we anticipate that the structures will likely be 1 to 4 levels above grade, constructed using conventional wood/light metal, reinforced masonry, and/or steel post/beam construction methods, founded on spread footings with slab on grade floors established at or near existing site grades We project that wall loads will not exceed 7,000 pounds per linear foot and column loads will not exceed 200,000 pounds. Floor slab loads are anticipated to be relatively light, with an average uniform loading not exceeding 150 pounds per square foot. 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.

We also understand that pavements at the site will likely include light-duty parking areas and internal drive lanes, and public roadways which we anticipate will utilize primarily asphalt concrete as well as isolated Portland cement concrete pavements. Traffic is projected to consist of mostly automobiles and light trucks, a light volume of medium-weight delivery trucks, one to two weekly garbage trucks, and an occasional fire truck or heavy-weight 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 3 to 4 feet. If deeper cuts or fills are planned, CMT should be notified to provide additional recommendations, if needed.

1.4 Executive Summary

The most significant geotechnical aspects regarding site development include the following:

1. At each bore hole/test pit, we encountered a surficial layer of topsoil which we estimated to be about 12 inches in thickness. When stripping and grubbing, topsoil should be distinguished by the apparent organic content and not solely by color; thus, we estimate that topsoil stripping will need to include the upper about 8 inches. However, given the past agricultural uses of the site, the upper 12 to 15 inches may have been disturbed during farming and require some preparation following organic stripping.
2. Below the topsoil, natural soils were encountered and comprised primarily of brown silty/fine sandy CLAY (CL) with occasional brown fine sandy SILT (ML) and clayey/silty fine sand layers (SM,SC, SC-CL) roughly 2 to 5 feet thick extending to the full depth penetrated of 8 to 40 feet below the ground surface. The silt/clay soils were slightly moist to moist, medium stiff in consistency, based on blow

counts, and often exhibited a root hole/pinhole structure, poor bedding characteristics, and low unit weight within the upper about 8 feet. Laboratory results indicate that these surficial, low-density, fine-grained soils are susceptible to collapse or exhibit very low strength and high compressibility characteristics when wetted under loading (see section 3.3 Collapse-Consolidation Tests below). Below about 8 feet the natural soils begin to increase in density; rootholes and pinholes reduce, and laboratory testing indicates the collapse potential is diminished with moderate pre-consolidation and moderate strength characteristics. These low strength/potentially collapsible soils will be problematic for supporting structures and utilities.

3. Groundwater was not encountered within the exploration at the time of the field work and is not anticipated to affect planned construction.
4. Foundations and floor slabs may be constructed on suitable undisturbed natural soils structural/engineered fill which extends to suitable natural soils or structurally supported over an intermediate depth foundation system or ground improvements which are further discussed below.

CMT must assess that topsoil, undocumented fills, potentially collapsible soils, debris, disturbed or unsuitable soils have been removed and that suitable soils have been encountered/properly prepared prior to placing site grading fills, footings, slabs, and pavements.

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

2.0 FIELD EXPLORATION

2.1 General

In order to define and evaluate the subsurface soil and groundwater conditions, 13 bore holes were drilled at the site to depths of approximately 11.5 to 40.0 feet below the existing ground surface and 12 test pits were excavated with a small excavator at the site to depths of approximately 8.0 to 11.0 feet below the existing ground surface. Locations of the bore holes and 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.

Samples of the subsurface soils encountered in the bore holes were collected at varying depths through the hollow stem drill augers. Relatively undisturbed samples of the subsurface soils were obtained by driving a split-spoon sampler with 2.5-inch outside diameter rings/liners into the undisturbed soils below the drill augers. Disturbed samples were collected utilizing a standard split spoon sampler. This standard split spoon sampler was driven 18 inches into the soils below the drill augers using a 140-pound hammer free-falling a distance of 30 inches. The number of hammer blows needed for each 6-inch interval was recorded. The sum of the hammer blows for the final 12 inches of penetration is known as a standard penetration test and this ‘blow count’ was recorded on the bore hole logs. The blow count provides a reasonable approximation of the relative density of granular soils, but only a limited indication of the relative consistency of fine-grained soils because the consistency of these soils is significantly influenced by the moisture content.

Representative soil samples were collected by obtaining disturbed "grab" samples and cutting relatively undisturbed "block" samples from within each test pit. The samples were placed in sealed plastic bags and containers prior to transport to the laboratory.

The subsurface soils encountered in the bore holes and 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. Logs of the bore holes and test pits, including a description of the soil strata encountered, are presented on each individual Bore Hole/Test Pit Logs, ***Figures 2 through 26*** included in the Appendix. Sampling information and other pertinent data and observations are also included on the logs. In addition, a Key to Symbols defining the terms and symbols used on the logs is provided as ***Figure 27*** in the Appendix.

Neither groundwater nor saturated soils were observed within the bore holes and test pits during the field work. Groundwater is not anticipated to affect planned construction.

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/non-engineered fill and settlement of the backfill in the test pits over time should be anticipated. The bore holes were backfilled with auger cuttings.

2.2 Infiltration Testing

Falling-head infiltration testing was also performed as part of our field exploration at three separate locations across the site at a depth of about 5 feet below the existing ground surface. The testing consisted of excavation to about 5 feet below the ground surface and hand digging a small hole at the bottom of the excavation and filling the hand dug hole with water and measuring the rate of water drop over time. This process was repeated multiple times until subsequent readings were consistent. The results of the tests are tabulated below.

Location	Soil Type	Infiltration rate (minutes per inch)
I-1	Fine sandy CLAY (CL)	12
I-2	Fine Sandy CLAY (CL)	6
I-3	Fine Sandy CLAY (CL)	15

The rates presented above are expected to increase (become slower) over time due to siltation, thus we recommend an appropriate factor of safety be applied for design.

[1] American Society for Testing and Materials

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 Collapse-Consolidation, ASTM D-2435, Consolidation properties
6. Laboratory Compaction Test, ASTM D 1557, Modified Proctor density
7. California Bearing Ratio, ASTM D-2937, Subgrade support properties

3.2 Lab Summary

Laboratory test results are presented on the bore hole logs (***Figures 2 through 26***) and in the following **Lab Summary Table**:

LAB SUMMARY TABLE

BORE HOLE	DEPTH (feet)	SOIL CLASS	SAMPLE TYPE	MOISTURE CONTENT(%)	DRY DENSITY (pcf)	GRADATION			ATTERBERG LIMITS			LABORATORY VANE SHEAR psf
						GRAV.	SAND	FINES	LL	PL	PI	
B-1	7.5	CL	Rings	10.4			44	56.2				
B-2	10	SC-CL	SPT	5.7			51	49.4				
B-3	5	CL	Rings	9.0	93							
B-4	5	CL	SPT	7.5		1	33	66.4				
	7.5	CL	Rings	6.2					27	15	12	
	25	CL	Rings	14.2	99		24	76.3				6640
B-5	5	CL	Rings	14.1	76							
	15	CL	SPT	13.8			32	68.2				
B-6	7.5	CL	SPT	11.7	85		26	73.6				
B-7	15	CL	Rings	9.3	112							
B-9	2.5	CL	Rings	12.2	90							
	10	CL	Rings	8.6	107							
B-10	2.5	CL	SPT	11.3					33	18	15	
	7.5	CL	Rings	12.6	78							
B-12	5	CL	Rings	13.8	80							
	10	CL	Rings	5.7			51	49.4				
I-1	5	CL	Bag	8.9			39	61.1				
I-2	5	CL	Bag	11.0			22	78.4	30	18	12	
TP-1	2	CL	Bag	2.8		0	42	57.0				
	7.5	CL	Bag	11.6		0	22	77.9				
TP-2	2	CL	Block	9.6	84	0	26	73.5				
TP-4	2	CL	Bag			0	19	81.2	32	18	14	
TP-5	3	CL	BLock	15.6	63							
	5	CL	Bag	12.6		0	18	82.4				
TP-6	6	CL	Bag	13.2		0	21	79.0				
TP-7	9	CL	Block	11.8		0	22	78.2				
TP-9	7	CL	Block	14.7		0	33	67.1				
TP-10	4	CL	Block	19.1	75							
	8	CL	Block	22.0	78							
TP-11	6	CL	Block	15.1		1	35	64.2				
TP-12	5.5	CL	Bag	14.3		0	28	71.8	32	18	14	

3.3 Collapse-Consolidation Tests

To provide data necessary for our settlement analyses, a collapse-consolidation test was performed on each of 8 representative samples of the fine-grained soils encountered in the exploration borings.

The collapse portion of the test was performed in accordance with the following procedure:

1. Load sample at in-situ moisture content to specific axial pressure.

2. Measure and record axial deflection.
3. Saturate sample.
4. Measure and record resulting collapse.

The test results are tabulated below:

Borehole /Test Pit No.	Depth (feet)	Soil Type	Natural Dry Density (pcf)	Natural Moisture Content (%)	Axial Load When Saturated (psf)	Percent Collapse (-) or Swell (+)
B-3	5	CL	93	9	542	-1.8
B-4	7.5	CL	88	4.6	272	0*
B-7	15	CL	112	9.3	272	0
B-9	10	CL	107	8.6	2,000	0
B-10	7.5	ML	78	12.6	1,086	-7.6
B-12	5	CL	80	13.8	542	-2.9
TP-2	2	CL	84	9.6	542	-5.7
TP-10	8	CL	78	22	272	0*

* Exhibits very low strength and straight slope curve indicative of post-collapse type condition.

The results of the tests indicate that the near-surface fine sandy and silty CLAY soils within about the upper 8 feet are moderately collapsible and/or exhibit very low strength and high compressibility characteristics. These soils often exhibit a roothole/pinhole structure and have relatively low soil density.

Following the collapse portion of the test normal consolidation test loading was applied. Deeper samples tested such as at bore hole B-7 and B-8 exhibited moderate to moderately high strength and compressibility characteristics under loading.

Detailed results of the tests are maintained within our files and can be transmitted to you, at your request.

3.4 Compaction Test

A bulk sample of the near surface fine sandy CLAY was taken from bore hole B-4 at about 2 feet below the surface and a compaction test and subsequent California Bearing Ratio (CBR) test was performed on this sample. The compaction tests was completed in accordance with the (ASTM[2] D-1557) specifications.

Optimum Moisture Content (percent)	Maximum Dry Density (pcf)	USCS Soil Classification
14	113.7	CL

3.5 California Bearing Ratio (CBR) Test

To determine subgrade characteristics and to provide data for design of the proposed pavements, a California Bearing Ratio (CBR) test was performed on the bulk clay soil sample described above in section 3.4 Compaction Test. The results of the CBR test is presented below:

Moisture Content at Compaction (%)	Compacted Dry Density (PCF)	Percent Compaction	Percent Swell	Measured CBR @ 0.1/0.2
13.9	109.1	95.8	2.1	4/5

4.0 GEOLOGIC & SEISMIC CONDITIONS

4.1 Geologic Setting

The subject site is located in the east portion of Juab County in central Utah and ranges in elevation from approximately 5,092 to 5,138 feet above sea level. The site sits on the Basin and Range – Colorado Plateau Transitional Physiographic Province and is bounded by the San Pitch Mountains to the east and the Eastern Utah Desert Ranges on the west. The site is also 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) Annabella Graben Faults is part of the Intermountain Seismic Belt and follows the base of the Monroe Mountains to the southeast of the subject site. The Basin and Range-Colorado Plateau Transition Zone is a broad region in central Utah containing structural and stratigraphic characteristics of both the Basin and Range Province to the west and the Colorado Plateau province to the east. Essentially, extensional tectonics of the Basin and Range has been superimposed upon the adjacent coeval uplifted blocks of the Colorado Plateau and Middle Rocky Mountains. The result is that

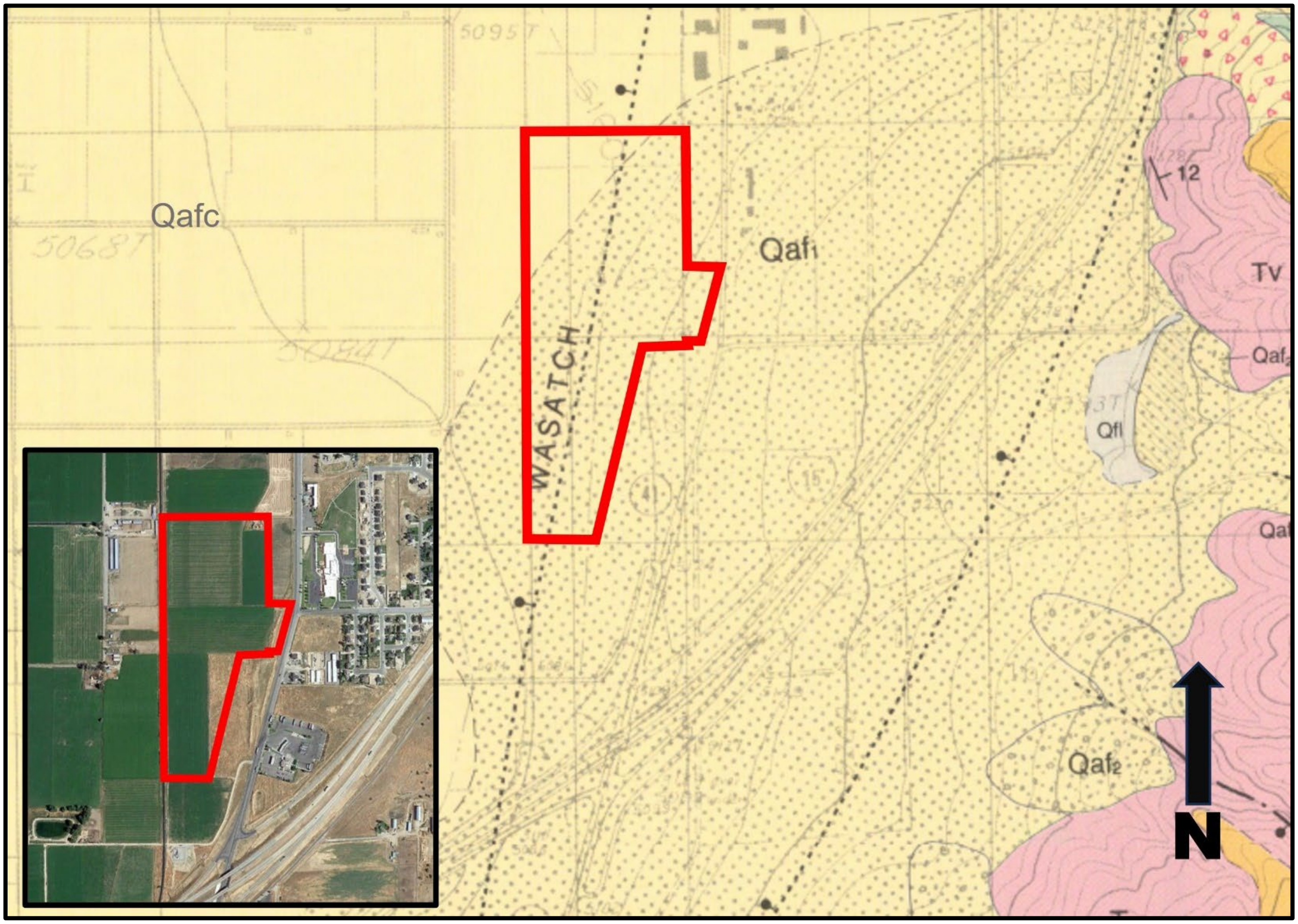
2 American Society for Testing and Materials

block faulting, the principal feature of the Basin and Range, extends tens of kilometers into the adjacent provinces forming a 100-km- (62 mi) wide zone of transitional tectonics, structure, and physiography[3].

Much of northwestern and some areas in south-central Utah -including Nephi-, was previously covered by the Pleistocene age Lake Bonneville. The Great Salt Lake, located to the northwest of the valley, is a remnant of this ancient freshwater lake. Lake Bonneville reached a high-stand elevation of approximately 5,160 and 5,200 feet above sea level 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 release, the lake level continued to drop slowly over time, until reaching the current level of the Great Salt Lake. Much of the sediment within the area previously covered by Lake Bonneville was deposited as lacustrine sediments during both the transgressive (rise) and regressive (fall) phases of this lake.

The geology of the Nephi, Utah, 7.5-minute Quadrangle, which includes the location of the subject site, has been mapped by Robert F. Biek[4]. The surficial geology at the location of the subject site and adjacent properties is mapped as “Level-1 alluvial-fan deposits” (Map Unit **Qaf$_1$**) and as “Coalesced alluvial-fan deposits” (Map Unit **Qafc**) both dated Quaternary in age. Unit **Qaf$_1$** is described in the referenced map as “Moderately to poorly sorted, locally derived material deposited at or near current base level near the mouths of canyons. Most fans are small and still actively forming.” Unit **Qafc** is described in the referenced map as “Poorly to moderately well-sorted boulder- to clay-sized material deposited in large alluvial fans extending into Juab Valley. The material is coarser near the mountain fronts and becomes finer grained toward the center of the valley.” (Refer to the **MAP**, shown below).

[3] Milligan, M. R., 2000, How Was Utah’s Topography Formed?; Utah Geological Survey. https://geology.utah.gov/map-pub/survey-notes/glad-you-asked/how-was-utahs-topography-formed/
4 Biek, R. F., 1991, Provisional Geologic Map of the Nephi Quadrangle, Juab County, Utah; Utah Geological Survey, Map 137, Plate 1, Map Scale 1:24,000. https://doi.org/10.34191/M-137



GEOLOGIC MAP

4.2 Faulting

No active surface fault rupture traces are mapped crossing, adjacent to, or projecting toward the site on the referenced geologic map. However, the nearest mapped active Holocene faults is the Nephi section of Wasatch Fault Zone approximately 1.11 miles northeast of the site[5].

4.3 Seismicity

4.3.1 Site Class

Utah has adopted the International Building Code IBC 2021 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 (and

[5] USGS, Faults: https://www.usgs.gov/programs/earthquake-hazards/faults

IBC 2021) Section 1613.2.2 refers to Chapter 20, Site Classification Procedure for Seismic Design, of ASCE[6] 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.

Our deepest bore hole extended to a depth of about 40 feet below the ground surface where refusal was encountered on very dense soil. However, relatively stiff, fine-grained soil were encountered in bore hole B-4 with laboratory vane shear testing of the clay soils having representative sampling blow counts indicates moderately high shear strength. Based on these findings and considering that similar soils are anticipated to a depth of 100 feet, it is our opinion the site best fits Site Class D – Stiff Soil Profile (with data), which we recommend for seismic structural design.

If desired and/or needed, CMT can perform a site-specific GMHA instead of using the higher exception values for design. Please contact CMT for a proposal to perform the GMHA.

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 39.691468 degrees north latitude and -111.839485 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 D (with data) soil profile:

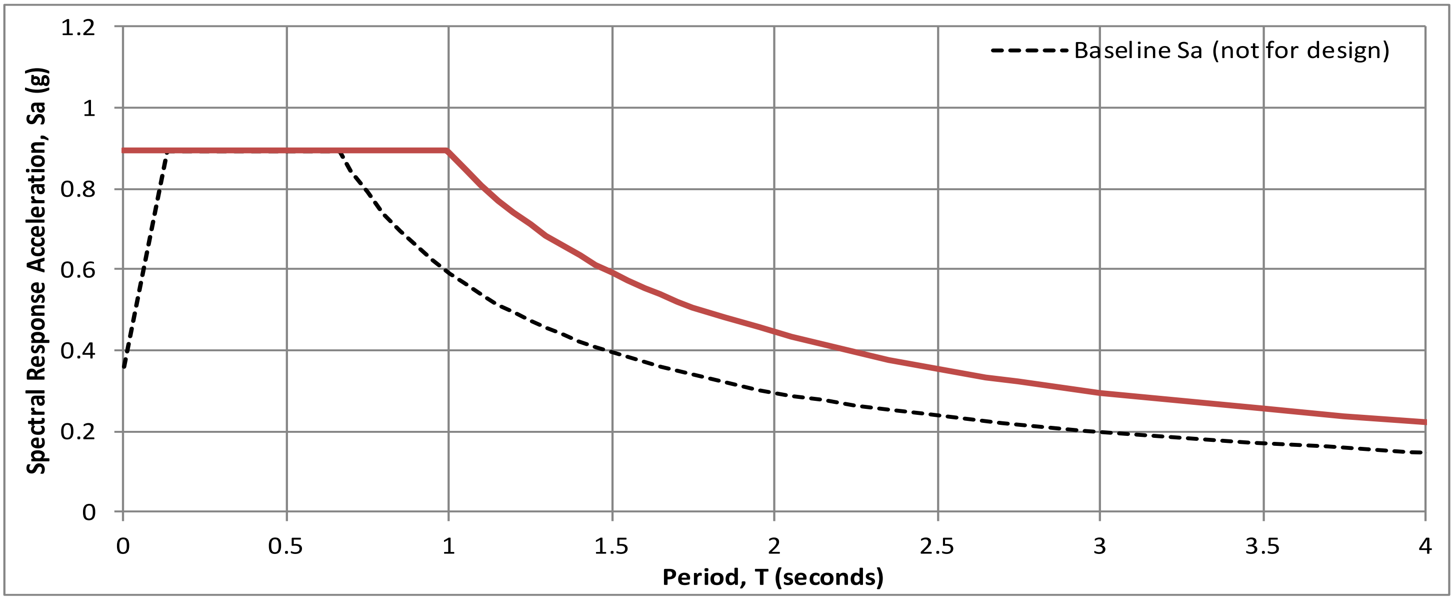
[6] American Society of Civil Engineers

SPECTRAL ACCELERATION PERIOD, T	SITE CLASS B/C BOUNDARY [mapped values] (g)	SITE COEFFICIENT	SITE CLASS D* [adjusted for site class effects] (g)	MULTI-PLIER	DESIGN VALUES (g)
Peak Ground Acceleration	PGA = **0.614**	F_{pga} = 1.100	PGA_M = 0.675	1.000	PGA_M = 0.675
0.2 Seconds (Long Period Acceleration)	S_S = **1.341**	F_a = 1.000	S_{MS} = 1.341	0.667	S_{DS} = 0.894
	(no exceptions needed)	F_a = (N/A)	S_{MS} = (N/A)	0.667	S_{DS} = (N/A)
1.0 Second (Long Period Acceleration)	S_1 = **0.491**	F_v = N/A	S_{M1} = N/A	0.667	S_{D1} = N/A
	(Exception 2:)	F_v = (1.809)	S_{M1} = (0.888)	0.667	S_{D1} = (0.592)

NOTES: 1. TL (seconds): **8**
2. Site Class: **D**
3. Have data to verify? **Yes**

*** Site Class D With Data**

4. ASCE 7-16 Requires Site-Specific Ground Motion Hazard Analysis (Since S1≥0.2 sec) - OR Can Use Exception 2 (per §11.4.8) (Sa/Cs Plot Assumes R=Ie=1.0)



As indicated in the above table, S_1 is greater than 0.2 seconds and a site-specific ground motion hazard analysis (GMHA) is required for the site, unless the Exception 2 values shown are used for seismic design. If a site-specific GMHA is desired instead of using the higher exception values for design, please contact CMT for a proposal to perform the GMHA.

4.3.3 Liquefaction

Liquefaction is defined as the condition when saturated, loose, sandy soils lose their support capabilities because of excessive pore water pressure which develops during a seismic event. Clayey soils, even if saturated, will generally not liquefy during a major seismic event.

Subsurface soils encountered consisted primarily of clay with plasticity indices greater than 7 percent (typically considered not liquefiable), and unsaturated sand soil layers to a depth of 40 feet indicative of low potential for liquefaction during a design seismic event.

4.4 Other Geologic Hazards

The site is not located on an active alluvial fan or an observed or mapped rock fall hazard area, and it is not at risk from debris flow or landslide hazards[7]. The site is located about 4.21 miles from a riparian zone[8].

5.0 SITE CONDITIONS

5.1 Surface Conditions

The site is currently undeveloped farmland comprised of multiple agricultural fields over an area of approximately 70-acres. The site slopes gently to the east at about 1 to 3 percent. Based upon aerial photos dating back to 1997 that are readily available on the internet, the site has not significantly changed. The site is bordered on the north, south, and east by similar vacant agricultural property and along the west by a Mavrick fuel station and Main Street (see **Vicinity Map** in **Section 1.1** above).

5.2 Subsurface Soils

At the locations of the bore holes and test pits, the upper about 12 inches consisted of topsoil/disturbed soils of CLAY base underlain by primarily brown silty/fine sandy CLAY (CL) with occasional brown fine sandy SILT (ML) and clayey/silty fine sand layers (SM,SC, SC-CL) roughly 2 to 5 feet thick extending to the full depth penetrated of about 8 to 40 feet below the ground surface.

The silt/clay soils were slightly moist to moist, medium stiff in consistency, based on blow counts, and often exhibited a root hole/pinhole structure, poor bedding characteristics, and low unit weight within the upper about 8 feet. Laboratory results indicate that these surficial, low-density, fine-grained soils are susceptible to collapse or exhibit very low strength and high compressibility characteristics when wetted under loading (see section 3.3 Collapse-Consolidation Tests above). Below about 8 feet the natural soils begin to increase in density; rootholes and pinholes grade less to none and laboratory testing indicates the collapse potential is diminished with moderate pre-consolidation and moderate strength characteristics.

The natural sand soils are slightly moist to moist and exhibit low to moderate density and strength characteristics with depth similar to the above described silt/clay soils. At depth they are anticipated exhibit moderately high strength and low compressibility characteristics.

For a more descriptive interpretation of subsurface conditions, please refer to the bore hole logs, ***Figures 2 through 26***, 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.

[7] Utah Geologic Hazards, https://geology.utah.gov/apps/hazards/
[8] Brighton Town, Municipal Services District, 2022; File # OAM2022-000545, Ordinance Amendment Related to Stream Setbacks in the Foothills and Canyons Overlay Zone. https://www.utah.gov/pmn/files/823335.pdf

5.3 Groundwater

Groundwater was not encountered at the time of our field explorations to the maximum depth explored of about 40 feet below the existing ground surface. Therefore, groundwater is not anticipated to affect the proposed construction.

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. 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/non-engineered fill and settlement of the backfill in the test pits over time should be anticipated.

Further, potentially collapsible soils were encountered, as described above, within upper approximately 8 feet across most of the site. However, the depth and lateral extent of these poor soils must be anticipated to vary across the site.

6.0 SITE PREPARATION AND GRADING

6.1 General

Based upon the conditions observed in the bore holes there is topsoil on the surface of the site which we estimated to be about 12 inches in thickness. When stripping and grubbing, topsoil should be distinguished by the apparent organic content and not solely by color; thus, we estimate that topsoil stripping will need to include the upper about 8 inches. However, given the past agricultural uses of the site, the upper 12 to 15 inches may have been disturbed during farming and require some preparation following organic stripping.

Non-engineered fills, if/where present must be removed below structures.

As discussed above, the surficial soils often exhibited a root hole/pinhole structure, poor bedding characteristics, and low unit weight within the upper about 8 feet. Laboratory results indicate that these surficial, low-density, fine-grained soils are susceptible to collapse when wetted under loading (visible collapse under varying loading conditions ranged from 1.8 to 7.6 percent, see section 3.3 Collapse-Consolidation Tests above) or at a minimum exhibit very low strength and high compressibility characteristics.

These low strength/potentially collapsible soils will be problematic for supporting structures and utilities. We recommend that they be completely removed from below building structures. An option may be to bypass these soils with an intermediate deep foundation system such as helical piers, micro piles or possible ground improvements such as Geopiers/stone columns or deep dynamic compaction. Deep dynamic compaction methods may be employed for larger areas but may not be practical or cost effective for smaller isolated areas. Once the individual building layouts become available, additional site-specific geotechnical exploration is recommended to further define the depth and lateral extent of these problematic surficial soils directly within the structural footprint.

For roadways we recommend preparing the upper 3 feet of existing soils by temporarily removing the upper 2 feet followed by scarifying, moisture conditioning the top, exposed 12 inches and recompacting to the requirements for structural fill as outlined in section **6.4 Fill Placement and Compaction** below. Following the compaction of the exposed soils we recommend installing a free draining separation geotextile fabric such as Mirafi 150N or equivalent across the compacted subgrade. Subsequently the removed 2 feet of soil, if free of deleterious material, may then be replaced in moisture conditioned lifts and compacted to the requirements for structural fill. Please note, however, that the surface soils consist primarily of fine-grained clay soils which are moisture sensitive (required tight moisture content control during compaction) and will require smaller lifts and significant effort to properly compact. This will be very difficult, if not impossible to achieve, during wet and cold periods of the year. An option may be to remove and replace with imported structural fill.

If more than about 2.5 feet of subsequent site grading fill is required over this prepared soil sequence, CMT must be notified to provide additional recommendations. The owner must be aware that some long-term movement and/or maintenance may be required where underlying, potentially collapsible soils remain unless they are completely removed.

Major utilities should be underlain by a minimum of 3 feet prepared structural soils or extend below potentially collapsible soils. Structural backfill above utilities should consist of a moderately low permeable soil (see section **6.4 Fill Material** below).

All excavations, where ground improvements or intermediate deep foundations are not utilized, must be observed by a geotechnical engineer to determine if the exposed soils are suitable and comply with the recommendations provided herein.

Fill placed over large areas to raise overall site grades can induce settlements in the underlying natural soils. If more than 3 feet of site grading fill is anticipated over the natural ground surface, we should be notified to assess potential settlements and provide additional recommendations as needed.

6.2 Temporary Excavations

Excavations deeper than about 8 feet are not anticipated at the site. Groundwater was not encountered within the depths explored, and thus is not anticipated to affect excavations.

The natural soils encountered at this site predominantly consisted of silt/clay. In clayey (cohesive) soils, temporary construction excavations not exceeding 4 feet in depth may be constructed with near-vertical side slopes. Temporary excavations up to 8 feet deep, above or below groundwater, may be constructed with side slopes no steeper than one-half horizontal to one vertical (0.5H:1V).

For sandy/gravelly (cohesionless) soils, temporary construction excavations not exceeding 4 feet in depth should be no steeper than one-half horizontal to one vertical (0.5H:1V). For excavations up to 8 feet and above groundwater, side slopes should be no steeper than one horizontal to one vertical (1H:1V). Excavations encountering saturated cohesionless soils will be very difficult to maintain, and will require very flat side slopes and/or shoring, bracing and dewatering.

To reduce disturbance of the natural soils during excavation, we recommend 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 fill that will ultimately be subjected to structural loads imposed by footings, floor slabs, pavements, etc. Structural fill will be required as backfill over foundations and utilities, as site grading fill, and potentially 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
Select Structural Fill	Placed below structures, flatwork and pavement. Well-graded sand/gravel mixture, with maximum particle size of 4 inches, a minimum 70% passing 3/4-inch sieve, a minimum 15% passing and a maximum 25% passing the No. 200 sieve (to reduce permeability where potentially collapsible soils are present), 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, a maximum 50% passing No. 200 sieve, and a maximum Plasticity Index of 15.
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 (see discussion below).
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 silt/clay soils are not suitable for use as structural fill, but may be used as site grading fill and non-structural fill. Note that these silt/clay soils are moisture-sensitive, which means they are inherently more difficult to work with in proper moisture conditioning (they are very sensitive to changes in moisture content), requiring very close moisture control during placement and compaction. <u>This will be very difficult, if not impossible, during wet and cold periods of the year</u>.

We also recommend the site grading fill thickness using on-site silt/clay soils be a maximum of 3 feet below structures, to minimize potential settlements.

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[9] 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 5 feet beyond the perimeter of structures, and below flatwork and pavement (applies to structural fill and site grading fill) extending at least 2 feet beyond the perimeter	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
Subgrade prep below pavement areas	3 feet	93
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

For the bedding zone around the utility, we recommend utilizing sand bedding fill material that meets current APWA[10] requirements.

[9] American Association of State Highway and Transportation Officials
[10] American Public Works Association

Above the bedding zone, we recommend that utility trench backfill have a minimum 15 to 25% fines, to reduce permeability (refer to **Section 6.3** above). In addition, utilities should be installed as close to the bottom of the potentially collapsible soils as reasonably possible.

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).

Where the utility does not underlie structurally loaded facilities and public rights of way, on-site fill and natural soils 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

The natural soils at this site will likely be susceptible to rutting and pumping. The likelihood of disturbance or rutting and/or pumping of the existing natural soils is a function of the soil moisture content, the load applied to the surface, as well as the frequency of the load. Consequently, rutting and pumping can be minimized by avoiding concentrated traffic, minimizing the load applied to the surface by using lighter equipment and/or partial loads, by working in drier times of the year, or by providing a working surface for the equipment. Rubber-tired equipment particularly, because of high pressures, promotes instability in moist/wet, soft soils.

If rutting or pumping occurs, traffic should be stopped and the disturbed soils should be removed and replaced with stabilization material. Typically, a minimum of 18 inches of the disturbed soils must be removed to be effective. However, deeper removal is sometimes required.

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**. This coarse material may be placed and worked into the soft soils until firm and non-yielding or the soft soils removed an additional, minimum of 18 inches, and backfilled with the clean stabilizing fill. A test area should be implemented to achieve a proper stabilization strategy. Often the amount of gravelly material can be reduced with the use of a geotextile fabric such as Mirafi RS280i or equivalent. Its use 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 and loading, the subsurface conditions observed in the field and the laboratory test data, as well as common geotechnical engineering practice.

7.1 Conventional Spread Foundation Recommendations Over Suitable Natural Soil

Based on our geotechnical engineering analyses, there are potentially collapsible soils within the upper about 8 feet. The proposed structures may be supported upon conventional spread and/or continuous wall foundations placed on suitable, undisturbed, *non-collapsible* natural soils and/or on structural fill extending to suitable natural soils. Footings may be designed using a net bearing pressure of 2,000 psf if placed on suitable, undisturbed, *non-collapsible,* natural soils.

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.

7.1.1 Installation

Under no circumstances shall foundations be placed directly on potentially collapsible soils, on undocumented fill, topsoil with organics, sod, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water.

Deep, large roots may be encountered where trees and larger bushes are located or were previously located at the site; such large roots should be removed. If unsuitable soils are encountered, they must be completely removed and replaced with properly compacted structural fill. Excavation bottoms should be examined by a CMT geotechnical engineer to confirm that suitable bearing soils have been exposed.

All structural fill should meet the requirements for such, and should 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.

The minimum thickness of structural fill below footings should be equivalent to one-third the thickness of structural fill below any other portion of the foundations where required replacement fill is 3 feet or more in any given area. For example, if the maximum depth of structural fill is 6 feet, all footings for the new structure should be underlain by a minimum 2 feet of structural fill.

7.1.2 Estimated Settlement

Foundations designed and constructed in accordance with our recommendations could experience some settlement, but we anticipate that total settlements of footings founded as recommended above will not exceed 1 inch, with differential settlements on the order of 0.5 inches over a distance of 25 feet. We expect approximately 50% of the total settlement to initially take place during construction.

7.2 Ground Improvements

Ground improvement methods such as geopiers/stone columns or possible deep dynamic compaction may be utilized to improve the upper surficial low-density soils for building support.

7.2.1 Geopier/Stone Columns

Geopier/stone column elements are a design-build product by a qualified contractor. Geopiers soil reinforcement elements are constructed by drilling a 24- or 30-inch diameter hole, removing a volume of soil, and then building a bottom bulb of clean, open-graded stone using a beveled, high-energy tamper. Stone columns are installed utilizing a vibrating mandral. Gravel is fed internally through the mandral to the bottom of the reinforced zone and the gravel consolidated with vibration.

Column lengths for this project will likely extend to estimated depths of approximately 10 to 15 feet from the existing ground surface. The result of construction is a reinforced zone of soil directly under footings that allows for the construction of shallow spread footings proportioned for a relatively high bearing pressure. Geopiers/stone column elements are spaced singly or in close groups to support concentrated column loads.

Geopiers/stone column soil reinforcement must be designed and constructed by licensed design-build companies. The installer should provide a Geopiers/stone column layout and detailed design calculations sealed by a professional engineer licensed in the State of Utah. The design calculations should demonstrate that the soil reinforcement is designed to control settlement to magnitudes within the individual building criteria.

Typically design net bearing pressure for spread footings installed over Geopiers/stone columns may be on the order of 4,000 to 5,000. Final design will be provided by the Geopiers/stone columns contractor selected.

7.2.1 Deep Dynamic Compaction (DDC)

Deep dynamic compaction (DDC) technique involves using a crane to drop weights of between 5 and 20 tons, from heights of up to 20 m. This method of ground improvement technique is best suited to large, open sites where few obstructions are present. Depending on the weight used and the drop height, the depth of treatment could vary. The number of drops, weights used, and the height of the drops depend on the required post treatment bearing capacity, settlement performance, and soil conditions. Compaction would be completed on a grid with subsequent structural backfill/site grading fill placement in order to bring the site up to grade following densification volume loss. This method of ground improvement is also typically a design-build product by a qualified contractor.

7.3 Intermediate Deep Foundations

To bypass the potentially collapsible soils, foundations and floor slabs may be structurally supported on an intermedium deep foundation such as helical piers or micro piles.

7.3.1 Helical Piers

Helical piers can be configured with various numbers and sizes of helices by which the capacity and required depth of embedment may be optimized for particular subsurface conditions. *The optimum lead helix configuration and final bearing depths are best determined by a test installation after the design loads have been determined prior to preparing the final bid package.* A test installation is relatively inexpensive, and the materials are able to be re-used and, typically, not included in the cost of the test. Further, the installation of helical piers is fairly quick and once installed footing construction may begin immediately.

Helical pier capacity can be verified in the field by measuring the installation torque. The relationship between the 2 quantities is empirical and may be expressed by the following equation:

ultimate capacity (lbs) = 10 x installation torque (ft-lbs)

A bearing depth for helical piers is not readily apparent from the boring data. Based on blow counts in boring B-4 the soils may not become sufficiently stiff/dense until about 35 feet below the ground surface. This bearing depth is likely to vary across a given site and therefore test piers are recommended before full design and installation.

7.3.2 Micro Piles

Micropiles consist of small diameter (typically less than 12 inches in diameter) deep foundation elements constructed using high-strength, small-diameter steel casing and/or threaded bars with grout.

Micropiles resist compressive, uplift, and lateral loads through side friction and end bearing. Micropiles are spaced singly or in close groups to support concentrated column loads and are typically designed by specialty subcontractors.

<u>Prior to production, it will be critical that 3 or more test piles be installed and loaded to verify design capacities.</u> This foundation system would also fall under design-build construction by a qualified contractor.

Representatives of CMT would be more than happy to sit down with representatives of the design-build team and contractors to further discuss the available options.

7.4 Lateral Resistance

For spread footings the 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 select granular 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 350 pcf. A combination of passive earth resistance and friction may be utilized if the passive resistance component of the total is divided by 1.5.

Lateral resistance for other foundation alternatives will cover from the individual design of opposing structural elements.

8.0 LATERAL EARTH PRESSURES

The lateral earth pressure values given below are for a backfill material that will consist of drained on-site soils or imported structural fill placed and compacted in accordance with the recommendations presented herein.

The lateral pressures imposed upon subgrade facilities will depend upon the relative rigidity and movement of the backfilled structure. Following are the recommended lateral pressure values, which also assume that the soil surface behind the wall is horizontal and that the backfill within 3 feet of the wall will be compacted with hand-operated compacting equipment. We anticipated below grade walls to be less than 12 feet high and therefore employing a seismic at-rest lateral earth pressure for design is not needed.

CONDITION	STATIC (psf/ft)*	SEISMIC (psf/ft)**
Active Pressure (wall is allowed to yield, i.e. move away from the soil, with a minimum 0.001H movement/rotation at the top of the wall, where "H" is the total height of the wall)	43	47
At-Rest Pressure (wall is not allowed to yield)	64	N/A
Passive Pressure (wall moves into the soil)	350	195

*Equivalent Fluid Pressure (applied at 1/3 Height of Wall)
**Equivalent Fluid Pressure (added to static and applied at 1/3 Height of Wall)

9.0 FLOOR SLABS

Floor slabs may be structurally supported or established upon suitable, non-collapsible, undisturbed, natural soils and/or on structural fill extending to suitable natural soils (same as for foundations). Floor slabs shall not be established over frozen soils or within ponded water.

Properly engineered floor slabs should be established upon uniform, compacted bearing soils or structural supported.

To help control normal shrinkage and stress cracking, the floor slab thickness and joint layout should be designed by a qualified engineer. Design provisions should address the following features:

1. Adequate reinforcement for the anticipated floor loads;
2. Using smooth bar reinforcement for load transfer through interior floor joints;
3. Portland cement concrete mix design selection to minimize shrinkage concerns;
4. Joint layout and spacing in accordance with ACI[11] or other local standards recommendations; and
5. Properly isolate floor slabs from foundations and other structural elements per recommendations provided by ACI 302 (Guide to Concrete Floor and Slab Construction).

10.0 DRAINAGE RECOMMENDATIONS

Some of the on-site near-surface silty/clayey soils are potentially collapsible when subjected to water under loading, thus it is very 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 the structure should be sloped to provide drainage away from the foundations. We recommend a minimum slope of 6 inches in the first 10 feet away from the structure. This slope should be maintained throughout the lifetime of 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. Landscape sprinklers should be aimed away and maintained a distance of at least 4 feet, from the foundation walls. The sprinkling systems should be designed with proper drainage and be well-maintained. Over watering should be avoided.

5. Detention/retention basins must be located well away and down gradient of buildings and infrastructure.

6. Other precautions that may become evident during construction.

[11] American Concrete Institute

11.0 PAVEMENTS

All pavement areas must be prepared as discussed above in **Section 6.1**. We anticipate the natural silt/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 is based upon a California Bearing Ratio (CBR) of 3 for the natural silt/clay soils. Given the projected traffic as discussed above in **Section 1.3**, the following pavement sections are recommended for the given ESAL's (18-kip equivalent single-axle loads) per day:

Light Vehicle Traffic and Internal Drives

MATERIAL	PAVEMENT SECTION THICKNESS (inches)					
	LIGHT VEHICLE PARKING AREAS (1-2 ESAL per day)			INTERNAL DRIVE AREAS (4-6 ESAL'S per day)		
Asphalt	3	3	---	3.5	3.5	---
PC Concrete	---	---	6	---	---	6
Road-Base	9	4	5	11	6	6
Subbase	---	7	0	---	7	0
Total Thickness	12	14	11	14.5	16.5	12

Main Access Drives And Loading Zones

MATERIAL	PAVEMENT SECTION THICKNESS (inches)			
	(up to 12 ESAL per day)			
Asphalt	3.5	3.5	4	---
PC Concrete	---	---	---	6.5
Road-Base	14	8	12	7
Subbase	0	8	0	0
Total Thickness	17.5	19.5	16	13.5

The above sections are estimated and should be refined once project traffic volume and types become available.

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 have a minimum CBR of 40 %. 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.

The rigid pavement sections recommended above are for non-reinforced Portland cement concrete. Concrete should be designed in accordance with the American Concrete Institute (ACI) and joint details should conform to the Portland Cement Association (PCA) guidelines. The concrete should have a minimum 28-day unconfined compressive strength of 4,000 pounds per square inch and contain 6% ±1% air-entrainment.

For dumpster pads, we recommend a pavement section consisting of 6.5 inches of Portland cement concrete and 6 inches of aggregate base over properly prepared suitable natural subgrade or site grading structural fills extending to suitable natural soils. Dumpster pads constructed overlying undocumented fills or potentially collapsible soils must be heavily reinforced.

12.0 QUALITY CONTROL

We recommend that CMT be retained as part of a comprehensive quality control testing and observation program. With CMT onsite 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 his 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

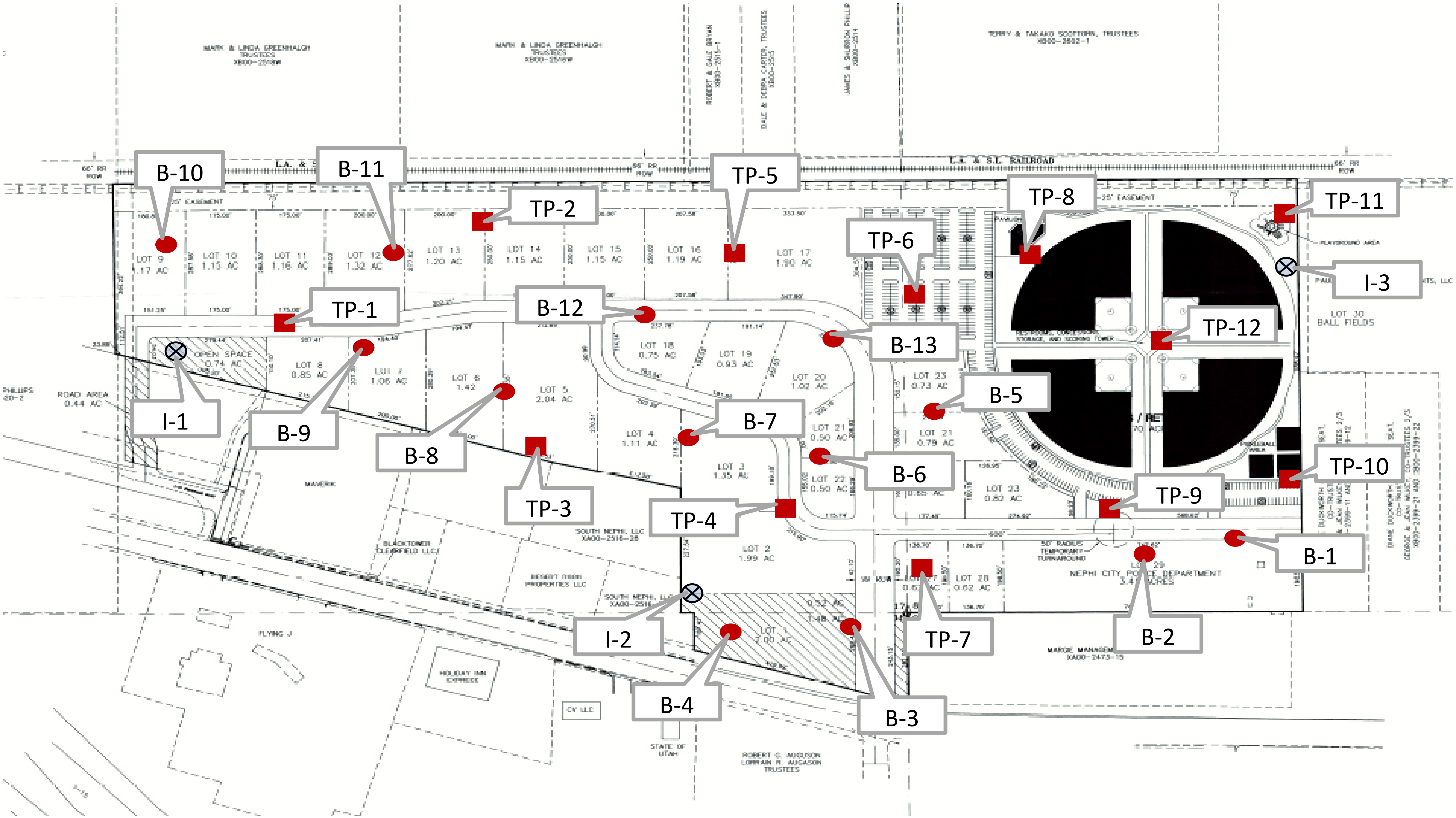
The recommendations provided herein were developed by evaluating the information obtained from the subsurface explorations and soils encountered therein. The exploration logs reflect the subsurface conditions only at the specific location at the particular time designated on the logs. Soil and ground 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



CMT TECHNICAL SERVICES	Crimson Flats Development About 1500 South Main Street, Nephi, Utah	SITE MAP	Date:	4-Jan-2024	Figure: 1
			CMT No.:	21343	

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Bore Hole Log B-1

Total Depth: 16.5'
Water Depth: (see Remarks)
Date: 12/18/24
Job #: 21343

Depth (ft)	Soil Description	Sample Type	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Topsoil; brown silty clay with roots; disturbed												
	Brown Silty CLAY (CL) with trace roots; dry, medium stiff												
	Light Brown Silty SAND (SM); dry, medium dense		1	4 5 5	10								
4	grades brown with trace clay		2	4 4 5	9								
8	Brown Sandy CLAY (CL); slightly moist, medium stiff		3	6 3 5	8	10.4		0	44	56			
	Dark Brown Silty CLAY (CL) with trace sand; slightly moist, medium stiff		4	5 3 5	8								
12													
16	Red Brown Sandy CLAY (CL); moist, medium stiff		5	3 4 5	9								
	END AT 16.5'												
20													
24													
28													

Remarks: Groundwater not encountered during drilling.

Coordinates: 39.6922383°, -111.838013°
Surface Elev. (approx): Not Given

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Steve Laird

CMT TECHNICAL SERVICES

Figure: 2

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Bore Hole Log B-2

Total Depth: 11.5'
Water Depth: (see Remarks)

Date: 12/18/24
Job #: 21343

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gradation: Gravel %	Sand %	Fines %	Atterberg: LL	PL	PI
0		Topsoil; brown silty clay with roots												
		Brown Silty CLAY (CL) with trace sand; slightly moist, medium stiff												
				6	3 2 1	3								
4														
				7	3 4 4	8								
8		Brown Fine Sandy CLAY (CL)		8	3 1 0	1								
		Red Brown Clayey Fine Sand/Fine Sandy Clay (SC-CL); slightly moist, medium stiff												
				9	3 1 0	1	5.7		0	51	49			
		END AT 11.5'												
12														
16														
20														
24														
28														

Remarks: Groundwater not encountered during drilling.

Coordinates: 39.6916149°, -111.83776°
Surface Elev. (approx): Not Given

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Steve Laird

CMT TECHNICAL SERVICES

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Bore Hole Log B-3

Total Depth: 16.5'
Water Depth: (see Remarks)
Date: 12/18/24
Job #: 21343

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0		Topsoil; brown silty clay with roots												
		Light Brown Silty CLAY (CL) with sand dry, medium stiff												
4				10	4 3 4	7								
		Light Brown Sandy CLAY (CL) with pinholes/rootholes dry, medium stiff		11	8 8 8	16	9	93						
8				12	5 2 7	9								
		Light Reddish Brown SAND (SP-SC) with some clay dry, medium dense		13	5 6 6	12								
12														
16		Light Brown Silty SAND (SM) with some gravel dry, dense		14	15 9 19	28								
		END AT 16.5'												
20														
24														
28														

Remarks: Groundwater not encountered during drilling.

Coordinates: 39.6896542°, -111.8369881°
Surface Elev. (approx): Not Given

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Steve Laird

CMT TECHNICAL SERVICES

Figure: 4

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Bore Hole Log B-4

Total Depth: 40'
Water Depth: (see Remarks)

Date: 12/18/24
Job #: 21343

Depth (ft)	Soil Description	Sample Type	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Fill; brown sand dry, dense												
			15	8 10 8	18								
4													
	Brown Sandy CLAY (CL) dry, medium stiff		16	4 5 4	9	7.5		1	33	66			
8			17	10 12 10	22	6.2	88				27	15	12
	grades with gravel												
	Light Brown Sandy CLAY (CL) dry, medium stiff		18	3 3 4	7								
12													
	grades reddish brown sandy clay/clayey sand medium stiff/dense		19	4 3 4	7								
16													
20			20	2 3 3	6								
24													
	Reddish Brown Silty CLAY (CL) with sand slightly moist, medium stiff		21	4 4 5	9	14	99	0	23	77			
28													

Remarks: Groundwater not encountered during drilling.

Coordinates: 39.6888755°, -111.8369583°
Surface Elev. (approx): Not Given

CMT TECHNICAL SERVICES

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Steve Laird

Figure: 5

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Bore Hole Log B-4

Total Depth: 40'
Water Depth: (see Remarks)

Date: 12/18/24
Job #: 21343

Depth (ft)	Soil Description	Sample Type	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
28													
			22										
32													
	Red Clayey SAND (SC) medium dense to dense		23	5 5 10	15								
36	grades with gravel												
			24	50/1"									
40	REFUSAL AT 40.0'												
44													
48													
52													
56													

Remarks: Groundwater not encountered during drilling.

Coordinates: 39.6888755°, -111.8369583°
Surface Elev. (approx): Not Given

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Steve Laird

CMT TECHNICAL SERVICES

Figure: 5

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Bore Hole Log B-5

Total Depth: 16.5'
Water Depth: (see Remarks)
Date: 12/18/24
Job #: 21343

Depth (ft)	Soil Description	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Topsoil; brown silty clay with roots											
	Light Brown Silty CLAY (CL) with some sand dry, medium stiff											
		25	4 5 3	8								
4												
	Light Brown Sandy CLAY (CL) with pinholes/rootholes dry, medium stiff	26	6 6 7	13	14.1	76						
8	grades with more sand	27	4 4 3	7								
	Light Brown Silty SAND (SM) dry, medium dense	28	6 6 7	13								
12												
16	Reddish Brown Fine Sandy CLAY (CL) moist, medium stiff	29	3 3 2	5	13.8		0	32	68			
	END AT 16.5'											
20												
24												
28												

Remarks: Groundwater not encountered during drilling.

Coordinates: 39.6901472°, -111.83911335°
Surface Elev. (approx): Not Given

CMT TECHNICAL SERVICES

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Steve Laird
Page: 1 of 1

Figure: 6

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Bore Hole Log B-6

Total Depth: 11.5'
Water Depth: (see Remarks)

Date: 12/18/24
Job #: 21343

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0		Topsoil; brown silty clay with roots												
		Light Brown Silty CLAY (CL) dry, medium stiff												
4				30	3 4 4	8								
		Light Brown Sandy CLAY (CL) dry, medium stiff		31	3 2 3	5								
8		grades red brown slightly moist		32	1 2 3	5	11.7		0	26	74			
				33	3 1 1	2								
12		END AT 11.5'												
16														
20														
24														
28														

Remarks: Groundwater not encountered during drilling.

Coordinates: 39.6898208°, -111.8385646°
Surface Elev. (approx): Not Given

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Steve Laird

CMT TECHNICAL SERVICES

Figure: 7

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Bore Hole Log B-7

Total Depth: 16.5'
Water Depth: (see Remarks)
Date: 12/19/24
Job #: 21343

Depth (ft)	Soil Description	Sample Type	Sample #	Blows (N)	Blows (N) Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Topsoil; brown silty clay with roots												
	Light Brown Sandy CLAY (CL) dry, medium stiff		34	6 8 8	16								
4													
	Brown Silty CLAY (CL) with some sand dry, medium stiff		35	5 5 5	10								
8	Brown Sandy CLAY (CL) with trace pinholes dry, medium stiff		36	9 7 6	13								
			37	5 7 6	13								
12													
16	grades red brown, stiff		38	13 13 18	31	9.3	112						
	END AT 16.5'												
20													
24													
28													

Remarks: Groundwater not encountered during drilling.

Coordinates: 39.6886467°, -111.8388418°
Surface Elev. (approx): Not Given

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Steve Laird

CMT TECHNICAL SERVICES

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Bore Hole Log B-8

Total Depth: 11.5'
Water Depth: (see Remarks)
Date: 12/19/24
Job #: 21343

Depth (ft)	Soil Description	Sample Type	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Topsoil; brown silty clay with roots												
	Brown Silty CLAY (CL) with some sand; dry, medium stiff												
			39	4 5 4	9								
4													
			40	3 3 3	6								
8	Brown Sandy CLAY (CL); dry, medium stiff		41	3 2 4	6								
			42	5 5 6	11								
12	END AT 11.5'												
16													
20													
24													
28													

Remarks: Groundwater not encountered during drilling.

Coordinates: 39.6875133°, -111.8390024°
Surface Elev. (approx): Not Given

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Steve Laird

CMT TECHNICAL SERVICES

Figure: 9

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Bore Hole Log B-9

Total Depth: 11.5'
Water Depth: (see Remarks)
Date: 12/19/24
Job #: 21343

Depth (ft)	Soil Description	Sample Type	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Topsoil; brown silty clay with roots												
	Brown Sandy CLAY (CL) dry, medium stiff												
	grades with gravel		43	9 10 11	21	12.2	90						
4	grades rootholes and trace pinholes												
	Brown Silty CLAY (CL) with some sand dry, medium stiff		44	5 5 7	12								
8			45	11 11 13	24								
	Red Brown Sandy CLAY (CL) trace rootholes dry, medium stiff		46	9 9 13	22	8.6	107						
	END AT 11.5'												
12													
16													
20													
24													
28													

Remarks: Groundwater not encountered during drilling.

Coordinates: 39.6863133°, -111.8397917°
Surface Elev. (approx): Not Given

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Steve Laird

CMT TECHNICAL SERVICES

Figure: 10

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Bore Hole Log B-10

Total Depth: 16.5'
Water Depth: (see Remarks)
Date: 12/19/24
Job #: 21343

Depth (ft)	Soil Description	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Topsoil; brown silty clay with roots											
	Light Brown Sandy Clay/Clayey Sand (CL-SC) dry, medium dense/stiff	47	5 5 5	10	11.3					33	18	15
4	grades with roothole, less clay	48	6 9 9	18								
8	Brown Sandy SILT (ML) with some clay and pinholes dry, medium dense	49	7 5 5	10	12.6	78						
	Brown Sandy CLAY (CL) dry, medium stiff	50	5 5 6	11								
12												
16		51	9 9 12	21								
	END AT 16.5'											
20												
24												
28												

Remarks: Groundwater not encountered during drilling.

Coordinates: 39.6850056°, -111.8406523°
Surface Elev. (approx): Not Given

CMT TECHNICAL SERVICES

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Steve Laird

Figure: 11

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Bore Hole Log B-11

Total Depth: 11.5'
Water Depth: (see Remarks)
Date: 12/19/24
Job #: 21343

Depth (ft)	Soil Description	Sample Type	Sample #	Blows (N)	Blows (N) Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Topsoil; brown silty clay with roots												
	Brown Sandy CLAY (CL) dry, medium stiff												
			52	3 5 5	10								
4													
			53	6 9 5	14								
8	grades with some gravel		54	7 9 8	17								
	Brown Silty SAND (SM) with gravel and some clay dry, medium dense		55	7 11 7	18								
12	END AT 11.5'												
16													
20													
24													
28													

Remarks: Groundwater not encountered during drilling.

Coordinates: 39.6866801°, -111.8407546°
Surface Elev. (approx): Not Given

CMT TECHNICAL SERVICES

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Steve Laird

Figure: 12

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Bore Hole Log B-12

Total Depth: 11.5'
Water Depth: (see Remarks)
Date: 12/19/24
Job #: 21343

Depth (ft)	Soil Description	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Topsoil; brown silty clay with roots											
	Brown Silty CLAY (CL) dry, medium stiff											
		56	6 7 5	12								
4												
	Red Brown Sandy CLAY (CL) with trace pinholes dry, medium stiff	57	5 6 7	13	13.8	80						
8	grades light brown sandy clay/clayey sand	58	4 4 5	9								
		59	11 11 13	24	5.7		0	51	49			
	END AT 11.5'											
12												
16												
20												
24												
28												

Remarks: Groundwater not encountered during drilling.

Coordinates: 39.6883843°, -111.8400602°
Surface Elev. (approx): Not Given

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Steve Laird

CMT TECHNICAL SERVICES

Figure: 13

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Bore Hole Log B-13

Total Depth: 11.5'
Water Depth: (see Remarks)
Date: 12/19/24
Job #: 21343

Depth (ft)	Soil Description	Sample Type	Sample #	Blows (N)	Total	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Topsoil; brown silty clay with roots												
	Brown Silty CLAY (CL) with some sand — dry, medium stiff												
			60	3 4 4	8								
4													
			61	3 4 4	8								
8	Red Brown Sandy CLAY (CL) — dry, medium stiff		62	4 3 3	6								
	Red Brown Silty CLAY (CL) with some sand — moist, medium stiff												
			63	3 2 2	4								
12	END AT 11.5'												
16													
20													
24													
28													

Remarks: Groundwater not encountered during drilling.

Coordinates: 39.6894756°, -111.8398651°
Surface Elev. (approx): Not Given

Equipment: Hollow-Stem Auger
Automatic Hammer, Wt=140 lbs, Drop=30"
Excavated By: Direct Push
Logged By: Steve Laird

CMT TECHNICAL SERVICES

Figure: 14

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Test Pit Log — TP-1

Total Depth: 8'
Water Depth: (see Remarks)
Date: 12/18/24
Job #: 21343

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; brown sandy silty clay										
1	Brown Fine Sandy CLAY (CL) with roots and rootholes; dry to slightly moist, stiff		1								
2			2	2.8		1	42	57			
5			3								
7.5			4	11.6		0	22	78			
8	END AT 8'										

Remarks: Groundwater not encountered during excavation.

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

Equipment: Mini Excavator
Excavated By: CMT Technical Services
Logged By: Carolina Olivera

CMT TECHNICAL SERVICES

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Test Pit Log — TP-2

Total Depth: 9.5'
Water Depth: (see Remarks)
Date: 12/18/24
Job #: 21343

Depth (ft)	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation: Gravel %	Gradation: Sand %	Gradation: Fines %	Atterberg: LL	Atterberg: PL	Atterberg: PI
0–1	Topsoil; brown sandy silty clay with roots and trace gravel		5								
1–9.5	Brown Sandy CLAY (CL) with roots and rootholes; dry, stiff										
2			6	9.6	84	0	26	74			
5	dry to slightly moist		7								
8	medium stiff to stiff										
8.5			8								
9.5	END AT 9.5'										

Remarks: Groundwater not encountered during excavation.

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

Equipment: Mini Excavator
Excavated By: CMT Technical Services
Logged By: Carolina Olivera

CMT TECHNICAL SERVICES

Figure: 16

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Test Pit Log — TP-3

Total Depth: 10'
Water Depth: (see Remarks)
Date: 12/18/24
Job #: 21343

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; brown sandy silty clay with roots and trace gravel										
1	Brown Sandy CLAY (CL) with roots and rootholes; dry to slightly moist, stiff										
2			9								
5	grades with more sand		10								
7			11								
9			12								
10	END AT 10'										

Remarks: Groundwater not encountered during excavation.

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

Equipment: Mini Excavator
Excavated By: CMT Technical Services
Logged By: Carolina Olivera

CMT TECHNICAL SERVICES

Figure: 17

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Test Pit Log — TP-4

Total Depth: 9.5'
Water Depth: (see Remarks)

Date: 12/18/24
Job #: 21343

Depth (ft)	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0	Topsoil; brown sandy silty clay with roots and trace gravel										
1	Brown Fine Sandy CLAY (CL) with roots and rootholes dry to slightly moist, stiff		13								
2			14			0	19	21	32	18	14
5	grades with more sand		15								
8	stiff to medium stiff		16								
9.5	END AT 9.5'										

Remarks: Groundwater not encountered during excavation.

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

Equipment: Mini Excavator
Excavated By: CMT Technical Services
Logged By: Carolina Olivera

CMT TECHNICAL SERVICES

Figure: 18

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Test Pit Log — TP-5

Total Depth: 9'
Water Depth: (see Remarks)
Date: 12/18/24
Job #: 21343

Depth (ft)	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gravel %	Sand %	Fines %	LL	PL	PI
0–1	Topsoil; brown sandy silty clay with roots and trace gravel										
1–9	Brown CLAY (CL) with sand, roots and rootholes dry to slightly mosit, stiff		17								
3			18	15.6	63						
5	grades with more sand										
6			19	12.6		0	18	82			
8			20								
9	END AT 9'										

Remarks: Groundwater not encountered during excavation.

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

Equipment: Mini Excavator
Excavated By: CMT Technical Services
Logged By: Carolina Olivera

CMT TECHNICAL SERVICES

Figure: 19

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Test Pit Log — TP-6

Total Depth: 9'
Water Depth: (see Remarks)
Date: 12/18/24
Job #: 21343

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; brown sandy silty clay with roots and trace gravel										
1	Brown Sandy CLAY (CL) with roots and rootholes; dry to slightly moist, stiff		21								
3			22								
5	grades with more sand										
6	slightly moist, medium stiff to stiff		23	13.2		0	21	79			
8			24								
9	END AT 9'										

Remarks: Groundwater not encountered during excavation.

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

Equipment: Mini Excavator
Excavated By: CMT Technical Services
Logged By: Carolina Olivera

Figure: 20

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Test Pit Log — TP-7

Total Depth: 10'
Water Depth: (see Remarks)

Date: 12/19/24
Job #: 21343

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; brown sandy silty clay with roots and trace gravel										
1	Brown Sandy CLAY (CL) with roots and rootholes; dry to slightly moist, stiff		25								
2.5			26								
5	grades with more sand		27								
9	slightly moist		28	11.8		0	22	78			
10	END AT 10'										

Remarks: Groundwater not encountered during excavation.

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

Equipment: Mini Excavator
Excavated By: CMT Technical Services
Logged By: Carolina Olivera

CMT TECHNICAL SERVICES

Figure: 21

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Test Pit Log — TP-8

Total Depth: 10'
Water Depth: (see Remarks)

Date: 12/19/24
Job #: 21343

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; brown sandy silty clay with roots and trace gravel										
1	Brown Sandy CLAY (CL) with roots and rootholes dry to slightly moist, medium stiff	■	29								
3		■	30								
4.5	grades with more sand										
6		■	31								
8	Reddish Brown GRAVEL (GP) with clayey sand and thin roots slightly moist, medium dense to dense										
9		◢	32								
10	END AT 10'										

Remarks: Groundwater not encountered during excavation.

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

Equipment: Mini Excavator
Excavated By: CMT Technical Services
Logged By: Carolina Olivera

CMT TECHNICAL SERVICES

Page: 1 of 1

Figure: 22

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Test Pit Log — TP-9

Total Depth: 10'
Water Depth: (see Remarks)
Date: 12/19/24
Job #: 21343

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; dark brown sandy silty clay with roots and trace gravel										
1	Brown CLAY (CL) with fine sand, roots and rootholes; slightly moist, medium stiff		33								
3			34								
4	grades more sand		35								
5	grades red brown										
7	slightly moist to moist, very soft to soft		36	14.7		0	33	67.1			
10	END AT 10'										

Remarks: Groundwater not encountered during excavation.

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

Equipment: Mini Excavator
Excavated By: CMT Technical Services
Logged By: Carolina Olivera

CMT TECHNICAL SERVICES

Figure: 23

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Test Pit Log TP-10

Total Depth: 11'
Water Depth: (see Remarks)

Date: 12/19/24
Job #: 21343

Depth (ft)	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation Gravel %	Gradation Sand %	Gradation Fines %	Atterberg LL	Atterberg PL	Atterberg PI
0–1	Topsoil; brown to dark brown sandy silty clay with roots and rootholes										
1–11	Brown Sandy CLAY (CL) with roots and rootholes; slightly moist, stiff										
1		■	37								
2.5		■	38								
3.5	grades with more sand										
4.5		■	39	19.1	75						
6	grades reddish brown										
8		■	40	22	78						
11	END AT 11'										

Remarks: Groundwater not encountered during excavation.

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

Equipment: Mini Excavator
Excavated By: CMT Technical Services
Logged By: Carolina Olivera

CMT TECHNICAL SERVICES

Figure: 24

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Test Pit Log TP-11

Total Depth: 10'
Water Depth: (see Remarks)
Date: 12/19/24
Job #: 21343

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation: Gravel %	Gradation: Sand %	Gradation: Fines %	Atterberg: LL	Atterberg: PL	Atterberg: PI
0		Topsoil; dark brown sandy silty clay with roots and trace gravel										
1		Brown Sandy CLAY (CL) with roots and rootholes slightly moist to moist, medium stiff to stiff	■	41								
3			■	42								
6		grades with more sand	■	43	15.1		1	35	65			
10		END AT 10'										

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

Remarks: Groundwater not encountered during excavation.

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

Equipment: Mini Excavator
Excavated By: CMT Technical Services
Logged By: Carolina Olivera

CMT TECHNICAL SERVICES

Figure: 25

Crimson Flats Development

About 1500 South Main Street, Nephi, Utah

Test Pit Log TP-12

Total Depth: 10.5'
Water Depth: (see Remarks)
Date: 12/19/24
Job #: 21343

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; brown to dark brown sandy silty clay with roots and rootholes										
1	Brown Sandy CLAY (CL) with roots and rootholes; dry to slightly moist, stiff		44								
3			45								
4.5	grades with more sand										
5.5			46	14.3		0	28	72	32	18	14
6	grades reddish brown										
8			47								
10.5	END AT 10.5'										

Remarks: Groundwater not encountered during excavation.

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

Equipment: Mini Excavator
Excavated By: CMT Technical Services
Logged By: Carolina Olivera

CMT TECHNICAL SERVICES

Figure: 26

Crimson Flats Development

Key to Symbols

About 1500 South Main Street, Nephi, Utah

Date: 12/18/24
Job #: 21343

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

COLUMN DESCRIPTIONS

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

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

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

Sample Type: Type of soil sample collected; 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).

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 TECHNICAL SERVICES

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