Attachment 3

Geotechnical Report

GEOTECHNICAL SITE ASSESSMENT

SINGLE-FAMILY RESIDENCE
53 MULE DEER COURT
APN 038-730-39
RENO, NEVADA, 89523

PREPARED FOR:

BRIAN GRAHAM

JANUARY 2023
FILE: 3109

CONSTRUCTION MATERIALS ENGINEERS INC.
300 Sierra Manor Drive, Suite 1
Reno NV 89511

January 25, 2023
File: 3109

Brian Graham
bgraham@qdconstruction.com

RE: Geotechnical Site Assessment
53 Mule Deer Court Single-Family Residence
APN 038-730-39
Reno, Nevada, 89523

Dear Mr. Graham,

Construction Materials Engineers Inc. (CME) is pleased to submit our geotechnical site assessment for the proposed single-family residence to be constructed at 53 Mule Deer Court, Reno, Nevada. The following report includes the results of our field investigation, laboratory testing, and presents our recommendations for the design and construction of the project.

We thank you for the opportunity to provide our services and look forward to working on future endeavors together. Please feel free to call us should you have any questions or require additional information.

Sincerely,

CONSTRUCTION MATERIALS ENGINEERS, INC.

PROFESSIONAL ENGINEER - STATE OF NEVADA
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GEOTECHNICAL SITE ASSESSMENT

53 Mule Deer Court Single-Family Residence
APN 038-730-39
Reno, Nevada, 89523

1.0 INTRODUCTION

Presented herein are the results of Construction Materials Engineers, Inc. (CME) geotechnical site assessment, laboratory testing program, and associated geotechnical recommendations for the proposed residence to be constructed at 53 Mule Deer Court, in Reno, Washoe County, Nevada. The general area covered by this report is included as Plate A-1 (Exploration Location Map) in Appendix A. The general project vicinity is presented as Figure 1 below.

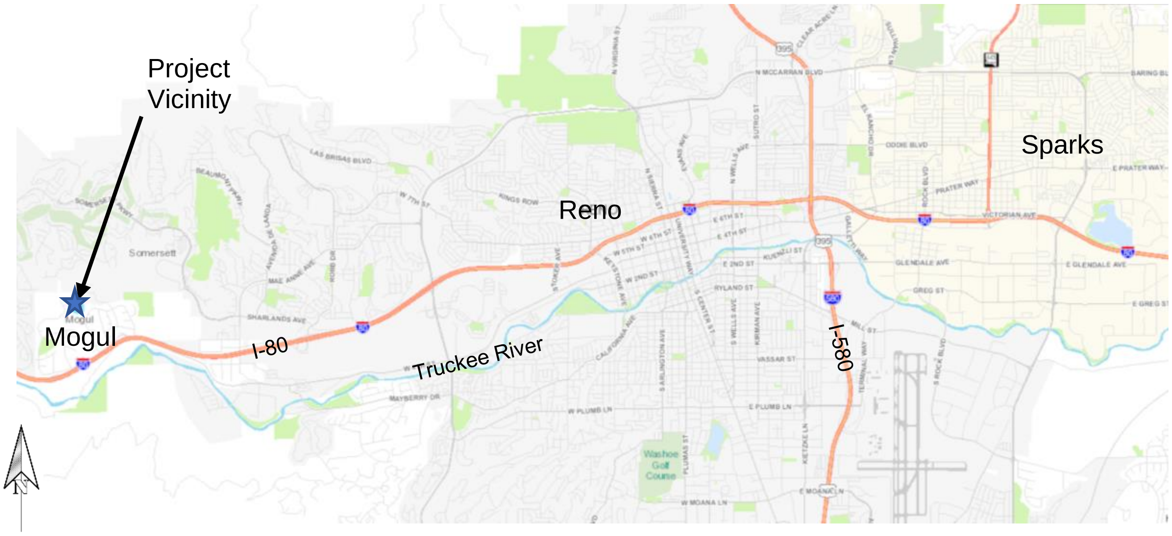


Figure 1: General Project Vicinity

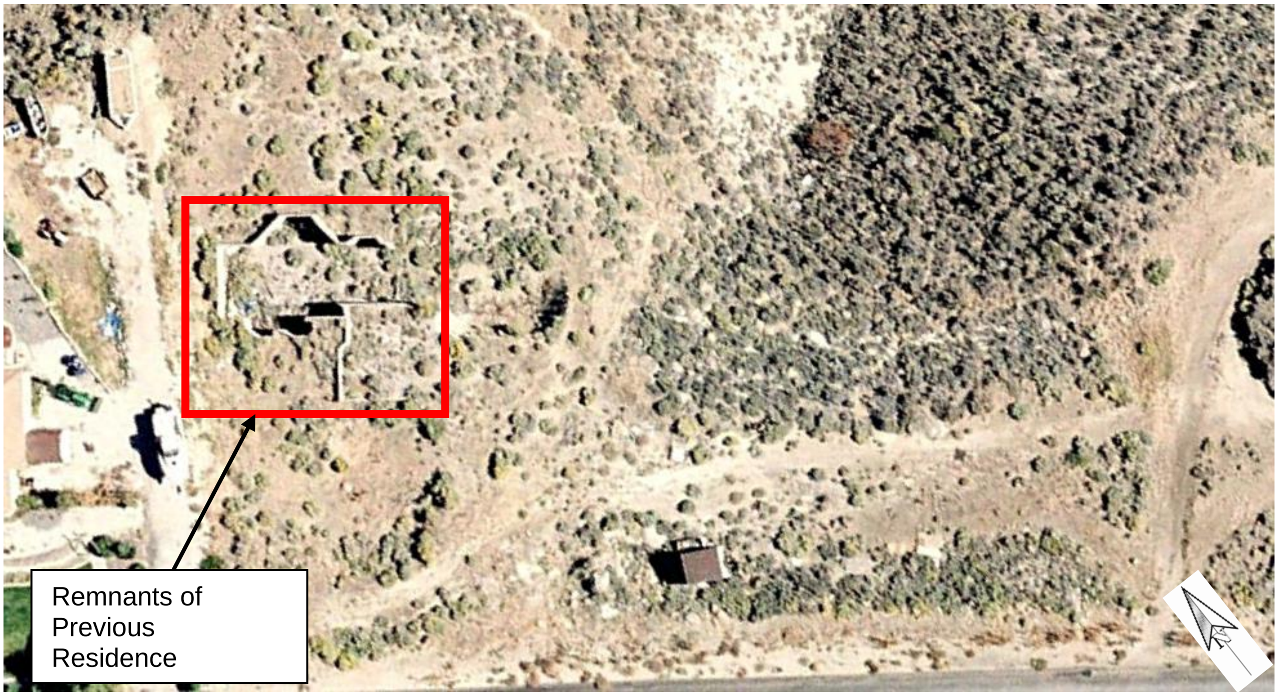
(Reference Base Map Washoe Regional Mapping System (washoecounty.us))

Details of the project described herein serve as the basis for our project understanding and provide the foundation for the geotechnical engineering analysis performed. Recommendations presented in this report are based on surface/subsurface conditions encountered during our field exploration and on details of the proposed project.

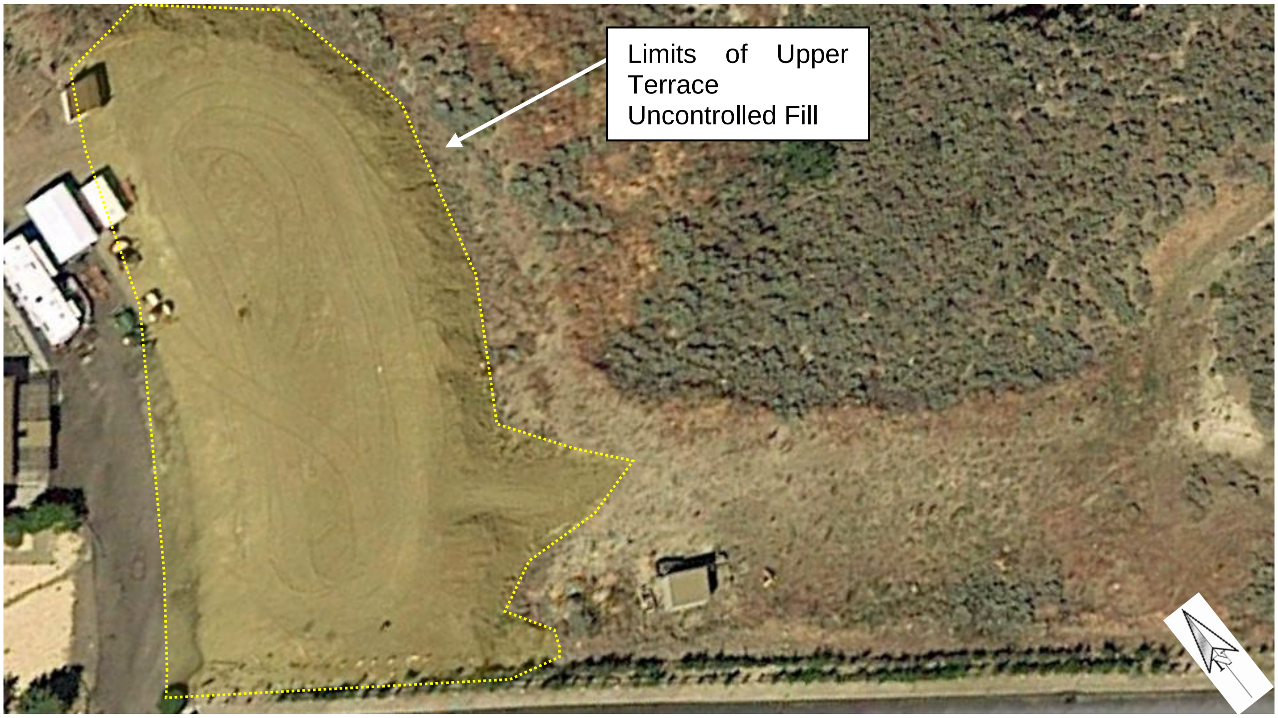
2.0 SITE AND PROJECT DESCRIPTION

2.1 HISTORICAL SITE DEVELOPMENT

Based on historical aerial mapping and conversations with the owner, the project site was previously developed as a single-family residence with basement and onsite sewage disposal field. Based a review of Google Earth historical imagery the residence was constructed after 1990 and subsequently burnt down between 1999 and 2002. In 2014 the historic building pad was filled with approximately 10 to 15 feet of uncontrolled fill by the owner of the westmost neighboring parcel (i.e., owner at the time earthwork was performed). The abandoned residence foundation, stem-walls and all below grade improvements were left in place and buried beneath the uncontrolled fill. Historical aerial images of the site are presented on the following page.



Historical Aerial Image Exhibit 1: Circa 2004 (Google Earth)



Historical Aerial Image Exhibit 2: Circa 2016 (Google Earth)

2.2 CURRENT SITE CONDITIONS

The subject site consists of an irregular-shaped 5.7-acre parcel (Washoe County Assessor Parcel Number (APN) 038-730-39) which is bounded to the northeast, northwest, and south by privately owned land, and the southwest by Mule Deer Court. A canal forms the northeast boundary of the parcel. A canyon which trends southeast to northwest, bisects the site. The southwest quadrant of the site is currently terraced with the western portion of the pad approximately 10 to 20 feet higher than the eastern portion. The upper terrace pad elevation is between an elevation of 4,852 and 4,856 and is about 70 feet higher in elevation than the base of the canyon flowline. At the base of the canyon is a 40-foot-wide drainage easement (refer to Figure 2 below).

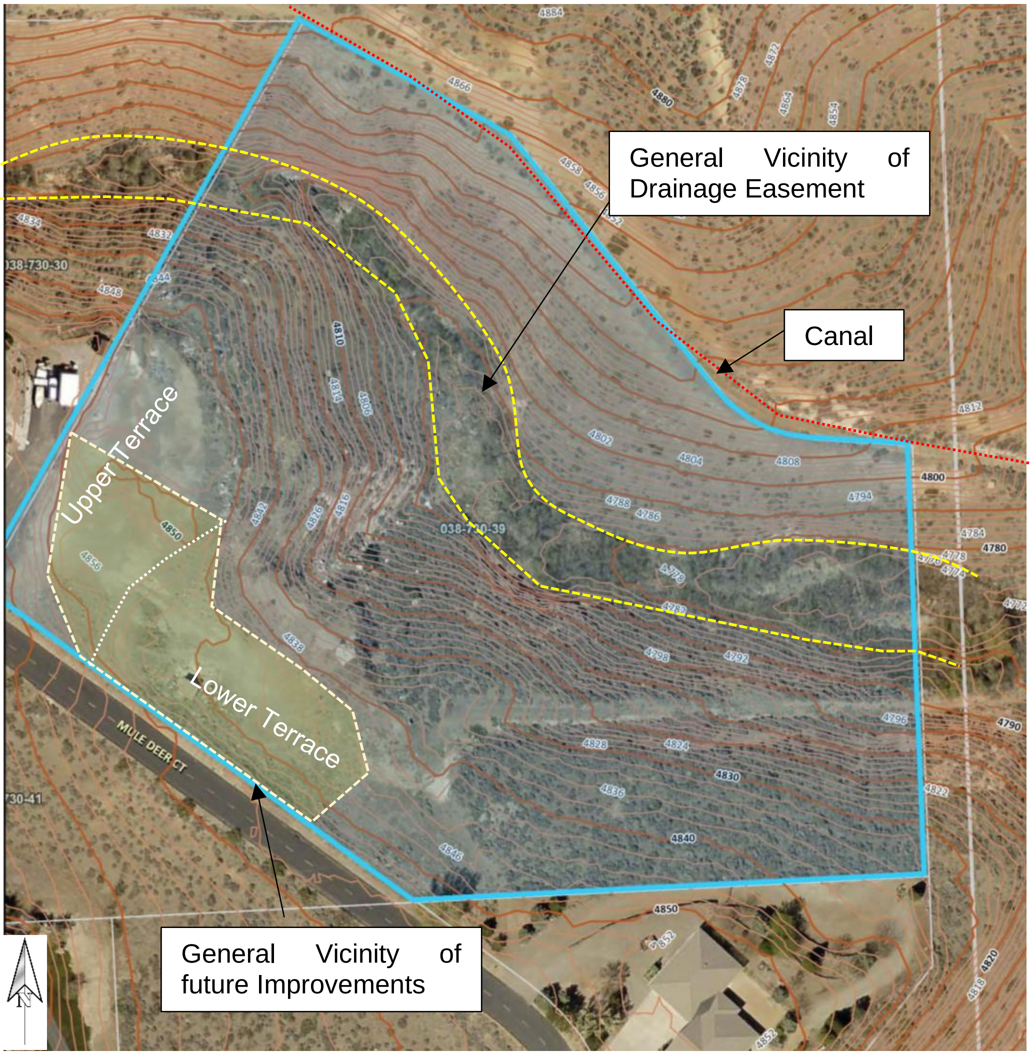


Figure 2: Washoe County GIS Contours (N.T.S)

(Reference Base Map Washoe Regional Mapping System (washoecounty.us))

The northeastern quadrant of the pad is a steeply sloping hillside which forms the northeastern limits of the canyon. Although the parcel is over 5 acres in size, the area of development is generally limited to the southwestern quadrant (refer to area highlighted in yellow on Figure 2 above) due to the existing canyon as the primary site access is via Mule Deer Court. Vegetation across the parcel is sparse consisting of short brush, weeds and grasses.

2.3 PROJECT DESCRIPTION

The proposed project is currently in the conceptual planning phases and the preliminary site layout is presented on Plate A-1. The following serves as our understanding of the proposed site development:

- Construction of a single-family residence. The proposed structure will be wood framed supported on shallow spread footings with raised floor construction or slab on grade construction.
- The structure may be terraced with stepped footings, constructed using a partial or daylight basement, or on a cut/fill pad with an estimated finished pad elevation on the order of 4650 to 4852 (Washoe County GIS Contours from Figure 2).
    - The western limits of the building pad will be located within the upper terrace uncontrolled fill zone requiring remediation. The existing uncontrolled fill may be on the order of 4 to 10 feet thick.
    - The eastern portion of the building pad where the proposed garage and driveway will be located spans the lower terrace area and is generally outside the uncontrolled fill zone. It is anticipated the eastern quadrant of the building pad will be brought up between 4 and 6 feet to create a level building pad.
    - Total differential fill below the building pad is anticipated to be on the order of 5 feet or less with a gradual transition spanning the long axis of the future building.
- The proposed residence will utilize the existing onsite sewage disposal field located on the northwest quadrant of the uncontrolled fill pad on the upper site terrace.
- Appurtenant construction may include associated flatwork, driveway, landscaping, and subsurface utilities.

3.0 SUBSURFACE EXPLORATION

The subsurface field exploration was performed on September 16th, 2022 and included excavation of eight (8) test pits using a Link-Belt 245 X4 excavator equipped with a 48-inch wide, 5-tooth bucket. Test pits depths ranged from 10 to 14 feet below existing ground surface (bgs).

Test pits were backfilled with the equipment available and were not compacted to the standards required for structural fill. During the time of construction, the test pit backfill located within the building or other structure footprints shall be removed and recompacted to at least 90 percent relative compaction.

Soil samples were visually examined and classified during exploration in general accordance with ASTM D2488. Exploration locations (Plate A-1), test pit logs (Plate A-2), Unified Soil Classification Chart (Plate A-3), and Rock Classification Chart (Plate A-4), are attached as Appendix A.

4.0 LABORATORY TESTING

Soil testing performed in CME's laboratory was conducted in general accordance with ASTM Standards. Representative soil types were selected and analyzed to determine index properties and engineering properties. The following laboratory tests were completed as part of this investigation:

- In situ moisture content (ASTM D2216) (Appendix A);
- Grain size distribution (ASTM D6913) (Appendix B); and
- Plasticity index (ASTM D4318) (Appendix B);
- Moisture Density Curve (ASTM 1557) (Appendix B);
- Direct Shear (ASTM D3080) (Appendix B); and
- Expansion Index (ASTM D4829) (Appendix B).

In addition, our firm contracted with an outside laboratory to complete the following analytical testing for the corrosion potential of the site soil:

- Soluble Sulfates (ASTM C1580) (Appendix B)

5.0 GENERAL SUBSURFACE SOIL PROFILE ENCOUNTERED

Based on a review of the *Preliminary Revised Geologic Maps of the Reno Urban Area, Nevada* (Ramelli, et al, 2011), the project area is mapped as several different geologic units. Geologic units consist of alluvial fan deposits and sedimentary bedrock consisting of diatomaceous siltstone, sandstone, and/or mudstone. In general, the subsurface profile appears to be consistent with the mapped geology. Table 1 below summarizes the general soil profile characteristics.

Table 1: General Soil Profile Description Summary

Test Pit ID	General Geologic Profile [(2)]	Depth (ft)	USCS Soil Classification	Permitted For Reuse as Structural Fill	Groundwater
TP-1	UC	0.0 – 1.3	Sandy Lean Clay (**CL**)	🚫	Not Encountered or Observed
		1.3 – 10.0	Silty Sand with Gravel and Cobbles (**SM**)	🚫	
TP-2	UC	0.0 – 10.0	Clayey Sand with Gravel and Cobbles (**SC**)	🚫	
TP-3	UC	0.0 – 8.0	Clayey Sand with Gravel (**SC**)	🚫	
		4.0 – 8.0	Lean Clay with Sand (**CL**)	🚫	
	Q_{r6}	8.0 – 14.0	Lean Clay with Sand (**CL**), Sandy Lean Clay (**CL**)	🚫	
TP-4	UC	0.0 – 5.0	Clayey Sand with Gravel (**SC**)	🚫	
	Q_{r6}	5.0 – 12.0	Sandy Lean Clay (**CL**), Clayey Sand with Gravel and Cobbles (**SC**)	🚫	
TP-5	UC	0.0 – 1.0	Sandy Lean Clay with Gravel and Cobbles (**CL**)	🚫	
		1.0 – 10.0	Clayey Sand with Gravel and Cobbles (**SC**), Clayey Sand (**SC**)	🚫	
TP-6	Q_{r6}	0.0 – 10.0	Clayey Sand with Gravel and Cobbles (**SC**), Clayey Sand (**SC**)	🚫	
		10.0 – 11.0	Fat Clay with Sand (**CH**)	🚫	
TP-7	Q_{r6}	0.0 – 3.0	Clayey Sand (**SC**)	🚫	
		3.0 – 9.5	Fat Clay with Sand (**CH**), Sandy Lean Clay (**CL**)	🚫	
	T_{nds}	9.5 – 10.0	Sedimentary Rock (**Bedrock**)	🚫	
TP-8	Q_{r6}	0.0 – 4.5	Clayey Sand (**SC**)	🚫	
		4.5 – 10.0	Fat Clay with Sand (**CH**), Sandy Lean Clay (**CL**)	🚫	
	T_{nds}	10.0 – 12.0	Sedimentary Rock (**Bedrock**)	🚫	

General Geologic Profile Definitions:

UC – Uncontrolled Fill: Includes soil with substantial occurrence of deleterious materials or debris, refer to Section 5.1.1 (Uncontrolled Fill) for additional information.

Q_{r6} – Pre-Donner Lake Alluvial Fan Deposits: Generally consisting of mixed alluvium and alluvial sediments consisting of clayey sand, sandy lean clay, lean clay with sand, and fat clay with sand. Refer to Section 0 for additional information.

T_{nds} – Diatomaceous Siltstone and Sandstone: Sedimentary bedrock generally characterized as intensely weathered, soft, and intensely fractured.

🚫 Not Permitted

NOTES

1. Soil descriptions are a generalization of the exploration logs; for detailed descriptions, see Appendix A.

5.1.1 UNCONTROLLED FILL (UC)

Uncontrolled fill (UC) was found in five of the eight test pits and is generally localized to the upper terrace of the site. The uncontrolled fill was encountered with varying degrees of thicknesses ranging from 4 feet to greater than 10 feet (refer to Plates A-1 and A-2). The uncontrolled fill contained a substantial amount of manmade debris (rebar, concrete, asphalt, conduits, and remnant foundations) and organics. In addition, the soil observed and tested in our laboratory was moderately plastic with plasticity indices ranging from 16 to 26 (refer to Plate B-2, Appendix B) and is considered potentially expansive.

The depth of the uncontrolled fill was not fully realized within Test Pits TP-1, TP-2, and TP-5 to the depth of exploration (10 feet).

Photograph 1:TP-1 Sidewall (0.0-5.0)

Photograph 2:TP-1 Sidewall (0.0-10.0)

Photograph 3: TP-2 Sidewall (0.0-5.0)

Photograph 4: TP-2 Sidewall (5.0-10.0)

TP-2 contained uncontrolled fill that contained asphalt slabs generally localized within the upper 5.0 feet. The existing underground concrete foundation from the previously constructed residence was also encountered at a depth of 7.0 feet below ground surface (see Photograph 3 and Photograph 4).

Uncontrolled fill thicknesses of up to 8 feet were observed within TP-3 classifying as clayey sand (**SC**) and lean clay with sand (**CL**) (refer to the photographs below).

Photograph 5: TP-3 Sidewall (0.0-5.0)

Photograph 6: TP-3 Sidewall (5.0-12.0)

Uncontrolled fill was observed within the upper 5 feet of TP-4 and contained various debris (concrete, wood, etc.) and diatomaceous soil/rock fragments. Native soil was encountered at depths of 5.0 to 10 feet (refer to the photographs on the following page).

Photograph 7:TP-4 Sidewall (0.0-5.0)

Photograph 8:TP-4 Sidewall (5.0-10.0)

TP-5 contained uncontrolled fill with a substantial occurrence of concrete chunks, wood, and a conduit pipe. The existing underground concrete foundation from the previously constructed residence was encountered at a depth of 7.0 feet below ground surface.

Photograph 9: TP-5 Sidewall (0.0-5.0)

Photograph 10: TP-5 Sidewall (5.0-10.0)

5.1.2 MIXED ALLUVIUM AND ALLUVIAL SEDIMENTS (Q_{R6})

Mixed alluvium and alluvial sediments (Q_{r6}) were generally encountered underlying the uncontrolled fill soil horizon and within the lower terrace test pit excavations (TP-6, TP-7, and TP-8). The native soil horizon generally classified as clayey sand (SC), sandy lean clay (CL), lean clay with sand (CL), and fat clay with sand (CH).

5.1.3 SEDIMENTARY BEDROCK (T_{NDS})

Sedimentary bedrock (T_{nds}) was encountered within test pits TP-7 and TP-8 at depths of 9 ½ and 10 feet below ground surface. The sedimentary bedrock appeared to be a mudstone which was intensely weathered and weak.

5.2 SOIL MOISTURE AND GROUNDWATER CONDITIONS

Soil moisture content varied but was generally encountered in a slightly moist to moist condition. Groundwater was not encountered during the subsurface exploration.

Construction planning should include the assumption that groundwater fluctuations may occur due to precipitation, temperature, runoff, or adjacent irrigation. Depending on the season of construction, seepage may be encountered, especially during spring runoff. The contractor should anticipate this condition and be prepared for dewatering during construction.

6.0 DISCUSSION

6.1 GENERAL INFORMATION

The following definitions and standards are applicable for recommendations in this report related to design and construction of the proposed project:

Table 2: General Definitions and Specifications for Report Recommendations

Definitions Existing Onsite Soil	
Fine Grained Soil	• Soil with more than 40 percent by weight passing the number 200 sieve and a plasticity index less than 15 (PI<15).
Clay Soil	• For the purposes of this report, clay soil may be defined as any soil having more than 15 percent by weight passing the number 200 sieve and a plasticity index greater than or equal to 15 (PI≥15).
Granular Soil	• Soil not meeting the requirement for a fine-grained or clay soil with: ○ A particle size of 4-inches or less, ○ Less than 30 percent by weight retained on the ¾-inch sieve; ○ Less than 30 percent by weight passing the No. 200 sieve; ○ Plasticity index less than 15 (PI<15).
Uncontrolled Fill	• Soil/material placed and/or compacted but not observed, monitored, tested, or documented by a licensed materials test engineering firm. • For the purposes of this report includes zones of deleterious materials or debris located within the uncontrolled fill soil. Uncontrolled fill is not suitable for reuse as excavated. Screening and/or selective grading may be required to remove concrete, asphalt, organic material, fabric, and/or other manmade debris.
Definitions for Mass Grading and Site Preparation	
Structural Fill	• Soil generated from onsite grading may be reused as structural fill provided it meets the requirements of a granular soil and is free of organics or deleterious materials. • Structural fill is the supporting soil placed in densified lifts below foundations, concrete slabs-on-grade, pavements, or any structural element that derives support from the underlying sub-soils material. • Imported structural fill shall meet the requirements in Section 8.3.
Structural Areas	• Includes all areas that will be used for the support of concrete slabs, flatwork, foundations, pavements, or other structures deriving support from the underlying soil.
Subgrade	• The elevation directly below the aggregate base layer for both concrete slabs-on-grade and pavements; • Bottom of excavation for foundations bottomed on native soil materials and structural fill. • The native soil surface elevation below structural fill.
Relative Compaction	• The dry density of soil in the field expressed as a percentage of the density of the soil after densification during placement**.** Relative compaction shall be in accordance with ASTM D1557.
Standard Specifications	• Work shall be performed in general conformance to the “Orange Book”, Standard Specifications for Public Works Construction, 2012, Revision 8 (SSPWC, 2012).

6.2 CONSTRUCTION CONCERNS

Based on the results of our field and laboratory studies, the proposed project as described in this report may be constructed as currently proposed. Table 3 (General Geotechnical Considerations and Overview Summary) provides a general summary of the construction and design considerations as they pertain to the project. Geotechnical recommendations for design and construction of the project are included as Section 7.0 and Section 8.0.

Table 3: General Geotechnical Considerations and Overview Summary

Subject	Geotechnical Consideration
Groundwater/ Seasonal Runoff	• Groundwater was not encountered or observed during the subsurface exploration. • Groundwater is not anticipated to affect the proposed construction. Depending on the season of construction, seepage may be encountered, especially during spring runoff. Dewatering and stormwater management during construction shall be the responsibility of the contractor.
Reuse of Onsite Materials	• A majority of the soil encountered on-site does not meet the requirements of structural fill. Imported earthen materials will be required for construction.
Potentially Expansive Soil	• The majority of the onsite soil encountered (both native and uncontrolled fill) during the current exploration is considered potentially expansive (EI>20, PI>15) and is not suitable for reuse as structural fill. • Footings and flatwork improvements for the proposed single-family residence bottomed on potentially expansive soil (refer to Section 5.0) may be subject to deformations due to volumetric changes (i.e., shrink/swell) of the clay soil with fluctuations in moisture content. Consequently, remedial earthwork is recommended (refer to Section 8.2).
Uncontrolled Fill	• Uncontrolled fill was encountered in the upper 4 to 10 feet of the proposed building pad (refer to Plate A-1). Thicker zones of uncontrolled fill may be present within the proposed improvement area especially in the northwestern quadrant of the subject site and will need to be determined at the time of construction. • Uncontrolled fill observed within the excavations was riddled with random manmade debris and organics (refer to Plate A-2). In addition, the material tested is considered potentially expansive (PI>15, EI>20) so reuse of this material in structural areas is not permitted. • Remedial earthwork will be required where uncontrolled fill soil is encountered which will include complete removal and replacement with densified structural fill. Refer to Section 8.2.1 (Uncontrolled Fill Remedial Earthwork)
General Information	• This report shall be reviewed by the design team and contractor in its entirety.

7.0 DESIGN RECOMMENDATIONS

7.1 SEISMIC DESIGN PARAMETERS

Seismic design parameters are based on site-specific estimates of spectral response ground acceleration as designated in the 2018 IBC. Based on our professional experience, a Site Class C is recommended for project design. A copy of the ASCE 7 Hazards Report is provided in Appendix C. A summary of seismic design parameters are provided in Table 4 (Seismic Design Parameters (2018 IBC)).

Table 4: Seismic Design Parameters (2018 IBC)

Approximate Latitude of Site		39.52099°
Approximate Longitude of Site		-119.9335°
Site Class Selected for this Site		C
Risk Category		II
S_S	Spectral Response Acceleration at Short Period (0.2 sec.)	1.532
S_1	Spectral Response Acceleration at 1-second Period	0.524
F_a	Site amplification factor at Short Period (0.2 sec.)	1.200
F_V	Site amplification factor at 1-second Period	1.476
S_{DS}	Design Spectral Response Acceleration at Short Period (0.2 sec.)	1.225
S_{D1}	Design Spectral Response Acceleration at 1-second Period	0.516
S_{MS}	Site-modified spectral acceleration value at Short Period (0.2 sec.)	1.838
S_{M1}	Site-modified spectral acceleration value at 1-second Period	0.774
T_L	Long-period transition period in seconds	6
PGA	MCE_G peak ground acceleration	0.646
PGA_M	Site modified peak ground acceleration	0.775

NOTES:

1. See requirements for Site Specific Ground Motions in Section 11.4.8 of ASCE 7.

7.2 FOUNDATION DESIGN

Based on the anticipated foundation loading, structure type, and soil conditions encountered during the subsurface exploration, foundation design parameters presented in Table 5 (Foundation Design Parameters) can be utilized for the design of shallow spread footings provided the recommendations contained in this report have been adhered to.

Table 5: Foundation Design Parameters

Allowable Bearing Pressures (psf) (1,2,3,4)	
Footings bottomed at least 2 feet (4) below the proposed finished grade elevation on structural fill	2,500
Allowable Friction Coefficient (5)	
Between foundation bottom and supporting soil consisting of structural fill	0.42
Allowable Passive Soil Pressure (psf) (1,6)	
Backfill soil consisting of properly compacted structural fill	300(5)

NOTES:

1. (psf)-Pounds per square foot
2. The allowable bearing pressure may be increased by one-third for total loading conditions including wind and seismic forces (2018 IBC). The allowable bearing pressure is a net value; therefore, the weight of the foundation which extends below grade and backfill may be neglected when computing dead loads. The allowable bearing pressure includes a FOS of 3.0 against bearing failure.
3. Based on a minimum isolated and continuous foundation width of 1.25 feet.
4. For frost protection, footings should be bottomed at least 2 feet below adjacent exterior grade.
5. The passive earth pressure should be used as a triangular distribution. The frictional resistance and passive earth pressure provided in the table are “allowable” and may be used in combination without reduction as a FOS of 1.5 is included.
6. The passive resistance should be neglected within the frost zone. Design values are based on footings backfilled with properly compacted structural fill.

Spread footings shall be proportioned and located to maintain stability (e.g., bearing, overturning, sliding, uplift, eccentricity). Eccentric loading, where required, shall be evaluated for allowable bearing pressures.

Lateral loads (such as wind or seismic) may be resisted by passive soil pressure and friction at the bottom of the footing. Overturning moments and uplift loading can be resisted by the weight of the foundation, weight of the structure, and any soil overlying the foundation. A unit weight of 125 pounds per cubic foot may be assumed for backfill soil consisting of properly densified structural fill.

It is recommended that footing excavations be observed by the project soil engineer prior to placing concrete reinforcing steel to confirm the subsurface conditions are similar to those described in this report. Field density testing and continuous observation during earthwork operations will be required if footings are bottomed on densified structural fill.

7.2.1 SETTLEMENT

Due to the presence of both the proposed structural fill and existing alluvial sediments as encountered during the current exploration, the primary modes of settlement response expected are summarized below:

Immediate Settlement (Short-Term)	Immediate settlement is associated with the rearrangement of soil grains due to additional stress/load. This settlement component is typically relevant to unsaturated granular and fine-grained non-plastic to low plasticity soil such as densified structural fill which will be used on this project.
Consolidation (Long-Term)	Consolidation is the gradual rearrangement of soil particles with the reduction of porewater pressure. In order for consolidation to occur, the additional stress/load must increase pore water pressure in the soil (i.e., the soil must be fully or nearly fully saturated). Consolidation is typically relevant in fine-grained soil similar to the clay sediments encountered during the current exploration. Native clay soils were encountered in test pit TP-6, TP-7 and TP-8. Based on empirical correlations and our general understanding of the geologic features at the site, this material is significantly overconsolidated and the anticipated settlement response due to anticipated loading is less than ½ inch.
Differential Settlement	To limit the potential for differential settlement, differential fill thicknesses across the structure bottom of foundation elevation shall be less than 5 feet, in addition no sharp transitions are recommended. If fill thicknesses beneath the proposed building footprint differ more than 5-feet, the thinnest fill side may need to be overcut such that the resultant differential fill thickness gradually transitions across the pad and the total differential is less than 5-feet or less.
Total Estimated Settlement	Based on the findings of our investigation, estimated total settlements will be to be on the order of 1-inch or less with differential settlement on the order of ½ of the total estimated settlement.

7.2.2 FOOTINGS ADJACENT TO SLOPES

The proposed residence and associated site improvements are bounded to the north and northeast by the edge of a deep channel/canyon. A detached retaining wall will be located adjacent to the slope. All footings will need to maintain a minimum embedment depth of 2 feet. For sloping backfill conditions on the toe side of the foundation, the minimum embedment shall be maintained for a lateral distance of 5 feet which may require deepening of foundations located in close proximity to the slope face. Refer to Figure 3 (on the following page) for a typical embedment diagram.

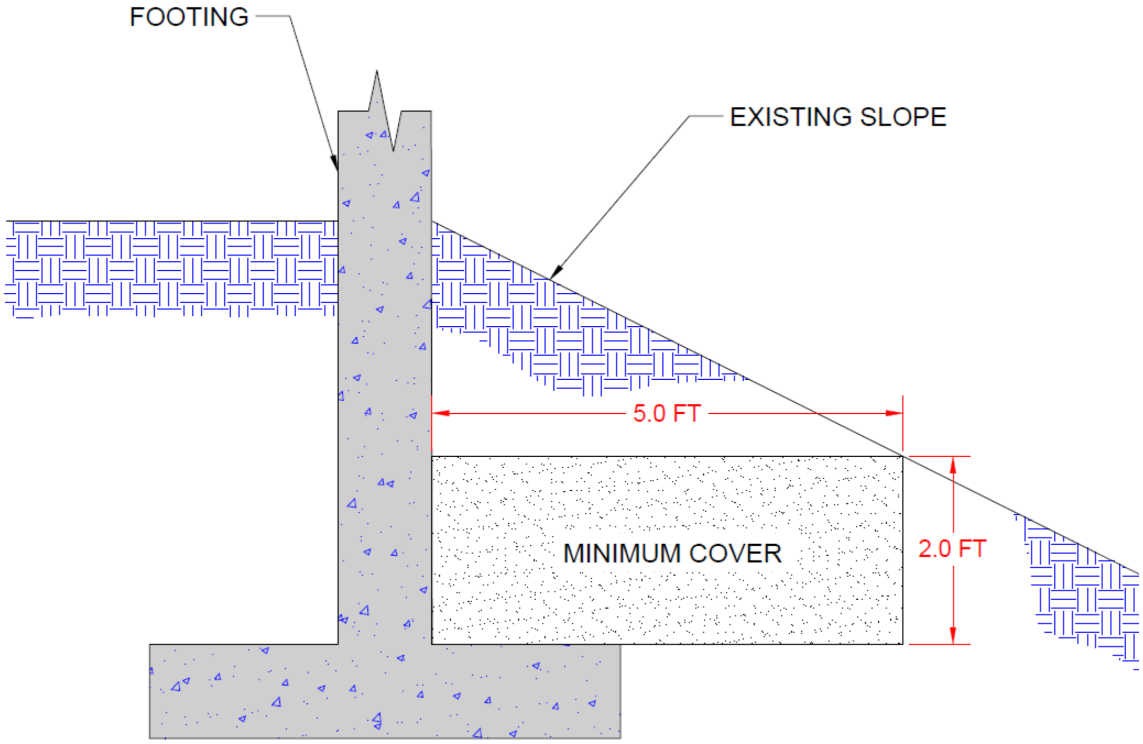


Figure 3: Typical Footing Embedment Diagram Adjacent to Slopes

7.3 STATIC LATERAL EARTH PRESSURES

Static lateral earth pressures presented in this section are based on the following assumptions:

- Retained backfill will have a level backslope and consist of structural fill;
- Retained backfill will extend a minimum lateral distance behind the wall equal to the total height of the retained soil;
- Back-of-wall drainage will be incorporated for retained wall heights greater than 3 feet.

Static lateral earth pressures on the retaining wall are dependent on the relative rigidity, allowable movement of the retaining structure, strength properties of the backfill soil, and drainage conditions behind the retaining wall. The lateral earth pressure is strongly dependent on the lateral deformations which occur in the soil.

A restrained retaining wall (i.e., displacement not permitted) will experience higher lateral earth pressures than a retaining wall that is free to move (cantilever conditions). The restrained retaining wall lateral earth pressure is based on the at-rest soil coefficient (K_o), and lateral earth pressure values for the retaining wall that is free to rotate with the ability to deflect at the top (wall movement greater than 0.001H for cohesionless soils and greater than 0.01H for cohesive soils) are based on active soil coefficient (K_a). Static lateral earth pressure values are presented in Table 6 (Static Lateral Earth Pressures).

Table 6: Static Lateral Earth Pressures

Earth Pressure Condition	Backfill Slope	Earth Pressure Coefficient	Equivalent Fluid Density (psf) (1,2)
Active (P_a)	Level	0.28 (Ka)	35
At-Rest (P_o)	Level	0.44 (Ko)	55
Passive (P_p)	Level	2.4 (Kp)	300

NOTES:

1. Pounds per square foot per foot of depth
2. Assuming maximum unit weight of 125 pcf and a soil friction angle of at least 34 degrees.
3. Assumes free-draining conditions above the groundwater table.
4. Retained backfill shall consist of densified material meeting the requirements of a granular soil. Retained backfill shall extend a distance behind the wall equal to the total retained height of soil.
5. Passive pressure includes a factor of safety of 1.5.
6. For active earth pressure, wall must rotate about base away from the retained soil to mobilize. Lateral movements of about 0.01 H, where H is wall height will be required for design of active earth pressure condition.
7. For passive earth pressure to develop, wall must move horizontally to mobilize resistance.
8. Does not include surcharge loading.
9. Assumes no dynamic loading.
10. Ignore passive pressure in frost zone (i.e., ground surface to 24 inches below proposed finished grade elevation)

Subterranean structures and short retaining walls, including foundations, should be designed to resist the lateral earth pressure exerted by the retained soil plus any additional lateral force that will be applied to the wall due to surcharge loads placed at or near the wall.

Over-compaction of retained backfill shall be avoided as it will result in increased lateral forces exerted on the wall by the soil. Heavy equipment should not be used for placing and/or compacting backfill adjacent to the retaining wall and should be kept a minimum of three feet or at a distance determined by a 1H:1V slope away from the base of the wall, whichever is greater.

7.4 SLOPE STABILITY

7.4.1 GLOBAL STABILITY

A global stability analysis was performed to assess the global stability of the existing slope for both static and seismic conditions. Based on existing laboratory testing available, empirical correlations, and professional engineering judgement, Table 7 (Slope Stability Strength Parameters) presents general soil strength parameters used in slope stability analyses.

Table 7: Slope Stability Strength Parameters

Material	Moist Unit Weight (pcf)	Estimated Effective Friction Angle (°)	Estimated Effective Cohesion (psf)
Imported Structural Fill	125	34	100
Native Overburden Soil (1) (SC and CL)	126.5	27.6	519
Sedimentary Bedrock (Observed in TP-7 and TP-8 @ 9.5-10 feet)	120.0	30	1000

NOTES:

1. Strength parameters were estimated based on the direct shear results in Appendix B.

An average design ground acceleration at zero seconds for a 2% probability occurrence in 50-years (i.e., 2,475-year return period) for a Site Class C soil (PGA_M) is 0.775 g. For our pseudo-static (i.e., seismic) slope stability analyses, we assumed slope deformations on the order of 4- to 6-inches are acceptable. Therefore, in accordance with Section 4.2 of the U.S. Department of Transportation Publication No. FHWA-NHI-00-043 published March 2001, a horizontal seismic design acceleration coefficient (k_h) of 0.387 was used for slope stability analyses.

Table 8 presents modeled slope under static and pseudo-static analyses.

Table 8: Slope Stability Factors of Safety

Load Case	Slope Stability Factor of Safety	
	Minimum Design FOS	Calculated FOS
Static slope stability	1.50	2.1
Pseudo-static slope stability	1.10	1.2

NOTES:

2. The civil designer shall confirm actual project cross sections are consistent with slope stability model cross sections presented in Appendix E.
3. Static Minimum Recommended Slope Stability Factor of Safety is consistent with AASHTO LRFD Bridge Design Specifications, 8th Edition Section 11.6.2.3.
4. Pseudo-static Minimum Recommended Slope Stability Factor of Safety is based on the FHWA LRFD Seismic Analysis and Design of Transportation Geotechnical Features and Structural Foundations Reference Manual, Section 6.2.2.

Global stability of the modeled slope yielded an acceptable factor of safety for both static and pseudo-static condition. Slope stability models analyzed with satisfactory factors of safety are presented in Appendix D.

8.0 CONSTRUCTION RECOMMENDATIONS

8.1 SITE PREPARATION

8.1.1 SITE CLEARING

Stripping and Grubbing	Surface vegetation, duff, and topsoil shall be stripped and grubbed prior to initiating fill placement or construction activities. Surface vegetation shall be disposed of outside the construction limits of the site. Topsoil shall be stockpiled onsite for use in non-structural landscape areas. Stripped and grubbed material shall not be incorporated into or permitted for placement as structural fill. Stripping and grubbing depths on the order of 4 to 6 inches may be required and may extend deeper where concentrated areas of brush or shrubs are located.
Vegetative Root Balls	Root balls located at the base of mature brush or shrubs shall be completely removed. Voids resulting from grubbing shall be cleaned of loose material, widened to permit access to compaction equipment, and backfilled with properly compacted structural fill as described in Section 8.3.

8.1.2 SUBGRADE PREPARATION

Scarification and Moisture Conditioning	Scarification and moisture conditioning including uniform mixing of soils to achieve recommended moisture contents will be required. It is recommended that the moisture content of the in-situ soils be determined during construction to evaluate if moisture conditioning is required. Moisture conditioning and scarification depth will be dependent on the soil type: • Granular soils shall be scarified to a minimum depth of 12 inches and moisture conditioned, if required, prior to densification. It is recommended that these soils have moisture contents of plus or minus 2 percent of optimum moisture (ASTM D1557) prior to densification. • Clay or fine-grained soils shall be scarified to a minimum depth of 12 inches, and moisture conditioned to at least 3 percent over optimum (ASTM D1557), prior to densification. It is mandatory that this moisture content be maintained by periodic surface wetting, or other methods, until the surface is covered by at least one lift of fill. Moisture contents above 3 percent of optimum moisture will be acceptable if the soil horizon maintains its stability when subjected to construction equipment loads and density can be achieved in subsequent structural fill lifts.

Densification and Compaction	Prior to placement of structural fill, subgrade soils shall be scarified, moisture conditioned, and densified to at least 90 percent relative compaction (ASTM D1557). Uniform mixing of the site soil to achieve recommended soil moisture contents may be required. It is recommended that the moisture content of the in-situ soil be determined during construction to evaluate the extent of moisture conditioning required. After the densification process, a firm, stable surface shall be produced. Densification of the subgrade soils will be dependent on soil type: • Granular soils are not considered cohesive and the particles generally require shaking or vibratory action (i.e., smooth drum roller) for densification. • Clay soil is considered cohesive and particles are best densified using high impact ram or sheepsfoot roller compactors. • To determine if oversaturated subgrade materials have a potential for pumping, proof-rolling with heavy rubber-tired construction equipment such as a fully loaded water truck is recommended. Pumping or soft areas shall be over excavated and replaced with densified structural fill.

8.2 REMEDIAL EARTHWORK

8.2.1 UNCONTROLLED FILL REMEDIAL EARTHWORK

As previously noted, the uncontrolled fill is riddled with debris and is considered potentially expansive. Uncontrolled fill will be located below a majority of the proposed structural improvements (e.g., residential structure foundations and slab, flatwork, pavement, retaining wall foundations). The general vicinity and estimated thicknesses of the uncontrolled fill is included on Plate A-1; however, the actual limits of the uncontrolled fill will need to be determined at the time of construction during mass grading and foundation grade preparation.

Uncontrolled fill shall be completely removed below the improvement area replaced with densified structural fill. At a minimum CME recommends the removal shall extend a lateral distance equal to a minimum of 5 feet beyond the exterior limits of the structure; or a distance approximated by a 1H: 1V project downward and outward from the outside edge of the foundation [i.e., “Zone of Influence”], whichever is greater (refer to Figure 4). This material shall be hauled offsite or placed in non-structural areas.

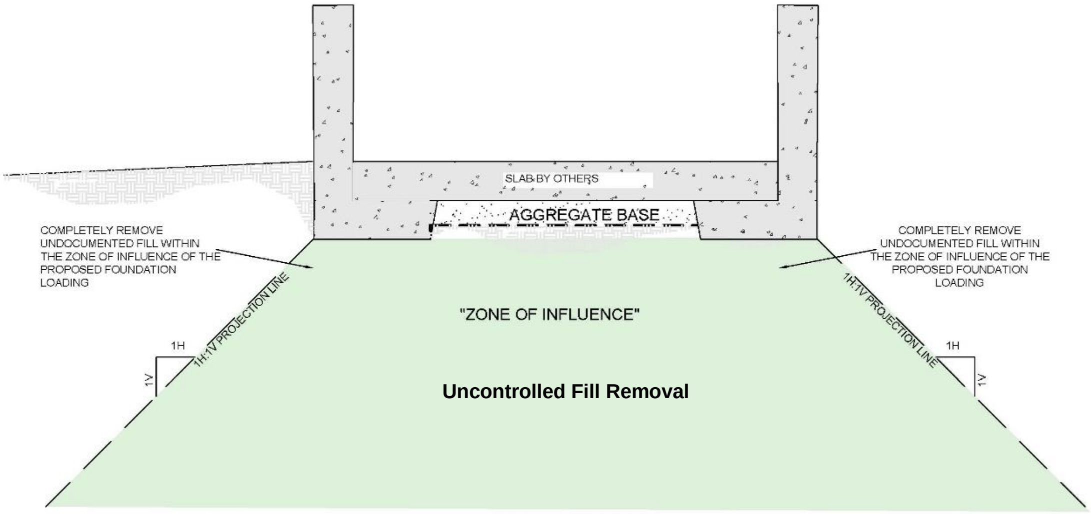


Figure 4: Typical Uncontrolled Fill Remedial Earthwork Schematic

8.2.2 EXPANSIVE CLAY SOIL REMEDIAL EARTHWORK

The uppermost overburden soils located below the uncontrolled fill consist of potentially expansive material classifying as lean clay with gravel and cobbles (CL), moderately plastic clayey sand (SC), lean clay with sand (CL), and fat clay (CH). The need for remedial earthwork of this soil horizon will be dependent on the proximity of the proposed structural element to this potentially expansive soil horizon. To mitigate the potential for deformation of structural elements due to volumetric changes (i.e., shrink/swell) of the underlying soil, a vertical and lateral offset is recommended. Remedial earthwork may require overexcavation and replacement with structural fill to achieve the recommended vertical and lateral offsets and will be dependent on the final site grading.

The plasticity indices of the onsite material tested in our laboratory generally ranged from 24 to 27 although variations may exist. Table 9 (Minimum Vertical and Lateral Offset from Potentially Expansive Soil) summarizes the recommended minimum vertical and lateral offsets for pavement structural sections and the building structure footprint. Based on the soil tested in our laboratory, we expect the majority of the soil will comply with a PI range of “20-30”.

Table 9: Minimum Vertical and Lateral Offset from Potentially Expansive Soil

Typical Structural Area[1,2,3]	**Minimum Vertical and Lateral Offsets for Various Plasticity Index (PI) Ranges**			
	15-20		**20-30**	
	Vertical Thickness (ft)	**Lateral Offset (ft)**	**Vertical Thickness (ft)**	**Lateral Offset (ft)**
Flatwork and Pavement (i.e., sidewalk and parking areas)	0.5	0.5	1.0	1.0
Building Structure Footprint (Includes perimeter foundations, interior column footings, and interior concrete slabs)	1.5	1.5	2.5	2.5

NOTES:

1. The overexcavation shall encompass the entire structure area footprint and extend laterally beyond the structural element a distance equal to the minimum lateral offset presented for each structural area.
2. For pavement, flatwork, and interior concrete slabs, the vertical offsets shall begin at the base of the aggregate base and lateral offset shall be from the exterior edge of the pavement structural section.
3. For foundations the vertical and lateral offsets are in reference to the exterior perimeter of the foundation.
4. Where questionable soil is encountered, the project geotechnical engineer shall be notified.
5. If plasticity indices outside of this range are encountered, please notify this office for alternative recommendations.

A typical schematic showing the minimum vertical and lateral offset based on the proposed structure type is presented as

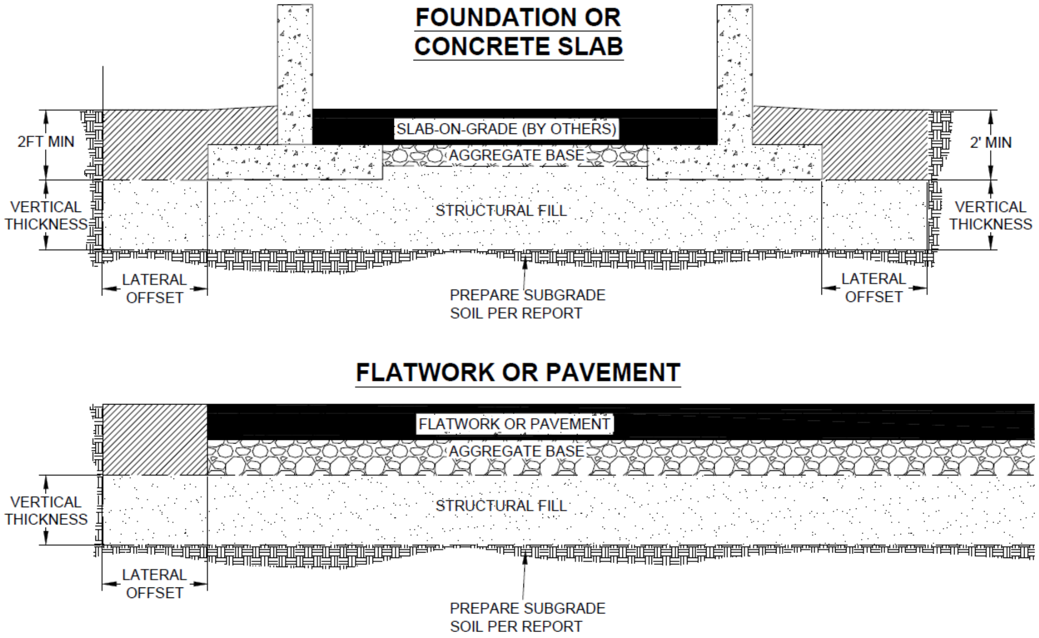


Figure 5: Vertical and Lateral Offset from Potentially Expansive Soil Schematic

8.3 STRUCTURAL FILL GUIDELINES

Structural fill is defined as supporting soil placed below foundations, concrete slabs-on-grade, pavements, or any structural element that derives support from the underlying sub-soil. Structural fill derived from on-site shall meet the requirements for a granular soil (refer to Section 6.1). Based on laboratory test results, majority of the soil on-site does not meet the requirements of structural fill. Imported structural fill will be required.

Imported structural fill shall be free of debris, vegetation, and organics, meeting the requirements provided in Table 10 (Guideline Specification for Imported Structural Fill).

<table>
<tr><th colspan="6">Table 10: Guideline Specification for Imported Structural Fill</th></tr>
<tr><th colspan="3">Sieve Size</th><th colspan="3">Percent by Dry Weight Passing</th></tr>
<tr><td colspan="3">4-inches</td><td colspan="3">100</td></tr>
<tr><td colspan="3">¾ inch</td><td colspan="3">70 – 100</td></tr>
<tr><td colspan="3">No. 40</td><td colspan="3">15 – 65</td></tr>
<tr><th colspan="2">Percent Passing No. 200</th><th colspan="2">Maximum Liquid Limit</th><th colspan="2">Maximum Plastic Index</th></tr>
<tr><td colspan="2">5 – 15</td><td colspan="2">45</td><td colspan="2">14</td></tr>
<tr><td colspan="2">16 – 35</td><td colspan="2">40</td><td colspan="2">10</td></tr>
<tr><th colspan="6">R-Value (Traffic Areas Only)</th></tr>
<tr><td colspan="6">30</td></tr>
<tr><th colspan="6">Water Soluble Sulfate (SO_4) in Soil (%) by Mass</th></tr>
<tr><td colspan="6"><0.2</td></tr>
</table>

NOTES:

1. R-Value is required for materials placed in roadways or areas to receive vehicular traffic only. Not required for building foundations or ancillary improvements outside of traffic areas.
2. Water Soluble Sulfate required where structural fill will be located adjacent to, above, or in direct contact with concrete elements. Please contact the project geotechnical engineer for additional guidance.

Structural fill shall be placed in maximum 8-inch thick (loose) level lifts or layers and densified to at least 90 percent relative compaction. The required moisture content of the soils, prior to densification, shall range between plus or minus 3 percent of optimum moisture, as determined by moisture-density relationship test results (ASTM D1557). Moisture contents greater than 3 percent of optimum moisture are acceptable if the soil lift is stable and required relative compaction can be attained in the soil lift and succeeding soil lifts. Grading should not be performed with frozen soils or on frozen soils.

8.4 TRENCHING AND CONFINED EXCAVATIONS

All excavations regardless of depth should be evaluated to check the stability prior to occupation by construction personnel. Shoring or sloping of trench walls may be required to protect construction personnel and provide temporary stability. In areas where temporary confined excavations may be unstable, trench boxes may be used to provide safe ingress and egress for construction personnel.

Excavations should comply with current OSHA safety requirements (Federal Register 29 CFR, Part 1926). Rock/soil is classified as Stable Rock, Type A, B or C, which requires different temporary excavation cut slope gradients. Maximum allowable slopes for excavations less than 20 feet deep are presented in Table 11 (Maximum Allowable Temporary Slopes). Ultimately, it is the contractor’s responsibility to determine soil type in the field during trenching activities. Based on the soil conditions encountered during the subsurface exploration, it is anticipated that the trench excavations will comply with Type B or C conditions.

Table 11: Maximum Allowable Temporary Slopes

Soil or Rock Type	Maximum Allowable Slopes[1] for Excavations (< 20 Feet)[2]	
Stable Rock	Vertical	90º
Type A	3H:4V	53º
Type B	1H:1V	45º
Type C	3H:2V	34º

NOTES:

1. Angles expressed in degrees from the horizontal and have been rounded off.
2. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.
3. For detailed description of the soil types outlined above visit the US Department of Labor Safety and Health Topics website at: https://www.osha.gov/SLTC/trenchingexcavation/construction.html

Trench excavations should be protected from surface water/runoff. Temporary drainage swales should be excavated to divert surface flows into a collection area away from the open excavation. If warranted, dewatering of pipe trench excavations can be accomplished by use of a temporary dewatering system.

If subsurface water conditions differ from those encountered during our subsurface exploration, the geotechnical engineer should be notified immediately.

8.5 CONCRETE SLABS

All interior concrete slabs and flatwork shall be directly underlain by aggregate base. The minimum thickness of base material shall comply with the following:

Structure Type	Aggregate Base Minimum Thickness (in)
Curb and Gutter	6.0
Exterior Sidewalks and Slabs	4.0
Interior Structure Slabs	6.0

Subgrade soil below the aggregate base and the aggregate base shall be prepared in accordance with the recommendations of this report.

The contractor should submit a concrete mix design to the owner at least 10 working days prior to construction for approval. Concrete mix proportions and construction techniques, including the addition of excess water and improper curing, can adversely affect the finished quality of the concrete resulting in cracking, curling and spalling of slabs. We recommend that all placement and curing be performed in accordance with procedures outlined by the American Concrete Institute. Special considerations should be given to concrete placed and cured during hot or cold weather conditions. Proper control joints and reinforcing should be provided to minimize any damage resulting from shrinkage.

8.6 SITE DRAINAGE AND MOISTURE MIGRATION MANAGEMENT

Site Drainage	The project site will be subjected to seasonal runoff. Adequate surface drainage shall be constructed and maintained to convey the water away proposed structures. The permanent finished slope grade away from the structure should be at least 5 percent for a minimum distance of 10 feet away from the building. The slope gradient can be reduced to 2 percent for impervious surfaces, such as concrete slabs-on-grade and pavement, constructed adjacent to the building. It is recommended that all runoff is collected within permanent drainage paths away from the structure to convey water off the property.
Crawl Space	Crawlspace moisture is commonly associated with raised floor construction. Introduction of this moisture can be due to several sources: excessive landscape irrigation, poor site drainage, excessive precipitation, or leakage from other adjacent water sources (pools, ponds, irrigation lines, water features, etc.). Consequently, it is common for water to seep into fill material, perch on the native or compacted soils, travel along the surface of the native or compacted soils, and daylight where the cut/fill line is exposed. The civil designer shall consider the potential for moisture migration into the crawl space and provide site grading and drainage in accordance with local standard of practice. Soil exposed within the crawl space shall be completely covered with a moisture barrier (visqueen sheeting) and properly maintained to prohibit any moisture penetration from the subgrade soils.
Concrete Slab-on-Grade	The transmission of moisture to the base of the slab can occur through two physical processes: water vapor transmission and/or capillary action of the underlying soils. Water vapor can be transmitted through the slab and the transmission rate depends on the difference in the water vapor pressure between the air voids in the slab and the air above the slab. Moisture vapor migrating through the slab can cause the debonding and discoloration of tile, linoleum, or other products placed directly on the concrete slab. For heated facilities and where sensitive floor coverings or equipment are planned, as noted in Section 1907 (Minimum Slab Provisions) of the 2018 IBC, a polyethylene vapor retarder is recommended for slab-on-grade construction[1]. The vapor retarder system shall conform to ASTM E1745. A Class A (ASTME-1745) vapor retarder is recommended for project design (such as a 15-mil Stego Wrap or approved alternate). The vapor retarder may be placed between the base course and subgrade (ASTM E1643[2]).

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[1] When a vapor retarder is required, a capillary break shall be installed.

[2] Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

Retaining Walls and Stem-walls	The design values provided in Section 7.3 (Static Lateral Earth Pressures) assumes that proper drainage measures have been incorporated in the design to prevent the buildup of hydrostatic pressure within the retained backfill. Retained backfill drainage systems are generally recommended in semi-arid areas for wall heights greater than 3 feet. Drainage options commonly include weep holes, back-of-wall/subdrain (i.e., perforated pipe with drain rock), and/or pre-manufactured drainage composites. The method of retained backfill drainage will be dependent on the site layout, wall height, and wall type. Stem-walls constructed for this project with retained heights of less than 3 feet will not require a retained backfill drainage system provided the backfill is compacted to at least 90 percent relative compaction and the recommendations for site drainage are adhered to (refer to Section 8.6.1Drainage Options Retaining Structures).

8.6.1 DRAINAGE OPTIONS RETAINING STRUCTURES

Exterior retaining structures shall include back-of-wall drainage to limit the potential for buildup of hydrostatic pressures. Several back-of-wall drainage designs are available to the site civil and structural designer.

Design options for retaining wall drainage are presented below:

- The most common method for drainage of retaining walls is the installation of a back-of-wall drain (i.e., French Drain), this method of drainage is typically used where weep holes cannot be effectively used or where drainage through the face of the structure is not feasible.
- Alternatively, a pre-manufactured geocomposite drain or drainage panel such as Mirafi® G100W or G100N, or approved equal may be considered. This material shall be installed in accordance with the manufacturer's recommendations. Typically, a drainage pipe and drainage media is required at the base of the installation. Installation recommendations vary by manufacturer.
- If drainage can be obtained through the front of the retaining wall (e.g., exterior retaining structures), weep holes could be installed near the base of the retaining wall. Weep hole sizing and spacing is dependent on the amount of drainage anticipated behind the retaining wall. A filter cover shall cover the weep holes to prevent piping and loss of backfill material.

Typical back-of-wall drainage options for retaining structures are included as Figure 6 and Figure 7 below.

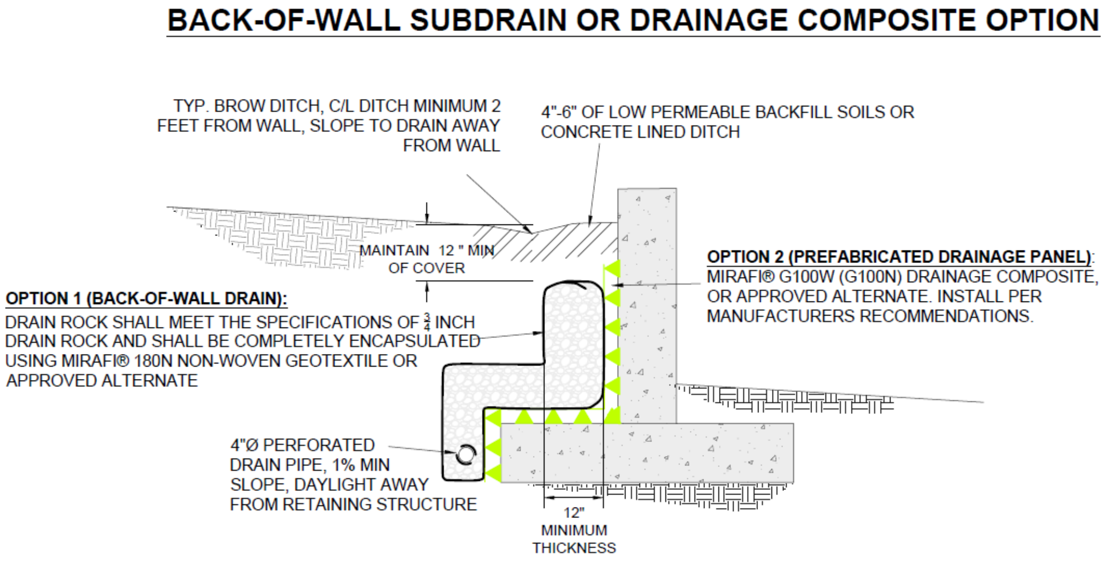


Figure 6: Option 1 Typical Basement Retaining Wall Back-of-Wall Drainage Schematic

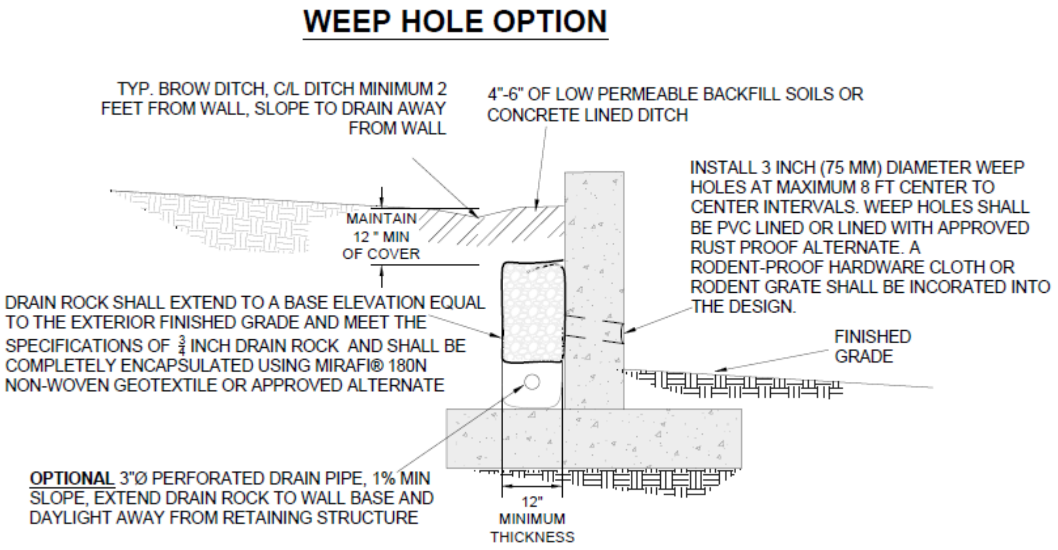


Figure 7: Option 2 Typical Non-Basement Retaining Wall Back-of-Wall Drainage Schematic

8.7 CONCRETE CORROSION CONSIDERATION

Many external sources can affect the potential for sulfate attack against concrete ranging from soil type, marine/wetland environments, to deicing and industrial conditions. The American Concrete Institute (ACI) Committee 201 and ACI 318-14 have established guidelines for determining the potential for sulfate attack from external sources. Table 12 (General Guideline Requirements for Concrete Subject to Sulfate Exposure) has been developed to provide the design engineer with guideline recommendations for cement type based on the severity of potential sulfate exposure associated with the tested soil encountered during the current exploration.

Table 12: General Guideline Requirements for Concrete Subject to Sulfate Exposure

Severity of Potential Exposure	Water Soluble Sulfate (SO_4) in soil (%) by mass	Sulfate (SO_4) in water (ppm)	Maximum Water Cementitious Materials Ratio	Cementitious Material Requirements
S0 (negligible)	$SO_4 < 0.10$	$SO_4 < 150$	No Requirement	No Requirement
S1 (Moderate)	$0.10 < SO_4 < 0.20$	$150 < SO_4 < 1{,}500$	0.50	ASTM C150 Type II Cement
S2 (Severe)	$0.2 < SO_4 < 2.0$	$1{,}500 < SO_4 < 10{,}000$	0.45	ASTM C150 Type V Type I Cement with 20% Class N Pozzolan Type I Cement with 20% Class F Fly Ash
S3 (Very Severe)	$SO_4 > 2.0$	$SO_4 > 10{,}000$	0.40	Refer to ACI 201.2R.16 and ACI 318-14

NOTES:

1. Table reference: ACI 201.2R.16, publication Table 6.1.4.1a and 6.1.4.1b and ACI 318-14, Table 19.3.1.1

Soil chemistry test results are included in Appendix B and Table 13 (Soil Sulfate Content Results).

Table 13: Soil Sulfate Content Results

Exploration Designation	Sample ID	Sample Depth (ft)	Sulfate Content (%)	Severity of Potential Exposure	w/cm by mass, maximum	Permitted Cement Type
TP-5	5B	4.0-5.0	< 0.02	S0	No Restriction	No Restriction

NOTES:

1. Recommendations based on ACI 201.2R-16.

A corrosion specialist should be consulted to determine if the site soil conditions warrant further investigation or if proposed structures require corrosion protection.

9.0 CONSTRUCTION OBSERVATION AND TESTING SERVICES

The recommendations presented in this report are based on the assumption that the owner/project manager provides sufficient field testing and construction review during all phases of construction. These construction observations and testing services should include but not be limited to:

- Observation, documentation and field density testing during site preparation and grading;
- Structural observation and inspection per 2018 IBC for concrete and reinforcing steel;
- Field density testing of utility bedding sand and trench backfill;
- Laboratory testing for materials qualification and compliance with project specifications; and
- Observation, testing, and documentation during paving operations.
- Foundation inspection prior to placing rebar;

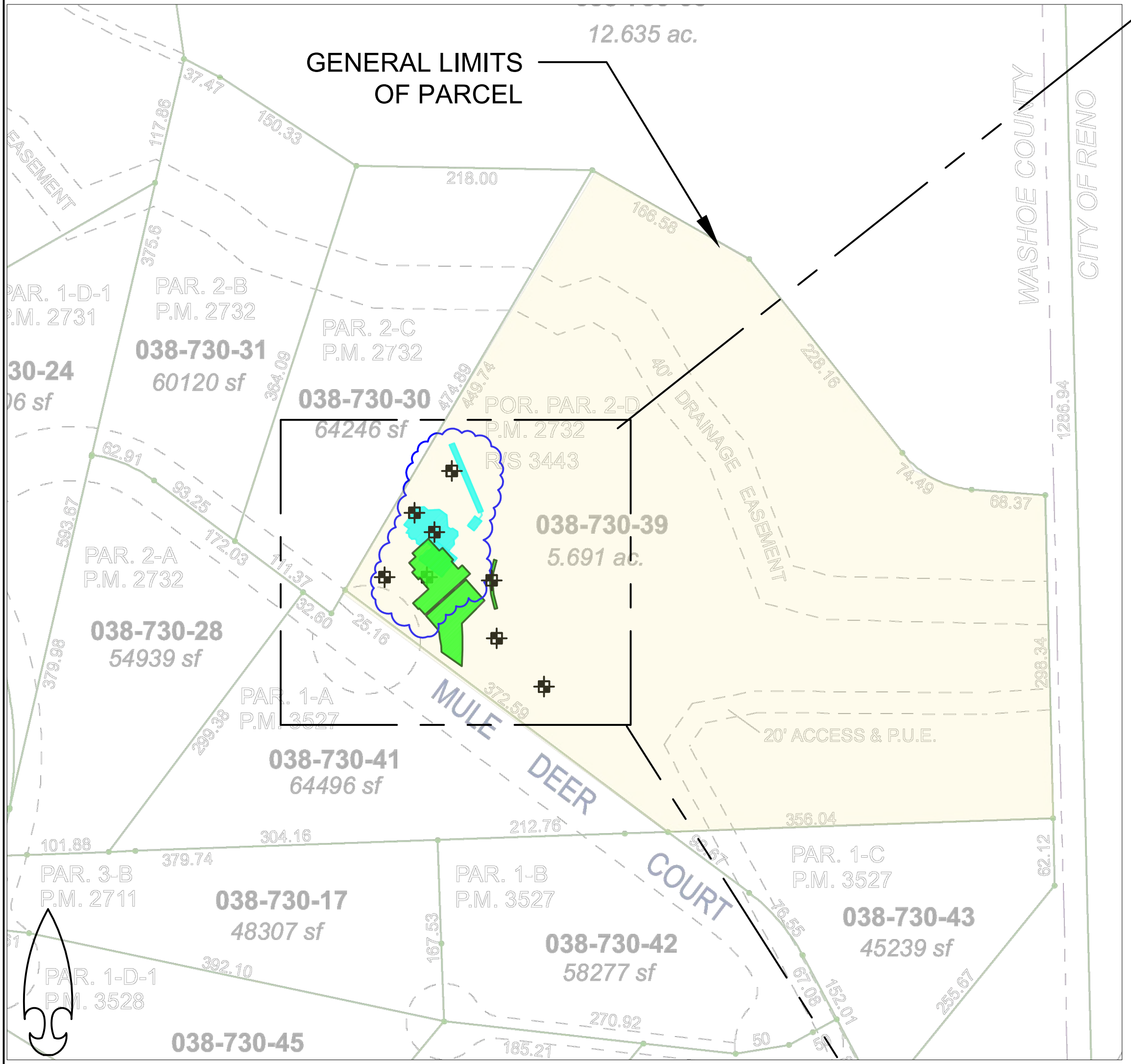
CME employs a large staff of certified inspectors and testers to provide these services. Prior to construction, the owner/project manager should schedule a preconstruction conference to include, but not be limited to: owner/project manager, project engineer, general contractor, earthwork and materials subcontractors, and geotechnical engineer. It is the owner's/project manager's responsibility to set-up this meeting and contact all responsible parties. The conference will allow parties to review the project plans, specifications, and recommendations presented in this report, and discuss applicable material quality and mix design requirements. All quality control reports should be submitted to the owner/project manager for review and distributed to the appropriate parties.

Additionally, all plans and specifications should be reviewed by the engineer responsible for this geotechnical report to determine if they have been completed in accordance with the recommendations contained herein. It is the owner's/project manager's responsibility to provide the plans and specifications to the geotechnical engineer.

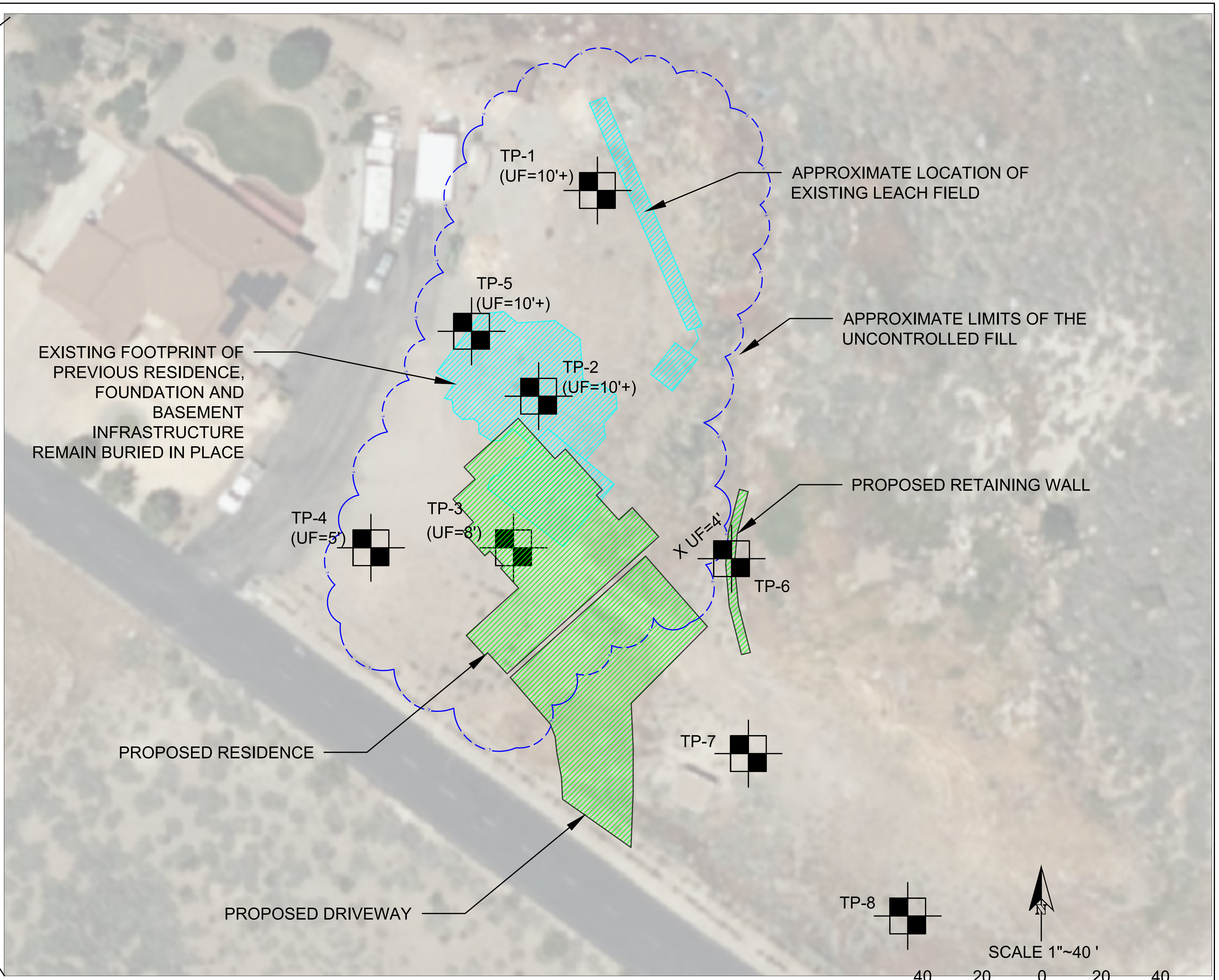
10.0 LIMITATIONS

Exploration Location and Geologic Variations	• This report has been prepared in accordance with generally accepted local geotechnical practices. The conclusions and recommendations of this report are provided for the design and construction of the proposed project as described in this report. The analyses and recommendations contained herein are based upon field exploration locations included on Plate A-1. • Exploration locations included as part of this report should be considered accurate only to the degree implied by the methods used. This report does not reflect soil, rock, or groundwater variations that may become evident during the construction period, at which time re-evaluation of the recommendations may be necessary.
General Intent and Information Distribution	• The intent of this report is to provide geotechnical information related to construction and design of the project. The owner/project manager is responsible for distribution of this report to all designers and contractors whose work is affected by geotechnical recommendations provided. In the event of changes in the design, location, or ownership of the project prior to construction, our recommendations should be reviewed by our geotechnical representative. • If our engineer is not accorded the privilege of making this recommended review, the CME can assume no responsibility for misinterpretation or misapplication of his recommendations or their validity in the event changes have been made in the original design concept without our prior review.
Warranties	• CME makes no other warranties, either expressed or implied, as to the professional advice provided under the terms of this agreement and included in this report. Any use, reliance on, or decisions, which a third party makes based upon the information contained in this report, are the sole responsibility of such third parties. CME accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.
Clay Soil	• Clay soils may be present in discontinuous areas below the proposed improvements. Clay soils may potentially shrink or swell (volume changes) in response to changes in the moisture content of the soil. Moisture changes in these soils can occur as a result of seasonal variations in precipitation, poor site drainage, landscape irrigation, leaking underground pipes, capillary action, or from other sources. Volume changes in clay soils can cause differential movements in structural elements constructed in the sphere of influence or bearing on the clay soil. The project geotechnical engineer shall be notified where questionable soils are encountered.
Standard Owner Maintenance and Monitoring Responsibility	• All structures are subjected to deterioration from environmental and manmade exposures. As a result, all structures require frequent monitoring and regular maintenance to prevent damage and/or deterioration. Such monitoring and maintenance are the sole responsibility of the Owner. CME, Inc. shall have no responsibility for such issues or resulting damages.
Environmental Hazards Evaluation	• Any evaluation of the site for the presence of surface or subsurface hazardous substances is beyond the scope of this study. When suspected hazardous substances are encountered during routine geotechnical investigations, they are noted in the exploration logs and reported to the client.

APPENDIX A



WASHOE COUNTY ASSESSOR PACEL MAP
(N.T.S)



EXPLORATION LOCATION MAP

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CME CONSTRUCTION MATERIALS ENGINEERS INC.
300 Sierra Manor Drive, Suite 1
Reno, NV 89511

BRIAN GRAHAM
53 MULE DEER COURT SINGLE-FAMILY RESIDENCE
EXPLORATION LOCATION MAP
RENO, NEVADA

PROJECT NO.: 3109

DATE:11/1/2022

LEGEND

- ⊞ APPROXIMATE TEST PIT LOCATION (UF=UNCONTROLLED FILL THICKNESS OBSERVED)
- ---- GENERAL LIMITS OF UNCONTROLLED FILL (NOTE MATERAL CONTAINES DEBRIS AND TRASH AS NOTED ON THE LOGS)
- 🟩 PROPOSED INFRASTRUCTURE EXTENTS
- ▨ EXISTING INFRASTRUCTURE EXTENTS

PLATE

A-1

LOG OF TEST PIT TP-1

PROJECT NO: 3109	**EXCAVATION CONTRACTOR:** CLIENT (Q&D)	**BEGIN DATE:** 9/16/2022
PROJECT: 53 MULE DEER CT RESIDENCE		**COMPLETION DATE:** 9/16/2022
LOCATION: FILL PAD, 39.52118, -119.93343	**EXCAVATION EQUIPMENT:** LINK-BELT 245 X4	**SURFACE ELEVATION:** 4866 (ft) (County GIS)
	BUCKET SIZE AND TYPE: 4 FEET, 5 TEETH	**BACKFILL METHOD:** TAMPED CUTTINGS
CLIENT: BRIAN GRAHAM	**TEST PIT WIDTH:**	**WATER DEPTH:** NOT ENCOUNTERED
LOGGED BY: CJJ	**TEST PIT LENGTH:**	**READING TAKEN:** 9/16/2022

FIELD							△ DCP CORRELATED SPT N VALUE △ 10 20 30 40 PL MC LL 0 20 40 60 80 100 ☐ FINES CONTENT (%) ☐ 20 40 60 80	LABORATORY					
ELEVATION (ft)	**DEPTH (ft)**	**SAMPLE**	**SAMPLE NO**	**POCKET PEN. (TSF)**	**GRAPHIC LOG**	**DESCRIPTION**		**LIQUID LIMIT**	**PLASTICITY INDEX**	**MOISTURE (%)**	**D. DENSITY (PCF)**	**% PASSING 200 SIEVE**	**REMARKS**
	0				🟩	**SANDY lean CLAY with GRAVEL and COBBLES (CL)**; brown; dry; about 5% subrounded to rounded COBBLES, up to 8.0 in. nominal diameter; about 15% coarse to fine, subrounded to rounded GRAVEL, up to 3.0 in. nominal diameter; about 35% coarse to fine, subrounded SAND; about 50% medium plasticity fines; hard [UNCONTROLLED FILL].							
	1.3				🟨	**SILTY SAND with GRAVEL and COBBLES (SM)**; light brown to tan; dry to moist; about 5% subangular to subrounded COBBLES, up to 5.0 in. nominal diameter; about 20% coarse to fine, subangular to subrounded GRAVEL, up to 3.0 in. nominal diameter; about 50% coarse to fine, subangular to subrounded SAND; about 25% medium plasticity fines; interbedded asphalt slabs upt to 7" thick [UNCONTROLLED FILL].							Large slabs of asphalt throughout test pit.
4864	2	▨	1A		🟨								
	3	▨			🟨								Grid and fabric at 3.0 feet.
4862	4	▨			🟨	Moist.	○ ☐	40	14	14.0		25.2	
	5				🟨								
4860	6				🟨								
	7				🟨								
4858	8				🟨	About 20% GRAVEL; about 25% fines.							
	9				🟨								
	10.0												

Bottom of excavation at 10.0 ft bgs

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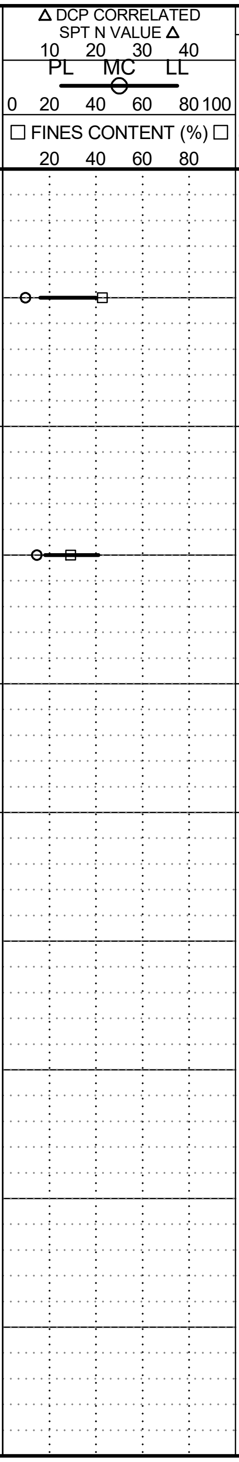
PROJECT NUMBER: 3109
PROJECT: 53 MULE DEER CT RESIDENCE
EXPLORATION: TP-1
ENTRY BY: CJJ **PLATE:** A-2
CHECKED BY: SAH **SHEET** 1 of 1

LOG OF TEST PIT TP-2

PROJECT NO: 3109	**EXCAVATION CONTRACTOR:** CLIENT (Q&D)	**BEGIN DATE:** 9/16/2022
PROJECT: 53 MULE DEER CT RESIDENCE		**COMPLETION DATE:** 9/16/2022
LOCATION: FILL PAD, 39.52099, -119.93349	**EXCAVATION EQUIPMENT:** LINK-BELT 245 X4	**SURFACE ELEVATION:** 4866 (ft) (County GIS)
	BUCKET SIZE AND TYPE: 4 FEET, 5 TEETH	**BACKFILL METHOD:** TAMPED CUTTINGS
CLIENT: BRIAN GRAHAM	**TEST PIT WIDTH:**	**WATER DEPTH:** NOT ENCOUNTERED
LOGGED BY: CJJ	**TEST PIT LENGTH:**	**READING TAKEN:** 9/16/2022



FIELD							LABORATORY					
ELEVATION (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE (%)	D. DENSITY (PCF)	% PASSING 200 SIEVE	REMARKS
4864	1 2	▨	2A		🟨	**CLAYEY SAND with COBBLES (SC)**; dark brown; dry; about 5% subrounded to rounded COBBLES, up to 6.0 in. nominal diameter; about 5% mostly fine, subrounded to rounded GRAVEL, up to 3.0 in. nominal diameter; about 50% mostly medium to fine, subangular to subrounded SAND; about 40% medium plasticity fines [UNCONTROLLED FILL]. 2.0	40	24	9.6		42.7	
4862	3 4	▨	2C		🟨	**CLAYEY SAND with GRAVEL (SC)**; tan and brown; dry to moist; about 20% coarse to fine, subrounded to rounded GRAVEL, up to 2.0 in. nominal diameter; about 50% coarse to fine, subangular to subrounded SAND; about 30% medium plasticity fines [UNCONTROLLED FILL]. 4.0	41	23	14.5		29.1	Large slabs of asphalt to 7.0 feet.
	5	▨	2B		🟩	**SANDY lean CLAY (CL)**; dark brown; moist; about 30% coarse to fine, subangular to subrounded SAND; about 70% medium plasticity fines [UNCONTROLLED FILL]. 5.0						Interbedded layers of clay and sand throughout test pit.
4860 4858	6 7 8 9				🟨	**CLAYEY SAND with GRAVEL (SC)**; tan and brown; moist; about 20% coarse to fine, subangular to subrounded GRAVEL, up to 3.0 in. nominal diameter; about 55% coarse to fine, subangular to subrounded SAND; about 25% medium plasticity fines [UNCONTROLLED FILL]. 10.0						Concrete foundation on the west side of test pit wall from 7.0 to 10.0 feet. Concrete slab with rebar at bottom of test pit.

Bottom of excavation at 10.0 ft bgs

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PROJECT NUMBER: 3109
PROJECT: 53 MULE DEER CT RESIDENCE
EXPLORATION: TP-2
ENTRY BY: CJJ **PLATE:** A-2
CHECKED BY: SAH **SHEET** 1 of 1

LOG OF TEST PIT TP-3

PROJECT NO: 3109
PROJECT: 53 MULE DEER CT RESIDENCE
LOCATION: FILL PAD, 39.52085, -119.93353
CLIENT: BRIAN GRAHAM
LOGGED BY: CJJ

EXCAVATION CONTRACTOR: CLIENT (Q&D)
EXCAVATION EQUIPMENT: LINK-BELT 245 X4
BUCKET SIZE AND TYPE: 4 FEET, 5 TEETH
TEST PIT WIDTH:
TEST PIT LENGTH:

BEGIN DATE: 9/16/2022
COMPLETION DATE: 9/16/2022
SURFACE ELEVATION: 4866 (ft) (County GIS)
BACKFILL METHOD: TAMPED CUTTINGS
WATER DEPTH: NOT ENCOUNTERED
READING TAKEN: 9/16/2022

FIELD							Δ DCP CORRELATED SPT N VALUE Δ 10 20 30 40 PL MC LL 0 20 40 60 80 100 ☐ FINES CONTENT (%) ☐ 20 40 60 80	LABORATORY					
ELEVATION (ft)	**DEPTH (ft)**	**SAMPLE**	**SAMPLE NO**	**POCKET PEN. (TSF)**	**GRAPHIC LOG**	**DESCRIPTION**		**LIQUID LIMIT**	**PLASTICITY INDEX**	**MOISTURE (%)**	**D. DENSITY (PCF)**	**% PASSING 200 SIEVE**	**REMARKS**
4866–4862	0–4.0	▨ (2–4)	3A		🟨	**CLAYEY SAND with GRAVEL (SC)**; dark brown; dry; about 20% coarse to fine, subangular to subrounded GRAVEL, up to 2.0 in. nominal diameter; about 50% coarse to fine, subangular to subrounded SAND; about 30% medium plasticity fines; hard [UNCONTROLLED FILL]. 4.0		41	23	14.5		29.1	Trash and debris in upper 4.0 feet. Easy digging throughout test pit.
4862–4858	4.0–8.0	▨ (4–6)	3B		🟩	**Lean CLAY with SAND (CL)**; brown and dark brown streaks; dry to moist; about 20% coarse to fine, subangular to subrounded SAND; about 80% medium to high plasticity fines [UNCONTROLLED FILL]. 8.0							Chunks of wood at 5.0 feet.
4858–4854	8.0–12.0	▨ (8–9)	3C		🟩	**Lean CLAY with SAND (CL)**; dark tan and orange; moist; about 20% coarse to fine, subangular to subrounded SAND; about 80% medium plasticity fines [ALLUVIAL SEDIMENTS]. 12.0							
4854–4852	12.0–14.0	▨ (12–13)	3D		🟩	**SANDY lean CLAY (CL)**; gray with red specks; moist; about 5% fine, subangular to subrounded GRAVEL; about 25% coarse to fine, subangular to subrounded SAND; about 70% medium plasticity fines [ALLUVIAL SEDIMENTS]. 14.0							

Bottom of excavation at 14.0 ft bgs

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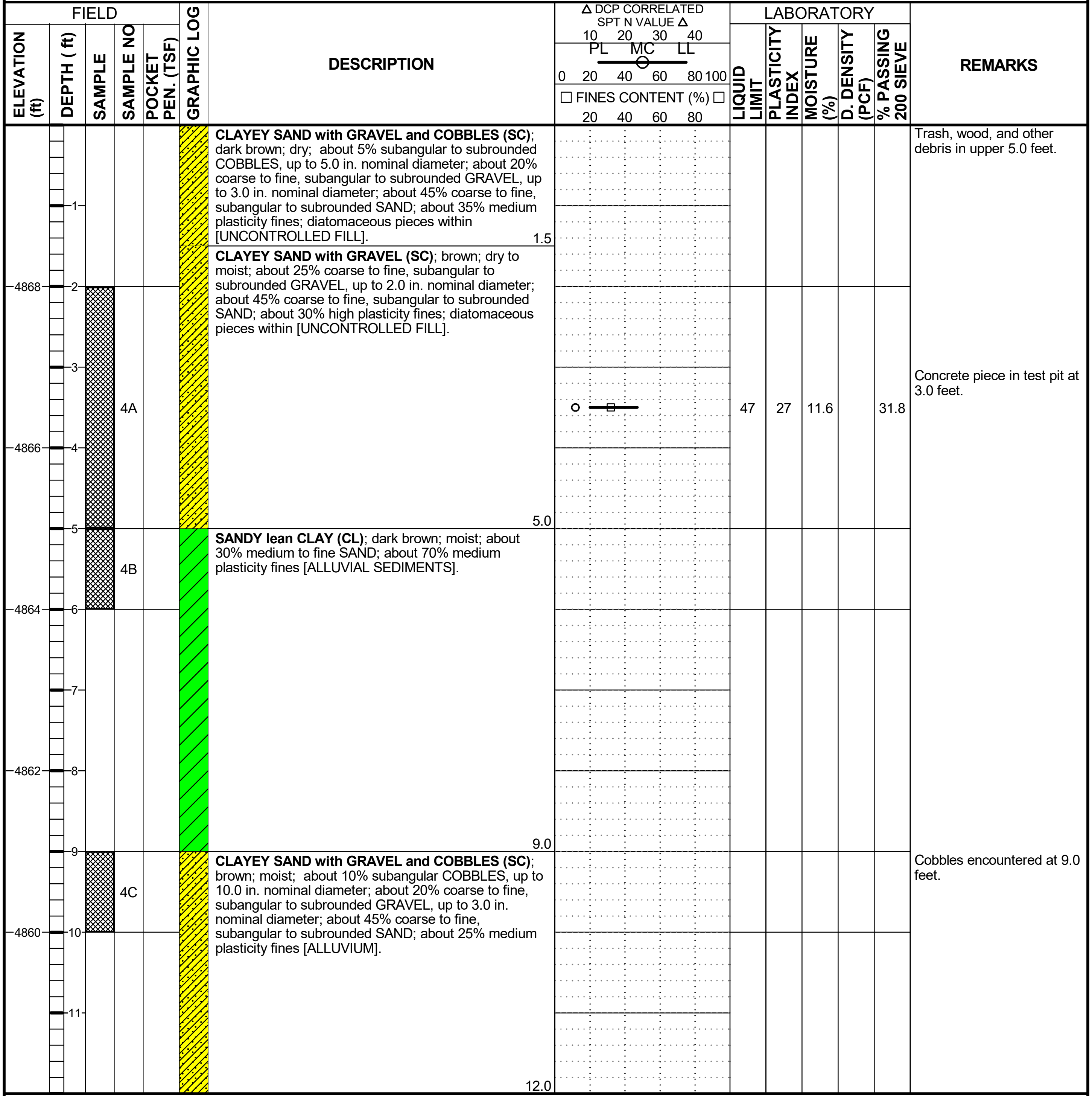
PROJECT NUMBER: 3109
PROJECT: 53 MULE DEER CT RESIDENCE
EXPLORATION: TP-3
ENTRY BY: CJJ **PLATE:** A-2
CHECKED BY: SAH **SHEET** 1 of 1

LOG OF TEST PIT TP-4

PROJECT NO: 3109	**EXCAVATION CONTRACTOR:** CLIENT (Q&D)	**BEGIN DATE:** 9/16/2022
PROJECT: 53 MULE DEER CT RESIDENCE		**COMPLETION DATE:** 9/16/2022
LOCATION: FILL PAD, 39.52085, -119.93370	**EXCAVATION EQUIPMENT:** LINK-BELT 245 X4	**SURFACE ELEVATION:** 4870 (ft) (County GIS)
	BUCKET SIZE AND TYPE: 4 FEET, 5 TEETH	**BACKFILL METHOD:** TAMPED CUTTINGS
CLIENT: BRIAN GRAHAM	**TEST PIT WIDTH:**	**WATER DEPTH:** NOT ENCOUNTERED
LOGGED BY: CJJ	**TEST PIT LENGTH:**	**READING TAKEN:** 9/16/2022



ELEVATION (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE (%)	D. DENSITY (PCF)	% PASSING 200 SIEVE	REMARKS
	0–1.5					**CLAYEY SAND with GRAVEL and COBBLES (SC)**; dark brown; dry; about 5% subangular to subrounded COBBLES, up to 5.0 in. nominal diameter; about 20% coarse to fine, subangular to subrounded GRAVEL, up to 3.0 in. nominal diameter; about 45% coarse to fine, subangular to subrounded SAND; about 35% medium plasticity fines; diatomaceous pieces within [UNCONTROLLED FILL]. 1.5						Trash, wood, and other debris in upper 5.0 feet.
4868–4866	1.5–5.0		4A			**CLAYEY SAND with GRAVEL (SC)**; brown; dry to moist; about 25% coarse to fine, subangular to subrounded GRAVEL, up to 2.0 in. nominal diameter; about 45% coarse to fine, subangular to subrounded SAND; about 30% high plasticity fines; diatomaceous pieces within [UNCONTROLLED FILL]. 5.0	47	27	11.6		31.8	Concrete piece in test pit at 3.0 feet.
4864–4862	5.0–9.0		4B			**SANDY lean CLAY (CL)**; dark brown; moist; about 30% medium to fine SAND; about 70% medium plasticity fines [ALLUVIAL SEDIMENTS]. 9.0						
4860	9.0–12.0		4C			**CLAYEY SAND with GRAVEL and COBBLES (SC)**; brown; moist; about 10% subangular COBBLES, up to 10.0 in. nominal diameter; about 20% coarse to fine, subangular to subrounded GRAVEL, up to 3.0 in. nominal diameter; about 45% coarse to fine, subangular to subrounded SAND; about 25% medium plasticity fines [ALLUVIUM]. 12.0						Cobbles encountered at 9.0 feet.

Bottom of excavation at 12.0 ft bgs

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PROJECT NUMBER: 3109
PROJECT: 53 MULE DEER CT RESIDENCE
EXPLORATION: TP-4
ENTRY BY: CJJ **PLATE:** A-2
CHECKED BY: SAH **SHEET** 1 of 1

LOG OF TEST PIT TP-5

PROJECT NO: 3109	**EXCAVATION CONTRACTOR:** CLIENT (Q&D)	**BEGIN DATE:** 9/16/2022
PROJECT: 53 MULE DEER CT RESIDENCE		**COMPLETION DATE:** 9/16/2022
LOCATION: FILL PAD, 39.52105, -119.93358	**EXCAVATION EQUIPMENT:** LINK-BELT 245 X4	**SURFACE ELEVATION:** 4867 (ft) (County GIS)
	BUCKET SIZE AND TYPE: 4 FEET, 5 TEETH	**BACKFILL METHOD:** TAMPED CUTTINGS
CLIENT: BRIAN GRAHAM	**TEST PIT WIDTH:**	**WATER DEPTH:** NOT ENCOUNTERED
LOGGED BY: CJJ	**TEST PIT LENGTH:**	**READING TAKEN:** 9/16/2022

FIELD							Δ DCP CORRELATED SPT N VALUE Δ 10 20 30 40 PL MC LL 0 20 40 60 80 100 ☐ FINES CONTENT (%) ☐ 20 40 60 80	LABORATORY					
ELEVATION (ft)	**DEPTH (ft)**	**SAMPLE**	**SAMPLE NO**	**POCKET PEN. (TSF)**	**GRAPHIC LOG**	**DESCRIPTION**		**LIQUID LIMIT**	**PLASTICITY INDEX**	**MOISTURE (%)**	**D. DENSITY (PCF)**	**% PASSING 200 SIEVE**	**REMARKS**
	1				🟩	**SANDY lean CLAY with GRAVEL and COBBLES (CL)**; brown; dry; about 5% subrounded to rounded COBBLES, up to 8.0 in. nominal diameter; about 15% coarse to fine, subrounded to rounded GRAVEL, up to 3.0 in. nominal diameter; about 35% coarse to fine, subrounded SAND; about 50% medium plasticity fines; hard [UNCONTROLLED FILL]. 1.0							
4865	2 3	▨	5A		🟨	**CLAYEY SAND with COBBLES and BOULDERS (SC)**; light orangish brown; dry to moist; about 5% subangular to subrounded BOULDERS, up to 20.0 in. nominal diameter; about 10% subangular to subrounded COBBLES, up to 12.0 in. nominal diameter; about 10% fine, subangular to subrounded GRAVEL, up to 3.0 in. nominal diameter; about 50% coarse to fine, subangular to subrounded SAND; about 25% high plasticity fines [UNCONTROLLED FILL]. 3.5		46	25	11.1		29.8	
4863 4861	4 5 6	▨	5B		🟨	**CLAYEY SAND (SC)**; dark brown; moist; about 60% angular to subangular SAND; about 40% medium plasticity fines [UNCONTROLLED FILL]. 7.0							Rebar and conduit pipe at 3.5 feet.
4859	7 8 9				🟨	**CLAYEY SAND with GRAVEL and COBBLES (SC)**; brown; moist; about 10% subangular to subrounded COBBLES, up to 10.0 in. nominal diameter; about 20% coarse to fine, subangular to subrounded GRAVEL, up to 3.0 in. nominal diameter; about 40% coarse to fine, subangular to subrounded SAND; about 30% medium plasticity fines [UNCONTROLLED FILL]. 10.0							Concrete foundation encountered. Concrete slab with rebar and wood at 8.0 feet.

Bottom of excavation at 10.0 ft bgs

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PROJECT NUMBER: 3109
PROJECT: 53 MULE DEER CT RESIDENCE
EXPLORATION: TP-5
ENTRY BY: CJJ **PLATE:** A-2
CHECKED BY: SAH **SHEET** 1 of 1

LOG OF TEST PIT TP-6

PROJECT NO: 3109	**EXCAVATION CONTRACTOR:** CLIENT (Q&D)	**BEGIN DATE:** 9/16/2022
PROJECT: 53 MULE DEER CT RESIDENCE		**COMPLETION DATE:** 9/16/2022
LOCATION: 39.52084, -119.93327	**EXCAVATION EQUIPMENT:** LINK-BELT 245 X4	**SURFACE ELEVATION:** 4852 (ft) (County GIS)
	BUCKET SIZE AND TYPE: 4 FEET, 5 TEETH	**BACKFILL METHOD:** TAMPED CUTTINGS
CLIENT: BRIAN GRAHAM	**TEST PIT WIDTH:**	**WATER DEPTH:** NOT ENCOUNTERED
LOGGED BY: CJJ	**TEST PIT LENGTH:**	**READING TAKEN:** 9/16/2022

FIELD							Δ DCP CORRELATED SPT N VALUE Δ 10 20 30 40 PL MC LL 0 20 40 60 80 100 ☐ FINES CONTENT (%) ☐ 20 40 60 80	LABORATORY					
ELEVATION (ft)	**DEPTH (ft)**	**SAMPLE**	**SAMPLE NO**	**POCKET PEN. (TSF)**	**GRAPHIC LOG**	**DESCRIPTION**		**LIQUID LIMIT**	**PLASTICITY INDEX**	**MOISTURE (%)**	**D. DENSITY (PCF)**	**% PASSING 200 SIEVE**	**REMARKS**
	0				🟨	**CLAYEY SAND with GRAVEL and COBBLES (SC)**; brown; dry; about 5% subangular to subrounded COBBLES, up to 8.0 in. nominal diameter; about 25% coarse to fine, subangular to subrounded GRAVEL, up to 3.0 in. nominal diameter; about 45% coarse to fine, subangular to subrounded SAND; about 25% low to medium plasticity fines [MIXED ALLUVIUM].							Fill on one end of the test pit down to 4.0 feet.
4850	2	▨	6A		🟨								
	3	▨			🟨	Diatomaceous pieces within.							
4848	4	▨			🟨	4.5							
	4.5	▨			🟩	**Lean CLAY with SAND (CL)**; brown with orange and white; dry to moist; about 25% medium to fine SAND; about 75% medium plasticity fines [ALLUVIAL SEDIMENTS]. 5.5							
	5.5				🟨	**CLAYEY SAND (SC)**; brown; dry to moist; about 20% coarse to fine, subangular to subrounded GRAVEL, up to 3.0 in. nominal diameter; about 45% coarse to fine, subangular to subrounded SAND; about 35% medium plasticity fines; diatomaceous pieces within [MIXED ALLUVIUM].							
4846	6				🟨								
4844	7.5	▨	6B		🟨	About 10% fine GRAVEL; about 50% SAND; about 40% fines. 10.0							
4842	10	▨	6C		🟩	**Fat CLAY with SAND (CH)**; dark brown; moist; about 25% medium to fine SAND; about 75% high plasticity fines [ALLUVIAL SEDIMENTS]. 11.0							

Bottom of excavation at 11.0 ft bgs

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PROJECT NUMBER: 3109
PROJECT: 53 MULE DEER CT RESIDENCE
EXPLORATION: TP-6
ENTRY BY: CJJ **PLATE:** A-2
CHECKED BY: SAH **SHEET** 1 of 1

LOG OF TEST PIT TP-7

PROJECT NO: 3109	**EXCAVATION CONTRACTOR:** CLIENT (Q&D)	**BEGIN DATE:** 9/16/2022
PROJECT: 53 MULE DEER CT RESIDENCE		**COMPLETION DATE:** 9/16/2022
LOCATION: 39.52066, -119.93325	**EXCAVATION EQUIPMENT:** LINK-BELT 245 X4	**SURFACE ELEVATION:** 4850 (ft) (County GIS)
	BUCKET SIZE AND TYPE: 4 FEET, 5 TEETH	**BACKFILL METHOD:** TAMPED CUTTINGS
CLIENT: BRIAN GRAHAM	**TEST PIT WIDTH:**	**WATER DEPTH:** NOT ENCOUNTERED
LOGGED BY: CJJ	**TEST PIT LENGTH:**	**READING TAKEN:** 9/16/2022

FIELD							Δ DCP CORRELATED SPT N VALUE Δ 10 20 30 40 PL MC LL 0 20 40 60 80 100 ☐ FINES CONTENT (%) ☐ 20 40 60 80	LABORATORY					
ELEVATION (ft)	**DEPTH (ft)**	**SAMPLE**	**SAMPLE NO**	**POCKET PEN. (TSF)**	**GRAPHIC LOG**	**DESCRIPTION**		**LIQUID LIMIT**	**PLASTICITY INDEX**	**MOISTURE (%)**	**D. DENSITY (PCF)**	**% PASSING 200 SIEVE**	**REMARKS**
	0–3.0	▨	7A			**CLAYEY SAND (SC)**; tan; dry; about 55% medium to fine SAND; about 45% medium plasticity fines; diatomaceous pieces within [MIXED ALLUVIUM]. 3.0							
	3.0–4.5	▨	7B			**Fat CLAY with SAND (CH)**; dark brown; dry; about 25% medium to fine SAND; about 75% high plasticity, high toughness fines [ALLUVIAL SEDIMENTS]. 4.5							
	4.5–9.5	▨ (5–6)	7C			**SANDY lean CLAY (CL)**; brown; dry to moist; about 30% medium to fine SAND; about 70% medium plasticity fines; calcareous stringers [ALLUVIAL SEDIMENTS]. 9.5							
	9.5–					**SEDIMENTARY ROCK (MUDSTONE), (HUNTER CREEK FORMATION)**, light brown to pale brown, intensely weathered, weak, moderately soft, intensely							Hard digging and scraping with bucket.

ELEVATION (ft)	DEPTH (ft)
	1
4848	2
	3
4846	4
	5
4844	6
	7
4842	8
	9

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PROJECT NUMBER: 3109
PROJECT: 53 MULE DEER CT RESIDENCE
EXPLORATION: TP-7
ENTRY BY: CJJ **PLATE:** A-2
CHECKED BY: SAH **SHEET** 1 of 2

ELEVATION (ft)	DEPTH (ft)	FIELD SAMPLE	SAMPLE NO	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	△ DCP CORRELATED SPT N VALUE △ 10 20 30 40 PL MC LL 0 20 40 60 80 100 ☐ FINES CONTENT (%) ☐ 20 40 60 80	LABORATORY LIQUID LIMIT	PLASTICITY INDEX	MOISTURE (%)	D. DENSITY (PCF)	% PASSING 200 SIEVE	REMARKS
						to moderately fractured. Bottom of excavation at 10.0 ft bgs							
	11												
4838	12												
	13												
4836	14												
	15												
4834	16												
	17												
4832	18												
	19												
4830	20												
	21												
4828	22												

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PROJECT NUMBER: 3109
PROJECT: 53 MULE DEER CT RESIDENCE
EXPLORATION: TP-7
ENTRY BY: CJJ **PLATE:** A-2
CHECKED BY: SAH **SHEET** 2 of 2

LOG OF TEST PIT TP-8

PROJECT NO: 3109
PROJECT: 53 MULE DEER CT RESIDENCE
LOCATION: 39.52051, -119.93306
CLIENT: BRIAN GRAHAM
LOGGED BY: CJJ

EXCAVATION CONTRACTOR: CLIENT (Q&D)
EXCAVATION EQUIPMENT: LINK-BELT 245 X4
BUCKET SIZE AND TYPE: 4 FEET, 5 TEETH
TEST PIT WIDTH:
TEST PIT LENGTH:

BEGIN DATE: 9/16/2022
COMPLETION DATE: 9/16/2022
SURFACE ELEVATION: 4848 (ft) (County GIS)
BACKFILL METHOD: TAMPED CUTTINGS
WATER DEPTH: NOT ENCOUNTERED
READING TAKEN: 9/16/2022

FIELD: ELEVATION (ft) | DEPTH (ft) | SAMPLE | SAMPLE NO | POCKET PEN. (TSF) | GRAPHIC LOG

DESCRIPTION

Δ DCP CORRELATED SPT N VALUE Δ: 10 20 30 40
PL MC LL: 0 20 40 60 80 100
☐ FINES CONTENT (%) ☐: 20 40 60 80

LABORATORY: LIQUID LIMIT | PLASTICITY INDEX | MOISTURE (%) | D. DENSITY (PCF) | % PASSING 200 SIEVE

REMARKS

ELEVATION (ft)	DEPTH (ft)	SAMPLE NO	DESCRIPTION	REMARKS
	0 – 1.0		**SANDY lean CLAY with GRAVEL and COBBLES (CL)**; brown; about 5% subangular to subrounded COBBLES, up to 6.0 in. nominal diameter; about 15% coarse to fine, subangular to subrounded GRAVEL, up to 3.0 in. nominal diameter; about 30% coarse to fine, subangular to subrounded SAND; about 50% medium plasticity fines [ALLUVIAL SEDIMENTS].	
	1.0 – 4.5		**CLAYEY SAND with GRAVEL (SC)**; brown with orange and white; about 15% coarse to fine, subangular to subrounded GRAVEL; about 45% coarse to fine SAND; about 40% low to medium plasticity fines; diatomaceous pieces within [MIXED ALLUVIUM].	Soil looks liked decomposed mudstone.
4846	2 – 5	8A		
4844	4			
	4.5 – 10.0		**Lean CLAY with SAND (CL)**; brown; moist; about 25% medium to fine SAND; about 75% medium plasticity fines [ALLUVIAL SEDIMENTS].	
4842	5 – 6	8B		
4840	8			
4838	10.0 – 12.0		**SEDIMENTARY ROCK (MUDSTONE), (HUNTER CREEK FORMATION)**, green and brown, intensely weathered, weak, moderately soft, intensely fractured.	

Bottom of excavation at 12.0 ft bgs

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PROJECT NUMBER: 3109
PROJECT: 53 MULE DEER CT RESIDENCE
EXPLORATION: TP-8
ENTRY BY: CJJ **PLATE:** A-2
CHECKED BY: SAH **SHEET** 1 of 1

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SOIL CLASSIFICATION CHART

PLATE

A-3

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	 LETTER	TYPICAL CLASSIFICATION NAMES
Course grained soils More than 50% of the material is larger than No. 200 sieve size	Gravel and gravelly soils	Clean gravels	▨	GW	Well-graded gravels, gravel-sand mixtures, few or no fines
			▨	GP	Poorly-graded gravels, gravel-sand mixtures, few or no fines
		Gravels with fines	▨	GM	Silty gravels, gravel-sand-silt mixtures
			▨	GC	Clayey gravels, gravel-sand-clay mixtures
	Sand and sandy soils	Clean sands	▨	SW	Well-graded sands, gravelly sands, few or no fines
			▨	SP	Poorly-graded sands, gravelly sands, few or no fines
		Sands with fines	▨	SM	Silty sands, sand-silt mixtures
			▨	SC	Clayey sands, sand-clay mixtures
Fine grained soils More than 50% of the material is smaller than No. 200 sieve size	Silts and clays	Liquid Limit less than 50	▨	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
			▨	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			▨	OL	Organic silts and organic silt-clays of low plasticity
		Liquid Limit greater than 50	▨	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			▨	CH	Inorganic clays of medium to high plasticity
			▨	OH	Organic clays of medium to high plasticity
			▨	PT	Peat or other highly organic soils

NOTES:
1. Dual classifications may occur (e.g. SP-SM, CL-ML, GP-GC)

SOIL SAMPLE TYPES

▩	Bulk Sample
☒	Standard Penetration Test (2.0" OD, 1.42" ID)
⧗	California Modified Sampler (3.0" OD, 2.42" ID)
▯	Thin walled Shelby Tube (3.0" OD)
▥	Rock Core

GROUNDWATER SYMBOLS

▽	Water level during drilling
▼	Water level after drilling

PARTICLE ANGULARITY

Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular	Particles are similar to angular, but have rounded edges
Subrounded	Particles have nearly plane sides, but have well-rounded corners and edges
Rounded	Particles have smoothly curved sides and no edges

PARTICLE SHAPE

Flat	Particles with width/thickness >3
Elongated	Particles with length/width >3
Flat and Elongated	Particles meet criteria for both flat and elongated

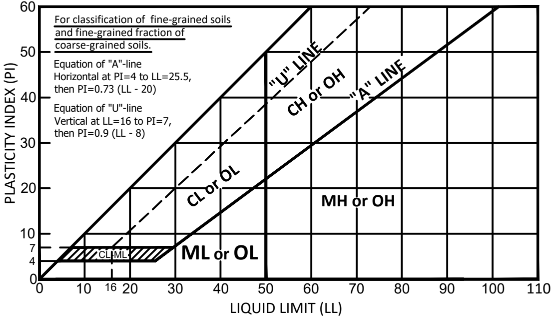
MOISTURE

Dry	No discernable moisture
Moist	Moisture present, but no free water
Wet	Visible free water

CEMENTATION

Weak	Crumbles or breaks with handling or light finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

PLASTICITY CHART



APPARENT DENSITY OF COHESIONLESS SOIL

	SPT (1.4" ID) N_{60}
Very Loose	< 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

Based on 60% energy ratio (ER_i). $N_{60} = N_{measured} * (ER_i/60)$

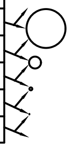
California Modified Sampler can be corrected to SPT by multiplying by 0.62

CONSISTENCY OF COHESIVE SOIL

	SPT (1.4"ID) N_{60}	Unconfined Compressive Strength (psf)	Pocket Penetrometer (tsf)
Very Soft	0 - 1	< 500	< 0.25
Soft	2 - 4	500 - 1,000	0.25 - 0.5
Medium Stiff	5 - 8	1,000 - 2,000	0.5 - 1.0
Stiff	9 - 15	2,000 - 4,000	1.0 - 2.0
Very Stiff	16 - 30	4,000 - 8,000	2.0 - 4.0
Hard	31 - 60	8,000 - 16,000	> 4.0
Very Hard	> 60	> 16,000	

PARTICLE SIZE, Ps

Boulders		Ps > 12"
Cobbles		3" < Ps ≤ 12"
Gravel	coarse	$\frac{3}{4}'' < Ps \le 3''$
	fine	$\frac{1}{5}'' < Ps \le \frac{3}{4}''$
Sand	coarse	$\frac{1}{16}'' < Ps \le \frac{1}{5}''$
	medium	$\frac{1}{64}'' < Ps \le \frac{1}{16}''$
	fine	$\frac{1}{300}'' < Ps \le \frac{1}{64}''$
Fines		$Ps \le \frac{1}{300}''$



PERCENT OF SOIL, Pp

Trace	Pp < 5%
Few	5 ≤ Pp ≤ 15%
Little	15 ≤ Pp ≤ 30%
Some	30 ≤ Pp ≤ 50%
Mostly	50 ≤ Pp ≤ 100%

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

ROCK CLASSIFICATION CHART

PLATE

A-4

BEDDING SPACING, Sb

Massive	10' < Sb
Very Thickly Bedded	3' < Sb ≤ 10'
Thickly Bedded	1' < Sb ≤ 3'
Moderately Bedded	4" < Sb ≤ 1'
Thinly Bedded	1" < Sb ≤ 4"
Very Thinly Bedded	$\frac{1}{4}$" < Sb ≤ 1"
Laminated	Sb ≤$\frac{1}{4}$"

ROCK HARDNESS

Extremely Hard	Cannot be scratched with a pocketknife or sharp pick. Can only be chipped with repeated heavy hammer blows.
Very Hard	Cannot be scratched with a pocketknife or sharp pick. Breaks with repeated heavy hammer blows.
Hard	Can be scratched with a pocketknife or sharp pick with difficulty (heavy pressure). Breaks with heavy hammer blows.
Moderately Hard	Can be scratched with a pocketknife or sharp pick with light or moderate pressure. Breaks with moderate hammer blows.
Moderately Soft	Can be grooved 1/16 in. deep with a pocketknife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Can be grooved or gouged easily with a pocketknife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Can be readily indented, grooved or gouged with fingernail, or carved with a pocketknife. Breaks with light manual pressure.

WEATHERING FOR INTACT ROCK

Description	Diagnostic Features					General Characteristics
	Chemical weathering-discoloration and/or oxidation		Mechanical weathering-grain boundary conditions	Texture and leaching		
	Body of rock	Fracture surfaces		Texture	Leaching	
Fresh	No discoleration, not oxidized.	No discoloration or oxidation.	No separation, intact (tight).	No change	No leaching	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.	No visible separation, intact (tight).	Preserved	Preserved	Hammer rings when crystalline rocks are stuck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty" feldspar crystals are "cloudy".	All fracture surfaces are discolored or oxidized.	Partial separation of boundaries visible.	Generally preserved	Generally preserved	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weather	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in situ disaggregation, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes."

CORE RECOVERY

The core recovery value (REC) provides an indication of the success of the coring operation in recovering the cored rock. Diminished core recovery can be attributed to voids within the rock mass or loss of rock mass due to drilling fluids.

$$\text{REC} = \frac{\Sigma(\text{Length of recovered core pieces})(100\%)}{\text{Total length of the core run}}$$

ROCK QUALITY DESIGNATION

Rock Quality Designation is a measure of the fracturing in a rock mass as observed in a core specimen. A high value of RQD indicates few or widely spaced fractures. RQD is valid for core diameters from 1.4 to 3.335 inches. RQD is based on ASTM D6032.

$$\text{REC} = \frac{\Sigma(\text{Length of intact core pieces} \geq 4\text{ inches})(100\%)}{\text{Total length of the core run}}$$

FRACTURE DENSITY

Unfractured	No fractures.
Very Slightly Fractured	Core lengths greater than 3 ft.
Slightly Fractured	Core lengths mostly from 1 to 3 ft.
Moderately Fractured	Core lengths mostly from 4 in. to 1 ft.
Intensely Fractures	Core lengths mostly from 1 to 4 in.
Very Intensely Fractured	Mostly chips and fragments.
Note: exclude mechanical breaks	

FRACTURE FILLING, FF

Clean	No visible separation
Very Thin	FF < $\frac{1}{32}$"
Moderately Thin	$\frac{1}{32}$" ≤ FF < $\frac{1}{8}$"
Thin	$\frac{1}{8}$" ≤ FF < $\frac{3}{8}$"
Moderately Thick	$\frac{3}{8}$" ≤ FF < 1"
Thick	1" ≤ FW

FRACTURE HEALING

Totally Healed	Fracture is completely healed or recemented to a degree at least as hard as surrounding rock.
Moderately Healed	Greater than 50 percent of fracture is healed or recemented.
Partly Healed	Less than 50 percent of fractured material, filling, or fracture surface is healed or recemented
Not Healed	Fracture surface filling is not healed or recemented.

FRACTURE ROUGHNESS

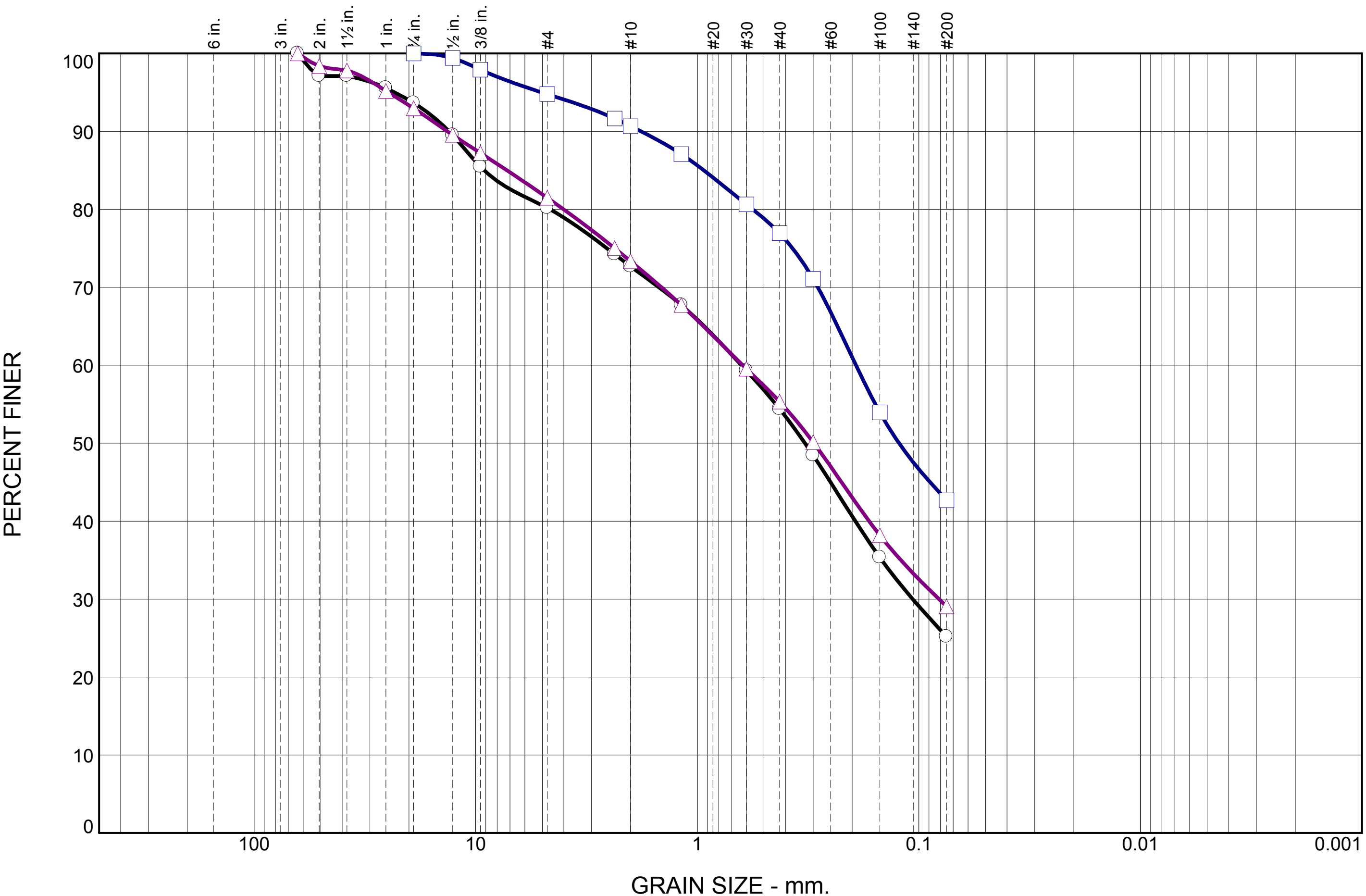
Stepped	Near-normal steps and ridges occur on the fracture surface.
Rough	Large, angular asperities can be seen.
Moderately Rough	Asperities are clearly visible and fracture surface feels abrasive.
Slightly Rough	Small asperities on the fracture surface are visible and can be felt.
Smooth	No asperities, smooth to the touch.

ROCK STRENGTH

Plastic	Plastic or very low strength
Friable	Crumbles easily by rubbing with fingers
Weak	An unfractured specimen will crumble under light hammer blows
Moderately Strong	Specimen will withstand a few heavy hammer blows before breaking
Strong	Specimen will withstand a few heavy ringing hammer blows and will yield with difficulty only dust and small flying pieces
Very Srong	Specimen will resist heavy ringing hammer blows and will yield with difficulty dust and small flying fragments

APPENDIX B

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	6.4	13.4	7.5	18.3	29.2	25.2	
□	0.0	0.0	5.2	4.1	13.8	34.2	42.7	
△	0.0	7.0	11.5	8.2	18.0	26.2	29.1	

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	40	26	9.1514	0.6323	0.3267	0.1066				
□	40	16	0.9338	0.1922	0.1228					
△	41	18	7.2212	0.6233	0.2977	0.0811				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ silty sand with gravel	10/03/2022	SM	14.0
□ clayey sand	09/30/2022	SC	9.6
△ clayey sand with gravel	10/3/22	SC	14.5

Project No. 3109 **Client:** BRIAN GRAHAM

Project: 53 MULE DEER COURT -SINGE FAMILY RESIDENCE GEO.

○ **Source of Sample:** TP-1 **Depth:** 2.0'-6.0' **Sample Number:** A

□ **Source of Sample:** TP-2 **Depth:** 0.0'-2.0' **Sample Number:** A

△ **Source of Sample:** TP-2 **Depth:** 2.0'-6.0' **Sample Number:** 2C

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

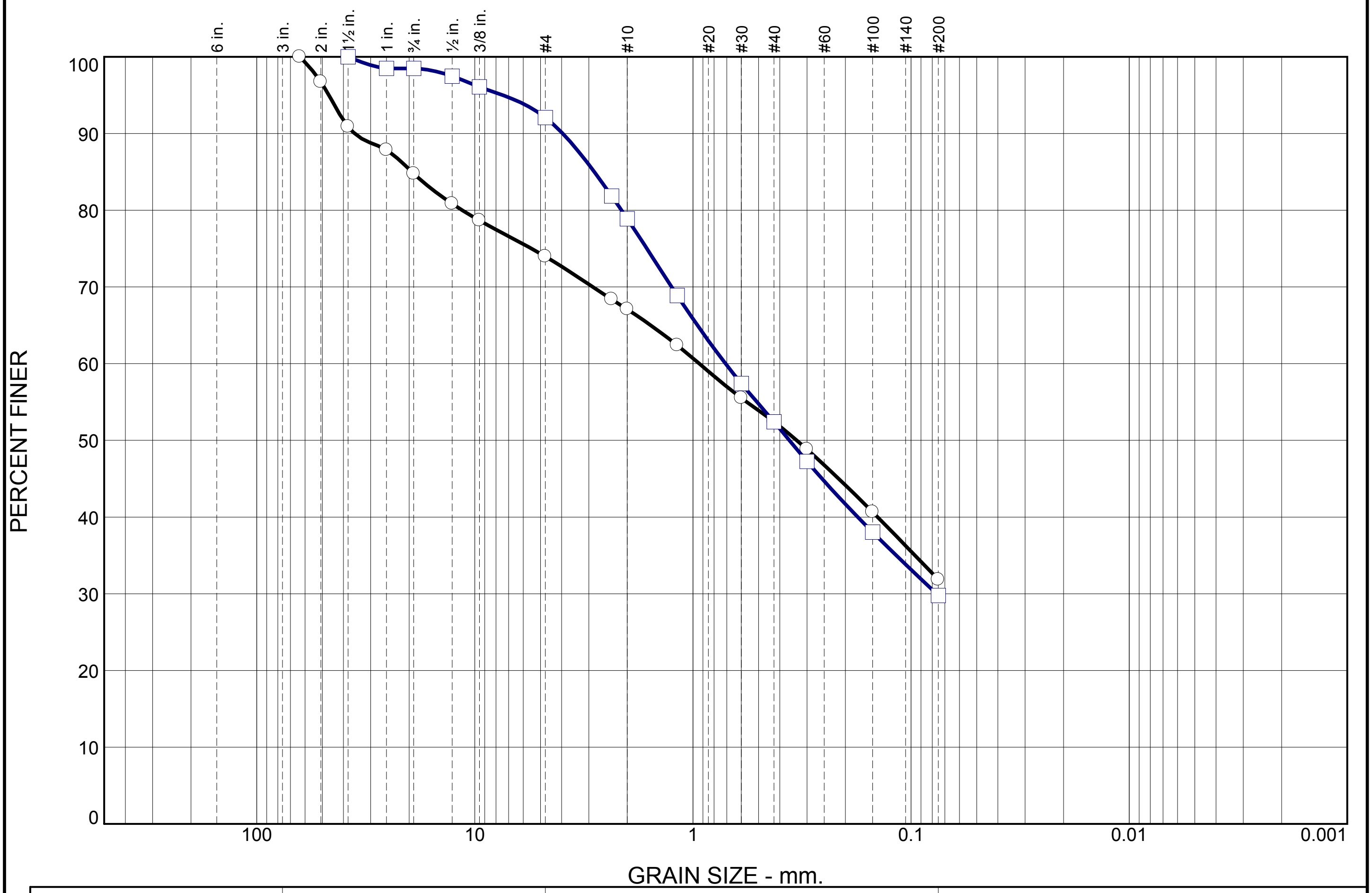
Remarks:

△SAMPLE COMBINED WITH TP-3 3A

PLATE B-1

Tested By: ○ GP □ HB △ GP **Checked By:** HB

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	15.2	10.8	6.9	14.7	20.6	31.8	
☐	0.0	1.5	6.4	13.2	26.5	22.6	29.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	47	20	19.4325	0.9348	0.3343					
☐	46	21	2.8323	0.7089	0.3610	0.0765				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ clayey sand with gravel	10/03/2022	SC	11.6
☐ clayey sand	09/30/2022	SC	11.1

Project No. 3109 **Client:** BRIAN GRAHAM

Project: 53 MULE DEER COURT -SINGE FAMILY RESIDENCE GEO.

○ **Source of Sample:** TP-4 **Depth:** 2.0'-5.0' **Sample Number:** A

☐ **Source of Sample:** TP-5 **Depth:** 1.5'-3.5' **Sample Number:** A

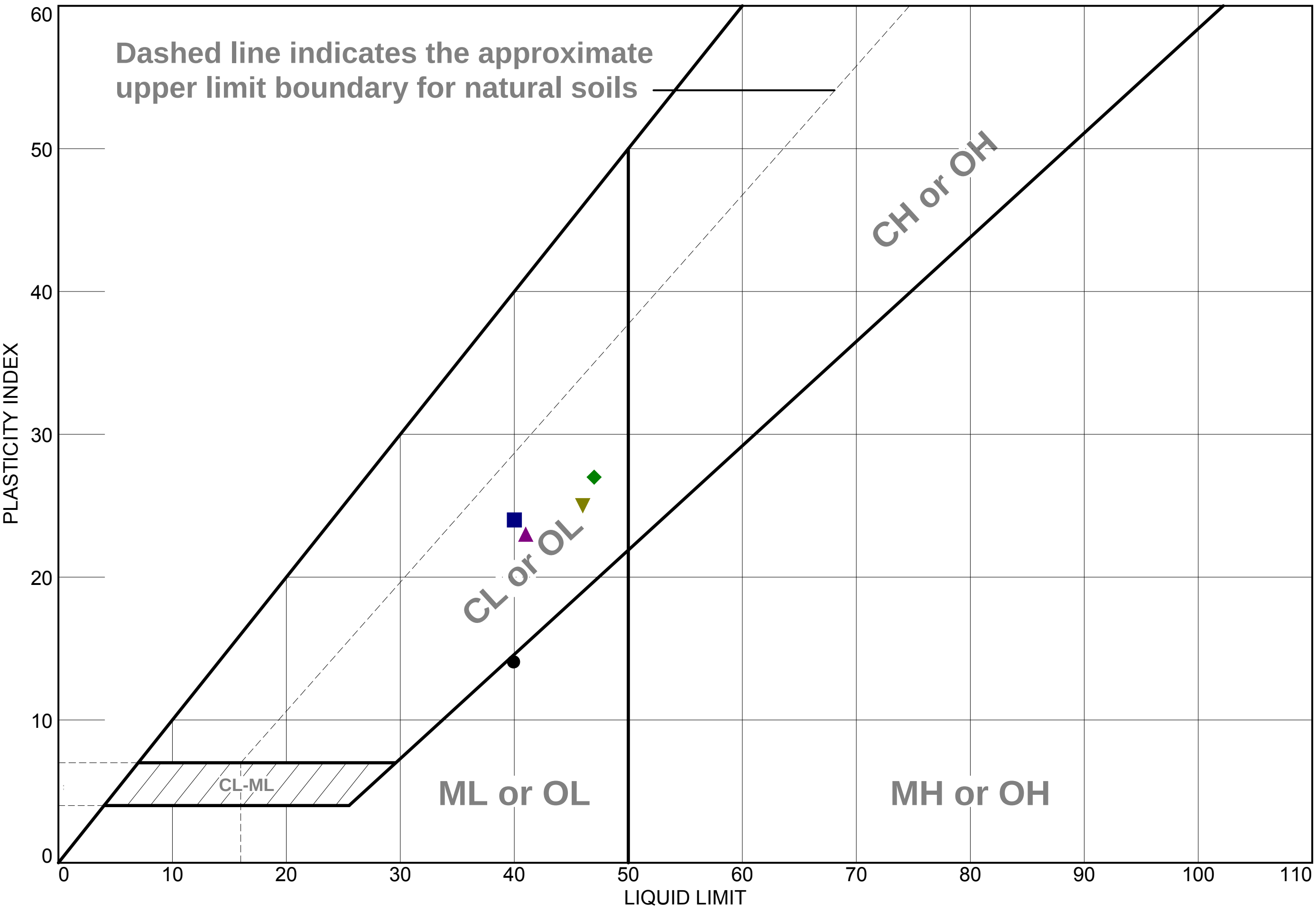
CME CONSTRUCTION MATERIALS ENGINEERS, INC.

Remarks:

PLATE B-1

Tested By: ○ GP ☐ HB **Checked By:** HB

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	silty sand with gravel	40	26	14	54.4	25.2	SM
■	clayey sand	40	16	24	76.9	42.7	SC
▲	clayey sand with gravel	41	18	23	55.3	29.1	SC
◆	clayey sand with gravel	47	20	27	52.4	31.8	SC
▼	clayey sand	46	21	25	52.4	29.8	SC

Project No. 3109 **Client:** BRIAN GRAHAM

Project: 53 MULE DEER COURT -SINGE FAMILY RESIDENCE GEO.

●**Source of Sample:** TP-1	**Depth:** 2.0'-6.0'	**Sample Number:** A
■**Source of Sample:** TP-2	**Depth:** 0.0'-2.0'	**Sample Number:** A
▲**Source of Sample:** TP-2	**Depth:** 2.0'-6.0'	**Sample Number:** 2C
◆**Source of Sample:** TP-4	**Depth:** 2.0'-5.0'	**Sample Number:** A
▼**Source of Sample:** TP-5	**Depth:** 1.5'-3.5'	**Sample Number:** A

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

Remarks:

PLATE B-2

Tested By: JH **Checked By:** HB

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

EXPANSION INDEX OF SOILS

(ASTM D4829 - 21)

Project Name:	53 MULE DEER COURT	Project No.:	3109
Client:	BRIAN GRAHAM	Laboratory No:	36918
Source:	TP-2 C (2'-6') & TP-3 A (2'-5')	Date Tested:	9/30/2022
Date Sampled/Cast:	9/28/2022	Tested By:	M. PONTONI

SPECIMEN PREPARATION

Oven or Air Dried	Oven Dried	% Retained on #4 Sieve:	0%
Wet Weight (g):	470.8	Specific Gravity:	2.70 (ESTIMATED)
Dry Weight (g):	419.23	Unit Weight Water (pcf):	62.4
Moisture Content:	12.3%	Weight of Ring (g):	370.12

COMPACTION RESULTS

Compacted Weight (g):	373.5	Compacted Weight (lb):	0.823
Moist Unit Weight (pcf):	113.3	Dry Unit Weight (pcf):	100.9

EXPANSION RESULTS

Initial Height (in):	1.00	Initial Dial Reading (in.):	0.000
Height Change (in):	0.0445	Final Dial Reading (in.):	0.043

CALCULATIONS

$S = (w * G_s * \alpha_d) / (G_s * \alpha_w) - \alpha_d$

$EI = (D_1 - D_2)/H_1 * 1000$

w = moisture content

G_s = specific gravity

α_w = unit weight of water (pcf)

α_d = dry unit weight (pcf)

ΔH = Change in Height

H_1 = Initial Height

D_1 = Initial dial reading

D_2 = final dial reading

S_{meas}= determined percent of saturation

EI_{50} = estimate of the expansion index

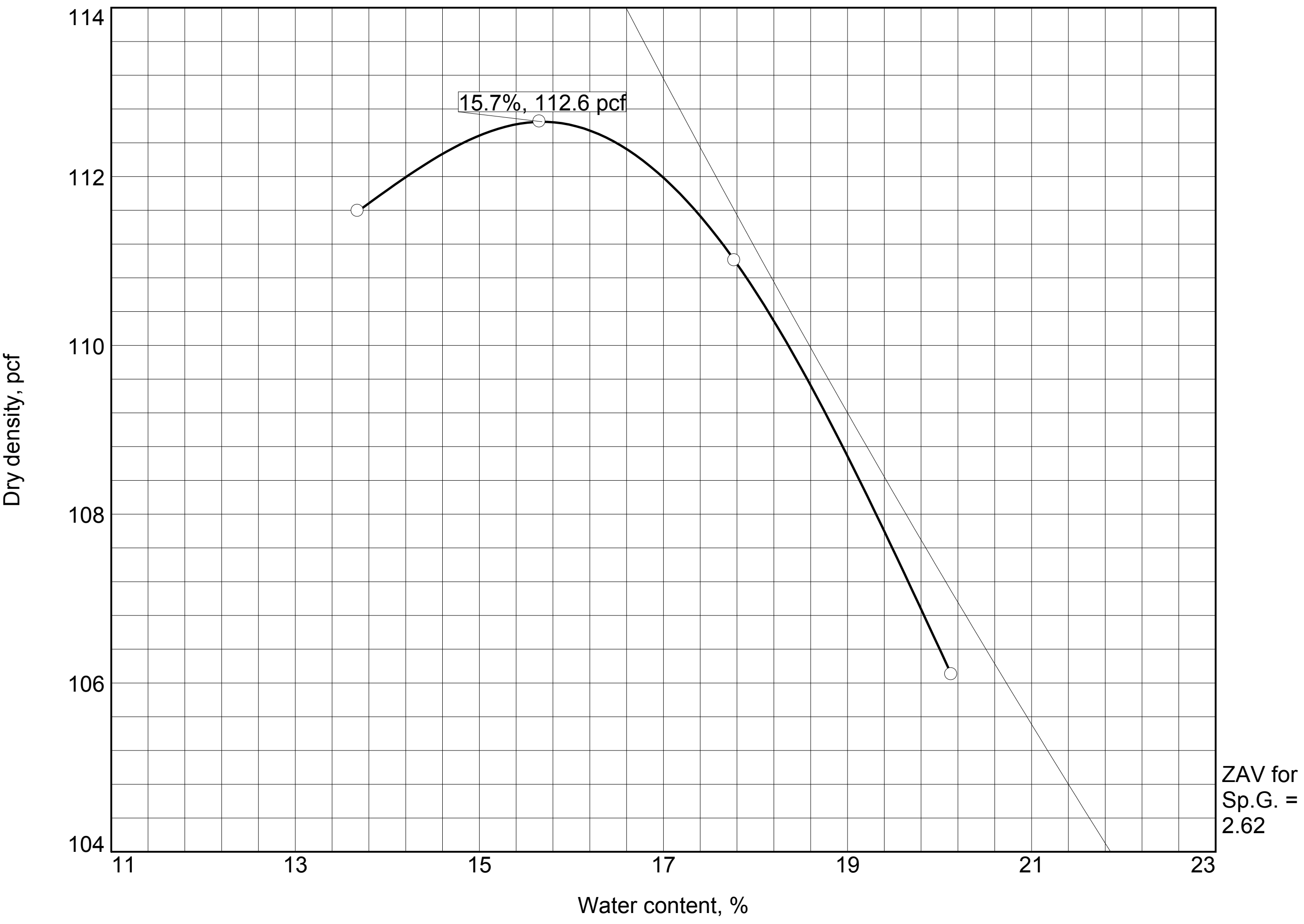
S: 49.5%

EI: 43

CLASSIFICATION TABLE

Expansion Index	0 -20	21 - 50	51 - 90	91 - 130	> 130
Potential Expansion	Very Low	Low	Medium	High	Very High

MOISTURE DENSITY CURVE



Test specification: ASTM D 1557-12 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
2.0'-6.0'	SC	A-2-7(2)	14.5		41	23		29.1

TEST RESULTS

Maximum dry density = 112.6 pcf

Optimum moisture = 15.7 %

MATERIAL DESCRIPTION

clayey sand with gravel

Project No. 3109 **Client:** BRIAN GRAHAM

Project: 53 MULE DEER COURT -SINGE FAMILY RESIDENCE GEO.

○**Source of Sample:** TP-2 **Sample Number:** 2C

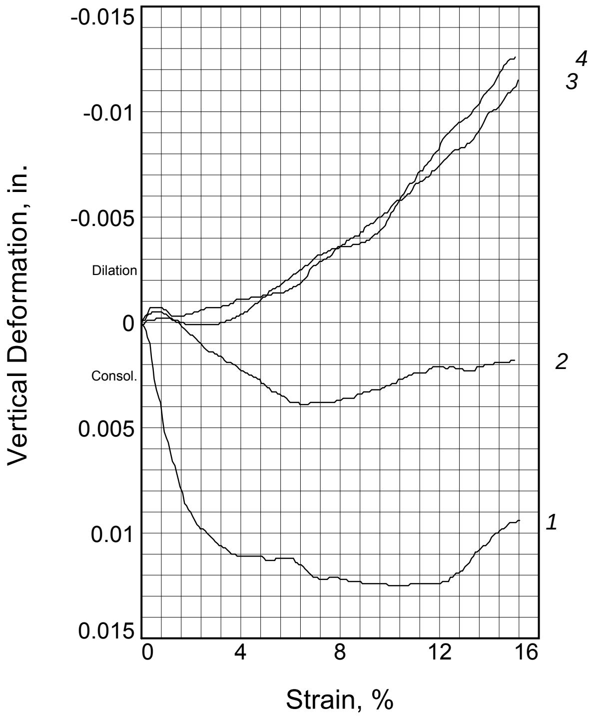
CME CONSTRUCTION MATERIALS ENGINEERS, INC.

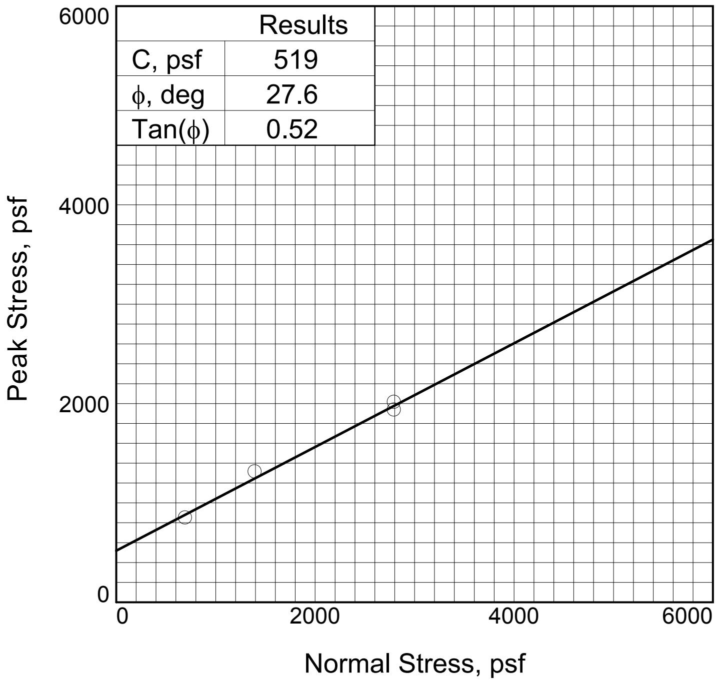
Remarks:

SAMPLE COMBINED WITH TP-3 3A

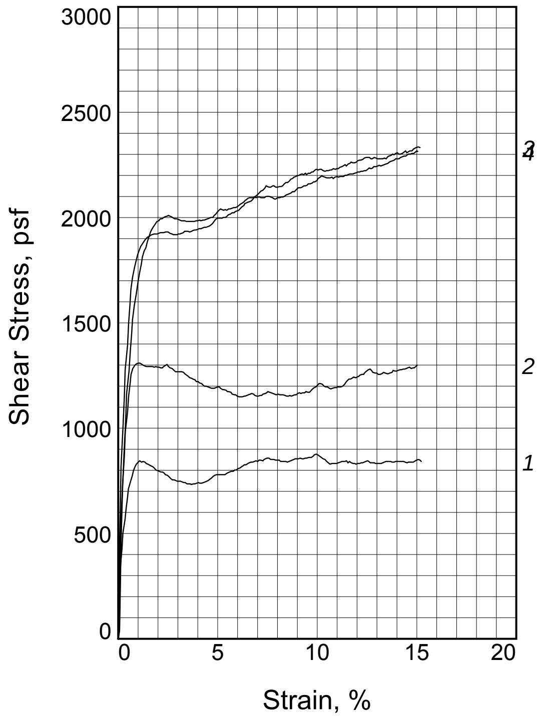
PLATE B-4

Tested By: JM **Checked By:** HB





	Results
C, psf	519
ϕ, deg	27.6
Tan(ϕ)	0.52



	Sample No.	1	2	3	4
Initial	Water Content, %	16.0	16.0	16.0	16.0
	Dry Density, pcf	101.1	101.1	101.1	101.2
	Saturation, %	64.8	64.8	64.8	64.9
	Void Ratio	0.6665	0.6667	0.6666	0.6661
	Diameter, in.	2.42	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00	1.00
At Test	Water Content, %	24.4	23.4	23.7	24.0
	Dry Density, pcf	101.2	102.1	102.2	102.0
	Saturation, %	98.9	97.0	98.3	99.5
	Void Ratio	0.6663	0.6515	0.6497	0.6519
	Diameter, in.	2.42	2.42	2.42	2.42
	Height, in.	1.00	0.99	0.99	0.99
	Normal Stress, psf	700	1400	2800	2800
	Peak Stress, psf	845	1309	1932	2010
	Strain, %	1.1	1.0	2.5	2.5
	Residual Stress, psf				
	Strain, %				
	Strain rate, in./min.	0.001	0.001	0.001	0.001

Sample Type: REMOLDED
Description: clayey sand with gravel

LL= 41 **PL=** 18 **PI=** 23
Assumed Specific Gravity= 2.70
Remarks:

PLATE B-5

Client: BRIAN GRAHAM

Project: 53 MULE DEER COURT -SINGE FAMILY RESIDENCE GEO.
Source of Sample: TP-2 **Depth:** 2.0'-6.0'
Sample Number: 2C
Proj. No.: 3109 **Date Sampled:** 9/16/2022

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

Tested By: M. PONTONI **Checked By:** N. ANDERSON

Analytical Report

Workorder#: **22091388**
Date Reported: **10/11/2022**

Client: CME-Construction Materials Engineers, Inc
Project Name: 3109/53 Mule Deer Ct./TP-5 5B 4'-5'
PO #: 3109
Sampled By: Client

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	Client Sample ID	Date/Time Sampled	Date Received
22091388-01	TP - 5 5B 4'-5'	09/16/2022 12:00	9/28/2022

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Sulfate	ASTM 1580C	< 0.02	%	0.02	AC	10/07/2022 10:54	

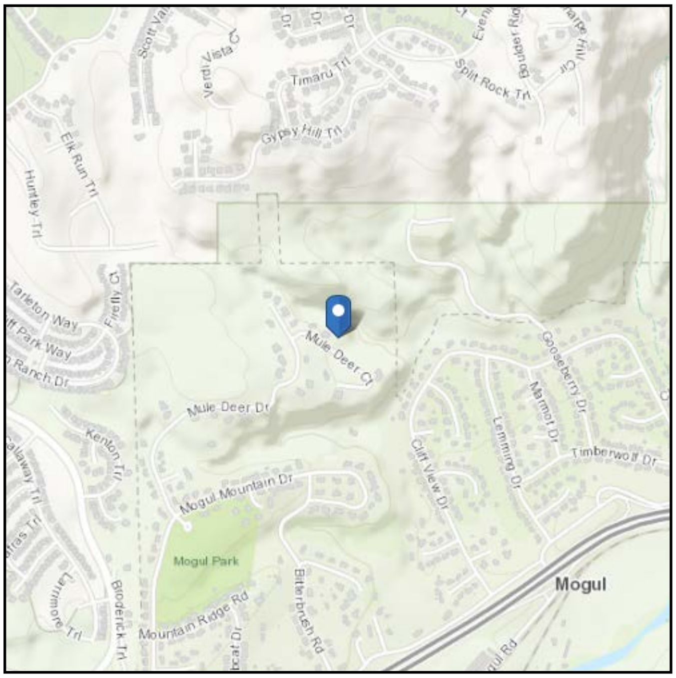
APPENDIX C

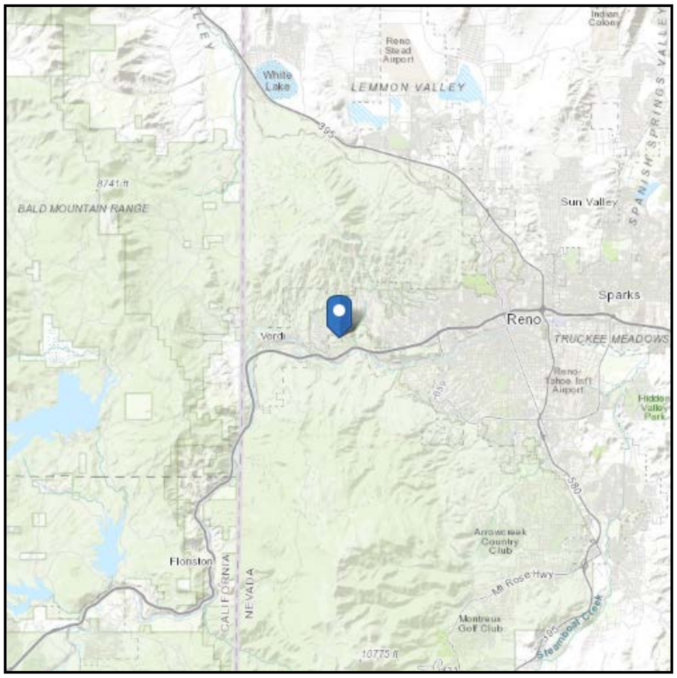
ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: C - Very Dense Soil and Soft Rock

Latitude: 39.52099
Longitude: -119.9335
Elevation: 4854.23 ft (NAVD 88)





AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

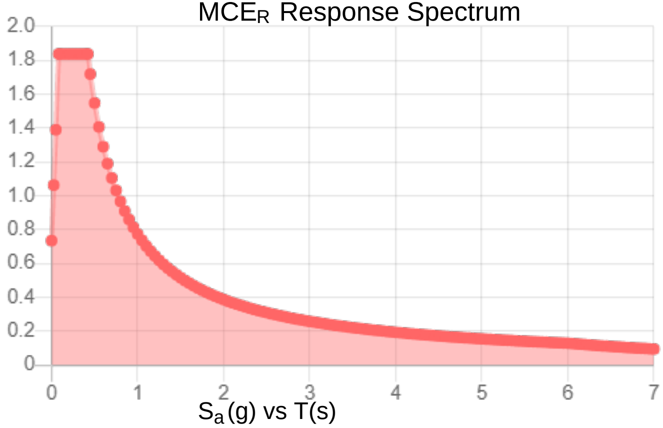
C - Very Dense Soil and Soft Rock

Site Soil Class:

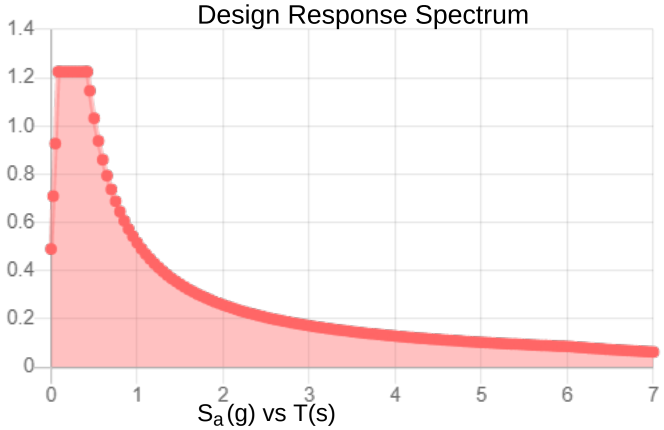
Results:

S_S :	1.532	S_{D1} :	0.516
S_1 :	0.524	T_L :	6
F_a :	1.2	PGA :	0.646
F_v :	1.476	PGA_M :	0.775
S_{MS} :	1.838	F_{PGA} :	1.2
S_{M1} :	0.774	I_e :	1
S_{DS} :	1.225	C_v :	1.206

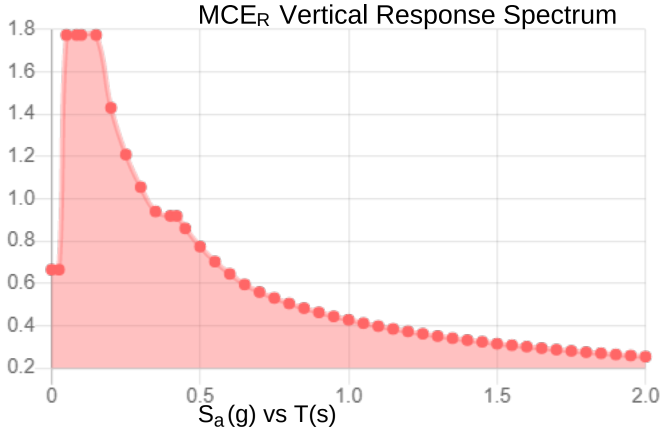
Seismic Design Category: D



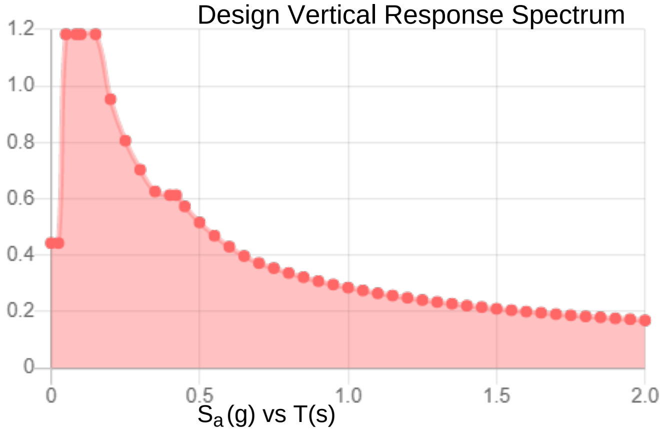
MCE_R Response Spectrum



Design Response Spectrum



MCE_R Vertical Response Spectrum



Design Vertical Response Spectrum

Data Accessed: **Mon Nov 21 2022**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-16 and ASCE/SEI 7-16 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-16 Ch. 21 are available from USGS.

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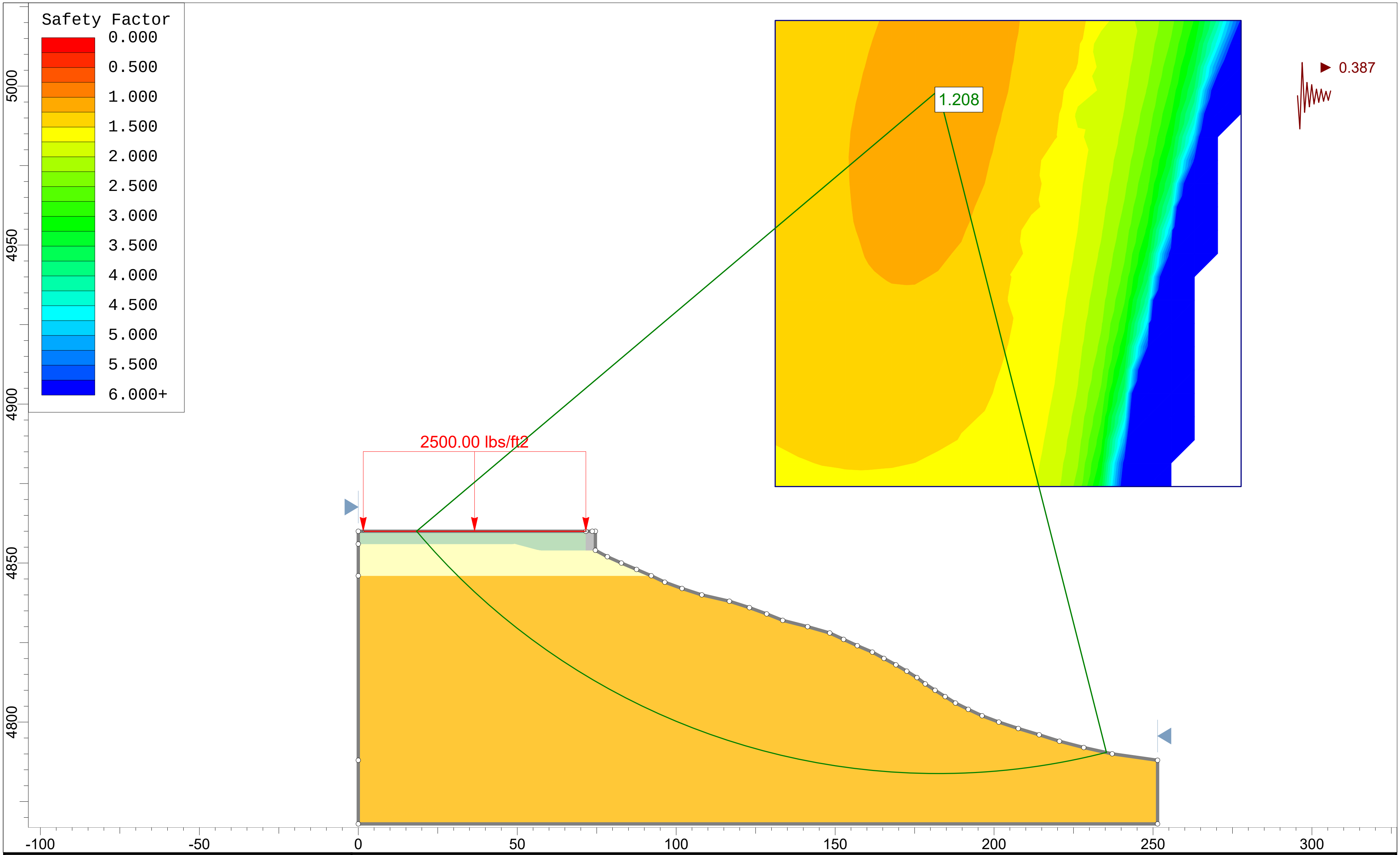
APPENDIX D

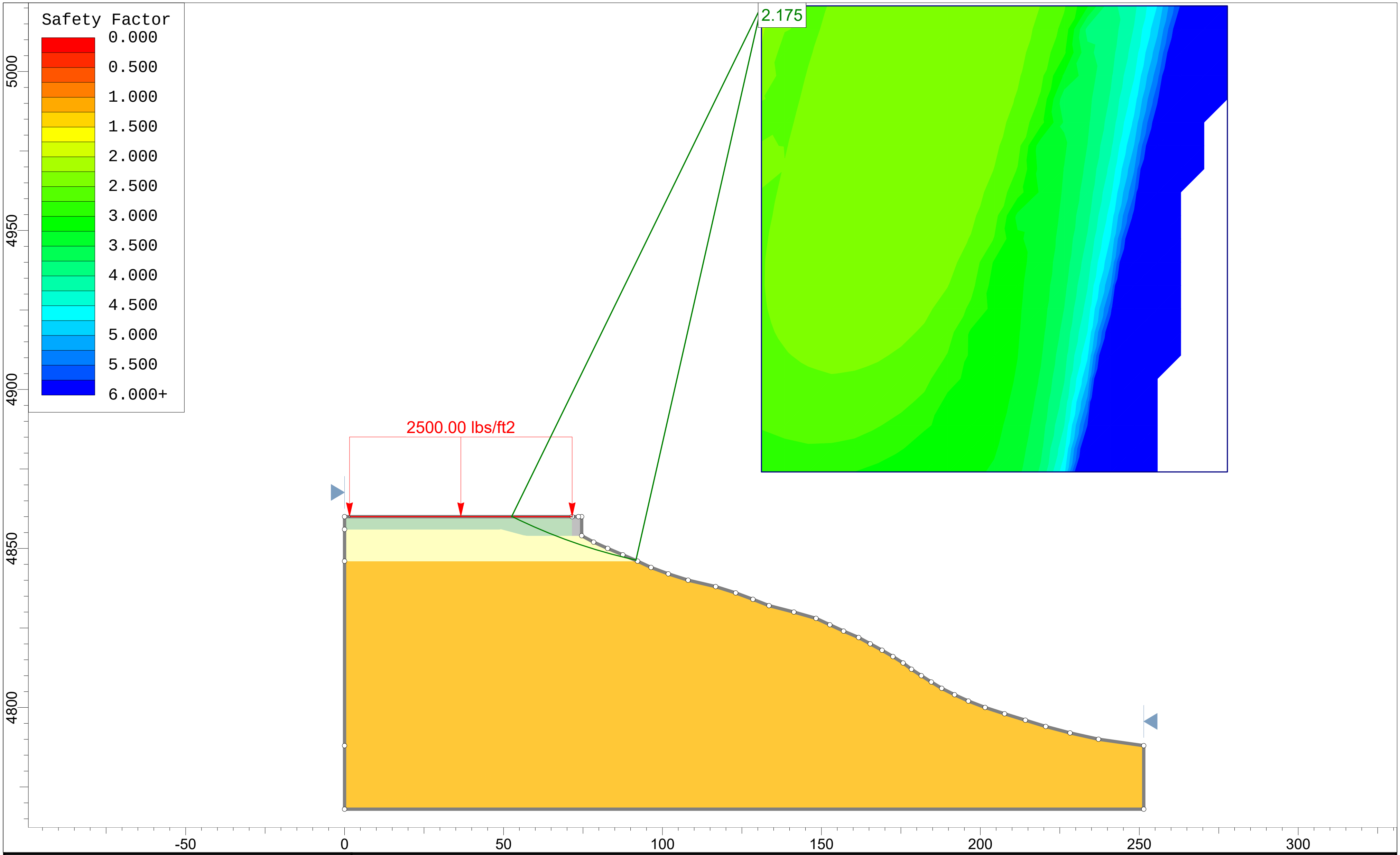


SLIDEINTERPRET 6.039

Project
53 Mule Deer Court Single Family Residence

Analysis Description
Slope Stability, Seismic

Drawn By	CJJ	*Scale*	1:501	*Company*	CME
Date	11/9/2022			*File Name*	3109_Slope Stability rev sah.slim



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