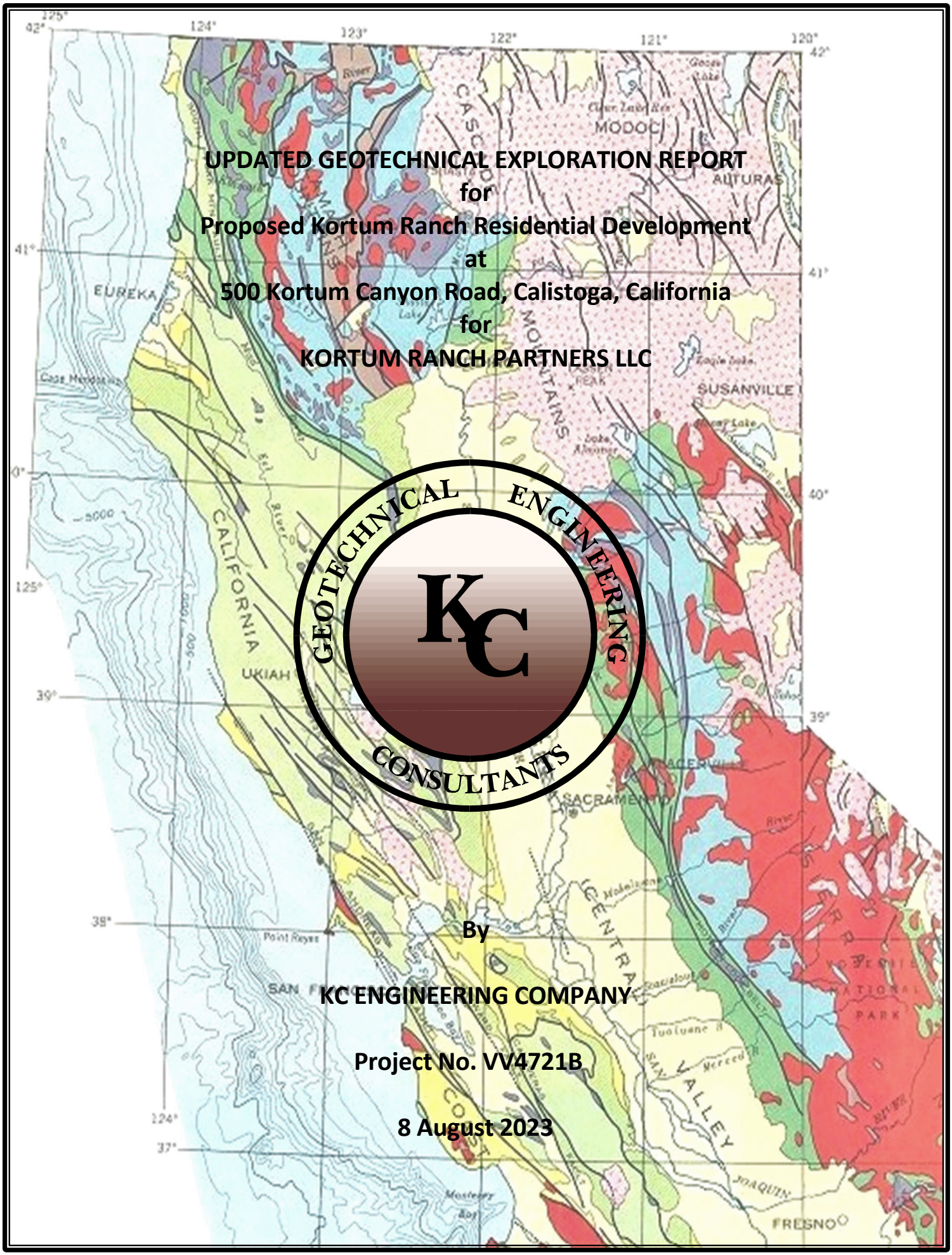

UPDATED GEOTECHNICAL EXPLORATION REPORT
for
Proposed Kortum Ranch Residential Development
at
500 Kortum Canyon Road, Calistoga, California
for
KORTUM RANCH PARTNERS LLC

By

KC ENGINEERING COMPANY

Project No. VV4721B

8 August 2023

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Project No. VV4721B
8 August 2023

Mr. David Wood
Kortum Ranch Partners LLC
251 Shipyard Way, Suite A
Newport Beach, CA 92663

Subject: Proposed Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
UPDATED GEOTECHNICAL EXPLORATION REPORT

Dear Mr. Wood:

In accordance with your authorization, **KC ENGINEERING COMPANY** has explored the geotechnical conditions of the surface and subsurface soils for the proposed Kortum Ranch residential development and surrounding improvements to be constructed at the subject site. Additionally, we retained **Bajada Geosciences** to evaluate geological landslide hazards as presented in their "Debris Flow Hazard Assessment" report attached herein. This report updates our prior 2021 geotechnical report and pertains to the areas investigated and not the entire property.

The accompanying report presents our conclusions and recommendations based on our exploration. Our findings indicate that the proposed Kortum Ranch residential development and surrounding improvements are geotechnically feasible for construction on the subject site provided the recommendations of this report are carefully followed and are incorporated into the project plans and specifications.

Should you have any questions relating to the contents of this report or should you require additional information, please contact our office at your convenience.

Reviewed by,

David V. Cymanski, G.E.
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
DAVID V. CYMANSKI
GE 2585
EXP. 6-30-24
GEOTECHNICAL
STATE OF CALIFORNIA

Respectfully Submitted,
KC ENGINEERING COMPANY

Daniel Sanchez
Staff Engineer

Copies: 1 email to client

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GEOTECHNICAL EXPLORATION

Purpose and Scope

The purpose of the geotechnical exploration for the proposed Kortum Ranch residential development located at 500 Kortum Canyon Road in Calistoga, California, was to determine the surface and subsurface soil conditions within the areas of the proposed improvements. Additionally, **Bajada Geosciences** evaluated geological landslide hazards as presented in their "Debris Flow Hazard Assessment" report attached herein. Based on the results of the exploration, geotechnical criteria were established for the grading of the site, landslide and debris flow mitigation, the design of foundations, slabs-on-grade, retaining walls, pavement sections, and the construction of other related facilities on the property. This report updates our prior 2021 geotechnical report and pertains to the areas investigated and not the entire property.

In accordance with your authorization, our exploration services included the following tasks:

a. A review of available geotechnical and geologic literature concerning the site and vicinity;
b. Site reconnaissance by our Geotechnical Engineer and Engineering Geologist to observe and map surface conditions;
c. Drilling of thirty exploratory borings, logging the subsurface conditions, and sampling of the subsurface soils;
d. Laboratory testing of the samples obtained to determine their classification and engineering characteristics;
e. Analysis of the data and formulation of conclusions and recommendations; and
f. Preparation of this written report.

Site Location and Description

The subject site is located at 500 Kortum Canyon Road in the City of Calistoga, California as shown on Figure 1, "Aerial Vicinity Map" included in the Appendix of this report. The approximate 50-acre hillside property consists of five parcels spanning across both sides of Kortum Canyon Road, including APN 011-290-007, -038, -039, and 011-310-009, -023.

The combined property was formerly known as the Busk Estate Property with an address of 1531 Foothill Boulevard, Calistoga. The property is located in a heavily wooded hillside setting and contains numerous structures, various gravel roads, earthen pathways and numerous retaining walls constructed by the Busk family. The site topography, layout of roads, prior structures and improvements are shown on Figure 2 "Property Topography & Prior Site Improvements". The prior structures included a wood framed apartment complex, wood framed houses, barns, metal

buildings, sheds and garage structures. All of these structures have since been removed. The retaining walls across the property vary in height and type of construction. In general, the walls range in height from about 18 inches to about 6 feet. The walls retain native and fill slopes with inclinations ranging up to 2H:1V, as well as horizontal terraces. The wall types observed consist of vertically stacked pre-cast concrete pipes, vertically placed telephone pole timbers, horizontally stacked railroad timbers, concrete, masonry block, mortared brick, and mortared rock walls. The retaining walls are in varying states of condition, ranging from plumb and performing well, to rotted, leaning and toppled over. The access roads lead to various relatively flat graded pad areas. The majority of the existing flat pad areas appear to have been graded by partial cutting on the uphill side and filling on the downhill side to create leveled surfaces. Our observations revealed that the majority of the access roads and earthen pathways were graded by cutting on the uphill side and side-casting the fill on the downhill side. Erosion and shallow sloughing of the uphill steep cut and fill slopes have occurred in localized areas across the property.

A 29.46-acre portion of the property located northwest of Kortum Canyon Road is now proposed to be subdivided into 22 residential lots as shown on Figure 3.0, "Overall Site Plan". When our 2021 geotechnical report was prepared, the property was proposed to be divided into various parcels and phases of development as shown on Figures 3.1 through 3.4 included in the Appendix of this report. At that time, our borings were drilled in areas of planned residential structures. The portion of the property located southeast of Kortum Canyon Road is no longer planned to be developed at this time. A description of the currently proposed development areas is noted below.

The project is accessed by a gated gravel road that extends uphill from Kortum Canyon Road as shown on Figure 3.0. Two previously graded flat pad areas are present in the areas of Lots 1 through 4 and our Borings 1, 2 and 3 as shown on Figure 3.1. The pad areas were graded by placement of fill materials on the northern and eastern sides of the pads. The surrounding hillside areas are densely vegetated and relatively steep. A lower earthen access road and trails are present on the northeast. An old landslide escarpment is located on the north portion of Lot 2. We understand from the prior Busk Estate caretaker that this landslide deposited materials downslope in the adjacent neighboring properties and Foothill Boulevard a decade or more ago, however no documentation of this event or records of mitigation measures were available for our review.

It is also noted that a mass debris flow slide occurred in the steep ravine area on the northwest side of Lot 4. This debris flow occurred during heavy rainfall in 2019 and was primarily a result of poor uphill drainage. The resulting debris flow escarpment was mitigated by placement of rip-rap rock slope protection as noted in our letter "Debris Flow Repair Recommendations & Plan

Review" dated 7/23/2019. Additional older and vegetated debris flow escarpments are present on the northerly facing ravine, upslope of the repaired mass debris flow noted above.

In the areas of Lots 5 through 8 and our Borings 4 through 7, as shown on Figure 3.1, a number of earthen and gravel roads are present and lead to a flat pad area with a previous metal pole type building. This main flat pad area appears to have been graded by cutting on the south and filling on the northern sides. Various other flat terraced areas are also present that contain various wood retaining walls.

The central portion of the property at Lots 9 through 12 and 17 through 20 is accessed via a paved driveway extending uphill from Silver Street on the northwest or from the main gravel road extending up Kortum Canyon Road. The areas investigated for this central area consisted of Borings 8 through 18 as shown on Figure 3.2. Two residences and seven other wood framed and metal buildings were previously located in this area. Numerous flat graded terraces and old wood, brick and CMU block retaining walls are present in numerous areas. Asphalt, gravel and earthen roads and pathways provide access to the structures. A swimming pool, spa and lined ponds and storm drain inlets are present. Borings 8 through 12 were explored on a descending slope consisting of a series of cut benches supported by vertical telephone pole timbers serving as retaining walls. Borings 13 through 15 were explored along a relatively flat access road achieved by cut and fill. Two near vertical terraced cuts are present on the slope above and south of the existing structures in the area of Borings 13 through 15. The cuts have weathered tuff bedrock exposed and have eroded and sloughed in a few areas. The area of Borings 16 and 17 consist of a large flat graded pad with another telephone timber pole retaining wall supporting the northwest end. Below the wall are cut benches exposing the native hillside, further down are cut access roads which lead to another fill pad area.

Lots 13 through 16 are located on the northwest portion of the property as shown on Figure 3.0 and Figure 3.3. These lots are accessed from Silver Street. The areas investigated at Borings 19 through 23 consist of two previously graded flat pad areas. The southern side of the pad areas were cut, while the northern sides were filled. Relatively steep hillside terrain surrounds these pad areas. The areas of Borings 24 through 28 comprises two broad swales/drainages. Storm drain inlets and culvert piping were observed in the northwestern most swale which appears to have been filled in the area of Borings 25 and 28. The area of Boring 24 is located on dirt/fill mound and rock piles. Dumped concrete and wood piles are also present nearby. Borings 26 and 27 reveal native material and are situated on gradual to moderate uphill sloping grades. Area of Boring 28 is located in a flat filled area and bounded by a moderate to steep upward slope on the northwestern side. Old concrete storm pipes of 24 to 36 inches in size are present near the toe of the adjacent slope.

We should point out that KC Engineering Co. previously performed an evaluation of the retaining walls across the subject site as presented in our letter "Retaining Wall Evaluation & Recommendations" dated 08/01/2019. That report discussed the various wall types and various states of performance and distress. The report summarized that all of the wood walls would require replacement with properly designed and constructed walls per the Building Code. In addition, the report noted that the cast-in-place concrete, the CMU block and vertically staked precast pipe walls were observed to be performing well and would likely require further evaluation depending on future project development and layouts.

The above description is based on a reconnaissance of the site by the Geotechnical Engineer, a review of the Existing Property Topographic Map by REB dated 1/11/21, a review of the Overall Site Plan by Adobe Associates dated 2/14/23, and a review of a Google Earth images. The Google Earth image was used as the basis for our "Aerial Vicinity Map" included as Figure 1. The REB topographic map was used as our "Property Topography & Prior Site Improvements" Figure 2. The Adobe Site Plan was used as our "Overall Site Plan" included as Figure 3.0. The previous project and structure layout site plans by REB were used as our Figures 3.1 through 3.4 in the Appendix showing our approximate boring and undocumented fill locations.

Proposed Development

Based on our review of the Overall Site Plan by Adobe Associates dated 2/14/23, we understand that the property will be subdivided to include twenty-two residential lots as shown on Figure 3.0 "Overall Site Plan". The lots are planned to range in size from about 0.4 to 6.1 acres. Specific structure and improvement layouts will be determined at a later date. The initial project improvements are planned to consist of installation of underground utilities and the main roadway to serve the lots. Cut and fill slopes are planned for the roadway alignment and for some of the lots. Over-excavation of undocumented fills, followed by placement and compaction of engineered fill for the building pads and roadways will be required. Various cut slopes, cut pads and fills of varying depths are expected for the proposed hillside building pads and roadways. Existing unsupported cuts and areas where old walls are removed will require slope flattening, cut slope buttressing, and/or construction of new retaining walls. Fill slopes will require toe keyways and subdrains followed by horizontal benching and placement of compacted fill. New concrete or CMU block retaining walls are expected in various areas to retain cuts and fills, and/or to be incorporated into the residence structures for split-level type construction. Additional site improvements will consist of paved roadway improvements, underground utilities, storm water bio-filtration swales and basins, and landscaping.

Field Exploration

Our field explorations were performed in February and March 2021 and included a reconnaissance of the site and the drilling of thirty exploratory test borings at the approximate locations shown on Figures 3.0 through 3.4. Bulk samples of the building pads and proposed roadway subgrade were also obtained. A more recent site reconnaissance was performed in July of 2023 by our Geotechnical Engineer and Engineering Geologist.

The borings were drilled to a maximum depth of 18.5 feet below the existing ground surface and generally into the underlying bedrock or dense material. The drilling was performed with a Mobile B-24 drill rig using power-driven, four-inch diameter solid flight augers. Visual classifications were made from auger cuttings and the samples in the field. As the drilling proceeded, relatively disturbed tube samples were obtained by driving a 3-inch O.D., California split-tube sampler, containing thin brass liners, into the boring bottom in accordance with ASTM D3550. Disturbed samples were also obtained by driving a 2-inch O.D., split-barrel SPT sampler into the boring bottom in accordance with ASTM D1586. The samplers were driven into the in-situ soils at various depths under the impact of a 140-pound hammer having a free fall of 30 inches. The number of blows required to advance the sampler 12 inches into the soil, after seating the sampler 6 inches, were adjusted to the standard penetration resistance (N-Value). The raw blow counts obtained using the California sampler were corrected to equivalent N-Values using Burmister's (1948) 65% energy and diameter correction formula. When the sampler was withdrawn from the boring bottom, the samples were removed, examined for identification purposes, labeled and sealed to preserve the in-situ moisture content, and transported to our laboratory for testing.

Classifications made in the field were verified in the laboratory after further examination and testing. The stratification of the soils, descriptions, location of disturbed soil samples and standard penetration resistance are shown on the respective "Log of Test Boring" contained within the Appendix.

Laboratory Testing

The laboratory testing program was directed towards providing sufficient information for the estimation of the engineering characteristics of the site soils so that the recommendations outlined in this report could be formulated. The laboratory test results are presented on the respective Boring Logs and data sheets in the Appendix.

Moisture content and dry density tests (ASTM D2937) were performed on representative relatively disturbed soil samples in order to determine the consistency of the soil and the

moisture variation throughout the explored soil profile as well as estimate the compressibility of the underlying soils.

The strength parameters of the foundation soils were determined from direct shear tests (ASTM D3080) and unconfined compression tests (ATSTM D2166) performed on selected relatively disturbed soil samples. Standard field penetration resistance (N-Values) and pocket penetrometer readings also assisted in the determination of strength and bearing capacity. The standard penetration resistances and pocket penetrometer readings are recorded on the respective Log of Test Borings in the Appendix.

In order to assist in the identification and classification of the subsurface soils, sieve analysis tests (ASTM D6913) and Atterberg Limits tests (ASTM D4318) were performed on selected soil samples. The Atterberg Limits test results were used to estimate the expansion potential of the near surface soils.

An R-Value test (Cal Test 301) was performed on a composite bulk sample representative of the proposed subgrade to assist in pavement section design. The location of the R-Value sample locations are shown on Figure 3.0.

Representative bulk samples of the near surface soils were obtained from the building pads to evaluate the presence and concentration of water-soluble sulfates in accordance with ASTM C1580. The location of the sulfate samples are shown on Figures 3.1 through 3.4. These test results were used to identify the corrosion potential of the soils to at or below grade concrete. A discussion is presented in the “Foundation” section of this report.

Subsurface Conditions

Based on our field exploration and laboratory testing, the surface and subsurface soil conditions in the areas investigated generally consist of variable surficial soil deposits and previously graded areas of undocumented fill materials underlain by dense fluvial and lacustrine deposits or weathered tuff and agglomerate bedrock. In general, the undocumented fills were found to be variable in consistency ranging from soft and loose to firm to stiff and medium dense, and generally consist of sandy and gravelly clay and silt with some debris and boulders. No compaction test data for the existing fills was available for our review. Variable amounts of gravels and weathered bedrock fragments, including some cobble-size to boulders were encountered in the fill. The native soils were found to be variable and consist of firm to very stiff silty clays, sandy clays, and sandy silts. The fill and native soils ranged from low plasticity to high plasticity (low to highly expansive).

The undocumented fills and native soil deposits were found to be underlain by dense fluvial and lacustrine deposits comprising weakly consolidated gravel, tuffaceous sand, silt and clay. Also present on the upper portions of the site are highly variable assemblages of tuff, tuff breccia, agglomerates, siltstones and sandstone bedrock materials that were found to be weak to moderately strong to strong. The approximate areas of undocumented fill are shown on Figures 3.1 through 3.4. The fill thicknesses found are noted below.

Borings 1 through 3 were drilled on the fill side of two previously graded cut and fill pad areas sitting adjacent to steep descending slopes. Boring 1, revealed fill in the upper 6 feet. In Boring 2, fill was present in the upper 9 feet and in Boring 3 fill was found in the upper 7.5 feet.

Borings 4 through 7 were explored across a large relatively flat pad where a large wood overhang structure was present. At Boring 4, fill is present in the upper 2.5 feet. At Boring 5, fill is present in the upper 3 feet. At Boring 6, native tuffaceous silty sand material is present at the surface. At Boring 7, fill is present in the upper 5 feet.

Artificial fills were found to depths of 2 to 5 feet below the surface for Borings 8, 9 and 10. At Boring 11, fill is present in the upper 4 feet and 3 feet for Boring 12. Boring 13 revealed fill in the upper 6 feet, while Borings 14 and 15 revealed 2.5 feet and 1 foot of fill, respectively. In Boring 16 fill was present in the upper 10 to 16 feet below the surface, and Boring 17 revealed fill in the upper 6 feet. Boring 18 reveal native material from the surface, no fill appeared to be present.

Native material was encountered at the surface for Borings 19 and 22. Borings 20 and 21 were drilled near the edge of a large flat pad where steep downward grades bound the north end. Fill was encountered down to 6 feet for Boring 20 and 5 feet for Boring 21. At Boring 23, fill is present to 4 feet below grade. At Boring 24, fill is present to 5 feet and to 3 feet in Boring 25. Fill was found to 4 feet in Boring 28.

Groundwater was not encountered in any of the borings at the time of drilling. Fluctuations in the groundwater conditions can occur with variations in seasonal rainfall, site irrigation and variations in subsurface stratification.

A more thorough description and stratification of the soils encountered along with the results of the laboratory tests are presented on the respective “Log of Test Boring” in the Appendix. The approximate locations of the borings are shown on Figures 3.0 through 3.4.

Site Geology

Our review of the 2013 Preliminary Geologic Map of the Calistoga 7.5’ Quadrangle, by the California Geological Survey (CGS), indicates that the materials on the lower northern portion of

the property consist of fluvial and lacustrine deposits comprising weakly consolidated gravel, tuffaceous sand, silt and clay. The materials on the upper southern portion of the property are mapped as Rhyolite of Calistoga comprising variable assemblages of massive or flow banded rhyolite: intercalated crystal and lithic tuff, and lithoidal welded tuff grading to vitrophyre, locally perlitic; and agglomerate with glassy bombs. A portion of the Calistoga Quadrangle showing the subject site is attached as Figure 4, "Geologic Map". A more site specific geologic map of the site including recently mapped landslide and debris flow scars and deposits are presented in the attached report by Bajada Geosciences.

Geo-Hazards

Seismicity & Ground Motion Analysis

The site is not located within an Alquist-Priolo Earthquake Fault Zone[1]. There are no known active faults crossing the site as mapped and/or recognized by the State of California. However, Calistoga is located in a seismically-active region and earthquake related ground shaking should be expected during the design life of structures constructed on the site. The California Geological Survey has defined an active fault as one that has had surface displacement in the last 11,700 years or has experienced earthquakes in recorded history.

Based on our review of the Fault Activity Map of California[2] and the USGS National Seismic Hazard Maps-Source Parameters[3], the nearest major active faults are the Maacama-Garberville Fault, the Rodgers Creek Fault, the Hunting Creek-Berryessa Fault and the West Napa Fault, located approximately 6 miles west, 9.6 miles west, 14.9 miles east and 16 miles southeast of the site, respectively. Numerous other active faults in the Bay Area and Central Valley may also produce significant seismic shaking at the site.

The 2022 CBC specifies that the potential for liquefaction and soil strength loss should be evaluated, where applicable, for the Maximum Considered Earthquake Geometric Mean (MCE_G) peak ground acceleration with an adjustment for site class effects in accordance with American Society of Civil Engineer (ASCE 7-16)[4]. The MCE_G is peak ground acceleration is based on the geometric mean peak ground acceleration with a 2 percent probability of exceedance in 50 years. The 2022 CBC MCE_G peak ground acceleration with adjustment for site class effects (PGA_M) was

[1] Parish, J.G., 2018 *Earthquake Fault Zones,* California Geological Survey, Special Publication 42, Revised 2018.
[2] Jennings, C.W. and Bryant, W.A., 2010, *Fault Activity Map of California*, California Geological Survey Geologic Data Map No. 6, scale 1:750,000
[3] U.S. Geological Survey, 2008 National Seismic Hazards Maps – Source Parameters, accessed 4/14/21, from USGS web site: https://earthquake.usgs.gov/cfusion/hazfaults_2008_search/query_main.cfm
[4] American Society of Civil Engineer (ASCE), 2016, Minimum Design Loads for Buildings and Other Structures, Standard 7-16 and Supplements 1-3.

calculated to be 0.909g using the ASCE 7 Hazards Tool web-based tool with a site coefficient (F_{PGA}) of 1.2 for Site Class C.

Structures at the site should be designed to withstand the anticipated ground accelerations. Based on the ASCE 7 Hazard Tool[5] and ASCE 7-16, the 2022 CBC earthquake design values are as follows: The ASCE hazard report is included in the Appendix.

Site Class:	C
Mapped Acceleration Parameters:	S_S = 1.823g; S_1 = 0.683g
Design Spectral Response Accelerations:	S_{DS} = 1.458g; S_{D1} = 0.637g

Fault Rupture

The site is not located within an Alquist-Priolo Earthquake Fault Zone. Based on our review of geologic maps, no known active or inactive faults cross or project toward the subject site. In addition, no evidence of active faulting was visible on the site during our site reconnaissance. Therefore, it is our opinion that there is no potential for fault-related surface rupture at the subject site.

Landsliding

Landslides are not mapped by the California Geological Survey on the property. However, our observations in the areas investigated on the property revealed the presence of mass debris flow escarpments as shown on Figures 3.1 and 3.2. Our limited reconnaissance of the accessible property areas did not reveal other large landslides. We should note that some of the existing cut slopes have signs of erosion and relatively shallow sloughing.

A relatively large old landslide escarpment is located in the northern portion of Lot 2 as shown on Figure 3.1. We understand from the prior Busk Estate caretaker that this landslide deposited materials downslope in the adjacent neighboring properties and onto Foothill Boulevard a decade or more ago, however no records or documentation of this event or any mitigation measures were available for our review. The escarpment area is now vegetated with weeds, bushes and some trees. It is also noted that a mass debris flow slide occurred in the steep ravine area on the north corner of Lot 4 as shown on Figure 3.1. This debris flow occurred during heavy rainfall in 2019 and was primarily a result of poor uphill drainage. The resulting debris flow escarpment was mitigated by placement of rip-rap rock slope protection as noted in our letter "Debris Flow Repair Recommendations & Plan Review" dated 07/23/2019. Additional older and vegetated debris flow escarpments are present on the northerly facing ravine, upslope of the

[5] https://asce7hazardtool.online, accessed 8/8/23

repaired mass debris flow noted above. The approximate area of the unmitigated old debris flow escarpments are shown on Figures 3.1 and 3.2.

Due to the presence of historical and recent debris flow landsliding, we retained Bajada Geosciences to evaluate the presence of landslides and debris flows. Their findings are presented in their report "Debris Flow Hazard Assessment" dated 8/8/23 attached in the Appendix of this report. A number of relatively small to large debris flow landslide areas were identified as discussed in the Bajada report and shown on their Geologic Map. Three areas of concern were identified that have the potential for future debris flows to mobilize downslope and adversely impact structures and infrastructure below the subject site. Mitigation measures were recommended for two areas identified as Areas A and B on Lots 2, 4, 9 and 10. These mitigation measures could consist of debris flow catchment basins or debris fencing. The smaller escarpment areas may alternatively require mitigation with rip-rap rock slope protection measures, such as the repair that was performed for the debris flow slide in 2019. A typical rip-rap repair cross-section is included in the Appendix.

As noted above, a number of the existing cut slopes above roadway and pad areas were previously cut to inclinations ranging from 2H:1V to near vertical conditions and have experienced erosion and shallow sloughing. As an example, two near vertical terraced cuts are present on the slope above and south of the prior structures in the area of Borings 13 through 15 on Lots 20 and 21. The cuts have weathered tuff bedrock exposed and have eroded and sloughed in a few areas. In general, these over-steepened slopes have the potential for additional sloughing and sliding due to seismic events and heavy rainfall. Mitigation of these slopes should include slope flattening, cut slope buttressing, placement of rip-rap, surface drainage improvements, or placement of retaining walls. Specific recommendations can be provided once actual grading and improvement plans are available. Typical cut slope buttress and rip-rap repair cross-sections and details are provided in the Appendix.

We should also note that cut slope inclinations steeper than 2H:1V may not be possible for roadway areas due to site geometry. Steeper cut slopes up to 1H:1V may be allowed above roadway and other non-habitable structure locations. In these instances, the property owners must accept the risk of increased erosion and the potential for shallow sloughing and landsliding. Where this occurs, increased maintenance should be expected which may include slope flattening, cut slope buttressing, placement of rock slope protection, subdrainage, or retaining wall construction.

Liquefaction

Soil liquefaction is a phenomenon in which loose and saturated cohesionless soils are subject to a temporary, but essentially total loss of shear strength, due to pore pressure build-up under the reversing cyclic shear stresses associated with earthquakes. Soils typically found most susceptible to liquefaction are saturated and loose, fine to medium grained sand having a uniform particle range and less than 35% fines passing the No. 200 sieve, and a corrected standard penetration blow count $(N_1)_{60}$ less than 30. According to Special Publication 117A by the California Geological Survey, the assessment of hazards associated with potential liquefaction of soil deposits at a site must consider translational site instability (i.e. lateral spreading, etc.) and more localized hazards such as bearing failure and settlement. The acceptable factor of safety against liquefaction is recommended in SP117 to be 1.3 or greater.

Based on our site exploration and laboratory test data, loose cohesionless sand deposits are not present on the property. Therefore, it is our opinion that liquefaction potential at the site is considered very low to nil.

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

General

From a geotechnical point of view, the proposed Kortum Ranch residential development and associated site improvements are considered to be feasible for construction on the subject site provided the recommendations presented in this report are incorporated into the project plans and specifications.

All grading and foundation plans for the development must be reviewed by the Geotechnical Engineer prior to contract bidding or submittal to governmental agencies to ensure that the geotechnical recommendations contained herein are properly incorporated and utilized in design.

KC ENGINEERING CO. should be notified at least two working days prior to site clearing, grading, and/or foundation operations on the property. This will give the Soil Engineer ample time to discuss the problems that may be encountered in the field and coordinate the work with the contractor.

Field observation and testing during the grading and/or foundation operations must be provided by representatives of ***KC ENGINEERING CO.*** to enable them to form an opinion regarding the adequacy of the site preparation, the acceptability of fill materials, and the extent to which the earthwork construction and the degree of compaction comply with the specification requirements. Any work related to the grading and/or foundation operations performed without the full knowledge and under the direct observation of the Soil Engineer will render the recommendations of this report invalid.

Geotechnical Considerations

The primary geotechnical considerations for the property are the presence of undocumented fills, differential cut and fill materials under building pad areas, the presence of moderate to highly expansive soil materials, the proposed structure footprints to be located adjacent to the descending slopes, the presence of disturbed soils from the removed structures, the old wood retaining walls, the presence of existing cut slope erosion and sloughing, and the potential for debris flows and landslides.

In general, the undocumented fills were found to be variable in consistency ranging from soft and loose to firm to stiff and medium dense, and generally consist of sandy and gravelly clay and silt with some debris and boulders. No compaction test data for the existing fills was available for our review. Variable amounts of gravels and weathered bedrock fragments, including some

cobble-size to boulders were encountered in the fill. The approximate areas of undocumented fill are shown on Figures 3.1 through 3.4. In our opinion, the undocumented fills are not considered suitable for support of proposed structures and new roadway areas. We recommend that the undocumented fills be over-excavated, followed by processing and compacting of the underlying native ground and excavating keyways where located on sloping terrain. The excavated old fills may then be reused as well compacted engineered fill, provided any debris and over-sized rocks and boulders are removed. Specific recommendations are provided in the "Grading" section below.

Most of the existing flat building pad areas consist of partial cut and partial undocumented fills. As discussed above, the undocumented fills should be over-excavated and be replaced as engineered fill. Where structures are located over part cut and part fill, we recommend that the cut portion of the pad be over-excavated and then be replaced as compacted fill to provide more uniform soil support conditions and to minimize the potential for differential soil and foundation movements. Specific recommendations are provided in the "Grading" section below.

The site soils were found to range from low to highly expansive and are prone to heave and shrink movements with changes in moisture content and, consequently, must be carefully considered in the design of grading, foundations, and drainage. The presence of fill and native clay and silt soils on the slopes can result in downhill soil creep. Soil creep is defined as slow downward progression of soil acting downhill and laterally on descending slopes as a result of gravity and cyclic wetting and drying cycles. Considering the expected varying depths of materials, the moderate to highly expansive nature of the soils, and the potential for soil creep and differential foundation movements, it is the opinion of **KC ENGINEERING COMPANY** that the proposed structures be supported on either a post-tensioned mat slab foundation system or a pier and grade beam foundation with a raised wood floor. Alternatively, spread-footing foundation systems may be use where structures are located in all cut materials or where structure footprints are setback 15 feet from adjacent descending slopes. Specific recommendations are provided in the "Foundation" section below.

Where the prior building structures were removed and where old wood retaining walls will be demolished and removed, the ground surface is expected to be disturbed in the upper 1 to 2 feet from the demolition and clearing operations. Therefore, we recommend that the upper 2 feet of building pads where prior existing structures stood and new structures will lie be processed and compacted as recommended in the "Grading" section below.

As noted in the "Site Location & Description" section above, we previously performed an evaluation of the existing retaining walls across the subject site as presented in our letter "Retaining Wall Evaluation & Recommendations" dated 08/01/2019. That report discussed the

various wall types and various states of performance and distress. The report summarized that all of the wood walls would require replacement with properly designed and constructed walls per the California Building Code. New concrete or CMU block retaining walls are expected in various areas to retain cuts and fills, and/or to be incorporated into the residence structures for split-level type construction. In addition, the report noted that the cast-in-place concrete, the CMU block and vertically staked precast pipe walls were observed to be performing well and would likely require further evaluation depending on future project development and layouts. Specific recommendations for new walls are presented in the "Retaining Wall" section below.

As discussed in the "Landsliding" section above, a number of relatively small to large debris flow landslide areas were identified as discussed in the attached Bajada report and shown on their Geologic Map. Three areas of concern were identified that have the potential for future debris flows to mobilize downslope and adversely impact structures and infrastructure below the subject site. Mitigation measures were recommended for two areas identified as Areas A and B on Lots 2, 4, 9 and 10. These mitigation measures should consist of debris flow catchment basins or debris fencing as recommended in the Bajada report. The smaller escarpment areas may alternatively be mitigated with rip-rap rock slope protection measures, such as the repair that was performed for the debris flow slide in 2019. A typical rip-rap repair cross-section is included in the Appendix.

In addition, some of the existing cut slopes have signs of erosion and relatively shallow sloughing. A number of the existing cut slopes above roadway and pad areas were previously cut to inclinations ranging from 2H:1V to near vertical conditions and have experienced erosion and shallow sloughing. As an example, two near vertical terraced cuts are present on the slope above and south the prior structures in the area of Borings 13 through 15. The cuts have weathered tuff bedrock exposed and have eroded and sloughed in a few areas. In general, these over-steepened slopes have the potential for additional sloughing and sliding due to seismic events and heavy rainfall. Mitigation of these slopes should include slope flattening, cut slope buttressing, placement of rip-rap, surface drainage improvements, or placement of retaining walls. Specific recommendations can be provided once actual grading and improvement plans are available. Typical cut slope buttress and rip-rap repair cross-sections and details are provided in the Appendix.

We should also note that cut slope inclinations steeper than 2H:1V may not be possible for roadway areas due to site geometry. Steeper cut slopes up to 1H:1V may be allowed above roadway and other non-habitable structure locations. In these instances, the property owners must accept the risk of increased erosion and the potential for shallow sloughing and landsliding. Where this occurs, increased maintenance should be expected which may include slope flattening, cut slope buttressing, placement of rock slope protection, subdrainage, or retaining

wall construction. Specific recommendations are presented in the "Grading" and "Slopes" sections below.

Demolition

As noted above, the property contained existing residences, various other wood and metal structures, numerous wood retaining walls, existing asphalt pavements, concrete flatwork, many trees, pipes, boulders, and other underground improvements throughout the property. The old structures have been removed. Prior to mass and pad grading, demolition and removal of any remaining foundation elements and other items noted above must be performed where new construction is planned.

Demolition should include the complete removal of all surface and subsurface structures and pipelines. This may include foundations, concrete footings, flatwork, concrete rubble, debris, tree roots, pipelines, walls and deleterious material. In addition, all underground structures must be located on the grading plans so that proper removal may be carried out. It is vital that ***KC ENGINEERING CO.***, intermittently observe the demolition operations and be notified in ample time to ensure that subsurface structures are not covered.

Excavations made by the removal of any structure or pipeline should be left open by the demolition contractor for backfill in accordance with the requirements for engineered fill. The removal of any underground structures should be done under the observation of the Soil Engineer to assure adequacy of the removal and that subsoils are left in proper condition for placement of engineered fills. Any soil exposed by the demolition operations, which are deemed soft or unsuitable by the Soil Engineer, shall be excavated as uncompacted fill soil and be removed as required by the Soil Engineer during grading. The demolition operation should be approved by the Soil Engineer prior to commencing grading operations. Any resulting excavations should be properly backfilled with engineered fill under the observation of the Soil Engineer. Should the location of any localized excavation be found to underlie any structure, backfill should be compacted to a minimum relative compaction of 92% or the excavation widened to extend 5 feet beyond the footprint of the structure and backfilled to the specifications for engineered fill as recommended in the "Grading" section herein.

Grading

Mass grading for the proposed residential development is expected to consist of various cutting and filling operations, along with removal of undocumented fills and cut slope mitigation. Recommendations for hillside and project grading are presented herein and in the "Slopes" section below. Grading activities may be performed during the rainy season, however, achieving proper compaction may be difficult due to excessive moisture; and delays may occur. Grading

performed during the dry months will minimize the occurrence of the above problems. When project grading plans become available for our review, supplemental grading recommendations may be required.

As discussed above, undocumented fill materials are present across the site. The approximate areas of undocumented fill are shown on Figures 3.1 through 3.4. In our opinion, the undocumented fills are not considered suitable for support of proposed structures, pools and new roadway areas. We recommend that the undocumented fills be over-excavated, followed by processing and compacting of the underlying native ground and excavating keyways where located on sloping terrain. The excavated old fills may then be reused as well compacted engineered fill, provided any debris and over-sized rocks and boulders are removed.

Most of the existing building pad areas consist of partial cut and partial undocumented fills. In addition, where the existing structures were removed, we expect the upper 1 to 2 feet will be disturbed from foundation removal operations. Therefore, where structures are located over part cut and part fill, and in areas where old structures are removed, we recommend as a minimum that the cut portion of the pad be over-excavated 1 foot followed by processing and compacting the lower 1 foot in-place and then the area/pad replaced as compacted fill to provide more uniform soil support conditions and to minimize the potential for differential soil and foundation movements. Additionally, we recommend a maximum fill differential of 5 feet vertically across any structure footprint. Over-excavation of undocumented fills and cut/fill areas should extend a minimum of 5 feet horizontally beyond the proposed structure footprint.

The surface of the site in areas to be graded should be stripped to remove all existing vegetation and/or other deleterious materials. It is estimated that stripping depths of 1 to 2 inches may be necessary. Any material that is deemed to be topsoil and requiring stripping may not be used as engineered fill but may be stockpiled and used later for landscaping purposes.

After demolition, stripping and over-excavating the above noted undocumented fills and in general fill areas, it is recommended that the upper 12 inches of the native existing grades be scarified and uniformly moisture conditioned and compacted to a minimum degree of relative compaction of 90% at least 3 percent above optimum moisture content as determined by ASTM D1557 Laboratory Test Procedure.

In areas where old structures were located or where cut/fill transitions occur, we recommend that the upper 1 foot be over-excavated, followed by scarifying the exposed bottom 12 inches, and uniformly mixing and compacting to a minimum degree of relative compaction of 90% at least 3 percent above optimum moisture content. After processing the lower 12 inches and compacting the over-excavated bottom, the site may be brought to the desired finished grades

by placing engineered fill in lifts of 8 inches in un-compacted thickness and compacting to a relative compaction of 90% at 3 percent over optimum in accordance with the aforementioned test procedure. Fills deeper than 10 feet should be compacted to a minimum of 95%. All soils encountered during our investigation are suitable for use as engineered fill when placed and compacted at the recommended moisture content, provided that over-sized rocks (6 inch plus) are removed.

Any loose or soft soil materials must be excavated to undisturbed native ground. Excavated soil materials may be used as engineered fill with the approval of the Soil Engineer provided they do not contain debris, over-sized rocks or excessive organics.

Should select import material be used, the import material should be approved by the Soil Engineer before it is brought to the site. Where select import soil is used, it should have a Plasticity Index not higher than 15 and no rocks larger than 6 inches.

The fill materials shall be placed in uniform lifts of not more than 8 to 12 inches in uncompacted thickness depending on size and weight of equipment used. Each layer shall be spread evenly and shall be thoroughly blade mixed during the spreading to obtain uniformity of material in each layer. Before compaction begins, the fill shall be brought to a water content that will permit proper compaction by either (a) aerating the material if it is too wet, or (b) spraying the material with water if it is too dry.

Compaction shall be by footed rollers or other types of acceptable compacting rollers. Rollers shall be of such design that they will be able to compact the fill to the specified density. Rolling shall be accomplished while the fill material is within the specified moisture content range. Rolling of each layer shall be continuous over its entire area and the roller shall make sufficient trips to ensure that the required density has been obtained. No ponding or jetting shall be permitted.

The standard test used to define maximum densities and optimum moisture content of all compaction work shall be the Laboratory Test procedure ASTM D1557 and field tests shall be expressed as a relative compaction in terms of the maximum dry density and optimum moisture content obtained in the laboratory by the foregoing standard procedure. Field density and moisture tests should be made in each compacted layer by the Soil Engineer in accordance with ASTM D6938, respectively. When footed rollers are used for compaction, the density and moisture tests shall be taken in the compacted material below the surface disturbed by the roller. When these tests indicate that the compaction requirements for any layer of fill, or portion thereof, have not been met, the particular layer, or portion thereof, shall be reworked until the compaction requirements have been met.

Slopes

As discussed in the "Landsliding" and "Geotechnical Considerations" sections above, a number of relatively small to large debris flow landslide areas were identified as discussed in the attached Bajada report and shown on their Geologic Map. Three primary areas of concern were identified that have the potential for future debris flows to mobilize downslope and adversely impact structures and infrastructure below the subject site. Mitigation measures were recommended for two areas identified as Areas A and B on Lots 2, 4, 9 and 10. These mitigation measures should consist of debris flow catchment basins or debris fencing as recommended in the Bajada report. Debris flow fencing systems by Geobrugg may be utilized. The project Civil Engineer in conjunction with the Geotechnical Engineer and Geologist should evaluate the estimate failure volumes to be captured. The smaller escarpment areas may alternatively be mitigated with rip-rap rock slope protection measures, such as the repair that was performed for the debris flow slide in 2019. A typical rip-rap repair cross-section is included in the Appendix.

In addition, some of the existing cut slopes have signs of erosion and relatively shallow sloughing. A number of the existing cut slopes above roadway and pad areas were previously cut to inclinations ranging from 2H:1V to near vertical conditions and have experienced erosion and shallow sloughing. As an example, two near vertical terraced cuts are present on the slope above and south the existing structures in the area of Borings 13 through 15. The cuts have weathered tuff bedrock exposed and have eroded and sloughed in a few areas. In general, these over-steepened slopes have the potential for additional sloughing and sliding due to seismic events and heavy rainfall. Mitigation of these over-steepened cut slopes should include slope flattening, cut slope buttressing, placement of rip-rap, surface drainage improvements, or placement of retaining walls. Specific recommendations can be provided once actual grading and improvement plans are available. Typical cut slope buttress and rip-rap repair cross-sections and details are provided in the Appendix.

Where fill slope grading is required, such as for building pads and roadways, we recommend that the toe of fill slopes be properly keyed into competent material before filling. Prior to placement of fill slopes and after stripping of vegetation, a toe of slope keyway must be constructed into competent soil materials prior to placement of engineered fill as required by the 2022 CBC Appendix J. A toe key excavation should be placed at the base of all such fills. This key should be a minimum of 12 feet in width, cut into competent non-yielding material a minimum of 2 vertical feet, and sloped into the hillside at a gradient of no less than 5%. Subsequent keyed benches should be excavated as the fill progresses upslope. Subdrainage in keyways surrounding structures will also be required. A typical fill slope, keyway, benching and subdrain detail is provided in the Appendix.

Unsupported cut and fill slopes should not be steeper than 2H:1V (horizontal to vertical). Fill slopes must be compacted as the filling operation progresses upslope, and include over-constructing the fill slope face and cutting back the looser surface soils to a firm and adequately compacted designed slope grade. Track-walking of slope surfaces does not provide adequate soil densities and is an unacceptable method of slope compaction. All fill slope and cut slope buttress materials must be placed in thin lifts, moisture conditioned to at least 3% above optimum moisture content, and compacted to a minimum relative compaction of 90%.

We should also recognize that cut slope inclinations steeper than 2H:1V may not be possible for roadway areas due to site geometry. Steeper cut slopes up to 1H:1V may be allowed above roadway and other non-habitable structure locations. In these instances, the property owners must accept the risk of increased erosion and the potential for shallow sloughing and landsliding. Where this occurs, increased maintenance should be expected which may include slope flattening, cut slope buttressing, placement of rock slope protection, subdrainage, or retaining wall construction.

Cut and fill slopes in soil may experience severe erosion when grading is halted during rainy weather. Before work is stopped, a positive gradient away from the slopes must be established to carry the surface runoff water away from the slopes to areas where erosion and sediment can be controlled. Concrete lined drainage facilities or other appropriate surface drainage conveyances as designed by the project Civil Engineer should be constructed above all cut and fill slopes where the natural drainage is directed toward the slopes from large drainage areas above. The purpose of the drainage facilities is to divert the excess surface runoff from the slopes and, consequently, minimize sloughing or erosion of the slope surfaces.

After the completion of the slope grading, erosion protection and hydro-seeding must be provided on all soil surfaces. Slope planting, preferably with deep-rooted native plants requiring minimal irrigation, should be completed on all exposed surfaces of cut and fill slopes. Graded slopes should not be left exposed through a winter season without the completion of erosion control measures and slope planting.

Surface and Subsurface Drainage

A very important factor affecting the performance of a structure is the proper design, implementation, and maintenance of surface drainage, as well as maintaining uniform moisture conditions around the structure. The site soils are considered to be moderately to highly expansive and subject to volume changes due to variations in moisture content. Ponded water will cause swelling and/or loss of soil strength and may also seep under structures. Should surface water be allowed to seep under the structure, differential foundation movement resulting in structural damage and/or standing water under the slab will occur. This may cause

dampness to the floor which may result in mildew, staining, and/or warping of floor coverings. To minimize the potential for the above problems, dampproofing and waterproofing should be provided as required by Section 1805 of the 2022 CBC. In addition, the following surface drainage measures are recommended and must be maintained by the property owner in perpetuity:

a) Positive building pad slopes and drainage must be provided by the project Civil Engineer to remove all storm water from the pad and to prevent storm and/or irrigation water from ponding adjacent to the structures foundation. The finished pad grade around the structure should be compacted and sloped 5% away from the exterior foundations and as required in Section 1804.4 of the 2022 CBC and directed to yard swales and/or catch basins. Earth swales should slope a minimum of 2% to a suitable outlet.

b) Enclosed or trapped planter areas adjacent to the structures foundation should be avoided if possible. Where enclosed planter areas are constructed, these areas must be provided with adequate measures to drain surface water (irrigation and rainfall) away from the foundation. Positive surface gradients and/or controlled drainage area inlets should be provided. Care should be taken to adequately slope surface grades away from the structures foundation and into area inlets. Drainage area inlets should be piped to a suitable discharge facility.

c) Adequate measures for storm water discharge from the roof gutter downspouts must be provided by the project Civil Engineer and maintained by the property owners at all times, such that no water is allowed to pond next to the structure. Closed pipe discharge lines should be connected to downspouts and discharged into a suitable drainage facility. It is important not to allow concentrated discharge on the surface of any slope so as to prevent erosion.

d) Site drainage should be designed by the project Civil Engineer. Civil engineering, hydraulic engineering, and surveying expertise are necessary to design proper surface drainage to assure that the flow of water is directed away from the foundation.

e) Over-irrigation of plants is a common source of water migrating beneath a structure. Consequently, the amount of irrigation should not be any more than the amount necessary to support growth of the plants. Foliage requiring little irrigation (drip system) is recommended for the areas immediately adjacent to the structures.

f) Landscape mounds or concrete flatwork should not be constructed to block or obstruct the surface drainage paths. The Landscape Architect or other landscaper

should be made aware of these landscaping recommendations and should implement them as designed. The surface drainage facilities should be constructed by the contractor as designed by the Civil Engineer.

In the case where an uphill slope is present above any proposed structure, we recommend that a subdrain be constructed at the toe of slope between the slope and structure to intercept subsurface water seepage. Subdrains should be a minimum of 4 feet deep, 18 inches wide and backfilled with a 4-inch diameter SDR35 perforated pipe at the bottom with ¾ inch crushed drainrock filled to with 6 inches of the surface and fully wrapped with filter fabric such as Mirafi 140N or equivalent. Caltrans Class 2 Permeable Material may alternatively be used without filter fabric. The subdrain should extend around the entire uphill side of the structure and be connected into a suitable discharge pipe or storm drain inlet.

Storm Water Swales & Basins

With respect to the proposed storm water bio-filtration swales and basins, we recommend that these drainage facilities be a minimum of 10 horizontal feet away from building structures. The bottom of the swales and basins should be sloped away from the structure foundation. In addition, we recommend that a subsurface drain be provided below the select treatment soils at the low side of the swale/basin. The subdrain should be connected to the nearest storm drain catch basin. A 4 inch SDR35 perforated pipe surrounded by Caltrans Class 2 Permeable Material should be provided to discharge collected water into the nearest catch basin. An impermeable liner may also be required in the bottom of the swales. Additional details can be provided when plans are available.

Foundations

Considering the expected varying depths of materials, the moderate to highly expansive nature of the soils, and the potential for soil creep and differential foundation movements, it is the opinion of **KC ENGINEERING COMPANY** that the proposed structures be supported on either a post-tensioned mat slab foundation system or a pier and grade beam foundation with a raised wood floor. Alternatively, spread-footing foundation systems may be use where structures are located in all cut materials or where structure footprints are setback 15 feet from adjacent descending slopes. Recommendations for these systems are provided below.

Representative bulk samples of the near surface soil were collected and transported to Sunland Analytical in Rancho Cordova for testing of water-soluble sulfates in accordance with ASTM C1580. The testing indicates sulfate contents of 1.6 to 88 ppm (mg/kg) for the samples collected. It is noted that the sulfate test results indicate low or “S0” sulfate exposure to concrete as identified in the Durability Requirements, Section 1904 of the 2022 California Building Code, and

Tables 19.3.1.1 of ACI 318-19 Building Code Requirements for Structural Concrete. No cement type restriction is required.

Post-Tensioned Slabs

Post-tensioned slabs should be a minimum 12 inches in thickness (for uniform thickness slabs). Where the post-tension slab is located within 15 feet of the top of slope, a perimeter footing should extend a minimum depth of 2 feet below pad grade to provide resistance to potential soil creep.

Post-tensioned slabs should be designed using the following criteria which is based on the design method of the "Standard Requirements for Design of Shallow Post-Tensioned Concrete Foundations on Expansive Soils", dated May 2008, Third Edition, prepared by the Post Tensioning Institute:

Edge Moisture Variation Distance:

e_m (Edge Lift)	=	4.4 feet
e_m (Center Lift)	=	8.5 feet

Differential Movement:

y_m (Edge Lift)	=	1.5 inches
y_m (Center Lift)	=	-1.0 inches

Estimated Differential Settlement: = 0.5 inches

Should a conventionally reinforced structural mat slab be desired it should also be a minimum of 12 inches in thickness and designed using the method presented in the WRI Design of Slab-On-Ground Foundations[6]. Based on this document, the slabs should be designed with a minimum edge cantilever length (l_c) of 5.0 feet and an interior clear span of 10 feet.

In addition to the recommendations and guidelines in the Third Edition by the PTI, the following recommendations should also be incorporated into the design and construction for the above post-tension and structural mat foundation systems:

a) An allowable bearing capacity of 1,000 p.s.f. may be utilized and may be increased by one-third to resist short-term wind and seismic loading.

[6] Snowden P.E., Walter L. "Design of Slab-On-Ground Foundations." Wire Reinforcement Institute. Tech Facts TF 700-R-03. 1981 (Update 1996)

b) To resist lateral loading, a coefficient of friction between the perimeter concrete thickened edge and the soil of 0.30 may be used.

c) All areas to receive slabs should be thoroughly soaked prior to placing the underslab components. This work should be performed under the observation of the Soil Engineer and approved prior to vapor barrier and concrete placement.

d) The reinforcement and/or cables shall be placed in the center of the slab unless otherwise designated by the Structural Engineer.

e) A vapor retarder membrane should be installed between the prepared building pad and the interior slab to minimize moisture condensation under the floor coverings and/or upward vapor transmission. The vapor barrier membrane should be a minimum 15-mil extruded polyolefin plastic that complies with ASTM E1745 Class A and have a permeance of less than 0.01 perms per ASTM E96 or ASTM F1249. It is noted that polyethylene films (visqueen) do not meet these specifications. The vapor barrier must be adequately lapped and taped/sealed at penetrations and seems in accordance with ASTM E1643 and the manufacturer's specifications. The vapor retarder must be placed continuously across the slab area.

f) The slabs should be thickened a minimum of 12 inches wide at the edges and extend below pad grade at least 6 inches to create frictional resistance for lateral loading, to provide additional edge rigidity, and to minimize moisture infiltration under the slab. Where the post-tension and mat slabs are located within 15 feet of the top of slope, a perimeter footing should extend a minimum depth of 2 feet below pad grade.

g) Water vapor migrating to the surface of the concrete can adversely affect floor covering adhesives. Provisions should be provided in the concrete mix design to minimize moisture emissions. This should include the selection of a water-cement ratio which inhibits water permeation (0.45 max). Additional suitable admixtures to limit water transmission may also be utilized. The slabs should not be subjected to rainfall or cleaning water prior to placement of the floor coverings.

h) Exterior porches, garages and attached covered patios areas should also be designed as part of the same post-tension foundation system.

i) We recommend that appropriate provisions be provided by the Structural Engineer and Contractor to minimize slab cracking, such as curing measures and/or admixtures to minimize concrete shrinkage and curling. American Concrete Institute methods and guidelines of curing, such as wet curing or membrane curing, are recommended to minimize drying shrinkage cracking.

j) The foundation plans, specifications, calculations and concrete mix designs should be provided to the Structural Engineer and us for review prior to construction to ensure conformance with the above recommendations.

Pier & Grade Beam

The piers should have a minimum diameter of 16 inches and extend a minimum depth of 10 feet below pad grade. The piers should be designed on the basis of skin friction acting between the soil/bedrock and that portion of the pier that extends below a depth of 3 feet below finished grade. For the soil/bedrock at the site, an allowable skin friction value of 550 p.s.f. can be used for combined dead and live loads. This value can be increased by one-third for transient loads which include wind or seismic forces. Reinforced concrete grade beams should be used to support bearing walls and to tie all piers together. Isolated piers should not be used. Reinforcing steel should be provided as necessary for structural support and continuity of pier and grade beam. Piers should be reinforced with a minimum of four No. 6 reinforcing bars for the full depth of the piers. The grade beams should be reinforced with a minimum of four No. 5 bars, two located near the top and two near the bottom of the grade beams. Spacing of the piers should be determined, as required, by the load distribution but minimum spacing should not be closer than three pier diameters, center to center. It is noted that the above recommendations are minimums only. The final design of the foundation must be performed by a qualified Structural Engineer or Architect in accordance with current standard of practice and for the anticipated loading conditions.

In order to mitigate against the effects of soil expansion on the foundations, it is recommended that the grade beams be designed to resist uplift loads. The grade beams should be designed for an uplift pressure of 2,000 p.s.f. acting against the bottom of the grade beam. Resistance to uplift is to be provided by the pier foundations and the dead load of the structure. An adhesion value of 400 psf may be applied to the portion of the pier below its upper 3 feet.

Any piers located on the slope or within 15 feet of top of slope should be designed to account for lateral soil creep forces. For these piers, we recommend that the upper 5 feet be designed for a uniform lateral pressure of 60 p.s.f. acting over two pier diameters in the outslope direction.

To resist lateral loads, the passive resistance of the soil can be used. The soil passive pressures can be assumed to act against the lateral projected area of the pier described by the vertical dimension of twice the pier diameter. It is recommended that a passive pressure equivalent of that of a fluid weighing 250 p.c.f. be used below the upper 3 feet, and below the upper 5 feet for piers on or within 15 feet of top of slope.

Even though the piers will be designed to develop their capacity through friction, their bottoms should be cleaned and/or tamped prior to placing reinforcing steel and pouring concrete. Also, it is important that care be exercised to ensure that any concrete spills during the concrete pour must be removed, and no "mushrooming" effects are allowed to remain around the top of the pier or bottom of the grade beam. It is the responsibility of the contractor to ensure that this condition does not occur.

Spread Footings

Spread-footing foundation systems may be use where structures are located in all cut materials or where structure footprints are setback 15 feet from adjacent descending slopes. Continuous spread footings should be utilized around the perimeter of the structures and for all interior bearing and shear walls. All interior and exterior column footings should be interconnected to the perimeter with reinforced concrete tie-beams. Isolated footings should not be utilized unless connected with reinforced tie-beams. The continuous and pad/column footings should extend a minimum depth of 24 inches below the interior slab subgrade soil elevation. The tie beams should extend to a minimum depth of 18 inches below the interior soil pad grade. The recommended design allowable bearing pressure for footings is 2,000 p.s.f. due to dead plus live loads. This value may be increased one-third for transient wind and seismic loads.

All foundations must be adequately reinforced to provide structural continuity and resist the anticipated loads as determined by the project Structural Engineer. The final footing design and reinforcement should be determined by the project Structural Engineer. However, continuous footings and tie-beams are recommended to be reinforced with a minimum of four No. 5 bars, two at the top and two near the bottom of the footing. Additional reinforcement will be as required by the structural engineer and in accordance with structural building code requirements. Foundations designed in accordance with the above criteria are expected to experience a total settlement of less than 1 of an inch with less than ¾ of an inch of differential settlement across the footprint.

To accommodate lateral building loads, the passive resistance of the foundation soil can be utilized. The passive soil pressures can be assumed to act against the front face of the footing below a depth of 1 foot below the ground surface. It is recommended that a passive pressure

equivalent to that of a fluid weighing 250 p.c.f. be used. For design purposes, an allowable friction coefficient of 0.32 can be assumed at the base of the spread footings. These two modes of resistance should not be added unless the frictional component is reduced by 50 percent since the mobilization of the passive resistance requires some horizontal movement, effectively reducing the frictional resistance.

Slab-on-Grade Construction

Interior floor slabs, and exterior concrete slabs, including sidewalks, driveways, non-structural detached general flatwork will likely experience some cracking due to finishing, curing methods, drying shrinkage, as well as moisture variations and related soil movements within the underlying clay soils. We should note that City or County maintained curbs, gutters, sidewalks and driveway aprons should be designed and constructed per the City of Calistoga Standards, Specifications and Plans. To reduce the potential cracking of the slabs-on-grade, the following recommendations are made:

a) All areas to receive slabs should be thoroughly wetted and soaked to seal any desiccation or shrinkage cracks prior to placing concrete. This work should be done under the observation of the Soil Engineer.

b) Slabs should be underlain by a minimum of 4 inches of ¾ inch angular gravel or clean crushed rock material placed between the finished subgrade and the slabs to serve as a capillary break between the subsoil and the slab. The gravel should not have more that 10% passing the No. 4 sieve per CBC Section 1805.4.1.

c) Interior and exterior slabs should be a minimum of 5 inches thick and reinforced with a minimum of No. 4 rebar spaced 18 inches center to center, each way. The actual slab thickness and reinforcement should be determined by the project Structural Engineer in accordance with the structural requirements and the anticipated loading conditions. The reinforcement shall be placed in the center of the slab unless otherwise designated by the design engineer.

d) A vapor retarder membrane should be installed between the prepared building pad aggregate base and any interior slabs to minimize moisture condensation under the floor coverings and/or upward vapor transmission. The vapor barrier membrane should be a minimum 15-mil extruded polyolefin plastic that complies with ASTM E1745 Class A and have a permeance of less than 0.01 perms per ASTM E96 or ASTM F1249. It is noted that polyethylene films (visqueen) do not meet these specifications. The vapor barrier must be adequately lapped and taped/sealed at penetrations and seems in accordance with ASTM E1643 and the

manufacturer's specifications. The vapor retarder must be placed continuously across the slab area.

e) Water vapor migrating to the surface of the concrete can adversely affect floor covering adhesives. Provisions should be provided in the concrete mix design to minimize moisture emissions. This should include the selection of a water-cement ratio which inhibits water permeation (0.45 max) and/or the addition of suitable admixtures to limit water transmission.

f) Slabs for driveways, and exterior flatwork should be placed structurally independent of the foundations. Driveway slab recommendations are presented in the "Pavement" section of the report. A 30-pound felt strip, expansion joint material, or other positive separator should be provided around the edge of all floating slabs to prevent bonding to the foundation. However, rebar doweling is recommended to minimize vertical movements between exterior slabs and building foundations. Doweling details should be determined by the Structural Engineer.

g) To minimize moisture infiltration under exterior slabs and to add edge rigidity, we recommend that slabs be thickened at the edges to extend below the aggregate base layer to the soil subgrade for a minimum width of 6 inches.

h) Slabs should be provided with crack control saw cut joints or tool joints to allow for expansion and contraction of the concrete. In general, contraction joints should be spaced no more than 20 times the slab thickness in each direction. The layout of the joints should be determined by the project Structural Engineer and/or Architect.

i) We recommend that appropriate provisions be provided by the Structural Engineer and Contractor to minimize slab cracking, such as curing measures and/or admixtures to minimize concrete drying-shrinkage and curling. American Concrete Institute methods and guidelines of curing, such as wet curing or membrane curing, are recommended to minimize drying shrinkage cracking.

Retaining Walls

New retaining walls that are to be incorporated into the project should be designed to resist lateral pressures exerted from a media having an equivalent fluid weight as follows:

Gradient of Back Slope	Equivalent Fluid Weight (p.c.f.)			Coefficient of Friction
	Unrestrained Condition (Active)	Restrained Condition (At Rest)	Passive Resistance	
Horizontal	60	75	250	0.32
2:1	70	85	250	0.32

It should be noted that the effects of any surcharge or compaction loads behind the walls must be accounted for in the design of the walls. We recommend that the project Structural Engineer use the formula P_Q = QHKa where Q = uniform surcharge load in psf, Ka = 0.50, and H = wall height. Because the surcharge pressure acting on the retaining wall is considered relatively uniform, the resultant force P_Q should be applied at mid-height of the wall.

Per Section 1803.5.12 of the 2022 California Building Code, dynamic lateral earth pressures on retaining walls supporting more than 6 feet of backfill in height are required. Based on the Mononobe-Okabe & Seed-Whitman equations, a total unit weight of 120 pcf and a Kh of ½ PGAm, an earthquake load of $19H^2$ should be applied at 1/3H where H = wall height, from the bottom of the wall is applicable.

Walls near descending slopes should be supported by piers as noted above. Walls more the 15 feet from descending slopes may be supported by footings.

The above criteria are based on fully drained conditions. In order to achieve fully-drained conditions, a gravel drainage filter blanket should be placed behind the wall. The blanket should be a minimum of 12 inches thick and should extend to within 12 inches of the surface and capped with compacted soil. If the excavated area behind the wall exceeds 12 inches, the entire excavated space behind the 12-inch blanket should consist of compacted engineered fill or blanket material. The gravel drainage blanket material may consist of either granular crushed rock or drain pipe fully encapsulated in geotextile filter fabric (Mirafi 140N or equivalent) or Class II permeable material that meets CalTrans Specification, Section 68. A 4-inch diameter SDR35 perforated drain pipe should be installed in the bottom of the drainage blanket and should be underlain by 4 inches of filter type material. Piping with a minimum gradient of 2% shall be provided to discharge water that collects behind the walls to an adequately controlled discharge system away from the structure foundations.

Basement walls should be waterproofed as specified by the Architect. Gravel blanket drains for basement walls should have the bottom drain pipe extend a minimum of 1 foot below the interior slab elevation.

If mechanically stabilized earth, segmental block retaining walls are utilized, the design and

construction of these proposed flexible modular retaining wall systems should conform to the recommendations of the manufacturer and/or Keystone Retaining Wall Systems or the National Concrete Masonry Association (NCMA). The following soil parameters would be applicable for design using on-site soil materials within the reinforced, retained and bearing zones: φ = 26 degrees, c = 100 p.s.f., γ = 120 p.c.f.. The wall backfill within the reinforced zone may consist of the on-site soil materials provided it has a maximum Liquid Limit of 40 and a maximum Plasticity Index of 20. The wall embedment should conform to the recommendations by Keystone or NCMA.

Pavement Areas

The driveways and parking areas will be paved with either asphalt concrete (AC) or Portland cement concrete (PCC) surfaces. Recommendations for these pavement surfaces are presented below. We emphasize that the performance of the pavement is critically dependent upon adequate and uniform compaction of the subgrade soils, as well as engineered fill and utility trench backfill within the limits of pavements. Pavements will typically have poor performance and shorter life where water is allowed to migrate into the aggregate base and subgrade soils. The main sources of water into pavement materials are landscape planters constructed within or adjacent to pavement areas. Where this is planned, it is suggested to extend the curbs into the soil subgrade at least 2 inches. The construction of all pavements should conform to the requirements set forth by the latest Standard Specifications of the Department of Transportation of the State of California (Caltrans) and/or the City of Calistoga.

R-Value: A composite bulk sample was obtained of the near surface soils within the planned driveways that is relatively representative of the anticipated subgrade soils. The sample was tested in accordance with the California Test Method 301 to determine the R-Value for the site soils. An R-Values of 12 was determined. However, due to the variable soil conditions across the site, we recommend a maximum R-value of 10 be used for design.

Preparation of Subgrade: After underground utilities have been placed in the areas to receive pavement and removal of excess material has been completed, the upper 12 inches of the subgrade soil should be scarified, moisture conditioned and compacted to a minimum relative compaction of 95% at a moisture content at 3% or more above optimum in accordance with the grading recommendations specified in this report. Prior to placement of aggregate baserock, it is recommended that the subgrade be proof rolled and observed for deflection by the Soils Engineer. Should deflection and/or pumping conditions be encountered, stabilization recommendations will be provided based on field conditions.

Aggregate Base: All aggregate base material placed subsequently should also be compacted to a minimum relative compaction of 95% based on the ASTM Test Procedure D1557. Aggregate base should meet the minimum requirements of Caltrans ¾" Class 2 per Section 26 and be crushed

and angular. The recommended aggregate base thicknesses for asphalt concrete pavements are noted in the table below. The minimum aggregate base thickness for Portland cement concrete PCC roadway pavements is 6 compacted inches.

Asphalt Concrete: Asphalt concrete shall conform with Section 39 of Caltrans Standard Specifications and shall be per the City of Calistoga Standards. Based on an R-Value of 10, and traffic indices typical for residential developments, the recommended pavement sections for asphalt concrete surfaces are summarized in the table below. The appropriate traffic index (TI) and any minimum pavement sections should be determined by the Civil Engineer in conformance with the City of Calistoga.

Traffic Condition	**Traffic Index (TI)**	**Asphalt Concrete (inches)**	**Class II Aggregate Base[1] (inches)**
Auto Parking Stalls	4.5	3.0	7.5
Driveways & Streets	6.0	3.0	12.5
Collectors	7.0	4.0	14.5

NOTES:
(1) Minimum R-Value = 78
(2) All layers in compacted thickness to CalTrans Standard Specifications.

Portland Cement Concrete: Where PCC pavement areas are utilized, the concrete should be poured on the compacted aggregate base layer described above of 6 inches. The concrete section should be designed by the project Civil or Structural Engineer per Chapter 620 of the Highway Design Manual or City Standards. We recommend a minimum of 6 inches thick PCC reinforced with a minimum of No. 4 rebar spaced at 16 inches on center, each way, underlain by 6 inches of compacted Class 2 aggregate base. Additional reinforcement may be required by the Structural Engineer. Pavement joints shall be per the HDM and City Standards.

Swimming Pool

The preliminary development plans shows that a number of swimming pools will be constructed behind the residences and adjacent to descending slopes. In the instance where pools are located within 15 feet of a descending slope or in a fill condition, we recommend that the pool shell be supported on drilled piers per the criteria noted in the “Foundation” section of this report. We recommend that the pool walls should be designed to resist a lateral soil pressure exerted from a media having an equivalent fluid weight of 85 p.c.f.

A gravel blanket consisting of an eight (8) inch thick layer of clean gravel, under the pool shell is recommended. Hydrostatic relief valves should be installed in the bottom of the pool shell to prevent damage during future maintenance. The gravel should be placed as high up the pool

wall as practical. A perforated pipe should be placed in the lowest section of the gravel and be discharge to daylight or a sump.

It is recommended that the pool deck/flatwork adjacent to the pool areas be reinforced, as designed by the project structural engineer, and cantilevered over the pool bond beam in lieu of the standard coping. This will eliminate construction expansion joints between the pool coping and deck slab, which is a continuing maintenance problem. A watertight seal should be placed beneath the concrete slab at the contact with the pool bond beam.

The surrounding concrete flatwork (pool decking) should have positive surface drainage and be provided with an adequate number of surface drains and conduit system to remove surface runoff from rainfall and pool splash. In addition, all concrete flatwork should be provided with construction joints at regular intervals to provide for expansion and contraction of the slab components. Slab recommendations are provided above.

The Soil Engineer should review the pool plans and calculations prior to construction and observe the pool excavation at the completion of excavating activities.

General Construction Requirements

Utility trenches extending underneath all traffic areas must be backfilled with native or import soil materials and compacted to relative compaction of 90% to within 12 inches of the subgrade. The upper 12 inches should be compacted to 95% relative compaction in accordance with Laboratory Test Procedure ASTM D1557. Backfilling and compaction of these trenches must also meet the requirements set forth by the City of Calistoga, Department of Public Works.

Applicable safety standards require that trenches in excess of 5 feet must be properly shored or that the walls of the trench slope back to provide safety for installation of lines. If trench wall sloping is performed, the inclination should vary with the soil type and applicable OSHA Safety Standards. The soils at the site are considered to be Type B, except where groundwater is encountered Type C should be used.

With respect to state-of-the-art construction or local requirements, utility lines are generally bedded with granular materials. These materials can convey surface or subsurface water beneath the structures. It is, therefore, recommended that all utility trenches which possess the potential to transport water be sealed with a compacted impervious cohesive soil material or lean concrete where the trench enters/exits the building perimeter. This impervious seal should extend a minimum of 2 feet away from the building perimeter.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. It should be noted that it is the responsibility of the owner or his representative to notify ***KC ENGINEERING CO.***, in writing, a minimum of two working days before any clearing, grading, or foundation excavation operations can commence at the site.

2. The recommendations of this report are based upon the assumption that the soil conditions do not deviate from those disclosed in the borings and from a reconnaissance of the site. Should any variations or undesirable conditions be encountered during the development of the site, ***KC ENGINEERING CO.***, will provide supplemental recommendations as dictated by the field conditions.

3. This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure that the information and recommendations contained herein are brought to the attention of the Architect and Engineer for the project and incorporated into the plans and that the necessary steps are taken to see that the Contractor and Subcontractors carry out such recommendations in the field.

4. At the present date, the findings of this report are valid for the property investigated. With the passage of time, significant changes in the conditions of a property can occur due to natural processes or works of man on this or adjacent properties. In addition, legislation or the broadening of knowledge may result in changes in applicable standards. Changes outside of our control may render this report invalid, wholly or partially. Therefore, this report should not be considered valid after a period of two (2) years without our review, nor should it be used, or is it applicable, for any properties other than those investigated.

5. Not withstanding, all the foregoing applicable codes must be adhered to at all times.

APPENDIX

Aerial Vicinity Map

Property Topography & Prior Site Improvements

Site Plans

Geologic Map

Log of Test Borings

Subsurface Exploration Legend

Laboratory Test Results

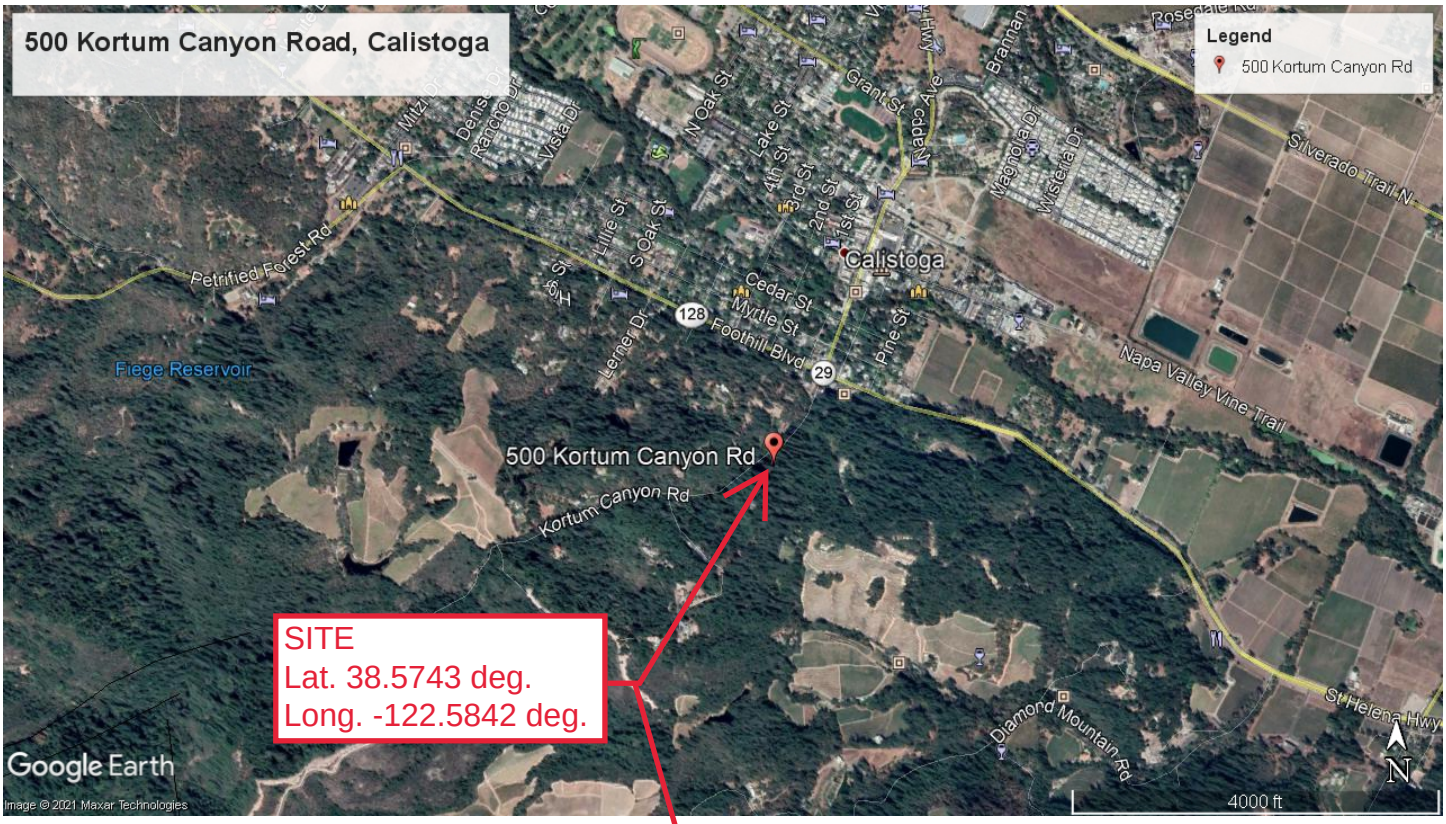
ASCE 7 Seismic Hazards Report

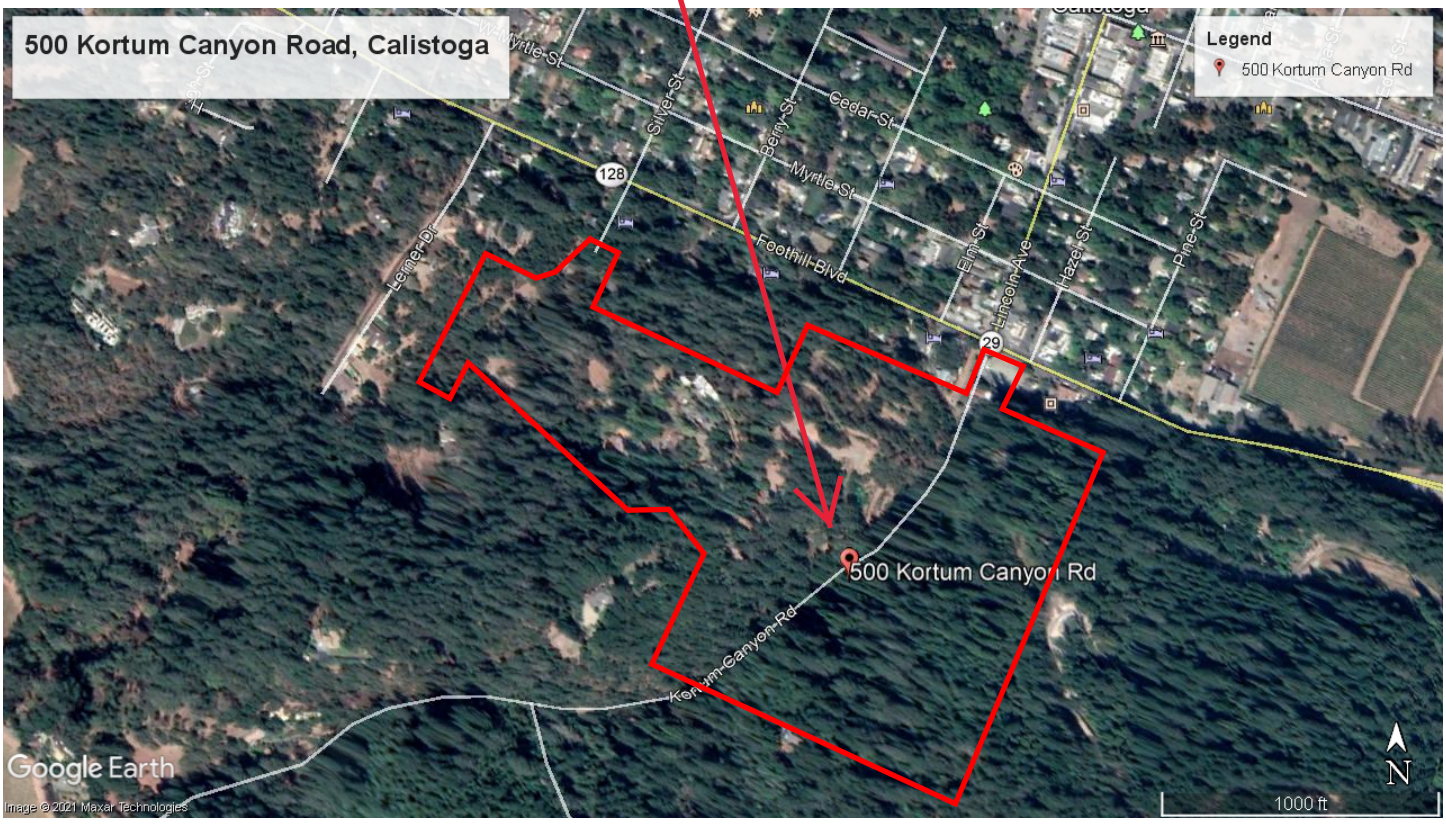
Typical Fill Slope Details

Typical Cut Slope Buttress Detail

Typical Landslide Rapair Utilizing Rip Rap

Debris Flow Hazard Assessment Report by Bajada Geosciences





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Vacaville, CA 95688
707.447.4025

Project No. VV4721B
Proposed Kortum Ranch Residential Devel.
500 Kortum Canyon Road, Calistoga, CA
Figure 1 – AERIAL VICINITY MAP

EXISTING PROPERTY TOPOGRAPHIC MAPPING

SCALE:1" = 100'

EXISTING PARCEL INFORMATION

APN	AREA (ACRES)	BUILDINGS
011-310-009	1.03	1X APARTMENT COMPLEX, 3X HOUSES & 1X BARN
011-310-023	32.13	1X BUILDING
011-290-077	1.77	NO BUILDINGS
011-290-039	9.19	2X HOUSES, 7X BUILDINGS
011-290-038	6.10	NO BUILDINGS

KC Engineering Company
Project No. VV4721B
Figure 2 - Property Topography & Prior Site Improvements

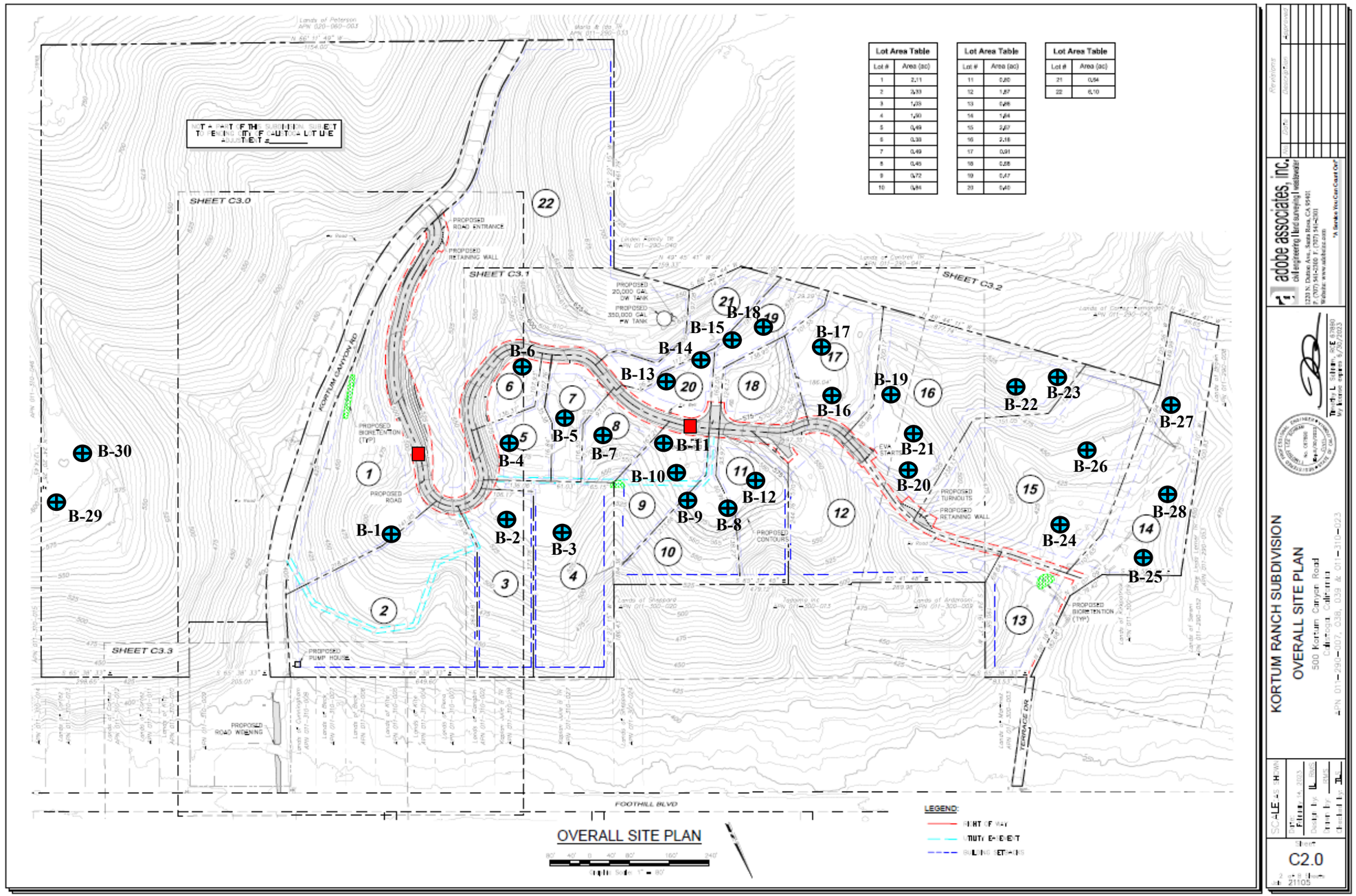
REB
CIVIL AND STRUCTURAL ENGINEERING SURVEYING AND LAND PLANNING
PHONE: 707 963 8638
345 LA FATA STREET
SUITE F - PO BOX 113
ST HELENA, CA 94574

COMMENTS:

REV	MM/DD/YYYY COMMENT	DRAFT	CHECK
1			
2			
3			
4			
5			
6			
7			

KORTUM RANCH
500 KORTUM CANYON RD., CALISTOGA, CA 94515
A.P.N. A.P.N. 011-310-009, & -023; 011-290-007, -038, & -039

DRAFTED BY: MAY
DESIGNED BY: REB
JOB #: 1610
ORIGINAL DATE: 01/11/2021
SCALE: 1" = 100'
SHEET TITLE: EXISTING PROPERTY TOPO
SHEET: C2
2 OF 10 SHEETS



LEGEN

- Approximate Boring Locations
- Approximate R-Value Sample Locations

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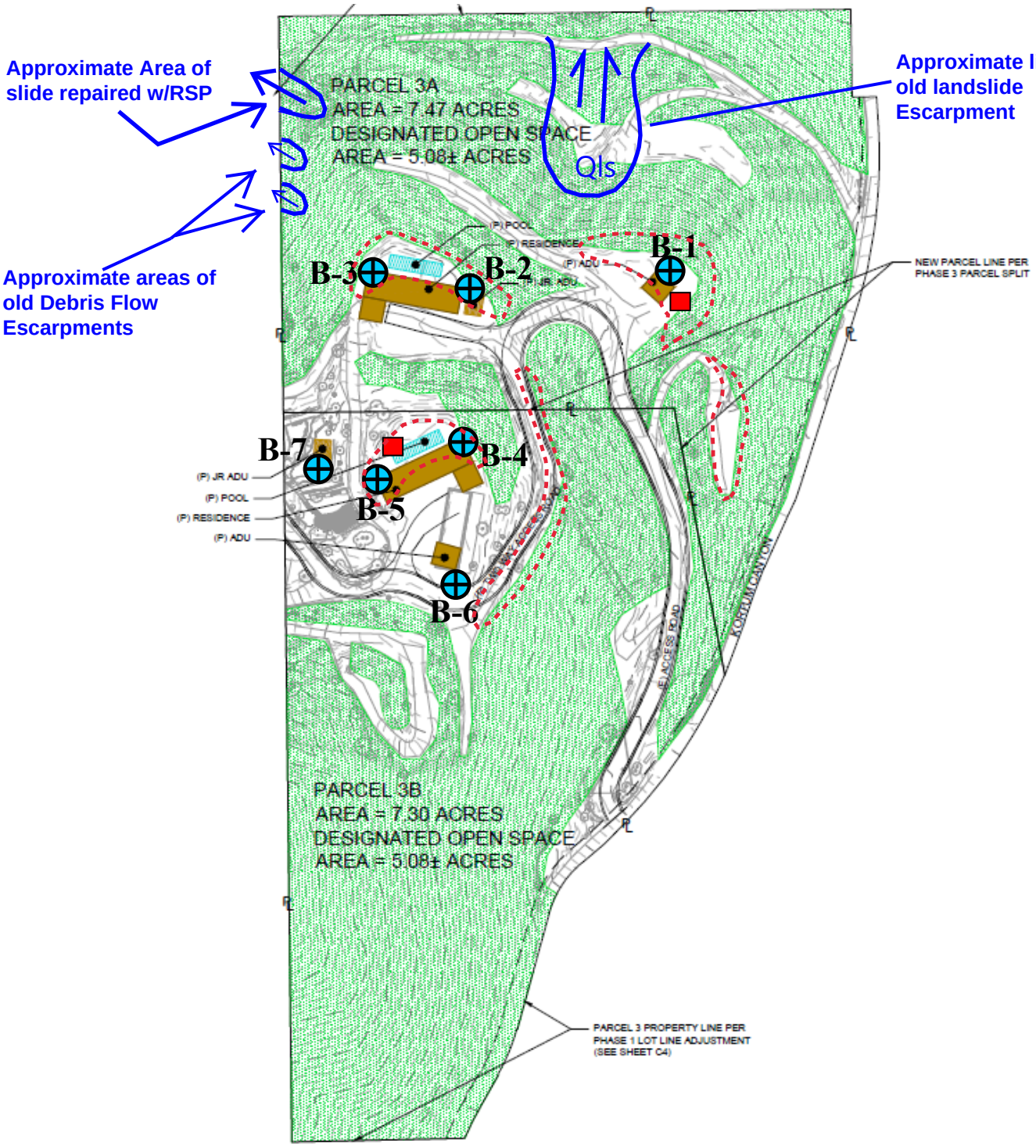
Vacaville, CA 95688
707-447-4025

Project No. VV4721B
Proposed Kortum Ranch Residential Subdivision
500 Kortum Canyon Road, Calistoga, CA
Figure 3.0 – OVERALL SITE PLAN



PARCEL SPLIT
PHASE 3 SITE PLAN
SCALE:1" = 80'

LEGEND

Approximate Boring Location

Approximate Sulfate Sample Location

af — **Approximate Areas of artificial undocumented fill**

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Vacaville, CA 95688
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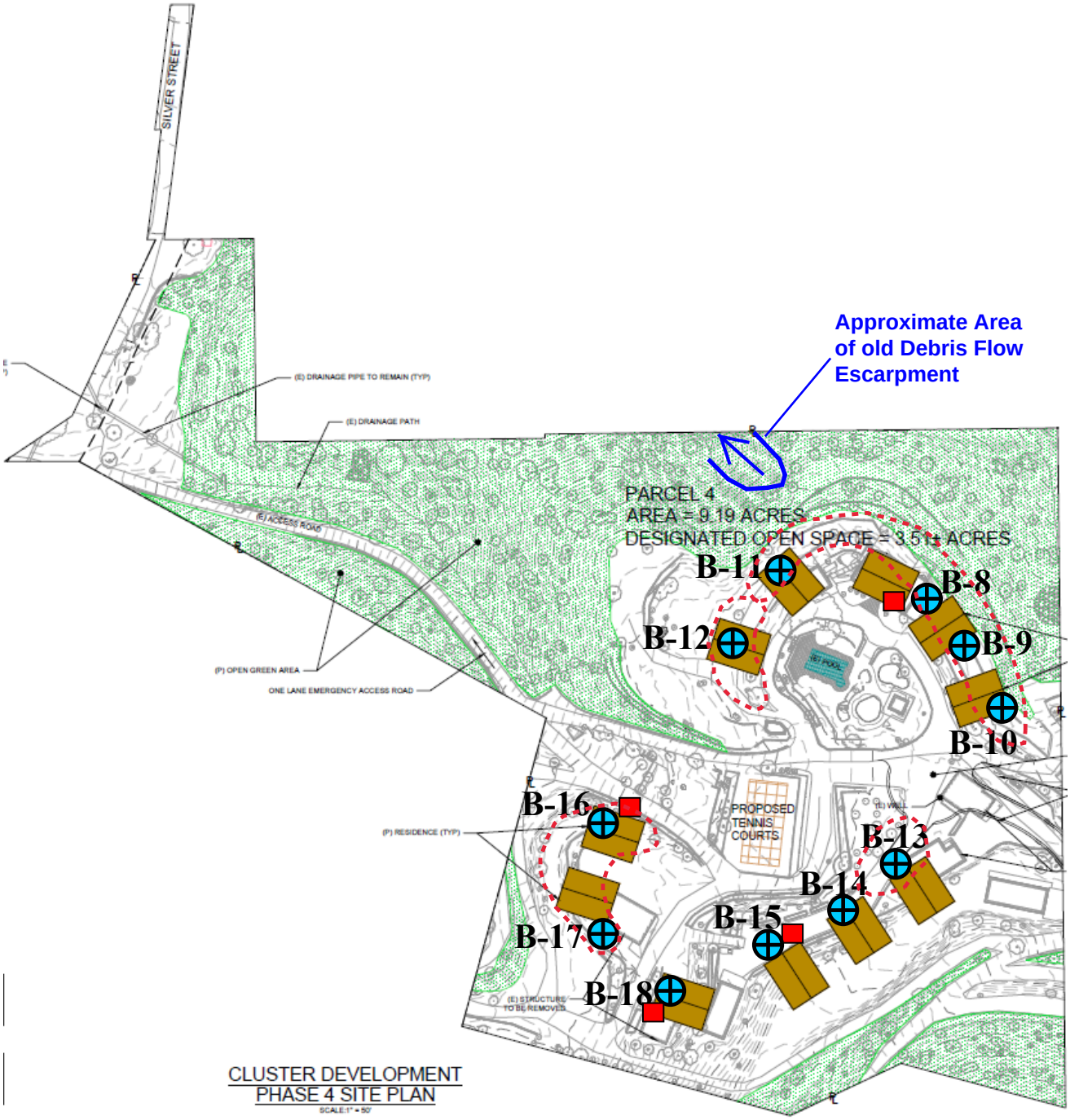
Project No. VV4721B
Proposed Kortum Ranch Residential Devel.
500 Kortum Canyon Road, Calistoga, CA
Figure 3.1 – PHASE 3 SITE PLAN



LEGEND

af — **Approximate Areas of artificial undocumented fill**

Approximate Boring Location

Approximate Sulfate Sample Location

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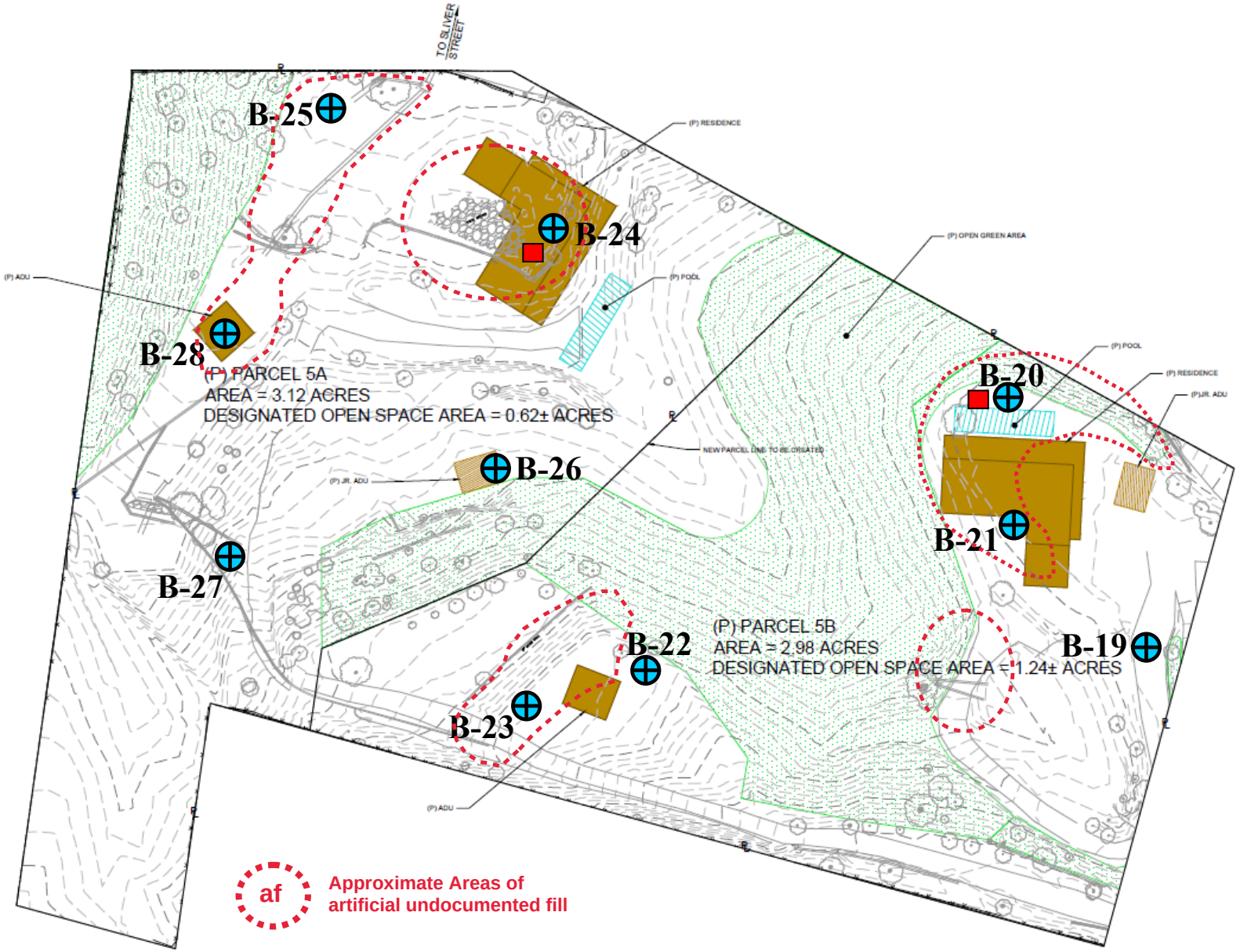
Vacaville, CA 95688
707.447.4025

Project No. VV4721B
Proposed Kortum Ranch Residential Devel.
500 Kortum Canyon Road, Calistoga, CA
Figure 3.2 – PHASE 4 SITE PLAN



LEGEND

Approximate Boring Location

Sulfate Sample Locations

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707-447-4025

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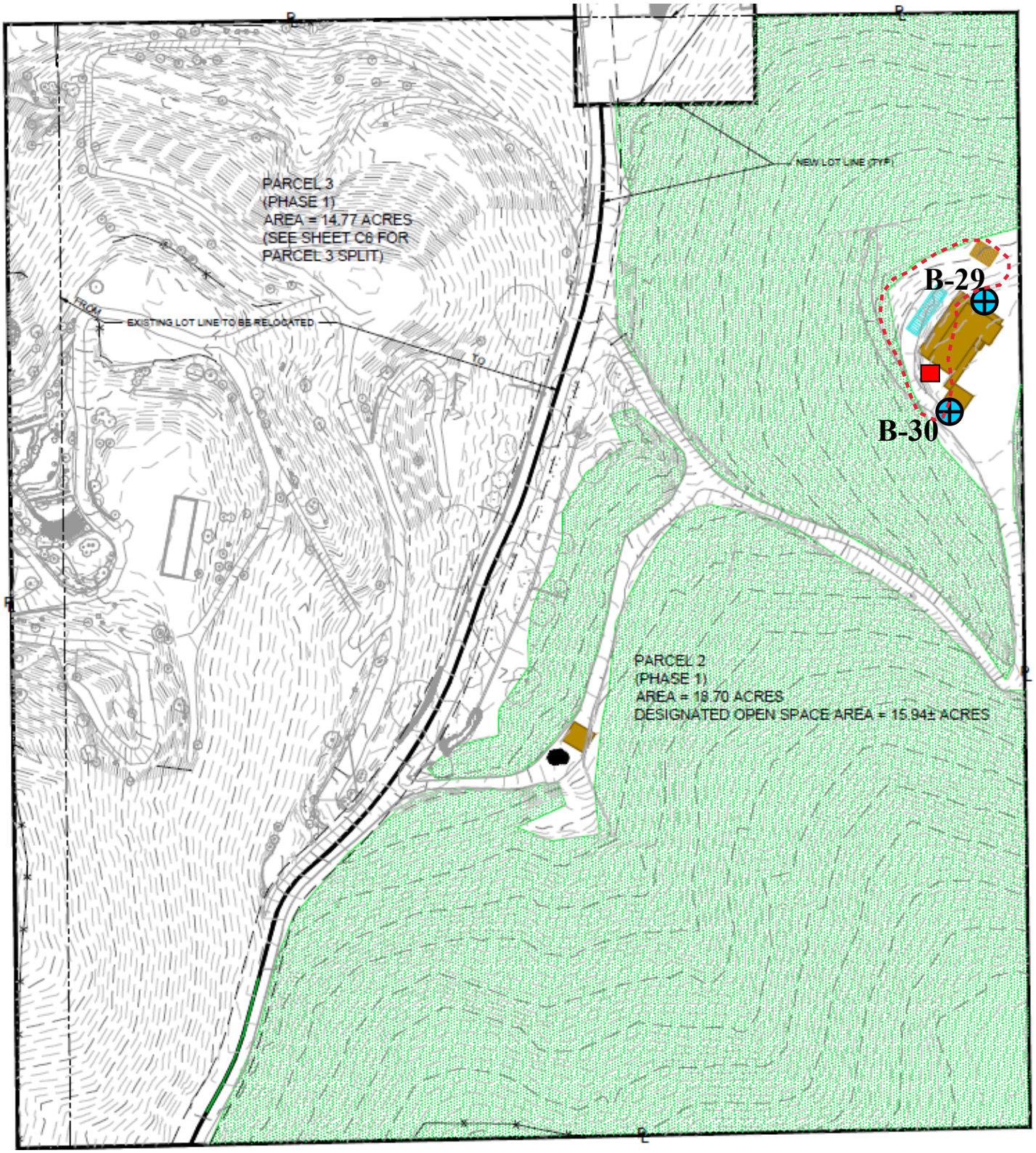
Proposed Kortum Ranch Residential Devel.
500 Kortum Canyon Road, Calistoga, CA
Figure 3.3 – PHASE 2 SITE PLAN



PHASE 1 SITE PLAN

LEGEND

af — Approximate Areas of artificial undocumented fill

Approximate Boring Location

Approximate Sulfate Sample Location

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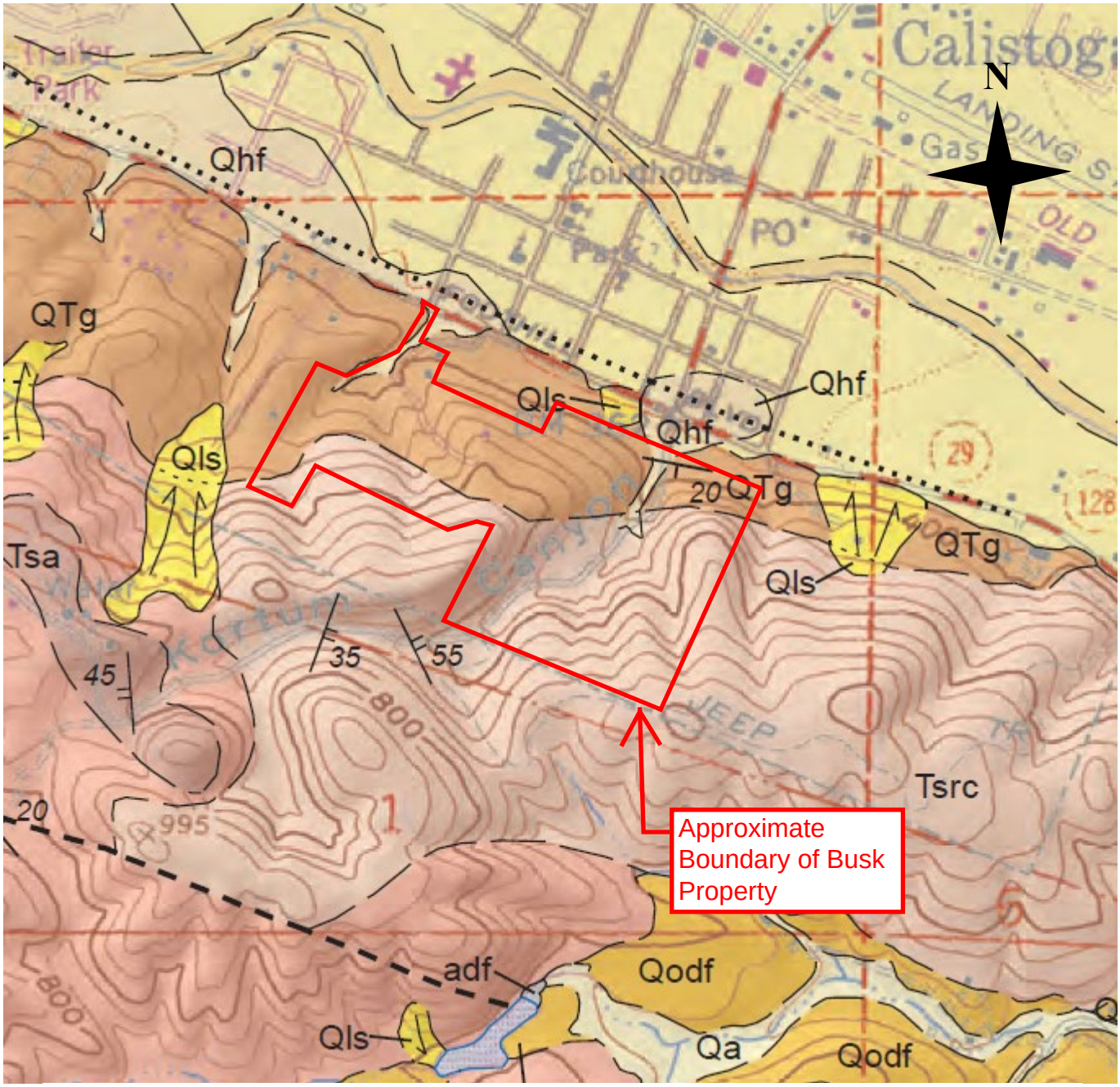
Vacaville, CA 95688
707.447.4025

Project No. VV4721B
Proposed Kortum Ranch Residential Devel.
500 Kortum Canyon Road, Calistoga, CA
Figure 3.4 – PHASE 1 SITE PLAN



PRELIMINARY GEOLOGIC MAP OF THE CALISTOGA 7.5' QUADRANGLE, NAPA AND SONOMA COUNTIES, CALIFORNIA: A DIGITAL DATABASE

By
Carlos I. Gutierrez, Marc Delattre, and Matt O'Neal

2013

QTg — **Unnamed fluvial and lacustrine deposits (early Pleistocene to Pliocene)** – Weakly consolidated gravel, tuffaceous sand, silt and clay, mapped west of Calistoga unconformably overlying the Sonoma Volcanics. Gravels generally consist of sub-rounded to rounded Tertiary volcanic clasts, including obsidian pebbles, with little or no basement material. Previously

Qls — **Landslide deposits (historical to Pleistocene)**

Tsrc — **Rhyolite of Calistoga** – Rhyolitic to rhyodacitic domes and flows found on both sides of the upper Napa Valley and forming domical hills protruding from the valley alluvium in and around Calistoga. Composed of highly variable assemblages of massive or flow banded rhyolite; intercalated crystal and lithic tuff, and lithoidal welded tuff grading to vitrophyre, locally perlitic; and agglomerate with glassy bombs. The unit has experienced widespread hydrothermal alteration to kaolinite and other clay minerals with finely disseminated pyrite, and more pronounced mineralization locally and along faults. Fission-track dating of zircons from this

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Vacaville, CA 95688
707.447.4025

Project No. VV4721B
Proposed Kortum Ranch Residential Devel.
500 Kortum Canyon Road, Calistoga, CA
Figure 4 – GEOLOGIC MAP

LOG OF TEST BORING
BORING NO.: 1

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/10/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▽ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0	1-1a			Yellowish Brown Sandy CLAY with weathered bedrock fragments, moist to very moist, firm to stiff (FILL)	CL					Sulfate 0-3' = 13.7 ppm
	1-1b					8	87.4	22.8		LL=40 PI=17 UCC=779 psf
5				Tan Tuff Breccia, agglomerute, highly weathered, strong (NATIVE)	Rx					
	1-2b					50-5"	108.7	14.3		
10				As Above						
	1-3					60				
15				Boring Terminated @ 16.0' Refusal on dense material, No Groundwater Encountered.						
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 2

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/10/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Olive Brown Sandy CLAY with Weathered tuff & volcanic Chunks up to 2.5" in diameter, very moist, firm (FILL)	CL					
	2-1					7	83.8	24.2		ϕ=49º c=0 %<200=57
5				As Above, boulder						
	2-2					50-2"				
				Light Brown Tuff Breccia, highly weathered, strong to very strong (NATIVE)	Rx					
10	2-3					50-3"				
				Boring Terminated @ 12.5' No Groundwater Encountered.						
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 3

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/10/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Light Brown Sandy CLAY with Volcanic fragments up to 2.5", moist, firm to very stiff (FILL)	CL					
	3-1a 3-1b					21	82.8	8.9		%<200=25 ϕ=34° c=388 psf
5										
	3-2			Light Brown Tuff Breccial/Agglomerate, moderatley to highly weathered, strong to very strong (NATIVE)	Rx	50-3"	94.3	16.5		
	3-3					25-0"				
10				Boring Terminated @ 10.0' Refusal on dense material. No Groundwater Encountered.						
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 4

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/10/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Brown CLAY with Sand & trace Gravels, very moist, soft (FILL)	CL					
	4-1			Reddish Brown Tuffaceous Sand, Silt & Clay, highly to completely weathered, moderately strong to strong (NATIVE)	Rx	50-4"				LL=32 PI=10 %<200=69
5	4-2			As Above		50-3"				
10				As Above						
	4-3					50-6"				
15				Boring Terminated @ 13.5' No Groundwater Encountered.						
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 5

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/10/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0	5-1c			Reddish Brown Sandy CLAY, very moist, firm (Fill in Upper 3ft)	CL					Sulfate 0-5' = 9.2 ppm
	5-1a									
	5-1b			Light Reddish Brown Clayey SILT, very moist to wet, stiff (NATIVE)	ML	23	93.3	26.0		LL=29 PI=8 UCC=4,076 psf %<200=45
5				Gray Tuffaceous Silt, very moist, stiff (NATIVE)	ML					
	5-2a									
	5-2b					11	59.4	63.7		
10										
	5-3			Gray Tuffaceous Sand with Silt, completely weathered, very moist, moderately strong	Rx	40	66.0	51.6		
15				As Above						
	5-4					45				
				Boring Terminated @ 18.5' No Groundwater Encountered.						
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

KC Engineering Co.

Figure 9

LOG OF TEST BORING
BORING NO.: 6

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/10/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Light Gray Tuffaceous Silty Sand, completely weathered, very moist, moderately strong (NATIVE)	Rx					
	6-1					42				
5				Yellowish Brown Tuffaceous Sand, Silt and Clay, completely weathered, very moist, moderately strong	Rx					
	6-2					36	58.2	26.1		%<200=39
				Boring Terminated @ 7.5' No Groundwater Encountered.						
10										
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 7

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/16/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Grayish Brown Sandy CLAY with Gravel & weathered Tuff, very moist, firm (FILL)	CL					
	7-1a 7-1b					6	96.5	19.3		%<200=22 UCC=557 psf
5				Grayish Brown Sandy CLAY with weathered Tuff, dry, stiff (NATIVE)	CL					
	7-2					12	70.5	43.9		%<200=50
10				Light Olive Brown Sand CLAY with fine Gravels, weathered rock, very moist, stiff to very stiff	CL					
	7-3			Pale Yellow SILTSTONE, highly weathered strong	Rx	50-5.5"	85.1	29.8		
				Boring Terminated 13.0' No Groundwater Encountered.						
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 8

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/16/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0	8-1b			Brown Clayey GRAVEL with Sand up to 2.5", moist, loose to medium dense (FILL)	GC					Sulfate 0-5' = 17.2 ppm
	8-1a					12	84.3	24.0		ϕ=42º c=0 %<200=35
5				Light Brown Sandy CLAY with weathered Gravels, Tuff, moist, very stiff to hard (NATIVE)	CL					
	8-2			Light Brown SANDSTONE, slightly to moderately weathered, strong to very strong	Rx	50-2"	110.3	15.8		
				Boring Terminated @ 7.0' No Groundwater Encountered. Refusal on dense material						
10										
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 9

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/16/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Light Brown Sandy CLAY with Volcanic rock pieces up to 2.5", dry, stiff to hard (FILL)	CL					
	9-1					49	101.3	15.2		
5				Light Brown Conglomerates Clay, Sand & weathered Volconic with Gravel up to 1', dry, very stiff (NATIVE)	CL					
	9-2					27	104.1	14.6		
10				As Above, hard						
	9-3					50-5.5"	99.1	9.4		
15				Boring Terminated @ 13.5' No Groundwater Encountered.						
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 10

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/16/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Yellowish Brown Sandy CLAY with weathered gravels, moist to very moist, (2 feet or less of fill)	CH					
	10-1					13	87.9	28.2		LL=63 PI=42 UCC=3,840 psf
5				Yellowish Brown Clay, Sand & weathered Gravels Conglomerate	GM					
	10-2					46	95.1	21.2		
10				Brown Sandy CLAY with volcanic rock fragments up to 2.5", moist, hard	CL					
	10-3					33	94.6	17.8		
				Boring Terminated @ 13.5' No Groundwater Encountered.						
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 11

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/16/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Yellowish Brown Gravelly CLAY with Sand, very moist, very stiff (FILL?)	CL					
	11-1					23	100.7	22.5		UCC=1,385 psf
5				Brown CLAY with Sand, weathered Gravels & Volcanic Cobble fragments, dry to moist, hard (NATIVE)	CL					
	11-2					50-4"	90.6	14.2		
				Boring Terminated @ 7.5' No Groundwater Encountered. Refusal on dense material.						
10										
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 12

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/16/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▽ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Yellowish Brown CLAY with Sand & Gravels, moist, stiff to hard (FILL UPPER 3')	CL					
	12-1b			Yellowish Brown Gravelly CLAY with Sand, dry, hard (NATIVE)	CH	47	96.5	16.6		LL=50 PI=26
5				As Above						
	12-2					50-5"	107.5	13.6		
				Boring Terminated @ 7.5' No Groundwater Encountered.						
10										
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 13

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/16/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Yellowish Brown Gravelly CLAY with Sand ,very moist, firm (FILL)	CL					
	13-1a 13-1b					5	95.6	21.3		LL=26 PI=4 %<200=46 UCC=1,082 psf
5				Light Gray Tuffaceous Silty Sand with fine weathered Gravels, very moist, very dense (NATIVE)	Rx					
	13-2					50-4"	98.5	21.2		
10				As Above						
	13-3					50-3"	93.3	27.9		
				Boring Terminated @ 13.5' No Groundwater Encountered.						
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 14

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/16/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Brown CLAY with Sand, Gravel, Brick pieces, moist, firm (FILL)	CL					
	14-1			Light Gray Tuffaceous Sandy SILT, dry, hard (NATIVE)	Rx	50-5"	87.7	19.7		
5				As Above						
	14-2					54	87.4	27.4		
				Boring Terminated @ 7.5' No Groundwater Encountered.						
10										
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 15

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/17/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▽ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Brown CLAY with Sand & Gravel, moist, stiff (FILL)	CL					
	15-1a			Light Gray Sandy SILT, with Clay, moist, hard (NATIVE)	ML					Sulfate 0-5' = 2.4 ppm
	15-1b					42	92.2	26.6		
5				As Above, with Obsidian fragments						
	15-2					42	96.7	22.5		
				Boring Terminated @ 7.5' No Groundwater Encountered.						
10										
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 16

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/17/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▽ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0	16-1a			Brown Silty CLAY, with weathered rock & volcanic rocks, cobble in size, dry, very stiff (FILL)	CL					Sulfate 0-3' = 88 ppm
	16-1b					18	75.6	22.0		ϕ=36º c=636 psf
5				As Above, hard						
	16-2					50-5.5"	96.9	17.5		
10				Reddish Brown CLAY with trace Sand with weathered rock fragments, dry, hard (FILL?)	CL					
	16-3					41				
15				Reddish Brown CLAY with speckled fine weathered gravel & obsidian pebbles, dry, hard (NATIVE)	CL					
	16-4a 16-4b					50-4"				
				Boring Terminated @ 18.5' No Groundwater Encountered.						
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 17

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 02/17/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▽ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Brown CLAY with Sand & 3/4 inch Gravel, concrete chunk (12 inches) Volcanic Rock Cobble in size, moist, firm (FILL)	CL					
5	17-1					7	97.4	18.8		LL=38 PI=17
				Pale Yellow Tuff Breccia & Agglomerate, highly weathered, moderately strong to strong, moist to wet (NATIVE)	Rx					
10	17-2					50-6"	62.6	52.2		
				As Above, completely weathered, strong						
15	17-3			Boring Terminated @ 14.5' No Groundwater Encountered.		50-5.5"	66.6	45.0		
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 18

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 03/02/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0	18-1a			Brown Sandy CLAY with weathered rock, gravel & organics, moist, firm to stiff (FILL)	CL					Sulfate 0-4' = 53.3 ppm
	18-1b					12	92.7	19.7	4.5+	UCC=1,343 psf %<200=54
5										
	18-2			Tan Silty CLAY with Sand, weathered Tuff & Organics, moist to very moist, stiff (FILL?)	CL	12				
10				Tan Silty Tuff, highly to completely weathered, moderately strong to strong (NATIVE)	Rx					
	18-3					50-6"	82.8	33.7		
				Boring Terminated @ 13.0' No Groundwater Encountered.						
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 19

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 03/02/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▽ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Brown Silty CLAY with fine Sand & weathered Tuff, dry, hard (NATIVE)	ML					
	19-1					34	75.3	24.6		
5										
	19-2			As Above, hard		50-4"	73.4	26.4		
10										
	19-3			As Above, hard		50-5"	77.6	24.5		
				Boring Terminated @ 13.0' No Groundwater Encountered.						
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 20

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: DS
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0	20-1a			Brown Gravelly CLAY with Sand & weathered Rock, moist, stiff to very stiff (FILL)	CL					Sulfate 0-4' = 67.9 ppm
	20-1b					21				LL=48 PI=20
5	20-2			Boring Terminated @ 6.0' No Groundwater Encountered. Refusal on dense material.		25-0"				
10										
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 21

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 03/02/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▽ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Brown Clayey Gravel with Sand & weathered rock pieces up to 3 inches with Clay, dry to moist, loose to medium dense (FILL)	GC					
	21-1					10	84.3	19.6		%<200=17
5				Brown & Gray Clayey Agglomerate (NATIVE)	Rx					
	21-2					50-5.5"				
10										
	21-3			Boring Terminated @ 12.0' No Groundwater Encountered. Refusal on dense material.		50-1"				
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 22

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 03/02/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Brown & Gray Agglomerates with Volcanic rock fragments, dry, hard (NATIVE)	Rx					
	22-1b					50-5.5"				
5				As Above						
	22-2					58				
				Boring Terminated 8.5' No Groundwater Encountered.						
10										
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 23

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 03/02/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Brown & Gray Volcanic & CLAY with rock fragments up to 1/2 inch, dry, very stiff (FILL)	CL					
	23-1					19			4.5+	
5				Yellowish Brown CLAY with weathered Gravels, dry, hard (NATIVE)	CL					
	23-2			Boring Terminated @ 8.0' No Groundwater Encountered.		50-5"	98.4	17.9		
10										
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 24

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 03/04/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Brown Clayey Sand with Volcanic chunks up to 3 inches, moist, loose to medium dense (FILL)	SC					Sulfate 0-3' = 28.6 ppm
	24-1b					13	117.1	7.0		%<200=45
5				Olive Gray Silty CLAY with Claystone, dry to moist, hard (NATIVE)	CL					
	24-2					36	81.9	32.6	4.5+	
10										
	24-3			Reddish Brown Gravelly SAND, moist, very dense	SM	50-5.5"	87.0	19.0		
				Boring Terminated @ 12.5' NO Groundwater Encountered.						
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 25

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ :

PROJECT NO.: VV4721B
DATE: 03/04/2021
ELEVATION:
LOGGED BY: 03/04/2021
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0										
	25-1			Brown & Gray Volcanic rock chunks up to 3 inches with Sandy & Clay, moist, loose (FILL)	GM	8				
				Brown & Gray Clayey Gravels with Sand, moist, medium dense (NATIVE)	GC					
5										
	25-2					16	105.0	14.3		
10										
				As Above, wet, very dense						
	25-3					50-5"	121.3	11.8		
				Boring Terminated @ 13.5' Groundwater in Hole, possible storm drain leakage.						
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 26

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 03/04/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▽ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Brown Clayey GRAVELS with Sand & weathered rock, very moist, medium dense (NATIVE)	GC					
	26-1			Olive Gray Claystone/Sandstone, moderately to completely weathered, moderately strong to strong	Rx	14	88.5	24.0		%<200=26
5										
	26-2			As Above		50-5"	93.3	14.4		
				Boring Terminated @ 7.5' No Groundwater Encountered.						
10										
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 27

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 03/04/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▽ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Dark Yellowish Brown Clayey SAND with weathered Gravels & Sandstone, moist, very dense (NATIVE)	SC					
	27-1					50-3"	85.1	15.1		ϕ=50º c=0
5				Light Olive Claystone/Sandstone with Gravel (Cemented Agglomerate) highly weathered, strong	Rx					
	27-2					50-6"				
				Boring Terminated @ 7.5' No Groundwater Encountered.						
10										
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 28

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 03/04/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Yellowish Brown Gravelly CLAY with Sand, moist, stiff (FILL)	CL					
	28-1b					19	116.5	11.5		UCC=2,512 psf
5				Olive SILT with weathered Claystone fragments, moist, very stiff (NATIVE)	ML					
	28-2a 28-2b					21	79.0	33.3		
10				Boring Terminated @ 8.5' No Groundwater Encountered.						
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 29

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 03/04/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0				Light Gray Silty Tuff/Agglomerate, moderately to completely weathered, moderately strong to strong	Rx					
	29-1					30	95.2	21.8		
5				As Above, strong						
	29-2					54	105.2	13.6		
				Boring Terminated 8.5' No Groundwater Encountered.						
10										
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

LOG OF TEST BORING
BORING NO.: 30

PROJECT: Kortum Ranch Residensial Dvlpmt.
CLIENT: Kortum Ranch, LLC
LOCATION: 500 Kortum Canyon Rd, Calistoga, CA
DRILLER: California Geo-Tech
DRILL RIG: B24
DEPTH TO WATER: INITIAL ▽ : n/a

PROJECT NO.: VV4721B
DATE: 03/04/2021
ELEVATION:
LOGGED BY: DS
BORING DIAMETER: 4"
FINAL ▼ : AFTER: hrs.

DEPTH	SAMPLE NO.	SAMPLER	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (PERCENT)	Qp (t.s.f.) Penetrometer	ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&c, Gradation)
0	30-1			Light Gray Silty Tuff/Agglomerate, moderately to completely weathered, moderately strong to strong (NATIVE)	Rx					Sulfate 0-3' = 1.6 ppm
5										
	30-2					17				
10				Boring Terminated @ 8.5' No Groundwater Encountered.						
15										
20										
25										

This information pertains only to this boring and is not necessarily indicative of the whole site.

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			SYMBOLS		TYPICAL NAMES
COARSE GRAINED SOILS More than half of material is retained on the No. 200 Sieve	GRAVEL More than half of coarse fraction is larger than No. 4 sieve	Clean gravels (<5% fines)	GW		Well graded gravels, gravel-sand mixtures, little or no fines (Cu>4 & 1≤Cc≤3)
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines (Cu < 4 and/or 1>Cc>3)
		Gravel with fines (>12% fines)	GM		Silty gravels and gravel-sand-silt mixtures (PI<4 or below "A" line)
			GC		Clayey gravels and gravel-sand-clay mixtures (PI>7 & on or above "A" line)
	SAND Half or more of the coarse fraction is smaller than No. 4 sieve	Clean sands (<5% fines)	SW		Well graded sands, gravelly sands, little or no fines (Cu>6 & 1≤Cc≤3)
			SP		Poorly graded sands, gravelly sands, little or no fines (Cu<6 and/or 1>Cc>3)
		Sand with fines (>12% fines)	SM		Silty sands and gravel-sand-silt mixtures (PI<4 or below "A" line)
			SC		Clayey sands and gravel-sand-clay mixtures (PI>7 & on or above "A" line)
FINE GRAINED SOILS Half or more of the material passes the No. 200 Sieve	SILTS AND CLAYS Liquid Limit is less than 50%		ML		Inorganic silts with gravel and sand having slight plasticity (PI<4 or below "A" line)
			CL		Inorganic clays of low to med. plasticity with gravel and sand (PI>7 & on or above "A" line)
			OL		Organic silts and clays of low plasticity
	SILTS AND CLAYS Liquid Limit is 50% or more		MH		Inorganic elastic silts (PI below "A" line)
			CH		Inorganic clays of high plasticity, fat clays (PI on or above "A" line)
			OH		Organic silts and clays of medium to high plasticity
HIGHLY ORGANIC SOILS			Pt		Peat and other highly organic soils

MTI-KC ENGINEERING COMPANY
865 Cotting Lane, Ste A, Vacaville, CA 95688
8798 Airport Road, Redding, CA 96002

SAMPLER AND LAB TESTING LEGEND

- Auger
- Bulk Sample, taken from auger cuttings
- California Sampler
- Bulk/Grab Sample
- Pitcher
- Standard Penetration Test
- Shelby Tube
- No Recovery

LL=Liquid Limit (%)
PI=Plasticity Index
¦ =Friction Angle
C=Cohesion
UCC=Unconfined Compression
R value=Resistance Value
Consol=Consolidation Test

SOIL GRAIN SIZE

U.S. STANDARD SIEVE OPENINGS

		#200		#40		#10		#4	¾"		3"		12"
CLAY	SILT	SAND							GRAVEL			COBBLES	BOULDERS
		FINE		MEDIUM		COARSE			FINE		COARSE		
	0.002		0.075		0.425		2.00	4.75		19.0		75	300

SOIL GRAIN SIZE IN MILLIMETERS

RELATIVE DENSITY (Coarse-grained soils)

SANDS & GRAVELS	BLOWS/FOOT[1]
Very Loose	0 – 4
Loose	4 – 10
Medium Dense	10 – 30
Dense	30 – 50
Very Dense	> 50

CONSISTENCY (Fine-grained soils)

SILTS & CLAYS	STRENGTH[2]	BLOWS/FOOT[1]
Very Soft	< 500	0 – 2
Soft	500 – 1,000	2 – 4
Firm	1,000 – 2,000	4 – 8
Stiff	2,000 – 4,000	8 – 15
Very Stiff	4,000 – 8,000	15 – 30
Hard	> 8,000	>30

1 – Number of blows of 140 pound hammer falling 30 inches to drive a 2-inch O.D. split spoon sampler (ASTM D1586)
2 – Unconfined compressive strength in lb/ft^2 as determined by lab testing or approximated by the standard penetration test (ASTM D1586) or pocket penetrometer.

WEATHERING (Bedrock)

Fresh	No visible sign of decomposition or discoloration; rings under hammer impact
Slightly weathered	Slight discoloration inwards from open fractures; little or no effect on normal cementation; otherwise similar to Fresh
Moderately weathered	Discoloration throughout; weaker minerals decomposed; strength somewhat less than fresh rock but cores can not be broken by hand or scraped with knife; texture preserved; cementation little to not affected; fractures may contain filling
Highly weathered	Most minerals somewhat decomposed; specimens can be broken by hand with effort or shaved with knife; texture becoming indistinct but fabric preserved; faint fractures
Completely weathered	Minerals decomposed to soil but fabric and structure preserved; specimens can be easily crumbled or penetrated

STRENGTH (Bedrock)

Plastic	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 blows and will yield with difficulty only dust and small flying fragments
Very strong	Specimen will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments

BEDDING (Bedrock) SPACING (inches)

Very thickly bedded	> 48
Thickly bedded	24 to 48
Thin bedded	2.5 to 24
Very thin bedded	5/8 to 2.5
Laminated	1/8 to 5/8
Thinly laminated	<1/8

FRACTURING (Bedrock) SPACING (inches)

Very little fractured	> 48
Occasionally fractured	12 to 48
Moderately fractured	6 to 12
Closely fractured	1 to 6
Intensely fractured	5/8 to 1
Crushed	<5/8

Materials Testing, Inc.

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Redding, California 96002
(530) 222-1116, fax 222-1611

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Vacaville, California 95688
(707) 447-4025, fax 447-4143

Client: Kortum Ranch LLC
251 Shipyard Way, Suite A
Newport Beach, CA 92663

Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California

Page No.: 1 of 4
Client No.: VV4721B
Figure No.: 0300-001
Date: 03/30/2021
Submitted by: KC Engineering
Date Sampled: 03/08/2021

Density of Soil in Place by the Drive-Cylinder Method (ASTM D2937) and Liquid Limit, Plastic Limit & Plasticity Index of Soils (ASTM D4318)

Sample #	Description	Dry Density p.c.f.	Moisture Content %	Liquid Limit	Plastic Limit	Plastic Index
1-1b @ 3.0'	Yellowish Brown Sandy Clay with weathered Bedrock (visual)	87.4	22.8	40	23	17
1-2b @ 7.5'	Grayish Yellow Tuff, Breccia/ Agglomerate	108.7	14.3	---	---	---
2-1 @ 3.0'	Olive Brown Sandy Clay (visual)	83.8	24.2	---	---	---
2-2 @ 7.5'	Olive Brown Sandy Clay (visual)	98.9	18.0	---	---	---
3-1b @ 3.0'	Light Brown Sandy Clay with Gravel (visual)	82.8	8.9	---	---	---
3-2 @ 7.5'	Light Brown Tuff, Breccia/Agglomerate (visual)	94.3	16.5	---	---	---
4-1 @ 2.5'	Reddish Brown Sandy Clay	---	---	32	22	10
5-1a @ 2.5'	Reddish Brown Sandy Clay with Gravel	---	---	29	21	8
5-1b @ 3.0'	Reddish Brown Sandy Clay with Gravel (visual)	93.3	26.0	---	---	---
5-2b @ 7.0'	Gray Tuffaceous Silt (visual)	59.4	63.7	---	---	---
5-3 @ 13.0'	Gray Tuffaceous Sand with Silt (visual)	66.0	51.6	---	---	---
5-4 @ 18.0'	Gray Tuffaceous Sand with Silt (visual)	71.3	40.5	---	---	---
6-2 @ 7.0'	Yellowish Brown Tuffaceous Sand with Silt	58.2	26.1	---	---	---
7-1b @ 3.0'	Grayish Brown Sandy Clay with Gravel (visual)	96.5	19.3	---	---	---
7-2 @ 7.0'	Grayish Brown Sandy Clay (visual)	70.5	43.9	---	---	---
7-3 @ 12.5'	Pale Yellow Siltstone (visual)	85.1	29.8	---	---	---

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251 Shipyard Way, Suite A
Newport Beach, CA 92663

Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California

Page No.: 2 of 4
Client No.: VV4721B
Figure No.: 0300-001
Date: 03/30/2021
Submitted by: KC Engineering
Date Sampled: 03/08/2021

Density of Soil in Place by the Drive-Cylinder Method (ASTM D2937) and Liquid Limit, Plastic Limit & Plasticity Index of Soils (ASTM D4318)

Sample #	Description	Dry Density p.c.f.	Moisture Content %	Liquid Limit	Plastic Limit	Plastic Index
8-1a @ 3.0’	Brown Clayey Gravel with Sand (visual)	84.3	24.0	---	---	---
8-2 @ 6.5’	Light Brown Sandstone (visual)	110.3	15.8	---	---	---
9-1 @ 3.0’	Light Brown Sandy Clay with Gravel (visual)	101.3	15.2	---	---	---
9-2 @ 7.0’	Light Brown Conglomerates (visual)	104.1	14.6	---	---	---
9-3 @ 13.0’	Light Brown Conglomerates (visual)	99.1	9.4	---	---	---
10-1 @ 3.0’	Yellowish Brown Sandy Clay (visual)	87.9	28.2	63	21	42
10-2 @ 7.0’	Yellowish Brown Conglomerates (visual)	95.1	21.2	---	---	---
10-3 @ 13.0’	Brown Sandy Clay with Rock fragments (visual)	94.6	17.8	---	---	---
11-1 @ 2.5’	Yellowish Brown Gravelly Clay with Sand (visual)	100.7	22.5	---	---	---
11-2 @ 7.0’	Brown Clay with Sand & weathered Gravels (visual)	90.6	14.2	---	---	---
12-1b @ 3.0’	Yellowish Brown Gravelly Clay	96.5	16.6	50	24	26
12-2 @ 7.0’	Yellowish Brown Gravelly Clay (visual)	107.5	13.6	---	---	---
13-1a @ 2.5’	Brown Clayey Gravel with Sand	---	---	26	22	4
13-1b @ 3.0’	Yellowish Brown Gravelly Clay with Sand (visual)	95.6	21.3	---	---	---
13-2 @ 7.0’	Light Gray Tuffaceous Silty Sand (visual)	98.5	21.2	---	---	---

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Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California

Page No.: 3 of 4
Client No.: VV4721B
Figure No.: 0300-001
Date: 03/30/2021
Submitted by: KC Engineering
Date Sampled: 03/08/2021

Density of Soil in Place by the Drive-Cylinder Method (ASTM D2937) and Liquid Limit, Plastic Limit & Plasticity Index of Soils (ASTM D4318)

Sample #	Description	Dry Density p.c.f.	Moisture Content %	Liquid Limit	Plastic Limit	Plastic Index
13-3 @ 13.0'	Yellowish Brown Sandy Silt Clay (visual)	93.3	27.9	---	---	---
14-1 @ 3.0'	Light Gray Tuffaceous Sandy Silt (visual)	87.7	19.7	---	---	---
14-2 @ 7.0'	Light Gray Tuffaceous Sandy Silt (visual)	87.4	27.4	---	---	---
15-1b @ 3.0'	Light Gray Sandy Silt (visual)	92.2	26.6	---	---	---
15-2 @ 7.0'	Light Gray Sandy Silt (visual)	96.7	22.5	---	---	---
16-1b @ 3.0'	Brown Silty Clay (visual)	75.6	22.0	---	---	---
16-2 @ 6.5'	Brown Silty Clay with Sand (visual)	96.9	17.5	---	---	---
17-1 @ 4.0'	Brown Sandy Clay with Gravel	97.4	18.8	38	21	17
17-2 @ 9.0'	Pale Yellow Tuff Breccia & Agglomerate (visual)	62.6	52.2	---	---	---
17-3 @ 14.0'	Pale Yellow Tuff Breccia & Agglomerate (visual)	66.6	45.0	---	---	---
18-1b @ 2.0'	Brown Sandy Clay with Gravel (visual)	92.7	19.7	---	---	---
18-3 @ 12.5'	Tan Silty Tuff (visual)	82.8	33.7	---	---	---
19-1 @ 3.0'	Brown Silty Clay with Gravel (visual)	75.3	24.6	---	---	---
19-2 @ 7.0'	Brown Silty Clay with Gravel (visual)	73.4	26.4	---	---	---

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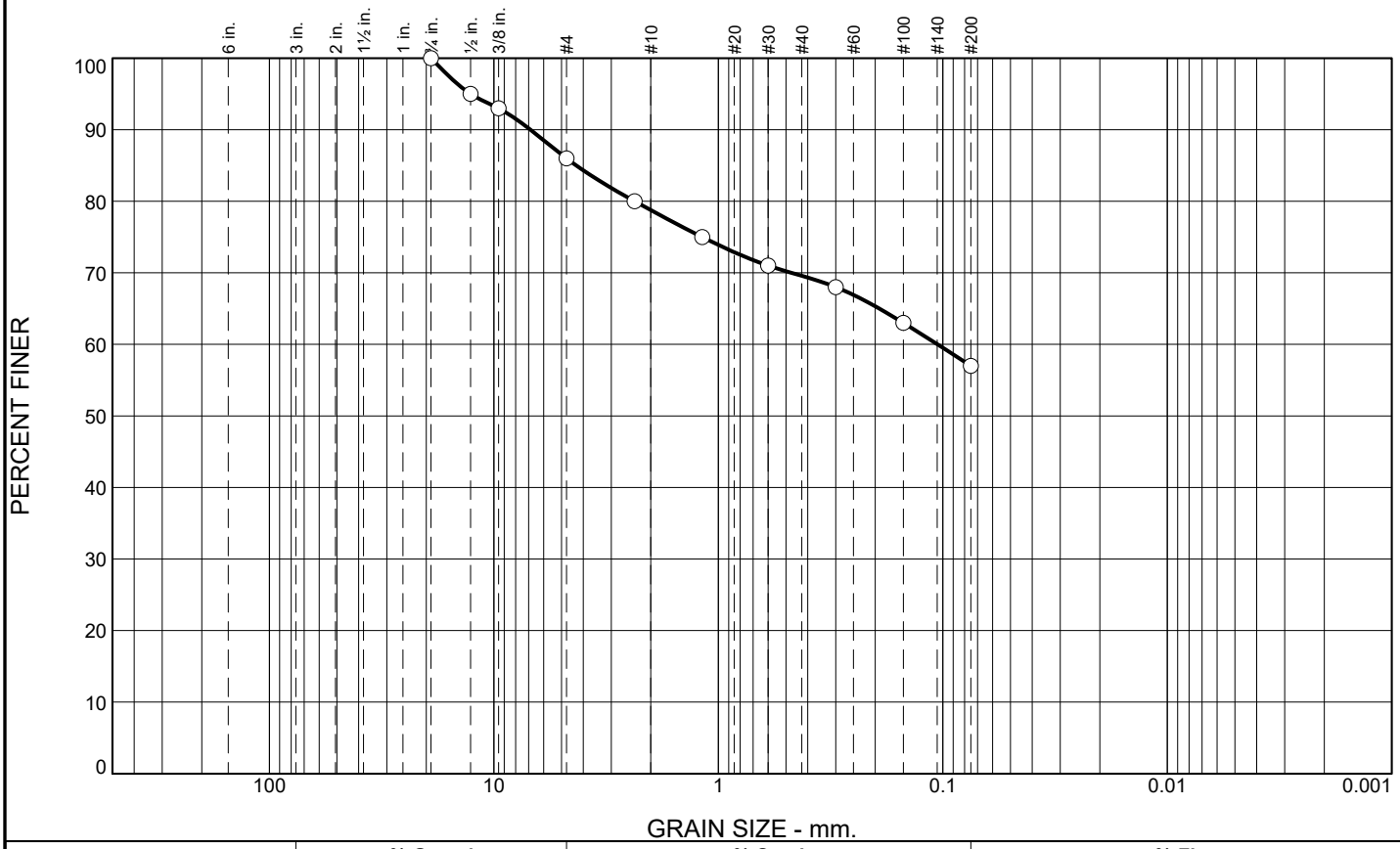
Page No.: 4 of 4
Client No.: VV4721B
Figure No.: 0300-001
Date: 03/30/2021
Submitted by: KC Engineering
Date Sampled: 03/08/2021

Density of Soil in Place by the Drive-Cylinder Method (ASTM D2937) and Liquid Limit, Plastic Limit & Plasticity Index of Soils (ASTM D4318)

Sample #	Description	Dry Density p.c.f.	Moisture Content %	Liquid Limit	Plastic Limit	Plastic Index
19-3 @ 12.5’	Brown Silty Clay with Gravel (visual)	77.6	24.5	---	---	---
20-1b @ 3.0’	Brown Gravelly Clay with Sand (visual)	---	---	48	28	20
21-1 @ 3.0’	Brown Clayey Gravel with Sand (visual)	84.3	19.6	---	---	---
23-2 @ 7.5’	Yellowish Brown Gravelly Clay (visual)	98.4	17.9	---	---	---
24-1b @ 2.5’	Brown Clayey Sand (visual)	117.1	7.0	---	---	---
24-2 @ 8.0’	Olive Gray Silty Clay with Claystone chunks (visual)	81.9	32.6	---	---	---
24-3 @ 12.0’	Yellow Gravely Clay (visual)	87.0	19.0	---	---	---
25-2 @ 8.0’	Brown & Gray Clayey Gravels(visual)	105.0	14.3	---	---	---
25-3 @ 13.0’	Brown & Gray Clayey Gravel with Sand (visual)	121.3	11.8	---	---	---
26-1 @ 3.0’	Olive Gray Claystone/Sandstone (visual)	88.5	24.0	---	---	---
26-2 @ 7.0’	Olive Gray Claystone/Sandstone (visual)	93.3	14.4	---	---	---
27-1 @ 2.0’	Dark Yellowish Brown Clayey Sand (visual)	85.1	15.1	---	---	---
28-1b @ 2.5’	Yellowish Brown Gravelly Clay with Sand (visual)	116.5	11.5	---	---	---
28-2b @ 8.0’	Olive Silt with weathered Claystone (visual)	79.0	33.3	---	---	---
29-1 @ 2.0’	Light Gray Silty Tuff/Agglomerate (visual)	95.2	21.8	---	---	---
29-2 @ 8.0’	Light Gray Silty Tuff/Agglomerate (visual)	105.2	13.6	---	---	---

Tested by John Hubbard.
The samples were tested according to the referenced standard test procedures and relate only to the items inspected or tested.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	14	7	9	13	57	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100		
1/2"	95		
3/8"	93		
#4	86		
#8	80		
#16	75		
#30	71		
#50	68		
#100	63		
#200	57		

* (no specification provided)

Material Description

Olive Brown Sandy Clay (visual)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 6.8735 D_{85}= 4.2961 D_{60}= 0.1056
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

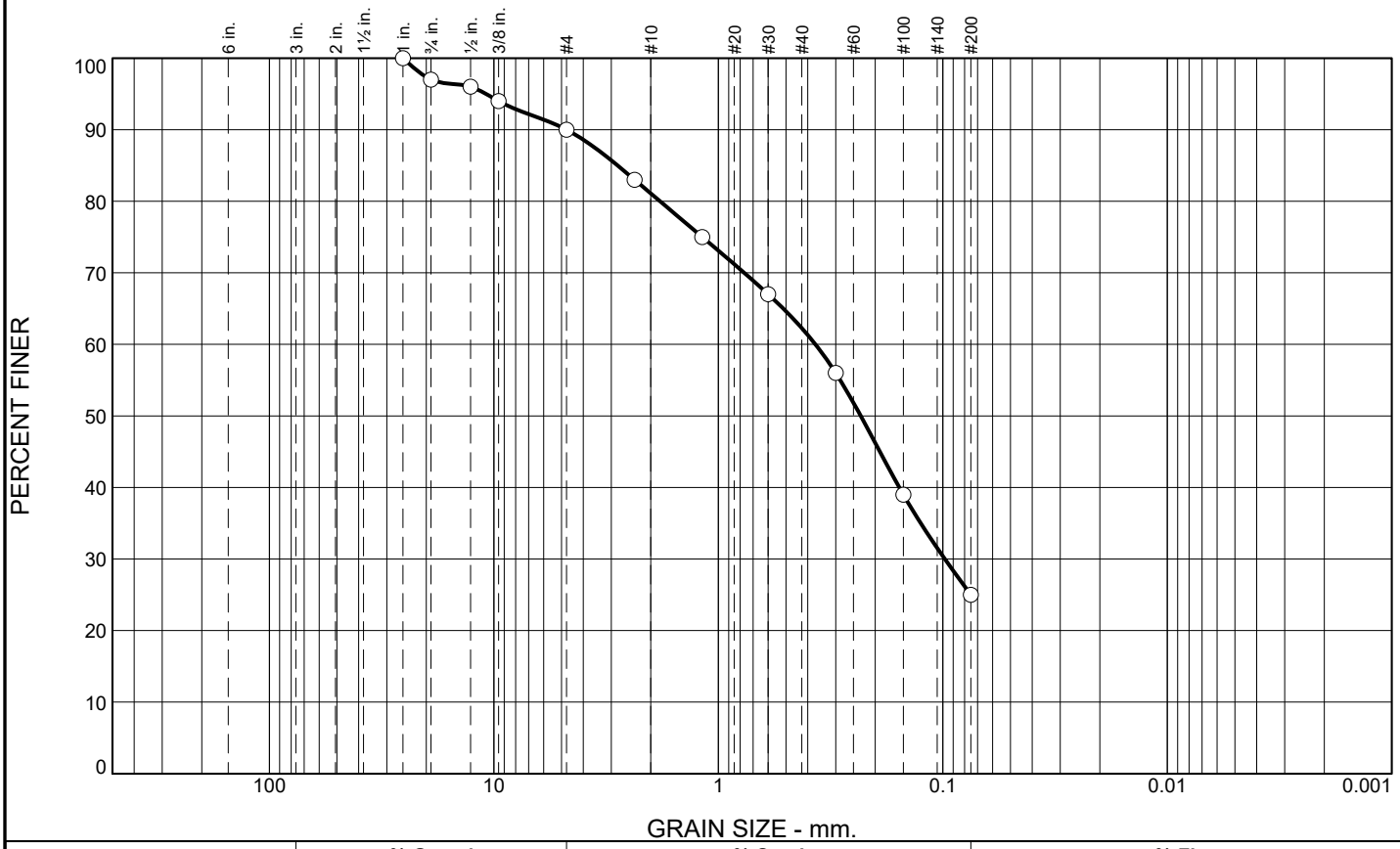
Material tested in accordance with ASTM D6913.

Location: 2-1
Sample Number: 5 **Depth:** 3.0' **Date:** 03/30/2021

Client: Kortum Ranch LLC
Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Project No: VV4721B **Figure** 0300-002

Tested By: John Hubbard

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	3	7	9	19	37	25	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100		
3/4"	97		
1/2"	96		
3/8"	94		
#4	90		
#8	83		
#16	75		
#30	67		
#50	56		
#100	39		
#200	25		

* (no specification provided)

Material Description

Yellowish Brown Clayey Sand (visual)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 4.7500 D_{85}= 2.8125 D_{60}= 0.3695
D_{50}= 0.2322 D_{30}= 0.0979 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

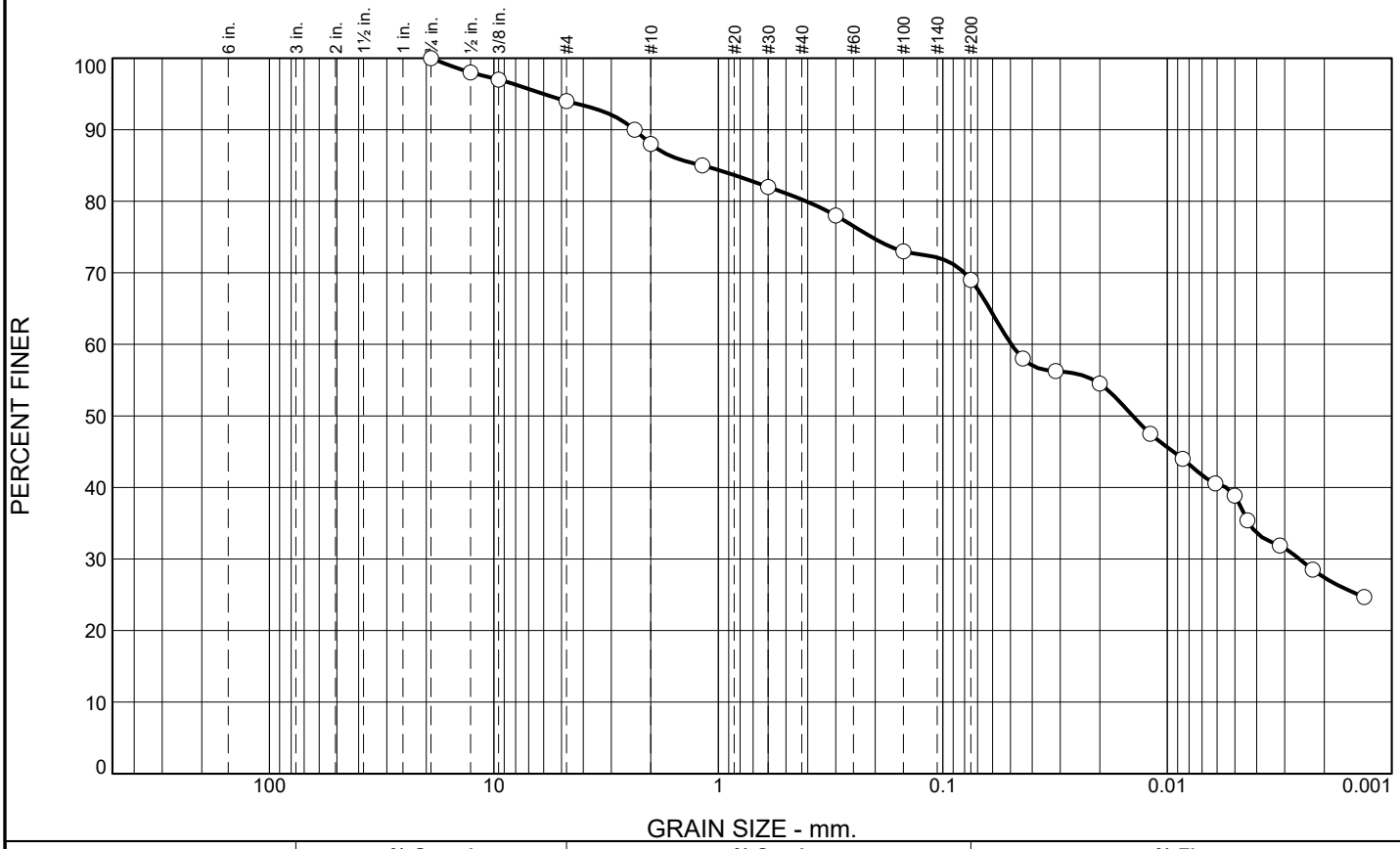
Material tested in accordance with ASTM D6913.

Location: 3-1a
Sample Number: 7 **Depth:** 2.5' **Date:** 03/30/2021

Client: Kortum Ranch LLC
Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Project No: VV4721B **Figure** 0300-003

Tested By: John Hubbard

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	6	6	8	11	30	39

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100		
1/2"	98		
3/8"	97		
#4	94		
#8	90		
#10	88		
#16	85		
#30	82		
#50	78		
#100	73		
#200	69		

* (no specification provided)

Material Description

Reddish Brown Sandy Clay

Atterberg Limits

PL= 22 LL= 32 PI= 10

Coefficients

D_{90}= 2.3600 D_{85}= 1.1800 D_{60}= 0.0496
D_{50}= 0.0143 D_{30}= 0.0026 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-4(5)

Remarks

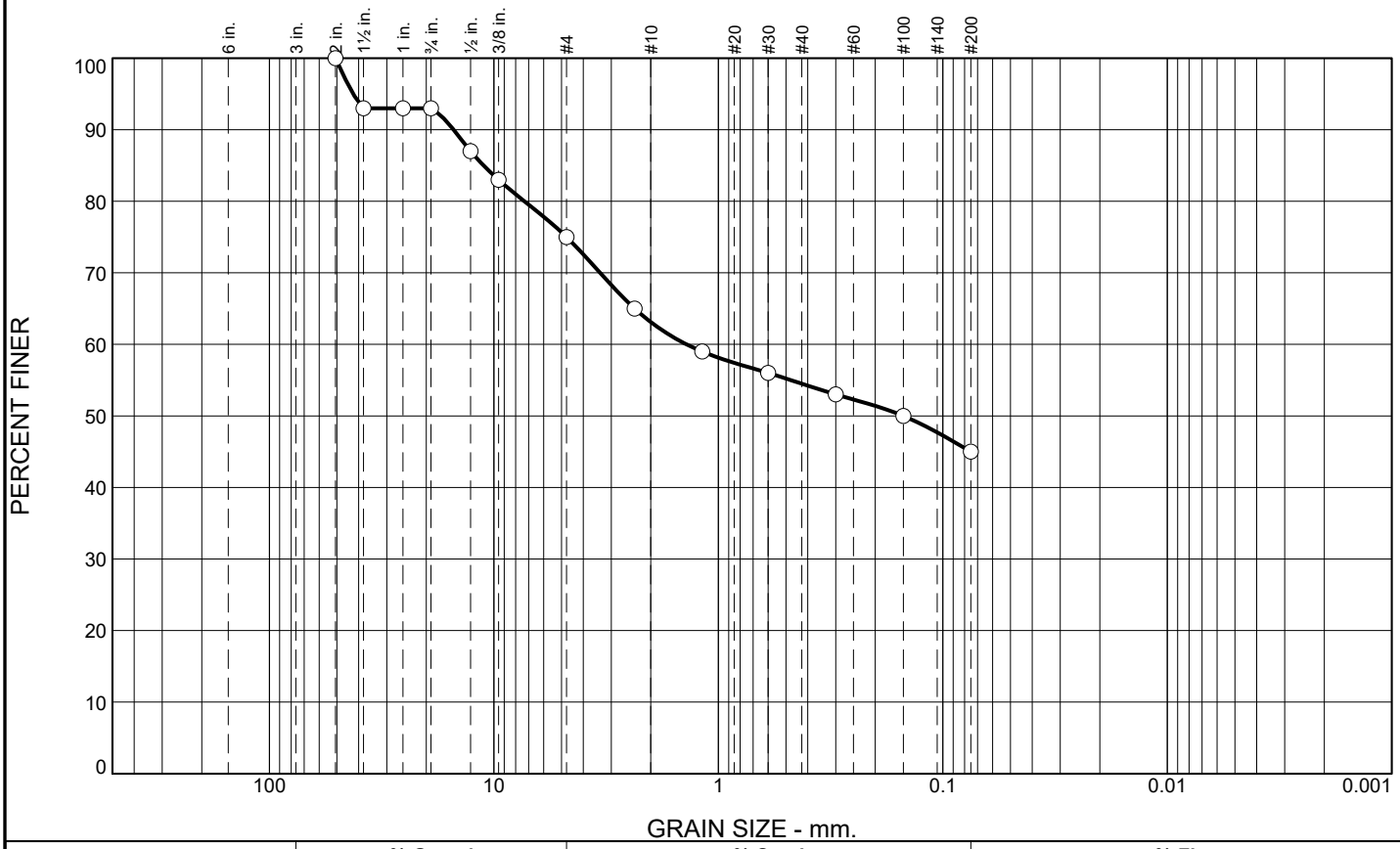
Material tested in accordance with ASTM D422.

Location: 4-1
Sample Number: 10 **Depth:** 2.5' **Date:** 03/30/2021

Client: Kortum Ranch LLC
Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Project No: VV4721B **Figure** 0300-004

Tested By: John Hubbard

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	7	18	12	9	9	45	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100		
1 1/2"	93		
1"	93		
3/4"	93		
1/2"	87		
3/8"	83		
#4	75		
#8	65		
#16	59		
#30	56		
#50	53		
#100	50		
#200	45		

* (no specification provided)

Material Description

Reddish Brown Clayey Sand with Gravel (visual)

Atterberg Limits

PL= 21 LL= 29 PI= 8

Coefficients

D_{90}= 15.1272 D_{85}= 11.1220 D_{60}= 1.3866
D_{50}= 0.1500 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-4(1)

Remarks

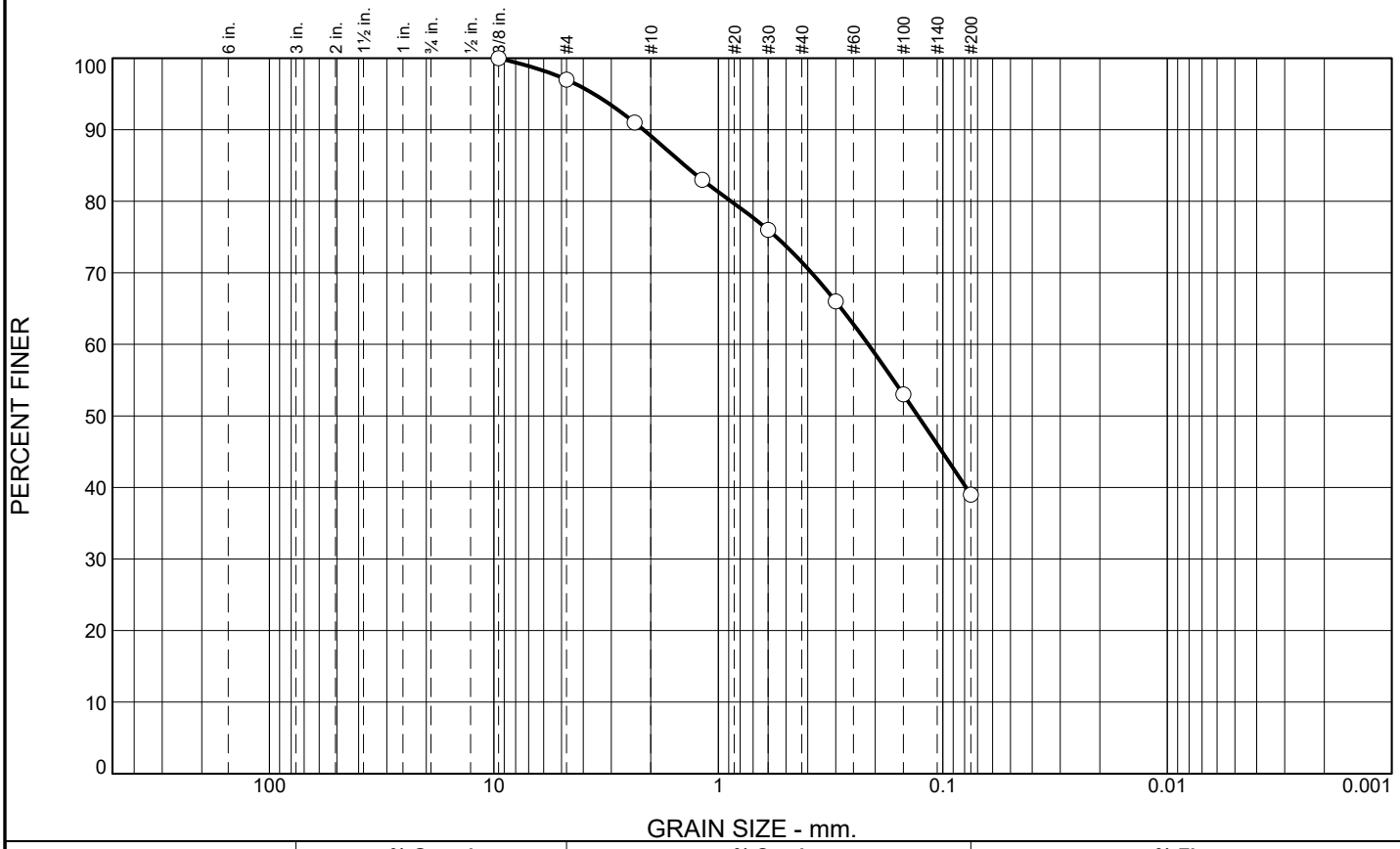
Material tested in accordance with ASTM D6913.

Location: 5-1b
Sample Number: 13 **Depth:** 2.5' **Date:** 03/30/2021

Client: Kortum Ranch LLC
Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Project No: VV4721B **Figure** 300-005

Tested By: John Hubbard

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	3	8	18	32	39	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100		
#4	97		
#8	91		
#16	83		
#30	76		
#50	66		
#100	53		
#200	39		

* (no specification provided)

Material Description

Yellowish Brown Tuffaceous Sand & Silt (visual)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 2.1571 D_{85}= 1.4096 D_{60}= 0.2150
D_{50}= 0.1291 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

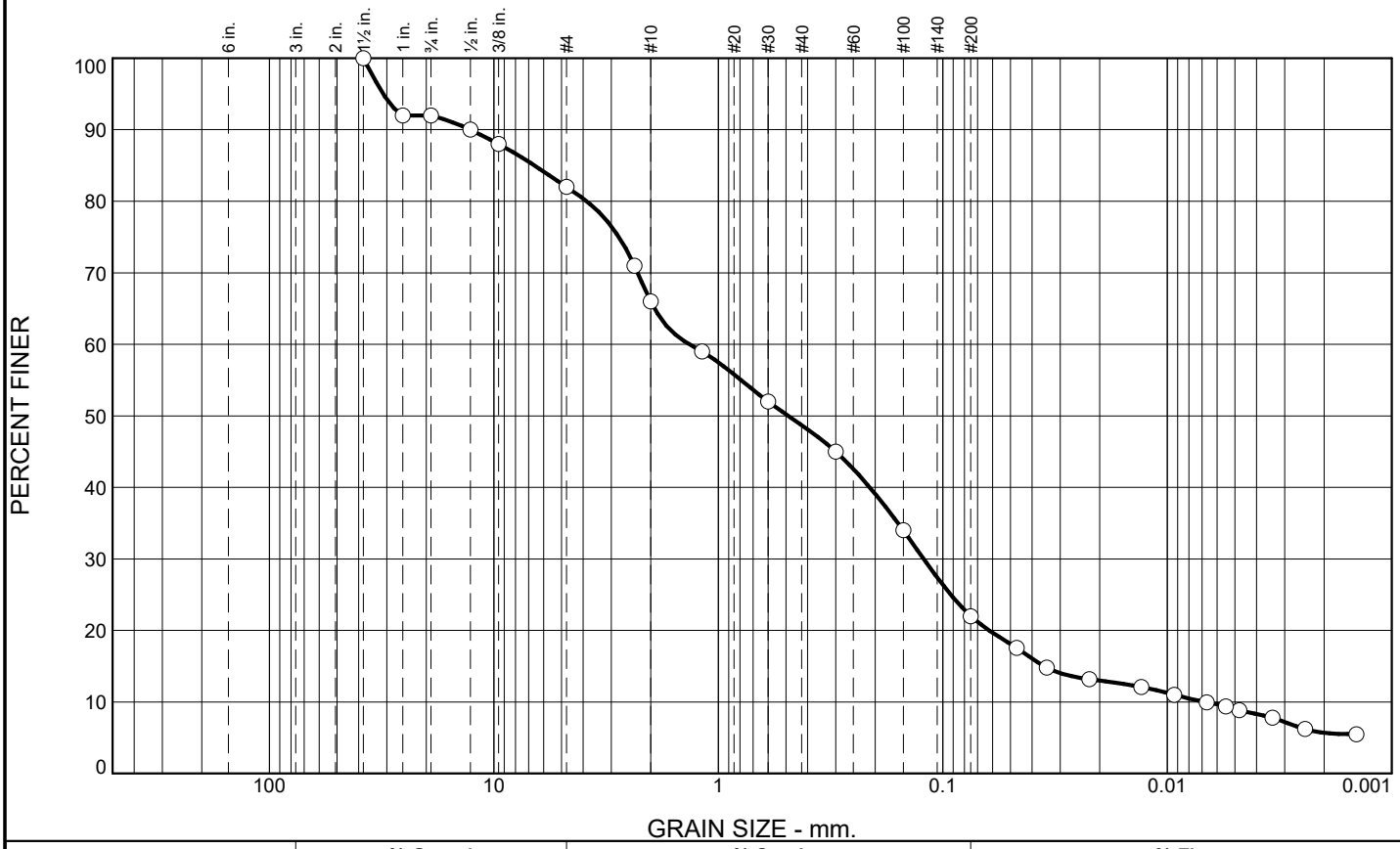
Material tested in accordance with ASTM D6913.

Location: 6-2
Sample Number: 21 **Depth:** 7.0' **Date:** 03/30/2021

Client: Kortum Ranch LLC
Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Project No: VV4721B **Figure** 0300-006

Tested By: John Hubbard

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	8	10	16	17	27	13	9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 1/2"	100		
1"	92		
3/4"	92		
1/2"	90		
3/8"	88		
#4	82		
#8	71		
#10	66		
#16	59		
#30	52		
#50	45		
#100	34		
#200	22		

* (no specification provided)

Material Description

Light Gray Silty Sand with Gravel (visual)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 12.7000 D_{85}= 6.6087 D_{60}= 1.3421
D_{50}= 0.4886 D_{30}= 0.1215 D_{15}= 0.0353
D_{10}= 0.0068 C_u= 196.70 C_c= 1.61

Classification

USCS= SM AASHTO=

Remarks

Material tested in accordance with ASTM D422.

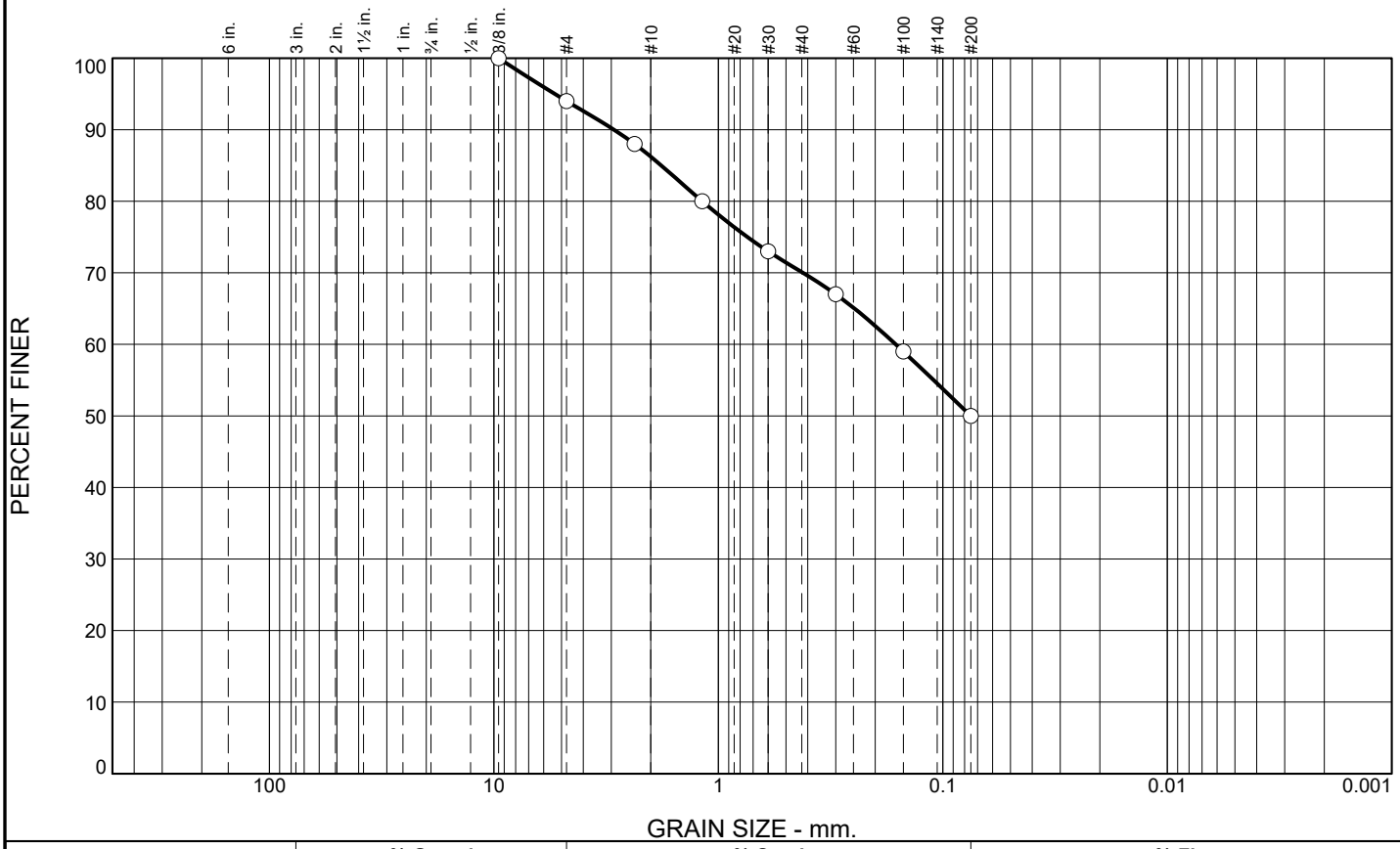
Location: 7-1a
Sample Number: 22 **Depth:** 2.5' **Date:** 03/30/2021

MATERIALS TESTING M T I INCORPORATED

Client: Kortum Ranch LLC
Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Project No: VV4721B **Figure** 0300-007

Tested By: John Hubbard

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	6	8	16	20	50	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100		
#4	94		
#8	88		
#16	80		
#30	73		
#50	67		
#100	59		
#200	50		

* (no specification provided)

Material Description

Grayish Brown Sandy Clay (visual)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 2.9176 D_{85}= 1.7968 D_{60}= 0.1624
D_{50}= 0.0750 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

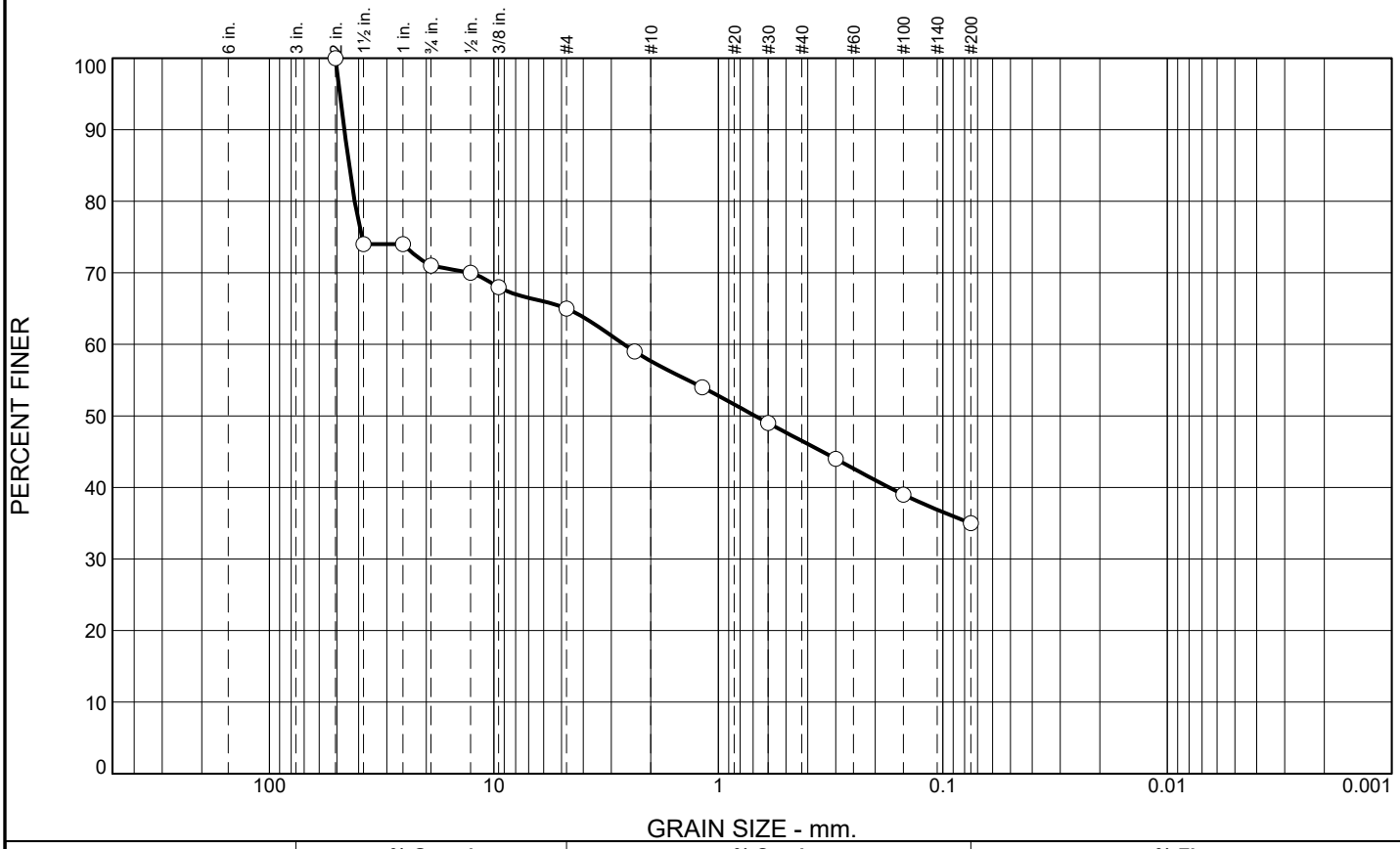
Material tested in accordance with ASTM D6913.

Location: 7-2
Sample Number: 24 **Depth:** 7.0' **Date:** 03/30/2021

Client: Kortum Ranch LLC
Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Project No: VV4721B **Figure** 0300-008

Tested By: Jack Bianchin

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	29	6	7	11	12	35	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100		
1 1/2"	74		
1"	74		
3/4"	71		
1/2"	70		
3/8"	68		
#4	65		
#8	59		
#16	54		
#30	49		
#50	44		
#100	39		
#200	35		

* (no specification provided)

Material Description

Brown Clayey Gravel with Sand (visual)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 46.3743 D_{85}= 44.1399 D_{60}= 2.6359
D_{50}= 0.6860 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= GC AASHTO=

Remarks

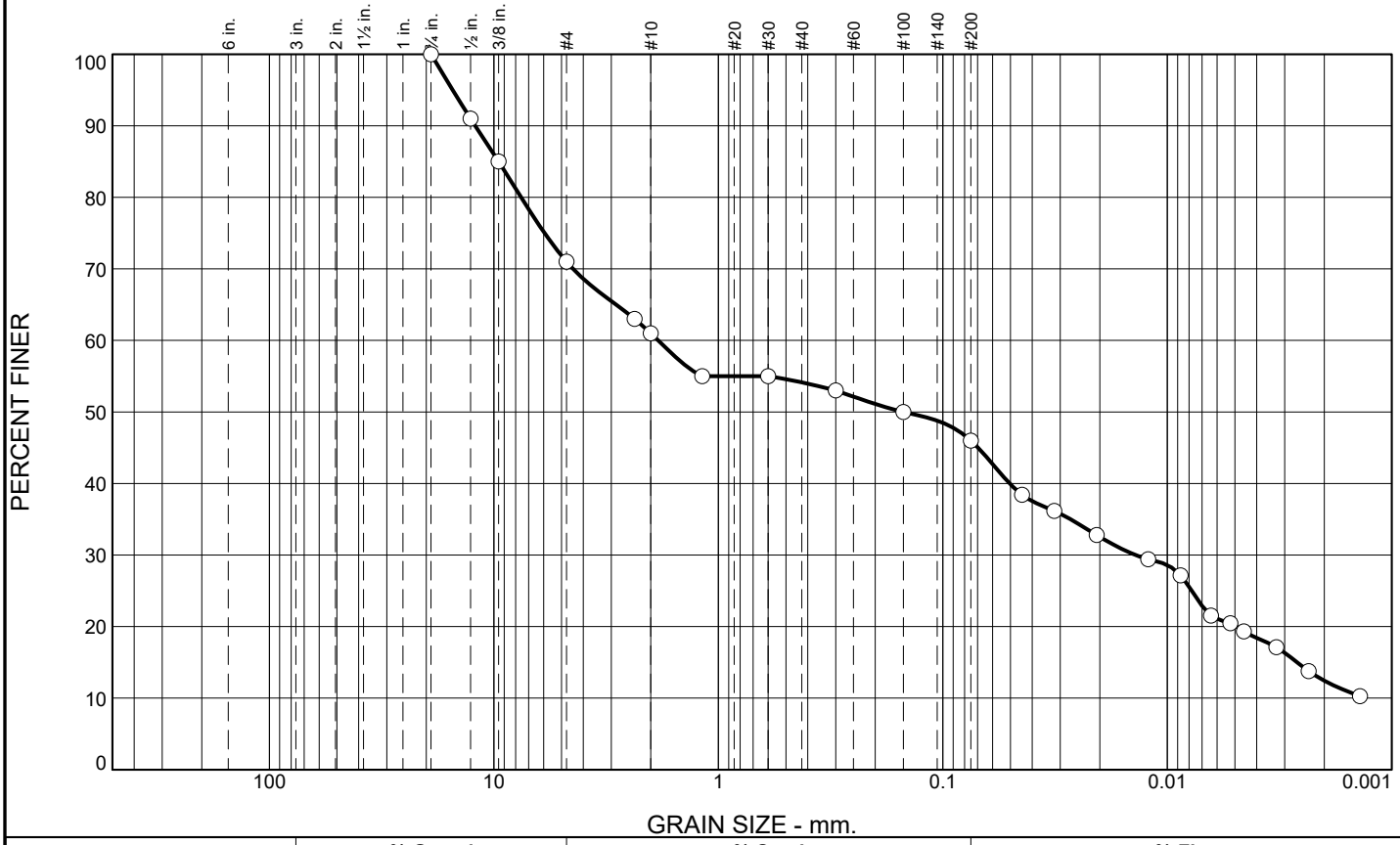
Material tested in accordance with ASTM D6913.

Location: 8-1a
Sample Number: 26 **Depth:** 3.0' **Date:** 03/30/2021

Client: Kortum Ranch LLC
Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Project No: VV4721B **Figure** 0300-009

Tested By: John Hubbard

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	29	10	7	8	26	20

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100		
1/2"	91		
3/8"	85		
#4	71		
#8	63		
#10	61		
#16	55		
#30	55		
#50	53		
#100	50		
#200	46		

* (no specification provided)

Material Description

Brown Clayey Gravel with Sand (visual)

Atterberg Limits

PL= 22 LL= 26 PI= 4

Coefficients

D_{90}= 12.1111 D_{85}= 9.5250 D_{60}= 1.8532
D_{50}= 0.1500 D_{30}= 0.0139 D_{15}= 0.0026
D_{10}= C_u= C_c=

Classification

USCS= GC-GM AASHTO= A-4(0)

Remarks

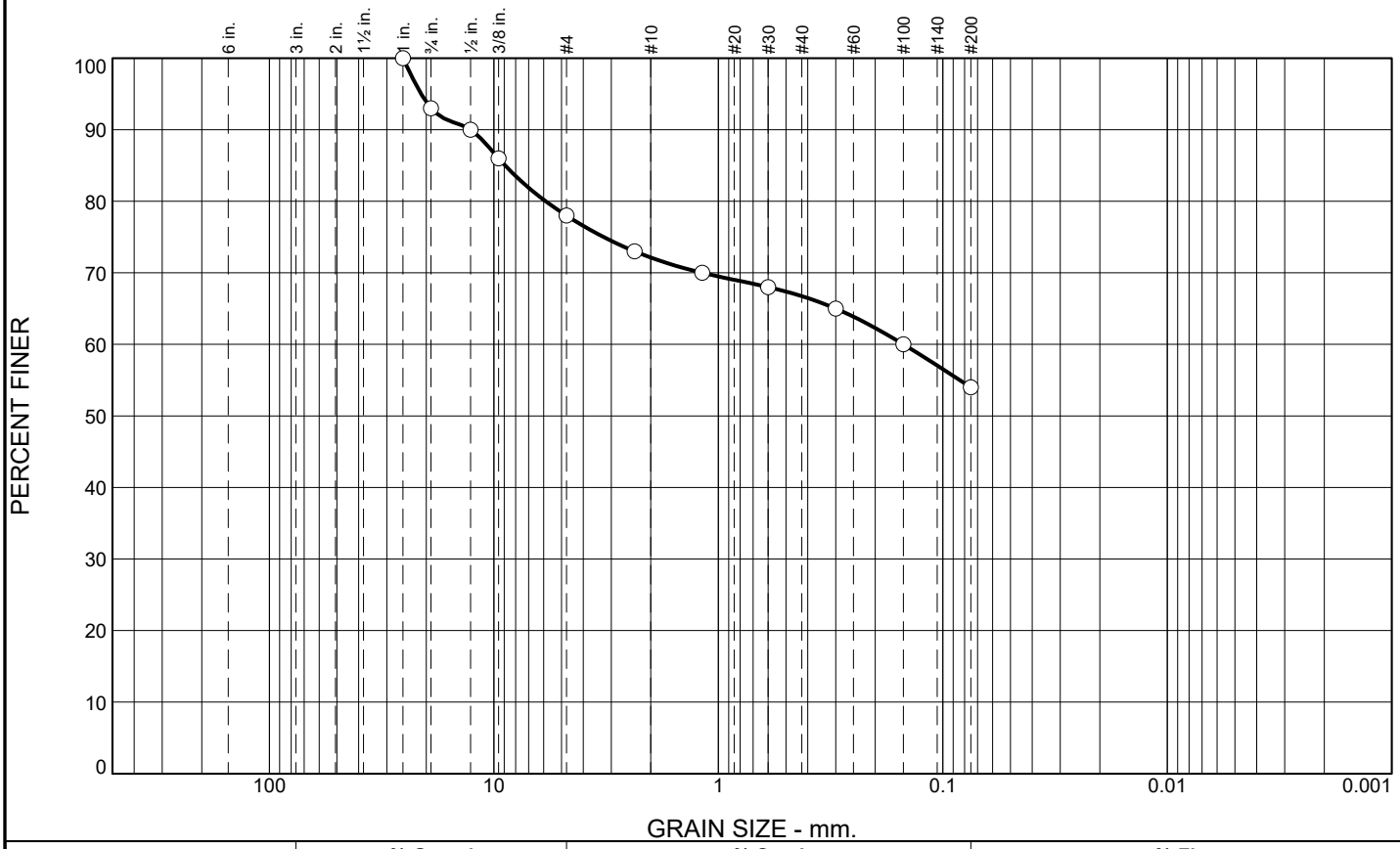
Material tested in accordance with ASTM D422.

Location: 13-1a
Sample Number: 41 **Depth:** 2.5' **Date:** 03/30/2021

Client: Kortum Ranch LLC
Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Project No: VV4721B **Figure** 0300-010

Tested By: John Hubbard

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	7	15	6	5	13	54	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100		
3/4"	93		
1/2"	90		
3/8"	86		
#4	78		
#8	73		
#16	70		
#30	68		
#50	65		
#100	60		
#200	54		

* (no specification provided)

Material Description

Brown Sandy Clay with Gravel (visual)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 12.7000 D_{85}= 8.9046 D_{60}= 0.1500
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

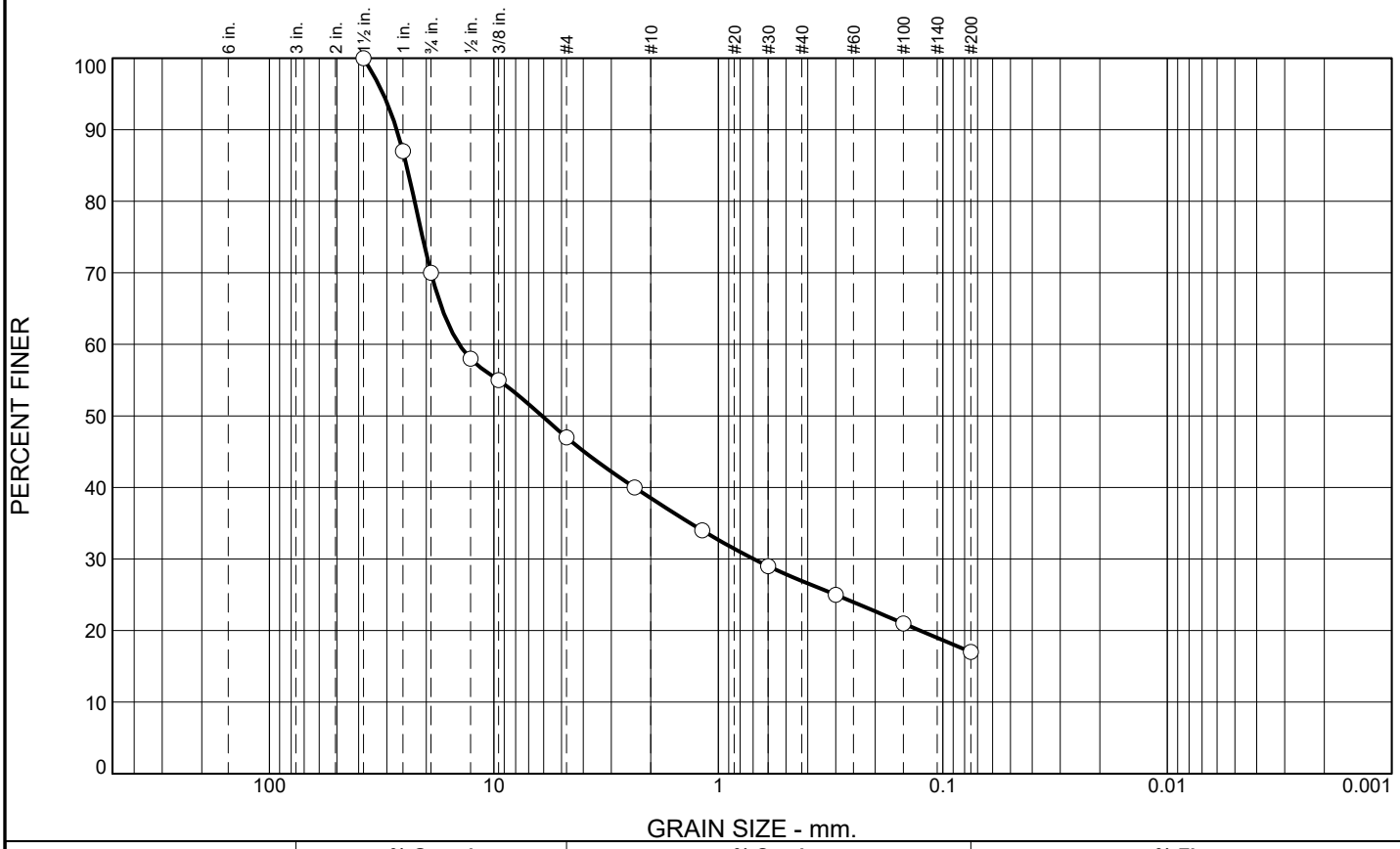
Material tested in accordance with ASTM D6913.

Location: 18-1b
Sample Number: 61 **Depth:** 2.0' **Date:** 03/30/2021

Client: Kortum Ranch LLC
Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Project No: VV4721B **Figure** 0300-011

Tested By: John Hubbard

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	30	23	8	12	10	17	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 1/2"	100		
1"	87		
3/4"	70		
1/2"	58		
3/8"	55		
#4	47		
#8	40		
#16	34		
#30	29		
#50	25		
#100	21		
#200	17		

* (no specification provided)

Material Description

Brown Clayey Gravel with Sand (visual)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 27.0539 D_{85}= 24.4837 D_{60}= 14.2798
D_{50}= 6.1046 D_{30}= 0.6968 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= GC AASHTO=

Remarks

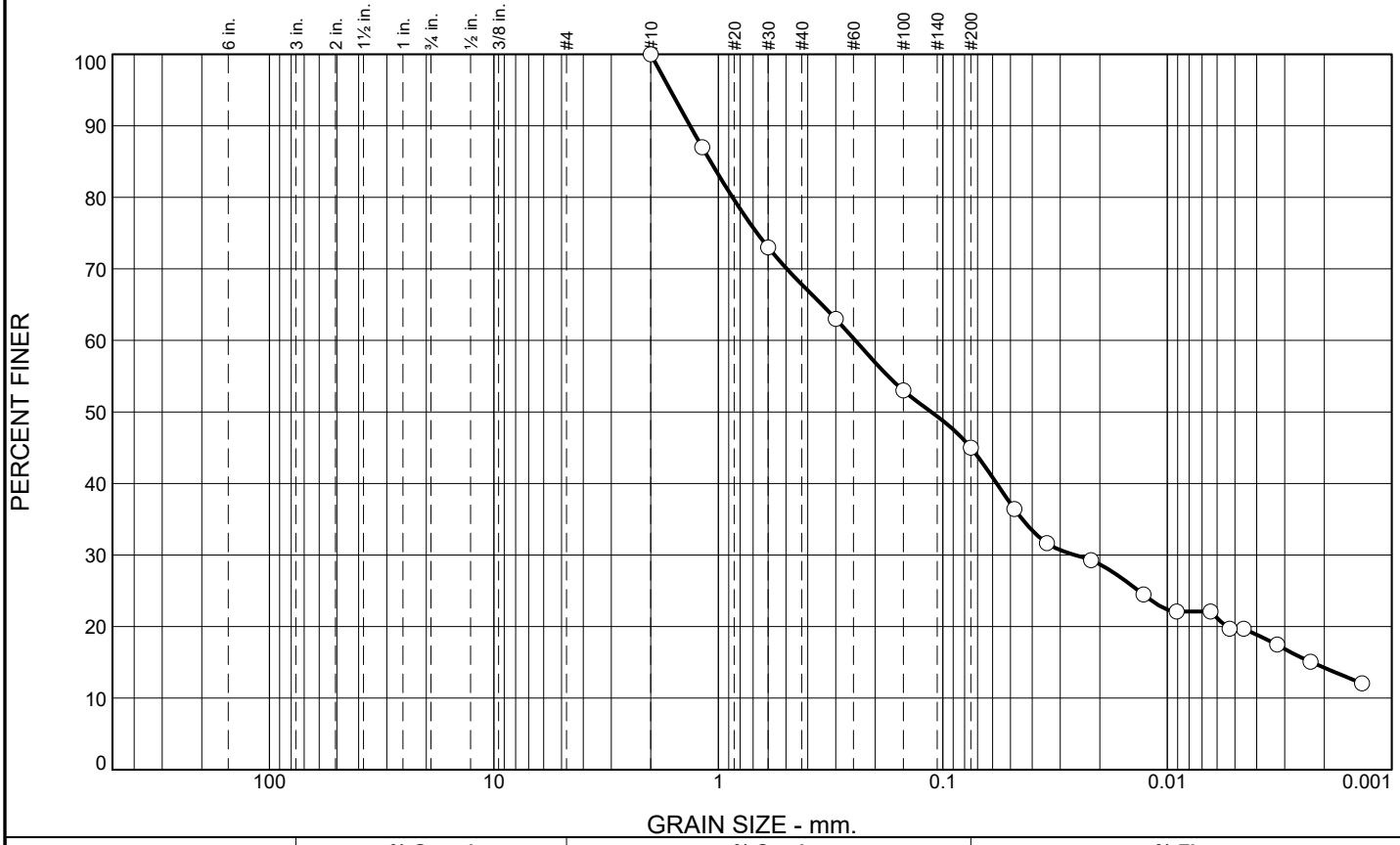
Material tested in accordance with ASTM D6913.

Location: 21-1
Sample Number: 67 **Depth:** 3.0' **Date:** 03/30/2021

Client: Kortum Ranch LLC
Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Project No: VV4721B **Figure** 0300-012

Tested By: John Hubbard

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	32	23	25	20

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100		
#16	87		
#30	73		
#50	63		
#100	53		
#200	45		

* (no specification provided)

Material Description

Brown Clayey Sand (visual)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.3375 D_{85}= 1.0831 D_{60}= 0.2456
D_{50}= 0.1125 D_{30}= 0.0258 D_{15}= 0.0023
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

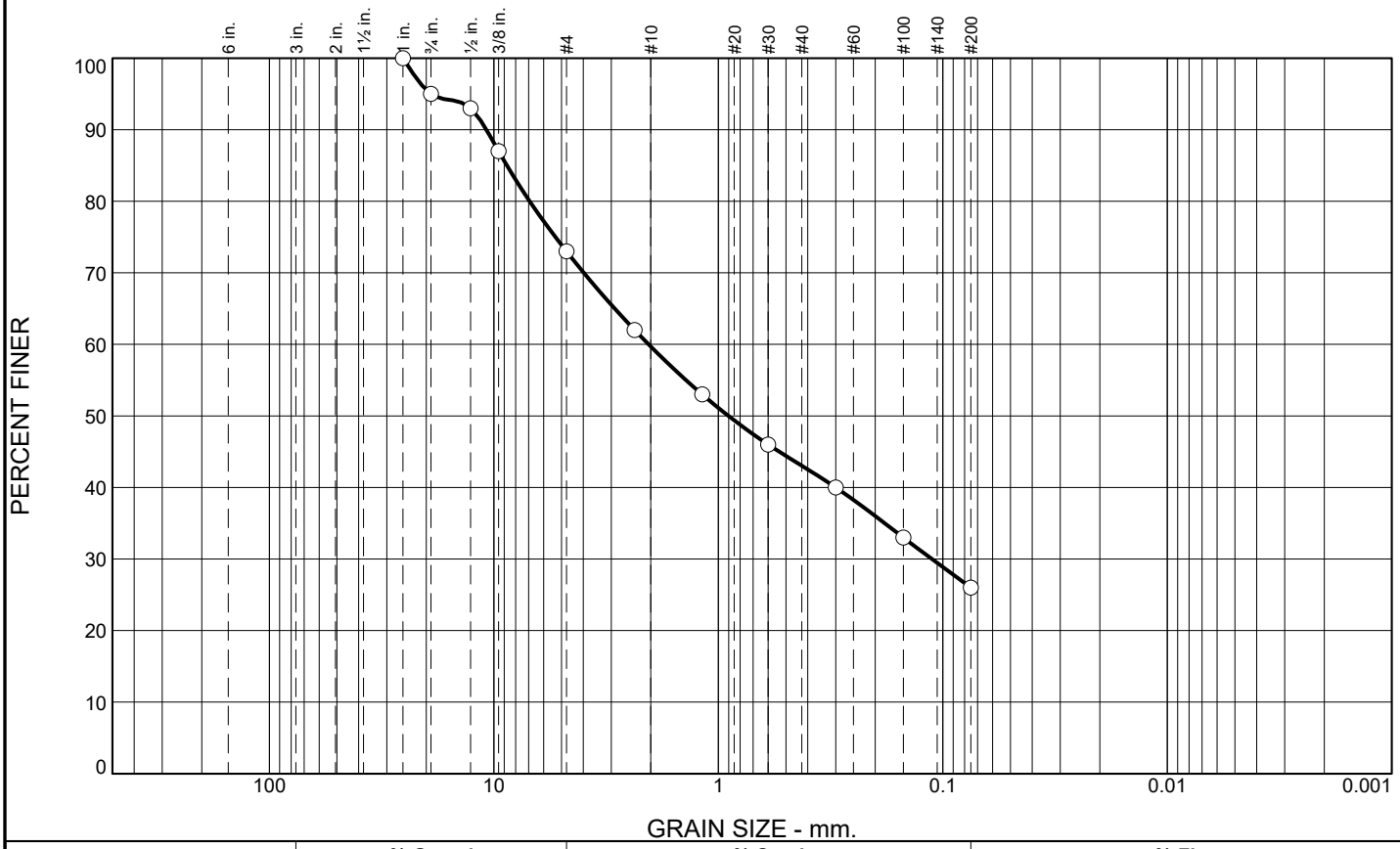
Material tested in accordance with ASTM D422.

Location: 24-1b
Sample Number: 75 **Depth:** 2.5' **Date:** 03/30/2021

Client: Kortum Ranch LLC
Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Project No: VV4721B **Figure** 0300-013

Tested By: John Hubbard

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	5	22	13	17	17	26	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100		
3/4"	95		
1/2"	93		
3/8"	87		
#4	73		
#8	62		
#16	53		
#30	46		
#50	40		
#100	33		
#200	26		

* (no specification provided)

Material Description

Olive Gray Claystone/Sandstone (visual)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 10.7951 D_{85}= 8.7466 D_{60}= 2.0463
D_{50}= 0.9014 D_{30}= 0.1118 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

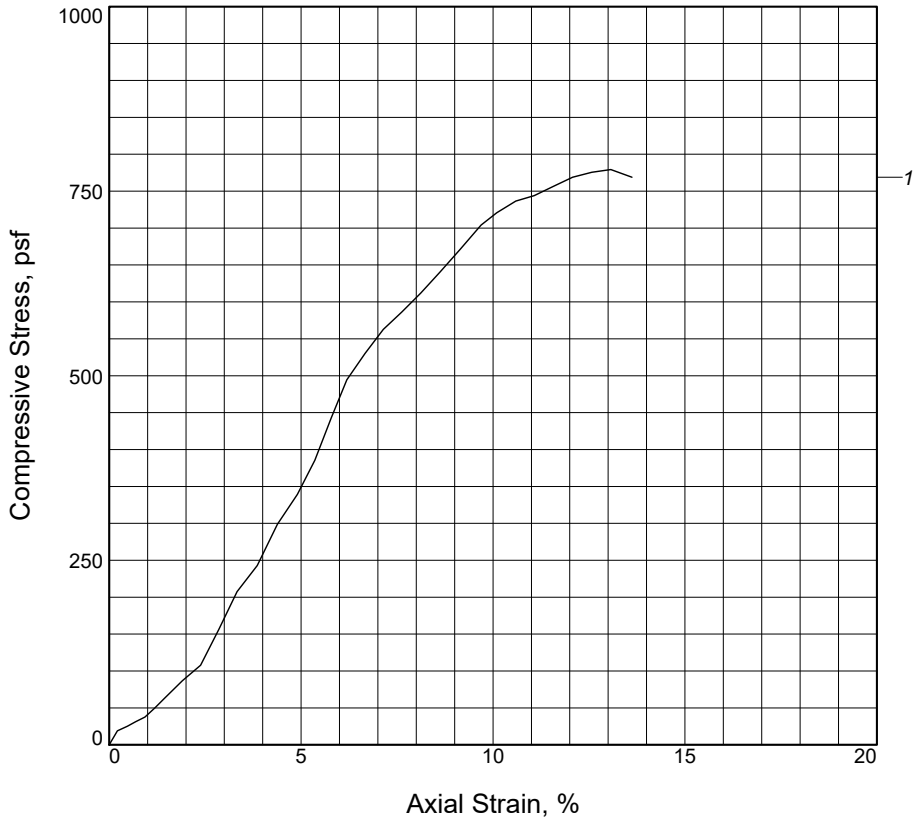
Material tested in accordance with ASTM D6913.

Location: 26-1
Sample Number: 81 **Depth:** 3.0' **Date:** 03/30/2021

Client: Kortum Ranch LLC
Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Project No: VV4721B **Figure** 0300-014

Tested By: John Hubbard

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	779			
Undrained shear strength, psf	390			
Failure strain, %	13.1			
Strain rate, in./min.	0.210			
Water content, %	22.8			
Wet density, pcf	96.7			
Dry density, pcf	78.7			
Saturation, %	59.3			
Void ratio	0.9432			
Specimen diameter, in.	2.41			
Specimen height, in.	4.20			
Height/diameter ratio	1.74			

Description: Yellowish Brown Sandy Clay with weathered Bedrock (visual)

LL = 40	**PL =** 23	**PI =** 17	**GS=** 2.45	**Type:** Tube

Project No.: VV4721B
Date Sampled: 03/11/2021

Remarks:
Material tested in accordance with ASTM D2166.
Type of Failure - Bulge and Conical

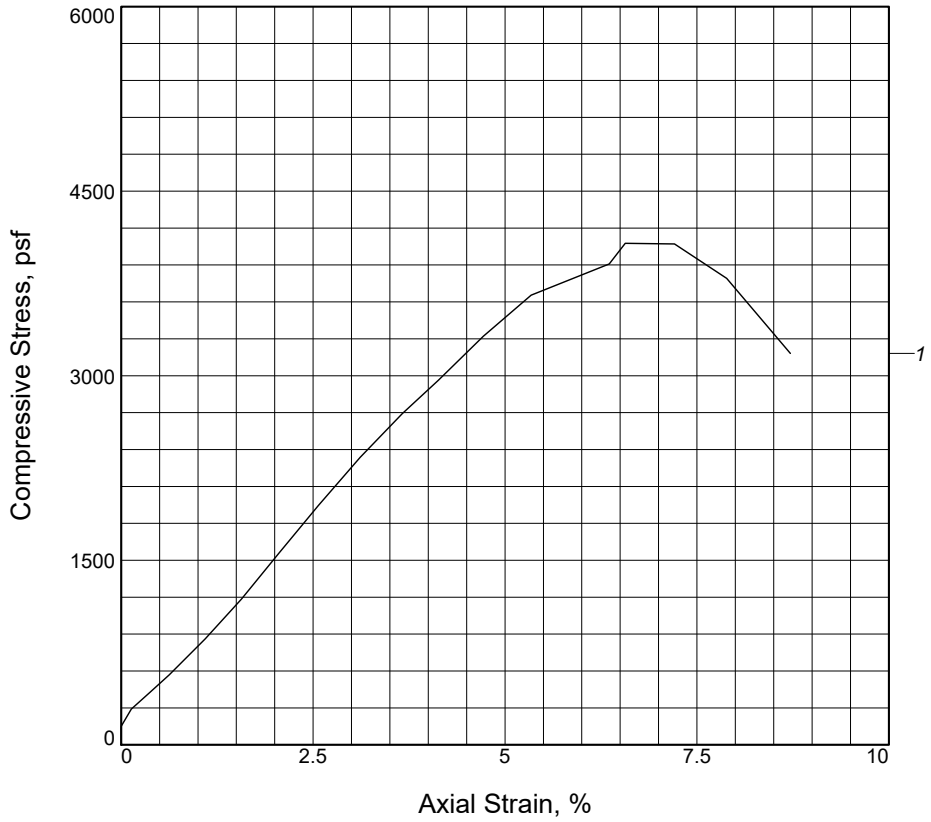
Figure 0300-015

Client: Kortum Ranch LLC

Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Location: 1-1b
Sample Number: 2 **Depth:** 3.0'

Tested By: Allante Blocker

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	4076			
Undrained shear strength, psf	2038			
Failure strain, %	6.6			
Strain rate, in./min.	0.030			
Water content, %	26.0			
Wet density, pcf	117.5			
Dry density, pcf	93.3			
Saturation, %	98.9			
Void ratio	0.6465			
Specimen diameter, in.	2.41			
Specimen height, in.	5.30			
Height/diameter ratio	2.20			

Description: Reddish Brown Sandy Clay with Gravel (visual)

LL =	**PL =**	**PI =**	**GS=** 2.46	**Type:** Tube

Project No.: VV4721B
Date Sampled: 03/22/2021

Remarks:
Material tested in accordance with ASTM D2166.
Type of Failure - Bulge

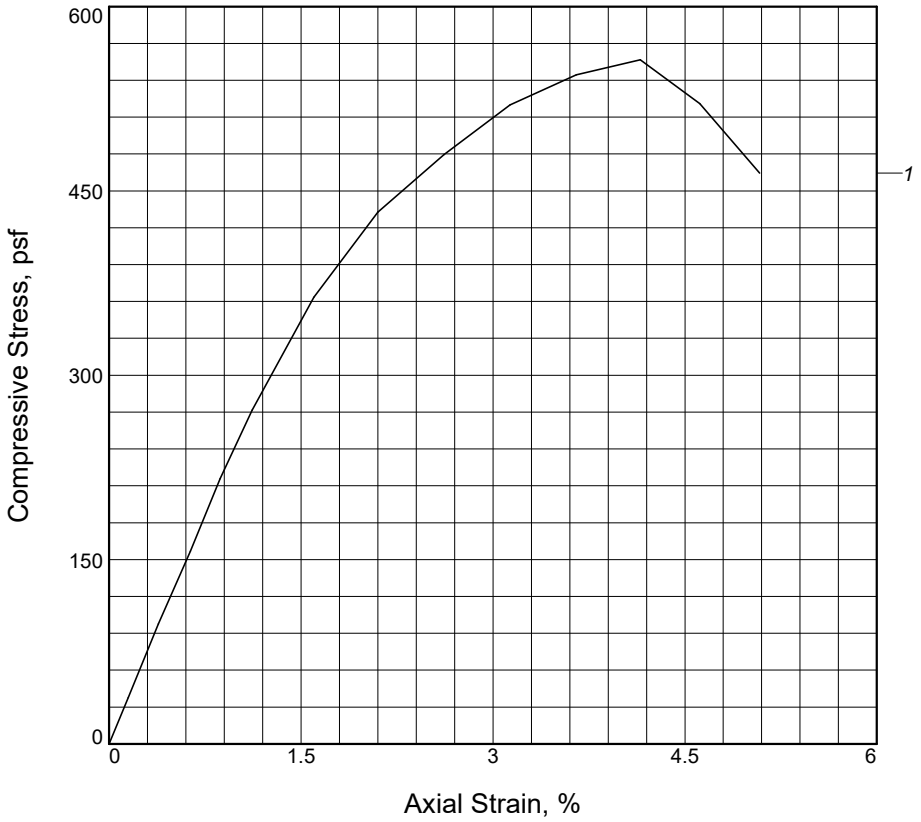
Figure 0300-016

Client: Kortum Ranch LLC

Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Location: 5-1b
Sample Number: 14 **Depth:** 3.0'

Tested By: Allante Blocker

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	557			
Undrained shear strength, psf	278			
Failure strain, %	4.2			
Strain rate, in./min.	0.030			
Water content, %	19.3			
Wet density, pcf	113.6			
Dry density, pcf	95.2			
Saturation, %	78.7			
Void ratio	0.5996			
Specimen diameter, in.	2.41			
Specimen height, in.	6.00			
Height/diameter ratio	2.49			

Description: Grayish Brown Sandy Clay with Gravel

LL =	**PL =**	**PI =**	**GS=** 2.44	**Type:** Tube

Project No.: VV4721B
Date Sampled: 03/30/2021

Remarks:
Material tested in accordance with ASTM D2166.
Tyoe of Failure - Shear and Conical

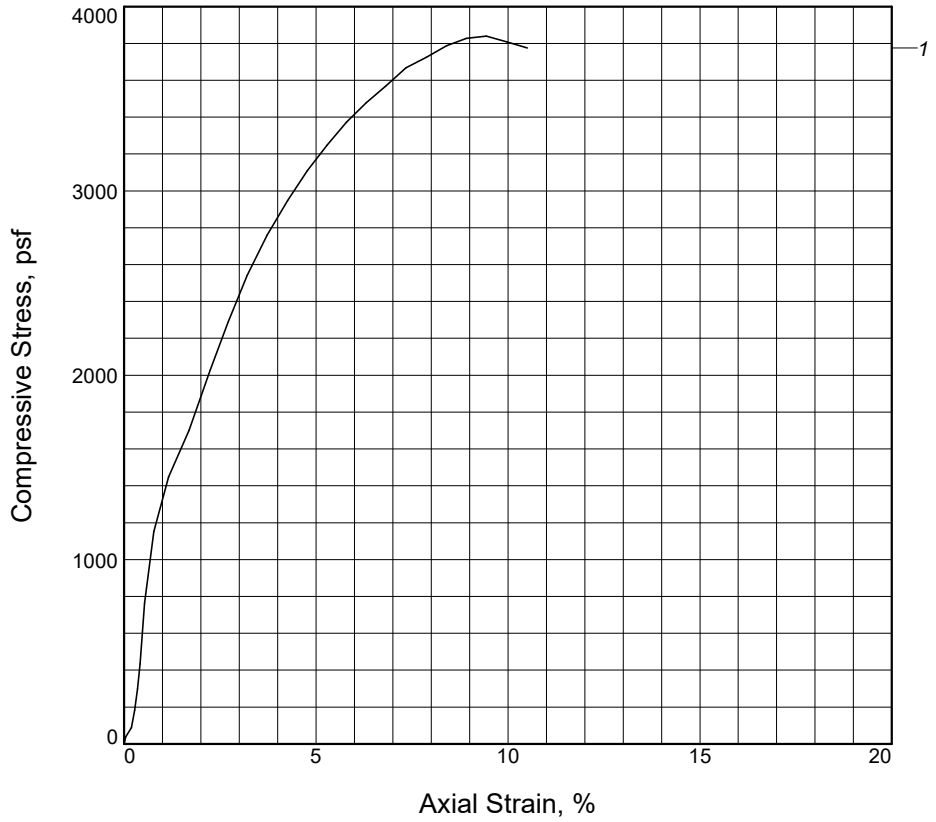
Figure 0300-017

Client: Kortum Ranch LLC

Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Location: 7-1b
Sample Number: 23 **Depth:** 3.0'

Tested By: Allante Blocker

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	3840			
Undrained shear strength, psf	1920			
Failure strain, %	9.4			
Strain rate, in./min.	0.030			
Water content, %	28.2			
Wet density, pcf	116.3			
Dry density, pcf	90.7			
Saturation, %	96.3			
Void ratio	0.7422			
Specimen diameter, in.	2.41			
Specimen height, in.	5.80			
Height/diameter ratio	2.41			

Description: Yellowish Brown Sandy Clay (visual)

LL = 63	**PL =** 42	**PI =** 21	**GS=** 2.53	**Type:** Tube

Project No.: VV4721B
Date Sampled: 03/30/2021

Remarks:
Material tested in accordance with ASTM D2166.
Type of Failure - Bulge and Shear

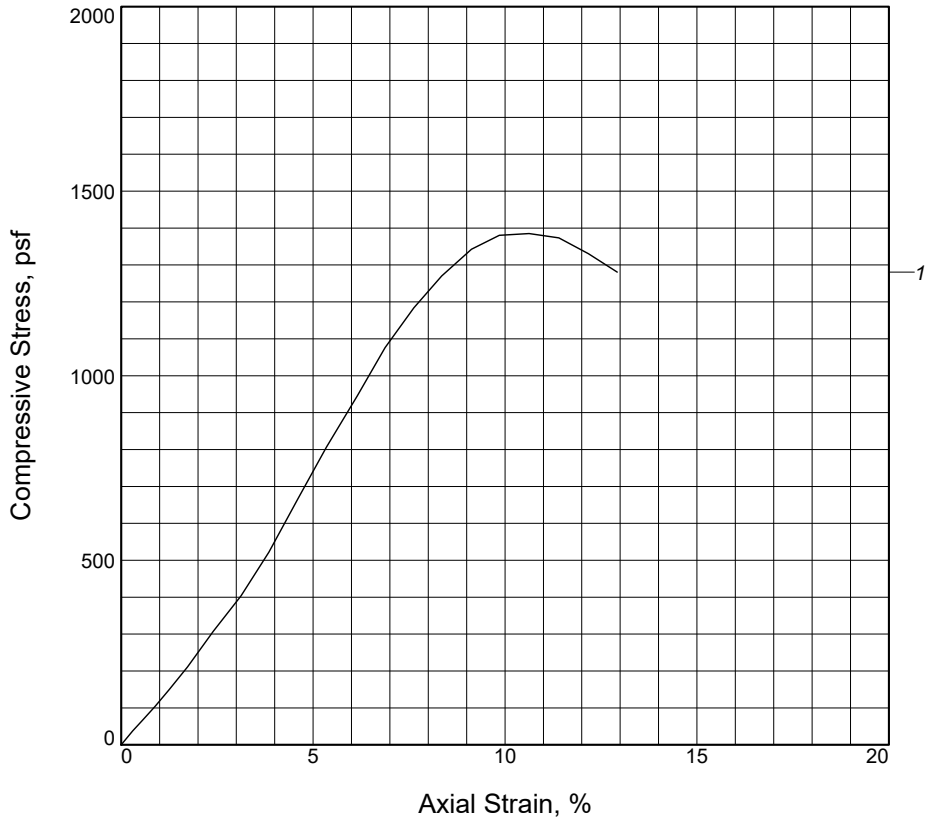
Figure 0300-018

Client: Kortum Ranch LLC

Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Location: 10-1
Sample Number: 32 **Depth:** 3.0'

Tested By: Allante Blocker

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	1385			
Undrained shear strength, psf	693			
Failure strain, %	10.6			
Strain rate, in./min.	0.030			
Water content, %	22.5			
Wet density, pcf	130.7			
Dry density, pcf	106.7			
Saturation, %	115.5			
Void ratio	0.4974			
Specimen diameter, in.	2.41			
Specimen height, in.	4.00			
Height/diameter ratio	1.66			

Description: Yellowish Brown Gravelly Clay with Sand (visual)

LL =	**PL =**	**PI =**	**GS=** 2.56	**Type:** Tube

Project No.: VV4721B
Date Sampled: 03/30/2021

Remarks:
Material tested in accordance with ASTM D2166.
Type of Failure - Shear and Conical

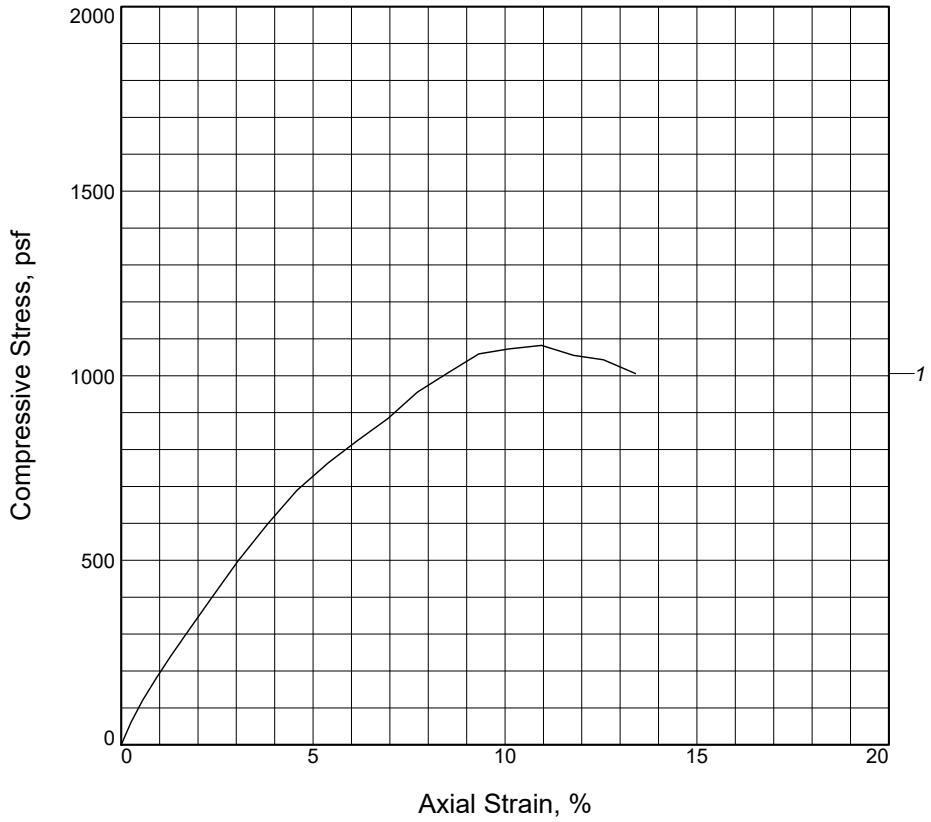
Figure 0300-019

Client: Kortum Ranch LLC

Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Location: 11-1
Sample Number: 35 **Depth:** 2.5'

Tested By: Allante Blocker

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	1082			
Undrained shear strength, psf	541			
Failure strain, %	11.0			
Strain rate, in./min.	0.050			
Water content, %	21.3			
Wet density, pcf	115.5			
Dry density, pcf	95.3			
Saturation, %	75.8			
Void ratio	0.7496			
Specimen diameter, in.	2.41			
Specimen height, in.	6.00			
Height/diameter ratio	2.49			

Description: Yellowish Brown Gravelly Clay with Sand (visual)

LL =	**PL =**	**PI =**	**GS=** 2.67	**Type:** Tube

Project No.: VV4721B
Date Sampled: 03/30/2021

Remarks:
Material tested in accordance with ASTM D2166.
Type of Failure - Bulge

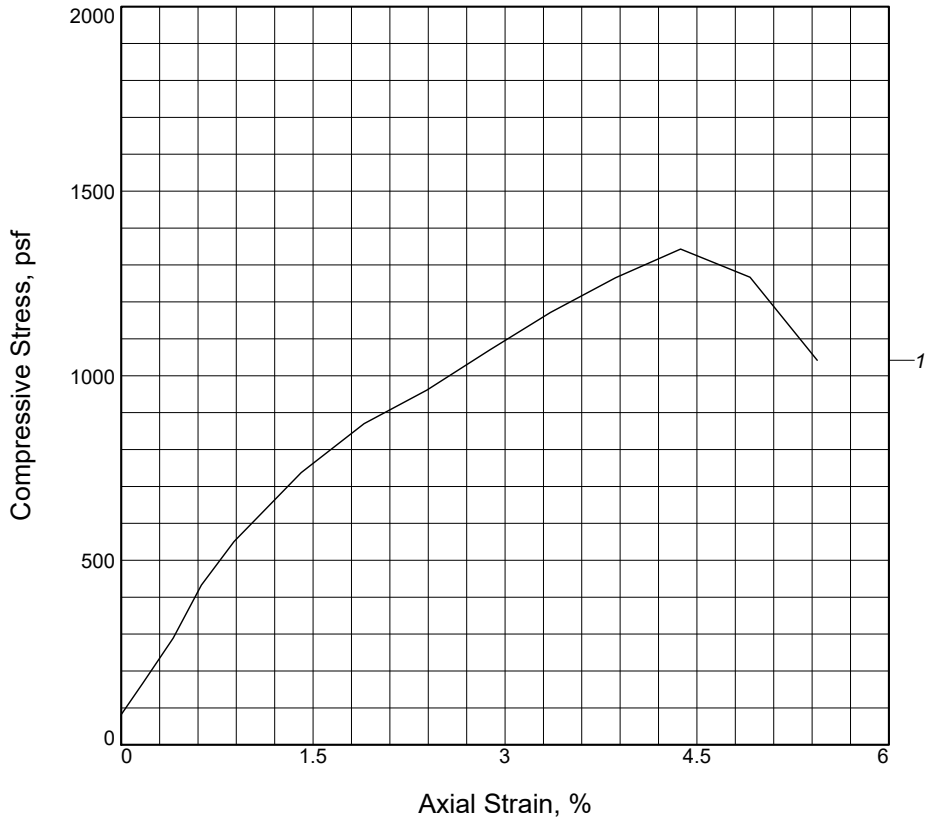
Figure 0300-020

Client: Kortum Ranch LLC

Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Location: 13-1b
Sample Number: 42 **Depth:** 3.0'

Tested By: Allante Blocker

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	1343			
Undrained shear strength, psf	672			
Failure strain, %	4.4			
Strain rate, in./min.	0.030			
Water content, %	19.7			
Wet density, pcf	110.3			
Dry density, pcf	92.2			
Saturation, %	73.1			
Void ratio	0.6593			
Specimen diameter, in.	2.41			
Specimen height, in.	5.90			
Height/diameter ratio	2.45			

Description: Brown Sandy Clay with Gravel (visual)

LL =	**PL =**	**PI =**	**GS=** 2.45	**Type:** Tube

Project No.: VV4721B
Date Sampled: 03/30/2021

Remarks:
Material tested in accordance with ASTM D2166.
Type of Failure - Bulge and Columnar

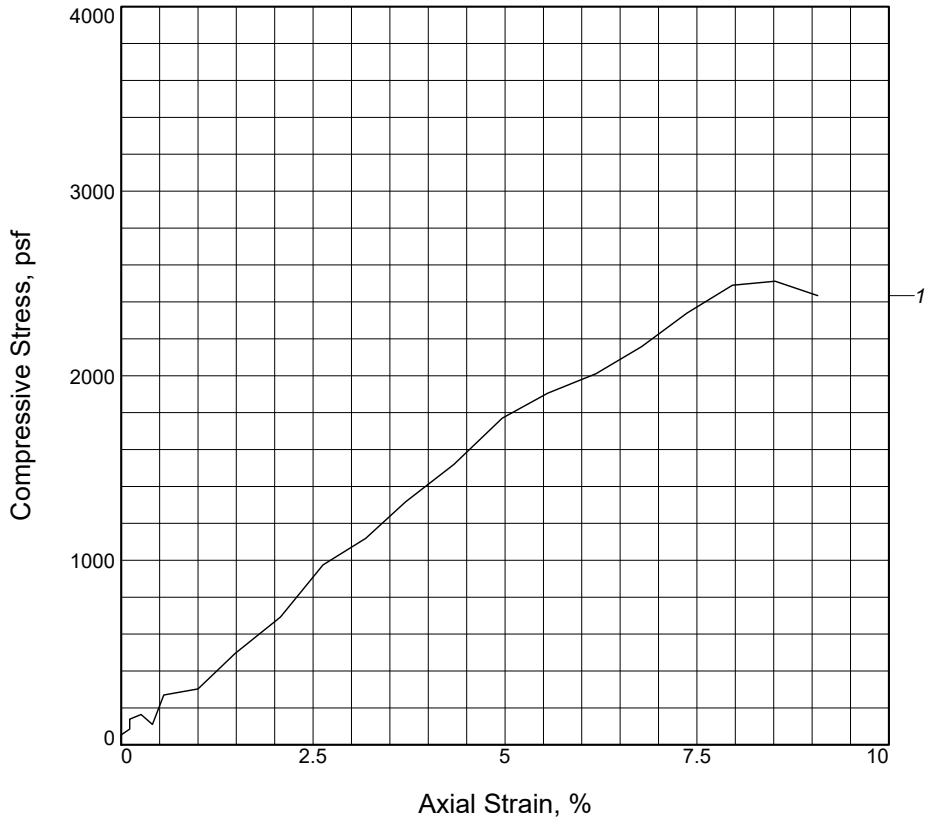
Figure 0300-021

Client: Kortum Ranch LLC

Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Location: 18-1b
Sample Number: 61 **Depth:** 2.0'

Tested By: Allante Blocker

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	2512			
Undrained shear strength, psf	1256			
Failure strain, %	8.5			
Strain rate, in./min.	0.015			
Water content, %	11.5			
Wet density, pcf	121.2			
Dry density, pcf	108.7			
Saturation, %	57.0			
Void ratio	0.5446			
Specimen diameter, in.	2.41			
Specimen height, in.	2.70			
Height/diameter ratio	1.12			

Description: Yellowish Brown Gravelly Clay with Sand (visual)

LL =	**PL =**	**PI =**	**GS=** 2.689	**Type:** Tube

Project No.: VV4721B
Date Sampled: 03/30/2021

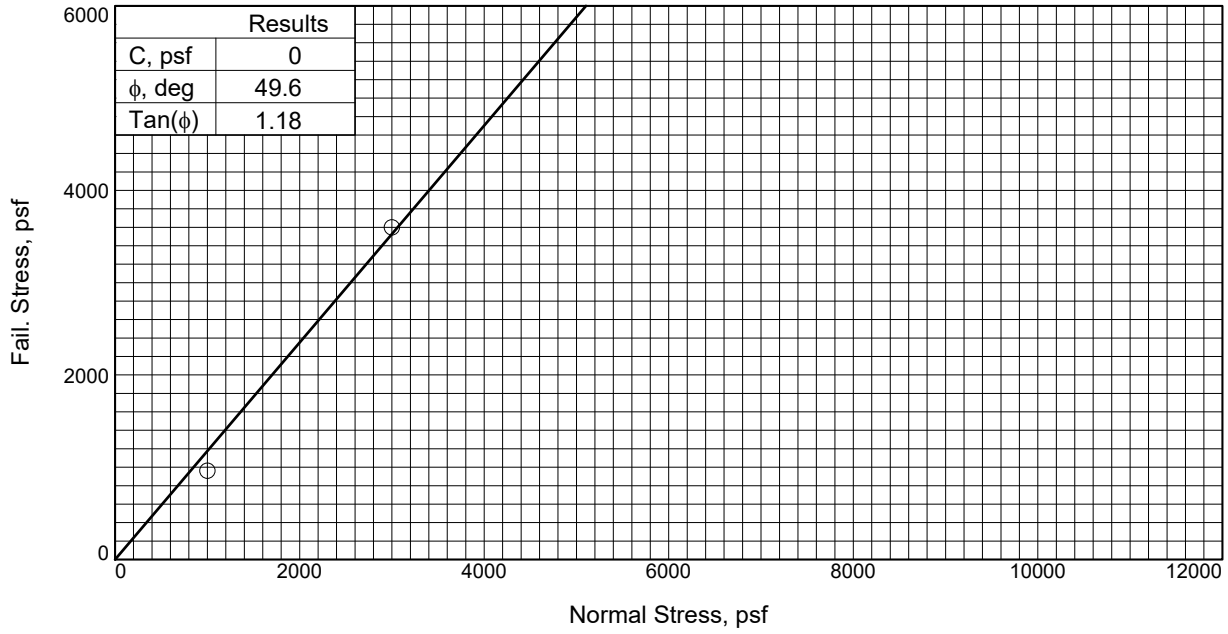
Remarks:
Material tested in accordance with ASTM D2166.
Type of Failure - Bulge

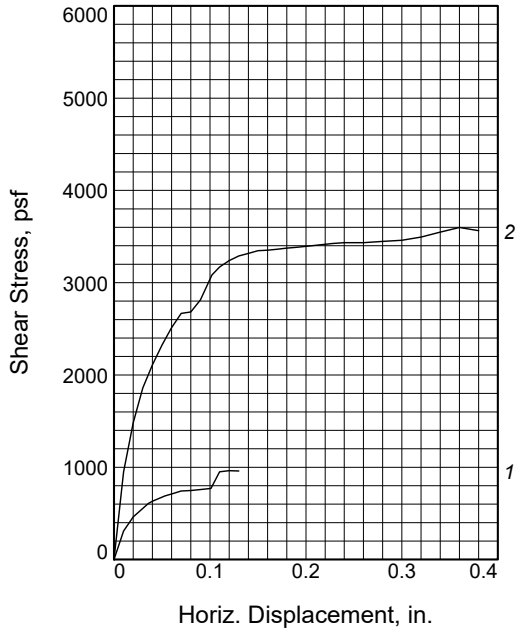
Figure 0300-022

Client: Kortum Ranch LLC

Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Location: 28-1b
Sample Number: 85 **Depth:** 2.5'

Tested By: Allante Blocker





Sample No.		1	2
Initial	Water Content, %	24.2	24.2
	Dry Density, pcf	85.1	97.6
	Saturation, %	83.1	122.7
	Void Ratio	0.6577	0.4453
	Diameter, in.	2.41	2.41
	Height, in.	1.00	1.00
At Test	Water Content, %	27.9	25.4
	Dry Density, pcf	84.7	89.5
	Saturation, %	94.8	99.3
	Void Ratio	0.6660	0.5771
	Diameter, in.	2.41	2.41
	Height, in.	1.00	1.09
Normal Stress, psf		1000	3000
Fail. Stress, psf		963	3599
Displacement, in.		0.12	0.36
Ult. Stress, psf			
Displacement, in.			
Strain rate, in./min.		0.002	0.015

Sample Type: Tube
Description: Olive Brown Sandy Clay (visual)

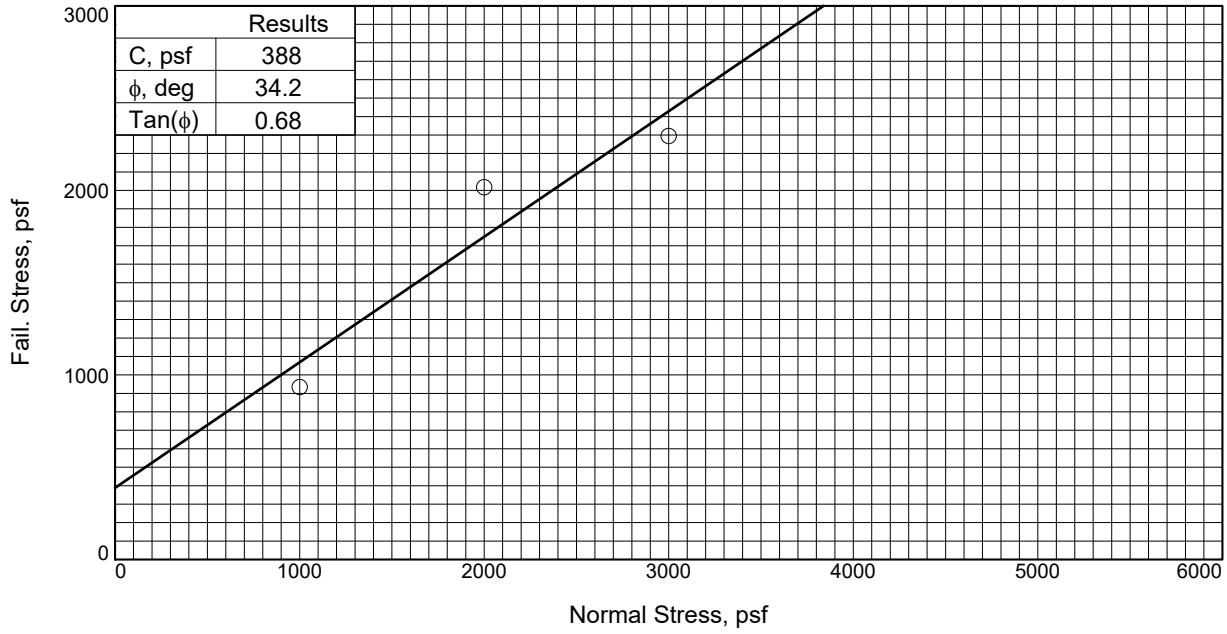
Specific Gravity= 2.26
Remarks: Material tested in accordance with ASTM D3080.

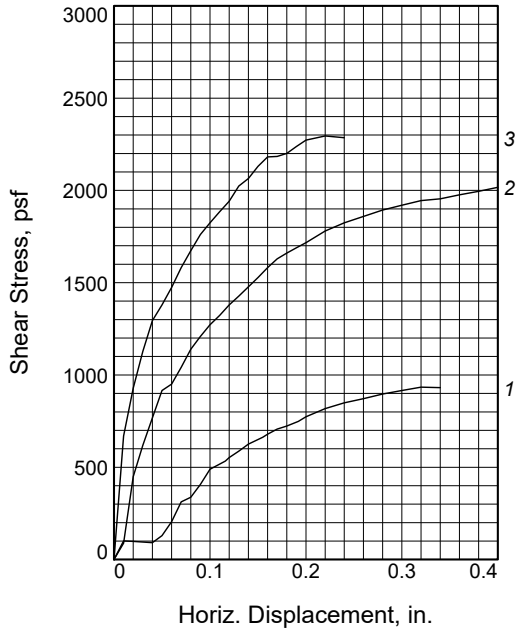
Figure 0300-023

Client: Kortum Ranch LLC

Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Location: 2-1
Sample Number: 5 **Depth:** 3.0'
Proj. No.: VV4721B **Date Sampled:** 03/30/2021

Tested By: Jack Bianchin





Sample No.		1	2	3
Initial	Water Content, %	8.9	8.9	8.9
	Dry Density, pcf	84.9	68.9	91.5
	Saturation, %	25.3	17.0	29.9
	Void Ratio	0.9122	1.3565	0.7741
	Diameter, in.	2.41	2.41	2.41
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	28.7	28.0	25.7
	Dry Density, pcf	79.7	62.9	80.8
	Saturation, %	72.0	46.1	66.3
	Void Ratio	1.0355	1.5787	1.0089
	Diameter, in.	2.41	2.41	2.41
	Height, in.	1.06	1.09	1.13
Normal Stress, psf		1000	2000	3000
Fail. Stress, psf		934	2017	2295
Displacement, in.		0.32	0.40	0.22
Ult. Stress, psf				
Displacement, in.				
Strain rate, in./min.		0.002	0.002	0.002

Sample Type: Tube
Description: Light Brown Sandy Clay with Gravel (visual)

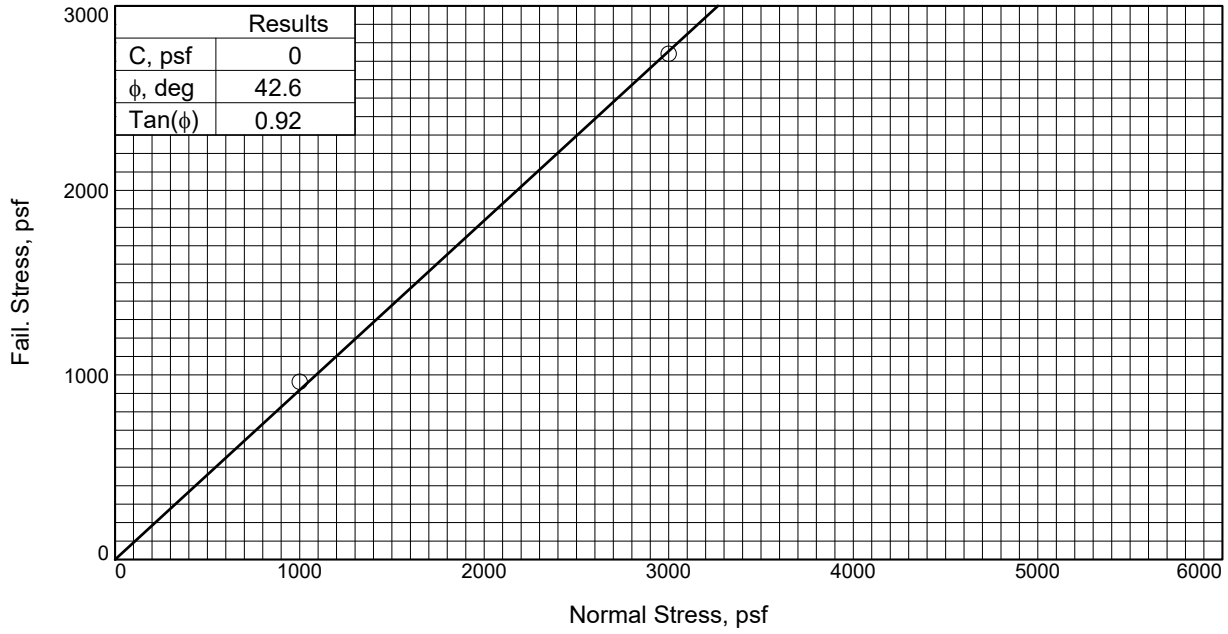
Specific Gravity= 2.60
Remarks: Material tested in accordance with ASTM D3080.

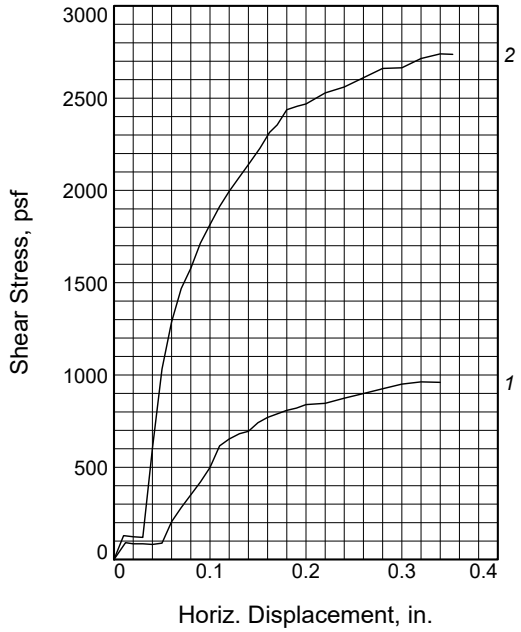
Figure 0300-024

Client: Kortum Ranch LLC

Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Location: 3-1b
Sample Number: 8 **Depth:** 3.0'
Proj. No.: VV4721B **Date Sampled:** 03/30/2021

Tested By: Cindy Gooden





Sample No.		1	2
Initial	Water Content, %	24.0	24.0
	Dry Density, pcf	88.6	81.3
	Saturation, %	70.1	59.1
	Void Ratio	0.9444	1.1198
	Diameter, in.	2.41	2.41
	Height, in.	1.00	1.00
At Test	Water Content, %	13.3	20.8
	Dry Density, pcf	86.0	72.1
	Saturation, %	36.5	41.2
	Void Ratio	1.0024	1.3914
	Diameter, in.	2.41	2.41
	Height, in.	1.03	1.13
Normal Stress, psf		1000	3000
Fail. Stress, psf		963	2740
Displacement, in.		0.32	0.34
Ult. Stress, psf			
Displacement, in.			
Strain rate, in./min.		0.002	0.002

Sample Type: Tube
Description: Brown Clayey Gravel with Sand (visual)

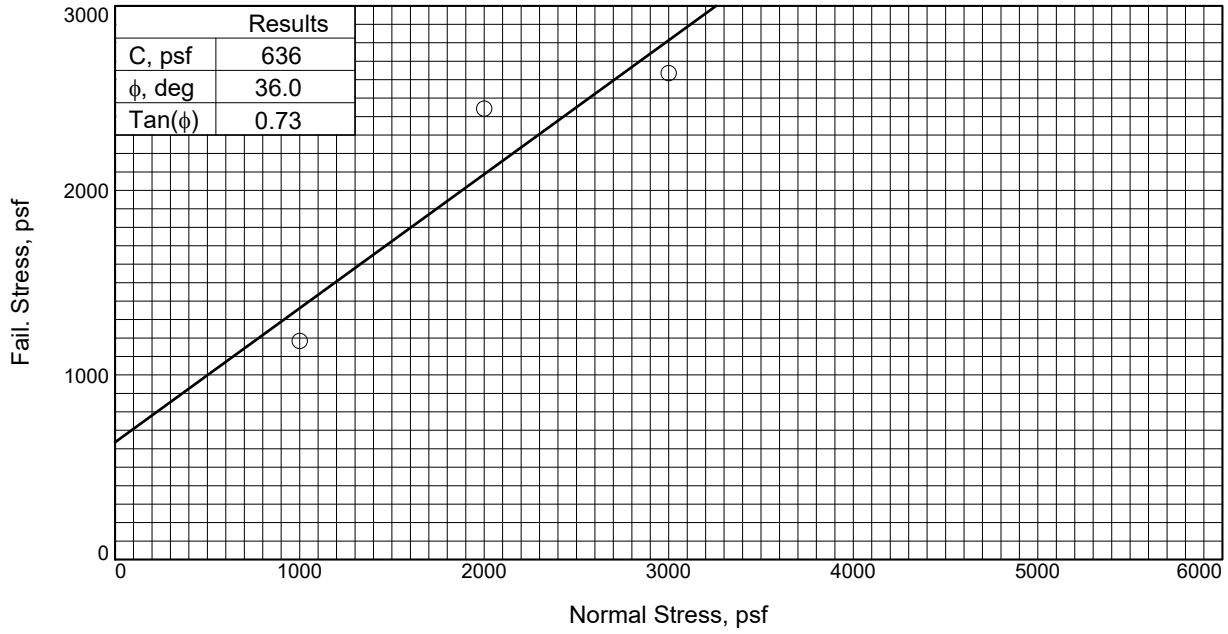
Specific Gravity= 2.76
Remarks: Material tested in accordance with ASTM D3080.

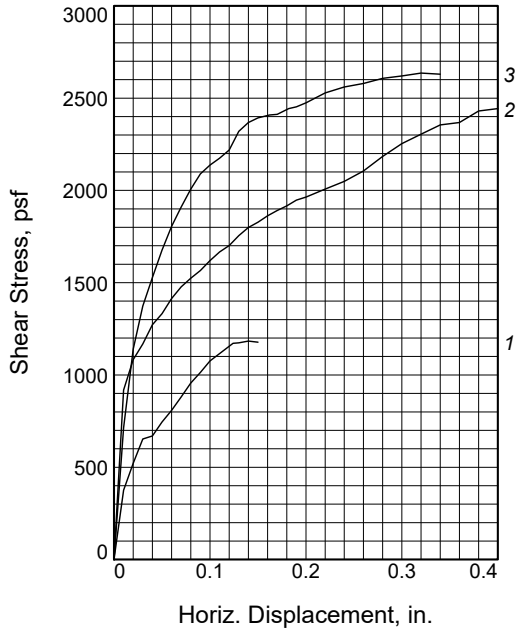
Figure 0300-025

Client: Kortum Ranch LLC

Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Location: 8-1a
Sample Number: 26 **Depth:** 3.0'
Proj. No.: VV4721B **Date Sampled:** 03/30/2021

Tested By: Jack Bianchin





Sample No.		1	2	3
Initial	Water Content, %	22.0	22.0	22.0
	Dry Density, pcf	67.7	78.2	81.0
	Saturation, %	41.0	53.3	57.1
	Void Ratio	1.3989	1.0752	1.0037
	Diameter, in.	2.41	2.41	2.41
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	39.6	35.0	34.6
	Dry Density, pcf	63.2	69.7	71.4
	Saturation, %	65.6	68.4	70.7
	Void Ratio	1.5680	1.3296	1.2736
	Diameter, in.	2.41	2.41	2.41
	Height, in.	1.07	1.12	1.13
Normal Stress, psf		1000	2000	3000
Fail. Stress, psf		1184	2443	2636
Displacement, in.		0.14	0.40	0.32
Ult. Stress, psf				
Displacement, in.				
Strain rate, in./min.		0.002	0.002	0.002

Sample Type: Tube
Description: Brown Silty Clay (visual)

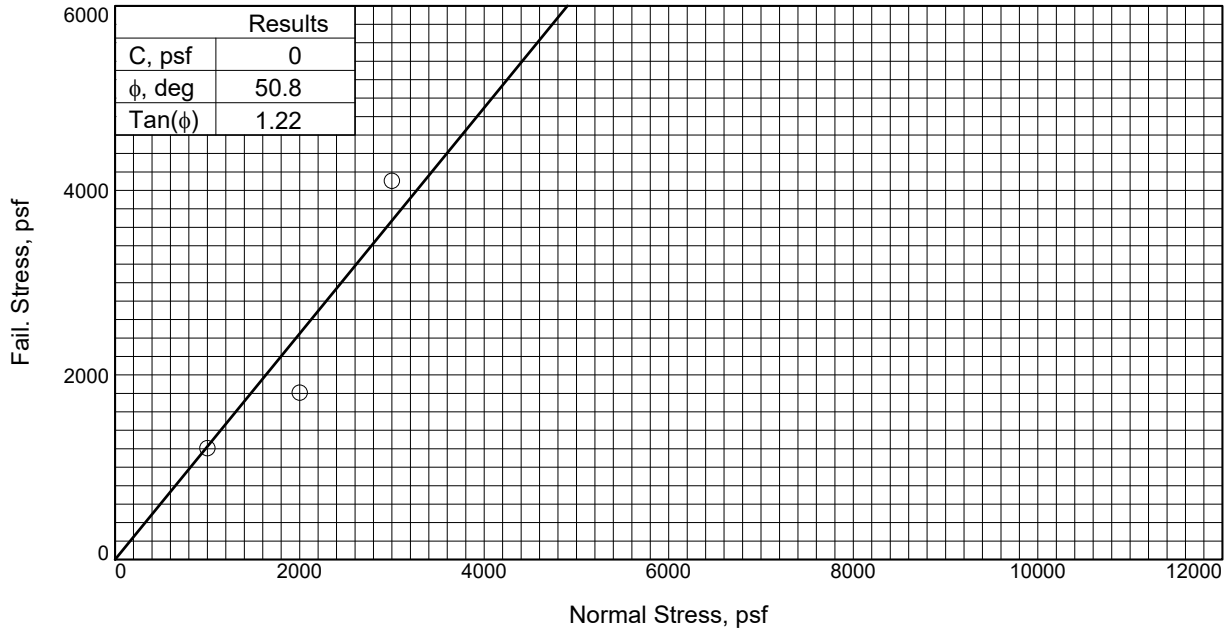
Specific Gravity= 2.6
Remarks: Material tested in accordance with ASTM D3080.

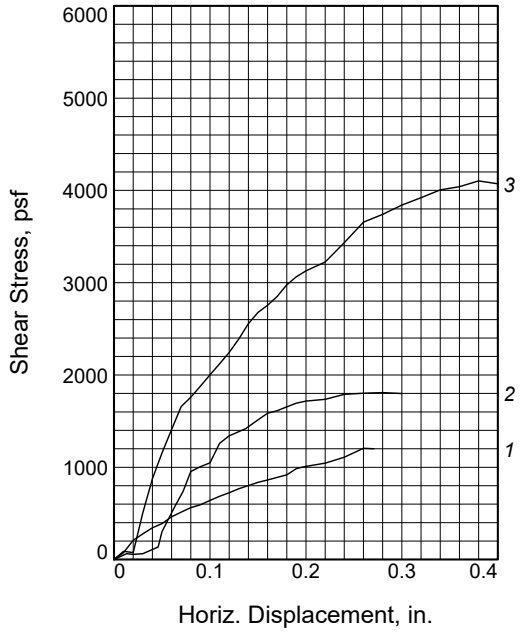
Figure 0300-026

Client: Kortum Ranch LLC

Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Location: 16-1b
Sample Number: 52 **Depth:** 3.0'
Proj. No.: VV4721B **Date Sampled:** 03/30/2021

Tested By: Cindy Gooden





Sample No.		1	2	3
Initial	Water Content, %	15.1	15.1	15.1
	Dry Density, pcf	88.9	84.6	81.7
	Saturation, %	47.4	42.6	39.6
	Void Ratio	0.8259	0.9183	0.9879
	Diameter, in.	2.41	2.41	2.41
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	35.4	35.6	36.1
	Dry Density, pcf	84.2	72.2	80.8
	Saturation, %	99.2	74.3	92.9
	Void Ratio	0.9278	1.2467	1.0094
	Diameter, in.	2.41	2.41	2.41
	Height, in.	1.06	1.17	1.01
Normal Stress, psf		1000	2000	3000
Fail. Stress, psf		1206	1809	4104
Displacement, in.		0.26	0.28	0.38
Ult. Stress, psf				
Displacement, in.				
Strain rate, in./min.		0.002	0.002	0.002

Sample Type: Tube
Description: Dark Yellowish Brown Clayey Sand (visual)

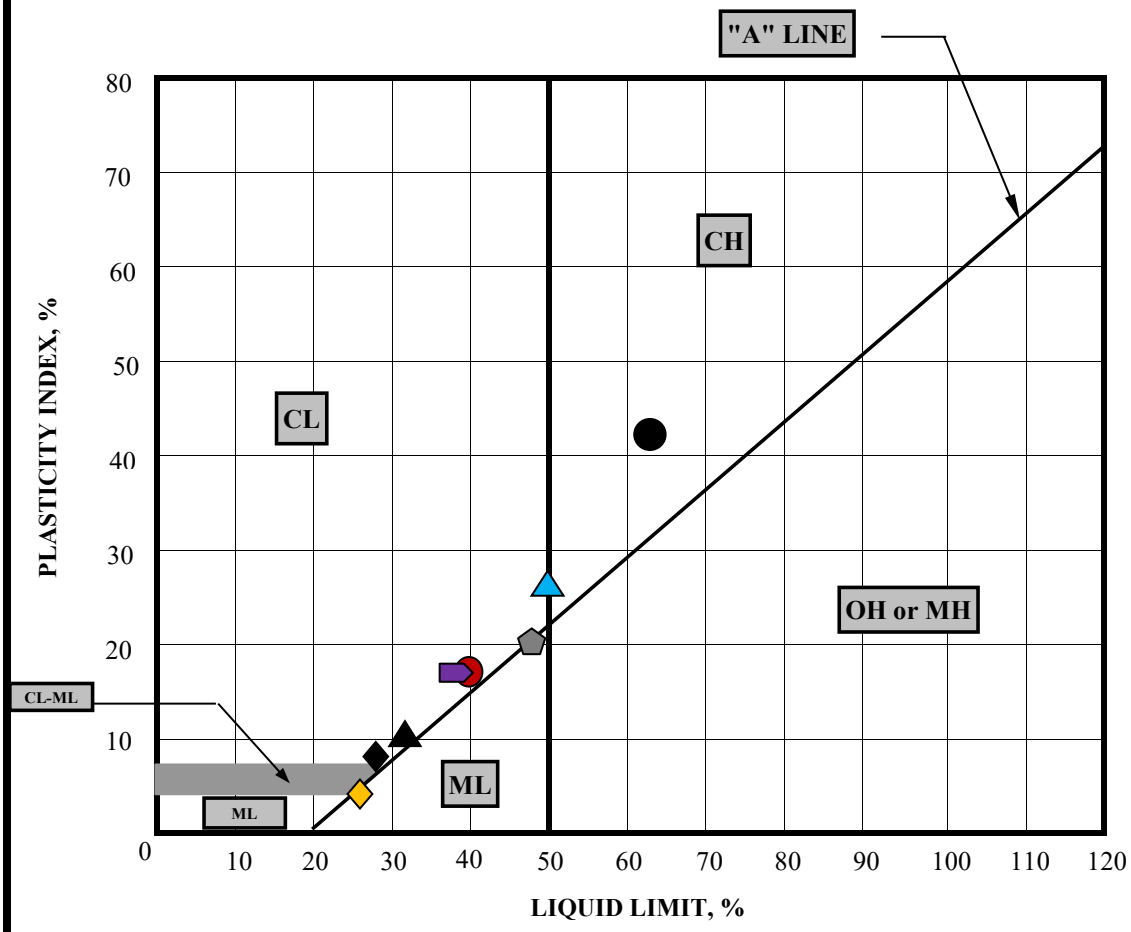
Specific Gravity= 2.6
Remarks: Material tested in accordance with ASTM D3080.

Figure 0300-027

Client: Kortum Ranch LLC

Project: Kortum Ranch Residential Development
500 Kortum Canyon Road, Calistoga, California
Location: 27-1
Sample Number: 83 **Depth:** 2.0'
Proj. No.: VV4721B **Date Sampled:** 03/30/2021

Tested By: Cindy Gooden



KEY SYMBOL	SAMPLE NUMBER	DEPTH	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	LIQUIDITY INDEX	UNIFIED SOIL CLASSIFICATION SYMBOL
●	1-1b	3.0'	N/A	40	23	17	N/A	CL
▲	4-1	2.5'	N/A	32	22	10	N/A	CL
◆	5-1a	2.5'	N/A	29	21	8	N/A	CL
●	10-1	3.0'	N/A	63	21	42	N/A	CH
▲	12-1b	3.0'	N/A	50	24	26	N/A	CL
◆	13-1a	2.5'	N/A	26	22	4	N/A	GC-GM
▬	17-1	4.0'	N/A	38	21	17	N/A	CL
⬟	20-1b	3.0'	N/A	48	28	20	N/A	ML

Note: Atterberg Limits tested in accordance with ASTM D4318.

Materials Testing, Inc.

PLASTICITY CHART AND DATA

Kortum Ranch LLC

500 Kortum Canyon Road, Callistoga, California

Project No:	Date:	Figure No:
VV4721B	3/30/2021	0300-028

Materials Testing, Inc.

8798 Airport Road
Redding, California 96002
(530) 222-1116, fax 222-1611

865 Cotting Lane, Suite A
Vacaville, California 95688
(707) 447-4025, fax 447-4143

Client:	Kortum Ranch LLC 251 Shipyard Way Newport Beach, CA	**Pages:** **Client No:** **Figure No:** **Date:**	1 of 1 VV4721B 0300-029 03/30/2021
Project:	Proposed Kortum Ranch Residential 500 Kortum Canyon Rd, Calistoga, CA	**Submitted by:** **Date Submitted:**	KC Engineering 03/8/2021

"R" VALUE TEST REPORT
(CTM 301)

Sample: A
Description: Brown Sandy Clay
Location: Subgrade @ 0.0' – 2.0'

SIEVE ANALYSIS

Sieve Size	1-1/2"	1"	3/4"	1/2"	3/8"	#4
As Received (% Pass)	---	---	---	---	---	100
As Used (% Pass)	---	---	---	---	---	100

RESISTANCE VALUE

Specimen Number	Dry Unit Weight, PCF	Moisture (%)	Exudation Pressure (PSI)	Expansion Pressure Dial Reading & PSF		R-Value
1	105.9	19.8	418	11	48	14
2	100.4	22.5	290	8	35	11
3	94.8	26.2	167	3	13	1

R-Value @ 300 PSI Exudation Pressure = **12**

Notes:

Tested by John Hubbard

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 03/17/2021
Date Submitted 03/11/2021

To: David Cymanski
K.C. Engineering
865 Cotting Lane Suite A
Vacaville, CA 95688

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : VV4721B 1-1A Site ID : PAD 0-3.
Thank you for your business.

* For future reference to this analysis please use SUN # 84269-175666.

EVALUATION FOR SOIL CORROSION

Sulfate-SO4	13.7 mg/kg	0.00137 %

METHODS
Sulfate-SO4 ASTM C1580

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 03/17/2021
Date Submitted 03/11/2021

To: David Cymanski
K.C. Engineering
865 Cotting Lane Suite A
Vacaville, CA 95688

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : VV4721B 5-1C Site ID : PAD 0-5.
Thank you for your business.

* For future reference to this analysis please use SUN # 84269-175668.

EVALUATION FOR SOIL CORROSION

Sulfate-SO4	9.2 mg/kg	0.00092 %

METHODS
Sulfate-SO4 ASTM C1580

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 03/19/2021
Date Submitted 03/15/2021

To: David Cymanski
K.C. Engineering
865 Cotting Lane Suite A
Vacaville, CA 95688

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : VV4721B KORTUM RANCH Site ID : 8-1B @ 0-5.
Thank you for your business.

* For future reference to this analysis please use SUN # 84290-175720.

EVALUATION FOR SOIL CORROSION

Sulfate-SO4	17.2 mg/kg	0.00172 %

METHODS
Sulfate-SO4 ASTM C1580

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 03/19/2021
Date Submitted 03/15/2021

To: David Cymanski
K.C. Engineering
865 Cotting Lane Suite A
Vacaville, CA 95688

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : VV4721B KORTUM RANCH Site ID : 15-1A @ 0-5.
Thank you for your business.

* For future reference to this analysis please use SUN # 84290-175721.

EVALUATION FOR SOIL CORROSION

Sulfate-SO4	2.4 mg/kg	0.00024	%

METHODS
Sulfate-SO4 ASTM C1580

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 03/17/2021
Date Submitted 03/11/2021

To: David Cymanski
K.C. Engineering
865 Cotting Lane Suite A
Vacaville, CA 95688

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : VV4721B 16-1A Site ID : PAD 0-3.
Thank you for your business.

* For future reference to this analysis please use SUN # 84269-175667.

EVALUATION FOR SOIL CORROSION

Sulfate-SO4	88.0 mg/kg	0.00880 %

METHODS
Sulfate-SO4 ASTM C1580

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 03/17/2021
Date Submitted 03/11/2021

To: David Cymanski
K.C. Engineering
865 Cotting Lane Suite A
Vacaville, CA 95688

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : VV4721B 18-1A Site ID : PAD 0-4.
Thank you for your business.

* For future reference to this analysis please use SUN # 84269-175664.

EVALUATION FOR SOIL CORROSION

Sulfate-SO4	53.3 mg/kg	0.00533 %

METHODS
Sulfate-SO4 ASTM C1580

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 03/17/2021
Date Submitted 03/11/2021

To: David Cymanski
K.C. Engineering
865 Cotting Lane Suite A
Vacaville, CA 95688

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : VV4721B 20-1A Site ID : PAD 0-4.
Thank you for your business.

* For future reference to this analysis please use SUN # 84269-175665.

EVALUATION FOR SOIL CORROSION

Sulfate-SO4	67.9 mg/kg	0.00679	%

METHODS
Sulfate-SO4 ASTM C1580

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 03/17/2021
Date Submitted 03/11/2021

To: David Cymanski
K.C. Engineering
865 Cotting Lane Suite A
Vacaville, CA 95688

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : VV4721B 24-1A Site ID : PAD 0-3.
Thank you for your business.

* For future reference to this analysis please use SUN # 84269-175669.

EVALUATION FOR SOIL CORROSION

Sulfate-SO4	28.6 mg/kg	0.00286	%

METHODS
Sulfate-SO4 ASTM C1580

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 03/17/2021
Date Submitted 03/11/2021

To: David Cymanski
K.C. Engineering
865 Cotting Lane Suite A
Vacaville, CA 95688

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : VV4721B 30-1A Site ID : PAD 0-3.
Thank you for your business.

* For future reference to this analysis please use SUN # 84269-175670.

EVALUATION FOR SOIL CORROSION

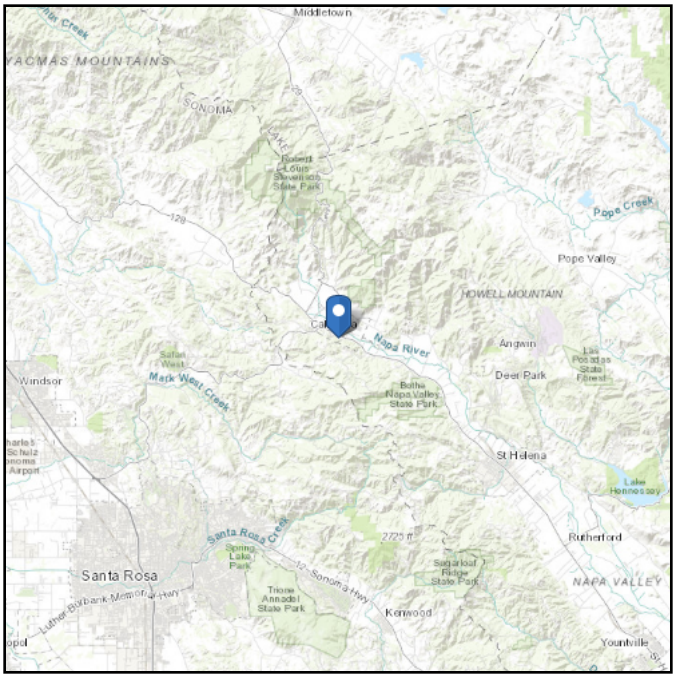
Sulfate-SO4	1.6 mg/kg	0.00016	%

METHODS
Sulfate-SO4 ASTM C1580

ASCE 7 Hazards Report

Address:
No Address at This Location

Standard:	ASCE/SEI 7-16	**Latitude:**	38.5743
Risk Category:	II	**Longitude:**	-122.5842
Soil Class:	C - Very Dense Soil and Soft Rock	**Elevation:**	581.6255590385265 ft (NAVD 88)



Seismic

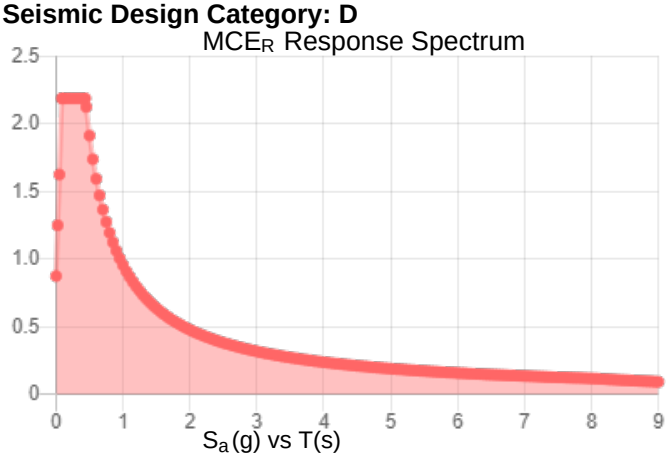
C - Very Dense Soil and Soft Rock

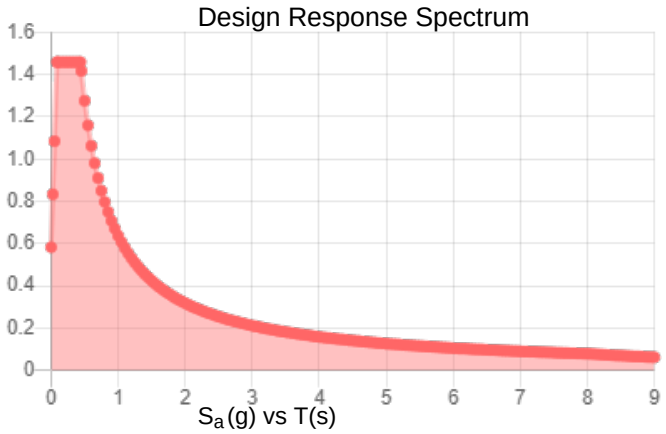
Site Soil Class:

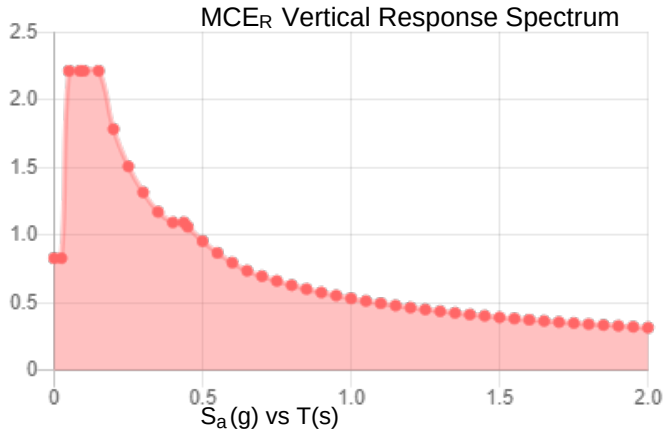
Results:

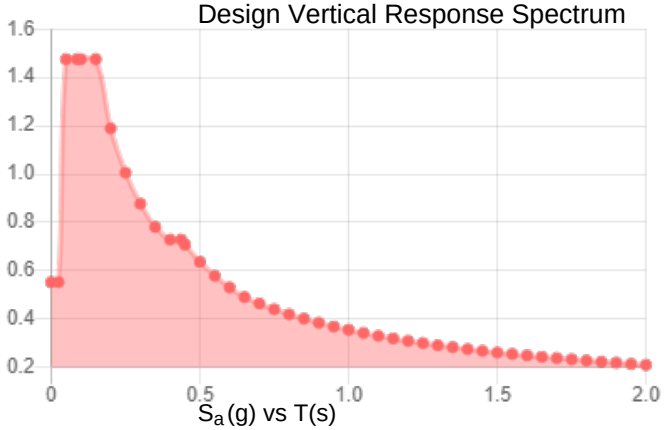
S_S :	1.823	S_{D1} :	0.637
S_1 :	0.683	T_L :	8
F_a :	1.2	PGA :	0.758
F_v :	1.4	PGA_M :	0.909
S_{MS} :	2.187	F_{PGA} :	1.2
S_{M1} :	0.956	I_e :	1
S_{DS} :	1.458	C_v :	1.265

Seismic Design Category: D









Data Accessed: **Tue Aug 08 2023**

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.

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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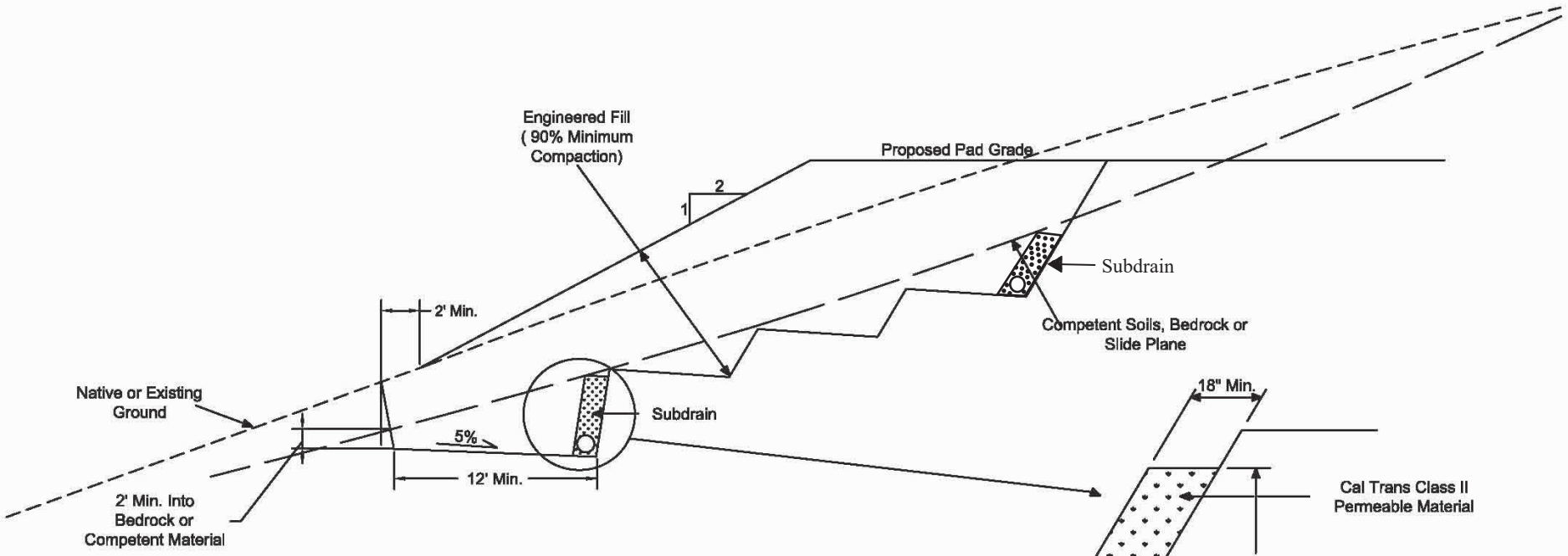
TYPICAL FILL SLOPE & SUBDRAIN DETAILS

(Not to Scale)



NOTES:

1. This is a typical cross-section for fill slope construction. Significant variations may be encountered during grading.
2. Dimensions of keyways and benches are subject to approval in the field by the Soil Engineer and Geologist.
3. The number and location of subdrains will be determined by the Soil Engineer and Geologist in the field.

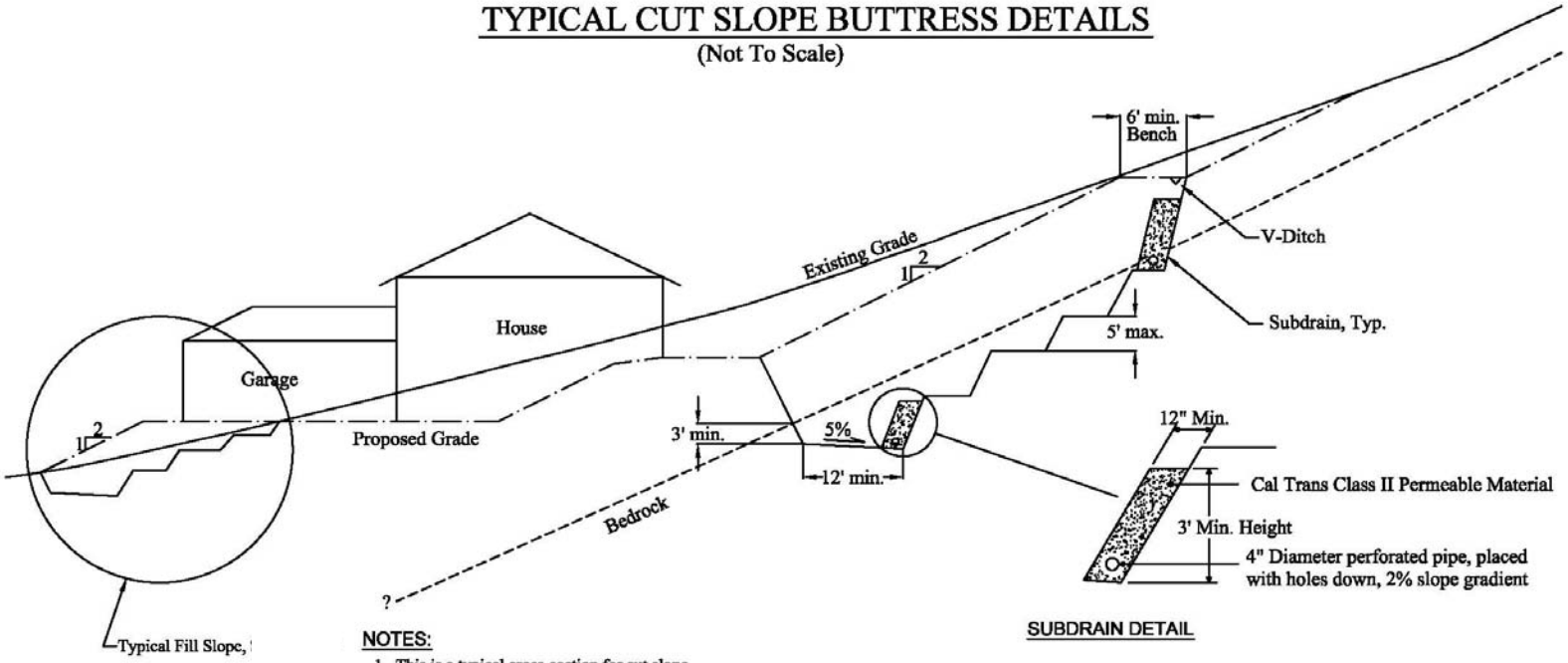
SUBDRAIN DETAIL

KC ENGINEERING COMPANY
865 Cotting Lane, Suite A
Vacaville, CA 95688

Proposed Hillside Fill Slope
TYPICAL FILL SLOPE, KEYWAY, BENCHING & SUBDRAIN DETAILS

TYPICAL CUT SLOPE BUTTRESS DETAILS

(Not To Scale)



NOTES:

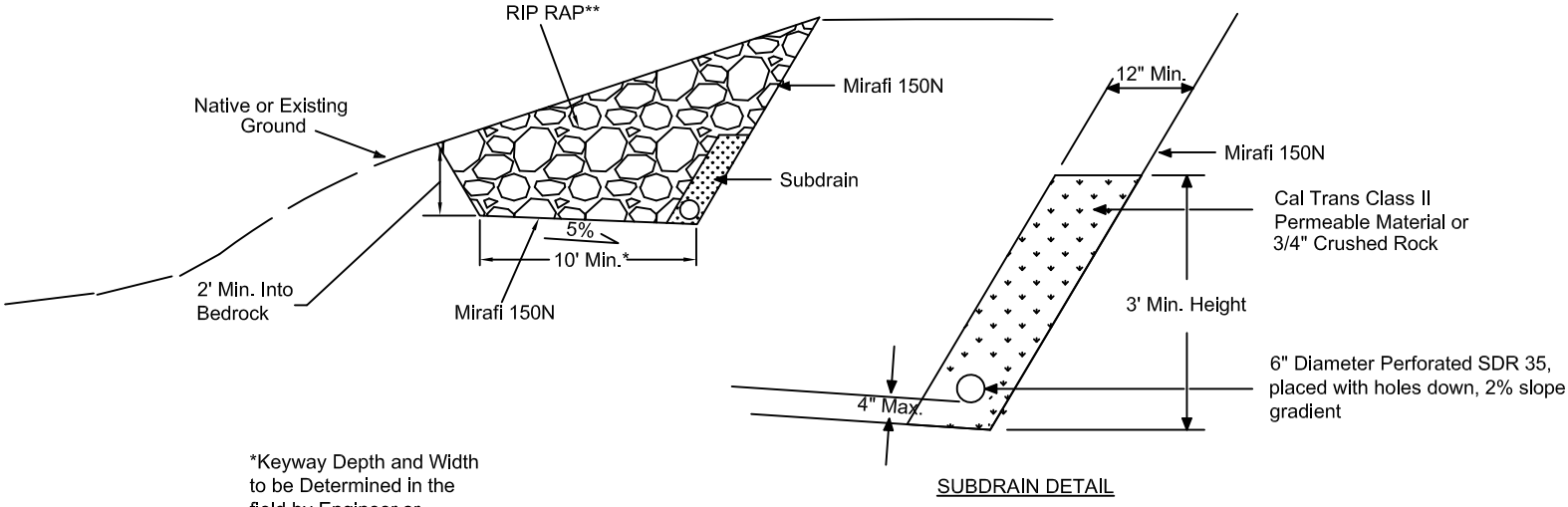
1. This is a typical cross-section for cut slope buttress and fill slope construction. Variations may be encountered during grading.
2. Dimensions of keyways and benches are subject to approval in the field by the Soil Engineer and Geologist.
3. The number and location of subdrains will be determined by the Soil Engineer and/or Geologist in the field.

KC ENGINEERING COMPANY
865 Cotting Lane, Suite A
Vacaville, CA 95688
707-447-4025

TYPICAL CUT SLOPE BUTTRESS DETAIL

LANDSLIDE REPAIR UTILIZING RIP RAP DETAIL

(Not to Scale)



SUBDRAIN DETAIL

*Keyway Depth and Width to be Determined in the field by Engineer or Geologist

**RIP RAP Per CalTrans Section 72 "Slope Protection " Method B Placement and 1/4-Ton Class Rock

BAJADA
Geosciences, Inc.
1300 Market Street, Suite 201
Redding, CA 96001
(530) 638-5263
DBE #46532

August 8, 2023
2301.0123

David Cymanski, G.E.
KC Engineering Company
865 Cotting Lane, Suite A
Vacaville, California 95688

Subject: **Debris Flow Hazard Assessment**
Kortum Ranch Development
APNs 011-290-007, -038, -039 & 011-310-023
500 Kortum Canyon Road
Calistoga, California

Dear Dave:

Bajada Geosciences, Inc. (BAJADA), is pleased to present this letter discussing our observations, and opinions regarding potential debris flows on the Kortum Ranch Development project located in Calistoga, California. The project is located on Assessor Parcel Numbers 011-290-007, -038, -039 & 011-310-023 at 500 Kortum Canyon Road in Calistoga, California. The location is shown on Plate 1 – Site Location Map. The following letter presents our understanding of the purpose of this study, work performed, our observations made during the study, and our opinions regarding areas of concern relative to future debris flows on the study parcels.

PROJECT UNDERSTANDING

We understand that the project consists of developing the 29.5-acre property into a number of residential lots ranging in size from 0.4 to 6.1 acres. Previous geotechnical studies have been performed at the site that included:

- An evaluation of mitigations for a 2019 debris flow failure on the property (KC Engineering Company [KC], 2019a);
- Observations and evaluations of existing retaining walls on the parcels (KC, 2019b)
- A geotechnical exploration report prepared for the proposed project (KC, 2021).

As noted above, KC (2019a) addressed a debris flow that occurred on the property in 2019. KC (2021) identified additional areas of slope stability concern at selected location across the property and recommended an engineering geologist be retained to assess locations of debris flows on the project property. This study provides that assessment.

WORK PERFORMED

Work performed for this study consisted of the following:

- Collected and reviewed selected, pertinent geologic data for the site. The primary source of those data is Delattre and Gutierrez (2013);
- Reviewed aerials photographs of the project site and region. Aerial photographs reviewed during this study are from 1956, 1958, 1968, 1982, 1993, 1998, 2002, 2005, 2007, 2009, 2010, 2012, 2014, 2016, 2018, and 2020;
- Collected and modeled open-source LiDAR data to develop a hillshade model and topographic data for the site. The hillshade model and topographic data serve as the base map shown on Plate 2 – Geologic Map.
- Mapping of geomorphic features using the hillshade model and aerial photographs to help constrain location of past and potential debris flows;
- Visiting the project site to validate and modify the locations of debris flows on the project site and to observe geologic conditions exposed on the property; and
- Preparation of this letter discussing our observations, conclusions and recommendations relative to debris flows at the site.

SITE GEOLOGY

The site is underlain by artificial fill, debris flows, lacustrine/fluvial deposits, and Rhyolite of Calistoga. KC (2021) documents many of the areas where artificial fills are present.

Debris flows have been mapped across the proposed development area. As noted on Plate 2, the majority of those slope failures are located in the northern third of the development area and offsite north of the northern property line. Most of those debris flows are underlain by the lacustrine/fluvial sediments with fewer debris flows situated on slopes underlain by the Rhyolite of Calistoga.

Of the debris flows mapped, we know that two have been historically active. Debris flow 1 (see ① on Plate 2) is discussed in KC (2019a). It failed in 2019, was 75 feet in length, and 20 to 35 feet wide. It was repaired using a rock slope protection (RSP) revetment that we observed during our site visit and that appears to be performing as intended.

Debris flow 2 (see ② on Plate 2) reportedly failed and caused damage to structures located downslope and north of the study property. We understand that this failure extended onto Foothill Boulevard (State Route 128). We are uncertain when this failure occurred but historical aerial photographs from 1982 show what appears to be a relatively recent landslide scarp at the head of where this failure occurred.

DEBRIS FLOWS DISCUSSION & OPINION

As noted previously stated, a majority of the mapped debris flows on Plate 2 are situated in the lacustrine/fluvial deposits in the northern portion of the property above residential structures built downslope and north of the study property. It is unlikely that any of these debris flows would fail and impact structures associated with the proposed on-site development; however, some could fail and impact proposed access roads. Of particular concern is that debris from these failures could mobilize off the study property and damage existing and future offsite structures and possibly SR 128.

Of particular concern are three locations noted on Plate 2 as Areas A, B, and C. Areas A and B are situated below a number of debris flows, most of which are located on the study property. These two areas also have two debris flows that have failed historically. Area C is also located below an area having numerous debris flows but most of these failures are located off the study property except for two relatively small failure features.

It is our opinion that future debris flow failures could adversely impact nonstructural improvements on the proposed development property and could adversely impact structures and infrastructure located downslope and north of the study property.

RECOMMENDATIONS

To reduce the risks associated with debris flows, improvements can be made to areas of concern. Typically, catchment basins and/or debris fencing are installed to capture debris from the failure prior to it impacting downslope improvements. A catchment basin can either be constructed as a single basin or a step-pool system that will catch debris but allow fluids to flow downslope. Figure 2 shows an example single basin and Figure 1 shows a step-pool design. The type of catchment suitable for the project will be based on estimates of debris volume that could fail downslope and the areas available for catchment. To estimate the failure volumes in any given area, we recommend that the area(s) of mapped debris failure(s) shown on Plate 2 be calculated and an average depth of at least 10 feet be used to estimate the total volume of sediment to be captured.

Figure 1

Figure 2

These basins will require maintenance after debris flows occur to reestablish the holding capacity of the basins.

Debris flow fencing consists of flexible ring fencing that is suspended across the debris flow channel, anchored into the channel sidewalls, and often supported by two or more posts. Wire ropes secure the fencing to the posts and anchors. The fencing captures the debris flowing downstream and allows much of the fluid to pass. After a debris flow, the fencing can be lowered to facilitate removal of the debris then re-established for the next debris flow event. Figure 3 provides a picture of a typical debris flow fence.

Figure 3

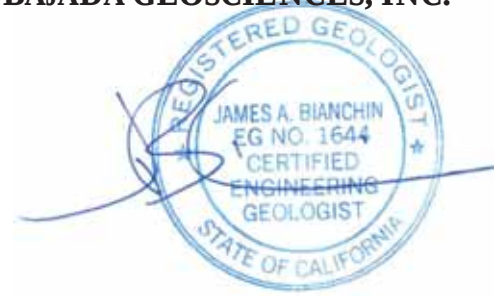
For the subject project, we recommend that debris flow catchment or fencing (catchments) be installed in at least Areas A and B. These areas, in our opinion, pose the relatively greatest risk to the property owners. We recommend consideration be given to installing a catchment in Area C also; however, there is a lower likelihood that debris from the subject property will adversely impact the properties downslope. Finally, although only three areas were delineated on Plate 2, additional catchments can be installed elsewhere within the proposed development area to reduce debris flow impacts on project roadways, if this is of concern.

CLOSURE

We appreciate the opportunity to assist you with this project. If you have questions or require additional information, please contact me at (530) 638-5263 at your convenience.

Regards,

BAJADA GEOSCIENCES, INC.



James A. Bianchin, C.E.G.
Principal Engineering Geologist

ATTACHMENTS

Plate 1 – Site Location Map

Plate 2 – Geologic Map

REFERENCES

Delattre, M.P., and Gutierrez, C.I. (2013), Preliminary Geologic Map of the Calistoga 7.5' Quadrangle, Napa and Sonoma Counties, California, California Geological Survey Preliminary Geologic Maps PGM-13-01, scale 1:24,000.

KC Engineering Company (2019a), Debris Flow Recommendation and Plan Review, Busk Estate Property, dated July 23, 3p.

_____ (2019b), Retaining Wall Evaluation & Recommendations, Busk Estate Property, dated August 1, 13 p.

_____ (2021), Geotechnical Exploration Report for Proposed Kortum Ranch Residential Development at 500 Kortum Canyon Road, Calistoga, for Kortum Ranch LLC, dated April 16, 121 p.

Base maps from Google Maps & MapQuest. Scale Undetermined.

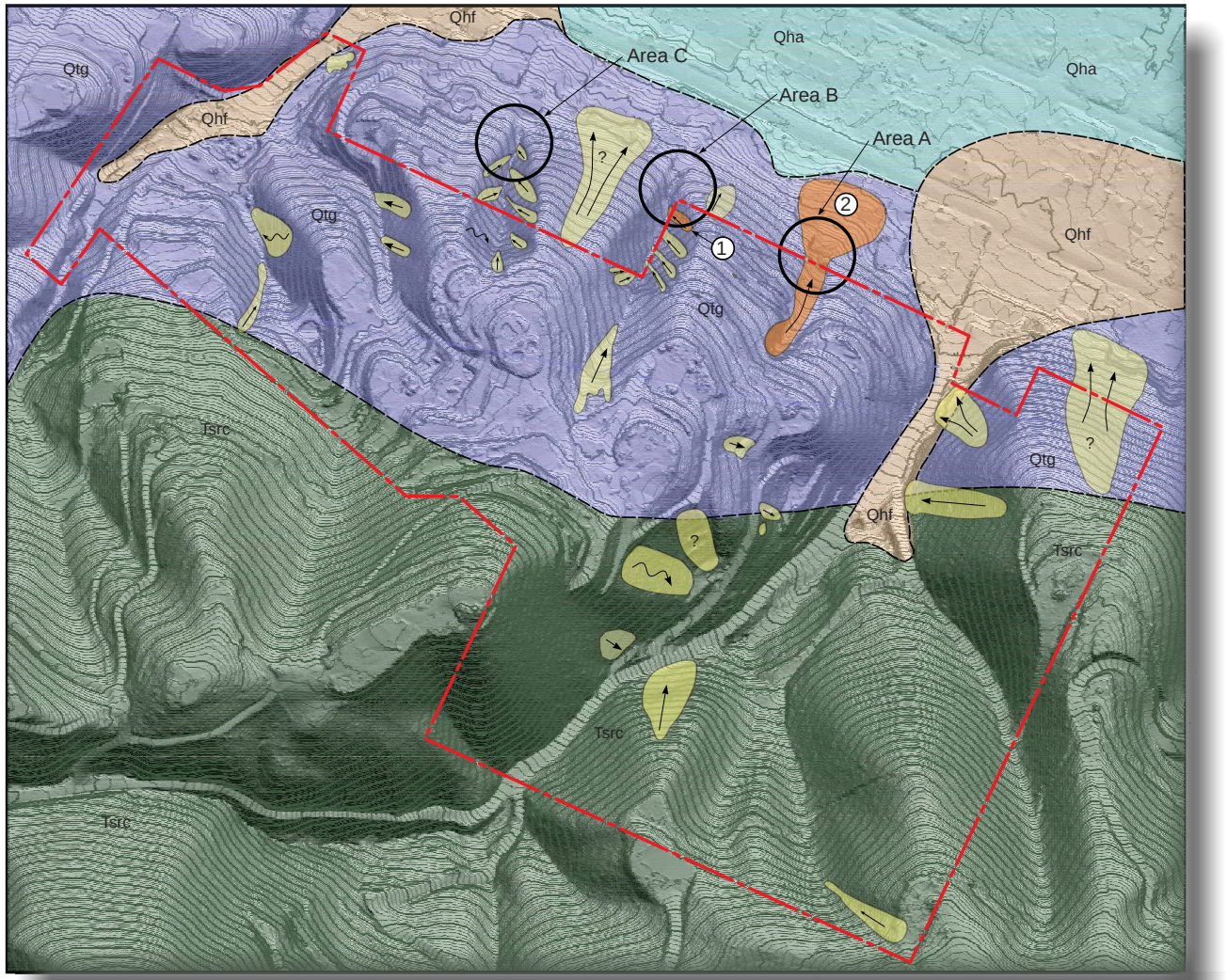
SITE LOCATION MAP

Kortum Ranch Development
500 Kortum Canyon Road
Calistoga California

Plate No.
1

BAJADA Geosciences, Inc.

Project no.
2301.0123

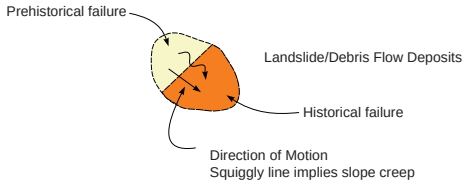


Qha **Alluvial deposits, undifferentiated (Holocene)** – Alluvium deposited in fan, terrace, or basin environments that could not be readily separated for mapping. Typically, consist of poorly to moderately sorted sand, silt, and gravel that form smooth geomorphic surfaces with little to no dissection.

Qhf **Alluvial fan deposits (Holocene)** – Sediment emanating from canyons to produce relatively undissected, fan-shaped deposits on alluvial valley floors. Sediments are typically moderately to poorly sorted and composed of sand, gravel, silt, and occasionally clay.

Qtg **Unnamed fluvial and lacustrine deposits (early Pleistocene to Pliocene)** – Weakly consolidated gravel, tuffaceous sand, silt and clay, mapped west of Calistoga unconformably overlying the Sonoma Volcanics. Gravels generally consist of sub-rounded to rounded Tertiary volcanic clasts, including obsidian pebbles, with little or no basement material. Previously mapped as part of the Glen Ellen Formation; name not used here because of new stratigraphic data from similar gravels to the west (McLaughlin and others, 2004), and uncertain age and lithologic correlations with the type locality.

Tsrc **Rhyolite of Calistoga** – Rhyolitic to rhyodacitic domes and flows found on both sides of the upper Napa Valley and forming domical hills protruding from the valley alluvium in and around Calistoga. Composed of highly variable assemblages of massive or flow banded rhyolite; intercalated crystal and lithic tuff, and lithoidal welded tuff grading to vitrophyre, locally perlitic; and agglomerate with glassy bombs. The unit has experienced widespread hydrothermal alteration to kaolinite and other clay minerals with finely disseminated pyrite, and more pronounced mineralization locally and along faults. Fission-track dating of zircons from this unit yielded ages of 2.6 Ma from near the east end of Franz Valley, and 3.7 Ma from lower Kortum Canyon Rd., although the latter age appears marginally too old based on contact relations with other dated units (Fox et. Al, 1985). More recent radiometric dating of this unit from near Glass Mountain to the east and Pepperwood Ranch to the west yielded ages of 2.78 Ma and 3.19 Ma, respectively (McLaughlin and others, 2005).



② Historical Debris Flow Discussed in Text

Property Line

0 125 250
Scale: 1"=250'
1:3,000

Geologic base map from Delattre & Guttierrez (2009).

GEOLOGIC MAP

Kortum Ranch Development
500 Kortum Canyon Road
Calistoga California

Plate No. 2

BAJADA Geosciences, Inc.

Project no. 2301.0123