Appendix D:

Geotechnical Due Diligence Exploration

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December 22, 2023

Project No. 23145-01

To: Meritage Homes
5 Peters Canyon Road, Suite 310
Irvine, California 92606

Attention: Ms. Louisa Feletto

Subject: Geotechnical Due Diligence Exploration and Preliminary Design Recommendations, Proposed Residential Development, Southwest Corner of La Sierra Avenue and Alhambra Avenue, City of Riverside, California

At your request, SA Geotechnical, Inc. (SA GEO) has conducted a geotechnical due diligence exploration and review for the proposed residential development located at the southwest corner of La Sierra Avenue and Alhambra Avenue in the City of Riverside, California (Figure 1). The purpose of this study was to evaluate the geotechnical site conditions in light of the proposed grading and improvements in order to provide a geotechnical summary and preliminary recommendations for project design, grading and construction. Our evaluation included review of collected geologic maps and data pertinent to the subject site; subsurface exploration; laboratory testing and analysis; and preparation of this report.

The subject site consists of a mixture of vacant/undeveloped property and rural single-family residential development. The site is composed of several conjoined parcels/lots, totaling approximately 9.8 acres. Based on our study, the primary geotechnical constraints at the site include: the presence of granitic bedrock at existing grade and/or shallow depth underlying the alluvium, the presence of undocumented artificial fills and weathered/unsuitable alluvium near-surface, and seismic shaking during a strong seismic event. The site geology generally consists of approximately 2.5 to 21.5 feet of older alluvium capping granitic bedrock. Along the central portion of the westerly boundary, granitic rock is mapped at existing grades. The older alluvium generally consists of reddish-brown silty sand and sandy silt with "Very Low" to "Medium" expansion potential. The underlying bedrock consists of fine to coarse-grained granitic bedrock (monzogranite, granodiorite, and diorite) that is generally weathered ("decomposed") in the uppermost 18 to 35 feet and considered rippable with heavy duty earthmoving equipment (i.e.: Caterpillar D9 bulldozer or equivalent). Groundwater was encountered in one boring (H-5) at a depth of 26.5 feet below ground surface. Percolation testing was also performed during this study and indicates that shallow stormwater infiltration is generally feasible at the site.

This report presents our findings, conclusions, and preliminary design recommendations for the subject residential development. Based on our review, the proposed development is considered geotechnically feasible provided the recommendations in this report are implemented during design, grading, and construction. Additional geotechnical exploration and analysis may need to be performed once the project plans for grading, foundations, and stormwater infiltration are developed.

References pertinent to the site are included in Appendix A. Boring and test pit logs are included in Appendix B. Laboratory test data is included in Appendix C. The geophysical survey/rippability report is included in Appendix D. Percolation test data is presented in Appendix E. Seismic design parameters are presented in Appendix F. General earthwork and grading specifications are presented in Appendix G.

If you have any questions regarding this report, please contact our office. We appreciate the opportunity to provide our services.

Respectfully submitted,

SA GEOTECHNICAL, INC.

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EXECUTIVE SUMMARY

The subject site is generally underlain at or near-surface by granitic bedrock that is successively overlain by variable thicknesses of older alluvium, generally thickening to the east. Granitic bedrock is exposed at the surface within the western portion of the site. Undocumented artificial fill associated with prior land use/grading was encountered in several test pits across the site, ranging from 1.5 to 5.5 feet thick. The older alluvium generally consisted of yellowish-brown, reddish-brown, and brown silty fine to coarse sand, sandy silt and sandy clay that was damp to moist and medium dense/stiff where encountered, ranging in thickness from 2.5 to 21.5 feet. Bedrock was found to consist of yellowish-brown, olive brown, pale reddish-brown, and gray fine to coarse-grained granitic rock (mixtures of monzogranitic, granodiorite, and diorite) that is damp to saturated, and dense to very dense. In general, the bedrock is weathered ("decomposed") in the uppermost 18 to 35 feet and moderately weathered to unweathered below. Bedrock will be encountered during onsite grading and within excavations for utility lines throughout the site. The granitic bedrock is generally considered excavatable (rippable) with heavy duty earthmoving equipment (i.e. Caterpillar D9 bulldozer) to a minimum depth of 18 feet. However, oversize rocks will be generated during grading and excavation for utilities.

The primary geotechnical constraints for site development include the following:

- Presence of shallow granitic bedrock throughout the site;
- Presence of undocumented fill and weathered/unsuitable alluvium near surface; and,
- Potential for strong seismic shaking during an earthquake event.

The undocumented fill and near surface/highly weathered older alluvium and granitic rock are considered unsuitable for support of compacted fill material and the proposed improvements. Remedial grading for the site should consist of the removal and recompaction of all undocumented fill materials, and highly weathered or disturbed alluvium and/or bedrock. Remedial removals are anticipated to range from 2.5 to 6 feet below existing grades. Overexcavation (within cut areas) is recommended to depths of 3 to 4 feet below design grades. Remedial removals and/or overexcavation within streets or utility alignments/connections should be performed to 1 foot below the deepest utility to facilitate future utility pipeline construction. The recommended remedial removal and overexcavation will also help reduce the potential for future differential settlement at the site. Based on verbal communication with the current landowner, the existing onsite residences rely on septic tanks and leach fields for sewage management. These features should be anticipated during demolition and grading. Wells, septic tanks, seepage pits, and related appurtenances will need to be properly removed and/or abandoned in accordance with County of Riverside Department of Environmental Health requirements (or other governing agency) and the project environmental consultant's recommendations.

Groundwater was encountered in one boring (H-5) during our exploration at a depth of 26.5 feet below ground surface. In general, groundwater is anticipated to remain more than 10 feet below design grades upon the completion of grading. However, perched groundwater may be present at shallow depths locally and along the bedrock contact. Groundwater will fluctuate on an annual and seasonal basis.

Building foundations and slabs should be designed to tolerate a total settlement of 1 inch and differential settlement of ½-inch over a span of 40 feet. The site is categorized as Site Class "C" for seismic design. Onsite soils are anticipated to have "Very Low" to "Low" expansion potential at the completion of grading. Onsite soils are not anticipated to be corrosive to concrete but are corrosive to metals.

Based on our findings, we conclude that the proposed residential development is feasible from a geotechnical viewpoint, provided it is designed and constructed in accordance with the recommendations presented in this report and any future design/plan review reports. The site is considered locally suitable for infiltration of stormwater at shallow depths.

1.0 INTRODUCTION

1.1 Introduction and Scope of Services

At your request, SA Geotechnical, Inc. (SA GEO) has conducted a geotechnical due diligence exploration and review for the proposed residential development at the subject property in the City of Riverside, California (Figure 1). The purpose of our study was to assess the onsite geologic and geotechnical conditions and provide preliminary recommendations for design, grading, and construction of the proposed improvements. We have reviewed the Conceptual Site Plan, dated November 8, 2023, which shows the generalized lot layout; however, contains no existing or proposed grades. A Google Earth satellite image was utilized as the base for our Geotechnical Map (Plate 1).

Our scope of services for this study included the following tasks:

- Review of available geologic and geotechnical maps, reports, and data for the subject site and surrounding area. A list of references is included in Appendix A.
- Review of available historic aerial photographs and topographic maps dating back to 1948.
- Notification and coordination with DigAlert to identify and clear boring and test pit locations of underground utilities.
- Subsurface exploration consisting of ten hollow-stem auger borings (H-1 through H-6 and P-1 through P-4) to depths ranging from 5 to 30.5 feet below ground surface (bgs). Eight backhoe test pits (TP-1 through TP-8) were also excavated, ranging in depth from 8.5 to 15 feet bgs. Boring and test pit logs are included in Appendix B.
- Percolation testing in four borings (P-1 through P-4) in general conformance with the 2011 Riverside County Design Handbook for Low Impact Development Best Management Practices.
- A geophysical refraction survey, which included two survey lines (SL-1 and SL-2), was performed to collect compression wave (p-wave) velocity data to assist in evaluation of hardness and rippability of the mapped granitic bedrock.
- Laboratory testing of selected samples to determine engineering properties of onsite soils, including in-situ moisture and density, grain size distribution, plasticity, consolidation, shear strength, maximum density and optimum moisture content, R-value, expansion potential, and soluble sulfate content. Laboratory test results are included in Appendix C.
- Geotechnical evaluation and analysis of the compiled data with respect to the proposed grading and development.
- Preliminary evaluation of faulting, seismicity, and seismic and static settlement in accordance with the 2022 California Building Code (CBC).
- Preparation of this report including our findings, conclusions, preliminary recommendations, and accompanying illustrations.

SA GEO's expertise and scope of services do not include assessment of potential subsurface environmental contaminants or environmental health hazards.

1.2 Site Location, Existing Conditions, and History

The subject site is located at the southwest corner of the La Sierra Avenue and Alhambra Avenue intersection, in the city of Riverside, California. The approximately 9.8-acre site is bound by La Sierra Avenue to the east, Alhambra Avenue to the north and west, and existing single family residential developments to the south and west. We understand that the subject site is composed of six conjoined lots/parcels, three of which are developed with rural single-family residences. The other parcels remain largely undeveloped and/or used for equestrian activity. The site is moderately sloping to the southeast with several mature trees throughout. Based on verbal communication with the current property owner, the existing onsite residences rely on septic systems and leach fields for sewage waste management.

Based on our review of available historic aerial photographs dating back to 1948, the following summarizes our understanding of the site history:

- **1948:** The aerial photograph depicts the northerly portion of the site used for agriculture (citrus orchard). Three residences appear to occupy the subject site, two of which are still present on site (at the east and southeast portions of the site). Various outbuildings are also located onsite. La Sierra Avenue and Alhambra Avenue are present. Neighboring properties to the south and northwest are undeveloped. Scattered rural residences are located to the north and west.
- **1959:** The subject property remained largely unchanged. A chicken farming operation was constructed to the northwest of the site, while scattered rural residences were constructed to the west.
- **1966/1967:** No significant changes were observed onsite.
- **1985:** The site appears to have been partially cleared of the orchard. The residence and swimming pool along the western boundary were present by this time. Additional outbuildings and equestrian-related features were also noted. The chicken farming operation to the northwest had been removed/demolished.
- **1994:** By 1994, the remaining portion of the orchard was removed. Additional equestrian-related features were noted in the northerly portion of the site. Otherwise, the site appears mostly unchanged. The single-family residences (offsite) adjacent to the southerly property line were constructed.
- **1998/1999:** No discernable changes to the site were observed.
- **2002-2023:** The site remained relatively unchanged during this time. Various outbuildings and equestrian features were added/removed. By 2018 the single-family residences to the northwest (Lindy Street) were under construction.

1.3 Proposed Grading and Improvements

Prior to site development and grading, the existing structures/foundations, and utilities to be abandoned will be demolished and removed from the site. Based on review of the Conceptual Site Plan, the development is proposed to include grading of 93 single-family residential lots, interior streets, a park/amenity area, stormwater infiltration features, and utility improvements to support the development. We anticipate that the proposed single-family units will be one to two-story wood-framed structures. Slopes and/or retaining walls will most likely be required to accommodate grade changes, especially along the western property boundary. Grading cuts/fills and utility depths are not known at this time.

1.4 Subsurface Exploration

Our subsurface exploration was performed on December 6 through 13, 2023, and included drilling of 10 hollow-stem auger borings, excavation of eight backhoe test pits, field percolation testing, and a geophysical refraction survey consisting of two survey lines. The approximate boring, test pit, and seismic survey line locations are shown on the Geotechnical Map (Plate 1). Boring and test pit logs are provided in Appendix B.

Hollow-stem auger borings (H-1 through H-6 and P-1 through P-4) were drilled to depths of 5 to 30.5 feet below ground surface (bgs). All borings were geotechnically logged, and samples were taken at selected intervals. Relatively undisturbed ring samples were obtained from the exploratory borings with a 2.5-inch inside-diameter, split-barrel sampler. The samplers were driven into the soil with a 140-pound automatic safety hammer, free-falling 30-inches. The drive samples were also used to obtain a measure of resistance of the soil to penetration (recorded as blows-per-foot on our geotechnical boring logs). Bulk samples were collected for additional laboratory testing. After completion of drilling the excavations were backfilled with soil cuttings and tamped.

Following drilling, percolation testing was performed in four borings (P-1 through P-4) in general conformance with the 2011 County of Riverside Design Handbook for Low Impact Development Best Management Practices.

The test pit exploration included eight locations (TP-1 through TP-8) that were excavated with a rubber-tired backhoe (Deere 310SL) to depths ranging from 8.5 to 15 feet bgs. The excavations were geotechnically logged by an engineering geologist. Representative bulk samples of onsite soils were collected from trenching spoils and used for additional soil identification purposes.

A geophysical refraction survey was performed by GeoVision on December 13, 2023, and included two survey lines (SL-1 and SL-2), focused within the westerly portion of the site underlain by granitic bedrock at existing grades. The approximate geophysical survey line locations are shown on the Geotechnical Map (Plate 1). The refraction survey was used to measure compressional (P) wave velocities of the granitic bedrock as part of our rippability assessment. The geophysical report is provided in Appendix D.

1.5 Laboratory Testing

Laboratory testing was performed on representative samples of onsite soils collected during our field exploration to characterize their engineering properties. Laboratory tests performed on selected samples included:

- Moisture content and dry density;
- Grain-size distribution;
- Atterberg limits;
- Direct shear;
- Expansion Index;

- R-value;
- Soluble sulfate; and
- Maximum dry density and optimum moisture content.

Laboratory tests were conducted in general conformance with applicable ASTM International test methods. Laboratory test results are provided in Appendix C. In-situ moisture content and dry density data are included on the geotechnical boring logs (Appendix B).

2.0 GEOTECHNICAL FINDINGS

2.1 Geologic Setting and Earth Units

The site is located in the Peninsular Ranges geomorphic province of Southern California, characterized by series of ranges and northwest trending valleys, subparallel to regional faults. The subject site is mapped by the United States Geological Survey (USGS, 2001 & 2002) as underlain by older alluvial fan deposits overlying granitic bedrock. Granitic bedrock is also mapped at existing grade within the western-most portion of the site. Also, undocumented artificial fill material, associated with prior land use, was encountered in various test pits across the site. The Geotechnical Map (Plate 1) depicts the site earth unit distribution and estimated depth to bedrock. The earth units, as encountered during our exploration are described below from oldest to youngest.

Granitic Bedrock (Map Symbol - Kgr): The site is underlain by Cretaceous-age intrusive igneous bedrock that is generally described as yellowish-brown, olive brown, pale reddish-brown, and gray fine to coarse-grained granitic rock (monzogranite, granodiorite, and diorite) that is damp to saturated, and dense to very dense. In general, the bedrock is weathered ("decomposed") in the uppermost 18 to 35 feet. Boring H-1 was terminated due to hard rock and difficult drilling conditions at a depth of 8 feet bgs; the remainder of borings were drilled 10 to 27 feet into bedrock without encountering refusal. The backhoe test pits were generally excavated 2.5 to 9 feet into bedrock before encountering difficulty digging and/or refusal. Test pit location TP-2 was terminated less than 1 foot into bedrock due to hard rock conditions. The depth to bedrock, as encountered during our subsurface exploration, is provided on the Geotechnical Map (Plate 1).

Older Alluvium (Map Symbol – Qalo): Older alluvium is mapped covering most of the site and generally varies in thickness from 2.5 to 11.5 feet. Locally, along the easterly property line, older alluvium was encountered to a depth of 21.5 feet bgs. The alluvium generally consisted of yellowish-brown, reddish-brown, and brown silty fine to coarse sand, sandy silt, and sandy clay that was damp to moist and medium dense/stiff.

Undocumented Artificial Fill (Map Symbol – Afu): Undocumented artificial fill material was encountered in several test pits across the site, varying in thickness from 1.5 to 5.5 feet. The undocumented artificial fill material generally consists of brown to reddish brown silty fine-to-coarse sand that was damp to moist and loose to medium dense. Undocumented artificial fill is also mapped overlying bedrock in the western portion of the site (beneath the existing home/pool) as a result of grading and terracing for home construction.

2.2 Geotechnical Conditions

Based on our review of the geotechnical exploration and laboratory testing data (Appendix C), the geotechnical conditions are generally as follows:

Soil Moisture Content and Dry Density: Laboratory testing performed on samples collected from the borings indicate that the native older alluvium had moisture contents in the range of 1.9 to 14.6 percent and dry densities varying from 110.1 to 123.0 pounds per cubic foot (pcf). The blow counts in the alluvium varied from 9 to 61 blows per foot. The granitic bedrock samples had dry densities in the range of 105.0 to 118.9 pcf and moisture contents in the range of 3.5 to 15.5 percent. Blow counts in bedrock were well over 50 blows per foot.

Soil Properties: Grain-size distribution tests were conducted on two bulk samples collected from the uppermost 5 feet and seven ring samples collected at depths of 5, 7.5, 10, and 15 feet. The near-surface bulk samples were classified in accordance with the Unified Soil Classification System (USCS) as sandy clay (CL) and silty sand (SM), with fines contents (passing No. 200 sieve) of 63 and 30 percent, respectively. Soil plasticity testing performed on the bulk samples indicates that the sandy clay soil has a Liquid Limit of 30 percent and Plasticity Index of 13 (USCS classification of CL). The silty sand sample was non-plastic.

The ring samples were found to have fines contents ranging from 44 to 50 percent (at a depth of 5 feet), 12 and 54 percent (at a depth of 7.5 feet), 67 percent (at a depth of 10 feet), and 79 percent (at a depth of 15 feet). The samples were given USCS classifications of SM and SM/ML (5 feet), SP-SM and ML (7.5 feet), CL (10 feet), and ML (15 feet). The Liquid Limit of the ring sample collected at a depth of 10 feet (CL) was 25 percent with Plasticity Index of 9.

Maximum dry density of the near-surface silty/sandy soil indicates a maximum dry density of 132.0 pounds per cubic foot (pcf) at an optimum moisture content of 8.0 percent.

Consolidation: Tests were performed on four samples collected at depths of 5, 7.5, and 15 feet. In general, the testing showed that the materials have relatively low compressibility potential. The samples had minor collapse potential (less than 0.75%) upon the addition of water at a load of 3.2 tsf.

Shear Strength: Direst shear testing was performed on one relatively undisturbed ring sample collected at a depth of 5 feet, representative of the native older alluvium. One remolded direct shear (remolded to 90% relative compaction of the maximum density) was also performed, representative of future compacted fill material. The test results for the in-situ sample indicate an ultimate internal friction angle of 32 degrees at zero cohesion with peak internal friction angle of 39 degrees and a cohesion of 100 pounds per square foot (psf). The remolded sample had an ultimate internal friction angle of 27 degrees and a cohesion of 150 psf. The peak values for the internal friction angles and the cohesion of the remolded sample were 28 degrees and 350 psf, respectively.

R-value: One sample collected from the uppermost 5 feet in Boring H-4 had an R-value of 18.

Expansion Potential: Two near-surface samples collected from the upper five feet were tested to evaluate the expansion potential of onsite alluvial soils. The testing shows that the silty sand and sandy clays have expansion indices of 0 to 59, respectively, indicating "Very Low" to "Medium" expansion potential.

Chemical Properties: Soluble sulfate content of the soil was measured in two samples representative of the near surface soils. Soluble sulfate content testing indicates the soil may be classified as "S0" per Table 19.3.1.1 of ACI-318-14. We anticipate that the onsite soils are corrosive to metals.

2.3 Groundwater

Groundwater was encountered in one boring, H-5, at a depth of 26.5 feet bgs. Based on the recorded groundwater depth and our understanding of the site geology, perched groundwater can occur within highly weathered portions of granitic bedrock and/or at the bedrock/alluvium/fill contact. Historic high groundwater mapping by the State has not been performed for the region.

Groundwater levels may fluctuate on an annual and seasonal basis, based on variations in future residential irrigation and rainfall amounts. The presence of locally saturated soils and/or perched water cannot be ruled out and may be encountered during grading, construction of utility infrastructure and future homeowner improvements.

2.4 Regional Faulting and Seismicity

Regional Faults: The site is not located within a fault-rupture hazard zone as defined by the Alquist-Priolo Special Studies Zones Act (CGS, 2018). Also, based on mapping by the State (Jennings and Bryant, 2010) and Riverside County (2023), there are no active faults mapped at the site.

Seismicity: Properties in southern California are subject to seismic hazards of varying degrees depending upon the proximity, degree of activity, and capability of nearby faults. These hazards can be primary (i.e., directly related to the energy release of an earthquake) or secondary (i.e., related to the effect of earthquake energy on the physical world). Since there are no active faults at the site, the potential for primary ground rupture is considered very low. The primary seismic hazard for this site is ground shaking during a future earthquake. The maximum moment magnitude for the controlling fault is 8.1 M_W, which would be generated from the San Jacinto Fault.

The site is located within an area of "high" liquefaction susceptibility per the County of Riverside (2023). However, based on the shallow bedrock condition and absence of groundwater within potentially liquefiable soils (older alluvium), the liquefaction potential is considered very low. Please also note that the alluvium in Boring H-6, which was encountered to a depth of 21.5 feet, generally consisted of fine-grained clayey soils that are typically not considered prone to liquefaction. Other secondary seismic hazards, such as tsunami and seiche are considered nil due to site elevation and distance from the ocean or other confined bodies of water.

2.5 Settlement

In general, the anticipated settlements depend upon the building loads, type of foundations, and the geotechnical properties of the supporting subgrade. Shallow bedrock is generally present throughout the site. Considering the subsurface soil conditions, laboratory test data, and lightly loaded residential structures, we estimate total settlement (combined static and seismic) to be on the order of 1 inch with differential settlement of ½-inch over a 40-foot span. This assumes remedial grading measures recommended in Section 3.2 of this report are implemented during grading.

2.6 Shrinkage and Bulking

The shrinkage and bulking (reduction or increase in volume of excavated materials upon recompaction and replacement as fill) varies by soil type, earth unit, and location. The volume changes depend primarily on in-situ density and the maximum dry density of the soil type. We anticipate that the near surface alluvial materials will have 0 to 5 percent shrinkage. The weathered bedrock is anticipated to bulk less than 5 percent. Ground subsidence is estimated to be on the order of 0.1 foot. These values exclude losses due to removal of vegetation and debris and is dependent on the accuracy of the site topographic survey and type of equipment and compaction method used by the contractor.

2.7 Rippability and Generation of Oversize Material

The rippability characteristics of bedrock depend upon the rock type, hardness, the depth and degree of weathering and fracturing, rock structure, equipment size/type used for excavation, and operator experience and skill level. Based on our subsurface exploration, the underlying granitic bedrock is weathered/decomposed to variable depths.

A geophysical refraction survey was performed as part of our study and included two survey lines (SL-1 and SL-2) within the western portion of the site, where grading cuts are anticipated, and the shallowest hard rock was encountered during drilling (see Plate 1). The refraction survey was used to measure compressional (P) wave velocities of the granitic bedrock to assist in rippability assessment. The survey lines were approximately 205 (SL-1) and 235 (SL-2) feet in length to provide a minimum investigation depth of approximately 40 feet bgs. The published Caterpillar Tractor Company bulldozer ripper performance charts, our experience, and the experience of the geophysics subcontractor indicate that granitic rocks with velocities below approximately 5,800 feet/second are "rippable" with some difficulty using a D9R (single shank) bulldozer.

SL-1 and SL-2 encountered weathered rock (p-wave velocity less than 5,800 feet/second) to depths generally ranging from 18 to 35 feet, below which mildly weathered to unweathered rock was encountered. Localized "plateaus" of hard rock were encountered in SL-2, within the vicinity of the existing home and where granitic outcrops were observed in the field. The seismic line velocity profile and accompanying geophysical report are included in Appendix D. Oversize rocks (defined as rock exceeding 12 inches in the maximum diameter) are anticipated to be generated during grading, especially in deeper excavations.

2.8 Percolation Testing

Percolation testing was performed on December 12, 2023, in general accordance with the Riverside County Design Handbook for Low Impact Development Best Management Practices (2011). The Percolation Test method was generally performed as described in the handbook. In order to prevent caving during testing, a 3-inch-diameter perforated pipe was installed in the boring and the annular space was backfilled with 3/4-inch gravel. The borings were presoaked and tested to determine if onsite soils fell under the "Sandy Soil" criteria as defined in the handbook. All percolation borings were considered "Sandy". Test results were tabulated, and final measurements were used to calculate the infiltration rate. The percolation data sheets are provided in Appendix E.

The County Handbook does not include calculation adjustments to account for the presence of the annular backfill material described above which can result in overestimation of infiltration rates. We have used a correction factor to account for the volume loss due to the annular material, based on the porosity, pipe size used, and the boring diameter. The correction factor is noted on the percolation test data sheets.

The calculated infiltration rates are provided below, which include the correction factor discussed above; however, the rates do not include a factor of safety reduction. A discussion of the overall feasibility of stormwater infiltration is provided in Section 3.15. The infiltration test results are representative of the location and depths the tests were performed.

TABLE 1 – PERCOLATION TEST RESULTS

Boring No.	***Tested Depth (Below Ground Surface)***	***Calculated Infiltration Rate (in./hr.)***
P-1	3 to 5	1.5
P-2	2.5 to 5	2.6
P-3	7 to 10	0.3
P-4	4 to 7.25	1.0

2.3 Existing Utilities

No onsite utilities were marked during the DigAlert utility clearance process. We understand that active domestic water and numerous irrigation pipelines service the homes and equestrian areas. Overhead electrical lines are present along Alhambra Avenue, adjacent to the site. Also, based on verbal communication with the current property owner, the existing onsite residences rely on septic systems and leach fields for sewage management. Septic systems and related appurtenances should be anticipated during demolition and grading.

3.0 CONCLUSION AND PRELIMINARY RECOMMENDATIONS

3.1 General Conclusion and Recommendation

Based on our subsurface exploration and evaluation, construction of the proposed residential development, as described herein, is considered geotechnically feasible provided the preliminary recommendations in this report are implemented during design, grading, and construction. The geotechnical consultant should review the WQMP once available. Additional geotechnical exploration and percolation testing may need to be performed during the design phase, depending upon the location/depth of the infiltration device. Also, grading, foundation, utility, structural and wall plans for the project should be reviewed by the geotechnical consultant during the design phase. Updated recommendations should be provided once the project plans are finalized and reviewed by SA GEO and as needed.

The recommendations in this report should be considered minimum and may be superseded by more restrictive requirements of others. In addition to the following recommendations, General Earthwork and Grading Specifications are provided in Appendix G.

3.2 Site Preparation and Earthwork

Site preparation and grading should be performed in accordance with the recommendations included herein and the requirements of the City of Riverside.

3.2.1 Site Demolition and Clearing

Prior to remedial grading, the existing structures/foundations, landscape, and utilities to be abandoned should be demolished. Deleterious materials and debris should be cleared and disposed of offsite. Concrete material may be mixed with onsite soils and placed as compacted fill provided that it is broken into pieces that are smaller than 6 inches in the largest diameter and placed in accordance with Section 3.2.5. Excavations for the removal of existing foundations, utilities and vegetation, including onsite trees, should be observed by the geotechnical consultant. Large roots, highly organic soils, and utility/pipeline debris should be removed and not incorporated into new fills.

Soil that is disturbed as part of excavations or during removal of trees or underground utilities should be evaluated by the geotechnical consultant. Excavations that require backfill should be properly documented and compacted under the observation and testing of the geotechnical consultant in accordance with the recommendations provided in Section 3.2.6.

Based on verbal communication with the current landowner, the existing onsite residences rely on septic tanks and leach fields for sewage management. These features should be anticipated during demolition and grading. Wells (if any), septic tanks, seepage pits, and related appurtenances will need to be properly removed and/or abandoned in accordance with County of Riverside Department of Environmental Health requirements (or other governing agency) and the project environmental consultant's recommendations. Any voids created during demolition and removal should be backfilled with suitable onsite or import materials and compacted in accordance with the recommendations provided in Section 3.2.6.

3.2.2 Protection of Existing Improvements and Utilities

Existing buildings, improvements and utilities adjacent to the site that are to be protected in place should be located and visually marked prior to grading operations. Excavations adjacent to improvements to be protected in-place or any utility easement should be performed with care, so as not to undermine existing foundations or destabilize the adjacent ground.

Stockpiling of soils more than 5 feet in height at or near existing structures and over utility lines should not be allowed. If deep excavations are required, shoring or other special measures (i.e., setback or laybacks) to provide safety and mitigate the potential for lateral/vertical movements may be required.

3.2.3 Remedial Grading Measures

Remedial grading at the site should consist of removal of all undocumented fill materials, unsuitable alluvium, and highly weathered/disturbed bedrock. In general, we recommend that remedial removals (within design fill areas) consist of removal and recompaction of soils in the upper 2.5 to 6 feet. Where deeper unsuitable material is encountered, the removals should be extended to competent alluvium or bedrock. Bedrock is anticipated to be shallow throughout the site; thus, we recommend that removals within the proposed streets and at utility connections be deepened to approximately 1 foot below the lowest pipeline to facilitate utility construction and limit excavation difficulty. The geotechnical consultant should review and approve the removal bottoms prior to fill placement and should provide specific recommendations based on actual conditions, if necessary.

Excavations deeper than 4 feet will need to be laid back a minimum inclination of 1H:1V (horizontal to vertical) or provided with shoring. Shallow, unconfined excavations (4 feet or less) may consist of near-vertical excavation, pending field review of the exposed materials. Excavations should be performed in accordance with Cal/OSHA requirements for Soil Type "B". Locally, Soil Type "C" may be encountered (loose, friable sand) and should be laid back a minimum inclination of 1.5H:1V. The contractor's qualified person should verify compliance with Cal/OSHA requirements. Excavations near existing structures (within a 1H:1V projection) should be provided with shoring that is designed to support the surcharge load of the existing structure. Otherwise, excavations may be performed in sections that are 20 feet long or less. The conditions should be reviewed in the field by the project geotechnical consultant. Additional recommendations will be provided based on the actual conditions encountered during excavation and grading, as needed.

3.2.4 Lot Capping/Overexcavation

The proposed grading is anticipated to expose cut and fill transitions at finish grade within some lots. Lots with design cuts are also anticipated throughout the site but mostly within the western portion of the site. At minimum, we recommend overexcavation of the cut lots in the upper 4 feet and replacement with compacted fill to provide a uniform fill blanket over each lot. Lots with design cuts into bedrock should be overexcavated to depths of 3 to 4 feet. We recommend shallower overexcavation (3 feet) within the back of the lot and deeper overexcavation (4 feet) within the front of the lots. For lots underlain by bedrock it is recommended that the overexcavation bottoms slope a minimum of 1 percent toward deeper fill areas or the adjacent street to limit ponding of nuisance water along the fill/bedrock contact.

In areas where granitic rock is expected within streets or utility trenches/connections, overexcavation is recommended to 1 foot below the deepest utility, to facilitate utility construction and limit excavation difficulty.

Additional lot overexcavation may be recommended during grading in areas where earth materials are highly variable within an individual lot. The conditions should be evaluated by the geotechnical consultant in the field during grading. The overexcavation bottoms should be mapped and approved by the geotechnical consultant.

A disclosure should be provided to homeowners that hard rock may be encountered below compacted fill. A table including a summary of fill thicknesses for each lot may be provided at the completion of grading in order to inform the homeowners of the subsurface soil conditions.

3.2.5 Rippability and Placement of Oversize Material

Granitic bedrock with p-wave velocities greater than 5,800 feet/second are generally regarded as very difficult to rip, marginally rippable, and/or non-rippable (greater than 7,000 to 8,000 feet/second). Velocities below 5,800 feet/second are anticipated to be rippable with some difficulty; however, it should be noted that rock characteristics, fracture spacing and orientation, and skill and experience level of operators play a significant role in determining rippability. These velocity thresholds for rippability should be scaled downward for trenching operations.

Seismic Lines 1 and 2 (SL-1 and SL-2) encountered weathered rock (p-wave velocity less than 5,800 feet/second) to depths ranging from 18 to 35 feet, below which mildly weathered to unweathered rock was encountered. Localized "plateaus" of weathered to mildly weathered rock (velocity of 5,000 to 5,800 feet/second) were encountered in SL-2, within 10 feet of existing grade. Localized hard zones and/or contact irregularities within the weathered rock zone, if encountered, will require additional excavation and processing effort. We anticipate bedrock to generally be rippable to the anticipated design/remedial grading and deepest utility lines with heavy duty earthmoving equipment (i.e., Caterpillar D-9 bulldozer, Caterpillar 330 excavator); however, this will need to be reviewed by the geotechnical consultant once grading and utility plans are available. Blasting is not anticipated to be required.

Grading cuts within bedrock are anticipated to produce some oversize rock (greater than 12 inches in size). If grading equipment cannot break down the material into smaller pieces, oversize rock will need to be disposed of in deeper fill areas. Oversize rocks may be placed in fills deeper than 10 feet below design grades. The grading contractor should consider performing the remedial grading within design fill areas to facilitate placement of oversize rocks. Rocks smaller than 6 inches may be placed in the upper 4 feet of each lot. Rocks larger than 6 inches and smaller than 12 inches in the largest dimension may be placed at depth between 4 and 10 feet below design finish grades or 1 foot below the deepest utility line, whichever is deeper. Rocks greater than 3 inches in dimension are typically not suitable for backfill of utility trench excavations (unless accepted by the agency/utility owner). Thus, we recommend that the grading contractor consider placement of rocks larger than 3 inches in dimension outside of proposed utility alignments.

The Grading and Earthwork Specifications in Appendix G include details for placement of oversize rock.

3.2.6 Fill Placement

Upon the completion of remedial grading measures, the approved removal bottoms should be scarified a minimum of 6 inches. The removal bottoms and fill materials should be compacted to at least 90 percent of maximum dry density, as determined by ASTM Test Method D1557. Fill materials should be placed in loose lifts no thicker than 8 inches.

Fill materials should be relatively free of deleterious material. The existing undocumented fill material, native alluvial soils, and bedrock are considered suitable for re-use as compacted fill provided any deleterious material is removed and the recommendations provided in the prior sections are followed. Concrete material may be mixed with onsite soils and placed as compacted fill provided it is broken into pieces that are smaller than 6 inches in the largest diameter and placed in accordance with Section 3.2.5. Placement of concrete as compacted fill should be approved by the project environmental consultant.

We recommend that the moisture content of new compacted fill soils be above the optimum moisture content but should be within the compactable moisture range. Appropriate equipment should be used and other measures (e.g., mixing, stockpiling, drying) may be needed to achieve the uniform and correct moisture content for placement of the fill. If the soils become extremely wet, special measures for mixing and drying may be required that will need to be determined based on the actual field conditions.

3.2.7 Import

The geotechnical consultant should evaluate and accept any import soils prior to transportation to the subject site. We recommend that import soils have similar engineering properties as onsite soils. At minimum, the import materials should have Expansion Index of less than 50, Plasticity Index of less than 15, fines content (passing Sieve 200) of less than 50 percent, and negligible soluble sulfate content.

3.3 Settlement Potential

The amount of settlement will depend upon the type of foundation(s) selected and future loading by additional fill and structures. Based on our subsurface exploration and analysis, considering the remedial grading recommendations provided in this report are implemented during grading, and the anticipated structural loads typically associated with the proposed residential units, we estimate a total settlement of 1 inch and a differential settlement of ½-inch over a span of 40-foot.

SA GEO should be provided with the foundation plans and structural loads, once available, to further evaluate the potential for post-construction settlement of the proposed buildings and associated improvements. Additional laboratory testing will also be performed at the completion of grading. The parameters provided herein will then be confirmed/updated based on the planned foundation layout and loads, and additional testing/analysis.

3.4 Foundation Design

The slab and foundations should be designed by the project structural engineer based on the proposed structure type and the anticipated loading conditions. Onsite soils are anticipated to have "Very Low" to "Low" expansion potential (EI>20) at the completion of grading. Thus, they are subject to climatic and landscape moisture fluctuations and should be designed in accordance with the requirements of the 2022 California Building Code. The following foundation recommendations are provided with the assumption that the recommendations included in Section 3.2 of this report are implemented during grading of the site.

The recommended net allowable bearing capacity for continuous and isolated footings may be calculated based on the following equation:

$q_{all} = 600\ D + 200\ B + 1{,}000$ (but not to exceed 4,000 psf)

where:
D = embedment depth of footing, in feet
B = width of footing, in feet

Also, the following parameters may be used for design of foundation and slabs:

- Soil unit weight = 120 pcf
- Soil internal friction angle = 28 degrees
- Coefficient of Friction = 0.35
- Subgrade modulus (k) of 100 pci (corrected for large slabs)
- Soil elastic modulus (Es) of 2,000 psi

The dead load of concrete below adjacent grades (buried concrete foundations) may be neglected. The allowable bearing pressure and friction coefficient may be increased by one-third for wind and seismic loading.

We recommend that strip and isolated footings for the buildings have a minimum embedment depth of 12 inches below the lowest adjacent grade. Continuous footings should be at least 12 inches wide and isolated column footings should be at least 24 inches wide. The footings of freestanding and isolated structures, such as walls and pilasters, should have a minimum embedment depth of 18 inches into approved soils.

The following table provides our general guidelines and preliminary recommendations for design of post-tensioned foundations and slabs on expansive soil in accordance with the 2022 California Building Code (CBC) and Post-Tension Institute (PTI) DC 10.5 Edition provisions.

GEOTECHNICAL GUIDELINES FOR DESIGN OF POST-TENSIONED SLABS*

Parameter	*Recommendation*
Center Lift	
* Edge Moisture Variation Distance, e_m	9.00 feet
* Center Lift, y_m	0.35 inches
Edge Lift	
* Edge Moisture Variation Distance, e_m	5.0 feet
* Edge Lift, y_m	0.50 inch
Presaturation, as needed, to obtain the minimum moisture down to the minimum depth	1.1 x optimum down to 6 inches
****Based on method in CBC 2022***	

For post-tensioned slabs, we recommend that the slabs have a thickened edge such that the slab is embedded a minimum of 12 inches below the lowest adjacent grade. The thickened edge should be tapered and have a minimum width of 12 inches.

In addition, as indicated in the DC 10.5 Edition of PTI, shape factor calculations should be performed by the project structural engineer in order to determine if strengthening/modification of foundations are necessary. Per PTI guidelines, the modifications to the foundations design should be considered if the shape factor (ratio of square of foundation perimeter over foundation area) exceeds 24.

If non-post-tensioned slabs-on-grade and foundations are considered at the site in accordance with Wire Reinforcement Institute (WRI) method (per the 2022 CBC), an effective Plasticity Index of 15 or less is considered appropriate for the upper 15 feet of soil materials. For non-post-tensioned slabs, we recommend a minimum embedment of 12 inches below the lowest adjacent grade for the perimeter footings. Also, the upper 6 inches of subgrade soil should be pre-saturated to 110 percent of optimum moisture content prior to placement of moisture barrier and concrete.

The foundations and slabs should be designed to tolerate the total and differential settlements discussed in Section 3.3 of these recommendations.

For the design of pole-type foundations (i.e., light poles, shade structures, etc.), an allowable soil-bearing pressure (S_1) of 340 psf/ft may be used for Equation 18-1 (the "pole" equation) of the 2022 CBC, Section 1807.3.2.1, to determine the depth of embedment for the footings, considering level ground conditions. The equation is applicable for designed embedment depths of less than 12 feet for the purpose of computing lateral pressure. Also, for vertical loads on pole-type foundations, an allowable skin friction of 250 pounds per square foot may be used. For cast-in-place pole-type foundations, the vertical end bearing pressure should be neglected.

3.5 Retaining Wall Design and Lateral Earth Pressures

Recommendations for lateral earth pressures for permanent retaining walls and structures with approved onsite drained soils and above groundwater table are as follows:

Conditions	*Level (pcf)*	*2:1 Sloping*
Active	43	68
At-Rest	63	90
Passive	340	160 (sloping down)

The parameters provided above are based on a soil internal friction angle of 28 degrees and soil unit weight of 120 pcf.

To design an unrestrained retaining wall, such as a cantilever wall, the active earth pressure may be used. For a restrained retaining wall, the at-rest pressure should be used. Passive pressure is used to compute lateral soils resistance developed against lateral structural movement. The passive pressures provided above may be increased by one-third for wind and seismic loads. Passive resistance is taken into account only if it is ensured that the soil against embedded structure will remain intact with time. Future landscaping/planting and improvements adjacent to the retaining walls should also be taken into account in the design of the retaining walls. Excessive soil disturbance, trenches (excavation and backfill), future landscaping adjacent to footings and over-saturation can adversely impact retaining structures and result in reduced lateral resistance.

For sliding resistance, a friction coefficient of 0.35 may be used at the concrete and soil interface. The coefficient of friction may be increased by one-third for wind and seismic loading. The retaining walls may also need to be designed for additional lateral loads if other structures or walls are planned within a 1H:1V projection.

The seismic lateral earth pressure for walls retaining more than 6 feet of soil may be estimated to be an additional 18 pcf for active and at-rest conditions. The earthquake soil pressure has a triangular distribution and is added to the static pressures. For the active and at-rest conditions, the additional earthquake loading is zero at the top and maximum at the base. The seismic lateral earth pressure does not apply to walls retaining less than, or equal to, 6 feet of soil (2022 CBC Section 1803.5.12).

Drainage behind walls retaining more than 30 inches of soil should also be provided in accordance with the attached Figure 4. Specific drainage connections, outlets and avoiding open joints should be considered for the retaining wall design.

3.6 Seismic Design Parameters

The following table summarizes the seismic design criteria for the subject site. The seismic design parameters are developed in accordance with ASCE 7-16 and 2022 CBC. Please note that, considering the proposed structures and anticipated structural periods, site-specific ground-motion hazard analysis was not performed for the site. The seismic response coefficient, Cs, should be determined per the parameters provided below and using equation 12.8-2 of ASCE 7-16.

Selected Seismic Design Parameters from 2022 CBC/ASCE 7-16	*Seismic Design Values*	*Reference*
Latitude	33.6570 North	
Longitude	-117.1996 West	
Controlling Seismic Source	San Jacinto	USGS, 2023
Site Class per Table 20.3-1 of ASCE 7-16	C	
Spectral Acceleration for Short Periods (Ss)	1.5 g	SEA/OSHPD, 2023
Spectral Accelerations for 1-Second Periods (S_1)	0.57 g	SEA/OSHPD, 2023
Site Coefficient F_a, Table 11.4-1 of ASCE 7-16	1.2	SEA/OSHPD, 2023
Site Coefficient F_v, Table 11.4-2 of ASCE 7-16	1.43	SEA/OSHPD, 2023
Design Spectral Response Acceleration at Short Periods (S_{DS}) from Equation 11.4-4 of ASCE 7-16	1.2 g	SEA/OSHPD, 2023
Design Spectral Response Acceleration at 1-Second Period (S_{D1}) from Equation 11.4-4 of ASCE 7-16	0.543 g	SEA/OSHPD, 2023
T_S, S_{D1} /S_{DS} 11.4.6 of ASCE 7-16	0.45 sec	
T_L, Long-Period Transition Period	8 sec	SEA/OSHPD, 2023
Peak Ground Acceleration Corrected for Site Class Effects (PGA_M) from Equation 11.8-1 of ASCE 7-16	0.618 g	SEA/OSHPD, 2023
Seismic Design Category, Section 11.6 of ASCE 7-16	D	SEA/OSHPD, 2023

3.7 Slope Setback

Footings for structures located above descending slopes should be set back from the slope face in accordance with the minimum requirements of the City of Riverside and section 1808.7.1 of the 2022 California Building Code, whichever is greater. The setback distance is measured from the outside edge of the footing bottom along a horizontal line to the face of the slope. The tables below summarize the minimum setback criteria for structures above descending slopes:

Structural Setback Requirements

Case A – Building and Retaining Wall Footings Above Descending Slopes	
Slope Height [H] (feet)	*Minimum Setback from Slope face (feet)*
Less than 10	5
10 to 20	½ * H
20 to 30	10
Greater than 30	⅓ * H (maximum of 40')

Case B – Freestanding Wall Footings Above Descending Slopes	
Slope Height [H] (feet)	*Minimum Setback from Slope face (feet)*
Less than 10	5
10 to 20	½ * H
Greater than 20	Maximum of 10

For freestanding walls and other structures that are sensitive to lateral movement (e.g., smooth stucco finish, glass screens, etc.), SA GEO recommends that the structural setback requirements in accordance with Case A above be followed or that additional design measures be used to help control the potential for cracking and displacements. Otherwise, typical freestanding walls may have a setback in accordance with Case B.

3.8 Corrosivity

Based on prior laboratory testing, soluble sulfate exposure in the onsite soils may be classified as "S0" per Table 19.3.1.1 of ACI-318-14. Structural concrete elements in contact with soil include footings and building slabs-on-grade. The flatwork and sidewalk concrete are typically not considered structural elements. Concrete mix for structural elements should be based on the "S0" soluble sulfate exposure class of Table 19.3.2.1 in ACI-318-14. Other American Concrete Institute (ACI) guidelines for structural concrete are recommended. Also, onsite soils are anticipated to be moderately corrosive to metals.

3.9 Expansion Potential

At the completion of grading, we anticipate that onsite soils will have "Very Low" to "Low" expansion potential. The geotechnical recommendations provided in this report including the design parameters for foundations, slab-on-grade and flatwork improvement should be implemented during design and construction.

Homeowners and their design/construction team should be familiar with the recommendations in this report as well as principles described in a useful reference published by the California Geotechnical Engineers Association (CalGeo), titled, "Coexisting with Expansive Soil: An Informational Guide for Homeowners." This free booklet can be downloaded at www.calgeo.org.

3.10 Interior Slab Moisture Mitigation

In addition to geotechnical and structural considerations, the project owner should also consider interior moisture mitigation when designing and constructing slabs-on-grade.

The intended use of the interior space, type of flooring, and type of goods in contact with the floor may dictate the need for, and design of, measures to mitigate potential effects of moisture emission from and/or moisture vapor transmission through the slab. Typically, for human occupied structures, a vapor retarder or barrier is recommended under the slab to help mitigate moisture transmission through slabs. The most recent guidelines by the American Concrete Institute (ACI 302.1R-04) suggest that the vapor retarder be placed directly under the slab (no sand layer). However, the location of the vapor retarder may also be subject to the builder's past successful practice. Placement of 1 or 2 inches of sand over the moisture retardant has been common practice by builders in southern California. Specifying the strength of the retarder to resist puncture and its permeance rating is important. These qualities are not necessarily a function of the retarder thickness. A minimum of 10-mil is typical but some materials, such as 10-mil polyethylene ("Visqueen"), may not meet the desired standards for toughness and permeance.

Vapor retarders, when used, should be installed in accordance with standards such as ASTM E 1643 and/or those specified by the manufacturer.

Concrete mix design and curing are also significant factors in mitigating slab moisture problems. Concrete with lower water/cement ratios results in denser, less permeable slabs that also "dry" faster with regard to when flooring can be installed (reduced moisture emission quantities and rates). Rewetting of the slab following curing should be avoided since it can result in additional drying time prior to flooring installation. Proper concrete slab testing prior to flooring installation is also important.

Concrete mix design, the type and location of the vapor retarder should be determined in coordination with all parties involved in the finished product, including the project owner, architect, structural engineer, geotechnical consultant, concrete subcontractors, and flooring subcontractors.

3.11 Exterior Concrete

The driveway, patio slabs and other flatwork elements should be at least 4 inches thick. Considering that the onsite soils are anticipated to have "Very Low" to "Low" expansion potential at the completion of grading, reinforcement of concrete is not necessary from a geotechnical standpoint; however, reinforcement will reduce the potential for concrete cracking as a result of shrinkage. If reinforcement is used, we recommend that No. 3 bars be placed at 24 inches on center both ways. Equivalent wire mesh reinforcement may also be used. Concrete slabs should be provided with construction or weakened plane control joints at a maximum spacing of 10 feet. The control joints should have a thickness that is ¼ of the total concrete thickness. The subgrade soils in the upper 6 inches should be presaturated to 110 percent of optimum moisture content.

For exterior slabs, the use of a granular sublayer is primarily intended to facilitate presaturation and subsequent construction by providing a better working surface over the saturated soil. It also helps retain the added moisture in the native soil in the event that the slab is not placed immediately. Where these factors are not significant, the layer may be omitted. If used, we recommend placement of 2 to 4 inches of granular material over subgrade soils.

Exterior concrete elements such as curb and gutter, driveways, sidewalks and patios are susceptible to lifting and cracking when constructed over expansive soils. With expansive soils, the impacts to flatwork/hardscape can be significant, generally requiring removal and replacement of the affected improvements. Please also note that reducing concrete problems is often a function of proper slab design, concrete mix design, placement, and curing/finishing practices. Adherence to guidelines of the American Concrete Institute (ACI) is recommended. Also, the amount of post-construction watering, or lack thereof, can have a very significant impact on the adjacent concrete flatwork.

On projects with expansive soils, additional measures such as thickened concrete edges/footings, subdrains and/or moisture barriers should be considered where planter or natural areas with irrigation are located adjacent to the concrete improvements. Design and maintenance of proper surface drainage is also very important.

For **vehicular** traffic, at minimum, a pavement section consisting of 6 inches of PCC over subgrade compacted to 95 percent relative compaction should be used. However, the recommended section should be evaluated during the design and grading phase based on the anticipated traffic loads/frequency of use and additional R-value testing.

The above recommendations typically are not applied to curb and gutter but should be considered in areas with highly expansive soils.

3.12 Preliminary Asphalt Concrete Pavement Design

Final structural pavement sections should be based on R-value testing after the completion of grading and in accordance with City of Riverside requirements. The laboratory test results on a sample collected in the upper 5 feet shows an R-value of 18. Using a design R-value of 15 and estimated traffic indices (TIs), we recommend the following preliminary pavement sections:

Street Location	*Estimated TIs*	*Pavement Section*
Parking Stalls	TI – 4.0	0.25' AC / 0.35' AB
General Drives	TI – 5.5	0.35' AC / 0.65' AB
Driveways with Heavy Truck Traffic	TI – 7.0	0.35' AC / 1.10' AB or 0.45' AC / 0.85'
AC = Asphalt Concrete, AB = Aggregate Base		

Please note that for two-stage paving operations, we recommend that the final AC cap be a minimum of 0.10 foot thick and the base AC course have a minimum thickness of 0.25 foot.

Asphalt concrete pavement should be placed in accordance with the requirements of Sections 301 and 302 of the Standard Specifications of Public Works Construction (the Greenbook). Prior to construction of pavement sections, the subgrade soils should be scarified to a minimum depth of 6 inches, moisture-conditioned as needed, and recompacted in-place to a minimum of 90 percent relative compaction (per ASTM D1557). Subgrade should be firm prior to AB placement.

AB materials can be crushed aggregate base or crushed miscellaneous base in accordance with the Greenbook (Section 200-2). The materials should be free of any deleterious materials. Aggregate base materials should be placed in 6- to 8-inch-thick loose lifts, moisture-conditioned as necessary, and compacted to a minimum of 95 percent relative compaction (per ASTM D1557). Asphalt concrete should also be compacted to a minimum relative compaction of 95 percent.

Unpaved median and parkway areas should also be provided with vertical moisture barriers.

3.13 Trench Excavation and Backfill

Excavations should be performed in accordance with the requirements set forth by Cal/OSHA Excavation Safety Regulations (Construction Safety Orders, Section 1504, 1539 through 1547, Title 8, California Code of Regulations). In general, onsite soils may be classified as Type "B" soils for excavations into compacted fill, older alluvium, or bedrock. Locally, Type "C" soils (loose, friable sand, bedrock fractures) may also be encountered. Cal/OSHA regulations indicate that, for workmen in confined conditions, the steepest allowable slopes in Type "B" and "C" soils are 1H:1V and 1.5H:1V, respectively, for excavations less than 20 feet deep. Where there is no room for these layback slopes, we anticipate that shoring will be necessary. Adequate shoring/shields should be provided, as deemed necessary. Excavations should be reviewed periodically by the contractor's qualified person to confirm compliance with Cal/OSHA requirements.

Utility trench backfill should be in accordance with City of Riverside and/or the governing jurisdiction's specifications. Please note that some agencies require select material for backfilling of trenches and therefore import soils may be required. Native onsite soils are generally considered suitable for use as trench backfill from a geotechnical viewpoint provided that they are approved by the governing agency. Native backfill materials should be compacted to a minimum of 90 percent relative compaction (per ASTM D1557). Rocks greater than 3 inches in largest diameter should generally not be used as trench backfill unless approved by the agency and geotechnical consultant of record. Excavation and backfilling of HDPE pipes (if any) should be in accordance with the manufacturer's requirement and the Greenbook. Select granular backfill (i.e., clean sand with SE 30 or better) may be used in lieu of native soils but should also be compacted or densified with water jetting and flooding.

Trenches excavated next to structures and foundations should also be properly backfilled and compacted to provide full lateral support and reduce settlement potential.

3.14 Groundwater

Groundwater was encountered in one boring (H-5) at a depth of 26.5 feet below ground surface. Groundwater levels may fluctuate on an annual and seasonal basis, based on variations in future residential irrigation and rainfall amounts. Locally saturated soils and/or perched water may be encountered during grading and construction of utility lines and during excavations by future homeowners. In general, groundwater is anticipated to remain more than 10 feet below design grades upon the completion of grading; however, perched water should be anticipated within weathered bedrock and/or at the bedrock/alluvium/fill contact.

3.15 Stormwater Infiltration

Based on our onsite percolation testing, storm water infiltration is considered locally feasible at the tested locations, between 3 and 7 feet bgs. Additional infiltration testing may need to be conducted onsite once a water quality management plan has been prepared in order to evaluate the infiltration rates at the actual location and depth of the proposed device(s). For preliminary design purposes, a design infiltration rate of 0.4 inches per hour may be used for devices that are 3 to 7 feet deep in the vicinity of percolation test borings (P-1 through P-4). For depths between 7 and 10 feet a rate of 0.1 inches per hour may be used. These rates include a minimum factor-of-safety of 3, in accordance with the 2011 Riverside County Design Handbook for Low Impact Development Best Management Practices.

Infiltration systems should maintain a minimum 5-foot vertical separation from bedrock/confining layers. The depth to granitic bedrock (Kgr) is noted on Plate 1 (Geotechnical Map). Infiltration systems should also maintain a minimum 10-foot vertical separation from groundwater. Considering these constraints and the fine-grained nature of the soils at depths below 10 feet, the systems should not be deeper than 10 feet below existing grades.

Infiltration systems should be designed and constructed in accordance with County/City of Riverside guidelines. Infiltration systems should have a minimum setback of 15 feet from proposed residential structures. The subgrade soil utilized as the infiltration surface should be reviewed and approved by the geotechnical consultant prior to installation of any infiltration devices. Special care should be taken to limit disturbance to native soils used as the infiltration surface. Proper maintenance will also be required to extend the operational life and reduce siltation or reduction in infiltration performance. All infiltration devices should be provided with an overflow system.

3.16 Surface Drainage and Irrigation

Maintaining adequate surface drainage, proper disposal of run-off water, and control of irrigation will help reduce the potential for future moisture-related problems and differential movements from soil heave/settlement.

Surface drainage should be carefully taken into consideration during grading, landscaping, and building construction. Positive surface drainage should be provided to direct surface water away from structures and slopes and toward the street or suitable drainage devices. Ponding of water adjacent to the structures should not be allowed. Buildings should have roof gutter systems and the run-off should be directed to parking lot/street gutters by area drainpipes or by sheet flow over paved areas. Paved areas should be provided with adequate drainage devices, gradients, and curbing to prevent run-off flowing from paved areas onto adjacent unpaved areas.

Considering the climatic conditions in southern California and the relatively low expansion potential of onsite soils, a two-percent slope away from structures should be provided and is in substantial compliance with the 2022 CBC. Also, swales with one-percent slopes are acceptable from a geotechnical standpoint and are common practice in this locale.

Construction of planter areas immediately adjacent to structures should be avoided if possible. If planter boxes are constructed adjacent to or near buildings, the planters should be provided with controls to prevent excessive penetration of the irrigation water into the foundation and flatwork subgrades. Provisions should be made to drain excess irrigation water from the planters without saturating the subgrade below or adjacent to the planters. Raised planter boxes may be drained with weepholes. Deep planters (such as palm tree planters) should be drained with below-ground, water-tight drainage lines connected to a suitable outlet. Moisture barriers should also be considered.

It is also important to maintain a consistent level of soil moisture, not allowing the subgrade soils to become overly dry or overly wet. Properly designed landscaping and irrigation systems can help in that regard.

3.17 Maintenance of Graded Slopes

To reduce the erosion and slumping potential of graded slopes, all permanent manufactured slopes should be protected from erosion by planting with appropriate vegetation, or suitable erosion protection should be applied as soon as is practical. Proper drainage should be designed and maintained to collect surface waters and direct them away from slopes. A rodent-control program should also be established and maintained to reduce the potential for damage related to burrowing. In addition, the design and construction of improvements and landscaping should also provide appropriate drainage measures.

3.18 Additional Subsurface Exploration and Laboratory Testing

Additional subsurface exploration and laboratory testing may be necessary during the design phase of the project for determination/confirmation of the percolation rates, depending on the location and depth of the proposed system(s). Also, additional laboratory testing should be performed during and upon the completion of grading to confirm/update the design parameters provided herein.

3.19 Review of Future Plans

The project grading, foundation, street improvement, wall, water quality management, and landscape plans should be reviewed and accepted by the geotechnical consultant prior to grading and construction. Additional recommendations should be provided upon the review of the project plans and as needed.

3.20 Observation and Testing during Grading and Construction

Geotechnical observation and testing should be performed by SA GEO during the following phases of grading and construction:

- During site demolition, preparation and clearing;
- During excavations performed for remedial grading and to relocate or remove existing underground improvements;
- During removal/abandonment of cesspits, septic tanks, wells, etc.;
- During earthwork, including observation and acceptance of remedial removal and overexcavation bottoms and fill placement, including import material (if any);
- Following the completion of grading, in order to verify soil properties for foundations, slab-on-grade and pavement areas;
- Upon completion of any foundation or structural excavation, prior to pouring concrete;
- During slab and flatwork subgrade preparation including pre-saturation, prior to pouring of concrete;
- During placement of backfill for utility trenches;
- During construction of infiltration/stormwater filtration systems;
- During placement of backfill for retaining structures;
- During installation and backfill of subdrainage systems; and
- When any unusual soil conditions are encountered.

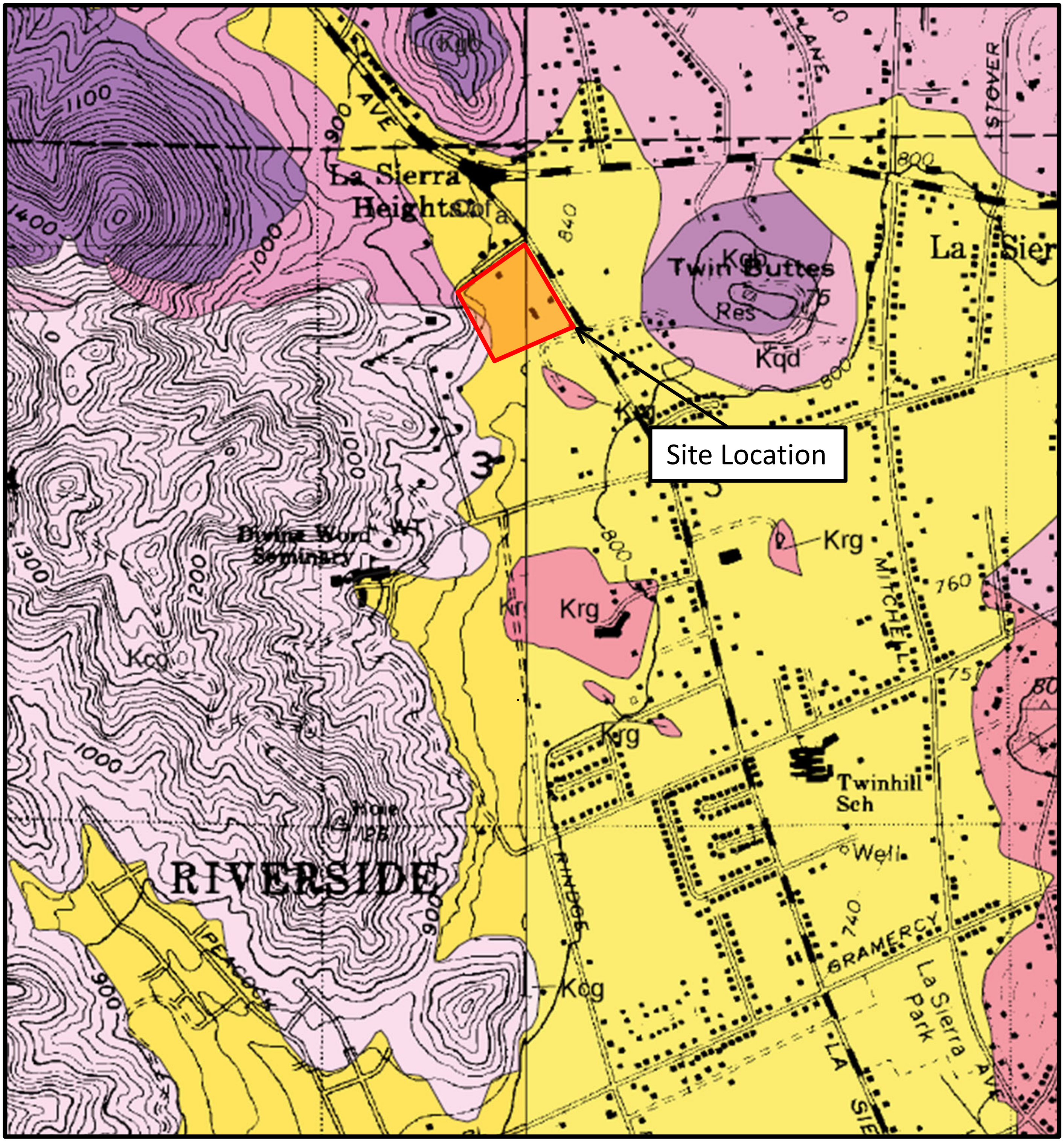
4.0 LIMITATIONS

This report has been prepared for the exclusive use of our client, Meritage Homes, within the scope of services requested for the subject property described herein. This report or its contents should not be used or relied upon for other projects or purposes, or by other parties without the acknowledgement of SA GEO and the consultation of a geotechnical professional. The means and methods used by SA GEO for this study are based on local geotechnical standards of practice, care, and requirements of governing agencies. No warranty or guarantee, expressed or implied, is given.

Our findings, conclusions, and recommendations are professional opinions based on interpretations and inferences made from geologic and engineering data from specific locations and depths, observed or collected at a given time. By nature, geologic conditions can vary from point to point, can be very different in-between exploration points, and can also change over time. Our conclusions and recommendations are, by nature, preliminary and subject to verification and/or modification during grading and construction when more subsurface data is exposed.

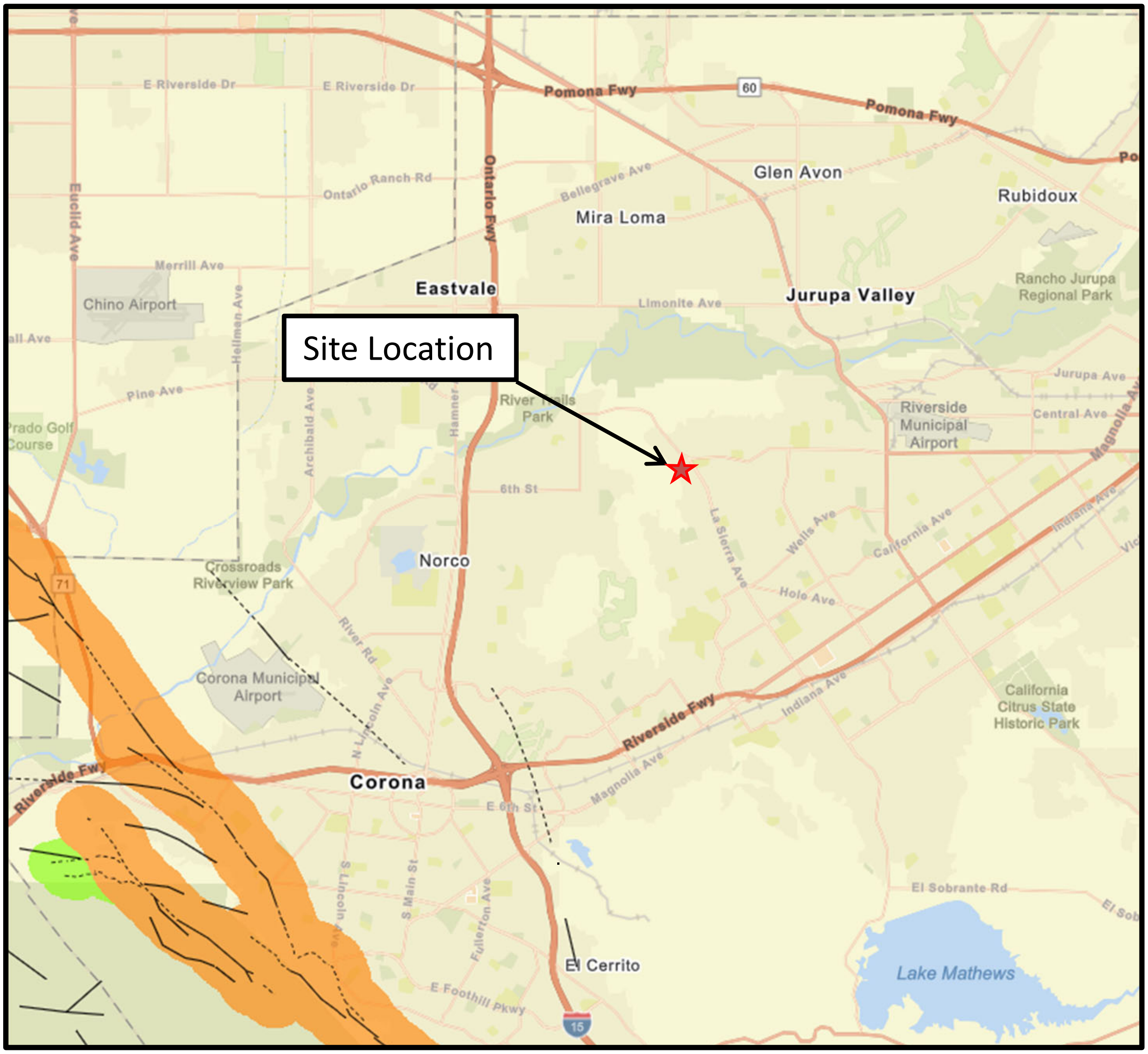
Source: Google Earth

Site Location Map		
Meritage Homes Proposed Residential Development La Sierra Avenue/Alhambra Avenue Riverside, California	Project Number: 23145-01 Date: December 22, 2023 Figure 1	S/A



Source: Geologic Map of the Corona North and Riverside West 7.5' Quadrangles, (USGS, 2001 & 2002)

Regional Geologic Map	
Meritage Homes Proposed Residential Development La Sierra Avenue/Alhambra Avenue Riverside, California	Project Number: 23145-01 Date: December 22, 2023 Figure 2



Source: Fault Activity Map of California (Jennings and Bryant, 2010)

Holocene fault displacement (during past 11,700 years) without historic record. Geomorphic evidence for Holocene faulting includes sag ponds, scarps showing little erosion, or the following features in Holocene age deposits: offset stream courses, linear scarps, shutter ridges, and triangular faceted spurs. Recency of faulting offshore is based on the interpreted age of the youngest strata displaced by faulting.

Late Quaternary fault displacement (during past 700,000 years). Geomorphic evidence similar to that described for Holocene faults except features are less distinct. Faulting may be younger, but lack of younger overlying deposits precludes more accurate age classification.

Quaternary fault (age undifferentiated). Most faults of this category show evidence of displacement sometime during the past 1.6 million years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age. Unnumbered Quaternary faults were based on Fault Map of California, 1975. See Bulletin 201, Appendix D for source data.

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement. Some faults are shown in this category because the source of mapping used was of reconnaissnce nature, or was not done with the object of dating fault displacements. Faults in this category are not necessarily inactive.

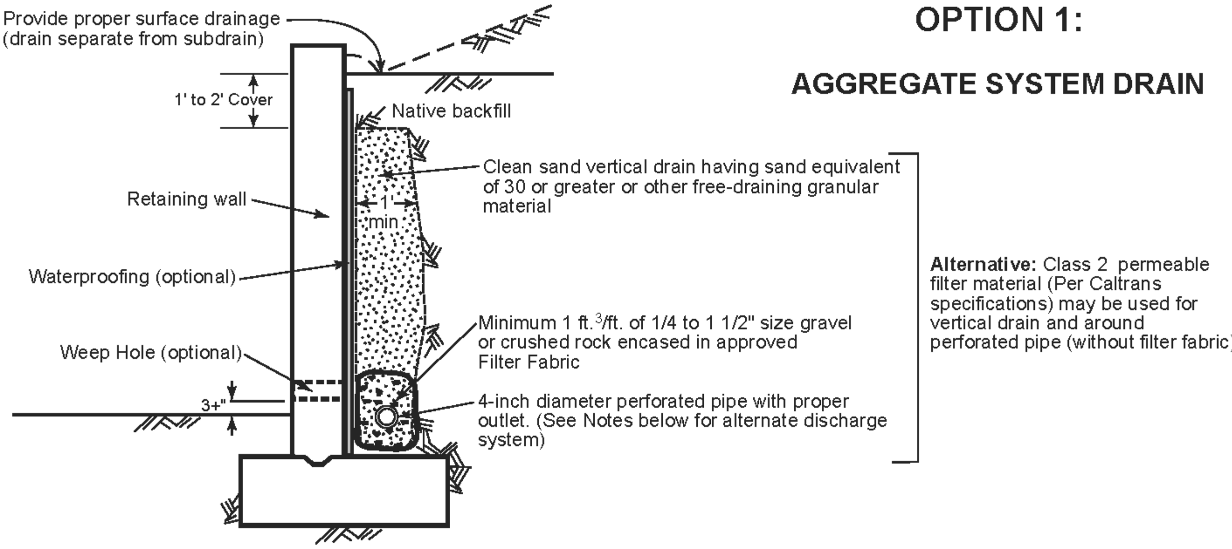
Regional Fault Map

Meritage Homes
Proposed Residential Development
La Sierra Avenue/Alhambra Avenue
Riverside, California

Project Number: 23145-01
Date: December 22, 2023
Figure 3

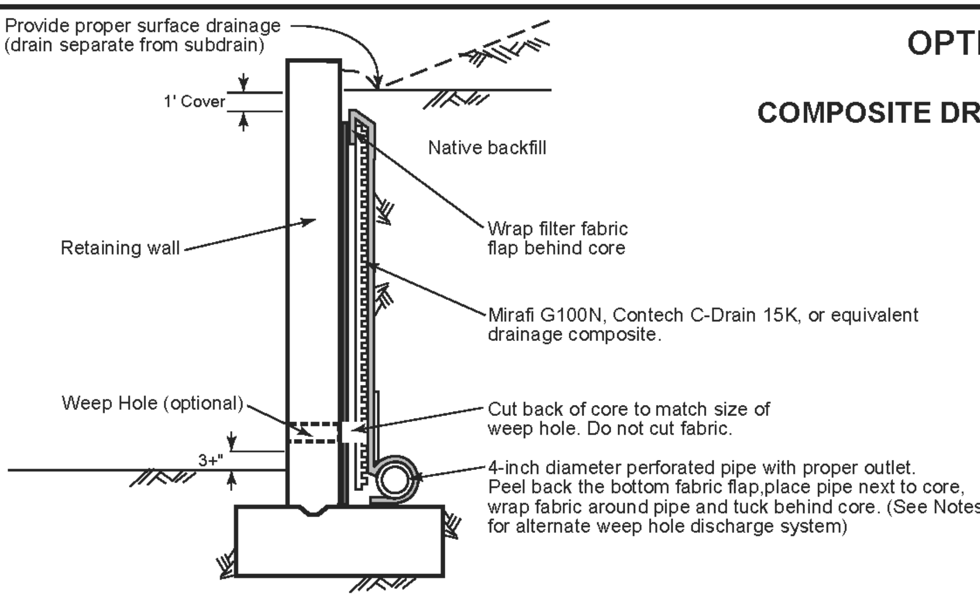
OPTION 1:

AGGREGATE SYSTEM DRAIN



OPTION 2:

COMPOSITE DRAINAGE SYSTEM



NOTES:

1. PIPE TYPE SHOULD BE PVC OR ABS, SCHEDULE 40 OR SDR35 SATISFYING THE REQUIREMENTS OF ASTM TEST STANDARD D1527, D1785, D2751 , OR D3034.
2. FILTER FABRIC SHALL BE APPROVED PERMEABLE NON-WOVEN POLYESTER, NYLON, OR POLYPROPYLENE MATERIAL.
3. DRAIN PIPE SHOULD HAVE A GRADIENT OF 1 PERCENT MINIMUM.
4. WATERPROOFING MEMBRANE MAY BE REQUIRED FOR A SPECIFIC RETAINING WALL (SUCH AS A STUCCO OR BASEMENT WALL).
5. WEEP HOLES MAY BE PROVIDED FOR LOW RETAINING WALLS (LESS THAN 3 FEET IN HEIGHT) IN LIEU OF A VERTICAL DRAIN AND PIPE AND WHERE POTENTIAL WATER FROM BEHIND THE RETAINING WALL WILL NOT CREATE A NUISANCE WATER CONDITION. IF EXPOSURE IS NOT PERMITTED, A PROPER SUBDRAIN OUTLET SYSTEM SHOULD BE PROVIDED.
6. IF EXPOSURE IS PERMITTED, WEEP HOLES SHOULD BE 2-INCH MINIMUM DIAMETER AND PROVIDED AT 25-FOOT MAXIMUM SPACING ALONG WALL. WEEP HOLES SHOULD BE LOCATED 3+ INCHES ABOVE FINISHED GRADE.
7. SCREENING SUCH AS WITH A FILTER FABRIC SHOULD BE PROVIDED FOR WEEP HOLES/OPEN JOINTS TO PREVENT EARTH MATERIALS FROM ENTERING THE HOLES/JOINTS.
8. OPEN VERTICAL MASONRY JOINTS (I.E., OMIT MORTAR FROM JOINTS OF FIRST COURSE ABOVE FINISHED GRADE) AT 32-INCH MAXIMUM INTERVALS MAY BE SUBSTITUTED FOR WEEP HOLES.
9 THE GEOTECHNICAL CONSULTANT MAY PROVIDE ADDITIONAL RECOMMENDATIONS FOR RETAINING WALLS DESIGNED FOR SELECT SAND BACKFILL.

Retaining Wall Drainage Detail

Figure 4

Appendix A

APPENDIX A

REFERENCES

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Riverside County Flood Control (RCFC), 2011, Design Handbook for Low Impact Development Best Management Practices.

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Structural Engineers Association/Office of Statewide Health Planning and Development (SEA/OSHPD), 2023, U.S. Seismic Design Maps, web site address: https://seismicmaps.org/; Date Accessed: December 13, 2023.

U.S. Geological Survey (USGS), 2001, Geologic Map of the Riverside West 7.5’ Quadrangle, Riverside County, California, Version 1.0, Open File Report 01-451, 1:24,000 Scale.

APPENDIX A (Cont'd)

REFERENCES

U.S. Geological Survey (USGS), 2002, Geologic Map of the Corona North 7.5' Quadrangle, Riverside and San Bernardino Counties, California, Version 1.0, Open File Report 02-22, 1:24,000 Scale.

U.S. Geological Survey (USGS), 2023, Unified Hazard Tool, NSHM 2014 Dynamic Deaggregation Program; web site address: https://earthquake.usgs.gov/hazards/interactive/; Date Accessed: December 13, 2023.

Appendix B

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	*GRAVEL AND GRAVELLY SOILS* MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	*CLEAN GRAVELS* (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	*CLEAN SANDS* (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND - SILT MIXTURES
			SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	*SILTS AND CLAYS*	LIQUID LIMIT LESS THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Dual symbols are used to indicate gravels or sand with 5-12% fines and soils with fines classifying as CL-ML. Symbols separated by a slash indicate borderline soil classifications.

Sampler and Symbol Descriptions

- ■ Modified California sample (D-#)
- ◪ Standard Penetration Test (S-#)
- ▯ Shelby tube sample (T-#)
- ▩ Large bulk sample (B-#)
- ☒ Small bulk sample (SB-#)
- ▽ Approximate depth of groundwater during drilling
- ▼ Approximate depth of static groundwater

Note: Number of blows required to advance driven sample 12 inches (or length noted).

Laboratory and Field Test Abbreviations

AL	Atterberg limits (plasticity)
CC	Chemical Testing incl. Soluble Sulfate
CN	Consolidation
DS	Direct Shear
EI	Expansion Index
GS	Grain Size Analysis (Sieve, Hydro. and/or -No. 200)
MD	Maximum Density and Optimum Moisture
RV	Resistance Value (R-Value)
SE	Sand Equivalent
UU	Unconsolidated Undrained Shear Strength

Notes:

1. Soil classifications are based on the Unified Soil Classification System and include color, moisture, and relative density or consistency. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate. Bedrock descriptions are based on visual classification and include rock type, moisture, color, grain size, strength, and weathering.
2. Descriptions on these boring logs apply only at the specific boring locations and at the time the borings were drilled. They are not warranted to be representative of subsurface conditions at other locations or times.

S/A

KEY TO LOG OF BORING

Date(s) Drilled: 12-08-2023	**Logged By:** AC, AZ	**H-1**
Drilling Method: Hollow Stem	**Drill Bit Size/Type:** 10”	
Drill Rig Type: CME 75	**Hammer Type:** Auto (140lbs @ 30”)	Page 1 of 1
Sampling Method(s): Modified California, Bulk		**Total Depth Drilled (ft)** 8
Approximate Groundwater Depth: Groundwater Not Encountered		**Approximate Ground Surface Elevation (ft)**
Comments:		

Depth (ft)	SAMPLES: Type Number	SAMPLES: Blows Per Foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	REMARKS
0	B-1		SM	**Granitic Bedrock (Kgr)** @ 0-2.5’: Pale yellow silty fine- to medium-grained GRANITE, damp, dense, highly weathered (decomposed granite).			B-1 @ 0-5’
	D-1	50/ 2"	SP-SM	@ 2.5’: Pale yellow to light grey silty to clean fine- to coarse-grained GRANITE, dry, very dense, weathered (decomposed granite). - No Ring Recovery -			
5	D-2	50/ 3"	SP-SM	@ 5’: Yellow to white fine- to coarse-grained GRANITE, dry to damp, very dense, weathered. - No Ring Recovery - No 7' sample due to hard drilling conditions.			
10				Notes: Total Depth: 8 Feet (Refusal). No Groundwater Encountered. Backfilled with Cuttings and Tamped.			
15							
20							
25							
30							

Log Of Boring

Meritage Homes
Proposed Residential Development
La Sierra Ave & Alhambra Ave
Riverside, California

Project Number: 23145-01

Appendix B

Date(s) Drilled: 12-08-2023	Logged By: AC, AZ	**H-2**
Drilling Method: Hollow Stem	**Drill Bit Size/Type:** 10”	
Drill Rig Type: CME 75	**Hammer Type:** Auto (140lbs @ 30”)	Page 1 of 2
Sampling Method(s): Modified California, Bulk		**Total Depth Drilled (ft)** 30
Approximate Groundwater Depth: Groundwater Not Encountered		**Approximate Ground Surface Elevation (ft)**
Comments:		

Depth (ft)	SAMPLES: Type Number	SAMPLES: Blows Per Foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	REMARKS
0	B-1		CL	**Older Alluvium (Qalo)** @ 0-2.5’: Reddish brown silty fine-grained sandy CLAY, dry, medium stiff.			B-1 @ 0-5’ GS, AL, EI, CC
	D-1	50/ 6"	SM	@ 2.5’: Reddish brown silty fine- to medium-grained SAND, damp to slightly moist, very dense.	10.5	120.8	
5	D-2	50/ 4"	SP-SM	**Granitic Bedrock (Kgr)** @ 5’: Reddish brown to yellowish brown fine- to medium-grained GRANITE, damp, very dense, highly micaceous, weathered (decomposed granite).	6.0	105.0	
	D-3	50/ 3"	SP-SM	@ 7.5': Yellowish brown to grey fine- to medium-grained GRANITE, moist, very dense, highly micaceous, weathered (decomposed granite).	4.3		GS
10	D-4	50/ 3"	SP-SM	@ 10': Pale yellowish grey to light grey fine- to medium-grained GRANITE, damp, very dense, micaceous, highly silicic, weathered (decomposed granite).	4.6	108.0	Harder drilling at 11'
15	D-5	50/ 3"	SP-SM	@ 15': Dark grey to yellowish grey fine- to medium-grained GRANITE, damp, very dense, highly micaceous, weathered (decomposed granite).	4.5		
20	D-6	50/ 2"	SP-SM	@ 20': Dark grey to yellowish grey fine- to coarse-grained GRANITE, moist, very dense, highly micaceous, weathered (decomposed granite). - No Ring Recovery -			
25	D-7	50/ 3"	SP-SM	@ 25': Dark grey to light grey silty fine- to medium-grained GRANITE, damp, very dense, micaceous, weathered (decomposed granite). - No Ring Recovery -			
30							

Date(s) Drilled: 12-08-2023	**Logged By:** AC, AZ	**H-2**	
Drilling Method: Hollow Stem	**Drill Bit Size/Type:** 10"		
Drill Rig Type: CME 75	**Hammer Type:** Auto (140lbs @ 30")	Page 2 of 2	
Sampling Method(s): Modified California, Bulk		**Total Depth Drilled (ft)**	30
Approximate Groundwater Depth: Groundwater Not Encountered		**Approximate Ground Surface Elevation (ft)**	
Comments:			

Depth (ft)	SAMPLES: Type Number	SAMPLES: Blows Per Foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	REMARKS
30	D-8	50/ 2"	SP-SM	@ 30': Pale yellow to light grey fine- to coarse-grained GRANITE, damp, very dense, weathered (decomposed granite). - No Ring Recovery -			
35				Notes: Total Depth: 30 Feet. No Groundwater Encountered. Backfilled with Cuttings and Tamped.			
40							
45							
50							
55							

Log Of Boring

Meritage Homes Proposed Residential Development La Sierra Ave & Alhambra Ave Riverside, California	Project Number: 23145-01 Appendix B

Date(s) Drilled: 12-08-2023	**Logged By:** AC, AZ	**H-3**	
Drilling Method: Hollow Stem	**Drill Bit Size/Type:** 10"		
Drill Rig Type: CME 75	**Hammer Type:** Auto (140lbs @ 30")	Page 1 of 2	
Sampling Method(s): Modified California, Bulk		**Total Depth Drilled (ft)**	30.5
Approximate Groundwater Depth: Groundwater Not Encountered		**Approximate Ground Surface Elevation (ft)**	
Comments:			

Depth (ft)	SAMPLES Type Number	SAMPLES Blows Per Foot	USCS	MATERIAL DESCRIPTION Hand Augered to 3.5' for Utility Clearance	Moisture Content (%)	Dry Density (pcf)	REMARKS
0	B-1		SM	**Older Alluvium (Qalo)** @ 0-3.5': Reddish brown silty fine- to medium-grained SAND, dry to damp, loose.			B-1 @ 0-5'
	D-1	9	SM	@ 3.5': Reddish brown silty fine- to medium-grained SAND, slightly moist, loose.	6.6	115.3	
5	D-2	13	SM/ ML	@ 5': Reddish brown silty fine-grained SAND/sandy SILT, moist, medium dense/stiff.	7.0	117.3	GS, CN
	D-3	32	ML	@ 7.5': Reddish brown fine sandy slightly clayey SILT, moist, very stiff.	14.6	118.7	
10	D-4	61	SM	@ 10': Upper: Reddish brown silty fine- to coarse-grained SAND, moist, dense, some bedrock fragments.	11.6	123.5	
			SP-SM	**Granitic Bedrock (Kgr)** Lower: Yellowish brown to grey silty to clean fine- to coarse-grained GRANITE, moist, dense, highly weathered (decomposed granite).			
15	D-5	50/ 5"	SP	@ 15': Yellowish brown to brownish grey fine- to coarse-grained GRANITE, damp, very dense, micaceous, highly weathered (decomposed granite).	3.5	114.5	
20	D-6	50/ 3"	SP	@ 20': Light grey to yellowish grey fine- to coarse-grained GRANITE, damp, very dense, micaceous, weathered (decomposed granite).	3.7	115.7	
25	D-7	50/ 5"	SP	@ 25': Olive grey to grey fine- to coarse-grained GRANITE, damp, very dense, micaceous, weathered (decomposed granite).	3.7		
							Harder drilling at 28'
30							

Date(s) Drilled: 12-08-2023	Logged By: AC, AZ	H-3
Drilling Method: Hollow Stem	Drill Bit Size/Type: 10”	
Drill Rig Type: CME 75	Hammer Type: Auto (140lbs @ 30”)	Page 2 of 2
Sampling Method(s): Modified California, Bulk		Total Depth Drilled (ft): 30.5
Approximate Groundwater Depth: Groundwater Not Encountered		Approximate Ground Surface Elevation (ft):
Comments:		

Depth (ft)	SAMPLES: Type Number	SAMPLES: Blows Per Foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	REMARKS
30	D-8	50/ 3"	SP	@ 30': Dark grey to white fine- to coarse-grained GRANITE, damp, very dense, micaceous, weathered (decomposed granite), quartz veins up to 1" thick.	3.8		
35				Notes: Total Depth: 30.5 Feet. No Groundwater Encountered. Backfilled with Cuttings and Tamped.			
40							
45							
50							
55							

Log Of Boring

Meritage Homes Proposed Residential Development La Sierra Ave & Alhambra Ave Riverside, California	Project Number: 23145-01 Appendix B

Date(s) Drilled: 12-08-2023	**Logged By:** AC, AZ	**H-4**
Drilling Method: Hollow Stem	**Drill Bit Size/Type:** 10"	
Drill Rig Type: CME 75	**Hammer Type:** Auto (140lbs @ 30")	Page 1 of 2
Sampling Method(s): Modified California, Bulk		**Total Depth Drilled (ft)** 30.5
Approximate Groundwater Depth: Groundwater Not Encountered		**Approximate Ground Surface Elevation (ft)**
Comments:		

Depth (ft)	Samples: Type Number	Samples: Blows Per Foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	REMARKS
0	B-1		SM/ ML	**Older Alluvium (Qalo)** @ 0-2.5': Reddish brown silty fine-grained SAND/sandy SILT, damp, medium dense/medium stiff.			B-1 @ 0-5' RV
	D-1	40	SM	@ 2.5': Reddish brown to brownish grey silty fine- to coarse-grained SAND, damp, medium dense, Kgr in sampler tip.	7.3	123.9	
5	D-2	50/ 4"	SC- CL	**Granitic Bedrock (Kgr)** @ 5': Reddish brown to pale reddish brown clayey fine to coarse grained GRANITE, moist, very dense, highly weathered (decomposed granite).	14.7	114.9	DS
	D-3	50/ 4"	SP- SM	@ 7.5': Pale reddish brown to yellowish brown fine- to coarse-grained GRANITE, damp, very dense, weathered (decomposed granite).	6.5		
10	D-4	50/ 4"	SP- SM	@ 10': Pale yellow to white fine- to coarse-grained GRANITE, damp, very dense, trace mica, weathered (decomposed granite).	4.5		
15	D-5	50/ 4"	SP- SM	@ 15': Pale yellow to pale reddish brown fine- to coarse-grained GRANITE, damp, very dense, trace mica, weathered (decomposed granite). - No Ring Recovery -			
20	D-6	50/ 4"	SP- SM	@ 20': Light grey to yellowish grey fine- to coarse-grained GRANITE, damp, very dense, micaceous, weathered (decomposed granite).	4.7		
25	D-7	50/ 4"	SP- SM	@ 25': Olive grey to grey fine- to coarse-grained GRANITE, damp, very dense, micaceous, weathered (decomposed granite).	3.9		
30							

Log Of Boring

Meritage Homes
Proposed Residential Development
La Sierra Ave & Alhambra Ave
Riverside, California

Project Number: 23145-01

Appendix B

Date(s) Drilled: 12-08-2023	**Logged By:** AC, AZ	**H-4**	
Drilling Method: Hollow Stem	**Drill Bit Size/Type:** 10"		
Drill Rig Type: CME 75	**Hammer Type:** Auto (140lbs @ 30")	Page 2 of 2	
Sampling Method(s): Modified California, Bulk		**Total Depth Drilled (ft)**	30.5
Approximate Groundwater Depth: Groundwater Not Encountered		**Approximate Ground Surface Elevation (ft)**	
Comments:			

Depth (ft)	SAMPLES: Type Number	SAMPLES: Blows Per Foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	REMARKS
30	D-8	50/ 5"	SP-SM	@ 30': Yellowish brown to brownish grey fine- to coarse-grained GRANITE, moist, very dense, highly micaceous, weathered (decomposed granite).	7.6		
				Notes: Total Depth: 30.5 Feet. No Groundwater Encountered. Backfilled with Cuttings and Tamped.			
35							
40							
45							
50							
55							

Log Of Boring

Meritage Homes
Proposed Residential Development
La Sierra Ave & Alhambra Ave
Riverside, California

Project Number: 23145-01

Appendix B

Date(s) Drilled: 12-08-2023	**Logged By:** AC, AZ	**H-5**	
Drilling Method: Hollow Stem	**Drill Bit Size/Type:** 10"		
Drill Rig Type: CME 75	**Hammer Type:** Auto (140lbs @ 30")	Page 1 of 2	
Sampling Method(s): Modified California, Bulk		**Total Depth Drilled (ft)**	30
Approximate Groundwater Depth: 26.5 feet		**Approximate Ground Surface Elevation (ft)**	
Comments:			

Depth (ft)	Type Number	Blows Per Foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	REMARKS
0				**Older Alluvium (Qalo)**			
	B-1		SM/ML	@ 0-2.5': Reddish brown silty fine-grained SAND/sandy SILT, dry to damp, loose to medium dense/stiff.			B-1 @ 0-5' GS, AL, DS, MD, EI, CC
	D-1	18	SM	@ 2.5': Reddish brown silty fine- to medium-grained SAND, damp, medium dense.	3.0	110.1	
5	D-2	20	SM	@ 5': Reddish brown silty fine- to coarse-grained SAND, damp, medium dense.	2.8	116.4	
	D-3	19	SM/ML	@ 7.5': Reddish brown silty fine-grained SAND/sandy SILT, damp, medium dense/stiff.	6.2	116.7	
10	D-4	34	ML	@ 10': Reddish brown fine sandy SILT, damp to moist, very stiff, Kgr in sampler tip.	9.1	123.5	
			SM	**Granitic Bedrock (Kgr)**			
15	D-5	50/4"	SM	@ 15': Reddish brown to yellowish brown to dark grey silty fine- to coarse-grained GRANITE, damp, very dense, weathered (decomposed granite), highly micaceous.	4.1	112.1	
20	D-6	50/4"	SP-SM	@ 20': Dark grey to yellowish grey fine- to coarse-grained GRANITE, damp, very dense, highly micaceous, weathered (decomposed granite).	3.1		
25	D-7	50/3"	SP-SM	@ 25': Dark grey to yellowish grey fine- to coarse-grained GRANITE, damp to moist, very dense, highly micaceous, weathered (decomposed granite).	3.6	102.5	
				Groundwater at 28' during drilling; 26.5' after 5 minutes			
30							

Log Of Boring

Meritage Homes
Proposed Residential Development
La Sierra Ave & Alhambra Ave
Riverside, California

Project Number: 23145-01

Appendix B

Date(s) Drilled: 12-08-2023	**Logged By:** AC, AZ	**H-5**	
Drilling Method: Hollow Stem	**Drill Bit Size/Type:** 10”		
Drill Rig Type: CME 75	**Hammer Type:** Auto (140lbs @ 30”)		Page 2 of 2
Sampling Method(s): Modified California, Bulk		**Total Depth Drilled (ft)**	30
Approximate Groundwater Depth: 26.5 Feet		**Approximate Ground Surface Elevation (ft)**	
Comments:			

Depth (ft)	SAMPLES Type Number	SAMPLES Blows Per Foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	REMARKS
30	D-8	50/ 1"	SP-SM	@ 30': Dark grey to yellowish grey fine- to coarse-grained GRANITE, saturated, very dense, highly micaceous, weathered (decomposed granite). - No Ring Recovery -			
35				Notes: Total Depth: 30 Feet. Groundwater Encountered at 26.5 feet. Backfilled with Cuttings and Tamped.			
40							
45							
50							
55							

Log Of Boring

Meritage Homes
Proposed Residential Development
La Sierra Ave & Alhambra Ave
Riverside, California

Project Number: 23145-01

Appendix B

Date(s) Drilled: 12-08-2023	**Logged By:** AC, AZ	**H-6**	
Drilling Method: Hollow Stem	**Drill Bit Size/Type:** 10”		
Drill Rig Type: CME 75	**Hammer Type:** Auto (140lbs @ 30”)	Page 1 of 2	
Sampling Method(s): Modified California, Bulk		**Total Depth Drilled (ft)**	30.5
Approximate Groundwater Depth: Groundwater Not Encountered		**Approximate Ground Surface Elevation (ft)**	
Comments:			

Depth (ft)	Samples: Type Number	Samples: Blows Per Foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	REMARKS
0			SM	**Older Alluvium (Qalo)** @ 0-2.5’: Reddish brown silty fine- to coarse-grained SAND, dry to damp, loose.			B-1 @ 0-5’
	B-1						
	D-1	11	SM	@ 2.5’: Reddish brown silty fine- to coarse-grained SAND, damp, loose.	3.1	115.4	
5	D-2	7	SM	@ 5’: Reddish brown silty fine-grained SAND, damp to moist, loose.	6.9	111.9	GS, CN
	D-3	14	ML	@ 7.5': Reddish brown silty fine-grained sandy SILT, damp to moist, medium stiff.	8.6	121.3	GS, CN
10	D-4	16	CL	@ 10': Reddish brown fine sandy CLAY, moist, stiff.	12.4	118.4	GS, AL
15	D-5	23	CL	@ 15': Reddish brown sandy CLAY, moist, very stiff.	13.4	117.6	GS, CN
20	D-6	30	CL	@ 20': Reddish brown sandy CLAY, moist, very stiff to hard. Kgr in sampler tip.	13.8	121.6	
			SM	**Granitic Bedrock (Kgr)**			
25	D-7	50/ 5"	SM	@ 25': Yellowish grey to white to pale olive grey fine- to coarse-grained GRANITE, very moist, very dense, micaceous, weathered (decomposed granite), quartz veins up to 0.25" thick.	15.5	118.9	
30							

Log Of Boring

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Proposed Residential Development
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Riverside, California

Project Number: 23145-01

Appendix B

Date(s) Drilled: 12-08-2023	Logged By: AC, AZ	**H-6**
Drilling Method: Hollow Stem	**Drill Bit Size/Type:** 10”	
Drill Rig Type: CME 75	**Hammer Type:** Auto (140lbs @ 30”)	Page 2 of 2
Sampling Method(s): Modified California, Bulk		**Total Depth Drilled (ft)** 30.5
Approximate Groundwater Depth: Groundwater Not Encountered		**Approximate Ground Surface Elevation (ft)**
Comments:		

Depth (ft)	SAMPLES Type Number	SAMPLES Blows Per Foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	REMARKS
30	D-8	50/ 3"	SP-SM	@ 30': Yellowish grey to dark grey silty fine- to coarse-grained GRANITE, moist, very dense, highly micaceous, weathered (decomposed granite). - No Ring Recovery -			
35				Notes: Total Depth: 30.5 Feet. No Groundwater Encountered. Backfilled with Cuttings and Tamped.			
40							
45							
50							
55							

Log Of Boring

Meritage Homes
Proposed Residential Development
La Sierra Ave & Alhambra Ave
Riverside, California

Project Number: 23145-01

Appendix B

Date(s) Drilled: 12-11-2023	**Logged By:** AC, AZ	**P-1**
Drilling Method: Hollow Stem	**Drill Bit Size/Type:** 8”	
Drill Rig Type: CME 75	**Hammer Type:** Auto (140lbs @ 30”)	Page 1 of 1
Sampling Method(s): Modified California		**Total Depth Drilled (ft)** 5
Approximate Groundwater Depth: Groundwater Not Encountered		**Approximate Ground Surface Elevation (ft)**
Comments:		

Depth (ft)	SAMPLES: Type Number	SAMPLES: Blows Per Foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	REMARKS
0				**Older Alluvium (Qalo)**			
	D-1	22	SM	@ 2’: Reddish brown silty fine- to medium-grained SAND, damp, medium dense.	3.3	114.1	
	D-2	38	SM	@ 3.5’: Reddish brown silty fine- to coarse-grained SAND, damp, medium dense.	3.6	111.0	
5				Notes: Total Depth: 5 Feet. No Groundwater Encountered. Installed 3” Slotted Pipe. Annular Backfill with ¾" Gravel. Presoak Performed 12/11/23. Percolation Testing Performed 12/12/23. Backfilled with Gravel and Cuttings.			
10							
20							
25							
30							

Log Of Boring

Meritage Homes
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La Sierra Ave & Alhambra Ave
Riverside, California

Project Number: 23145-01

Appendix B

Date(s) Drilled: 12-11-2023	Logged By: AC, AZ	**P-2**
Drilling Method: Hollow Stem	**Drill Bit Size/Type:** 8”	
Drill Rig Type: CME 75	**Hammer Type:** Auto (140lbs @ 30”)	Page 1 of 1
Sampling Method(s): Modified California		**Total Depth Drilled (ft)** 5
Approximate Groundwater Depth: Groundwater Not Encountered		**Approximate Ground Surface Elevation (ft)**
Comments:		

Depth (ft)	SAMPLES: Type Number	SAMPLES: Blows Per Foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	REMARKS
0				**Older Alluvium (Qalo)**			
	D-1	15	SM	@ 2’: Reddish brown to brownish grey silty fine- to medium-grained SAND, dry to damp, medium dense.	2.2	103.1	
	D-2	26	SM	@ 3.5’: Reddish brown to brownish grey silty fine- to coarse-grained SAND, dry to damp, medium dense.	2.2	110.1	
5				Notes: Total Depth: 5 Feet. No Groundwater Encountered. Installed 3” Slotted Pipe. Annular Backfill with ¾" Gravel. Presoak Performed 12/11/23. Percolation Testing Performed 12/12/23. Backfilled with Gravel and Cuttings.			
10							
20							
25							
30							

Log Of Boring

Meritage Homes
Proposed Residential Development
La Sierra Ave & Alhambra Ave
Riverside, California

Project Number: 23145-01

Appendix B

Date(s) Drilled: 12-11-2023	Logged By: AC, AZ	P-3
Drilling Method: Hollow Stem	Drill Bit Size/Type: 8”	
Drill Rig Type: CME 75	Hammer Type: Auto (140lbs @ 30”)	Page 1 of 1
Sampling Method(s): Modified California		Total Depth Drilled (ft): 10
Approximate Groundwater Depth: Groundwater Not Encountered		Approximate Ground Surface Elevation (ft):
Comments:		

Depth (ft)	SAMPLES Type Number	SAMPLES Blows Per Foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	REMARKS
0				**Older Alluvium (Qalo)**			
	D-1	27	SM	@ 2.5’: Reddish brown silty fine- to coarse-grained SAND, dry, medium dense, slightly friable.	1.9	111.6	
5	D-2	26	SM	@ 5': Reddish brown silty fine-grained SAND, damp, medium dense, trace root hairs.	3.9	116.1	GS
	D-3	16	SM	@ 8': Reddish brown silty fine-grained SAND, damp to moist, medium dense.	9.1	119.8	
10				Notes: Total Depth: 10 Feet. No Groundwater Encountered. Installed 3” Slotted Pipe. Annular Backfill with ¾" Gravel. Presoak Performed 12/11/23. Percolation Testing Performed 12/12/23. Backfilled with Gravel and Cuttings.			
20							
25							
30							

Log Of Boring

Meritage Homes
Proposed Residential Development
La Sierra Ave & Alhambra Ave
Riverside, California

Project Number: 23145-01

Appendix B

Date(s) Drilled: 12-11-2023	**Logged By:** AC, AZ	**P-4** Page 1 of 1
Drilling Method: Hollow Stem	**Drill Bit Size/Type:** 8”	
Drill Rig Type: CME 75	**Hammer Type:** Auto (140lbs @ 30”)	
Sampling Method(s): Modified California		**Total Depth Drilled (ft)** 7.5
Approximate Groundwater Depth: Groundwater Not Encountered		**Approximate Ground Surface Elevation (ft)** 836
Comments:		

Depth (ft)	SAMPLES Type Number	Blows Per Foot	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	REMARKS
0				**Older Alluvium (Qalo)**			
	D-1	18	SM	@ 2.5’: Reddish brown silty fine- to medium-grained SAND, damp, medium dense.	4.5	117.1	
5							
	D-2	33	SM	@ 6': Reddish brown silty fine-grained SAND, damp to slightly moist, medium dense.	6.0	115.7	
10				Notes: Total Depth: 7.5 Feet. No Groundwater Encountered. Installed 3” Slotted Pipe. Annular Backfill with ¾" Gravel. Presoak Performed 12/11/23. Percolation Testing Performed 12/12/23. Backfilled with Gravel and Cuttings.			
20							
25							
30							

Log Of Boring

Meritage Homes
Proposed Residential Development
La Sierra Ave & Alhambra Ave
Riverside, California

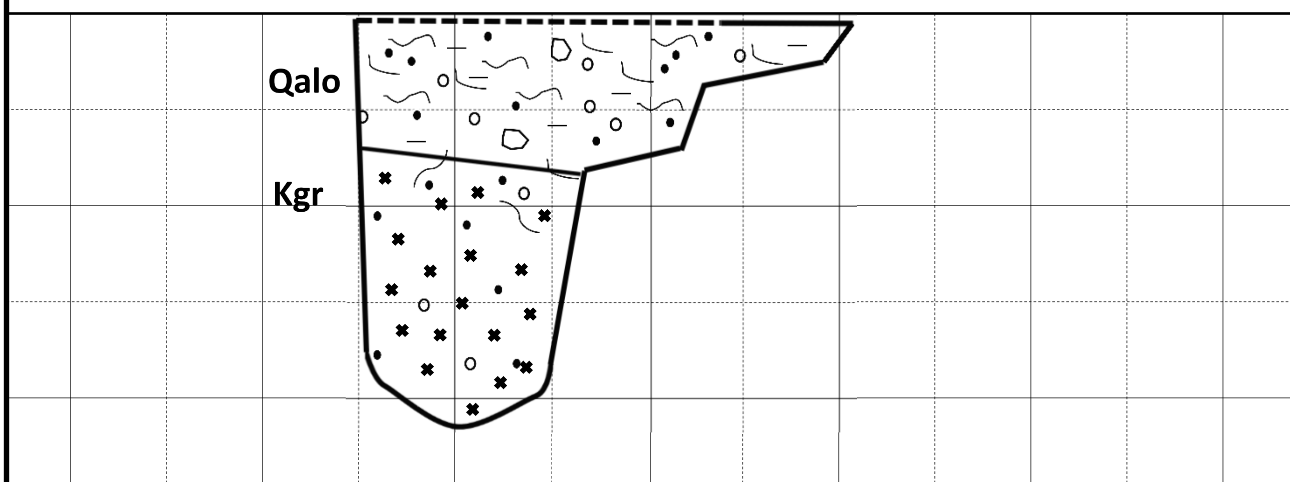
Project Number: 23145-01

Appendix B

Date(s)Excavated: 12/06/2022	**Logged By:** AZ/AC	**TP- 1**
Excavation Method: Backhoe		
Equipment Type: Deere 310		
Sampling Method(s): Bulk		**Total Depth (ft):** 11.5
Approximate Groundwater Depth: Not Encountered		**Approximate Ground Surface Elevation (ft)**
Comments:		

Depth (ft)	SAMPLES Type Number	Blows Per Foot	USCS	Log Of Test Pit Surface: Dirt & weeds	Moisture Content (%)	Dry Density (pcf)	REMARKS
0				**Older Alluvium (Qalo)**			
			SM	@ 0-2.5': Reddish brown silty fine- to medium-grained SAND, dry, medium dense, root hairs in upper 8".			
				Granitic Bedrock (Kgr)			
			SM	@ 2.5-5': Yellow to red to grey fine- to medium-grained GRANITE, dry to damp, dense, highly weathered (D.G.), with local hard rock fragments.			
5	B-1						B-1 @ 5-7'
			SP-SM	@ 5-11.5': Pale olive grey fine- to coarse-grained GRANITE, damp, dense, weathered (D.G.).			
10				Notes: Total Depth: 11.5 Feet (Refusal). Groundwater Not Encountered. Backfilled with Cuttings.			
15							

Graphic Orientation: North Wall **Trend:** -N58E--> **Scale**: 1" = 5'



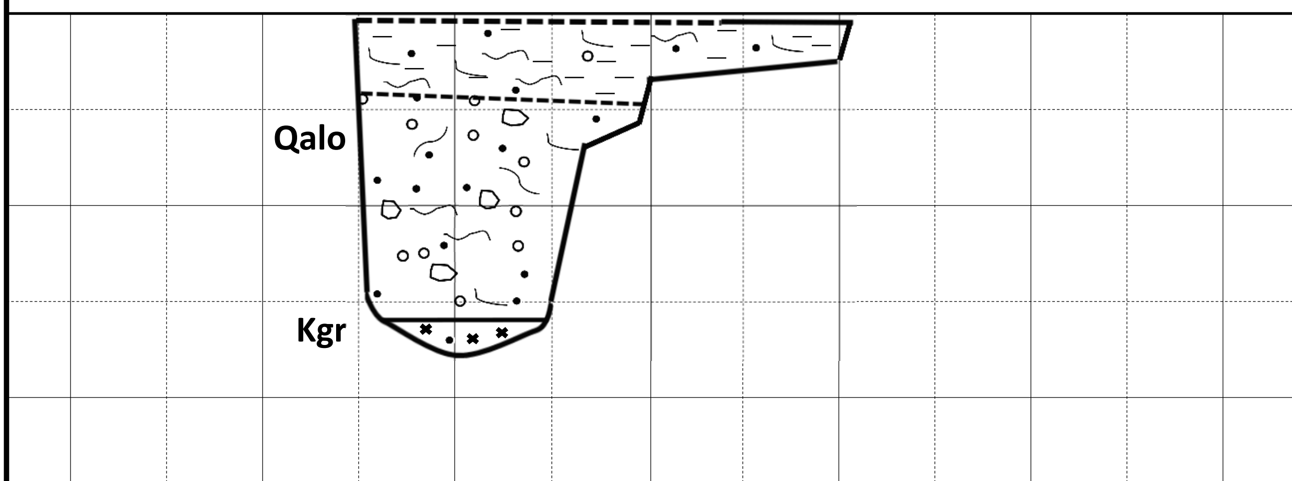
Log Of Test Pit

Meritage Homes Proposed New Residential Development La Sierra Ave & Alhambra Ave Riverside, California	Project Number: 23145-01 Appendix B

Date(s)Excavated: 12/06/2022	**Logged By:** AZ/AC	**TP- 2**
Excavation Method: Backhoe		
Equipment Type: Deere 310		
Sampling Method(s): Bulk		**Total Depth (ft):** 8.5
Approximate Groundwater Depth: Not Encountered		**Approximate Ground Surface Elevation (ft)**
Comments:		

Depth (ft)	SAMPLES: Type Number	SAMPLES: Blows Per Foot	USCS	Log Of Test Pit Surface: Dirt & weeds	Moisture Content (%)	Dry Density (pcf)	REMARKS
0			SM	**Older Alluvium (Qalo)** @ 0-2': Reddish brown silty fine-grained SAND, dry, medium dense, root hairs in upper 12-18".			
5	B-1		SM	@ 2-8': Reddish brown silty fine- to coarse-grained SAND, damp, dense, few coarse-grained bedrock fragments.			B-1 @ 2-6'
			SP	**Granitic Bedrock (Kgr)** @ 8-8.5': Pale olive grey fine- to coarse-grained GRANITE, damp, dense, weathered (D.G.).			
10				Notes: Total Depth: 8.5 Feet (Refusal). Groundwater Not Encountered. Backfilled with Cuttings.			
15							

Graphic Orientation: North Wall **Trend:** -N70E--> **Scale**: 1" = 5'



Log Of Test Pit

Meritage Homes
Proposed New Residential Development
La Sierra Ave & Alhambra Ave
Riverside, California

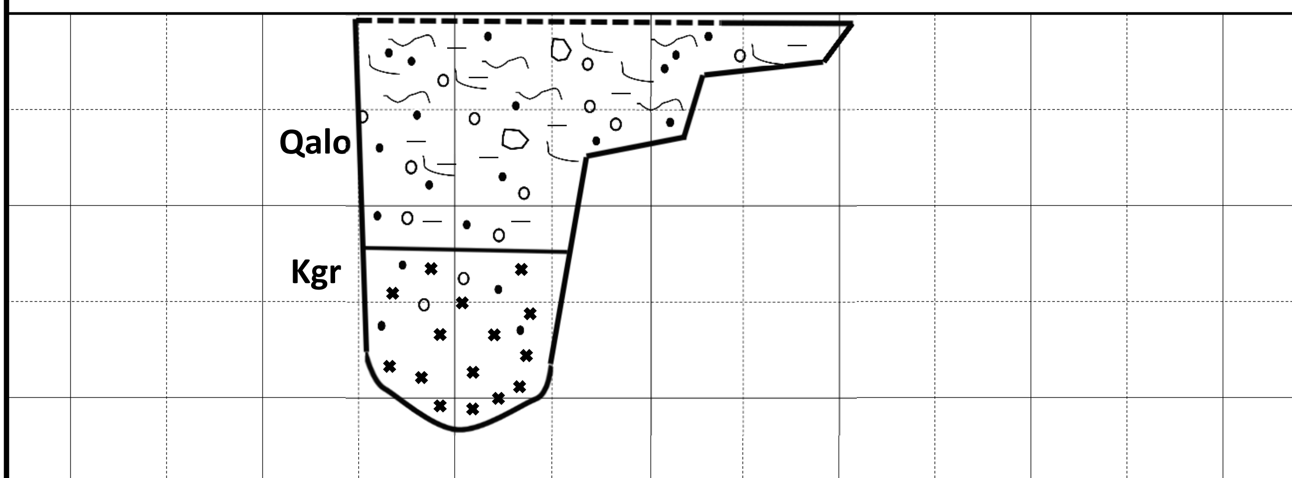
Project Number: 23145-01

Appendix B

Date(s)Excavated: 12/06/2022	Logged By: AZ/AC	TP- 3
Excavation Method: Backhoe		
Equipment Type: Deere 310		
Sampling Method(s): None		Total Depth (ft): 11.5
Approximate Groundwater Depth: Not Encountered		Approximate Ground Surface Elevation (ft)
Comments:		

Depth (ft)	SAMPLES Type Number	Blows Per Foot	USCS	Log Of Test Pit Surface: Dirt & weeds	Moisture Content (%)	Dry Density (pcf)	REMARKS
0							
			SM/ ML	**Older Alluvium (Qalo)** @ 0-6.5': Reddish brown silty fine-grained SAND/sandy SILT, damp to moist, medium dense/stiff, soil pores up to ¼" in upper 1.5', roots and root hairs in upper 4'.			
5			SM	**Granitic Bedrock (Kgr)** @ 6.5-9': Yellow, reddish brown, and grey fine- to medium-grained GRANITE, dry to damp, dense, highly weathered (D.G.), with local hard rock fragments.			
10			SP-SM	@ 9-11.5': Pale olive grey fine- to coarse-grained GRANITE, damp, dense, weathered (D.G.).			
15				Notes: Total Depth: 11.5 Feet (Refusal). Groundwater Not Encountered. Backfilled with Cuttings.			

Graphic Orientation: North Wall **Trend:** -N74E--> **Scale**: 1" = 5'



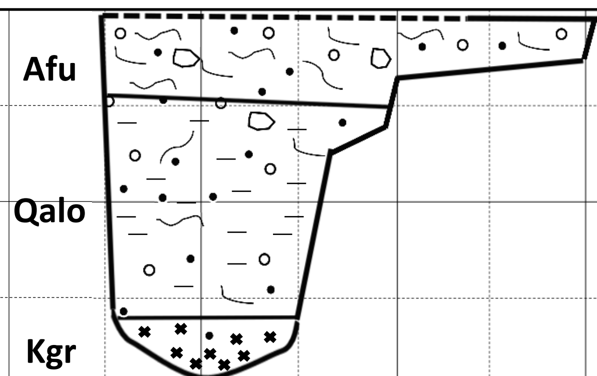
Log Of Test Pit

Meritage Homes Proposed New Residential Development La Sierra Ave & Alhambra Ave Riverside, California	Project Number: 23145-01 Appendix B

Date(s)Excavated: 12/06/2022	**Logged By:** AZ/AC	**TP- 4**
Excavation Method: Backhoe		
Equipment Type: Deere 310		
Sampling Method(s): None		**Total Depth (ft):** 15
Approximate Groundwater Depth: Not Encountered		**Approximate Ground Surface Elevation (ft)**
Comments:		

Depth (ft)	SAMPLES: Type Number	SAMPLES: Blows Per Foot	USCS	Log Of Test Pit Surface: Dirt & weeds	Moisture Content (%)	Dry Density (pcf)	REMARKS
0				**Undocumented Artificial Fill (Afu)**			
			SM	@ 0-2.5': Brown to reddish brown silty fine- to coarse-grained SAND, dry to damp, loose, root hairs in upper 2'.			
			SM	@ 2.5-5.5': Reddish brown silty fine- to medium-grained SAND, damp to moist, loose, some caving, slightly friable.			
5				**Older Alluvium (Qalo)**			
			SM/ ML	@ 5.5-12.5': Reddish brown to dark reddish brown silty fine-grained SAND/sandy SILT, moist, medium dense, scattered old root hairs.			
10				**Granitic Bedrock (Kgr)**			
			SP-SM	@ 12.5-15': Reddish brown to yellowish brown fine- to coarse-grained GRANITE, moist, medium dense, micaceous, highly weathered (D.G.).			
15							

Graphic Orientation: North Wall **Trend:** -N45E--> **Scale**: 1" = 8'



Notes:
Total Depth: 15 Feet (Equipment Limit).
Groundwater Not Encountered.
Backfilled with Cuttings.

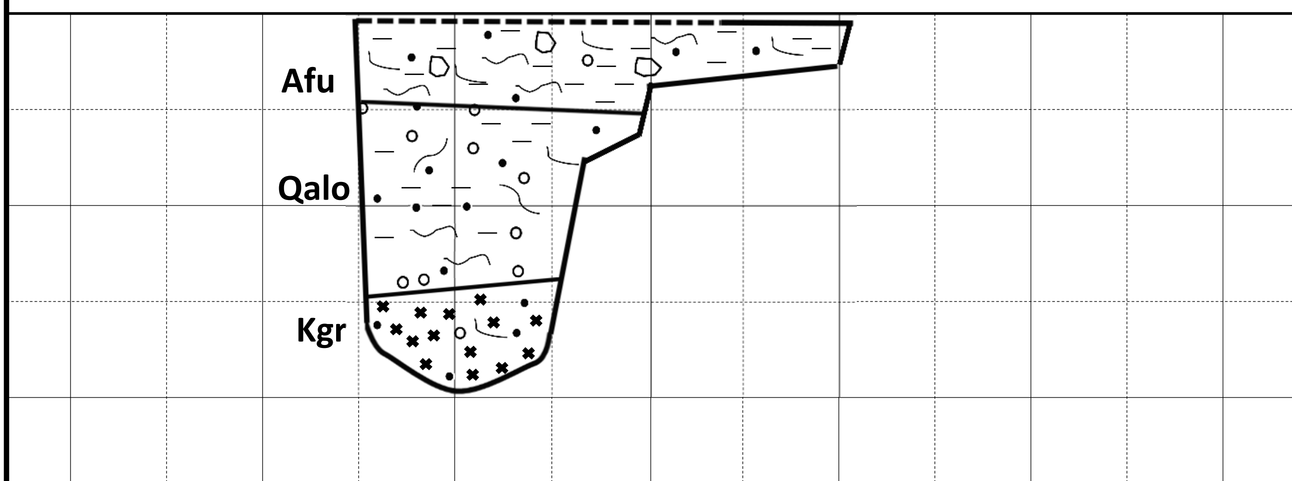
Log Of Test Pit

Meritage Homes Proposed New Residential Development La Sierra Ave & Alhambra Ave Riverside, California	Project Number: 23145-01 Appendix B

Date(s)Excavated: 12/06/2022	**Logged By:** AZ/AC	**TP- 5**
Excavation Method: Backhoe		
Equipment Type: Deere 310		
Sampling Method(s): None		**Total Depth (ft):** 9.5
Approximate Groundwater Depth: Not Encountered		**Approximate Ground Surface Elevation (ft)**
Comments:		

Depth (ft)	SAMPLES Type Number	SAMPLES Blows Per Foot	USCS	Log Of Test Pit Surface: Dirt & weeds	Moisture Content (%)	Dry Density (pcf)	REMARKS
0				**Undocumented Artificial Fill (Afu)**			
			SM	@ 0-2.5’: Reddish brown to brown silty fine- to coarse-grained SAND, dry, loose to medium dense, root hairs in upper 6”.			
				Older Alluvium (Qalo)			
5			SM	@ 2.5-7’: Reddish brown silty fine-grained SAND, damp to moist, loose to medium dense.			
				Granitic Bedrock (Kgr)			
			SP	@ 7-9.5’: Reddish brown to olive brown fine- to coarse-grained GRANITE, damp to moist, weathered (D.G.), with cohesive rock fragments 2-4”.			
10				Notes: Total Depth: 9.5 Feet (Refusal). Groundwater Not Encountered. Backfilled with Cuttings.			
15							

Graphic Orientation: North Wall **Trend:** -N60E--> **Scale**: 1” = 5’



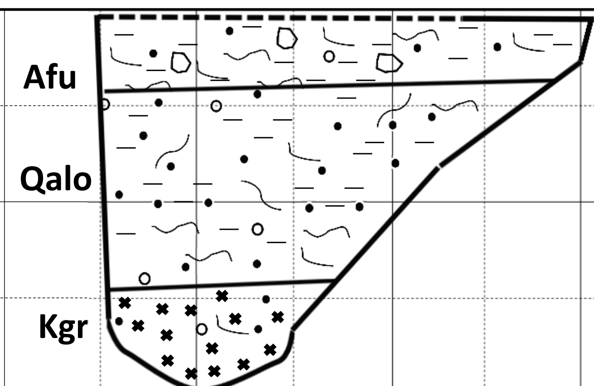
Log Of Test Pit

Meritage Homes Proposed New Residential Development La Sierra Ave & Alhambra Ave Riverside, California	Project Number: 23145-01 Appendix B

Date(s)Excavated: 12/06/2022	**Logged By:** AZ/AC	**TP- 6**
Excavation Method: Backhoe		
Equipment Type: Deere 310		
Sampling Method(s): None		**Total Depth (ft):** 9.5
Approximate Groundwater Depth: Not Encountered		**Approximate Ground Surface Elevation (ft)**
Comments:		

Depth (ft)	SAMPLES: Type Number	SAMPLES: Blows Per Foot	USCS	Log Of Test Pit	Moisture Content (%)	Dry Density (pcf)	REMARKS
				Surface: Dirt & weeds			
0			SM	**Undocumented Artificial Fill (Afu)** @ 0-1.5': Brown to reddish brown silty fine- to coarse-grained SAND, dry, loose to medium dense.			
5			SM	**Older Alluvium (Qalo)** @ 1.5-7': Reddish brown silty fine-grained SAND, moist, loose to medium dense, trace clay.			
10			SM	**Granitic Bedrock (Kgr)** @ 7-9.5': Pale reddish brown to light grey silty fine- to medium-grained GRANITE, moist, dense, hard rock fragments up to 14" in diameter, highly weathered (D.G.), last 6-12" very dense. Notes: Total Depth: 9.5 Feet (Refusal). Groundwater Not Encountered. Backfilled with Cuttings.			
15							

Graphic Orientation: North Wall **Trend:** -N44E--> **Scale**: 1" = 5'



Log Of Test Pit

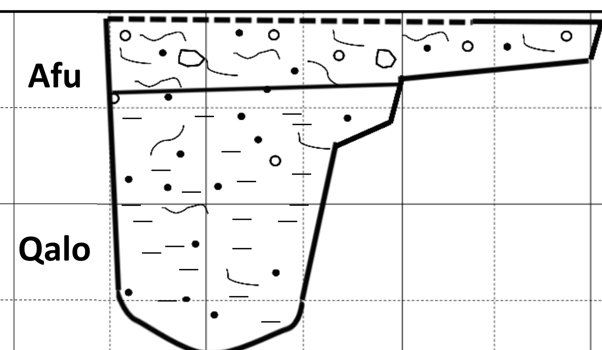
Meritage Homes Proposed New Residential Development La Sierra Ave & Alhambra Ave Riverside, California	Project Number: 23145-01 Appendix B

S/A

Date(s)Excavated: 12/06/2022	**Logged By:** AZ/AC	**TP- 7**
Excavation Method: Backhoe		
Equipment Type: Deere 310		
Sampling Method(s): None		**Total Depth (ft):** 14
Approximate Groundwater Depth: Not Encountered		**Approximate Ground Surface Elevation (ft)**
Comments:		

Depth (ft)	SAMPLES: Type Number	SAMPLES: Blows Per Foot	USCS	Log Of Test Pit	Moisture Content (%)	Dry Density (pcf)	REMARKS
				Surface: Dirt & weeds			
0			SM	**Undocumented Artificial Fill (Afu)** @ 0-2.5': Reddish brown to brownish grey silty fine- to coarse-grained SAND, dry to damp, loose, soil pores up to 2 millimeters in diameter.			
5	B-1		SM/ML	**Older Alluvium (Qalo)** @ 2.5-14': Reddish brown silty fine-grained SAND/sandy SILT, moist to very moist, loose/soft to medium stiff, soil pores present to 4' in depth. @ 7-14': Bedrock fragments up to 8" in diameter.			B-1 @ 2.5-7'
10				Notes: Total Depth: 14 Feet (Equipment Limit). Groundwater Not Encountered. Backfilled with Cuttings.			
15							

Graphic Orientation: North Wall **Trend:** -N18E--> **Scale**: 1" = 8'



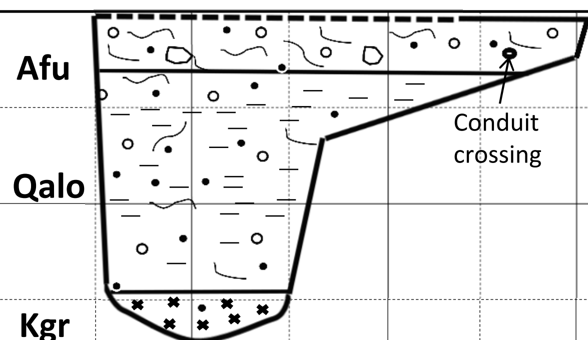
Log Of Test Pit

Meritage Homes Proposed New Residential Development La Sierra Ave & Alhambra Ave Riverside, California	Project Number: 23145-01 Appendix B

Date(s)Excavated: 12/06/2022	**Logged By:** AZ/AC	**TP- 8**	
Excavation Method: Backhoe			
Equipment Type: Deere 310			
Sampling Method(s): None		**Total Depth (ft):** 13.5	
Approximate Groundwater Depth: Not Encountered		**Approximate Ground Surface Elevation (ft)**	
Comments:			

Depth (ft)	SAMPLES Type Number	Blows Per Foot	USCS	Log Of Test Pit Surface: Dirt & weeds	Moisture Content (%)	Dry Density (pcf)	REMARKS
0				**Undocumented Artificial Fill (Afu)**			
			SM	@ 0-1.5': Reddish brown to brown fine- to coarse-grained silty SAND, dry, loose, slightly friable, scattered root hairs.			
				Older Alluvium (Qalo)			
			SM	@ 1.5-11': Reddish brown silty fine- to medium-grained SAND, damp to moist, loose to medium dense.			
5				@4.5': Becomes medium dense.			
				Granitic Bedrock (Kgr)			
			SP-SM	@ 11-13.5': Yellowish brown to reddish brown fine- to coarse-grained GRANITE, moist, dense, micaceous, highly weathered (D.G.).			
10				Notes: Total Depth: 13.5 Feet (Equipment Limit). Groundwater Not Encountered. Backfilled with Cuttings.			
15							

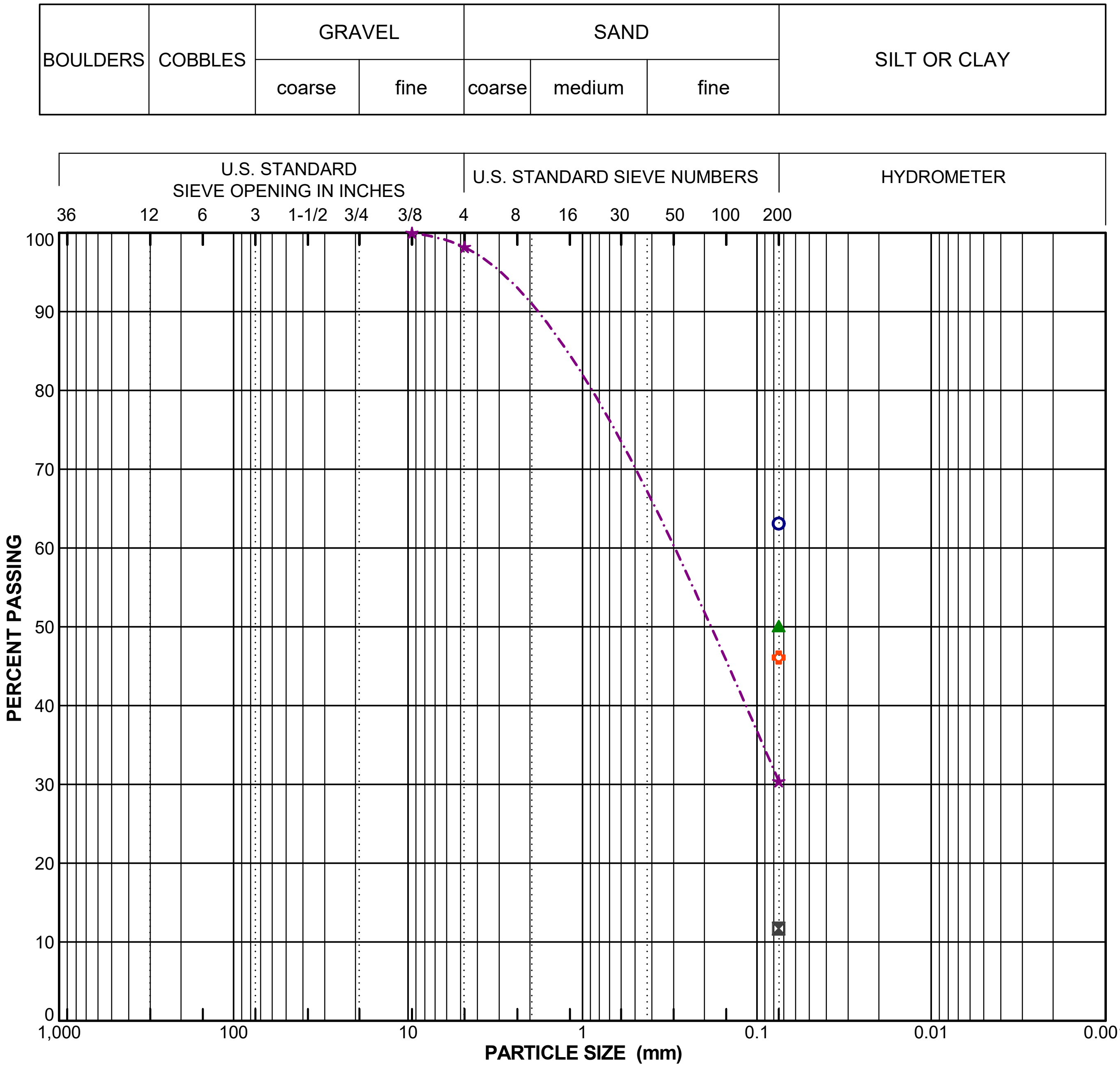
Graphic Orientation: North Wall **Trend:** -N65E--> **Scale**: 1" = 8'



Log Of Test Pit

Meritage Homes Proposed New Residential Development La Sierra Ave & Alhambra Ave Riverside, California	Project Number: 23145-01 Appendix B

Appendix C



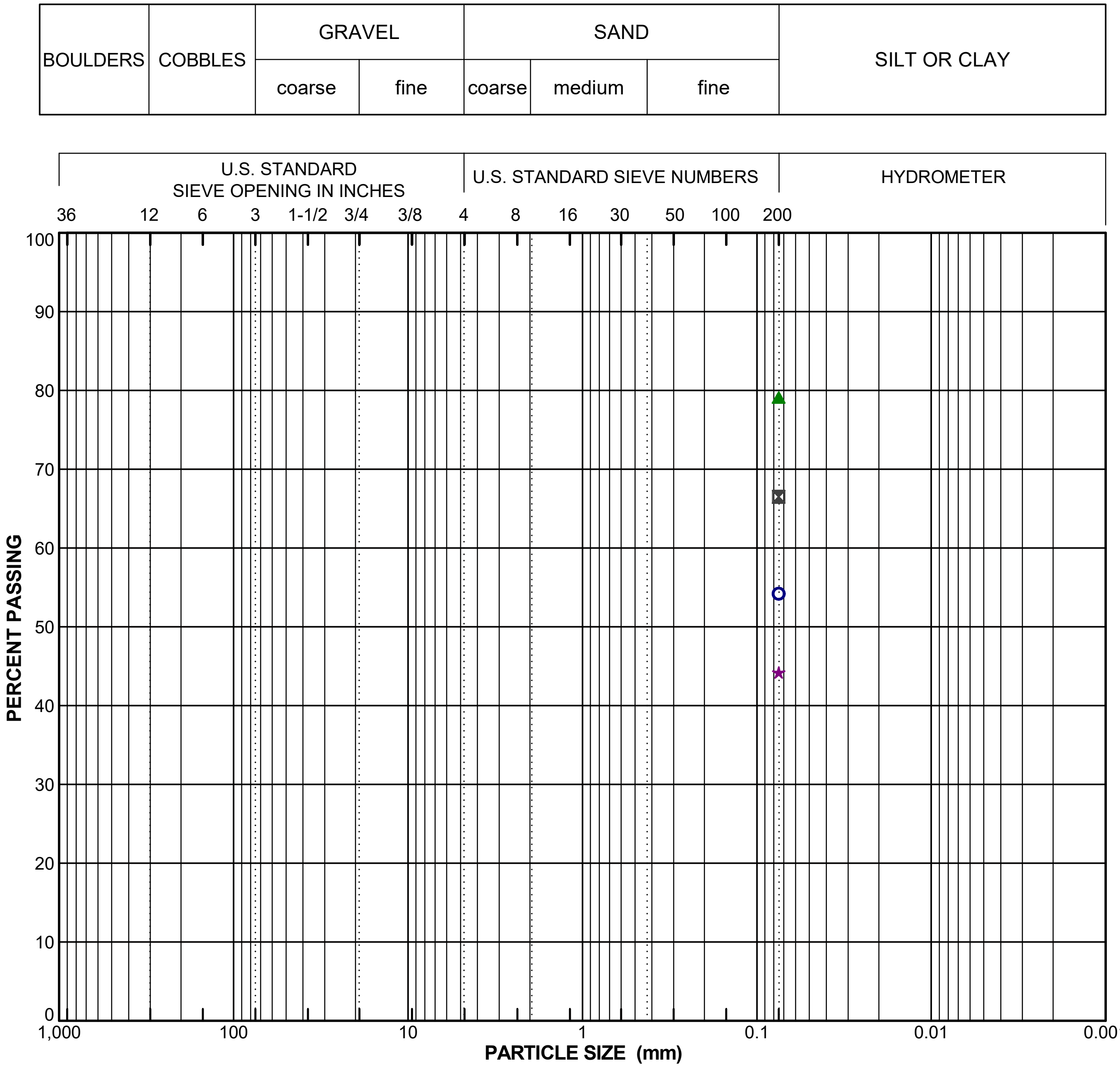
Symbol	Boring Number	Sample Number	Depth (feet)	Field Moisture (%)	LL	PI	Activity PI/-2μ	C_u	C_c	Passing No. 200 Sieve (%)	Passing 2μ (%)	USCS
○	H-2	B-1	0.0 - 5.0		30	13				63		CL
⊠	H-2	D-3	7.5	4						12		SP-SM
▲	H-3	D-2	5.0	7						50		ML/SM
★	H-5	B-1	0.0 - 5.0	15	NP	NP				30		SM
✪	H-6	D-2	5.0	7						46		SM

PARTICLE SIZE DISTRIBUTION

SA Geo / Meritage La Sierra (23145-01)
California
PROJECT NO. 22026-88

NMG Geotechnical, Inc.

Template: NMSIV; Prj ID: 22026-88.GPJ; Printed: 12/19/23



Symbol	Boring Number	Sample Number	Depth (feet)	Field Moisture (%)	LL	PI	Activity PI/-2μ	C_u	C_c	Passing No. 200 Sieve (%)	Passing 2μ (%)	USCS
○	H-6	D-3	7.5	9						54		ML
⊠	H-6	D-4	10.0	12	25	9				67		CL
▲	H-6	D-5	15.0	13						79		ML
★	P3	D2	5.0	4						44		SM

PARTICLE SIZE DISTRIBUTION

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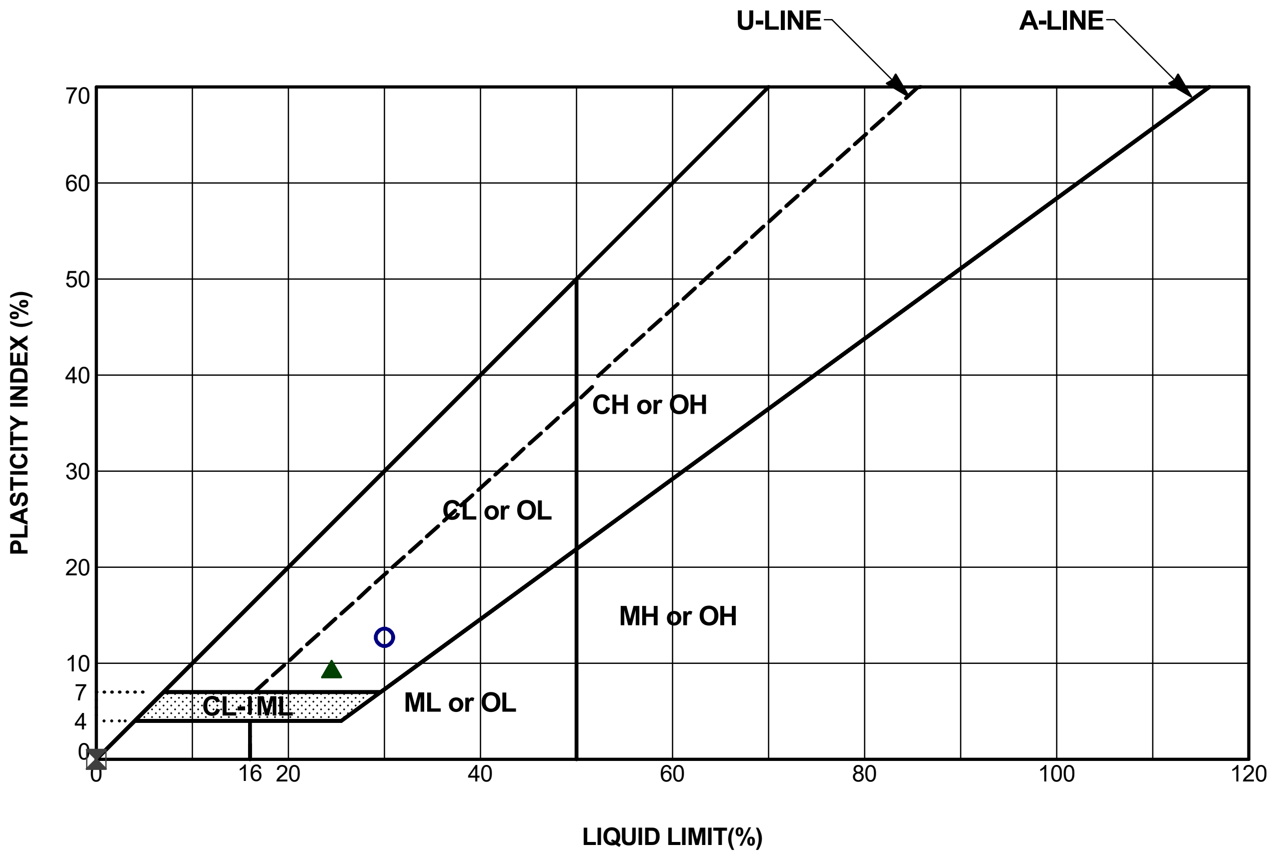
California
PROJECT NO. 22026-88

NMG Geotechnical, Inc.

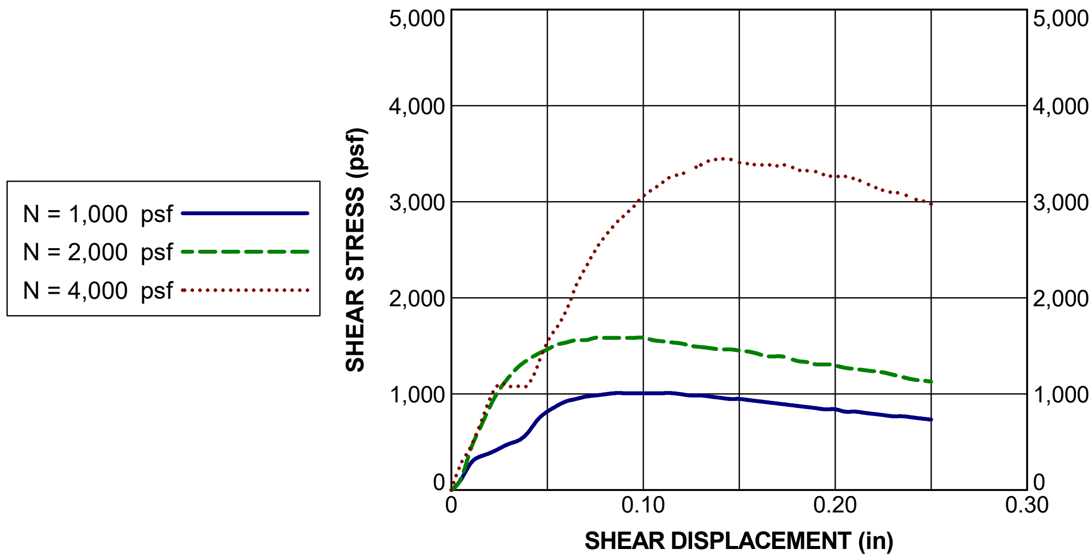


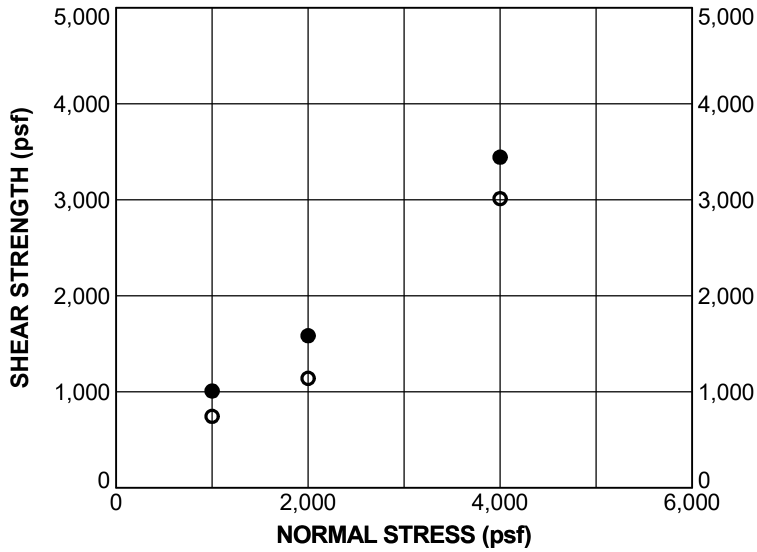
Symbol	Boring Number	Sample Number	Depth (feet)	Passing No. 200 Sieve (%)	LL	PI	USCS	Description
○	H-2	B-1	0.0 - 5.0	63	30	13	CL	Brown silty CLAY
⊠	H-5	B-1	0.0 - 5.0	30	NP	NP	SM	Dark yellowish brown silty SAND
▲	H-6	D-4	10.0	67	25	9	CL	Dark yellowish brown sandy CLAY

PLASTICITY CHART

SA Geo / Meritage La Sierra (23145-01)
California
PROJECT NO. 22026-88

NMG Geotechnical, Inc.





Boring No. H-4	**Sample No. D-2**	**Depth: 5.0 ft**	
Sample Description: Light yellowish brown sandy CLAY		**USCS:** CL	
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:**	
Final Moisture Content (%): 25.5	**Final Dry Density (pcf):** 112.2	**Degree of Saturation (%):** 100	
Sample Type: Undisturbed	**Rate of Shear (in./min.):** 0.005		

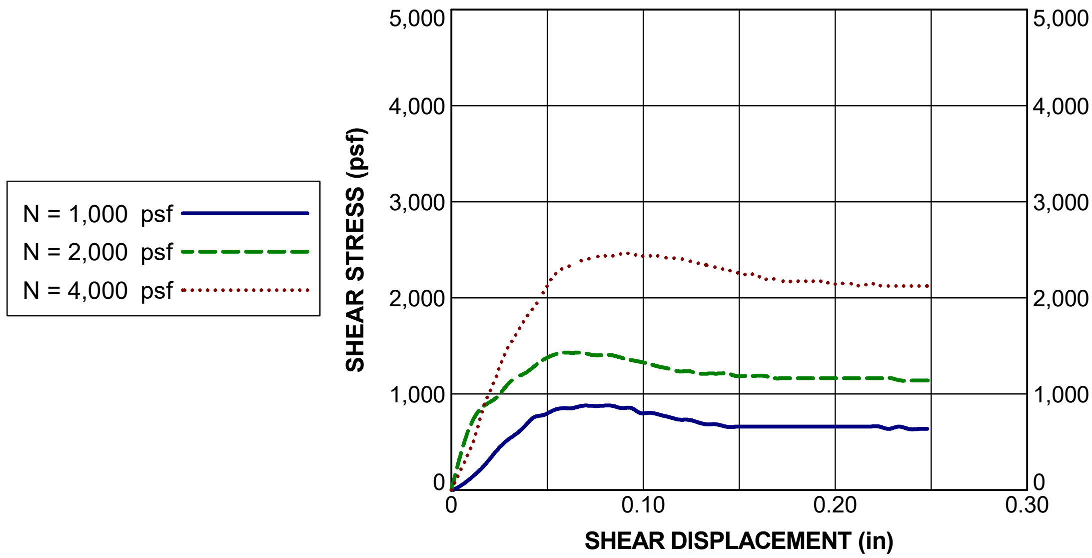
SHEAR STRENGTH PARAMETERS

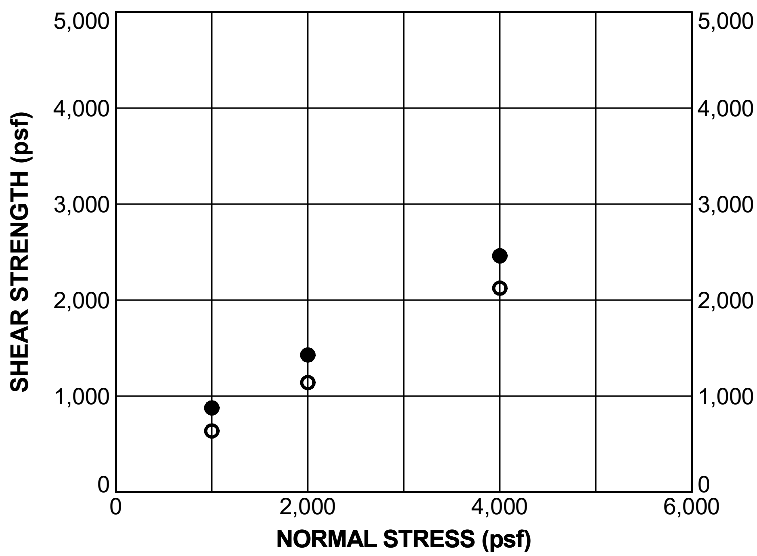
Parameter	Peak ●	Ultimate ○
Cohesion (psf)	100	0
Friction Angle (degrees)	39	32

DIRECT SHEAR TEST RESULTS

SA Geo / Meritage La Sierra (23145-01)
California
PROJECT NO. 22026-88

NMG Geotechnical, Inc.





Boring No. H-5		**Sample No. B-1**		**Depth: 0.0 - 5.0 ft**	
Sample Description:	Dark yellowish brown silty SAND			**USCS:**	SM
Liquid Limit:	NP	**Plasticity Index:**	NP	**Percent Passing No. 200 Sieve:**	30
Final Moisture Content (%):	14.7	**Final Dry Density (pcf):**	118.8	**Degree of Saturation (%):**	99
Sample Type:	Remolded to 90% RC	**Rate of Shear (in./min.):**	0.05		

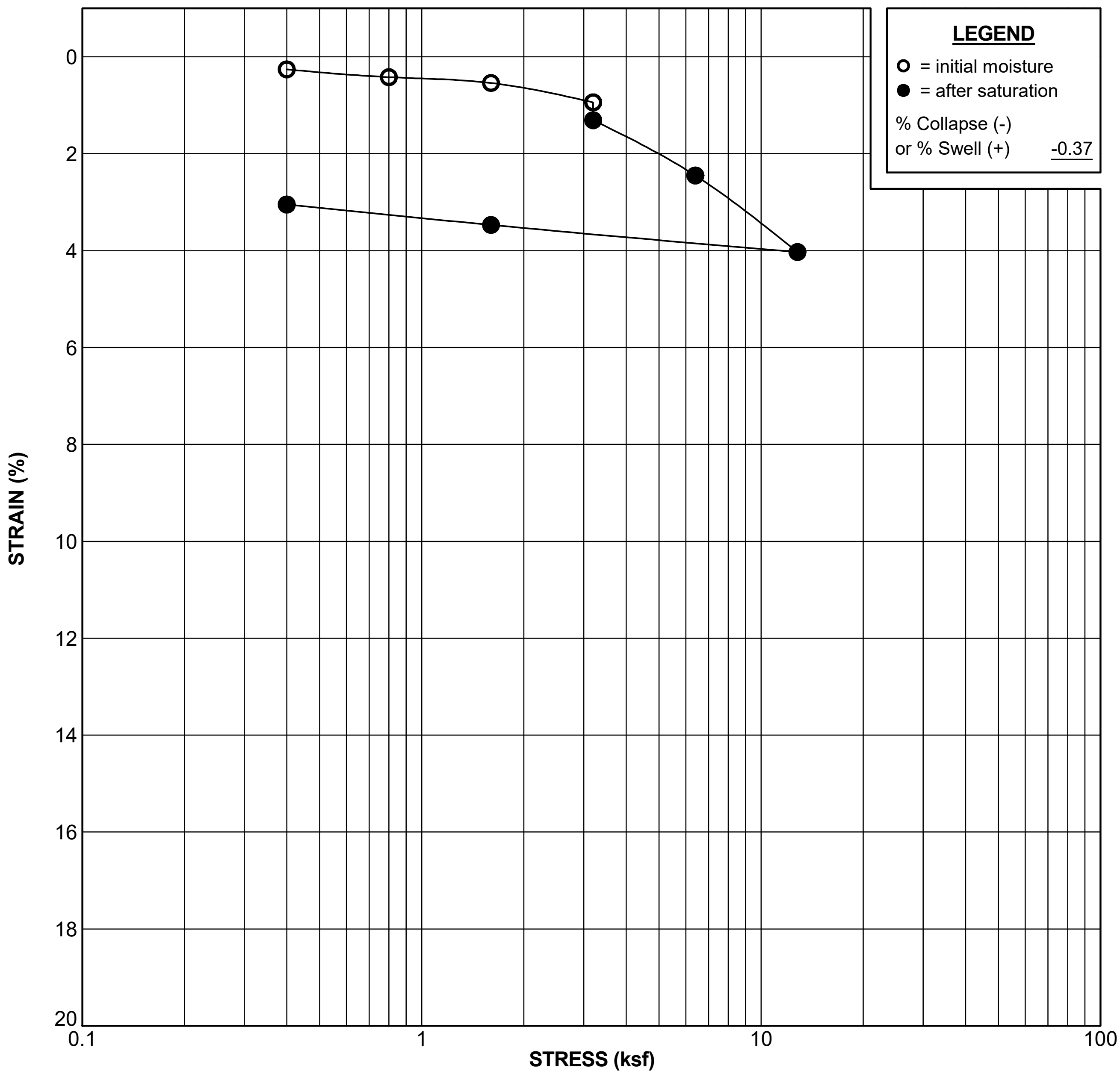
SHEAR STRENGTH PARAMETERS

Parameter	Peak ●	Ultimate ○
Cohesion (psf)	350	150
Friction Angle (degrees)	28	27

DIRECT SHEAR TEST RESULTS

SA Geo / Meritage La Sierra (23145-01)
California
PROJECT NO. 22026-88

NMG Geotechnical, Inc.



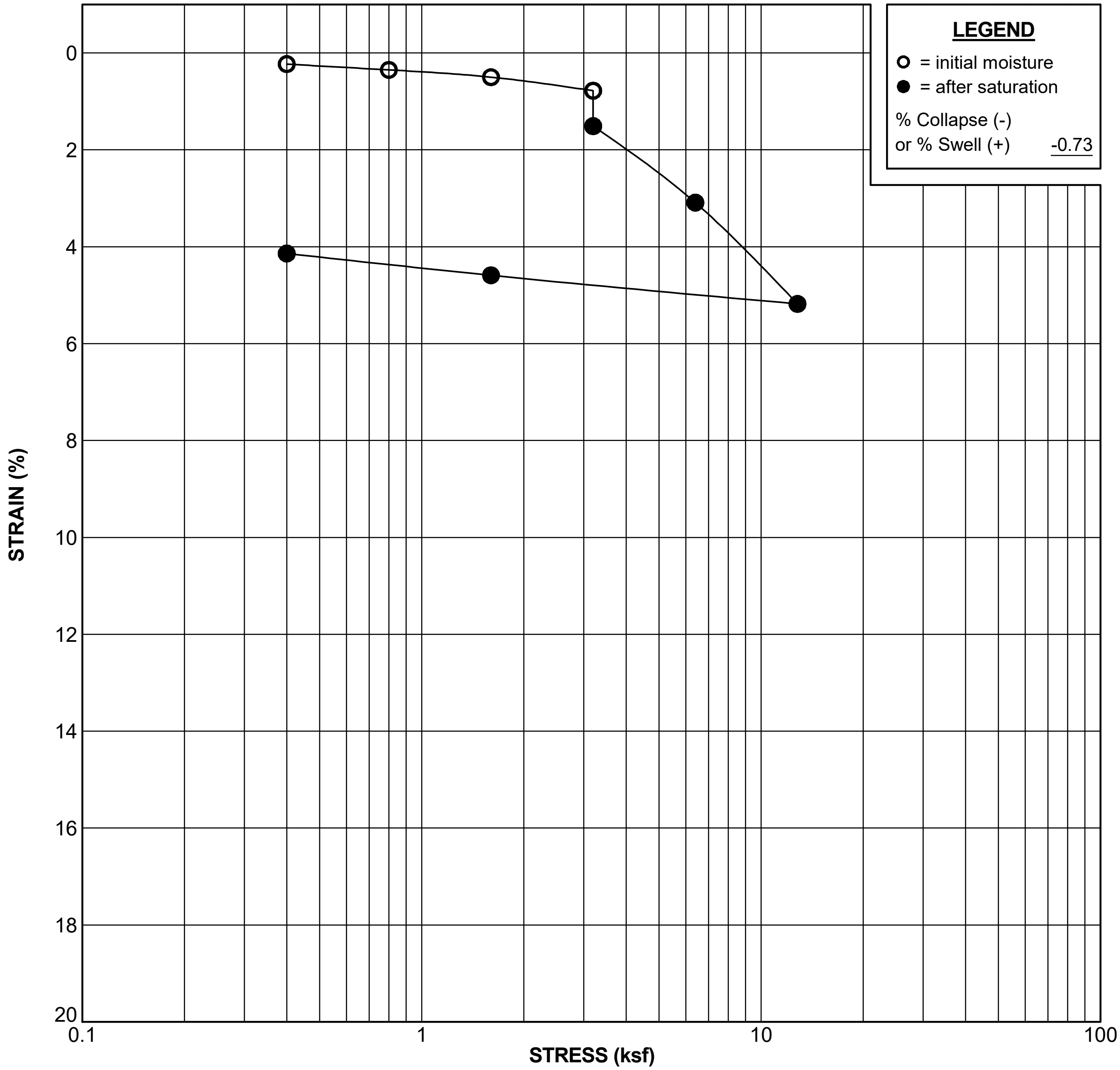
Boring No. H-3	Sample No. D-2	Depth: 5.0 ft
Sample Description: Dark yellowish brown sandy SILT/silty SAND	**USCS:** ML/SM	
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:** 50

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	7.3	115.2	44.8	0.430
Final	14.6	118.7	99.4	0.388

CONSOLIDATION TEST RESULTS

SA Geo / Meritage La Sierra (23145-01)
California
PROJECT NO. 22026-88

NMG Geotechnical, Inc.



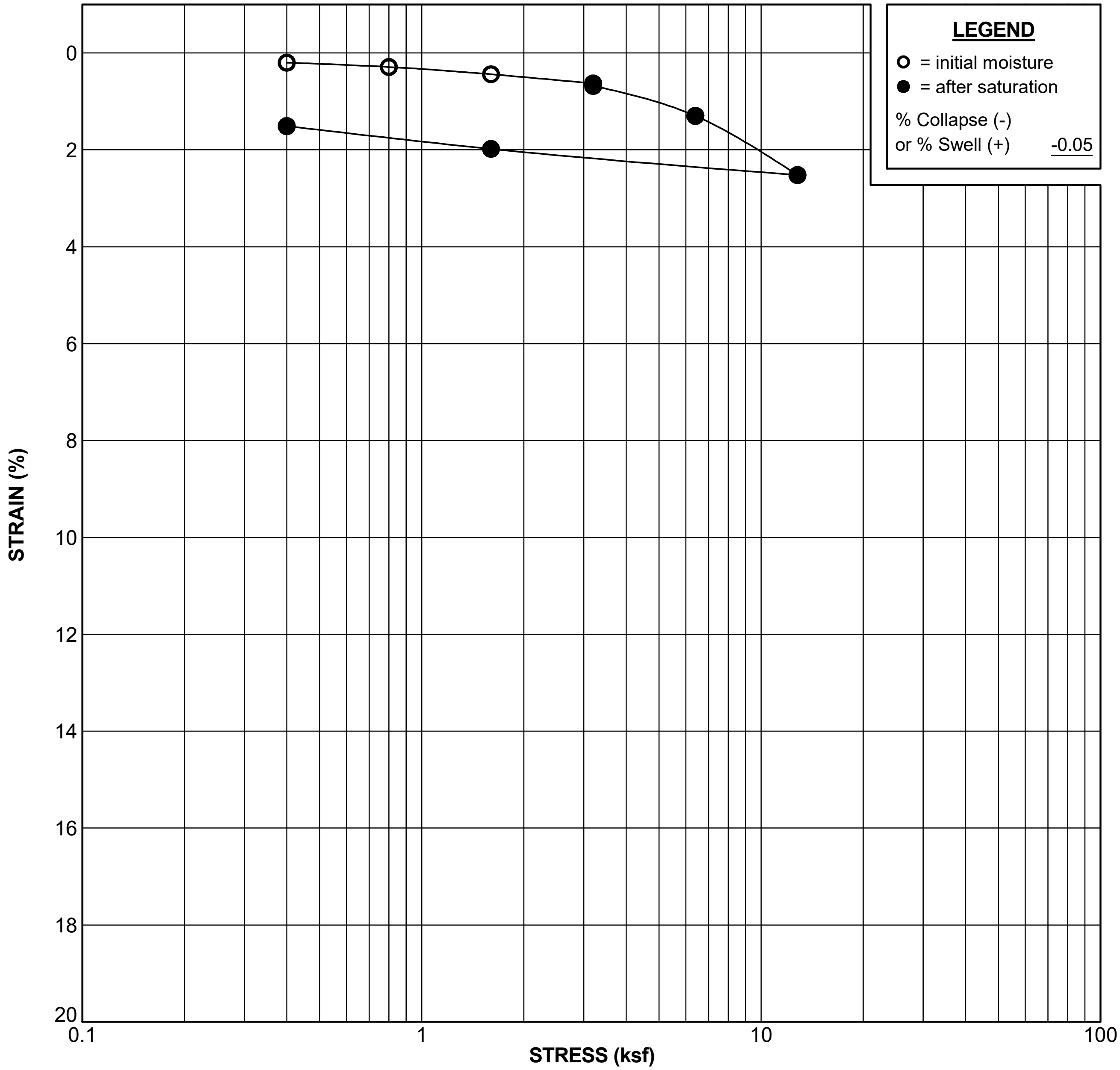
Boring No. H-6	Sample No. D-2	Depth: 5.0 ft
Sample Description: Dark yellowish brown silty SAND		**USCS:** SM
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:** 46

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	7.3	110.6	41.0	0.461
Final	15.5	115.1	99.3	0.404

CONSOLIDATION TEST RESULTS

SA Geo / Meritage La Sierra (23145-01)
California
PROJECT NO. 22026-88

NMG Geotechnical, Inc.



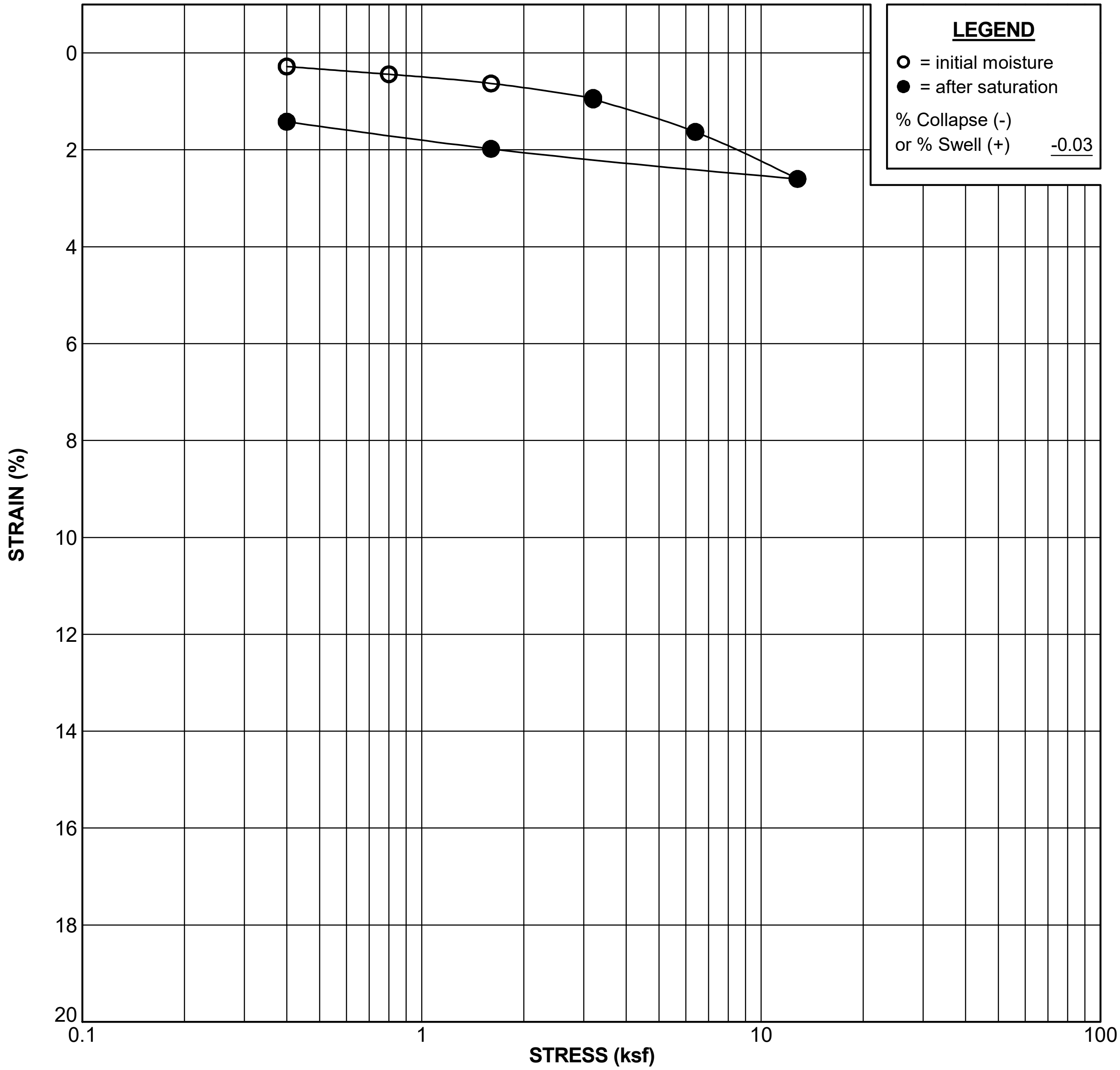
Boring No. H-6	Sample No. D-3	Depth: 7.5 ft
Sample Description: Dark yellowish brown sandy SILT		**USCS:** ML
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:** 54

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	9.0	119.4	60.2	0.401
Final	14.1	121.2	99.5	0.380

CONSOLIDATION TEST RESULTS

SA Geo / Meritage La Sierra (23145-01)
California
PROJECT NO. 22026-88

NMG Geotechnical, Inc.



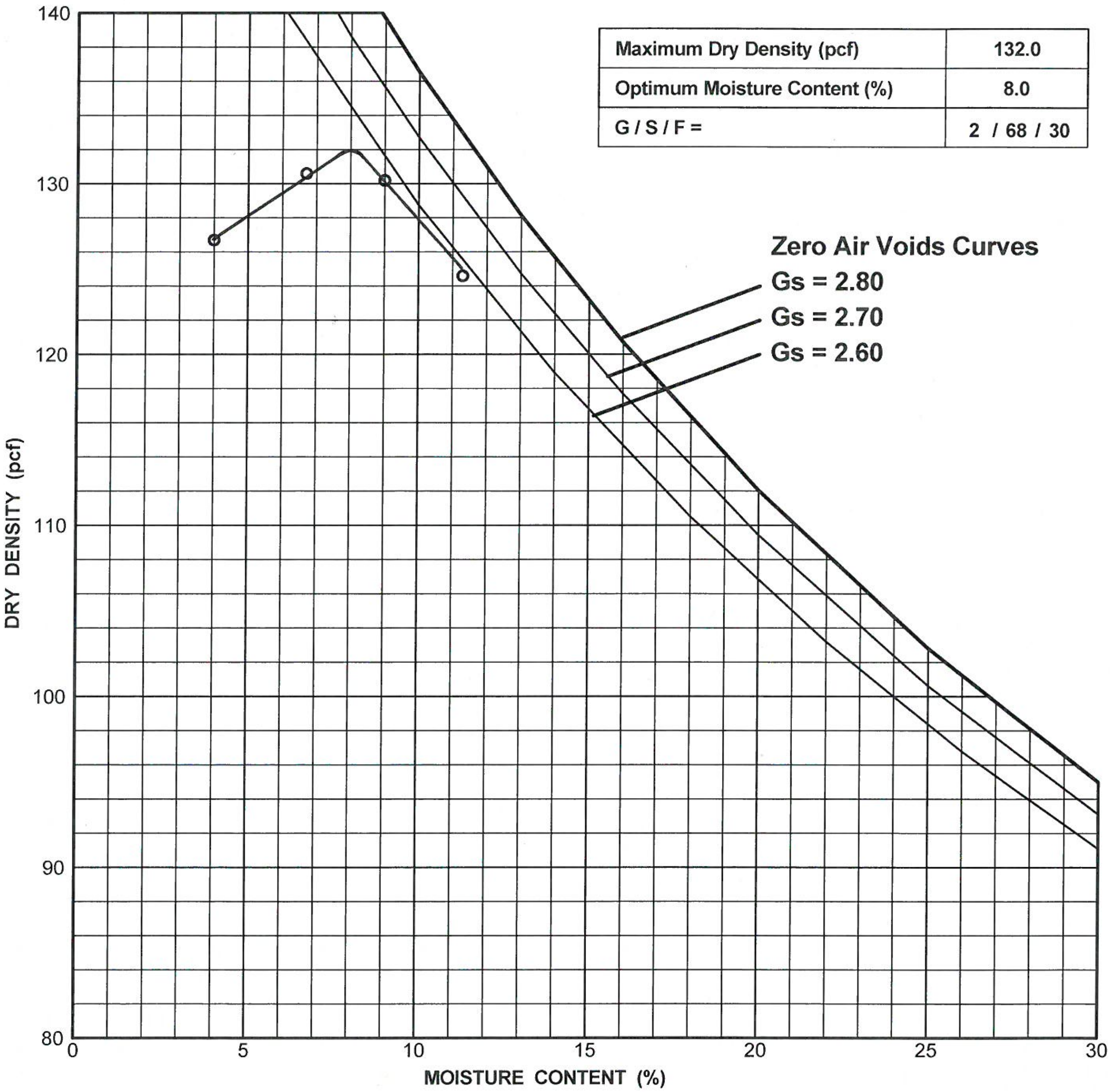
Boring No. H-6	Sample No. D-5	Depth: 15.0 ft
Sample Description: Dark yellowish brown sandy SILT		**USCS:** ML
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:** 79

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	13.5	116.0	78.0	0.474
Final	16.4	117.6	99.0	0.454

CONSOLIDATION TEST RESULTS

SA Geo / Meritage La Sierra (23145-01)
California
PROJECT NO. 22026-88

NMG Geotechnical, Inc.



Maximum Dry Density (pcf)	132.0
Optimum Moisture Content (%)	8.0
G / S / F =	2 / 68 / 30

Boring No. H-5	Sample No. B-1	Depth: 0.0 - 5.0 ft
Sample Description: Dark yellowish brown silty SAND		USCS: SM
Liquid Limit: NP	Plasticity Index: NP	Percent Passing No. 200 Sieve: 30
Comments: 1557A		

COMPACTION TEST RESULTS

SA Geo / Meritage La Sierra (23145-01)
California
PROJECT NO. 22026-88

NMG Geotechnical, Inc.

Template: NMCOMP_21; Prj ID: 22026-88.GPJ; Printed: 12/18/23

R-VALUE TEST DATA CTM 301 / ASTM D2844

Project:	SA Geo/La Sierra	Project No:	22026-88	Date:	12/19/2023
Boring Trench No:	H-4	Sample No:	B-1	Sample Depth:	0-5'
Field Description:	SM				
Lab Description:	Dark reddish brown sandy SILT/silty SAND				

Specimen Number	1		2		3		4	
Mold Number	1		2		3			
Water Adjustment (g)	+80		+92		+107			
Compactor Pressure (psi)	350		350		175			
Exudation Pressure (psi)	500		365		130			
Gross Weight (g)	3211.5		3278.3		3266.3			
Mold Tare (g)	2094.9		2114.1		2098.8			
Wet Weight (g)	1116.6		1164.2		1167.5			
Sample Height (in)	2.41		2.53		2.56			
Initial Dial Reading	0.0514		0.0410		0.0610			
Final Dial Reading	0.0523		0.0412		0.0611			
Expansion (in x10^{-4})	9		2		1			
Stability(psi) at 2,000 lbs (160 psi)	28	50	48	94	62	128		
Turns Displacement	3.92		4.80		4.68			
R-Value Uncorrected	58		27		12			
R-Value Corrected	55		27		12			
Moisture Content (%)	9.0		9.9		11.1			
Dry Density (pcf)	128.8		126.9		124.4			
Assumed Traffic Index	4.0		4.0		4.0			
G.E. by Stability	0.46		0.75		0.90			
G.E. by Expansion	0.30		0.07		0.03			
G_f	1.25							

Moisture Content				
Dish No.	ZZ	A	Q	
Weight of Moist Soil and Dish (g)	295.5	315.5	319.7	
Weight of Dry Soil and Dish (g)	275.2	291.7	292.8	
Water Loss (g)	20.3	23.8	26.9	
Weight of Dish (g)	50.3	50.1	50.3	
Dry Soil (g)	224.9	241.6	242.5	
Moisture Content (%)	9.0	9.9	11.1	

R-Value by Exudation = 18

R-Value by Expansion = 57

R-Value at Equilibrium = 18 by Exudation

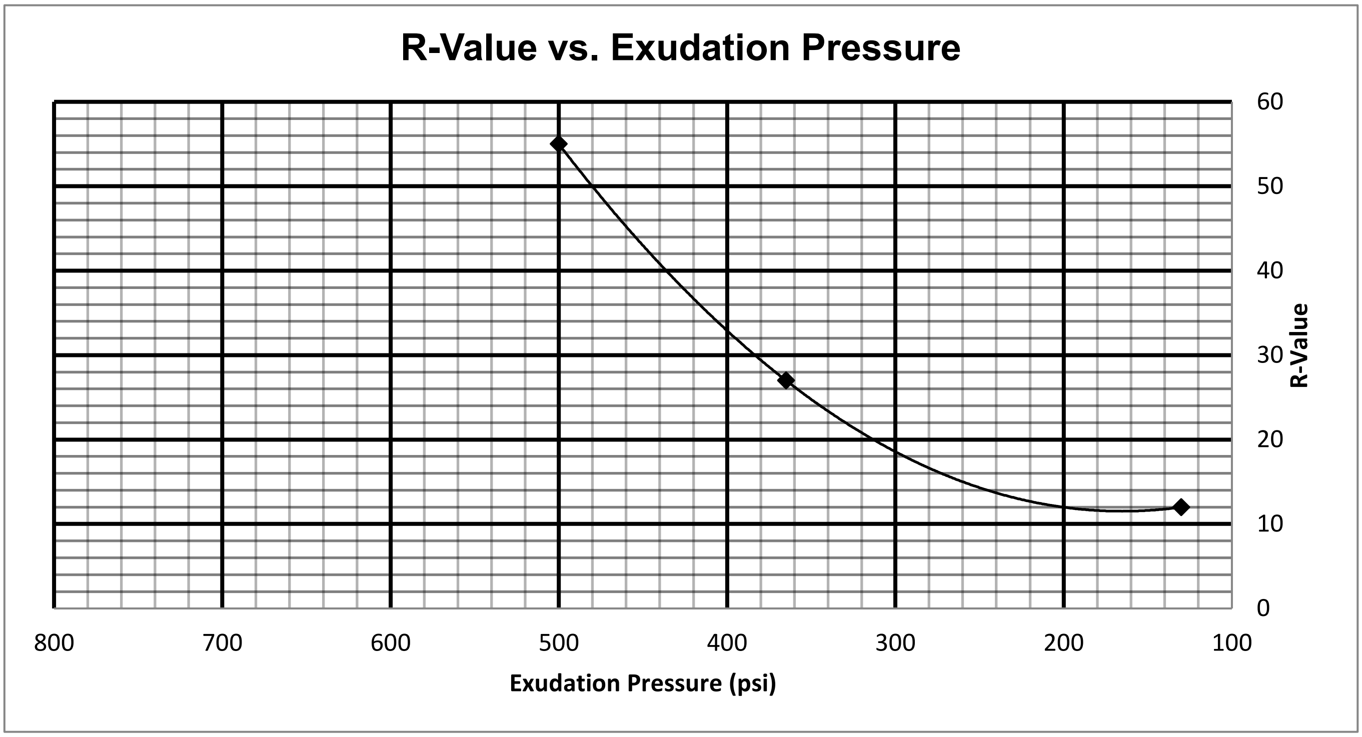
The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301 and/or ASTM Standard D2844

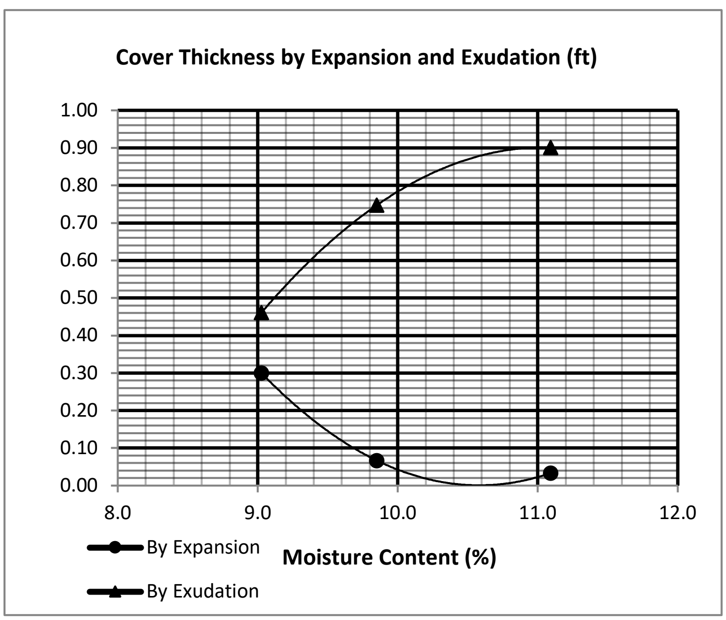
Remarks:	A traffic index of 4.0 was used for calculation purposes.				
Set up by:	AZE BAJ	Run by:	BAJ TG		
Calculated by:	BAJ	Checked by:	BAJ	Date Completed:	12/20/2023

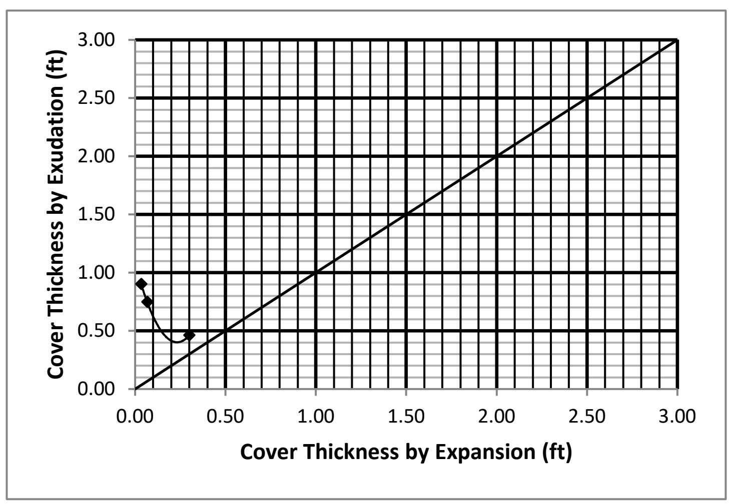
NMG Geotechnical, Inc.

R-VALUE GRAPHICAL PRESENTATION

Project:	SA Geo/La Sierra	Project No:	22026-88	Date:	12/19/2023
Boring Trench No:	H-4	Sample No:	B-1	Sample Depth:	0-5'
Field Description:	SM				
Lab Description:	Dark reddish brown sandy SILT/silty SAND				







Cover Thickness (ft) = 0.44

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301 and/or ASTM Standard D2844

Remarks:	A traffic index of 4.0 was used for calculation purposes.				
Set up by:	AZE BAJ	Run by:	BAJ		
Calculated by:	BAJ	Checked by:	BAJ	Date Completed:	12/20/2023

NMG Geotechnical, Inc.

Sample	*Compacted Moisture (%)*	*Compacted Dry Density (pcf)*	*Final Moisture (%)*	*Volumetric Swell (%)*	*Expansion Index[1] Value/Method*		*Expansive Classification[2]*	*Soluble Sulfate (%)*	*Sulfate Exposure[3]*
H-2 B-1 0-5'	9.0	112.9	20.4	5.88	59	A	Medium	0.05	S0
H-5 B-1 0-5'	8.0	117.0	13.8	-0.04	0	A	Very Low	0.05	S0

Test Method:
ASTM D4829

HACH SF-1 (Turbidimetric)

Notes:
1. Expansion Index (EI) method of determination:
   [A] E.I. determined by adjusting water content to achieve a 50 ±2% degree of saturation
   [B] E.I. calculated based on measured saturation within the range of 40% and 60%
2. ASTM D4829 *(Classification of Expansive Soil)*
3. ACI-318-14 Table 19.3.1.1 *(Requirement for Concrete Exposed to Sulfate-Containing Solutions)*

Expansion Index and Soluble Sulfate Test Results
(FRM001 Rev.5)

Project No. 22026-88

Project Name: SA Geo / Meritage La Sierra (23145-01)

NMG

Appendix D

REPORT

SEISMIC REFRACTION SURVEY

11130 Alhambra Avenue
Riverside, California

GEO*Vision* Project No. 23456

Prepared for

SA Geotechnical, Inc.
1000 N. Coast Highway, Suite 10
Laguna Beach, California 92651
(949) 403-7229

Prepared by

GEO*Vision*, Inc.
1124 Olympic Drive
Corona, CA 92881
(951) 549-1234

Report 23456-01 Rev 0

December 21, 2023

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LIST OF FIGURES

1 INTRODUCTION

A P-wave seismic refraction survey was conducted at the property located at 11130 Alhambra Avenue, Riverside, California on December 13, 2023. The purpose of this investigation was to determine the rippability of the Mesozoic crystalline rock at the site. P-wave seismic refraction data was acquired along two profiles, designated as Lines 1 and 2 (Figure 1).

Depending on the degree of weathering, jointing, etc., granitic rock may broadly be characterized as rippable using a Caterpillar D8R, D9R, and D10R ripper at P-wave velocities less than 5,800, 6,800, and 7,200 ft/s, respectively (Caterpillar, 2018). Granitic rock is expected to be marginally rippable by a D8R, D9R, and D10R between a P-wave velocity of 5,800 and 8,000 ft/s, 6,800 and 8,000 ft/s, and 7,200 and 8,500 ft/s, respectively, and nonrippable at higher seismic velocities (Caterpillar, 2018).

The following sections include a discussion of equipment and field procedures, methodology, data processing, and results of the geophysical survey.

Seismic Refraction Line

GEOVision geophysical services

Date:	12/21/2023
GV Project:	23456
Developed by:	C Xiong
Drawn by:	T Rodriguez
Approved by:	A Martin
File Name:	GV_23456

FIGURE 1
SITE MAP

11130 ALHAMBRA AVENUE
RIVERSIDE, CALIFORNIA

PREPARED FOR
SA GEOTECHNICAL, INC.

Notes:
Coordinate System: NAD 1983 StatePlane California VI FIPS 0406 Feet
Base map source: Nearmap (9-2023)

2 METHODOLOGY

Detailed discussions of the seismic refraction method can be found in Telford et al. (1990), Dobrin and Savit (1988), and Redpath (1973).

When conducting a seismic survey, acoustic energy is input to the subsurface by an energy source such as a sledgehammer impacting a metallic plate, weight drop, vibratory source, or explosive charge. The acoustic waves propagate into the subsurface at a velocity dependent upon the elastic properties of the material through which they travel. When the waves reach an interface where the density or velocity changes significantly, a portion of the energy is reflected to the surface and the remainder is transmitted into the lower layer. Where the velocity of the lower layer is higher than that of the upper layer, a portion of the energy is also critically refracted along the interface. Critically refracted waves travel along the interface at the velocity of the lower layer and continually refract energy back to the surface. Receivers (geophones) laid out in linear array on the surface record the incoming refracted and reflected waves. The seismic refraction method involves analysis of the travel times of the first energy to arrive at the geophones. These seismic first arrivals are from either the direct wave (at geophones close to the source) or critically refracted waves (at geophones further from the source).

Analysis of seismic refraction data depends upon the complexity of the subsurface velocity structure. If the subsurface target is planar then the slope intercept method (Telford et al., 1990) can be used to model multiple horizontal or dipping planar layers. A minimum of one end shot is required to model horizontal layers and reverse end shots are required to model dipping planar layers. If the subsurface target is undulating (i.e. bedrock valley) then layer based analysis routines such as the generalized reciprocal method (Palmer, 1980 and 1981, Lankston and Lankston, 1986 and Lankston, 1990); reciprocal method (Hawkins, 1961) also referred to as the ABC method; Hales' method (Hales, 1958); delay time method (Wyrobek, 1956 and Gardner, 1967); time-term inversion (Scheidegger and Willmore, 1959); plus-minus method (Hagedoorn, 1959); and wavefront method (Rockwell, 1967) are preferred to model subsurface velocity structure. These methods generally require a minimum of 5 shot points per spread (end shots, off end shots and a center shot). If subsurface velocity structure is complex and cannot be adequately modeled using layer-based modeling techniques (e.g., complex weathering profile in bedrock, numerous lateral velocity variations), then Monte Carlo or tomographic inversion techniques (Zhang and Toksoz, 1998; Schuster and Quintus-Bosz, 1993) are required to model the seismic refraction data. These techniques require a high shot density; typically, every 3 to 6 stations/geophones.

Errors in seismic refraction models not associated with errors in first arrival data can be caused by blind zones, hidden layers, and lateral velocity variability. A blind zone is a geologic layer with a lower seismic velocity than the overlying layer and, therefore, does not give rise to a seismic refraction. This type of layer, therefore, cannot be recognized or modeled and depths to underlying layers would be overestimated. The presence of blind zones will cause errors in depth averaged seismic velocity or slowness.

A hidden layer is a layer with a velocity increase, but of sufficiently small thickness relative to the velocities of overlying and underlying layers, that refracted arrivals do not arrive at the geophones before those from the deeper, higher velocity layer. Because the seismic refraction method generally only involves the interpretation of first arrivals, a hidden layer cannot be recognized or modeled and depths to underlying layers would be underestimated. However, it can be demonstrated that the presence of hidden layers does not cause significant errors in depth averaged seismic velocity or slowness, such as the average velocity of the upper 100 ft. A subsurface velocity structure that increases as a function of depth rather than as discrete layers, will also cause depths to subsurface refractors to be underestimated, in a manner very similar to that of the hidden layer problem.

Lateral velocity variability within a layer that is not characterized by the modeling scheme utilized for analysis will also result in depth errors to underlying layers. Additionally, at sites with steeply dipping or highly irregular bedrock surfaces, out-of-plane refractions (refractions from structures to the side of the line rather than from beneath the line) may severely complicate modeling. Tomographic inversion techniques can often resolve the complex velocity structures associated with hidden layers, velocity gradients and lateral velocity variations. However, in the event of an abrupt increase in velocity at a geologic horizon, the velocity model generated using tomographic inversion routines will smooth the horizon with velocity being underestimated at the interface and possibly overestimated at depth.

3 EQUIPMENT AND FIELD PROCEDURES

Seismic refraction equipment used during this investigation consisted of two Geometrics Geode 24-channel signal enhancement seismographs, 10 Hz vertical geophones, seismic cables with 10-foot spaced connectors, piezo hammer switches, and a 20-lb sledgehammer with an aluminum strike plate.

The locations of the seismic refraction profiles were established by SA Geotechnical, Inc. Seismic Lines 1 and 2 consisted of 42 and 48 geophones spaced 5 feet apart for line lengths of 205 and 235 feet, respectively. All geophone and shot point locations along each line were measured using a 300-foot tape measure. Elevations along each seismic refraction line were surveyed using a Trimble R10 GPS system with CenterPoint RTX real-time differential corrections.

Source locations included end shots at each end geophone, off-end shot locations as possible, and interior shot locations at nominal 15 to 30 ft intervals for a total of 12 to 15 source locations per line. The 20-lb sledgehammer was used as the energy source for all source locations. A hammer switch mounted on the hammer was used to trigger the seismograph upon impact with the aluminum plate. The final seismic record at each shot point was the result of stacking 8 to 13 shots to increase the signal to noise ratio. All seismic records were stored on a laptop computer. Data acquisition parameters, file names, and other observations were recorded on a field log, which is retained in project files.

4 DATA REDUCTION AND MODELING

The first step in data processing consisted of picking the arrival time of the first energy (first arrival) received at each geophone for each shot point. The first arrivals on each seismic record are either a direct arrival from a compressional (P) wave traveling in the uppermost layer or a refracted arrival from a subsurface interface where there is a velocity increase. First-arrival times were selected using the manual picking routines in the SeisImager™ software suite (Geometrics, Inc.). These first-arrival times were saved in an ASCII file containing shot location, geophone locations, and associated first-arrival time. Errors in the first-arrival times were variable with error generally increasing with distance from the shot point. Elevations for each geophone location were calculated from the GPS data.

Seismic refraction data were then modeled using the tomographic analysis technique available in the SeisImager™ Plotrefa software package. Refraction tomography techniques are often able to resolve complex velocity structure (e.g., velocity gradients) that can be observed in bedrock weathering profiles. Layer-based modeling techniques such as the GRM are more applicable to characterize geologic structure that exhibits layering (e.g., low velocity sediments over high velocity rock). It should be noted, however, that tomographic modeling techniques will generate a velocity model with a gradual increase in velocity with depth even though an abrupt velocity increase may be present.

Tomographic analysis was conducted as outlined in the following steps. A smooth velocity gradient initial model was developed covering the expected velocity range in weathered rock at the site. The initial model had 18 layers with the top of the bottom layer at a depth related to the effective depth of investigation of the model. Velocity ranges were also set to values outside of the starting model minimum and maximum. The velocity models were extended to permit the use of off-end shot points during the inversion, as applicable. A minimum of 10 iterations of non-linear raypath inversion were then implemented to model the seismic data. The starting model parameters were then adjusted, as necessary, and the modeling process repeated until an acceptable fit between observed and calculated first arrival data was achieved.

The final tomographic velocity models for the seismic line were exported as ASCII files and imported into the Golden Software Surfer® mapping system where the velocity model was gridded, contoured, and annotated for presentation.

5 DISCUSSION OF RESULTS

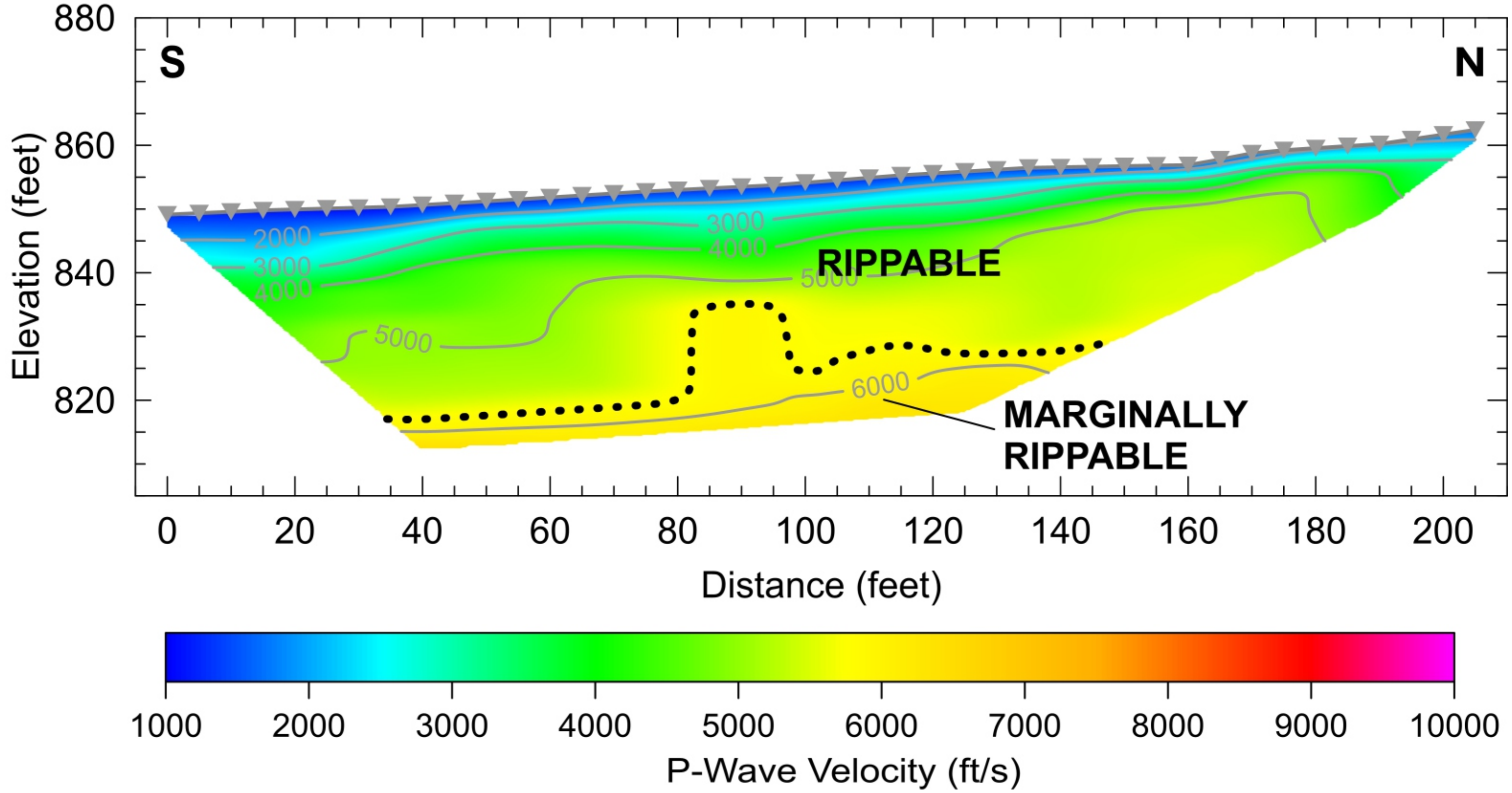
The P-wave seismic refraction models for Lines 1 and 2 are presented as Figures 2 and 3, respectively. A color scheme with blue-cyan, green-orange, and red-magenta representing low, intermediate, and high P-wave velocities, respectively, and velocity contours at 1,000 ft/s intervals are used to display the seismic velocity model. The depth of investigation for Lines 1 and 2 is about 35 and 70 feet, respectively.

Tomographic inversion techniques will typically model a gradual increase in seismic velocity with depth even if an abrupt velocity contact is present. Velocity gradients are, however, common in weathered rock geologic environments, such as the project site.

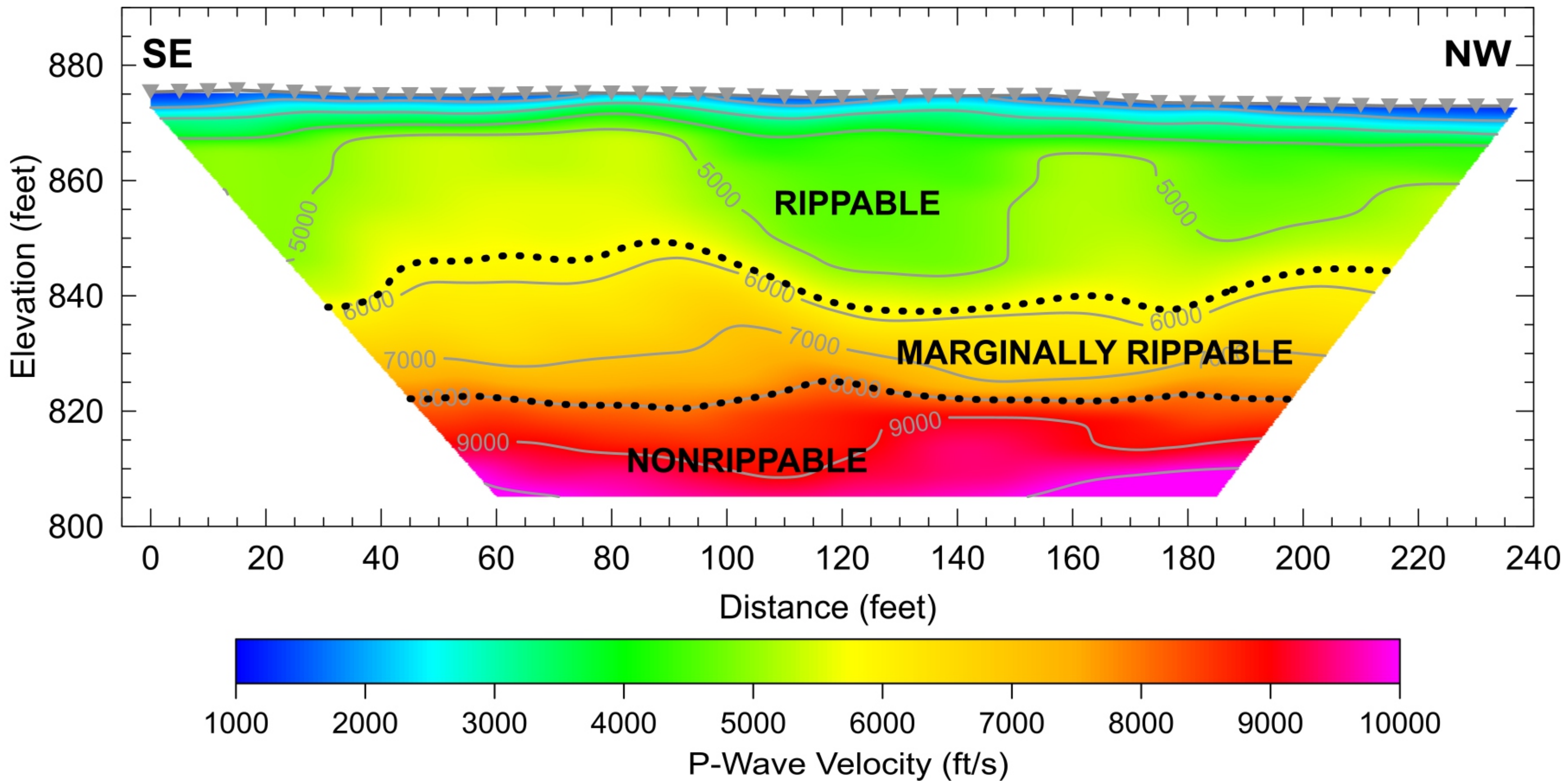
For the purpose of discussion, we assume that a Caterpillar D8R Ripper, or equivalent, will be used on site. Granitic rock with P-wave velocity of less than about 5,800 ft/s is considered rippable by a D8R assuming that the rock is sufficiently fractured and jointed. Granitic rock with P-wave velocity between about 5,800 and 8,000 ft/s is considered marginally rippable by a D8R, although it may be more cost effective to blast rather than rip rock in this velocity range. Granitic rock with P-wave velocity greater than 8,000 ft/s is considered nonrippable by a D8R.

P-wave velocity increases with depth beneath Line 1 (Figure 2) from about 1,250 to 2,000 ft/s at the surface to over 6,000 ft/s at a depth between about 30 and 35 ft. The rock is expected to be rippable by a D8R to a depth of about 18 to 32 ft and then marginally rippable to a depth of over 35 ft.

P-wave velocity increases with depth beneath Line 2 (Figure 3) from about 1,250 to 2,000 ft/s at the surface to over 9,000 ft/s at a depth between about 55 and 65 ft. The rock is expected to be rippable by a D8R to a depth of about 25 to 35 ft and then marginally rippable to a depth of about 50 and 55 ft. The granitic rock is considered nonrippable below a depth of 50 to 55 ft.



GEOVision geophysical services	FIGURE 2 LINE 1 P-WAVE SEISMIC REFRACTION MODEL
Project No: 23456 Date: DEC 21, 2023	11130 ALHAMBRA AVENUE RIVERSIDE, CALIFORNIA
Drawn By: A MARTIN Approved By: Antony J Martin R:\GVProjects\2023\23456 SA Geotechnical\Report\Figure 2.cdr	PREPARED FOR SA GEOTECHNICAL, INC.



GEOVision geophysical services

Project No: 23456	FIGURE 3 LINE 2 P-WAVE SEISMIC REFRACTION MODEL
Date: DEC 21, 2023	11130 ALHAMBRA AVENUE RIVERSIDE, CALIFORNIA
Drawn By: A MARTIN	
Approved By:	PREPARED FOR SA GEOTECHNICAL, INC.
R:\GVProjects\2023\23456 SA Geotechnical\Report\Figure 3.cdr	

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7 CERTIFICATION

All geophysical data, analysis, interpretations, conclusions, and recommendations in this document have been prepared under the supervision of and reviewed by a **GEO***Vision* California Professional Geophysicist.

Reviewed and approved by,

12/21/2023

Antony J. Martin Date
California Professional Geophysicist, P. Gp. 989
GEO*Vision* Geophysical Services

∗ This geophysical investigation was conducted under the supervision of a California Professional Geophysicist using industry standard methods and equipment. A high degree of professionalism was maintained during all aspects of the project from the field investigation and data acquisition, through data processing, interpretation, and reporting. All original field data files, field notes, observations, and other pertinent information are maintained in the project files and are available for the client to review for a period of at least one year.

A professional geophysicist's certification of interpreted geophysical conditions comprises a declaration of his/her professional judgment. It does not constitute a warranty or guarantee, expressed or implied, nor does it relieve any other party of its responsibility to abide by contract documents, applicable codes, standards, regulations, or ordinances

Appendix E

Percolation Data Sheet

Project Name: Meritage/La Sierra
Project Number: 23145-01
Test Hole Number: P-1
Date Excavated: 12/11/2023
Depth (in): 60
Radius (in.): 4
Date Presoak: 12/11/2023
Tested By: AZ/AC
Pipe Diameter (in.): 3
Date Tested: 12/12/2023

Sandy Soil Criteria

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)
1	8:16 8:26	10	24	33	9
2	8:26 8:38	12	33	40.2	7.2

Percolation Data

Time	Time Interval (mins.)	Total Elapsed Time (mins)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
8:39 8:49	10	10	37.8	42.6	4.8	28.8
8:49 8:59	10	20	36.4	41.6	5.3	31.7
8:59 9:09	10	30	35.4	41.2	5.8	34.6
9:10 9:20	10	41	35.4	40.8	5.4	32.4
9:21 9:31	10	52	36.6	42.0	5.4	32.4
9:31 9:41	10	62	36.2	42.0	5.8	34.6

Initial Height of Water (Ho) = 23.8
Final Height of Water (Hf) = 18
Change in Height Over Time (ΔH) = 5.76
Average Head Over Time (Havg) = 20.9
Annulus Gravel/Sand Correction (C) = 0.5

I_t = ΔH(60r)/Δt(r+2Havg)
I_t = 3.0 in./hr.
C x I_t = **1.5** **in./hr.**

Percolation Data Sheet

Project Name: Meritage/La Sierra | Project Number: 23145-01
Test Hole Number: P-2 | Date Excavated: 12/11/2023
Depth (in): 57 | Radius (in.): 4 | Date Presoak: 12/11/2023
Tested By: AZ/AC | Pipe Diameter (in.): 3 | Date Tested: 12/12/2023

Sandy Soil Criteria

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)
1	8:11 8:17	6	28.8	37.2	8.4
2	8:17 8:25	8	37.2	43.2	6

Percolation Data

Time	Time Interval (mins.)	Total Elapsed Time (mins)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
8:28 8:38	10	10	31.2	41.6	10.4	62.6
8:38 8:48	10	20	31.8	42.0	10.2	61.2
8:48 8:58	10	30	30.6	41.2	10.6	63.4
8:58 9:08	10	40	30.0	41.2	11.2	67.0
9:09 9:19	10	51	30.6	41.4	10.8	64.8
9:20 9:30	10	62	32.28	41.8	9.5	56.9

Initial Height of Water (Ho) = 24.7
Final Height of Water (Hf) = 15.2
Change in Height Over Time (ΔH) = 9.5
Average Head Over Time (Havg) = 20.0
Annulus Gravel/Sand Correction (C) = 0.5

I_t= ΔH(60r)/Δt(r+2Havg)
I_t= 5.2 in./hr.
C x I_t = **2.6** **in./hr.**

Percolation Data Sheet

Project Name: Meritage/La Sierra | Project Number: 23145-01
Test Hole Number: P-3 | Date Excavated: 12/11/2023
Depth (in): 120 | Radius (in.): 4 | Date Presoak: 12/11/2023
Tested By: AC | Pipe Diameter (in.): 3 | Date Tested: 12/12/2023

Sandy Soil Criteria

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)
1	10:23 10:33	10	58.4	64.7	6.2
2	10:33 10:53	20	64.7	74.6	10.0

Percolation Data

Time	Time Interval (mins.)	Total Elapsed Time (mins)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
11:04 11:14	10	10	80.4	84.0	3.6	21.6
11:15 11:25	10	21	84.0	85.2	1.2	7.2
11:25 11:35	10	31	85.2	87.1	1.9	11.5
11:35 11:45	10	41	87.1	88.6	1.4	8.6
11:47 11:57	10	53	81.2	83.6	2.4	14.4
12:15 12:25	10	81	82.8	85.0	2.2	13.0

Initial Height of Water (Ho) = 37.2

Final Height of Water (Hf) = 35.0

Change in Height Over Time (ΔH) = 2.2

Average Head Over Time (Havg) = 36.1

Annulus Gravel/Sand Correction (C) = 0.5

$I_t = \Delta H(60r)/\Delta t(r+2Havg)$

$I_t =$ 0.7 in./hr.

$C \times I_t =$ **0.3** **in./hr.**

Percolation Data Sheet

Project Name: Meritage/La Sierra
Project Number: 23145-01
Test Hole Number: P-4
Date Excavated: 12/11/2023
Depth (in): 86 Radius (in.): 4
Date Presoak: 12/11/2023
Tested By: AC Pipe Diameter (in.): 3
Date Tested: 12/12/2023

Sandy Soil Criteria

Trial Number	Time	Time Interval (mins.)	Initial Water Level (in.)	Final Water Level (in.)	Δ in Water Level (in.)
1	10:24 10:34	10	43.2	50.16	6.96
2	10:34 10:44	10	50.16	56.28	6.12

Percolation Data

Time	Time Interval (mins.)	Total Elapsed Time (mins)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Δ in Water Level (in.)	Percolation Rate (in./hr.)
10:52 11:02	10	10	50.4	56.8	6.4	38.2
11:04 11:14	10	22	52.7	58.1	5.4	32.4
11:14 11:24	10	32	50.4	56.0	5.6	33.8
11:24 11:34	10	42	49.2	55.3	6.1	36.7
11:34 11:44	10	52	51.5	57.5	6.0	36.0
11:45 11:55	10	63	48.1	54.2	6.1	36.7

Initial Height of Water (Ho) = 37.9

Final Height of Water (Hf) = 31.8

Change in Height Over Time (ΔH) = 6.1

Average Head Over Time (Havg) = 34.8

Annulus Gravel/Sand Correction (C) = 0.5

I_t= ΔH(60r)/Δt(r+2Havg)

I_t= 2.0 in./hr.

C x I_t = **1.0** **in./hr.**

Appendix F

USGS web services were down for some period of time and as a result this tool wasn't operational, resulting in *timeout* error.
USGS web services are now operational so this tool should work as expected.

Latitude, Longitude: 33.94189, -117.50110

Date	12/13/2023, 4:22:41 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	C - Very Dense Soil and Soft Rock

Type	Value	Description
S_S	1.5	MCE_R ground motion. (for 0.2 second period)
S_1	0.57	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.8	Site-modified spectral acceleration value
S_{M1}	0.815	Site-modified spectral acceleration value
S_{DS}	1.2	Numeric seismic design value at 0.2 second SA
S_{D1}	0.543	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	1.43	Site amplification factor at 1.0 second
PGA	0.515	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.618	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.578	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.671	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.57	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.617	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.515	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.645	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.944	Mapped value of the risk coefficient at short periods
C_{R1}	0.924	Mapped value of the risk coefficient at a period of 1 s
C_V	1.2	Vertical coefficient

DISCLAIMER

While the information presented on this website is believed to be correct, SEAOC /OSHPD and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in this web application should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. SEAOC / OSHPD do not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the seismic data provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the search results of this website.

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new USGS Earthquake Hazard Toolbox for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

Input

Edition

Dynamic: Conterminous U.S. 2014 (updat…

Latitude

Decimal degrees

33.94189

Longitude

Decimal degrees, negative values for western longitudes

-117.5011

Site Class

537 m/s (Site class C)

Spectral Period

Peak Ground Acceleration

Time Horizon

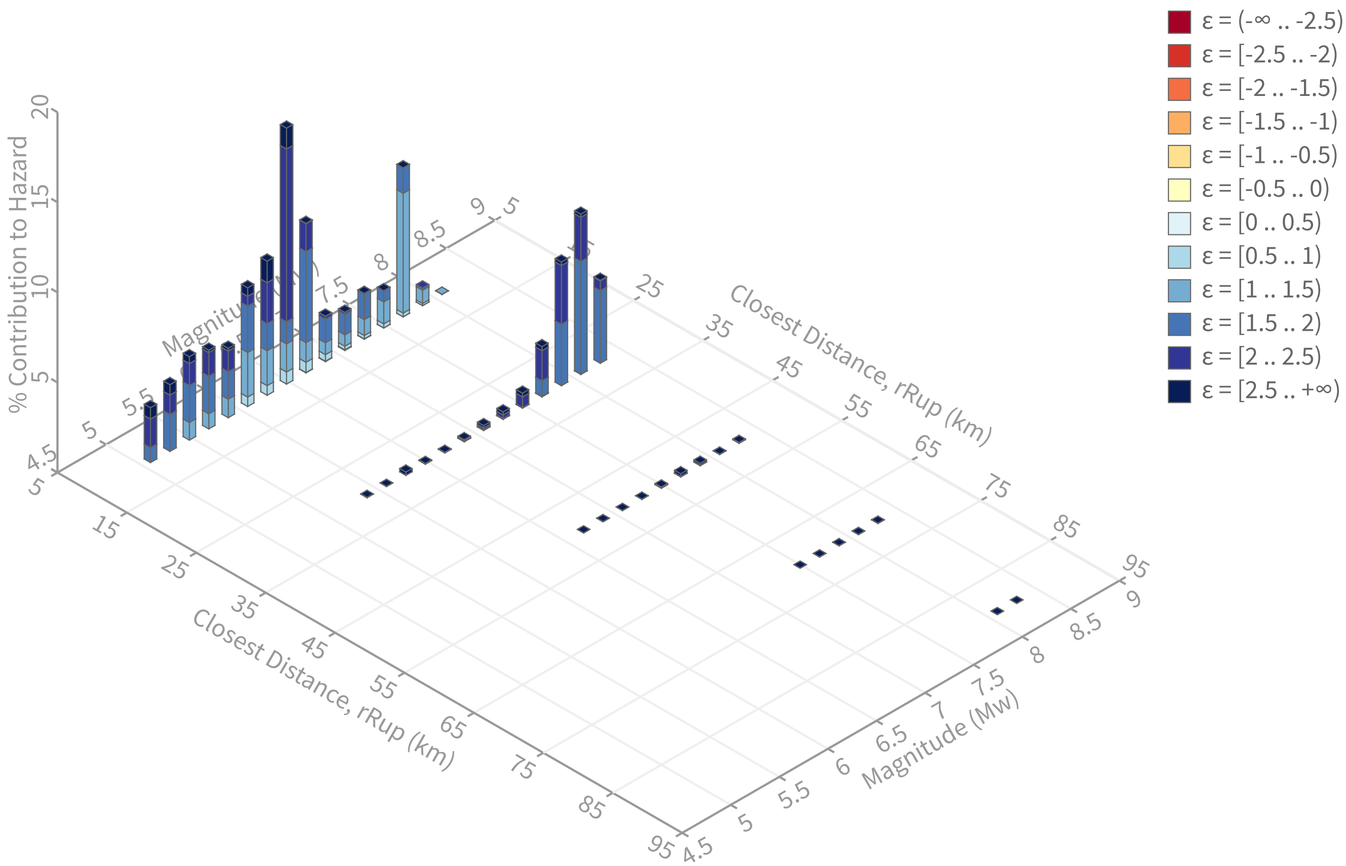
Return period in years

2475

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.71174273 g

Recovered targets

Return period: 2944.9187 yrs
Exceedance rate: 0.00033956794 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.07 %

Mean (over all sources)

m: 6.83
r: 15.41 km
ε_0: 1.81 σ

Mode (largest m-r bin)

m: 6.48
r: 13.3 km
ε_0: 2.06 σ
Contribution: 14.2 %

Mode (largest m-r-ε_0 bin)

m: 6.48
r: 14.84 km
ε_0: 2.26 σ
Contribution: 9.59 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM31	System							31.51
San Jacinto (San Bernardino) [3]		23.89	8.06	1.79	117.303°W	34.080°N	49.95	7.11
Elsinore (Glen Ivy) rev [0]		14.90	6.54	2.26	117.572°W	33.822°N	206.11	6.37
Whittier alt 1 [0]		14.13	7.48	1.40	117.588°W	33.833°N	213.47	6.34
San Andreas (San Bernardino N) [4]		32.90	8.00	2.17	117.314°W	34.194°N	31.47	2.88
Fontana (Seismicity) [2]		9.46	6.61	1.58	117.572°W	34.001°N	315.28	2.51
Chino alt 1 [4]		13.90	6.90	1.92	117.623°W	33.869°N	234.23	2.16
UC33brAvg_FM32	System							30.92
San Jacinto (San Bernardino) [3]		23.89	8.06	1.80	117.303°W	34.080°N	49.95	7.04
Elsinore (Glen Ivy) rev [0]		14.90	6.52	2.26	117.572°W	33.822°N	206.11	6.48
Whittier alt 2 [0]		14.52	7.57	1.39	117.588°W	33.832°N	213.42	6.21
San Andreas (San Bernardino N) [4]		32.90	8.00	2.17	117.314°W	34.194°N	31.47	2.91
Chino alt 2 [3]		13.71	7.04	1.82	117.615°W	33.864°N	230.62	2.21
Fontana (Seismicity) [2]		9.46	6.61	1.58	117.572°W	34.001°N	315.28	2.05
UC33brAvg_FM31 (opt)	Grid							19.03
PointSourceFinite: -117.501, 33.982		6.57	5.78	1.44	117.501°W	33.982°N	0.00	3.25
PointSourceFinite: -117.501, 33.982		6.57	5.78	1.44	117.501°W	33.982°N	0.00	3.25
PointSourceFinite: -117.501, 34.000		7.94	5.75	1.68	117.501°W	34.000°N	0.00	2.28
PointSourceFinite: -117.501, 34.000		7.94	5.75	1.68	117.501°W	34.000°N	0.00	2.28
PointSourceFinite: -117.501, 34.036		9.72	6.18	1.72	117.501°W	34.036°N	0.00	1.74
PointSourceFinite: -117.501, 34.036		9.72	6.18	1.72	117.501°W	34.036°N	0.00	1.74
PointSourceFinite: -117.501, 34.045		10.67	6.12	1.87	117.501°W	34.045°N	0.00	1.66
PointSourceFinite: -117.501, 34.045		10.67	6.12	1.87	117.501°W	34.045°N	0.00	1.66
UC33brAvg_FM32 (opt)	Grid							18.54
PointSourceFinite: -117.501, 33.982		6.56	5.79	1.43	117.501°W	33.982°N	0.00	3.19
PointSourceFinite: -117.501, 33.982		6.56	5.79	1.43	117.501°W	33.982°N	0.00	3.19
PointSourceFinite: -117.501, 34.000		7.94	5.75	1.68	117.501°W	34.000°N	0.00	2.28
PointSourceFinite: -117.501, 34.000		7.94	5.75	1.68	117.501°W	34.000°N	0.00	2.28
PointSourceFinite: -117.501, 34.045		10.69	6.12	1.88	117.501°W	34.045°N	0.00	1.64
PointSourceFinite: -117.501, 34.045		10.69	6.12	1.88	117.501°W	34.045°N	0.00	1.64
PointSourceFinite: -117.501, 34.036		9.86	6.14	1.76	117.501°W	34.036°N	0.00	1.60
PointSourceFinite: -117.501, 34.036		9.86	6.14	1.76	117.501°W	34.036°N	0.00	1.60

Appendix G

APPENDIX E

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

1.0 GENERAL

1.1 **Intent:** These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these general Specifications. Observations of the earthwork by the project Geotechnical Consultant during grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 **Geotechnical Consultant:** Prior to commencement of work, the project owner shall employ a geotechnical consultant. The geotechnical consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all keyway bottoms, and benches made on sloping ground to receive fill.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of subgrade and fill materials and perform adequate relative compaction testing of fill to determine the attained level of compaction and assess if, in their opinion, if the work was performed in substantial compliance with the geotechnical report(s) and these specifications. The Geotechnical Consultant shall provide test results to the owner on a routine and frequent basis.

1.3 **The Earthwork Contractor:** The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with applicable grading codes, the project plans, and these specifications.

The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork planned for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are corrected.

2.0 PREPARATION OF FILL AREAS

2.1 **Clearing and Grubbing:** Areas to be excavated and filled shall be cleared and grubbed. Vegetation, such as brush, grass, roots, and other deleterious material, man-made structures, and similar debris shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant. Borrow areas shall be cleared and grubbed to the extent necessary to provide a suitable fill material.

Concrete fragments that are free of reinforcing street may be placed in fills, provided they are placed in accordance with Section 3 and 4. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent organic matter. Nesting of organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area. As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, etc.) have chemical constituents that are considered hazardous waste. As such, the indiscriminate dumping or spillage of such fluids may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

The Geotechnical Consultant shall not be responsible for the identification or analysis of potentially hazardous materials; however, if observations, odors, or soil discoloration are suspect, the Geotechnical Consultant may request from the owner the termination of grading operations until such materials are deemed not hazardous as defined by applicable laws and regulations.

2.2 **Evaluation/Acceptance of Fill Areas:** All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

2.3 **Processing:** Ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Ground that is not satisfactory shall be removed/overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction. After scarification, the surface should be moisture conditioned, as necessary, to achieve the proper moisture content and compacted in accordance with Section 4 of these specifications.

2.4 **Overexcavation:** In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured, or otherwise unsuitable ground shall be overexcavated to competent ground as recommended by the Geotechnical Consultant during grading.

2.5 **<u>Benching</u>:** Fills to be placed on ground sloping steeper than 5H:1V (horizontal to vertical units) shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for fill placement.

3.0 FILL MATERIAL

3.1 **<u>General</u>:** Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 **<u>Oversize</u>:** Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or other underground construction.

3.3 **<u>Import</u>:** If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1 and/or requirements defined in the project geotechnical report(s). The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before import begins so that suitability can be determined, and appropriate laboratory tests performed.

4.0 FILL PLACEMENT AND COMPACTION

4.1 **<u>Fill Layers</u>:** Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 **<u>Fill Moisture Conditioning</u>:** Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with ASTM International (ASTM Test Method D1557).

4.3 **<u>Compaction of Fill</u>:** After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction and uniformity.

<u>Compaction of Fill Slopes</u>: In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557.

4.4 **<u>Compaction Testing</u>:** Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.5 **<u>Frequency of Compaction Testing</u>:** Tests shall be taken at intervals required by the governing agency and as deemed necessary by the Geotechnical Consultant in order to adequately qualify the fill material. In general, it should be anticipated that tests will be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill, unless recommended otherwise by the Geotechnical Consultant. In addition, test(s) shall be taken on slope faces and/or each 10 feet of vertical height of slope as deemed necessary by the Geotechnical Consultant. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.6 **<u>Compaction Test Locations</u>:** The Geotechnical Consultant shall document the approximate elevation and location of each compaction test. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided. Alternatively, GPS units may be used to determine the approximate location/coordinates of the field density tests.

5.0 SUBDRAIN INSTALLATION

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and standard details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys. The Contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The Contractor is responsible for the performance of subdrains.

6.0 EXCAVATION

Excavations, including over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical report(s) and plans are estimates. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 TRENCH BACKFILLS

7.1 Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

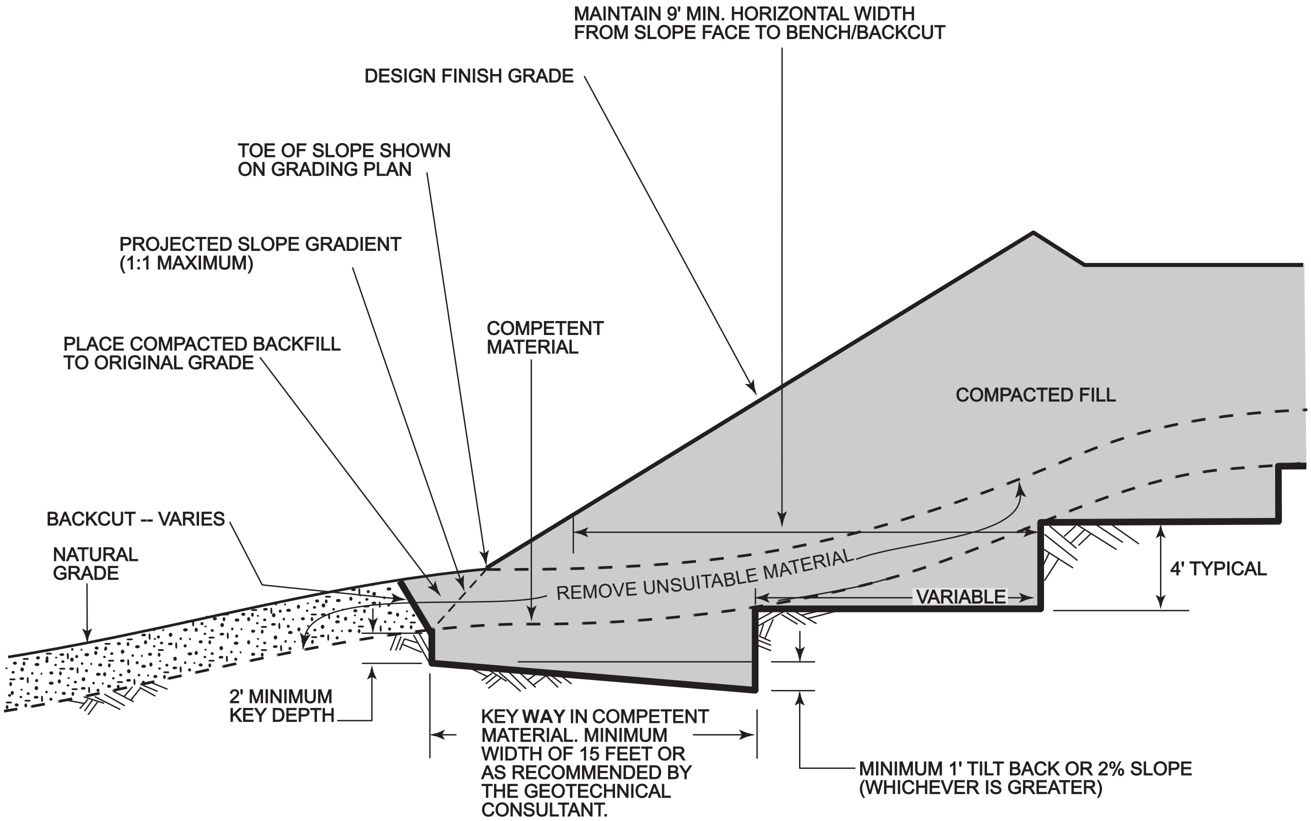
7.2 Bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum 90 percent of maximum from 1 foot above the top of the conduit to the surface, except in traveled ways (see Section 7.6 below).

7.3 Jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

7.4 Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill, unless required differently by the governing agency or the Geotechnical Consultant.

7.5 Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

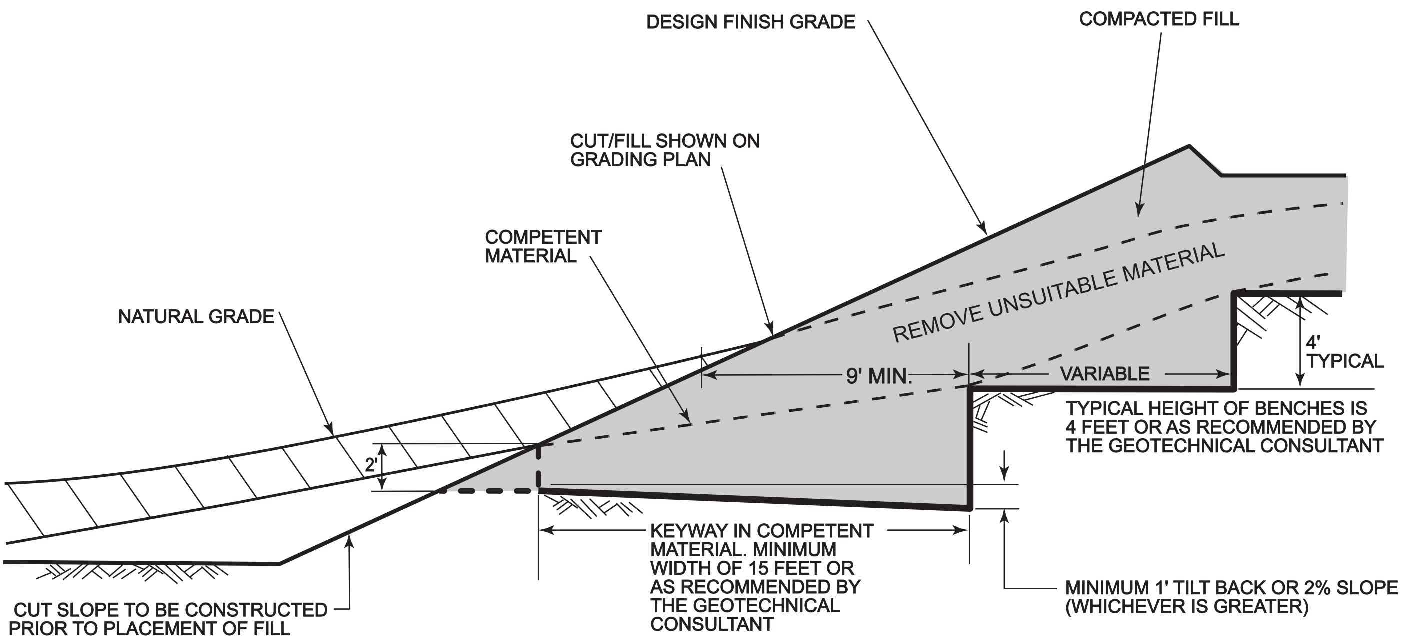
7.6 Trench backfill in the upper foot measured from finish grade within existing or future traveled way, shoulder, and other paved areas (or areas to receive pavement) should be placed to a minimum 95 percent relative compaction.



NOTE: BENCHING SHALL BE REQUIRED WHEN SLOPES ARE EQUAL TO OR STEEPER THAN 5H:1V OR WHEN RECOMMENDED BY THE GEOTECHNICAL CONSULTANT. WHERE THE NATURAL SLOPE APPROACHES OR EXCEEDS THE DESIGN SLOPE RATIO, SPECIFIC RECOMMENDATIONS SHOULD BE PROVIDED BY THE GEOTECHNICAL CONSULTANT.

FIGURE 1

TYPICAL FILL KEY ABOVE NATURAL SLOPE
MINIMUM STANDARD GRADING DETAIL

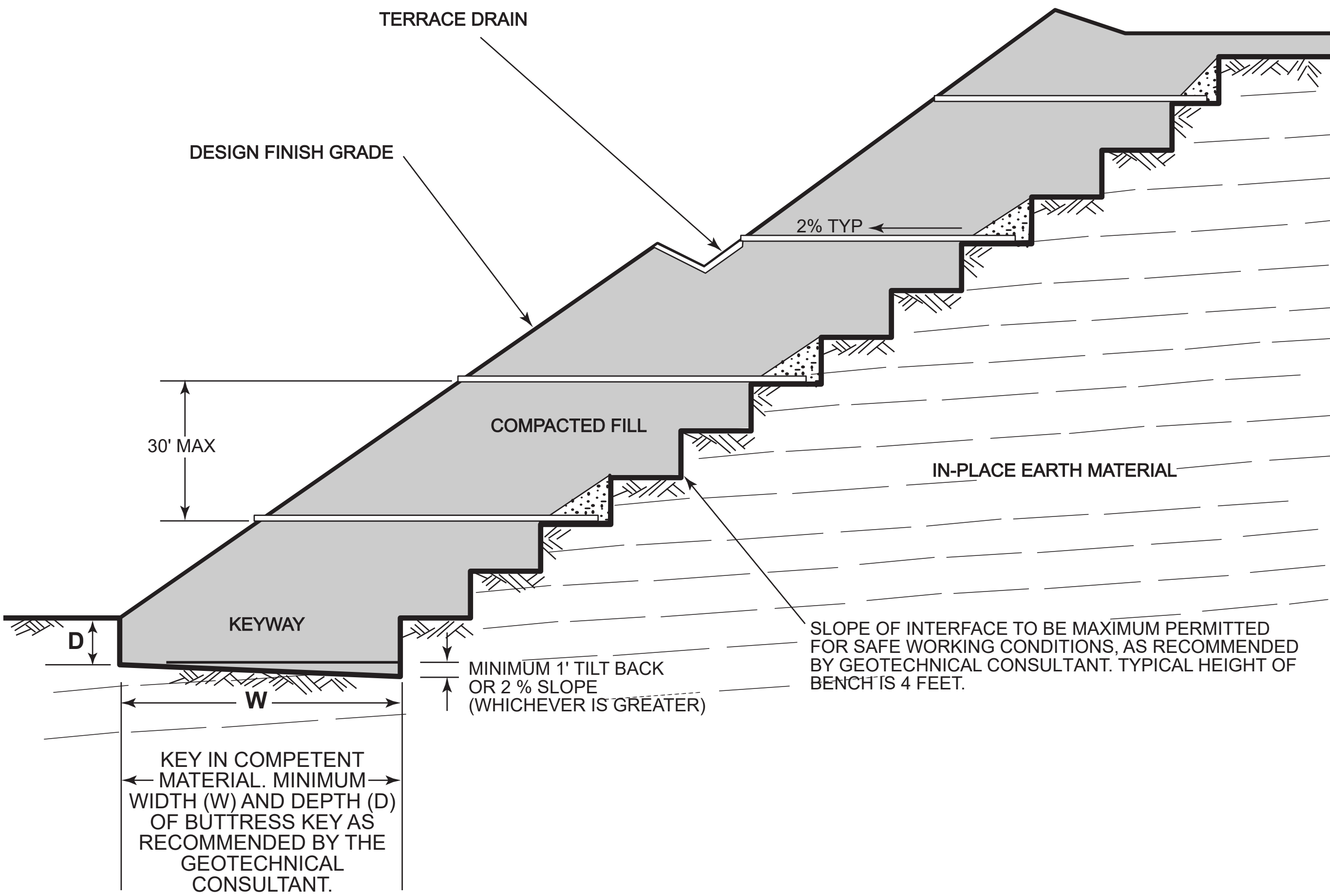


NOTE: BENCHING SHALL BE REQUIRED WHEN SLOPES ARE EQUAL TO OR STEEPER THAN 5H:1V OR WHEN RECOMMENDED BY THE GEOTECHNICAL CONSULTANT. WHERE THE NATURAL SLOPE APPROACHES OR EXCEEDS THE DESIGN SLOPE RATIO, SPECIFIC RECOMMENDATIONS SHOULD BE PROVIDED BY THE GEOTECHNICAL CONSULTANT.

FIGURE 2

TYPICAL FILL ABOVE CUT SLOPE
MINIMUM STANDARD GRADING DETAIL

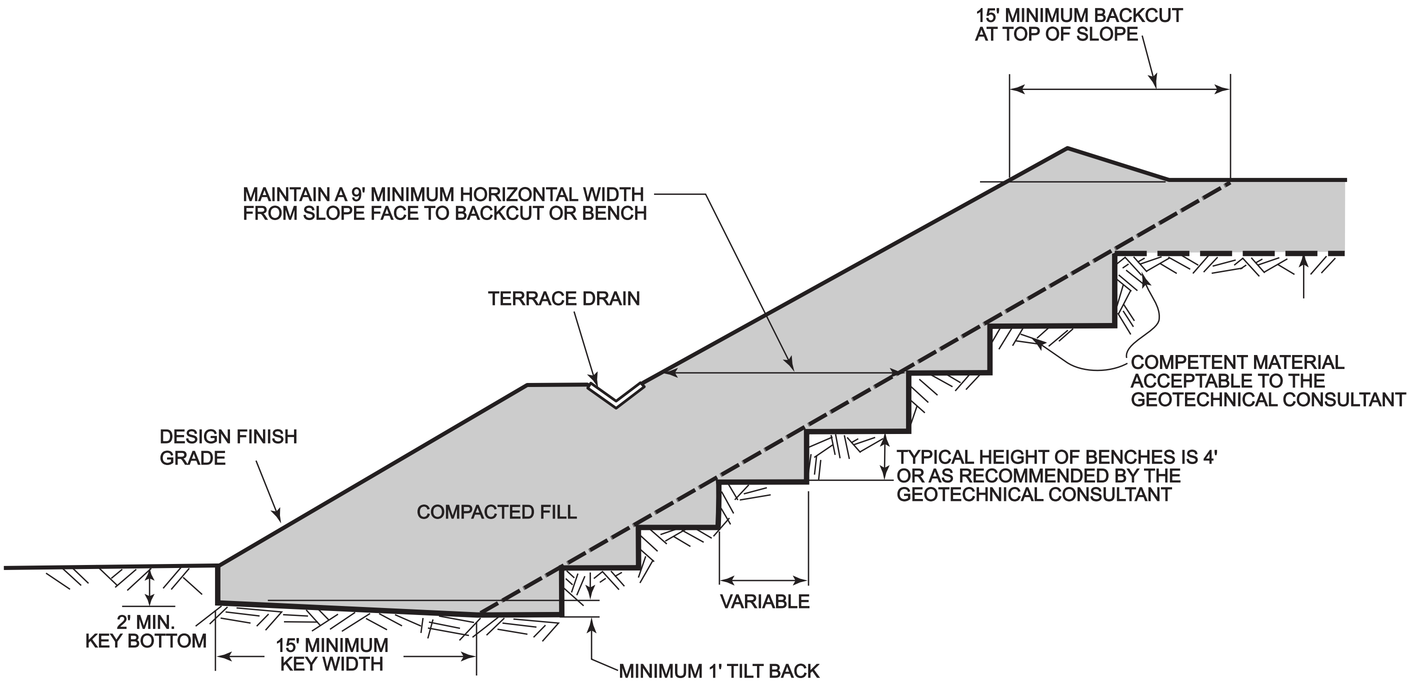
S/A



NOTE: FOR SUBDRAIN DETAILS, SEE FIGURE 5.

FIGURE 3

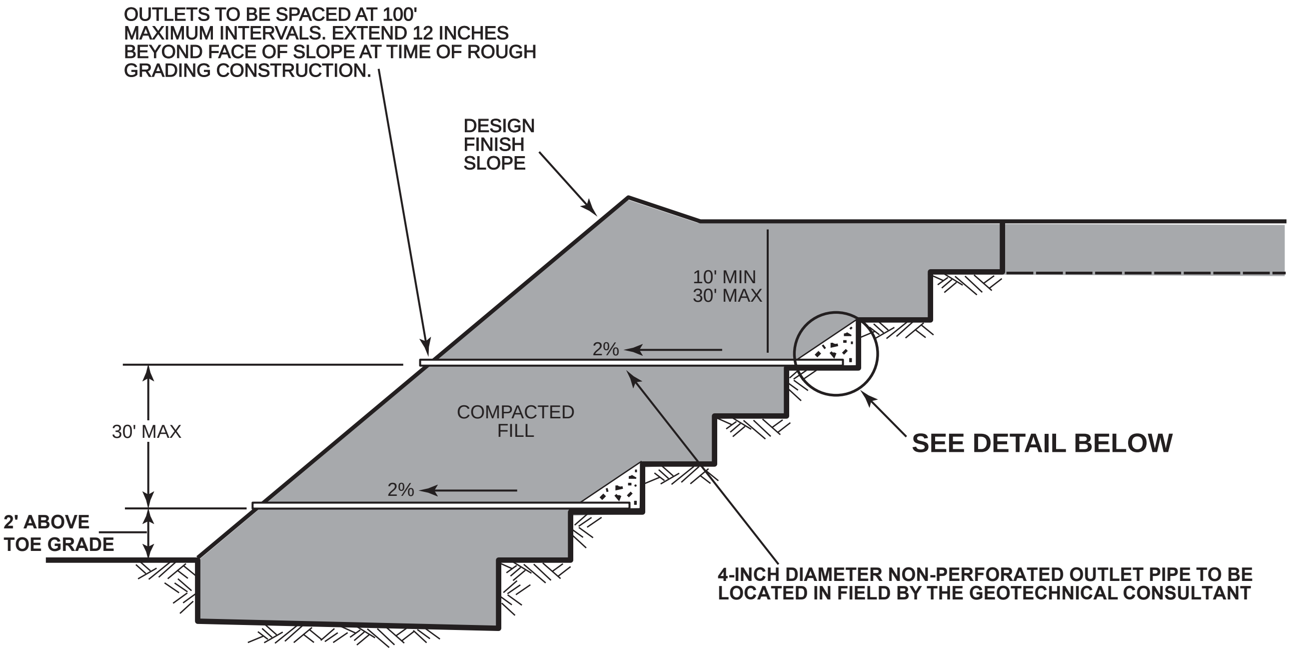
TYPICAL BUTTRESS FILL
MINIMUM STANDARD GRADING DETAIL



NOTE: FOR SUBDRAIN DETAILS, SEE FIGURE 5.

FIGURE 4

TYPICAL STABILIZATION FILL
MINIMUM STANDARD GRADING DETAIL



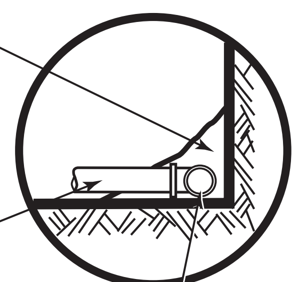
DETAIL

FILTER MATERIAL - MINIMUM OF THREE CUBIC FEET PER FOOT OF PIPE. SEE FILTER MATERIAL SPECIFICATION.

ALTERNATE: IN LIEU OF FILTER MATERIAL, THREE CUBIC FEET OF GRAVEL PER FOOT OF SUBDRAIN (WITHOUT PIPE) MAY BE ENCASED IN FILTER FABRIC.

GRAVEL TO CONSIST OF 1/2" TO 1" CRUSHED ROCK PER STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION. FIGURE 6 FOR FILTER FABRIC SPECIFICATION

FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 12 INCHES ON ALL JOINTS. SEE FIGURE 6 FOR FILTER FABRIC SPECIFICATION



OUTLET PIPE TO BE CONNECTED TO SUBDRAIN PIPE WITH TEE OR ELBOW

MINIMUM 4-INCH DIAMETER SCHEDULE 40 ASTM D1527 OR D1785 OR SDR 35 ASTM D2751 OR D 3034. FOR FILL DEPTH OF 60 FEET OR GREATER, USE ONLY SCHEDULE 40 OR EQUIVALENT. THERE SHALL BE A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE. PROVIDE CAP AT UPSTREAM END OF PIPE. SLOPE A MINIMUM OF 2 PERCENT TO OUTLET PIPE.

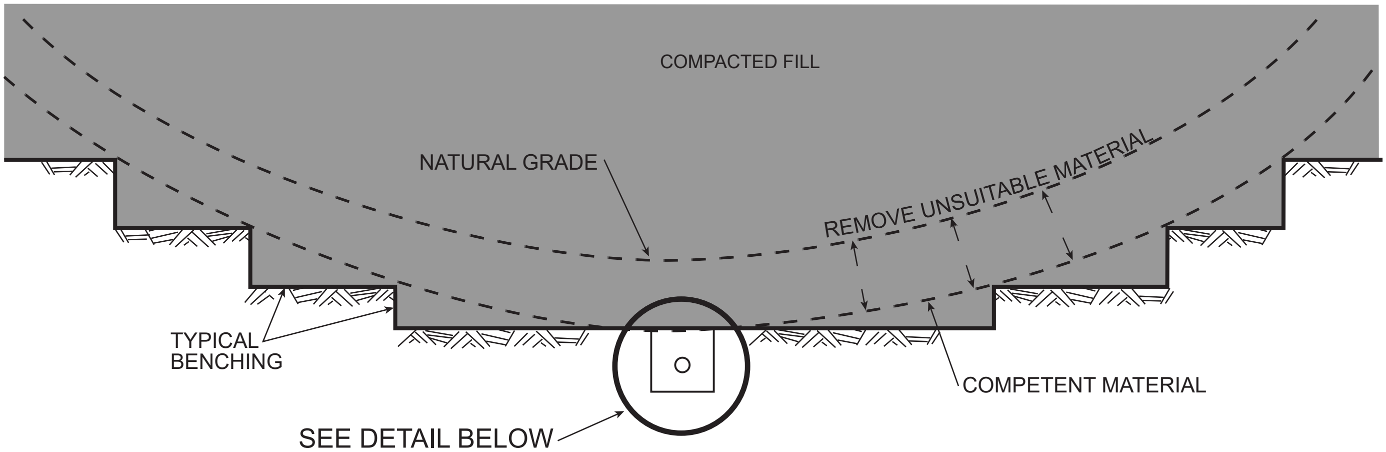
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT.

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

FIGURE 5

TYPICAL STABILIZATION AND BUTTRESS FILL SUBDRAINS MINIMUM STANDARD GRADING DETAIL

S/A



FILTER FABRICS SHALL BE PERMEABLE NON-WOVEN POLYESTER, NYLON, OR POLYPROPYLENE MATERIAL CONFORMING TO THE FOLLOWING:

1) GRAB TENSILE STRENGTH. POUNDS, MIN. ASTM D 4632..90

2) ELONGATION, AT PEAK LOAD, PERCENT, MIN. ASTM D 4632...50

3) PUNCTURE STRENGTH, LBS., MIN. ASTM D 3787...45

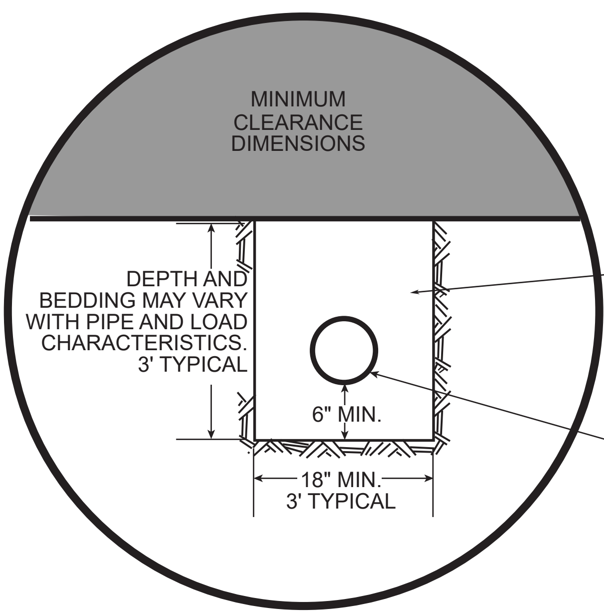
4) COEFFICIENT OF WATER PERMITTIVITY, 1/SEC. ASTM D 4491...>0.7

5) BURST STRENGTH, P.S.I., MIN. ASTM D 3786..180

NOTES: DOWNSTREAM 20' OF PIPE AT OUTLET SHALL BE NON-PERFORATED AND BACKFILLED WITH FINE-GRAINED MATERIAL

PIPE SHALL BE A MINIMUM OF 4-INCH DIAMETER. FOR RUNS OF 500 FEET OR MORE, USE 6-INCH DIAMETER PIPE, OR AS RECOMMENDED BY THE GEOTECHNICAL CONSULTANT

DETAIL



FILTER MATERIAL - MINIMUM OF NINE CUBIC FEET PER FOOT OF PIPE. SEE FIGURE 5 FOR FILTER MATERIAL SPECIFICATIONS.

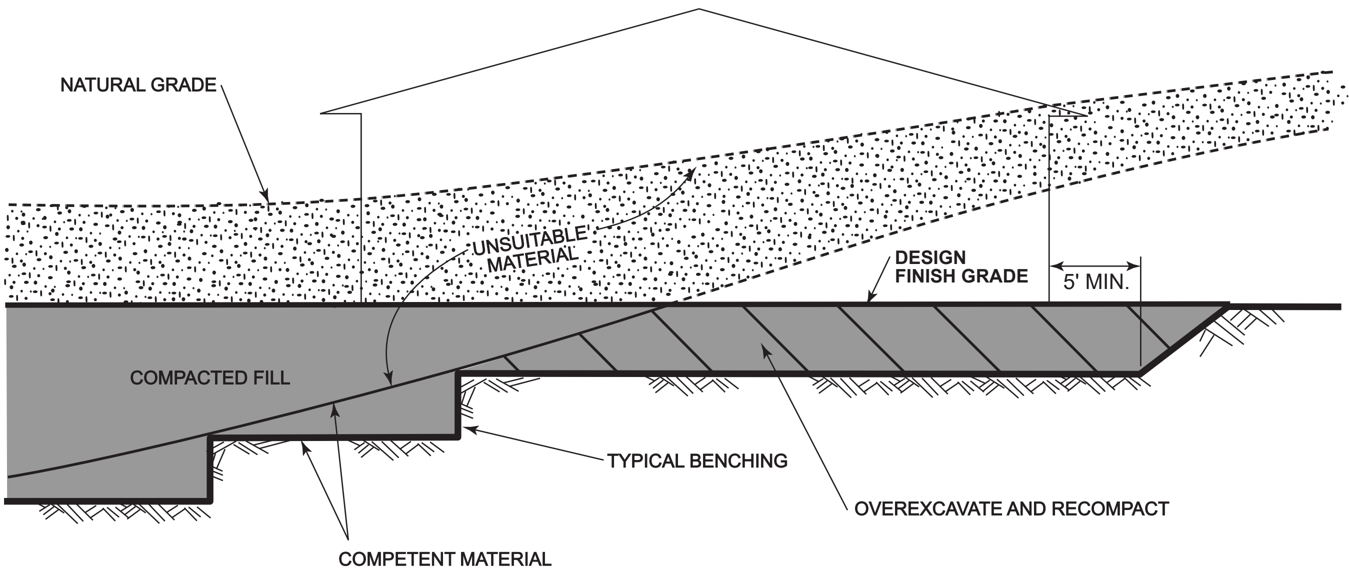
ALTERNATE: IN LIEU OF FILTER MATERIAL, NINE CUBIC FEET OF GRAVEL PER FOOT OF SUBDRAIN (WITHOUT PIPE) MAY BE ENCASED IN FILTER FABRIC. SEE FIGURE 5 TO GRAVEL SPECIFICATION. SEE ABOVE FOR FILTER FABRIC SPECIFICATION. FILTER FABRIC SHALL BE LAPPED MINIMUM OF 12 INCHES ON ALL JOINTS.

MINIMUM 4 INCH DIAMETER SCHEDULE 40 ASTM D 1527, OR D 1785, OR SDR 35 ASTM 2751 OR D 3034. FOR FILL DEPTH OF 60 FEET OR GREATER, USE ONLY SCHEDULE 40 OR APPROVED EQUIVALENT. THERE SHALL BE A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE.

FIGURE 6

TYPICAL CANYON SUBDRAIN MINIMUM STANDARD GRADING DETAIL

CUT LOT



CUT/FILL LOT TRANSITION LOT

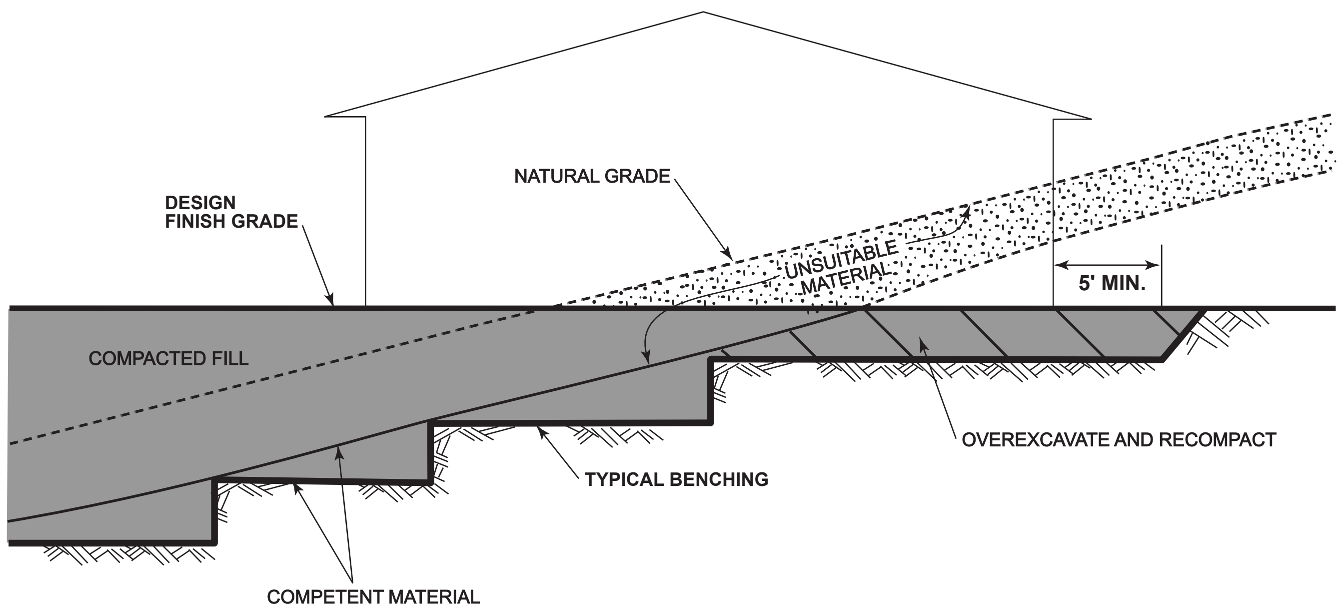
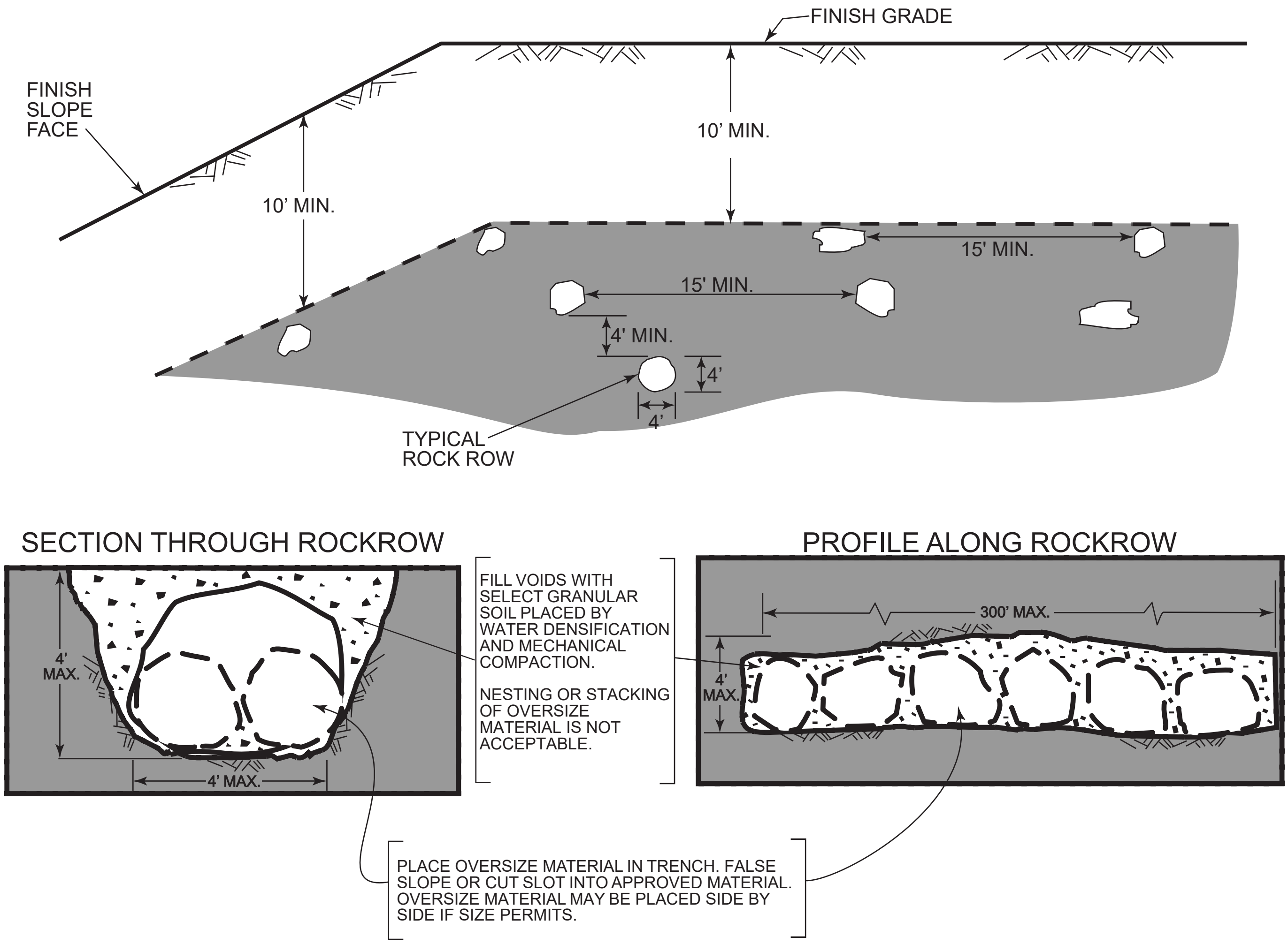


FIGURE 7

TYPICAL OVEREXCAVATION OF DAYLIGHT LINE
MINIMUM STANDARD GRADING DETAIL



NOTES:

A) OVERSIZED ROCK IS DEFINED AS LARGER THAN 12" IN SIZE IN GREATEST DIMENSION.

B) SPACE BETWEEN ROCKROWS SHOULD BE ONE EQUIPMENT WIDTH OR A MINIMUM OF 15 FEET.

C) THE WIDTH AND HEIGHT OF THE ROCKROW SHALL BE LIMITED TO FOUR FEET AND THE LENGTH LIMITED TO 300 FEET UNLESS APPROVED OTHERWISE BY THE GEOTECHNICAL CONSULTANT. OVERSIZE SHOULD BE PLACED WITH FLATEST SIDE ON THE BOTTOM.

D) OVERSIZE MATERIAL EXCEEDING FOUR FEET MAY BE PLACED ON AN INDIVIDUAL BASIS IF APPROVED BY THE GEOTECHNICAL CONSULTANT.

E) FILLING OF VOIDS WILL REQUIRE SELECT GRANULAR SOIL (SE > 20, OR LESS THAN 20 PERCENT FINES) AS APPROVED BY THE GEOTECHNICAL CONSULTANT. VOIDS IN THE ROCKROW TO BE FILLED BY WATER DENSIFYING GRANULAR SOIL INTO PLACE ALONG WITH MECHANICAL COMPACTION EFFORT.

F) IF APPROVED BY THE GEOTECHNICAL CONSULTANT, ROCKROWS MAY BE PLACED DIRECTLY ON COMPETENT MATERIALS OR BEDROCK, PROVIDED ADEQUATE SPACE IS AVAILABLE FOR COMPACTION.

G) THE FIRST LIFT OF MATERIAL ABOVE THE ROCKROW SHALL CONSIST OF GRANULAR MATERIAL AND SHALL BE PROOF-ROLLED WITH A D-8 OR LARGER DOZER OR EQUIVALENT.

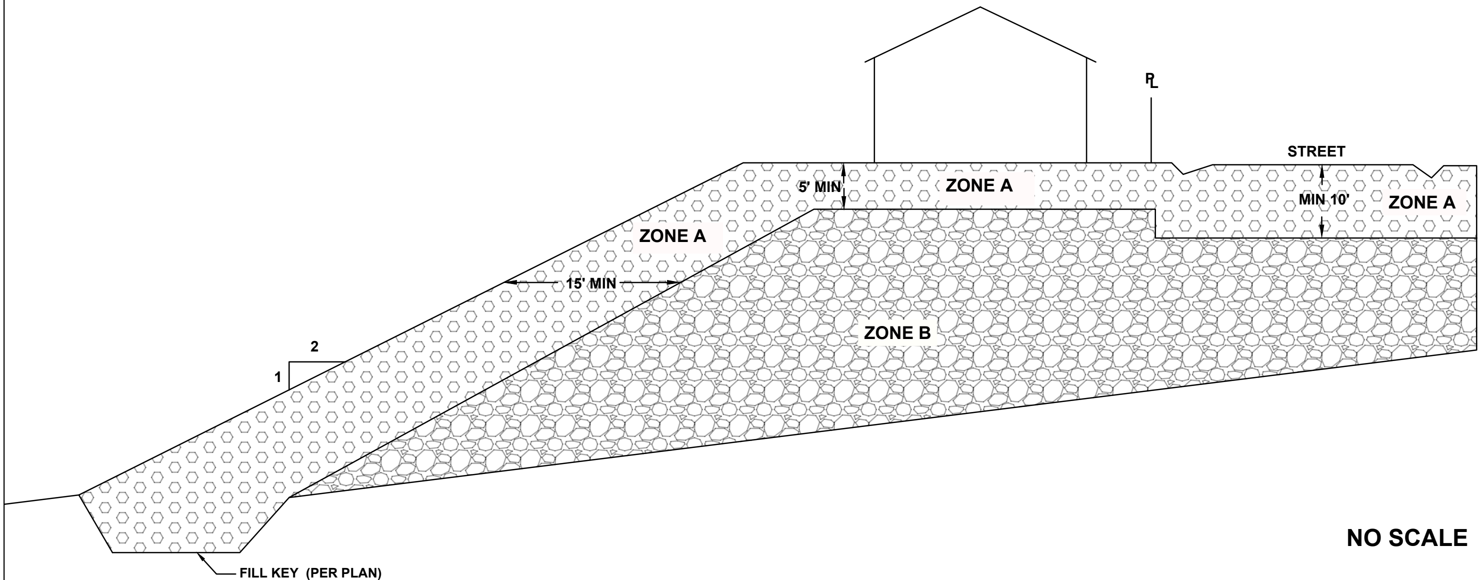
H) ROCKROWS NEAR SLOPES SHOULD BE ORIENTED PARALLEL TO SLOPE FACE.

I) NESTING OR STACKING OF ROCKS IS NOT ACCEPTABLE.

FIGURE 8

TYPICAL OVERSIZE ROCK PLACEMENT METHOD
MINIMUM STANDARD GRADING DETAIL

S/A



LEGEND

ZONE A:

- THE UPPER 5 FEET OF FILL UNDER PADS SHOULD NOT HAVE ROCKS GREATER THAN 12 INCHES IN THE LARGEST DIMENSION (12-INCH MINUS).
- FILLS IN PUBLIC STREETS, RIGHT OF WAYS AND EASEMENTS SHOULD CONTAIN ONLY 12-INCH MINUS MATERIALS TO A DEPTH OF 10 FEET BELOW FINISH GRADE OR 2 FEET BELOW THE DEEPEST UTILITY, WHICHEVER IS DEEPER.
- FILLS IN SLOPE AREAS MAY HAVE OVERSIZE ROCK PLACED PER ROCK BLANKET DETAIL TO WITHIN 15 FEET OF SLOPE FACE. FILL WITHIN 15 FEET OF SLOPE FACE SHOULD ONLY CONSIST OF 12-INCH MINUS MATERIAL.

ZONE B:

- ROCKS UP TO 2 FEET IN HEIGHT (LYING FLAT) WITH OCCASIONAL INDIVIDUAL FRAGMENTS UP TO 4 FEET MAXIMUM DIMENSION MAY BE PLACED WITHIN ZONE B AREA.
- ROCKS EXCEEDING 2 FEET IN THE SMALLEST DIMENSION MAY BE PLACED IN ROWS WITH THE FLATTEST SIDE DOWN (SEE NEXT PAGE). THE WIDTH OF THE ROWS MAY EXCEED 4 FEET PROVIDED THE FILL OPERATION CAN ACCOMMODATE A MINIMUM OF 15 FEET BETWEEN ROWS, AND PROVIDED THAT THERE IS SUFFICIENT EQUIPMENT TO PLACE FILL AGAINST AND OVER THE ROWS.
- FILL SOILS PLACED AGAINST OR OVER ROCK ROWS SHOULD BE FREE OF ROCKS THAT MAY CAUSE NESTING/VOIDS WITHIN THE ROCK ROWS AND ROCK FILL. THIS CONDITION SHOULD BE CAREFULLY REVIEWED IN THE FIELD BY THE GEOTECHNICAL CONSULTANT TO VERIFY SATISFACTORY OPERATIONS.
- ROCKS UP TO 10 FEET IN THE LEAST DIMENSION MAY BE PLACED AS INDIVIDUAL ROCKS WITHIN THE COMPACTED FILL. THE FILL SOILS NEAR AND AGAINST THESE ROCKS SHOULD BE FREE OF ROCKS THAT MAY CAUSE NESTING/VOIDS WITH THE LARGER ROCKS. THIS CONDITION SHOULD BE CAREFULLY REVIEWED IN THE FIELD BY THE GEOTECHNICAL CONSULTANT TO VERIFY SATISFACTORY OPERATIONS.
- ROCKS, LARGER THAN 10 FEET IN THE SMALLEST DIMENSION, SHOULD BE REDUCED IN SIZE TO MEET THE SPECIFIED DIMENSIONS FOR INDIVIDUAL ROCK PLACEMENT AND/OR FOR PLACEMENT IN ROCK ROWS.

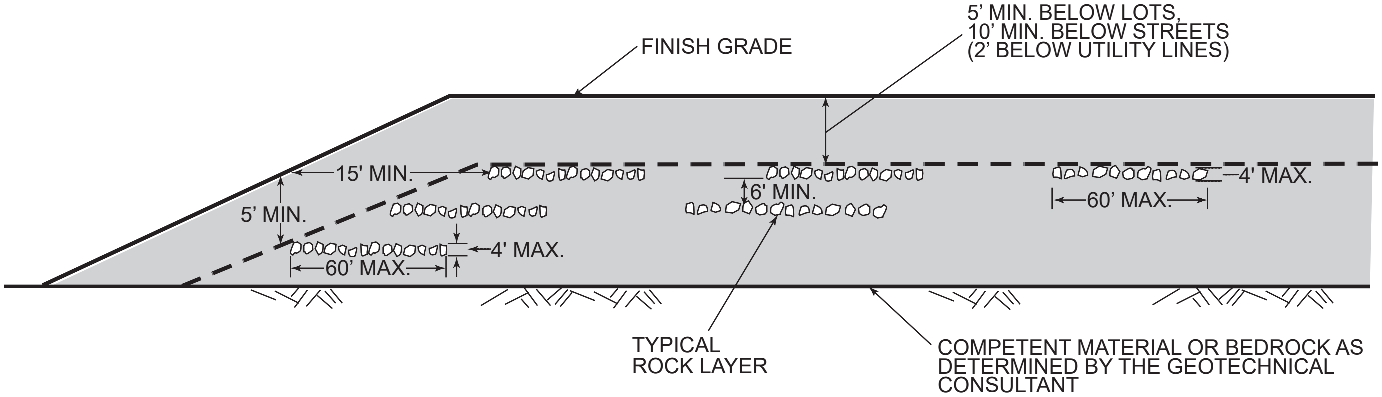
NOTES: CONTINUOUS OBSERVATION IS REQUIRED BY GEOTECHNICAL CONSULTANT DURING ROCK PLACEMENT.

FIGURE 9

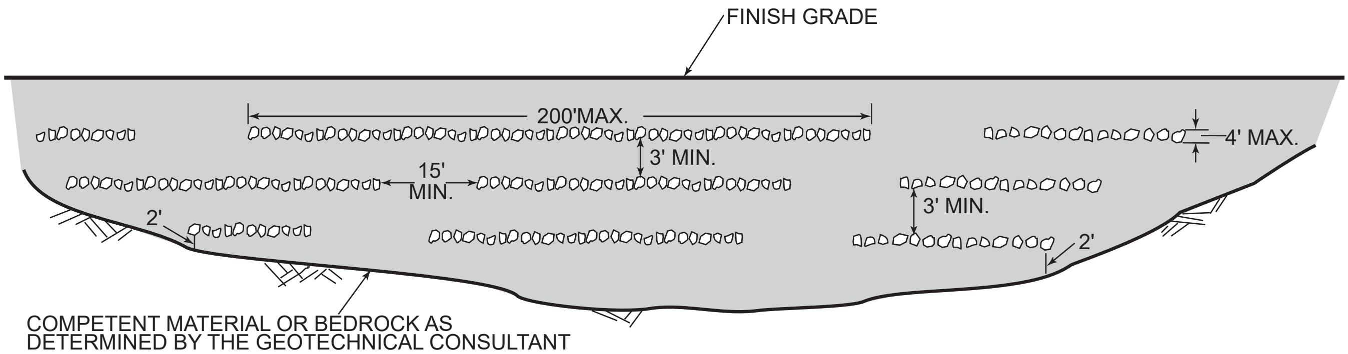
STRUCTURAL ROCK FILL PLACEMENT DETAIL

S/A

VIEW NORMAL TO SLOPE FACE



VIEW PARALLEL TO SLOPE FACE



NOTES:

1) ORIENTATION AND STAGGERING MAY VARY, BUT SHALL BE AS RECOMMENDED BY THE GEOTECHNICAL CONSULTANT.

2) ROCK LAYERS SHALL NOT BE MORE THAN 4 FEET IN HEIGHT. ROCK SHALL NOT BE STACKED OR NESTED.

3) EACH ROCK CELL MUST BE COVERED WITH A GRANULAR SOIL WITH A MINIMUM SAND EQUIVALENT (SE) OF 20 OR WITH LESS THAN 10% PASSING THE NO. 200 SIEVE AS DETERMINED BY THE GEOTECHNICAL CONSULTANT. THE GRANULAR SOIL IS TO BE FLUSHED, FLOODED, AND JETTED IN THE ROCK LAYER IN ORDER TO FILL THE VOIDS. ADDITIONAL LIFTS OF GRANULAR SOIL SHALL BE PLACED AS NECESSARY TO ALLOW FOR THE FILLING OF VOIDS BY FLOODING, AND JETTING. THE ROCK LAYER SHALL THEN BE ADEQUATELY COMPACTED WITH HEAVY EARTH MOVING EQUIPMENT.

4) ADEQUACY OF ABOVE PROCEDURE SHALL BE VERIFIED BY THE GEOTECHNICAL CONSULTANT.

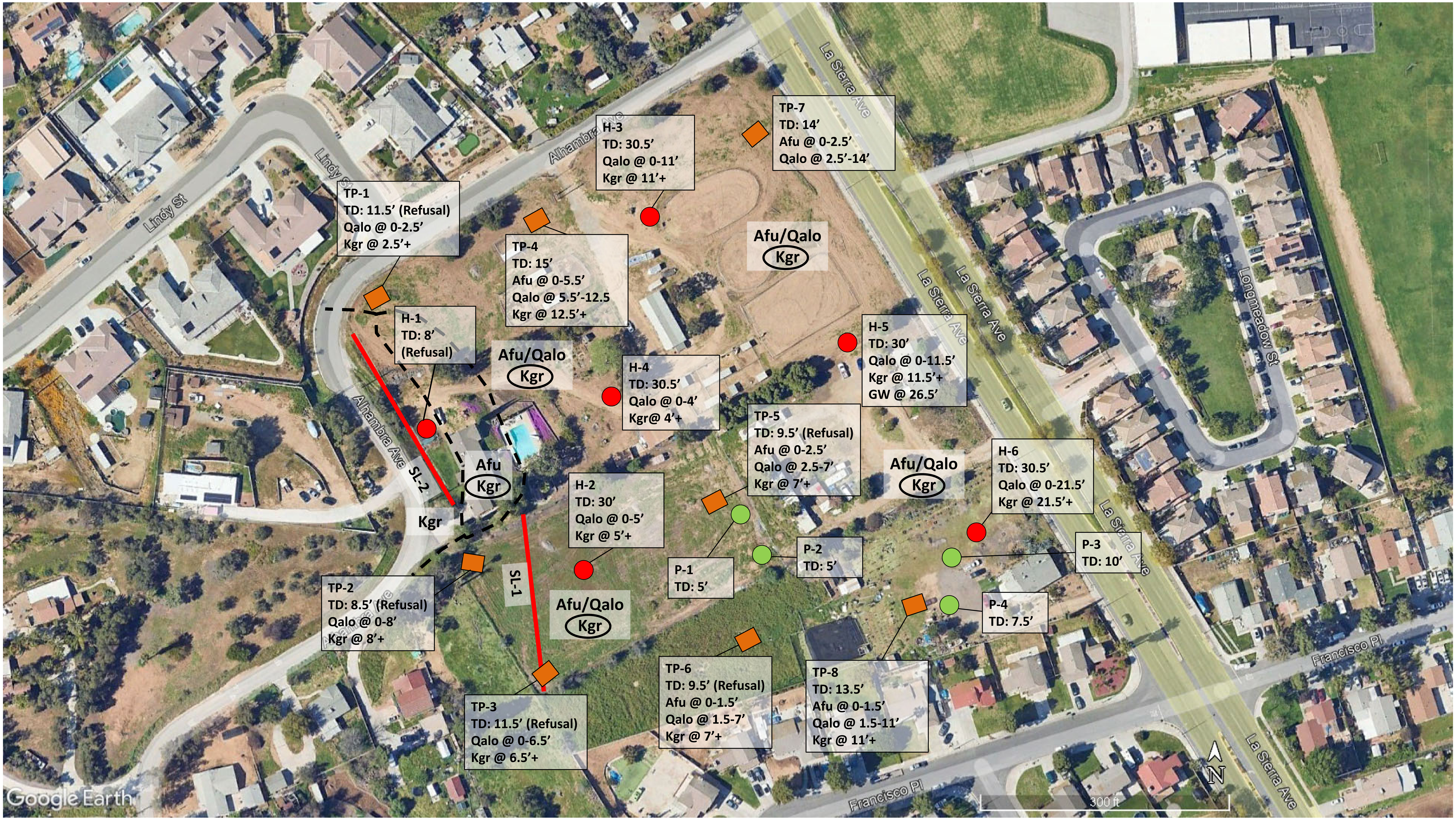
5) ROCKS EXCEEDING 2 FEET IN THE SMALLEST DIMENSION MAY BE PLACED IN ROWS AS SHOWN IN THE FIGURE WITH THE FLATTEST SIDE DOWN. THE WIDTH OF THE ROWS MAY EXCEED 4 FEET PROVIDED THE FILL OPERATION CAN ACCOMMODATE A MINIMUM OF 15 FEET BETWEEN ROWS, AND PROVIDED THAT THERE IS SUFFICIENT EQUIPMENT TO PLACE FILL AGAINST AND OVER THE ROWS. THE FILL SOILS SHOULD BE FREE OF ROCKS THAT MAY CAUSE NESTING/VOIDS WITHIN THE ROCK ROWS. THIS CONDITION SHOULD BE CAREFULLY REVIEWED IN THE FIELD BY THE GEOTECHNICAL CONSULTANT TO VERIFY SATISFACTORY OPERATIONS.

6) ROCKS UP TO 10 FEET IN THE LEAST DIMENSION MAY BE PLACED AS INDIVIDUAL ROCKS WITHIN THE COMPACTED FILL. THE FILL SOILS NEAR AND AGAINST THESE ROCKS SHOULD BE FREE OF ROCKS THAT MAY CAUSE NESTING/VOIDS WITH THE LARGER ROCKS. THIS CONDITION SHOULD BE CAREFULLY REVIEWED IN THE FIELD BY THE GEOTECHNICAL CONSULTANT TO VERIFY SATISFACTORY OPERATIONS.

7) ROCKS, LARGER THAN 10 FEET IN THE SMALLEST DIMENSION, SHOULD BE REDUCED IN SIZE TO MEET THE SPECIFIED DIMENSIONS FOR INDIVIDUAL ROCK PLACEMENT AND/OR FOR PLACEMENT IN ROCK ROWS.

FIGURE 10

OVERSIZE ROCK ROW PLACEMENT FOR ZONE B STRUCTURAL ROCK FILL



Basemap Source: Google Earth

LEGEND

H-6
TD: 30.5'
Qalo @ 0-21.5'
Kgr @ 21.5'+
Approximate Location of Hollow Stem Auger Boring, Showing Total Depth, Depth to Earth Units, and Depth to Groundwater (if encountered) in Feet.

P-4
TD: 7.5'
Approximate Location of Hollow Stem Auger Boring and Percolation Test, Showing Total Depth in Feet.

TP-8
TD: 13.5
Afu @ 0-1.5'
Qalo @ 1.5-11'
Kgr @ 11'+
Approximate Test Pit Location, Showing Total Depth, and Depth to Earth Units in Feet.

Geologic Contact, Dotted Where Buried

SL-2 Seismic Refraction Line

Earth Units - *Circled Where Buried*

Afu	Undocumented Artificial Fill
Qalo	Older Alluvium
Kgr	Granitic Bedrock

GEOTECHNICAL MAP

Meritage Homes
Proposed Residential Development
La Sierra Avenue/Alhambra Avenue
Riverside, California

Project Number: 23145-01
Date: December 22, 2023
Plate 1

S/A

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