PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

Prepared For
Rodeo Credit Enterprises, LLC

Tentative Tract 20576
Vicinity of Cataba Street and Mesa Street, Victorville
San Bernardino County, California
APN 3136-441-01, 02 & 3136-411-04, 05

Job No.: 24-108
March 28, 2024

BRUIN GEOTECHNICAL SERVICES, INC.
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est. 2004

SOIL AND MATERIAL
TESTING AND INSPECTIONS

March 28, 2024 Job No.: 24-108

Mr. Tim Roofian
Rodeo Credit Enterprises, LLC
26415 Carl Boyer Drive, Suite 220
Santa Clarita, CA 91350

Subject: **Preliminary Geotechnical Engineering Report for TTM 20576 – Tentative Tract 20576 in the Vicinity of Cataba Street and Mesa Street, Victorville, San Bernardino County, California, APN 3136-441-01, 02 & 3136-411-04, 05**

Dear Mr. Roofian:

Presented herewith in is our Geotechnical Engineering Report for the subject project. Our work was performed in accordance with the scope of work outlined in our original proposal dated January 23, 2024.

This report presents the results of our field investigation, laboratory testing, along with our engineering judgment, opinions, conclusions, and recommendations pertaining to the proposed development.

It has been a pleasure to be of service to you on this project. Should you have any questions regarding the contents of this report, or should you require additional information, please contact the undersigned at (661) 273-9078.

Respectfully submitted,

BRUIN GEOTECHNICAL SERVICES, INC.

Ryan D. Duke, P.E.
RDD/mes

REGISTERED PROFESSIONAL ENGINEER
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CIVIL ENGINEER
STATE OF CALIFORNIA

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EXECUTIVE SUMMARY

There appear to be no significant geotechnical constraints on-site that cannot be mitigated by our recommendations, the proposed planning, design, and utilization of sound construction practices.

Based on our geotechnical investigation of the subject site, the information obtained from our subsurface exploration, and review of available reports and literature, it is our professional opinion that the proposed development is feasible at the site provided that the geotechnical engineering recommendations contained in this report are implemented in the design and construction of the project.

The following key elements should be noted from this investigation:

- The subject site is located within the seismically active Southern California area. As such, the proposed development shall be designed in accordance with seismic considerations specified in the 2022 California Building Code (CBC) and the County requirements.

- The Limitations and Uniformity of Conditions Section should be read for an understanding of the report limitations.

This Executive Summary should be used in conjunction with the entire report for design and/or construction purposes. It should be recognized that specific details were not included or fully developed in this summary, and the report must be read in its entirety for a complete interpretation of the items contained herein.

SUMMARY OF PRELIMINARY RECOMMENDATIONS

DESIGN ITEM	RECOMMENDATIONS
REMEDIAL GRADING	
Structure Over-Excavation	60” below existing or finish grade, whichever is lower
Scarification	12” compacted at 90%
Horizontal Limits	5 feet beyond foundation perimeter
Traffic Pavement Concrete (Driveway)	Scarify 12” compacted to 95%
Exterior Non-Traffic Bearing Concrete Flatwork	Scarify 12” compacted to 90%
Native Soil Shrinkage	8-13%
PERIMETER (CONTINUOUS) FOUNDATION DESIGN VALUES	
Allowable Net Bearing Capacity	1,500 psf
Width	Minimum 15 inches
Embedment (Single-Story)	Minimum 24 inches below lowest adjacent soil elevation
Reinforcement	Minimum four No. 4 bars, two top and two bottom
ISOLATED (COLUMN/PIER) FOUNDATION DESIGN VALUES	
Allowable Net Bearing Capacity	1,800 psf
Width	Minimum 24 inches square
Embedment (Single-Story)	Minimum 24 inches below lowest adjacent soil elevation
Reinforcement	No. 4 mat, one top and one bottom
LATERAL LOAD RESISTANCE	
Allowable Passive Pressure	300 psf per foot
Coefficient of Friction	0.32
SOIL EXPANSION	
Expansion Index	0
Classification	Very Low
LATERAL EARTH PRESSURES	
Active (Well-Drained Soil)	38 psf
At Rest (Restrained Wall)	60 psf
CORROSION AND CHEMICAL ATTACK	
Soil Resistivity	9,000 ohm-cm
Sulfate Attack Potential	0.0106% (Negligible)
INTERIOR SLAB-ON-GRADE	
Thickness	Minimum 4” thick over 36” of compacted soil
Reinforcement	No. 4 bars, 16” on-center both ways
Vapor Barrier	Min. 15 mil.

GEOTECHNICAL ENGINEERING REPORT
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PRELIMINARY GEOTECHNICAL ENGINEERING REPORT
TENTATIVE TRACT MAP 20576
65.5 - ACRE RESIDENTIAL SUBDIVISION
VICINITY OF CATABA STREET AND MESA STREET, VICTORVILLE
SAN BERNARDINO COUNTY, CALIFORNIA
APN 3136-441-01, 02 & 3136-411-04, 05

1.0 INTRODUCTION

This report presents the results of our preliminary geotechnical investigation performed by Bruin Geotechnical Services, Inc. for the proposed residential development at the subject site based on discussions and preliminary site plans provided by the client. This report is specific to the proposed development.

The purpose of this investigation was to evaluate the on-site subsurface soil conditions relative to geotechnical engineering characteristics and to provide preliminary geotechnical recommendations relative to proposed residential development.

The scope of the authorized geotechnical investigation included the following tasks:

- Performing a site reconnaissance
- Conducting a limited field subsurface exploration through soil borings and sampling
- Laboratory testing program of selected soil samples
- Performing engineering analyses of the data
- Preparing this preliminary Geotechnical Engineering Report

This study also includes a review of published and unpublished literature and geotechnical maps with respect to active and potentially active faults located in proximity to the site which may have impact on the seismic design of the proposed structure.

2.0 SITE LOCATION AND DESCRIPTION

The subject site, herein after referred to as Site, is located at the vicinity of Cataba Street and Mesa Street, in the city of Victorville, San Bernardino County, California. The irregular-shaped parcel consists of approximately 65.5 acres total. The site is located in a developed residential area with single family residences in the parcels to the west, vacant land to the north, east, and south.

At the time of our investigation, the subject site was vacant. The site vegetation consisted low annual weeds and shrubs. The topography of the site is relatively flat with an approximate one (1) percent slope down toward the northeast. The elevation of the Site is approximately 3,400 feet above mean sea level. The aforementioned site description is

intended to be illustrative and is specifically not intended for use as a legal description of the Site.

Access to the Site is from either Mesa Street or Cataba Street, both of which are a paved roads.

The general location of the subject site is shown on Figure 1.

3.0 PROPOSED GRADING AND CONSTRUCTION

Based on our review of the preliminary site plans and discussions, Bruin GSI understands that Tentative Tract 20576 will be subdivided into 253 lots, with 242 residential lots, 4 open space lots, 6 Landscape Maintenance Assessment District (LMAD) lots, and one lot for a proposed retention basin. The structures are anticipated to be one or two-story single-family residences. We anticipate typical wood- or light gauge steel stud framing, with stucco and other light material finishes with conventional concrete continuous and isolated foundations and slab-on-grade floors. No basements are planned. We anticipate maximum structural loads of 1,800 pounds per lineal foot and 50 kips for isolated foundations.

Exterior improvements are anticipated to include paved streets, underground utilities, concrete flatwork (sidewalks, driveways, etc.), and landscape and hardscape areas. It is anticipated that the drainage will consist of sloped surfaces to drainage swales to curbs and gutters flowing to an approved area. The proposed structures will be connected to a public sewer system and existing utilities lines from the street.

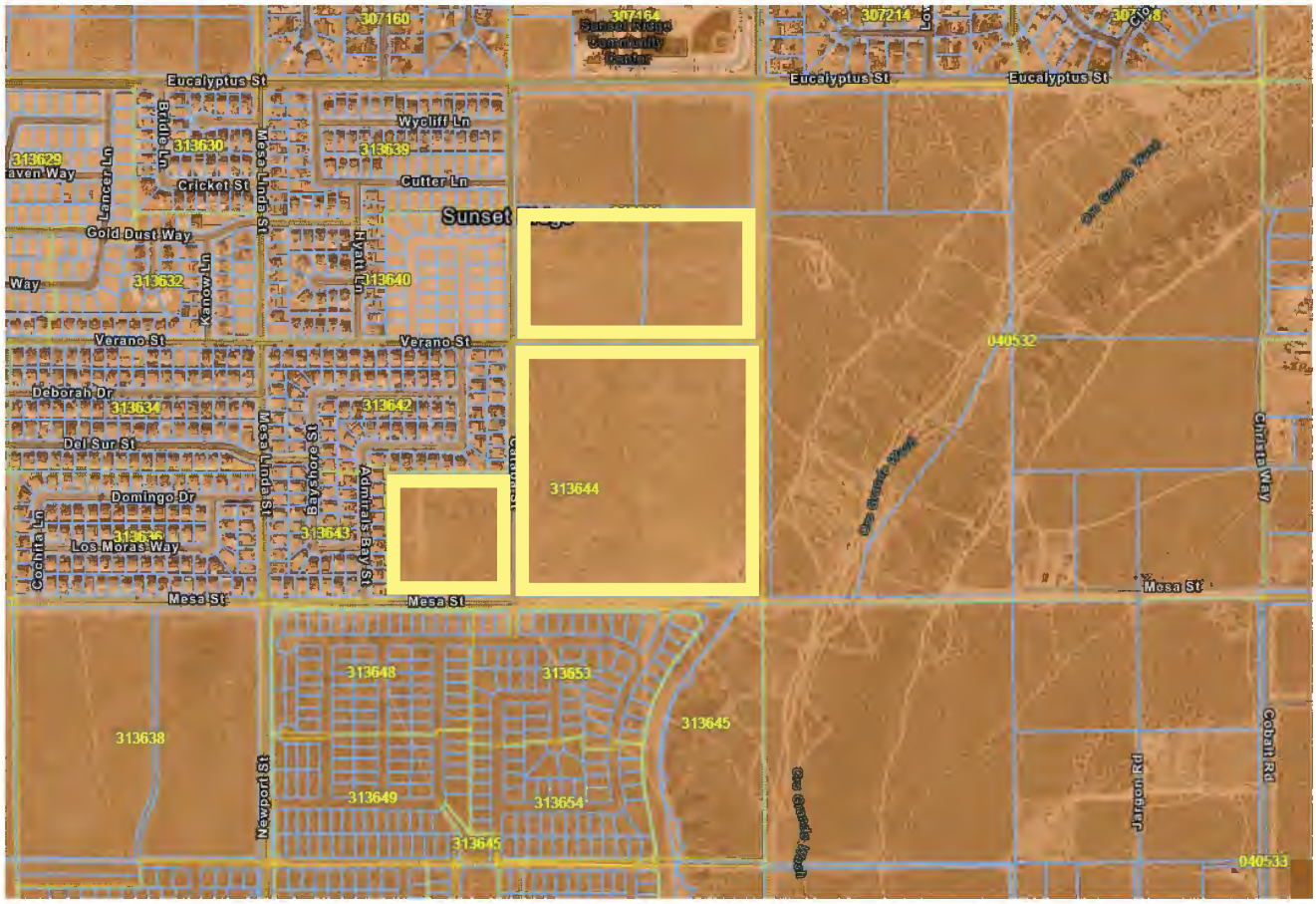
No grading plans were available at the writing of this report. However, due to the relatively flat topography, it appears the proposed earthwork will consist of conventional cut and fill methods to grade the Site, with anticipated maximum slope heights of approximately one to three (1-3) feet to achieve design grades.

4.0 GEOTECHNICAL INVESTIGATION

The geotechnical investigation included a field subsurface exploration program and a laboratory testing program on soil samples collected. These programs were performed in accordance with our proposal for Preliminary Geotechnical Engineering Report dated January 23, 2024. The scope of work did not include environmental assessment or investigation for the presence or absence of hazardous substances or toxic materials in structures, soil, surface water, groundwater, or air, below or around the site. The field subsurface exploration and laboratory testing programs are described below.

Vicinity Map

N.T.S.



= Denotes approximate parcel boundary

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Figure 1

4.1 Field Exploration Program

A site reconnaissance was made by our representative prior to instigating the field exploration program. The Site was observed, and boundaries roughly located for purposes of underground utility locating. As required by law, Bruin GSI contacted Underground Service Alert (one-call notification service) to attain underground utility marking and clearance, a minimum of 72 hours prior to performing the field subsurface investigation.

The field exploration program was initiated on February 22, 2024, under the technical supervision of our engineer. A total of eight (8) exploratory borings were drilled using a CME 75 drill rig with eight (8) inch hollow stem auger in accordance with generally accepted geotechnical exploration procedures (ASTM D 1452). The borings were advanced to maximum depths of fifty (50) feet below ground surface (bgs). The approximate locations of the borings within the area of the proposed construction were determined by sighting and pacing from existing site improvements, such as streets, and should be only considered accurate to the degree implied by the method used. The borings locations are shown on Figure 2.

Soil samples were obtained at various depth intervals, consisting of relatively undisturbed brass ring samples (Modified California split-spoon sampler) and Standard Penetration Test (SPT) samples driven by a 140-pound hammer falling 30 inches. After seating of the sampler, the number of blows required to drive the sampler one foot was recorded in six (6) inch increments, in general accordance with procedures presented in ASTM D 1586.

Bulk samples were also collected at various depths from auger cuttings during drilling and represent a mixture of soils within the noted depths. The soil samples were returned to the laboratory for analysis and testing.

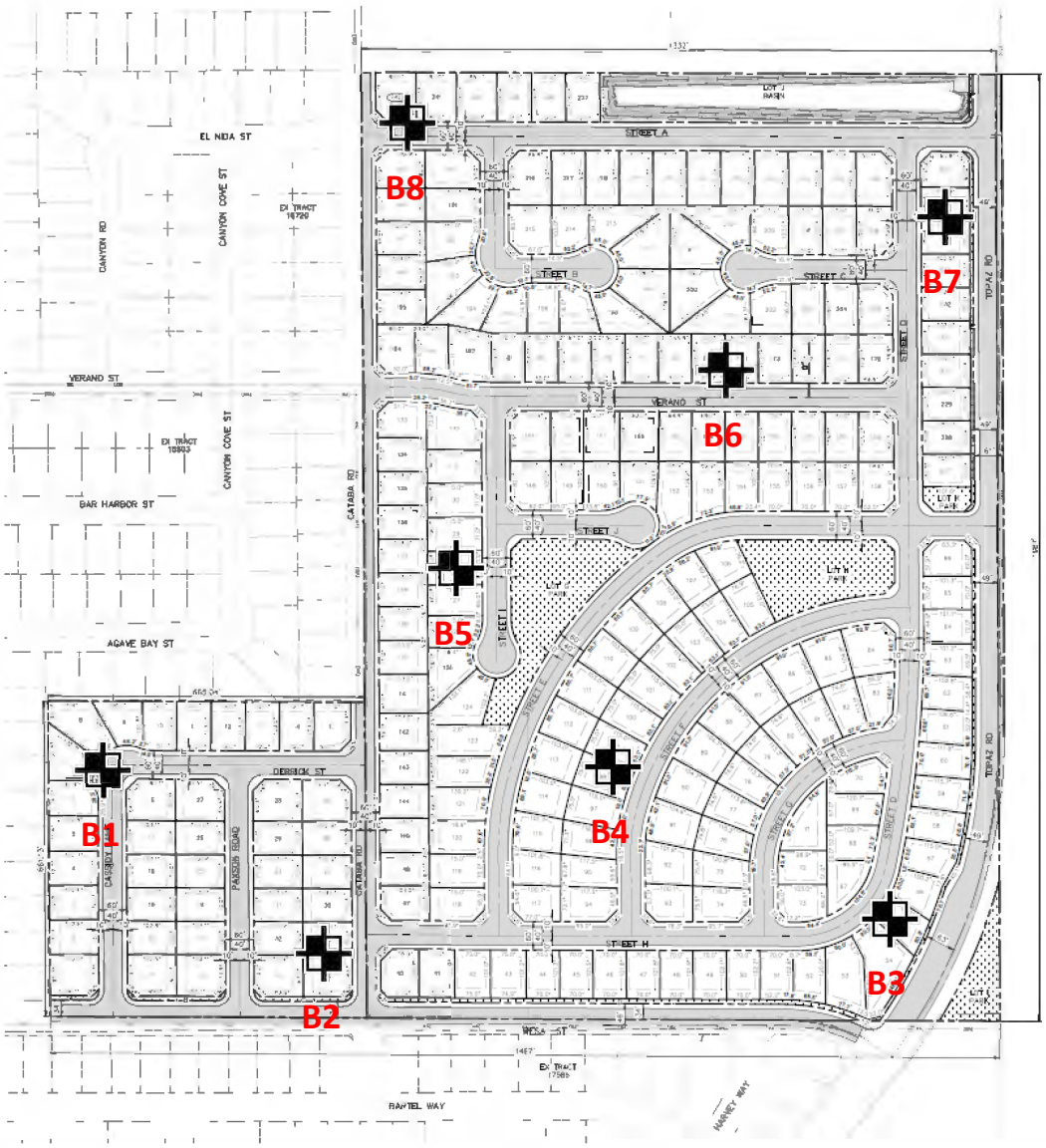
Final boring logs presented in Appendix A are Bruin GSI's interpretation of the field logs prepared by our representative during drilling, as well as laboratory test results. The stratification lines represent approximate boundaries between soil types. The actual soil transitions may be gradual.

4.2 Site and Subsurface Conditions

Native alluvial materials were encountered within all our exploratory borings. The soil strata encountered consisted of interbedded layers of silty sand (SM) poorly graded sands (SP) and occasional sandy silt (ML). The native materials were noted to be dry to moist, and loose to dense. For more detailed descriptions of the subsurface materials refer to the boring logs in Appendix A.

Boring Location Map

N.T.S.



B1 = Denotes Approximate Boring Location

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Figure 2

4.3 Groundwater Conditions

Groundwater was not encountered in any of our exploratory trenches, at least to the maximum depth explored (50 feet bgs). Bruin GSI reviewed available reports and electronic data bases to assess historic water level conditions in the vicinity of the Site. Sources reviewed included the historically highest groundwater contours prepared by State of California Department of Water Resources SGMA electronic database, historically highest groundwater levels in the immediate site vicinity indicate that groundwater level at the site are over 50 feet bgs. Based on this information, groundwater is not a design factor for this project.

4.4 Laboratory Testing

The field boring logs and soil samples were reviewed to assess which samples would be analyzed further. The selected soil samples collected during drilling activities at the Site were then tested in the laboratory to assist in evaluating engineering properties of subsurface materials deemed within structural influence.

The soil samples were classified in accordance with the Unified Soils Classification System and a testing program was established. The samples were tested to determine the following:

- In-situ moisture and dry unit weight determinations were determined in accordance with ASTM D 2937.
- Relative strength characteristics were estimated from results of direct shear tests (ASTM D 3080) performed on bulk soil samples remolded to approximately 90% of the maximum dry density as determined by ASTM D 1557 test method.
- Consolidation potential was determined on select soil samples in accordance with ASTM D 2435.
- Soil chemical analysis on a soil sample from the site was performed by Anaheim Test Lab, which included pH, resistivity, soluble sulfates and soluble chlorides as well as other chemical contents.

The following additional tests were performed:

- Identification of soils ASTM D 2488
- Expansion Index ASTM D 4829
- Maximum density – Optimum moisture ASTM D 1557
- Material Finer than the No. 200 Sieve ASTM D 1140
- Sand Equivalent Value ASTM D 2419

Pertinent tabular and graphic test results are presented in Appendix B.

4.5 Soil Engineering Properties

Physical tests were performed on the bulk and relatively undisturbed samples to characterize the engineering properties of the native soils.

Moisture content and dry unit weight determinations were performed on samples to evaluate the in-situ unit weights of the different materials. Moisture contents were generally two to eight (2-8) percent. In-place dry densities ranged generally 97 pounds per cubic foot (pcf) to 124 pcf. Moisture content and dry unit weight results are shown on the excavation logs in Appendix A.

The expansion index tests (ASTM D 4829) indicate that the surficial soils are within the “very low” expansion category.

Consolidation test results reveal that some samples tested in the upper four to seven feet (4-7) feet of soil has a slight to moderate potential to hydro-consolidate.

5.0 REGIONAL GEOLOGY AND SEISMIC HAZARDS

The project site is located in the City of Victorville.

The Mojave River Watershed is divided into five sub-basins based on hydrologic features (see Fig. 1.) The USGS Report 95-4189 identified these sub-basins as: (1) Headwaters - tributaries above the Mojave Forks Dam; (2) Upper Basin - Mojave Forks Dam to the Lower Narrows at Victorville; (3) Middle Basin - Lower Narrows to the Waterman Fault at Barstow; (4) Lower Basin - Waterman Fault to Afton Canyon; and (5) Tailwater - Afton Canyon to Silver Lake. The sub-basins include an aquifer system consisting of two interconnected aquifers - floodplain aquifer and regional aquifer. The floodplain aquifer is composed of sand and gravel, which is as much as 250 feet thick, and generally follows the surface expression of the Mojave River. The regional aquifer, which is composed of sand, silt and clay, generally underlies and surrounds the floodplain aquifer.

No known active faults have been mapped across the subject site. The potential hazards due to active fault ground rupture are considered minimal. According to current publications by the State of California, the project site is not located within the Alquist-Priolo special studies zone.

5.1 CBC Design Parameters

The following coefficients have been estimated in accordance with the requirements of the 2022 CBC, utilizing the Structural Engineers Association of California and California's Office of Statewide Health Planning and Development Seismic Design Maps Application:

https://seismicmaps.org/

The following seismic parameters are provided, based on the approximate latitude and longitude at the southwest corner of the subject site:

Latitude	34.44944264°
Longitude	-117.38432069°

Spectral Response Acceleration, Short Period) - S_s	1.427g	0.2(sec)
Spectral Response Acceleration at 1 sec. - S_1	0.553g	1.0(sec)
Mapped Spectral Response, Short period - S_{DS}	1.141g	0.2(sec)
Mapped Spectral Response at 1 sec. - S_{D1}	*	1.0(sec)
Site Coefficient – F_A	1.2	
Site Coefficient – F_V	*	
Site Modified Spectral Acceleration, Short period -S_{MS}	1.712g	
Site Modified Spectral Acceleration, Short period -S_{M1}	*	

Site Classification (2022 CBC, further defined in ASCE7-16 Chapter 20) = D Stiff Soil

* The actual method of seismic design should be determined by the Structural Engineer in accordance with Section 11.4.8 Site-Specific Ground Motion Procedures of the ASCE 7-16. Refer to Appendix C for the Design Maps Summary Report provided by the Structural Engineers Association of California and California's Office of Statewide Health Planning and Development website.

The actual method of seismic design should be determined by the Structural Engineer.

5.2 Liquefaction Potential

Liquefaction is a seismic phenomenon in which loose, saturated, granular (non-cohesive) soils react as a fluid when subject to high-intensity ground shaking. Research and historical data indicate loose granular soils with a specific range of

grain size distribution, saturated by a relatively shallow groundwater table are most susceptible to liquefaction.

The effects of liquefaction on level ground include settlement, sand boils and bearing capacity failures below structures.

In view of the relatively firm silty sand and sandy silt encountered in the borings, relative densities, and depth to static groundwater (over 100 feet), it is Bruin GSI's opinion that the potential for on-site liquefaction or seismically induced dynamic settlement should be negligible. Based on our review of the Seismic Hazards Map, the Site is not located in an area requiring a liquefaction analysis.

6.2.1 Other Liquefaction Associated Hazards

Potential hazards associated with liquefaction include lateral spreading and slow slides, foundation bearing failure, and ground surface settlement. Considering the upper native soils are not likely to liquefy, these hazards are not considered to be design factors for this project.

5.3 Other Secondary Seismic Hazards

Seismic hazards relative to earthquakes include landslides, ground lurching, tsunamis, seiches and seismic-induced settlement. As site topography is relatively flat, hazards from landslides are considered negligible. Ground lurching is generally associated with fault rupture and liquefaction. As these hazards are considered unlikely, it is Bruin GSI's opinion that the potential for ground lurching is low. Tsunami hazards are considered nonexistent due to the site location.

5.4 Soil Settlement

Differential soil settlement occurs when supporting soils are not uniform in density or classification and seismic shaking causes one type of soil to settle more than the other. When unaccounted for in design, such settlement can result in damage to structures, pavement and subsurface utilities. Soils with potential for hydro-consolidation can also cause differential settlement under loading conditions and the induction of moisture.

Re-compaction of the upper site soils is intended to remedy most potentials of settlement due to structures supported on native soils with non-uniform densities, soil classifications and hydro-consolidation.

Settlement of structures founded on compacted fill will be relatively small, less than one (1) inch. Differential settlement is anticipated to be on the order of 50% of the

total settlement in a thirty (30) foot span. Most settlement should take place during construction.

5.5 Erosion

The subject site drainage occurs by minor sheet flow and erosion could occur. Appropriate analysis, grading and drainage design and site maintenance should minimize the sheet flow erosion potential.

6.0 111 STATEMENT

Based on the typical construction and grading assumptions stated in this report, and provided additional subsurface investigation and analysis is performed to verify site conditions, subsequent to compliance with the finalized recommendations provided in a design-level report, it is our opinion the proposed structures will be safe from hazards associated with faulting, landslides, slippage, and settlement. The proposed development will not adversely impact the existing geologic stability of adjacent sites.

Bruin GSI shall be allowed the opportunity to review grading and structural plans as well as perform additional subsurface investigation and laboratory testing in order to substantiate this statement.

7.0 EFFECT OF PROPOSED GRADING ON ADJACENT PROPERTIES

Based on the construction and grading assumptions stated in this report, it is our opinion that the proposed grading and construction will not adversely affect the stability of adjoining properties provided that grading and construction are performed in compliance with the recommendations presented herein.

8.0 OPINIONS AND CONCLUSIONS

Based upon the results of our investigation, the proposed development is considered feasible from a geotechnical standpoint provided final recommendations presented in a design-level Geotechnical report are incorporated into the design and construction. If changes in the design of the structure are made or variations of changed conditions are encountered during construction, Bruin GSI should be contacted to evaluate their effects on these recommendations.

The upper four to seven (4-7) feet of soil were found to be non-uniform with some areas of the site soils subject to hydro-consolidation. Based on the laboratory testing and subsurface data obtained, it is Bruin GSI's opinion that the upper site soils will not provide a uniform soil support system without remediation through re-compaction. In order to

provide a more uniform soil support system and minimize the potential for differential settlement, the proposed structures should be supported by a re-compacted fill mat.

9.0 GEOTECHNICAL RECOMMENDATIONS

The following preliminary geotechnical engineering recommendations for the proposed development are based on observations from the limited field investigation program and the laboratory test results and our experience with sites of similar conditions. The following preliminary recommendations are provided for the purpose of assuring the feasibility of the proposed residential subdivision and for budgeting purposes only.

Additional subsurface investigation, soil sampling, laboratory testing and analysis shall be performed to provide a design-level Geotechnical report and either finalize or modify the recommendations provided herein as deemed appropriate.

The local Department of Building and Safety should be contacted prior to the start of construction to assure the project is properly permitted and inspected during construction. Any grading performed at the site shall be incompliance with the recommendations provided in a Final Design Level-Report, the local building code and the Earthwork and Grading Specifications for Rough Grading presented in Appendix D.

It is stipulated, upon completion of a design-level report, that field observations and testing during rough-grading operations should be provided by Bruin GSI so a decision can be formed regarding the adequacy of the site preparation, the acceptability of fill materials, and the extent to which the earthwork construction and the degree of compaction comply with the project geotechnical specifications. **Any work related to grading performed without the full knowledge of, and under the supervision of the Geotechnical Consultant, may render the recommendations of the report invalid.**

9.1 Earthwork

Prior to any grading, the site should be cleared and grubbed of all vegetation. All pavements, vegetation, trash, debris and abandoned underground utilities shall be removed from the area to be graded and should not be incorporated into engineered fill.

Any depressions resulting from removals during grubbing process (trees etc.) shall be observed by the Geotechnical Consultant. Depressions requiring backfill within structural areas will require placement of engineered fill, observed, and tested by the Geotechnical Consultant.

It is our professional opinion that the grading of the site can be performed with conventional earth-moving equipment.

9.2 Remedial Grading for Building Pads

To provide a more uniform bearing for the proposed structure foundations, slab-on-grade, and structural retaining walls and, subsequent to clearing and grubbing of the area to graded, the existing native soils will require over-excavation and recompaction from forty eight to seventy two (48-72) inches below existing grade or finish grade, whichever is lower. The excavation shall extend a minimum of five (5) feet beyond the limits of the proposed foundations, where obtainable. The bottom of the excavation shall be a level elevation.

The Geotechnical Consultant shall inspect the resulting surfaces prior to scarification and fill placement. A minimum of thirty six (36) inches of compacted fill is required beneath the proposed foundations.

Subsequent to approval of the resulting surface by the Geotechnical Consultant, the resulting soil surface shall be scarified (ripped) an additional twelve (12) inches, properly moisture conditioned or aerated to near optimum moisture content, and mechanically compacted with heavy compaction equipment to 90% relative compaction as determined by ASTM D 1557 test method. **Compaction shall be verified by testing.**

9.3 Remedial Grading for Flexible (Asphalt-Concrete) and Rigid (PCC) Pavement

Subsequent to clearing and grubbing the area to be graded, the existing native soils shall be excavated twelve (12) inches below existing grade or finish grade, whichever is lower. The exposed surface shall be scarified (ripped) an additional six (6) inches. The excavation shall extend a minimum of three (3) feet beyond the limits of the proposed pavement, where obtainable. The Geotechnical Consultant shall inspect the resulting surfaces prior to fill placement.

Subsequent to approval of the resulting surface by the Geotechnical Consultant, the resulting soil surface shall be properly moisture conditioned or aerated to near optimum moisture content, and mechanically compacted with heavy compaction equipment to 90% relative compaction (95% relative compaction beneath proposed PCC pavement in the upper twelve inches) as determined by ASTM D 1557 test method. **Compaction shall be verified by testing**.

9.4 Remedial Grading and Exterior Non-Traffic Bearing Concrete Flatwork (Sidewalks, Patios, Walkways, etc.)

Subsequent to clearing and grubbing the area to be graded, the existing native soils shall be scarified (ripped) six (6) inches below existing grade or finish grade, whichever is lower. The scarification shall extend a minimum of two (2) feet beyond the limits of the proposed flatwork, were obtainable. The Geotechnical Consultant shall inspect the resulting surfaces prior to fill placement.

Subsequent to approval of the resulting surface by the Geotechnical Consultant, the resulting soil surface shall be properly moisture conditioned or aerated to near optimum moisture content, and mechanically compacted with mechanical compaction equipment to 90% relative compaction as determined by ASTM D 1557 test method. **Compaction shall be verified by testing**.

9.5 Fill Placement and Compaction Requirements

The excavated native soils may be used as engineered fill to backfill the excavation. Materials for engineered fill should be free of organic material, debris, and other deleterious substances, and should not contain rocks greater than eight (8) inches in maximum dimension.

All native soil shall be moisture conditioned or air dried as necessary to achieve near optimum moisture condition, placed in lifts (eight to ten inches, measured loose) and then compacted in place by mechanical compaction equipment to a minimum relative compaction of 90% as determined in accordance with Test Method ASTM D 1557.

All import soil fill (meeting the requirements of Section 10.8) should be placed in eight-inch-thick maximum lifts measured loose, moisture conditioned or air dried as necessary to near optimum moisture condition, and then compacted in place to a minimum relative compaction of 90% as determined in accordance with Test Method ASTM D 1557. **A representative of the project consultant should be present on-site during grading operations to verify proper placement and compaction of all fill, as well as to verify compliance with the other geotechnical recommendations presented herein.**

9.6 Native Soil Shrinkage

A shrinkage factor of the upper site soils is estimated at ten to fifteen (10-15) percent. This estimate is based on the limited data collected from the subsurface exploration and laboratory test data with an average degree of compaction of 92% and may vary depending on contractor methods.

During compaction, an additional one-half of an inch (1/2") subsidence of the underlying soil is estimated. Losses from site clearing and grubbing operations mat effect quantity calculations and should be taken into account. Actual shrinkage of the soil may vary.

We recommend monitoring the rough grading excavations by survey with comparison to grading contractor earthwork yardage estimates to determine a closer estimate of actual shrinkage so adjustments (if necessary) may be made during grading.

9.7 Fill Slope Construction and Stability

Provided all material is properly compacted as recommended, fill slopes may be constructed at a 2:1 (horizontal to vertical) gradient or flatter. Permanent cut slopes may be constructed at 2:1 or flatter. Fill slopes constructed as recommended at a slope ratio not exceeding 2:1 (horizontal: vertical), are expected to be both grossly and surficially stable and are expected to remain so under normal conditions.

Proper drainage should be planned so water is not allowed to flow over the tops of slopes. The slopes should be planted as soon as possible to minimize erosion and maintenance.

If slopes are planned steeper than 2:1, the Geotechnical Consultant shall be notified for slope stability determinations.

9.8 Imported Soils

If imported soils are required to complete the planned grading, these soils shall be free of organic matter and deleterious substances, meeting the following criteria:

- 100% passing a 2-inch sieve
- 60% to 100% passing the #4 sieve
- no more than 20% passing a #200 sieve
- expansion index less than 20
- liquid limit less than 35
- plasticity index less than 12
- R-value greater than 40
- Low corrosion potential
    - Soluble Sulfates less than 1,500 ppm
    - Soluble Chlorides less than 150 ppm
    - Minimum Resistivity greater than 8,000 ohm-cm

Prospective import soils should be observed, tested and pre-approved by this firm prior to importing the soils to the site. Final approval of the import soil will be given once the material is on site either in place or adequate quantities to finish the grading.

9.9 Grading Observations and Testing

The grading of the site shall be observed and tested by the Geotechnical Consultant to verify compliance with the recommendations. Any grading performed without full knowledge of the Geotechnical Consultant may render the recommendations of this report invalid.

10.0 POST-GRADING AND DESIGN CONSIDERATIONS

10.1 Pad Drainage

A surface drainage system consisting of a combination of sloped concrete flatwork, swales and sheet flow gradients in landscape areas, and roof gutters and downspouts should be designed for the site. The roof gutters and downspouts should also be tied directly into the proposed area drain system. Drainage from structures should be designed at minimum 5% gradient to approved areas. The purpose of this drainage system will be to reduce water infiltration into the subgrade soils and to direct surface waters away from building foundations, walls and slope areas.

Concrete flatwork surfaces and paved sloped surfaces should be inclined at a minimum gradient of 2% away from the building foundations and similar structures. A minimum twelve-inch-high berm should be maintained along the top of the descending slope to prevent any water from flowing over the slope.

The owner is advised that all irrigation and drainage devices should be properly maintained throughout the lifetime of the development.

10.2 Foundation Design Recommendations

The proposed structure shall be constructed on a conventional concrete foundation system. Provided the recommendations in this report are incorporated into site development, foundation for load bearing walls and interior columns constructed on compacted certified fill may be designed as follows:

10.2.1 Allowable Bearing Capacity

Continuous Foundations Design Values: An allowable "net" bearing capacity of 1,500 psf. can be utilized for dead and sustained live loads. This value includes a minimum safety factor of three (3) and may be increased by one-third (1/3) for total loads, including seismic forces.

Continuous foundations for single and two-story structures should be embedded a minimum of fifteen (15) inches and twenty-four (24) inches below lowest adjacent soil elevation, respectively, and be a minimum of fifteen (15) inches in width. Reinforcement shall consist of a minimum of two No. 4 bars, one top and one bottom. Actual depth, width, and reinforcement requirements for continuous foundations will be dependent on the Expansion Index of the bearing soils, applicable sections of the governing building code and requirements of the structural engineer.

The allowable bearing capacity for continuous foundations may be increased by 200 psf. for each additional six inches of foundation depth and 200 psf. for each additional one foot of foundation width. The allowable bearing capacity should not exceed 2,000 psf. for continuous foundations to keep estimated settlements within allowable limits.

Isolated Pad (Column or Pier) Foundations Design Values: An allowable "net" bearing capacity of 1,800 psf can be utilized for dead and sustained live loads. This value includes a minimum safety factor of three (3) and may be increased by one-third (1/3) for total loads, including seismic forces.

Isolated foundations should be a minimum of twenty-four (24) inches square and embedded a minimum of twenty-four (24) inches below lowest adjacent soil elevation. Actual depth, width, and reinforcement requirements for isolated foundations will be dependent on the Expansion Index of the bearing soil, applicable sections of the governing building code and requirements of the structural engineer.

The allowable bearing capacity for continuous foundations may be increased by 150 psf for each additional six (6) inches of foundation depth and 150 psf for each additional one foot of foundation width. The allowable bearing capacity should not exceed 2,500 psf for isolated foundations to keep estimated settlements within allowable limits.

10.2.2 Lateral Load Resistance

Lateral load resistance for the spread footings will be developed by passive soil pressure against sides of footings below grade and by friction acting at the base of the concrete footings bearing on compacted fill. An allowable passive pressure of 300 Z PSF, where Z = Depth (in feet) below finish grade. In passive pressure calculations, the upper one (1) foot of soil should be subtracted from the depth, "Z", unless confined by pavement or slab. An appropriate safety factor should be used for design calculations.

Friction along the foundation base may provide resistance to lateral loading. The coefficient of friction was estimated to be 0.32 for site soils compacted to 90% of the maximum dry density as determined by ASTM D 1557 test method and may be used for dead load forces and includes a reduction factor of one-third (1/3).

For design of building foundations, passive resistance may be combined with frictional resistance provided that a one-third (1/3) reduction in the coefficient of friction is used.

10.2.3 Footing Reinforcement

Reinforcement for concrete footings should be designed by the structural engineer based on the anticipated loading conditions and expansion index of the supporting soil. Preliminary expansion index for the native soil is categorized as "very low" as determined by ASTM D 4829. Footings should be reinforced with a minimum of two (2) No. 4 bars, one (1) top and one (1) bottom.

10.2.4 Footing Observations

All footing trenches should be observed by a representative of the project geotechnical consultant to verify that they have been excavated into competent soils prior to placement of forms, reinforcement, or concrete. The excavations should be trimmed neat, level, and square. All loose, sloughed or moisture-softened soils and/or any construction debris should be removed prior to placing of concrete. **Excavated soils derived from footing and/or utility trenches should not be placed in building slab-on-grade areas or exterior concrete flatwork areas unless the soils are compacted to at least 90 percent of maximum dry density.**

10.2.5 Foundation Setbacks

Footings of structures (including retaining walls) located above a slope having a total height of ten (10) feet or less should have a minimum setback of five (5) feet, measured from the outside edge of the footing bottom along a horizontal line to the face of the slope. For footings above slopes having a total height greater than ten (10) feet, the setback should be, at minimum, equal to one third of the total height of the slope but need not exceed forty (40) feet. Refer to CBC Section 1804.

10.3 RETAINING WALLS AND STRUCTURES BELOW GRADE

The project may include shallow retaining walls or walls below grade (i.e., loading docks, light standards, flagpoles, or similar structures supporting soil materials. These walls are anticipated to be shallow (i.e., approximately 10 feet or less in height). Design lateral earth pressures, backfill criteria, and drainage recommendations for walls below grade are presented.

10.3.1 Lateral Earth Pressures

	Driving Earth Pressure*	Resisting Earth Pressure*
Well-Drained Soil	38	300***
Well-Drained Soil (2:1 Backfill)	60	
At-Rest (Restrained Wall)	55**	

*Equivalent fluid pressure (PSF) per foot of soil height

**For design purposes, a wall is considered restrained if it prevented from movement greater than 0.002H (H= height of wall in feet) at the top of the wall.

***The upper one foot of soil should be subtracted from the depth, “Z”, unless confined by pavement or slab. This is an ultimate value.

Note: The pressures recommended above are based on the assumption that the backfill will be compacted to 90% of the maximum dry density. The use of select may lower the recommended driving earth pressure. The revisiting pressure

provided is an ultimate value. An appropriate factor of safety is recommended.

Friction acting along the base of the foundation may provide resistance to lateral loading. The coefficient of friction is estimated to be 0.32 for native soils compacted to 90% of the maximum dry density, and may be used with dead loads. This value may be increase by one-third (1/3) for total loads, including seismic forces. Frictional and passive resistance may be combined without reduction.

The above values are for retaining walls that have been supplied with a proper sub-drain system. All walls should be designed to support any adjacent structural surcharge loads imposed by other nearby walls, footings or vehicular traffic within a distance approximately equal to the height of the wall.

Retaining walls over six (6) feet in height may need to be designed for a seismic load force that is applied to the static forces when the seismic shaking occurs. The geotechnical consultant should be contacted for retaining walls over six (6) feet in height.

10.3.2 Wall Backfill

Backfill behind shallow retaining walls or walls below grade should consist of non-expansive granular materials. Wall backfill should not contain organic material, rubble, debris, and rocks or cemented fragments larger than three (3) inches in greatest dimension. In the case where no shoring was used, the granular backfill should extend outward from the base of the wall to ground surface at a 1:1 (horizontal: vertical) slope. The geotechnical consultant should be allowed the opportunity to sample and test and comment about the adequacy of the proposed imported backfill material once adequate quantities to complete the project are on site.

Backfill should be placed in lifts not exceeding eight to ten (8 – 10) inches in thickness measured loose, moisture conditioned to above optimum moisture content and mechanically compacted with hand-operated equipment to minimum 90% of the maximum dry density as determined by ASTM D 1557. Walls below grade that are not free to deflect should be properly braced prior to placement and compaction of backfill. **Compaction should be verified by testing.**

10.3.3 Drainage and Waterproofing

It is recommended that waterproofing be provided behind the retaining walls to help reduce efflorescent formation.

Walls designed for drained earth pressures shall have adequate drainage provided behind the walls. Sub-drains or weep holes at the base of the walls shall be incorporated into design. Wall back-drains shall be designed by a registered Civil Engineer.

11.0 CORROSION AND CHEMICAL ATTACK

Soluble sulfate, pH, resistivity and chloride concentration test results are presented in Appendix B. The Resistivity (CTM 643) test results on a bulk soil sample from the site indicated that on-site soils are **moderately corrosive** when in contact with ferrous material (9,000 ohm-cm). Corrosion test results also indicate that the surficial soils at the site have a sulfate attack potential of 0.0106% by weight on concrete (Exposure Category S1).

Based on the preliminary chemical analysis performed on a sample of the native soil, foundation concrete shall consist of Type II cement with a minimum compressive strength of 2,500 psi and maximum water-cement ratio of 0.50 as indicated in the ACI 318 Table 19.3.2.1.

A higher compressive strength may be required by the structural engineer. Additional soil chemical analysis during grading is recommended. The minimum concrete compressive strength should be determined by the structural engineer.

The chemical test results should be distributed to the project design team for their interpretations pertaining to the corrosivity or reactivity of the construction materials (ferrous metals, and piping).

Additional soil samples shall be obtained and analyzed for corrosion and included in the design-level report.

12.0 EXCAVATIONS

It is Bruin GSI's opinion that standard construction techniques should be sufficient for site excavations. All excavations should be made in accordance with applicable regulations, including CAL/OSHA for and OSHA type "C" soil. Project safety is the contractor's responsibility and the owner. Bruin GSI will not be responsible for project safety.

The attention of contractors, particularly the underground contractors, should be drawn to the State of California Construction Safety Orders for "Excavations, Trenches, and Earthwork." Trenches or excavations greater than five (5) feet in depth should be shored or sloped back in accordance with OSHA Regulations prior to entry.

Open excavations, un-shored or un-surcharged (above the groundwater level) may be cut vertically to a maximum depth of no more than five (5) feet. Excavations higher than five (5) feet should be sloped back at a minimum 1.5:1 (horizontal to vertical) slope or flatter or shored. Sloughing will occur if the soil is dry or dries our while open. No excavation should be made within a 1:1 line projected outward from the toe of any existing foundation or structure.

No heavy equipment or other surcharge loads (i.e., excavation spoils) should be allowed within the top of slope a distance equal to the depth of the excavation, both measured from the top of the excavation.

Soil backfill around foundations or behind walls below grade should be placed in lifts not exceeding eight to ten inches, measured loose, moisture conditioned to near optimum moisture content and uniformly mechanically compacted to minimum 90% relative compaction as determined by ASTM D 1557 test method. Flooding or jetting is not recommended.

13.0 UTILITY TRENCHES AND BACKFILL

Standard construction techniques should be sufficient for site utility trench excavations. Utility trenches often settle even when backfill is placed under optimum conditions.

Trench backfill shall be moisture conditioned to near optimum moisture content, placed in lifts not exceeding eight to ten inches, measured loose, and uniformly compacted to minimum 90% of the maximum dry density with mechanical compaction equipment. **No flooding or jetting is recommended.**

Backfill of public utilities within road right-of-ways or on the subject site should be placed in strict conformance with the requirements of the governing agency. As a minimum it is recommended that utility trench backfill should be moisture conditioned to near optimum moisture content, placed in lifts not exceeding eight to ten (8-10) inches, measured loose, (depending on means of compaction) and uniformly compacted to minimum 90% of the maximum dry density with mechanical compaction equipment. If aggregate base is used for backfill material, it should be moisture conditioned to near optimum moisture content, placed in eight to ten inch lifts, measured loose, and uniformly compacted to minimum 95% of the maximum dry density using mechanical compaction equipment. **Compaction should be verified by testing.**

For purposes of this section of the report, "bedding" is defined as material placed in a trench up to one (1) foot above a utility pipe, and "backfill" is all material placed in the trench above the bedding. Unless concrete bedding is required around utility pipes, free-draining sand should be used as bedding. Sand proposed for use as bedding should be tested in our laboratory to verify its suitability and measure its compaction characteristics. **Sand bedding should be compacted by mechanical means to achieve at least 90% relative compaction based on ASTM D 1557.**

Backfill operations should be observed and tested by the Geotechnical Consultant to monitor compliance with these recommendations.

Where utility trenches enter the footprint of the building, trenches should be backfilled through their entire depths with on-site fill materials, sand-cement slurry, or concrete rather than with any sand or gravel shading. This "Plug" of less- or non-permeable materials will mitigate the potential for water to migrate though the backfilled trenches from outside of the building to the areas beneath the foundations and floor slabs.

The backfill soil should be moisture conditioned to near optimum moisture content, placed in lifts not exceeding eight to ten inches (8-10), measured loose, (depending on means of compaction) and uniformly compacted to minimum 90% of the maximum dry density with mechanical compaction equipment.

14.0 INTERIOR CONCRETE SLAB-ON-GRADE

It should be understood that as a manufactured product, concrete will crack even under ideal conditions. It is our experience that shrinkage is more pronounced in the Mojave Desert due to environmental conditions (high winds, daily extreme temperature differences and low humidity). Appropriate mix designs, placement procedures and concrete curing methods should be planned and implemented during construction in order to reduce the occurrence and magnitude of concrete shrinkage cracking.

Interior slab-on-grade construction should be supported by compacted soil, prepared as recommended in the "Remedial Grading for Proposed Building Pad(s)" Section of this report.

14.1 Vapor Barrier and Water Proofing

It is recommended that a vapor retarded/waterproofing be placed below the concrete slab on grade. Vapor/moisture transmission through slabs does occur and can impact various components of the structure.

Vapor retarded/waterproofing designing and inspection of installation is not the responsibility of the geotechnical engineer (most often the responsibility of the architect). Bruin Geotechnical Services, Inc. does not practice in the field of water and moisture vapor transmission evaluation/mitigation. Therefore, we recommend that a qualified person/firm be engaged/consulted to evaluate the general and specific water and moisture vapor transmission paths and any impact on the proposed development. This person/firm should provide recommendations for mitigation of potential adverse impact of water and moisture vapor transmission on various components of the structure as deemed necessary. The actual waterproofing design shall be provided by the architect, structural engineer, or contractor with experience in waterproofing.

In order to promote good building practices and alert the rest of the design/construction team of the appropriate standards and expect recommendations pertaining to vapor barriers/retarders, engineers (especially those aware of the issues surrounding blow-slab moisture protection and its effect on the success of their projects) should consider recommending and citing specific performance characteristics. The following paragraph includes criteria from the latest standards and expert recommendations and should be considered for use in your firm's own recommendations:

Vapor barrier shall consist of a minimum 15 mil extruded polyolefin plastic (no recycled content of woven materials permitted). Permeance as tested before and after mandatory conditions (ASTM E 17455 Section 7.1 and Sub-Paragraph 7.1.1-7.1.5): less than 0.01 perms [grains/(ft^2-hr-inHg)] and comply with the ASTM E1745 Class A requirements. Install vapor barrier according to ASTM E1643, including proper perimeter seal. Basis of design: Stego Wrap Vapor Barrier 15 mil and Stego Crete Claw Tape (perimeter seal tape). Approved Alternatives: Vaporguard by Reef Industries, Sundance 15 mil Vapor Barrier by Sundance Inc.

14.2 Thickness and Joint Spacing

Concrete slab-on-grade should be at least four (4) inches thick and provided with frequent construction joints or expansion joints. The slab-on-grade should have a minimum compressive strength of 2,500 psi at 28 days. More stringent requirements may be required by the structural engineer.

14.3 Reinforcement

Reinforcement of the slab-on-grade is contingent on the structural engineer's recommendations and the Expansion Index of the supporting soil. As a minimum, reinforcement should consist of No. 4 bars spaced sixteen (16) inches on center, both ways. The reinforcement should be positioned near the middle of the slabs by

means of concrete chairs or brick. Additional reinforcement may be required by the structural engineer.

14.4 Subgrade Preparation

As further measure to minimize cracking of concrete flatwork, the subgrade soils and all utility line trenches below concrete slab-on-grade areas should first be compacted to a minimum relative compaction of **90%** and then thoroughly moistened to achieve a moisture content that is near optimum moisture content. **A representative of the project geotechnical consultant should observe and verify the density and moisture content of the soils, and the depth or moisture penetration prior to pouring concrete.**

15.0 EXTERIOR CONCRETE FLATWORK (PATIOS, WALKWAYS, SIDEWALKS, etc.)

It should be understood that as a manufactured product, concrete will crack even under ideal conditions. It is our experience that shrinkage is more pronounced in the Mojave Desert due to environmental conditions (high winds, daily extreme temperature differences and low humidity). Appropriate mix designs, placement procedures and concrete curing methods should be planned and implemented during construction in order to reduce the occurrence and magnitude of concrete shrinkage cracking.

Exterior slab-on-grade construction should be supported by compacted soil, prepared as recommended in the "Remedial Grading and Exterior Non-Traffic Bearing Concrete" Section of this report. At locations where slabs cross trenches, observation and testing of trench backfill should be performed to confirm uniformity of conditions.

15.1 Thickness and Joint Spacing

To reduce the potential of unsightly cracking, concrete sidewalks, patio-type slabs should be at least four (4) inches thick and provided with frequent construction joints or expansion joints, especially at area of re-entrant corners, to help control cracking. Exterior perimeter slabs should be designed relatively independent of the foundation stems (free-floating) to help cracking due to settlement and/or expansion.

15.2 Reinforcement

Reinforcement of the exterior slab-on-grade is contingent on the structural engineer's recommendations and the Expansion Index of the supporting soil. As a minimum, reinforcement should consist of No. 3 bars spaced twenty-four (24) inches on center, both ways. The reinforcement should be positioned near the

middle of the slabs by means of concrete chairs or brick. Additional reinforcement may be required by the structural engineer.

15.3 Subgrade Preparation

As further measure to minimize cracking of concrete flatwork, the subgrade soils below concrete flatwork areas should first be compacted to a minimum relative compaction of 90% and then thoroughly moistened to achieve a moisture content that is near optimum moisture content. Pre-wetting of the soils to a depth of six (6) inches a maximum of 24-hours prior to concrete placement will promote uniform curing of the concrete and minimize the development of shrinkage cracks. **A representative of the project geotechnical consultant should observe and verify the density and moisture content of the soils, and the depth or moisture penetration a maximum of 24-hours prior to pouring concrete.**

16.0 RIGID (PCC) PAVEMENT

It should be understood that as a manufactured product, concrete will crack even under ideal conditions. It is our experience that shrinkage is more pronounced in the Mojave Desert due to environmental conditions (high winds, daily extreme temperature differences and low humidity). Appropriate mix designs, placement procedures and concrete curing methods should be planned and implemented during construction in order to reduce the occurrence and magnitude of concrete shrinkage cracking.

Exterior slab-on-grade construction should be supported by compacted soil, prepared as recommended in "Remedial Grading for Flexible (Asphalt-Concrete) and Rigid PCC Pavement" section of this report. At locations where slabs cross trenches, observation and testing of trench backfill should be performed to confirm uniformity of conditions.

16.1 Thickness and Joint Spacing

To reduce the potential of unsightly cracking, rigid concrete pavement should be at least four inches thick and provided with frequent construction joints or expansion joints, especially at area of re-entrant corners, to help control cracking. Perimeter pavement should be designed relatively independent of the foundation stems (free-floating) to help cracking due to settlement and/or expansion.

16.2 Reinforcement

Reinforcement of the exterior pavement is contingent on the structural engineer's recommendations and the Expansion Index of the supporting soil. As a minimum, reinforcement should consist of No. 3 bars spaced twenty-four (24) inches on

center, both ways. The reinforcement should be positioned near the middle of the slabs by means of concrete chairs or brick. Additional reinforcement may be required by the structural engineer.

16.3 Subgrade Preparation

As further measure to minimize cracking of concrete flatwork, the upper twelve inches of subgrade soils below concrete flatwork areas should first be compacted to a minimum relative compaction of **95%** and then thoroughly moistened to achieve a moisture content that is near optimum moisture content. Pre-wetting of the soils to a depth of six (6) inches a maximum of 24-hours prior to concrete placement will promote uniform curing of the concrete and minimize the development of shrinkage cracks. **A representative of the project geotechnical consultant should observe and verify the density and moisture content of the soils, and the depth or moisture penetration a maximum of 24-hours prior to pouring concrete.**

17.0 PRELIMINARY FLEXIBLE PAVEMENT DESIGN

Asphalt-concrete pavements shall be designed per the Caltrans Highway Design Manual based on R-Value and Traffic Index. An R-value of the native soil of 51 was utilized for the preliminary structural pavement section. During grading as soils are mixed, soil samples should be obtained and tested for R-Value determination.

For pavement design, the preliminary flexible pavement layer thickness is as follows:

RECOMMENDED ASPHALT PAVEMENT SECTION LAYER THICKNESS

Pavement Material	Recommended Thickness (TI = 5.0) Residential
Asphalt Concrete	3.5”
Class II Aggregate Base	5.0”
Compacted Subgrade	18”

Pavement Material	Recommended Thickness (TI = 9.0) Secondary Arterial
Asphalt Concrete	6.0”
Class II Aggregate Base	9.0”
Compacted Subgrade	18”

Pavement Material	Recommended Thickness (TI = 10.0) Major Arterial
Asphalt Concrete	6.0”
Class II Aggregate Base	10.0”
Compacted Subgrade	18”

Asphalt concrete should conform to Sections 203 and 302 of the latest edition of the Standard Specifications for Public Works Construction (“Greenbook”).

Class II aggregate base should conform to Section 26 of the Caltrans Standard Specifications, latest edition. The aggregate base and sub-base material should be compacted to at least 95 percent of the maximum dry density as determined by ASTM Method D 1557.

18.0 CONSTRUCTION CONSIDERATIONS

Based on our field exploration program, earthwork can be performed with conventional construction equipment.

18.1 Temporary Dewatering

Groundwater was not encountered in any of our borings to the maximum depth of our explorations. Based on the anticipated excavation depths, the need for temporary dewatering is considered low.

18.2 Construction Slopes

Excavations during construction should be conducted so that slope failure and excessive ground movement will not occur. The short-term stability of excavation depends on many factors, including slope angle, engineering characteristics of the subsoils, height of the excavation and length of time the excavation remains unsupported and exposed to equipment vibrations, rainfall, and desiccation.

Where spacing permits, and providing that adjacent facilities are adequately supported, open excavations may be considered. In general, unsupported slopes for temporary construction excavations should not be expected to stand at an inclination steeper than 1:1 (horizontal: vertical). The temporary excavation side walls may be cut vertically to a height of three (3) feet and then laid back at a 1:1 slope ratio above a height of three (3) feet.

Surcharge loads (equipment, spoil piles, etc.) should be kept away from the top of temporary excavations a horizontal distance equal to the depth of excavation.

Surface drainage should be controlled along the top of temporary excavations to preclude wetting of the soils and erosion of the excavation faces. Even with the implementation of the above recommendations, sloughing of the surface of the temporary excavations may still occur, and workmen should be adequately protected from such sloughing.

18.3 Temporary Shoring

If shoring is considered, Bruin GSI should be notified in order to provide appropriate design parameters.

19.0 ADDITIONAL SERVICES

Project plans and specifications should be reviewed prior to preparing a design-level report. This report is based on the assumption that an additional subsurface investigation will be performed along with client consultation during preliminary design and construction phases to provide a design-level report.

Retaining Bruin GSI as the geotechnical consultant to provide additional services from preliminary design through project completion will assure continuity of services.

Additional services include:

- Design-Level Geotechnical Report
- Consultation during design stages of the project.
- Review, stamp, and signature of the grading and building plans.
- Observation and testing during rough grading, fine grading and trench backfill as well as placement of engineered fill.
- Consultation as required during construction.

Cost estimates can be prepared if requested. Please contact our office.

20.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report is based on the development plans provided to our office. The preliminary conclusions and recommendations in this report may not be considered valid unless additional investigation is performed, and the conclusions of this report are verified or modified by the Geotechnical Consultant.

The subsurface conditions and characteristics described herein have been projected from individual borings or test pits placed across the subject property. Actual variations in the subsurface conditions and characteristics may occur.

If conditions encountered during construction differ from those described in this report, this office should be notified so as to consider the necessity for modifications. No responsibility for construction compliance with the design concepts, specifications, or recommendations is assumed a design-level report is prepared and unless on-site construction review is performed during the course of construction, which pertains to the specific recommendations contained herein.

It is recommended that Bruin GSI be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design specifications. If Bruin GSI is not accorded the privilege of making this recommended review, Bruin GSI can assume no responsibility for misinterpretation of the recommendations contained in this report.

This report has been prepared in accordance with generally accepted practice and standards in this community at this time. No warranties, either expressed or implied, are made as to the professional advice provided under the terms of the agreement and included in this report. This report has been prepared for the exclusive use of RCE and their authorized agents. Unauthorized reproduction of any portion of this report without expressed written permission is prohibited.

If parties other than Bruin GSI are engaged to provide construction geotechnical services, they must be notified that they will be required to assume complete responsibility for the geotechnical phase of the project by concurring with the findings and recommendations in this report or providing alternate recommendations.

Additional subsurface investigation shall be performed to prepare a design-level report

21.0 CLOSURE

The conclusions, recommendations, and opinions presented herein are: (1) based upon our evaluation and interpretations of the limited data obtained from our field and laboratory programs; (2) based upon an interpolation of soil conditions between and beyond the borings; (3) are subject to confirmation of the actual conditions encountered during construction; and, (4) are based upon the assumption that sufficient observation and testing will be provided during the grading, infrastructure installation and building phases of site development.

APPENDIX A

Boring Logs and Classification Key

BRUIN GEOTECHNICAL SERVICES INC. est. 2004 TM

Date(s) drilled	**2/22/2024**	**LOG OF BORING 1**	
Drilling Contractor	**GP Drilling**	**Page 1 of 1**	
Drilling Method	**Hollow Stem Auger**		
Drill Rig Type	**CME 75**	Logged By:	**BW**
Drill Bit Size/Type	**8"**	Checked By:	**MS**
Sampling Method(s)	**CSS/Bulk**	Total Depth of Borehole	**20' bgs**
Client: **Rodeo Credit Enterprises, LLC**	Groundwater	**None Encountered**	Boring Location: **See Figure 2**
Project Number: **24-108**	Borehole Backfill	**Native/ Cuttings**	Notes:
Project Location: **Victorville**	Hammer Data	**140#, 30" drop**	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
		SM		Yellowish brown silty fine to medium sand w/ coarse sand & occ. #4-1/2" gravel Dense, slightly moist	9-19	114.6	2.6
		SM		Light yellowish brown silty fine to coarse sand w/ occ. #4 gravel Dense, slightly moist	13-37	112.3	2.8
5'		SM		Dark yellowish brown silty fine to medium sand w/ occ.coarse sand to 3/4" gravel Dense, slightly moist	50-5"	110.9	4.5
		SM		Light reddish brown fine to medium sand w/ occ. coarse sand to 3/8" gravel Dense, slightly moist	12-16		
10'		SM		Light reddish brown fine to medium sand w/ occ. coarse sand to 3/8" gravel (cemented) Dense, slightly moist	50-4"	Dist.	3.8
15'		SP		Light brown slightly fine to coarse sand w/ occ. #4-3/8" gravel (slightly cemented) Dense, slightly moist	22-35	DIST	2.9
20'		SM		Reddish brown slightly silty fine to medium sand w/ occ. coarse sand to 3/4" gravel Medium dense, slightly moist	50-4"	Dist.	4.5
25'				Boring terminated @ 20' bgs No groundwater No caving			
30'							

BRUIN GEOTECHNICAL SERVICES INC. est. 2004 TM

Date(s) drilled	**2/22/2024**	**LOG OF BORING 2**	
Drilling Contractor	**GP Drilling**	**Page 1 of 1**	
Drilling Method	**Hollow Stem Auger**		
Drill Rig Type	**CME 75**	Logged By:	**BW**
Drill Bit Size/Type	**8"**	Checked By:	**MS**
Sampling Method(s)	**SPT**	Total Depth of Borehole	**15' bgs**
Client: **Rodeo Credit Enterprises, LLC**	Groundwater	**None Encountered**	Boring Location: **See Figure 2**
Project Number: **24-108**	Borehole Backfill	**Native/ Cuttings**	Notes:
Project Location: **Victorville**	Hammer Data	**140#, 30" drop**	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
		SM		Brown slightly silty fine to coarse sand w/ occ. #4-3/8" gravel Medium dense, slightly moist	1-4-16		5.4
		SM		Yellowish brown silty fine to medium sand w/ occ. coarse sand to #4 gravel Dense, slightly moist	15-25-28		2.7
5'		SM		Light brown silty fine to coarse sand w/ occ. #4 gravel Dense, slightly moist	16-21-25		4.0
		SM		Yellowish brown silty fine to medium sand w/ occ. coarse sand to 3/8" gravel Medium dense, slightly moist	17-18-20		4.8
10'		SM		Yellowish brown silty fine to coarse sand w/ occ. #4-1/2" gravel Medium dense, slightly moist	8-13-14		3.6
15'		SP		Yellowish brown slightly silty fine to coarse sand w/ occ. #4-1" gravel Medium dense, slightly moist	7-11-11		3.8
20'				Boring terminated @ 15' bgs No groundwater No caving			
25'							
30'							

Date(s) drilled	**2/22/2024**	**LOG OF BORING 3**	
Drilling Contractor	**GP Drilling**	**Page 1 of 2**	
Drilling Method	**Hollow Stem Auger**		
Drill Rig Type	**CME 75**	Logged By:	**BW**
Drill Bit Size/Type	**8"**	Checked By:	**MS**
Sampling Method(s)	**CSS**	Total Depth of Borehole	**50' bgs**
Client: **Rodeo Credit Enterprises, LLC**	Groundwater	**None Encountered**	Boring Location: **See Figure 2**
Project Number: **24-108**	Borehole Backfill	**Native/ Cuttings**	Notes:
Project Location: **Victorville**	Hammer Data	**140#, 30" drop**	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
		SM		Dark brown silty fine to medium sand w/ occ. coarse sand to 1/2" gravel Dense, moist	4-4	116.2	8.0
		SM		Dark yellowish brown silty fine to coarse sand Dense, slightly moist	8-9	110.4	2.9
5'							
		SM		Dark yellowish brown silty fine to medium sand w/ coarse sand & occ. #4-2" gravel Medium dense, slightly moist	13-17	DIST	2.7
		SP		Light brown slightly silty fine to coarse sand w/ occ. #4-1" gravel Medium dense, slightly moist	17-17	118.7	3.1
10'							
		SP		Dark reddish brown silty medium to coarse sand w/ occ. #4 gravel Medium dense, slightly moist	13-19	N/A	-
15'		SP		Dark yellowish brown slightly silty fine to coarse sand w/ occ. #4-1" gravel Dense, slightly moist	14-26	DIST	2.0
20'		SP		Dark yellowish brown slightly silty fine to coarse sand w/ occ. #4-1" gravel Dense, slightly moist	50-4"		
25'		SM		Light reddish brown slightly silty fine to medium sand w/ occ. coarse sand to 1/2" gravel Dense, slightly moist	20-34	DIST	2.8
30'		SM		Light reddish brown slightly silty fine to medium sand w/ occ. coarse sand to 1/2" gravel Medium dense, slightly moist	13-17		2.3

BRUIN GEOTECHNICAL SERVICES INC. est. 2004 TM

Date(s) drilled	**2/22/2024**	**LOG OF BORING 3**	
Drilling Contractor	**GP Drilling**	**Page 2 of 2**	
Drilling Method	**Hollow Stem Auger**		
Drill Rig Type	**CME 75**	Logged By:	**BW**
Drill Bit Size/Type	**8"**	Checked By:	**MS**
Sampling Method(s)	**CSS**	Total Depth of Borehole	**50' bgs**
Client: **Rodeo Credit Enterprises, LLC**	Groundwater	**None Encountered**	Boring Location: **See Figure 2**
Project Number: **24-108**	Borehole Backfill	**Native/ Cuttings**	Notes:
Project Location: **Victorville**	Hammer Data	**140#, 30" drop**	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
35'	■	SM		Light yellowish brown silty fine to coarse sand w/ occ. #4-3/8" gravel Dense, slightly moist	50-5"	113.6	2.3
40'	■	SP		Light yellowish brown fine to coarse sand w/ occ. #4-3/8" Medium dense, slightly moist	21-32	109.3	2.1
45'	■	SP		Light greyish brown slightly silty fine to coarse sand w/ occ. #4-1/2" gravel Dense, slightly moist	17-33	112.3	1.7
50'	■	ML		Light yellowish brown fine sandy silt w/ occ. medium sand Soft, slightly moist	16-22	97.1	5.2
55'				Boring terminated @ 50' bgs No groundwater No caving			
60'							

Date(s) drilled	**2/22/2024**	**LOG OF BORING 4**	
Drilling Contractor	**GP Drilling**	**Page 1 of 1**	
Drilling Method	**Hollow Stem Auger**		
Drill Rig Type	**CME 75**	Logged By:	**BW**
Drill Bit Size/Type	**8"**	Checked By:	**MS**
Sampling Method(s)	**CSS**	Total Depth of Borehole	**15' bgs**
Client: **Rodeo Credit Enterprises, LLC**	Groundwater	**None Encountered**	Boring Location: **See Figure 2**
Project Number: **24-108**	Borehole Backfill	**Native/ Cuttings**	Notes:
Project Location: **Victorville**	Hammer Data	**140#, 30" drop**	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
		SM		Brown silty fine to coarse sand w/ #4-3/8" gravel	19-34	114.5	4.9
				Dense, slightly moist			
		SM		Yellowish brown silty fine to coarse sand w/ occ. #4 gravel	50-6"	114.5	7.2
5'				Dense, moist			
		SP		Light reddish brown slightly silty fine to medium sand w/ coarse sand & occ. #4-3/8" grave	21-22	114.6	3.6
				Dense, slightly moist			
		SP		Reddish brown slightly silty fine to coarse sand w/ occ. #4-1/2" gravel	16-22	111.3	2.4
				Dense, dry			
10'		SP/SM		Dark reddish brown fine to medium sand w/ occ. coarse sand to #4 gravel	15-22	111.2	3.0
				Dense, slightly moist			
15'		SP/SM		Light brown fine to medium sand w/ occ. coarse sand to 3/8" gravel	50-6"	103.8	4.2
				Medium dense, slightly moist			
				Boring terminated @ 15' bgs			
				No groundwater			
20'				No caving			
25'							
30'							

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Date(s) drilled	**2/22/2024**	**LOG OF BORING 5**	
Drilling Contractor	**GP Drilling**	**Page 1 of 1**	
Drilling Method	**Hollow Stem Auger**		
Drill Rig Type	**CME 75**	Logged By:	**BW**
Drill Bit Size/Type	**8"**	Checked By:	**MS**
Sampling Method(s)	**CSS**	Total Depth of Borehole	**20' bgs**
Client: **Rodeo Credit Enterprises, LLC**	Groundwater	**None Encountered**	Boring Location: **See Figure 2**
Project Number: **24-108**	Borehole Backfill	**Native/ Cuttings**	Notes:
Project Location: **Victorville**	Hammer Data	**140#, 30" drop**	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
	■	SM		Dark brown silty fine to coarse sand	5-6	115.8	8.3
				Dense, moist			
	■	SM		Yellowish brown silty fine to coarse sand w/ occ. #4-3/8" gravel	15-18	113.8	3.8
				Dense, slightly moist			
5'	■	SM		Dark yellowish brown silty fine to coarse sand	18-21	113.8	3.7
				Dense, slightly moist			
	■	SM		Dark yellowish brown silty fine to coarse sand	18-25	118.2	5.8
				Medium dense, slightly moist			
	■	SM		Yellowish brown silty fine to coarse sand w/ occ. #4 gravel	17-26	N/A	
10'				Dense, slightly moist			
15'	■	SP		Light yellowish brown silty fine to coarse sand w/ occ. #4-1/2" gravel	18-19	112.6	1.9
				Dense, dry			
20'	■	SP		Light yellowish brown fine to coarse sand w/ occ. #4-1/2" gravel	27-29	103.8	2.2
				Medium dense, dry			
				Boring terminated @ 20' bgs			
				No groundwater			
25'				No caving			
30'							

BRUIN GEOTECHNICAL SERVICES INC. est. 2004 TM

Date(s) drilled	**2/22/2024**	**LOG OF BORING 6**	
Drilling Contractor	**GP Drilling**	**Page 1 of 1**	
Drilling Method	**Hollow Stem Auger**		
Drill Rig Type	**CME 75**	Logged By:	**BW**
Drill Bit Size/Type	**8"**	Checked By:	**MS**
Sampling Method(s)	**SPT/Bulk**	Total Depth of Borehole	**20' bgs**
Client: **Rodeo Credit Enterprises, LLC**	Groundwater	**None Encountered**	Boring Location: **See Figure 2**
Project Number: **24-108**	Borehole Backfill	**Native/ Cuttings**	Notes:
Project Location: **Victorville**	Hammer Data	**140#, 30" drop**	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
		SM		Brown silty fine to medium sand w/ coarse sand & occ. #4 gravel	3-6-11		7.6
				Medium dense, moist			
		SM		Brown silty fine to coarse sand w/ occ. #4 gravel	17-29-29		4.4
				Dense, slightly moist			
5'		SM		Yellowish brown slightly silty fine to coarse sand w/ occ. #4-1" gravel	8-8-9		4.2
				Medium dense, slightly moist			
		SM		Brown silty fine to medium sand w/ coarse sand	7-7-8		4.4
				Medium dense, slightly moist			
		SM		Light brown silty fine to coarse sand w/ occ. #4 gravel	11-11-16		
10'				Medium dense, slightly moist			
		SP		Light brown slightly silty fine to medium sand w/ coarse sand & occ. #4-3/8" gravel	15-20-22		4.0
				Desne, slightly moist			
15'		SP		Reddish brown slightly silty fine to coarse sand w/ occ. #4-1/2" gravel	13-25-19		4.2
				Dense, slightly moist			
20'		SP		Light yellowish brown medium to coarse sand w/ occ. #4-3/8" gravel	9-15-27		2.1
				Dense, dry			
				Boring terminated @ 20' bgs			
				No groundwater			
25'				No caving			
30'							

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Date(s) drilled	**2/22/2024**	**LOG OF BORING 7**	
Drilling Contractor	**GP Drilling**	**Page 1 of 1**	
Drilling Method	**Hollow Stem Auger**		
Drill Rig Type	**CME 75**	Logged By:	**BW**
Drill Bit Size/Type	**8"**	Checked By:	**MS**
Sampling Method(s)	**CSS**	Total Depth of Borehole	**20' bgs**
Client: **Rodeo Credit Enterprises, LLC**	Groundwater	**None Encountered**	Boring Location: **See Figure 2**
Project Number: **24-108**	Borehole Backfill	**Native/ Cuttings**	Notes:
Project Location: **Victorville**	Hammer Data	**140#, 30" drop**	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
		SM		Yellowish brown fine to coarse sand w/ occ. #4-1/2" gravel Dense, slightly moist	19-34	117.3	2.6
		SM		Yellowish brown silty fine to coarse sand w/ occ. #4-3/8" gravel Dense, slightly moist	11-14	112.1	4.2
5'							
		SP		Reddish brown slightly silty fine to coarse sand w/ occ. #4-1/2" gravel Dense, slightly moist	15-21	111.8	3.5
10'		SP		Yellowish brown slightly silty fine to coarse sand w/ occ. #4-3/8" gravel Dense, slightly moist	13-17	110.3	3.5
15'		SM		Light brown silty fine to coarse sand w/ occ. #4-1" gravel Dense, slightly moist	50-6"	110.0	4.2
20'		SP		Yellowish brown fine to coarse sand w/ #4-12/" gravel Medium dense, slightly moist	25-29	107.2	2.8
25'				Boring terminated @ 15' bgs No groundwater No caving			
30'							

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Date(s) drilled	**2/22/2024**	**LOG OF BORING 8**	
Drilling Contractor	**GP Drilling**	**Page 1 of 1**	
Drilling Method	**Hollow Stem Auger**		
Drill Rig Type	**CME 75**	Logged By:	**BW**
Drill Bit Size/Type	**8"**	Checked By:	**MS**
Sampling Method(s)	**CSS**	Total Depth of Borehole	**15' bgs**
Client: **Rodeo Credit Enterprises, LLC**	Groundwater	**None Encountered**	Boring Location: **See Figure 2**
Project Number: **24-108**	Borehole Backfill	**Native/ Cuttings**	Notes:
Project Location: **Victorville**	Hammer Data	**140#, 30" drop**	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
		SM		Dark brown silty fine to coarse sand w/ #4-1/2" gravel Very dense, moist	8-19	125.9	7.8
		SM		Yellowish brown silty fine to coarse sand w/ occ. #4 gravel Dense, slightly moist	30-36	118.6	2.9
5'							
		SM		Yellowish brown silty fine to medium sand w/ coarse sand (cemented) Dense, slightly moist	29-35	110.9	5.4
		SM		Yellowish brown silty fine to medium sand w/ occ. coarse sand to #4 gravel Medium dense, slightly moist	31-33	109.1	3.5
10'		SM		Yellowish brown silty fine to medium sand w/ coarse sand & occ. #4 Medium dense, slightly moist	14-17	107.8	3.1
		SM		Light reddish brown slightly silty fine to coarse sand w/ #4-1/2" gravel Very dense, slightly moist	25-41	126.0	4.9
15'		SP/SM		Light brown slightly silty fine to coarse sand w/ occ. #4-3/8" gravel and treaces of clay Very dense, slightly moist	26-27	124.3	5.3
				Boring terminated @ 15' bgs No groundwater No caving			
20'							
25'							
30'							

BRUIN GEOTECHNICAL SERVICES, INC.

GEOTECHNICAL REPORTS | MATERIAL TESTING | CONSTRUCTION INSPECTION

SOIL CLASSIFICATION KEY

MAJOR DIVISIONS			SYMBOL		TYPICAL NAMES
Coarse Grained Soils 50% or more larger than #200 sieve	**Gravels** More than half coarse-fraction is larger than No. 4 sieve size	Clean gravels with little or no fines	GW		Well graded gravels, gravel-sand mixtures
			GP		Poorly graded gravels, gravel-sand mixtures
		Gravel with over 12% fines	GM		Silty gravels, poorly graded gravel-sand-silt mixtures
			GC		Clayey gravels, poorly graded gravel-sand-clay mixtures
	Sands More than half coarse-fraction is smaller than No. 4 sieve size	Clean sands with little or no fines	SW		Well graded sands, gravelly sands
			SP		Poorly graded sands, gravelly sands
		Sands with over 12% fines	SM		Silty sands, poorly graded sand-silt mixtures
			SC		Clayey sands, poorly graded sand-clay mixtures
Fine Grained Soils 50% or more smaller than #200 sieve	**Silts and Clays** Liquid limit less than 50		ML		Inorganic silts, rock flour, clayey silts
			CL		Inorganic clays of low to medium plasticity, sandy clays, silty clays
			OL		Organic clays and organic silty clays of low plasticity
	Silts and Clays Liquid limit greater than 50		MH		Inorganic silts, micaceous or diatomaceous fine sandy/silty soils, elastic silts
			CH		Inorganic clays with high plasticity, fat clays
			OH		Organic clays of medium to high plasticity, organic silts
Highly Organic Soils			Pt		Peat and other highly organic soils

CLASSIFICATION SYSTEM BASED ON THE UNIFIED SOIL CLASSIFICATION SYSTEM

44732 Yucca Avenue
Tel (661) 273-9078

Lancaster, California 93534
www.bruingsi.net

Boring Log Key

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
1	2	3	4	5	6	7	8

COLUMN DESCRIPTIONS

1	Depth in feet below the ground surface
2	Sampling Method see "symbols" below
3	USCS symbol
4	Graphic depiction of the subsurface material
5	Description of the material encountered. May include consistency, moisture, color, and other descriptors
6	Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval
7	Dry weight per unit volume of soil sample measured in laboratory units in pounds per cubic foot
8	Water content of the sample expressed as a percentage of the dry weight of the sample

ABBREVIATIONS

DIST = Disturbed Sample
N/R = No Recovery
CHEM = Chemical Test
N/A = Not Analyzed

SAMPLING METHOD SYMBOLS


California Split Spoon (CSS)


Standard Penetration Test (SPT)


Bulk Sample


Grab Sample

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.

2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

APPENDIX B

Laboratory Test Data

SUMMARY OF LABORATORY TEST RESULTS

SIEVE ANALYSIS

Percent passing individual sieves

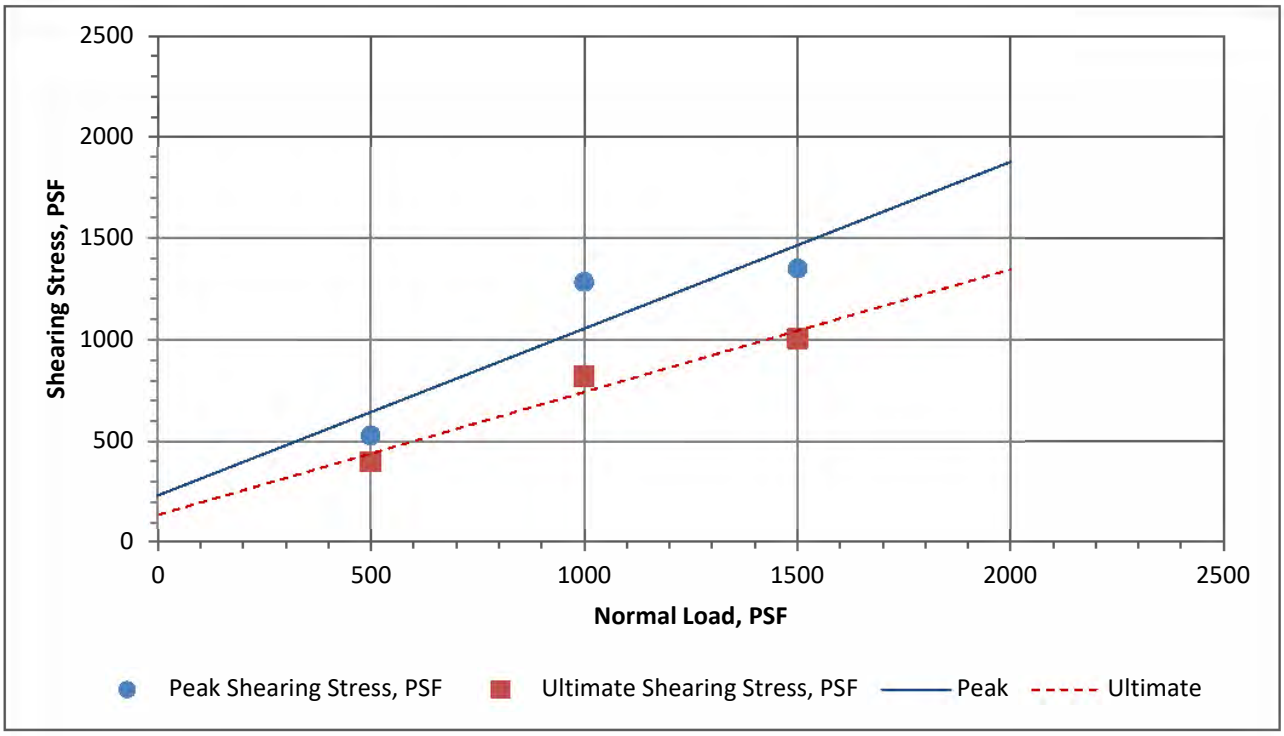
Sample I.D.	1/2"	3/8"	#4	#10	#40	#100	#200
B1@2		100	98	90	56	35	26
B1@6		100	99	94	66	47	37
B1@12		100	99	94	62	38	27
B1@20		100	98	90	49	25	19
B2@3		100	97	90	60	39	29
B2@8			100	97	75	53	38
B2@15	97	94	88	74	33	16	12
B3@1	99	98	95	89	55	42	26
B3@9	96	92	88	77	38	14	9
B3@15	96	94	84	67	26	10	6
B3@25	97	97	94	85	49	24	16
B3@35		100	99	93	58	35	24
B3@50				100	97	85	63
B4@6		100	97	87	36	16	12
B4@10		100	98	91	47	18	12
B5@15	96	944	90	75	25	10	7

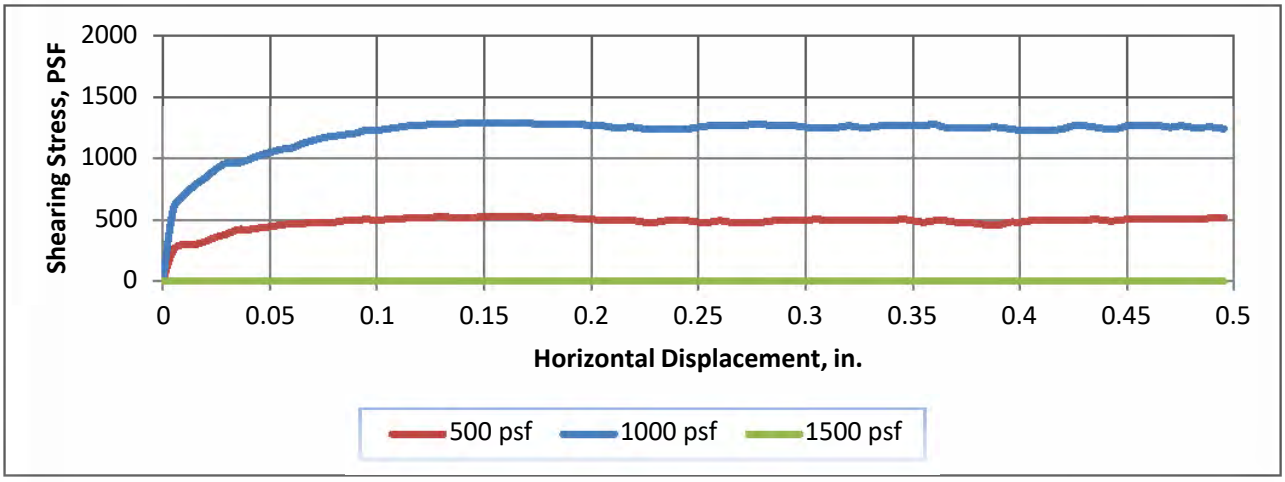
SAND EQUIVALENT

Sample I.D.	Sand Equivalent
B2@5	15
B3@6	30

EXPANSION INDEX

Sample I.D.	Expansion Index	Classification
B1@0-5’	0	Non-Expansive





Sample Description: (SM) - Dark yellowish brown silty fine to coarse sand

DIRECT SHEAR DATA (ASTM D-3080)

Sample ID	Symbol	Depth, feet	Dry Density, PCF	Average deg. of saturation
B3	●	3'	110	59

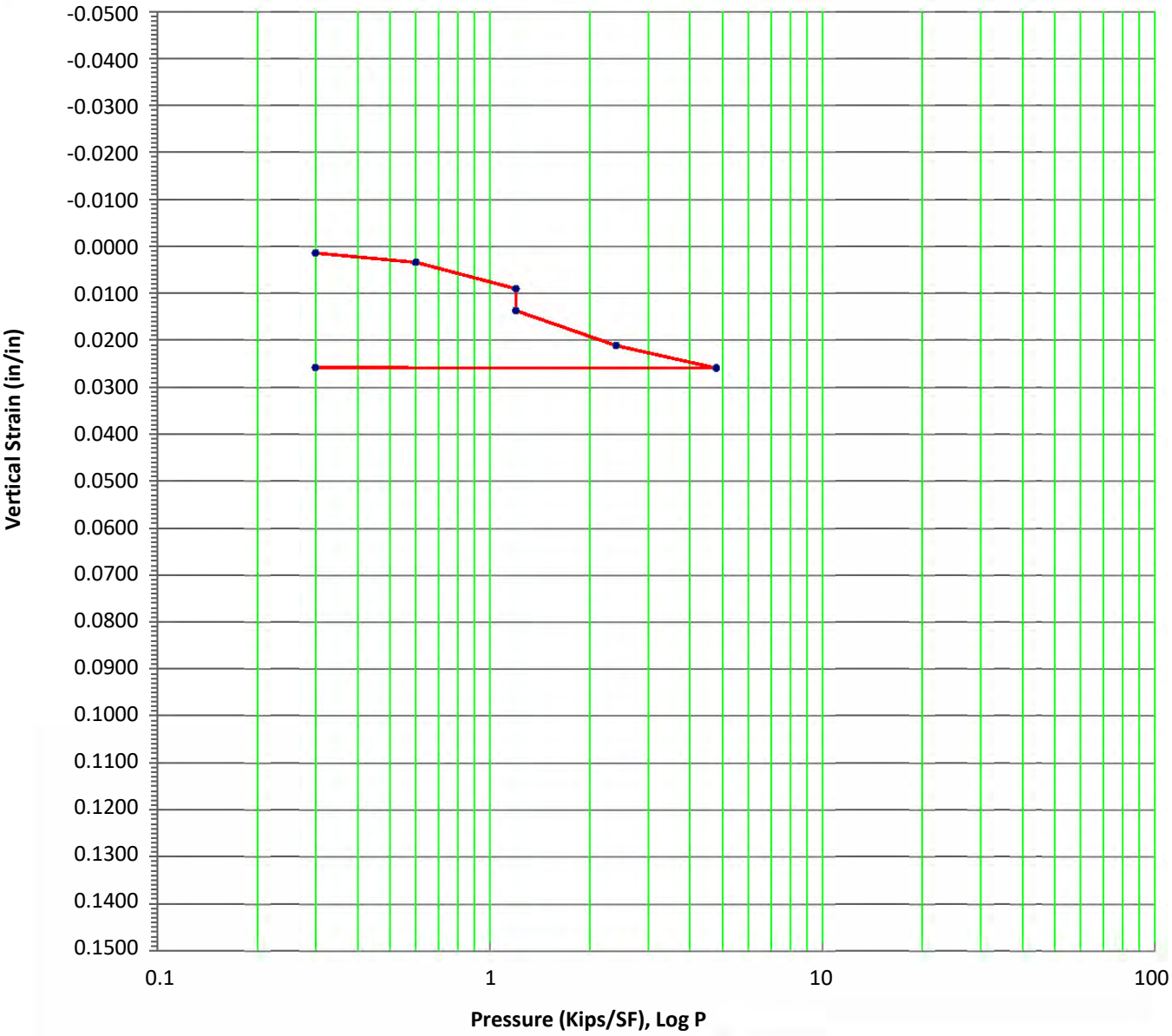
	Peak	Ultimate
Angle of friction, (degrees)	39	31
Cohesive Strength (PSF)	232	137

Direct Shear Test

RCE

BRUIN

J.N. 24-108



Consolidation Test

RCE

Sample location:	B3@9'	
Material:	SM/SP	
Initial Dry Density:	118.7	PCF
Moisture Content:	3.1	%
% Hydroconsolidation:	0.5	%

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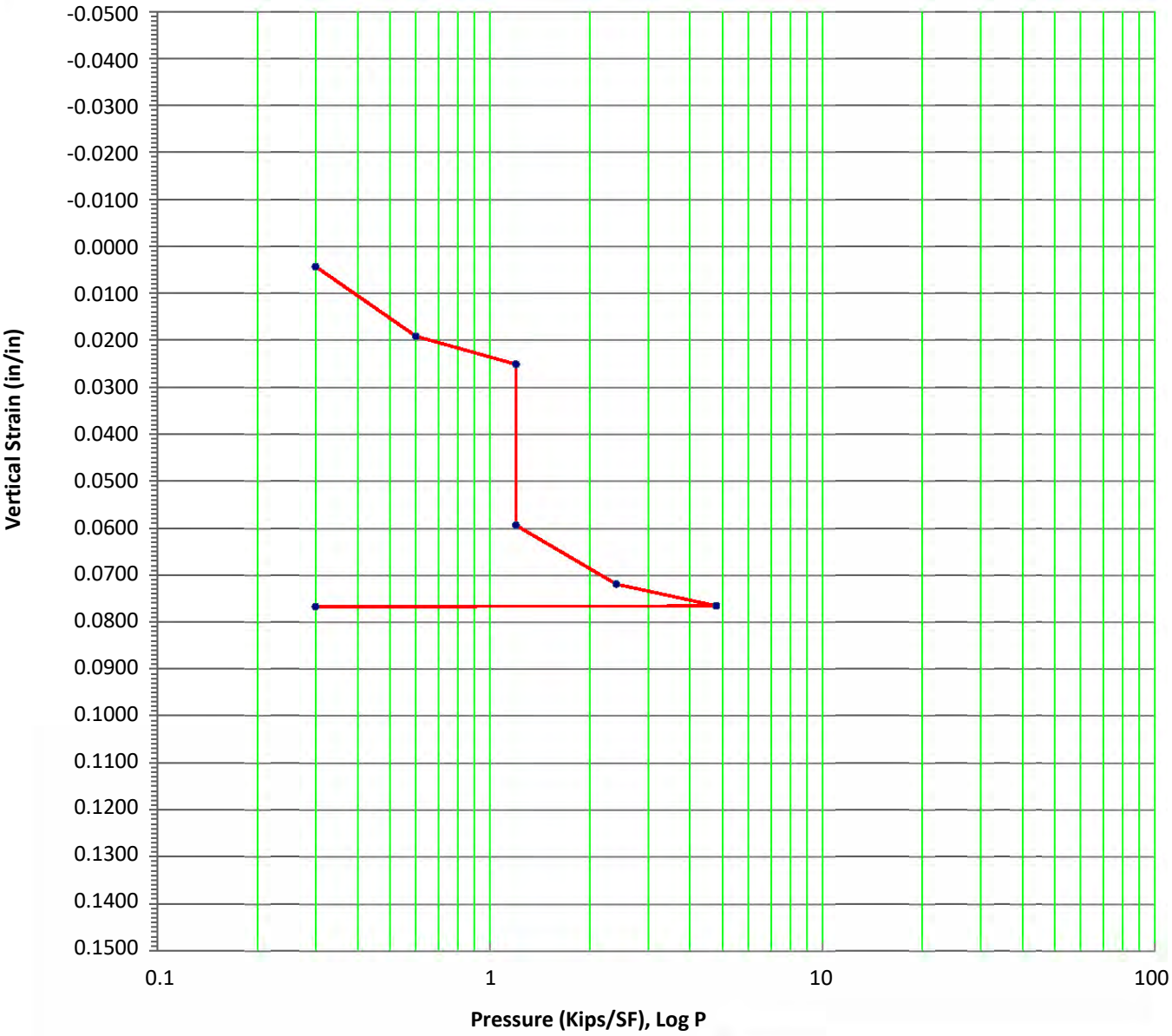
GEOTECHNICAL SERVICES INC.
est. 2001

Test Method: ASTM D-2435

J.N. 24-108



Consolidation Test

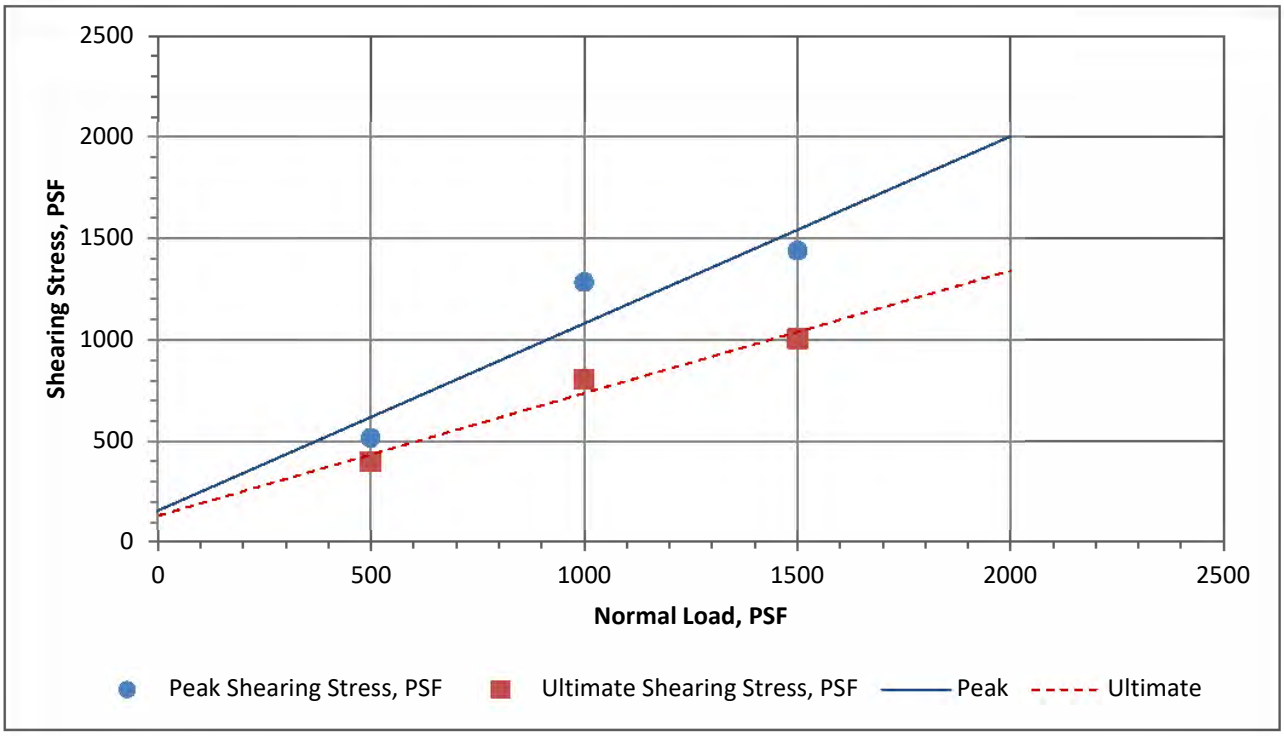
RCE

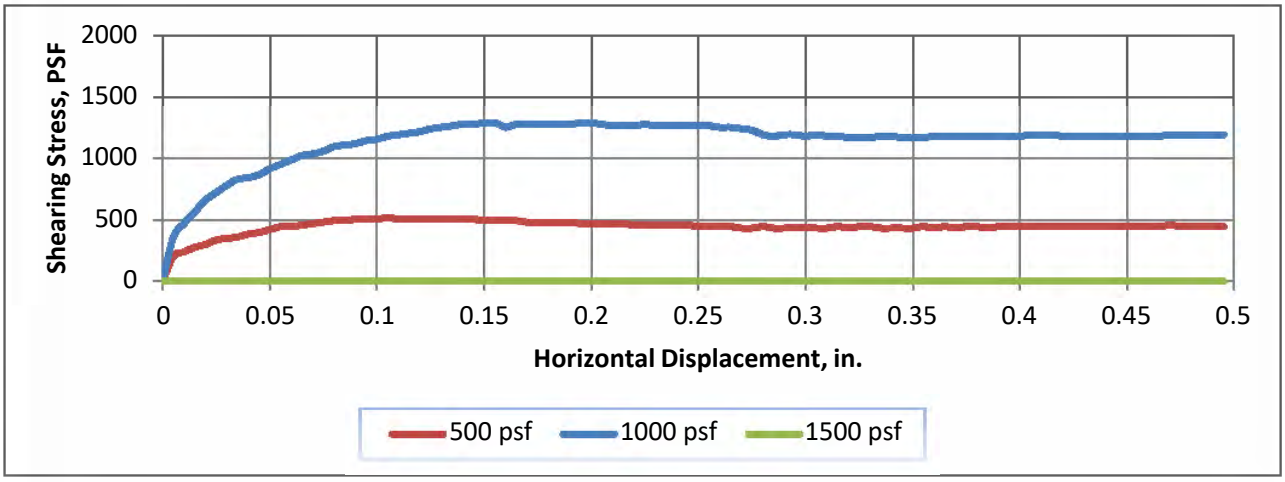
Sample location:	B4@4'	
Material:	SM	
Initial Dry Density:	114.5	PCF
Moisture Content:	7.2	%
% Hydroconsolidation:	3.4	%

BRUIN
GEOTECHNICAL SERVICES INC.
est. 2001

J.N. 24-108

Test Method: ASTM D-2435





Sample Description: (SM) - Dark yellowish brown silty fine to coarse sand

DIRECT SHEAR DATA (ASTM D-3080)

Sample ID	Symbol	Depth, feet	Dry Density, PCF	Average deg. of saturation
B5	●	5'	114	64

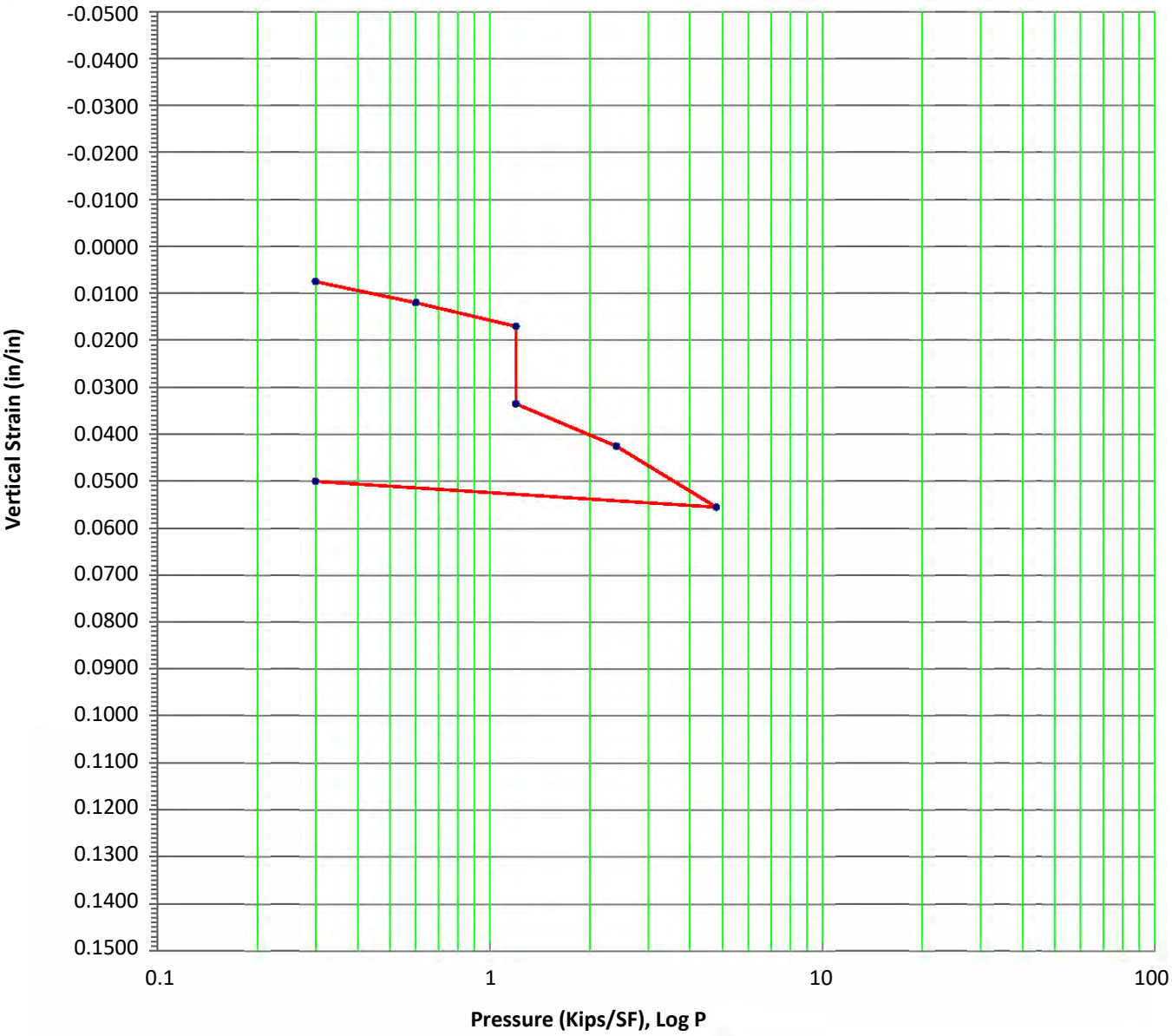
	Peak	Ultimate
Angle of friction, (degrees)	43	31
Cohesive Strength (PSF)	156	131

Direct Shear Test

RCE

BRUIN

J.N. 24-108



Consolidation Test

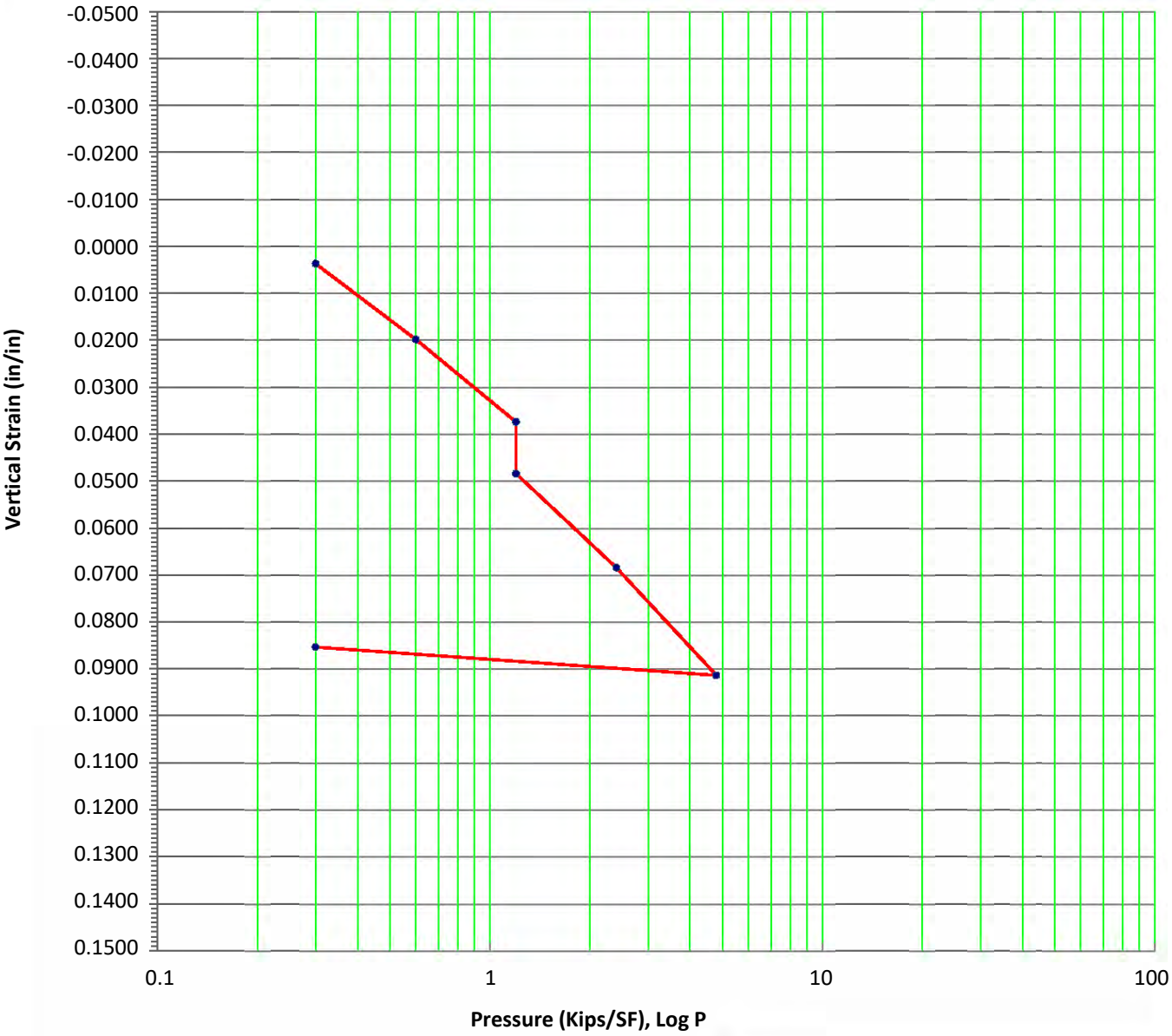
RCE

Sample location:	B5@7'	
Material:	SM	
Initial Dry Density:	118.2	PCF
Moisture Content:	5.8	%
% Hydroconsolidation:	1.7	%

BRUIN
GEOTECHNICAL SERVICES INC.
est. 2001

J.N. 24-108

Test Method: ASTM D-2435



Consolidation Test

RCE

Sample location:	B7@4'	
Material:	SM	
Initial Dry Density:	112.1	PCF
Moisture Content:	4.2	%
% Hydroconsolidation:	1.1	%

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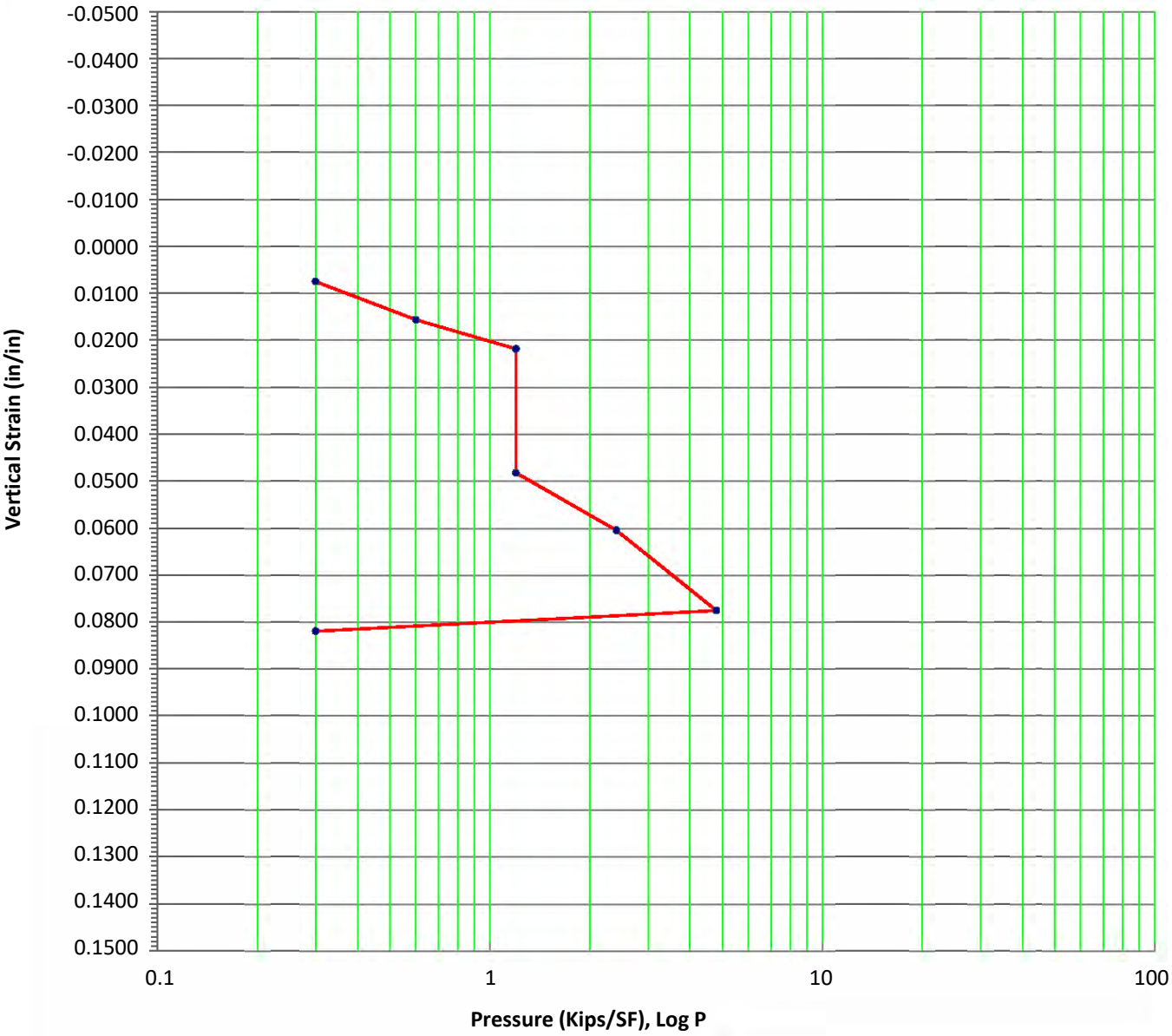
GEOTECHNICAL SERVICES INC.
est. 2001

Test Method: ASTM D-2435

J.N. 24-108



Sample location:	B8@3'	
Material:	SM	
Initial Dry Density:	118.6	PCF
Moisture Content:	2.9	%
% Hydroconsolidation:	2.6	%

Test Method: ASTM D-2435

Consolidation Test

RCE

BRUIN
GEOTECHNICAL SERVICES INC.
est. 2001

J.N. 24-108

ANAHEIM TEST LAB, INC

196 Technology Drive, Unit D
Irvine, CA 92618
Phone (949) 336-6544

TO:

Bruin Geotechnical Services, Inc.
44732 Yucca Avenue
Lancaster, CA 93534

DATE: 3/12/2024

P.O. NO.: Transmittal

LAB NO.: C-7748

SPECIFICATION: CA 301

MATERIAL: Brown, Clayey Sand

Project No.: 24-108
Project: RCE - Mesa
APN 3136-441-01, 02 & 3136-411-04, 05, Victorville, CA
Boring ID: B6 @ 0-5'

ANALYTICAL REPORT
"R" VALUE

BY EXUDATION	BY EXPANSION
51	N/A

RESPECTFULLY SUBMITTED

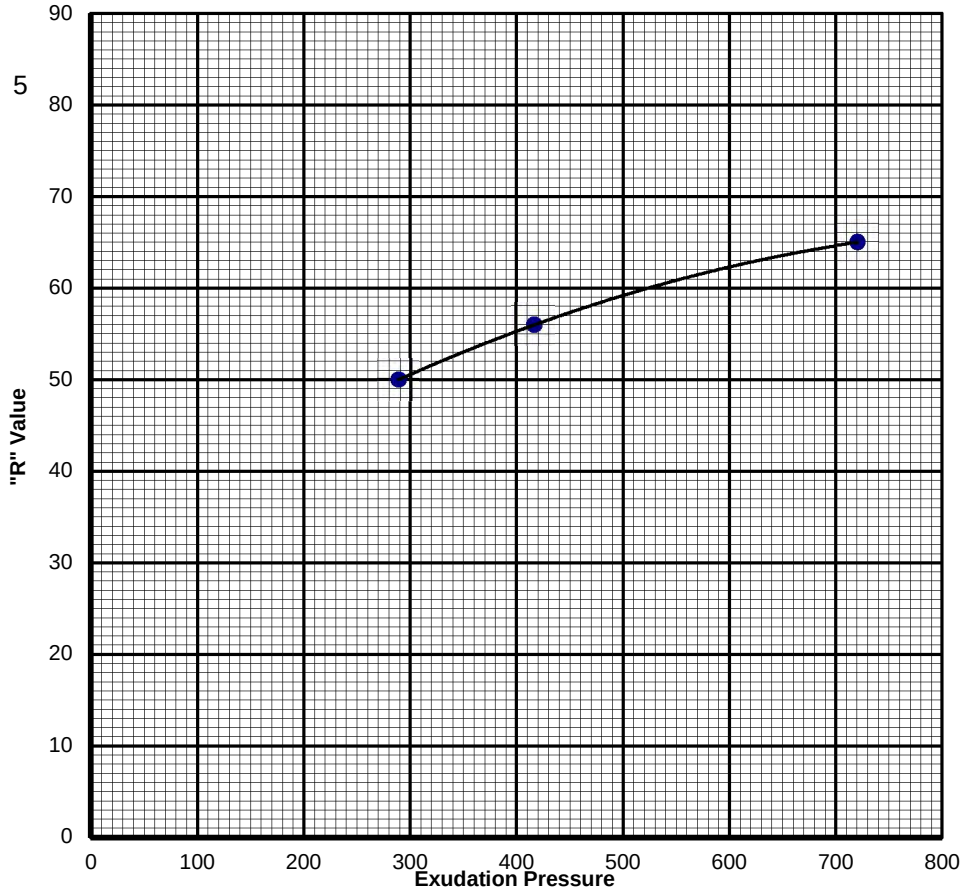
WES BRIDGER LAB MANAGER

"R" VALUE CA 301

Client: Bruin Geotechnical Services, Inc. **ATL No.:** C 7748 **Date:** 3/12/2024
Client Reference No.: 24-108
Sample: B6 @ 0-5' **Soil Type:** Brown, Clayey Sand

TEST SPECIMEN		A	B	C	D
Compactor Air Pressure	psi	150	100	250	
Initial Moisture Content	%	4.2	4.2	4.2	
Moisture at Compaction	%	8.5	9.4	8.1	
Briquette Height	in.	2.44	2.51	2.48	
Dry Density	pcf	131.5	129.3	132.3	
EXUDATION PRESSURE	psi	417	289	721	
EXPANSION PRESSURE	psf	22	0	65	
Ph at 1000 pounds	psi	25	27	22	
Ph at 2000 pounds	psi	50	57	40	
Displacement	turns	4.29	4.52	3.98	
"R" Value		56	50	65	
CORRECTED "R" VALUE		56	50	65	

Final "R" Value	
BY EXUDATION: @ 300 psi	**51**
BY EXPANSION: TI = 5.0	**N/A**



ANAHEIM TEST LAB, INC

196 Technology Drive, Unit D
Irvine, CA 92618
Phone (949) 336-6544

Bruin Geotechnical Services, Inc.
44732 Yucca Avenue
Lancaster, CA 93534

DATE: 3/12/2024

P.O. NO.: Transmittal

LAB NO.: C-7748

SPECIFICATION: CTM-643/417/422

MATERIAL: Soil

Project No.: 24-108
Project: RCE - Mesa
APN 3136-441-01, 02 & 3136-411-04, 05, Victorville, CA
Boring ID: B1 @ 0-5'

ANALYTICAL REPORT

CORROSION SERIES
SUMMARY OF DATA

pH	MIN. RESISTIVITY per CT. 643 ohm-cm	SOLUBLE SULFATES per CT. 417 (% by weight)	SOLUBLE CHLORIDES per CT. 422 ppm
7.9	9,000	0.0106%	14

RESPECTFULLY SUBMITTED

WES BRIDGER, LAB MANAGER

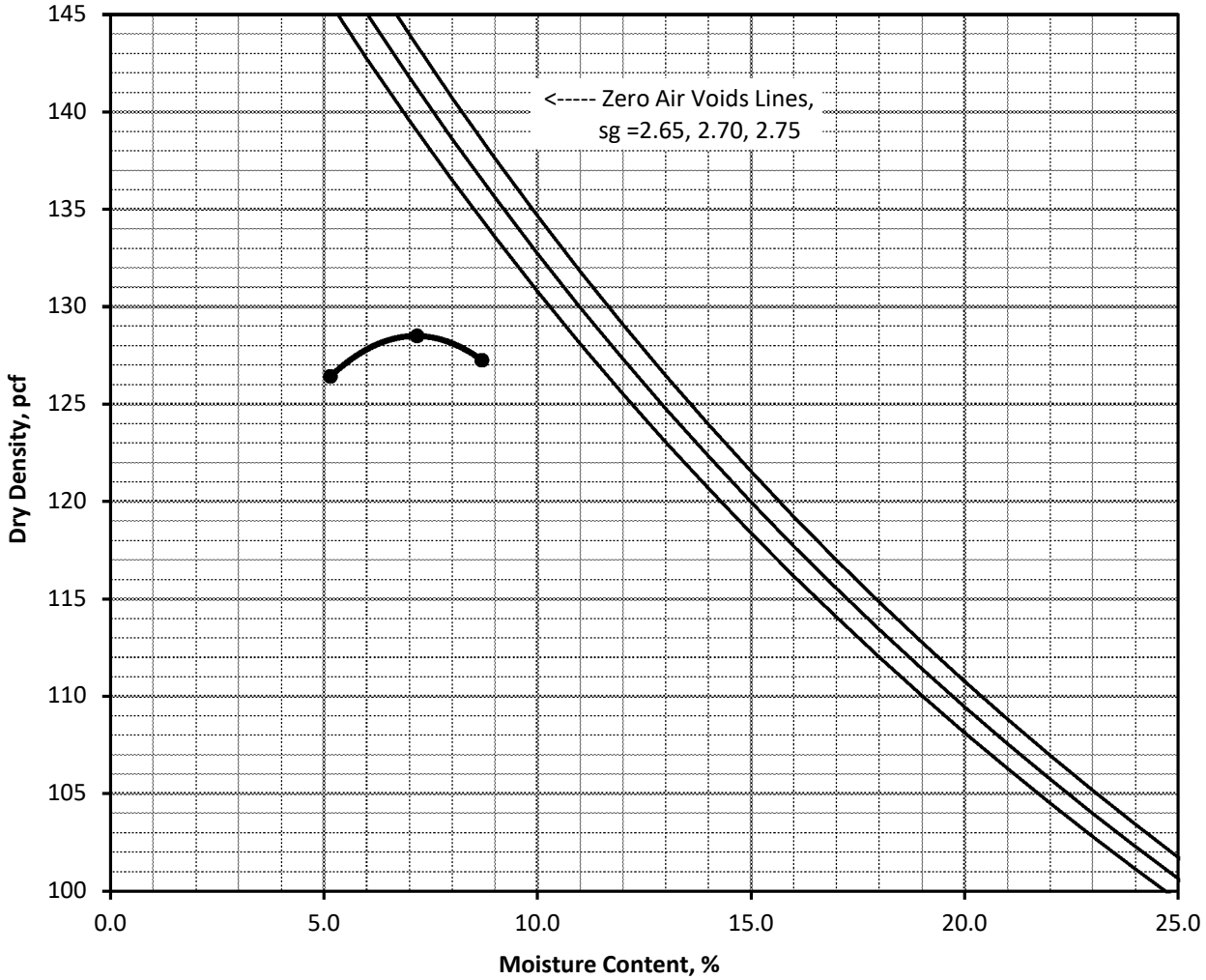
Bruin Geotechnical Services, Inc.

44732 Yucca Avenue
Lancaster, CA 93534
661-273-9078

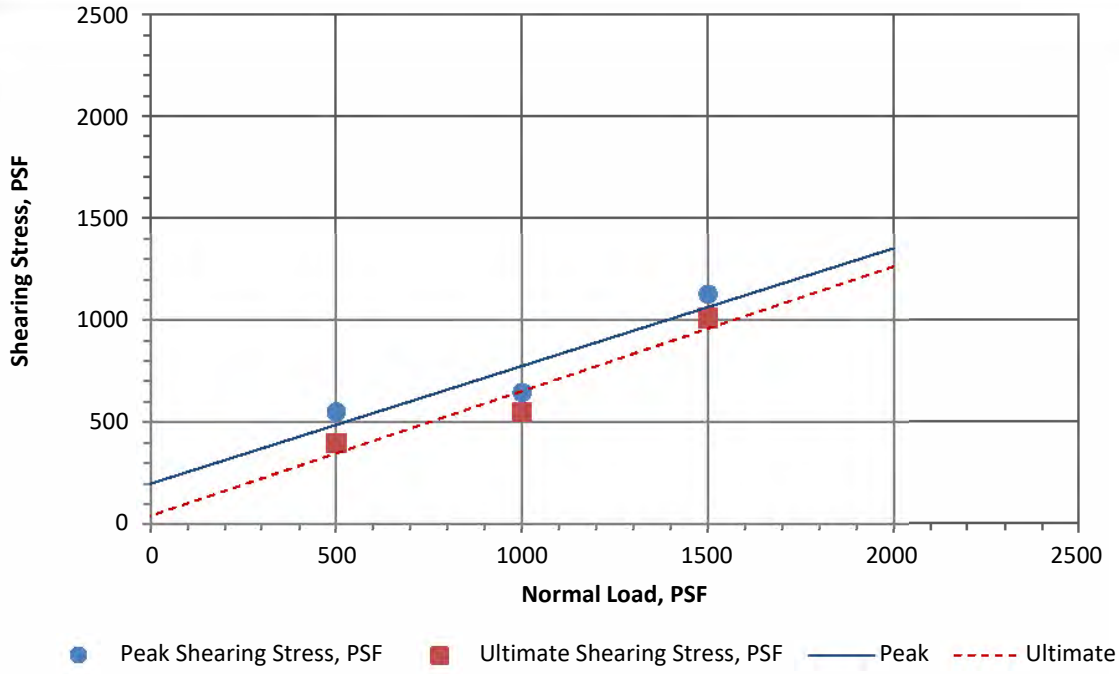
Maximum Density/Optimum Moisture Proctor ASTM D698/D1557

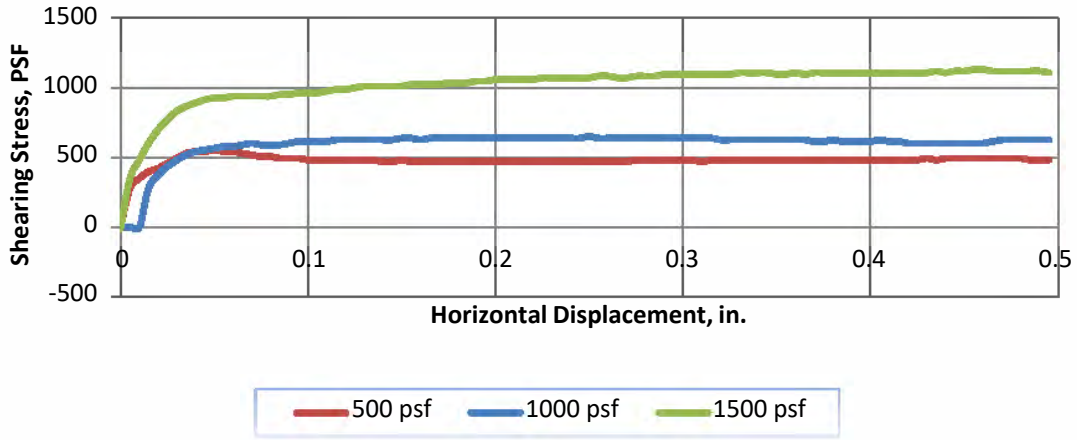
Job Number:	24-108	
Client:	RCE - Mesa	ASTM D 1557 A
Sample ID:	Bulk Sample 0-5' BGS	Rammer Type: 10#
Sample Location:	B1	
Description:	(SM) Brown silty fine to medium sand w/ coarse sand & occ. #4-3/8" gravel	

Maximum Density: 128.2
Optimum Moisture: 7.1



---- Zero Air Voids Line, Specific Gravity: 2.7 (assumed)





Sample Description: (SM) - Brown silty fine to medium sand w/ coarse sand and occ. #4-3/8" gravel

DIRECT SHEAR DATA (ASTM D-3080)

Sample ID	Symbol	Depth, feet	Dry Density, PCF	Average deg. of saturation
B1	●	0-5'	113	86

* Sample remolded to 90% relative compaction as determined by ASTM D-1557 Test Method

	Peak	Ultimate
Angle of friction, (degrees)	30	31
Cohesive Strength (PSF)	200	43

Direct Shear Test

RCE - Mesa

BRUIN

24-108

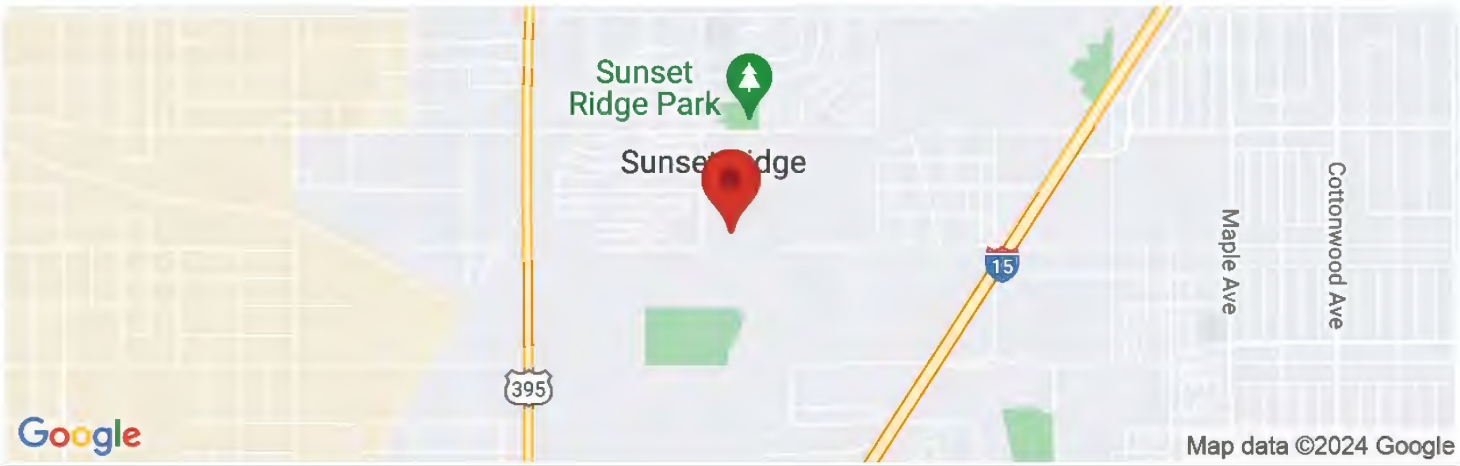
APPENDIX C

USGS Seismic Design Summary Report

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.

24-108 RCE

Latitude, Longitude: 34.44944264, -117.38432069



Date	4/1/2024, 12:10:57 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	1.427	MCE_R ground motion. (for 0.2 second period)
S_1	0.553	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.712	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.141	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.5	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.6	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	1.427	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.539	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.553	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.61	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.611	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.927	Mapped value of the risk coefficient at short periods
C_{R1}	0.906	Mapped value of the risk coefficient at a period of 1 s
C_V	1.385	Vertical coefficient

DISCLAIMER

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APPENDIX D

General Earthwork and Grading Guidelines

Earthwork and Grading Specifications for Rough Grading

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 more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 **The Geotechnical Consultant of Record:** Prior to commencement of work, the owner shall employ a qualified Geotechnical Consultant of Record (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 the 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 observations, mapping, and compaction testing.

During the 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.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to confirm that the attained level of compaction is being accomplished as specified. The Geotechnical Consultant shall provide the test results to the owner and the Contractor 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 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 the project plans and 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 "equipment" of work and the estimated quantities of daily earthwork contemplated 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 personnel will be available for observation and testing. 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 Consultants, 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 the specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified. It is the contractor's sole responsibility to provide proper fill compaction.

2.0 Preparation of Areas to be Filled

2.1 **Clearing and Grubbing:** Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 10 percent of organic matter. Nesting of the 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, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminant dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed. The contractor is responsible for all hazardous waste relating to his work. The Geotechnical Consultant does not have expertise in this area. If hazardous waste is a concern, then the Client should acquire the services of a qualified environmental assessor.

2.2 **Processing:** Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free from oversize material and the working surface is reasonably uniform, flat, and free from uneven features that would inhibit uniform compaction.

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

2.4 **Benching:** Where fills are to be places on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground 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 that 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

2.5 **Evaluation/Acceptance of Fill Areas:** All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observes, 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.

3.0 Fill Material

3.1 **General:** 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 **Oversize:** Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 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 such 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 underground construction.

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

4.0 Fill Placement and Compaction

4.1 **Fill Layers:** Approved fill material shall be placed in areas prepared to receive fill in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates that 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 **Fill Moisture Conditioning:** Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain relatively uniform moisture content within 2% of optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557-91).

4.3 **Compaction of Fill:** 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 D1557-91). 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 with uniformity.

4.4 **Compaction of Fill Slopes:** In addition to normal compaction procedures specified above, compaction of slopes, shall be accomplished by backrolling of slopes with sheepfoot 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 D1557-91.

4.5 **Compaction Testing:** 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).

4.6 **Frequency of Compaction Testing:** Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. 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.

4.7 **Compaction Test Locations:** The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that 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 then 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical repot(s), the grading plan, and the 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 by a land survey/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well we over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. 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 The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

7.2 All 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 then 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 of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

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

7.4 The 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.

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.