Appendix E-2 - Addendum Report to Geotechnical Engineering Investigation

Environmental
Geotechnology
Laboratory, Inc.

January 15, 2020

Grand Pacific Communities
Mr. Richard Chou
100 N. Barranca Street, Suite 950
West Covina, California 91791

Subject: **Report of Geotechnical Engineering Investigation, Proposed New Temple Development, Ten (10) Single-Family Residences with ADUs and JADUs, and Associated Structures, APN: 266-320-025, Cole Avenue & Landin Lane, Riverside, California, EGL Project No.: 19-283-003GE**

Ladies and Gentlemen:

In accordance with your request, Environmental Geotechnology Laboratory, Inc. (EGL) has prepared this geotechnical engineering report for the proposed development at the subject site. The purpose of this report was to evaluate the subsurface conditions and to provide recommendations for foundation designs and other relevant parameters for the proposed construction.

Based on the findings and observations during our investigation, it is concluded that the subject site is suitable for its intended use from the geotechnical engineering viewpoint, provided that recommendations set forth herein are followed.

This opportunity to be of service is sincerely appreciated. If you have any questions pertaining to this report, please call the undersigned.

Respectfully submitted,

Environmental Geotechnology Laboratory, Inc.

Ryan Jones, GE 2852
Project Engineer

REGISTERED PROFESSIONAL ENGINEER
RYAN KEITH JONES
No. 2852
Exp.
GEOTECHNICAL
STATE OF CALIFORNIA

Dist: (4) Addressee
HJ/RJ/ky

REPORT OF GEOTECHNICAL ENGINEERING INVESTIGATION

Proposed New Temple Development,
Ten (10) Single-Family Residences with ADUs and JADUs,
and Associated Structures

APN: 266-320-025

AT

Cole Avenue & Landin Lane
Riverside, California

Prepared by
ENVIRONMENTAL GEOTECHNOLOGY LABORATORY, INC.
Project No.: 19-283-003GE
January 15, 2020

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1.0 INTRODUCTION

1.1 Purpose

This report presents a summary of our preliminary geotechnical engineering investigation for the proposed development at the subject site. The purposes of this investigation were to evaluate the subsurface conditions at the area of proposed construction and to provide recommendations pertinent to grading, foundation design and other relevant parameters of the proposed development.

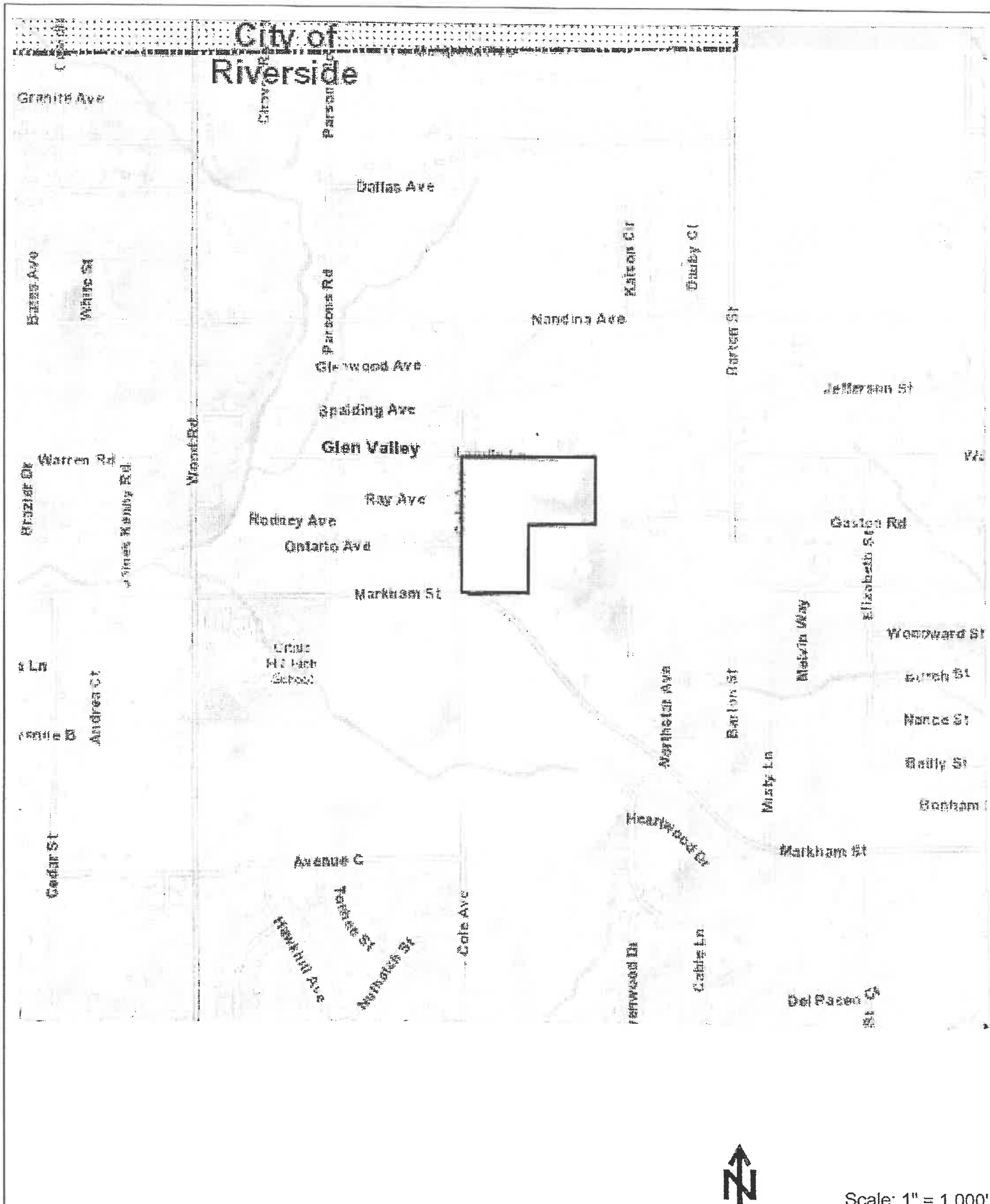
1.2 Scope of Services

Our scope of services included the followings:

- Review of available soil data of the subject site and its vicinity.
- Subsurface exploration consisting of logging and sampling of seven (7) backhoe test pits to a maximum depth of 10.0 feet below the existing grade at the subject site. The exploration was logged by an EGL engineer and presented in Appendix A.
- Perform two (2) percolation tests to determine the design infiltration rate of the soil at the site. Percolation testing on test pits TP-5 and TP-6 at depths of 5' and 9', respectively. Infiltration rate calculations are presented in Appendix C.
- Perform laboratory testing on representative onsite samples to establish soil-engineering characteristics. Field moisture and density are presented on test pit logs in Appendix A. Laboratory test results are presented in Appendix B.
- Engineering analyses of the geotechnical data obtained from our background studies, field investigation, and laboratory testing.
- Preparation of this report to present our findings, conclusions, and recommendations for the proposed construction.

1.3 Site Conditions

The subject site is an "L" shaped property with frontage located on the southeast corner of Cole Avenue and Landin Lane in the City of Riverside, California. The approximate regional location is shown on the Site Location Map (Figure 1). The project site is currently vacant and covered with some bushes and trees. Topographically, the subject site is relatively flat with gentle slopes to the west-northwest within the proposed development area. The northeast portion of subject site is designated as "conservation area" and will remain in its current condition. Detailed configuration of the site is shown on the Site Plan, Figure 2.



Scale: 1" = 1,000'

ENVIRONMENTAL GEOTECHNOLOGY LABORATORY	EGL Proj. No.: 19-283-003 Cole Avenue and Landin Lane Glen Valley, California

SITE (LOCATION) MAP

12/19

Figure 1

Base map adopted from Riverside County , "Map My County Version 8.1, Riverside County, California.", Official Map, 1999. Scale 1"=2,000'

11819 Goldring Road, Unit A, Arcadia, California 91006; Phone (626) 263-3588; Fax (626) 263-3599

1.4 Proposed Construction

Based on the *Site Plan* provided by Creative Design Associates Inc., it is our understanding that the proposed development at the site consists of a new temple development, consisting of 9 buildings on the northwest side of the property and ten (10) single-family residences on the southwest side of the property. The residences will have accessory dwelling units (ADUs) and junior accessory dwelling units (JADUs). The proposed buildings are anticipated to be one and/or two-story wood frame structures with concrete slab-on-grade. Column loads are unknown at this time, but are expected to be light to medium. Cut/fill grading operation is anticipated to achieve the desired grades.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

Our field exploration was performed at the subject property on November 22, 2019 with the aid of a rubber-tired backhoe equipped with a 36"-wide bucket of Best Bobcat Backhoe Services. A total of seven (7) test pits were excavated to a maximum depth of 10.0 feet below the existing ground surface. Upon completion of excavation and percolation testing, all test pits were backfilled with onsite soil removed from excavations and tamped. The purpose of the excavation was to investigate the engineering characteristics of the onsite soils with respect to the proposed development.

The test pits were supervised and logged by EGL's engineer. Relatively undisturbed ring samples and bulk samples were collected during excavation for laboratory testing. The approximate locations of these test pits are shown on the Site Plan (Figure 2). Logs of test pits are presented in Appendix A. Ring samples were taken at frequent intervals. The samples, advanced by hand-auger, were obtained by driving a split-tube ring sampler with successive blows of a 32-pound hammer dropping from a height of 48 inches.

2.2 Laboratory Testing

Representative samples were tested for the following parameters: in-situ moisture content and density, direct shear strength, consolidation and corrosion potential. In-situ moisture and density test results are presented on the test pit logs in Appendix A. The results of our laboratory testing along with a summary of the testing procedures are presented in Appendix B.

3.0 SUMMARY OF GEOTECHNICAL CONDITIONS

3.1 Soil Conditions

A total of seven (7) backhoe test pits, TP-1 to TP-7, were excavated within the proposed development area of the subject site. Our subsurface exploration and testing program revealed the existence of natural soil (Qs) and bedrock of Late Cretaceous Val Verde Tonalite (Kvt) to the maximum explored depth of 10.0 feet below existing ground surface. Detailed earth material descriptions encountered and observed in the backhoe test pits are described below and are shown on test pit logs, Appendix A.

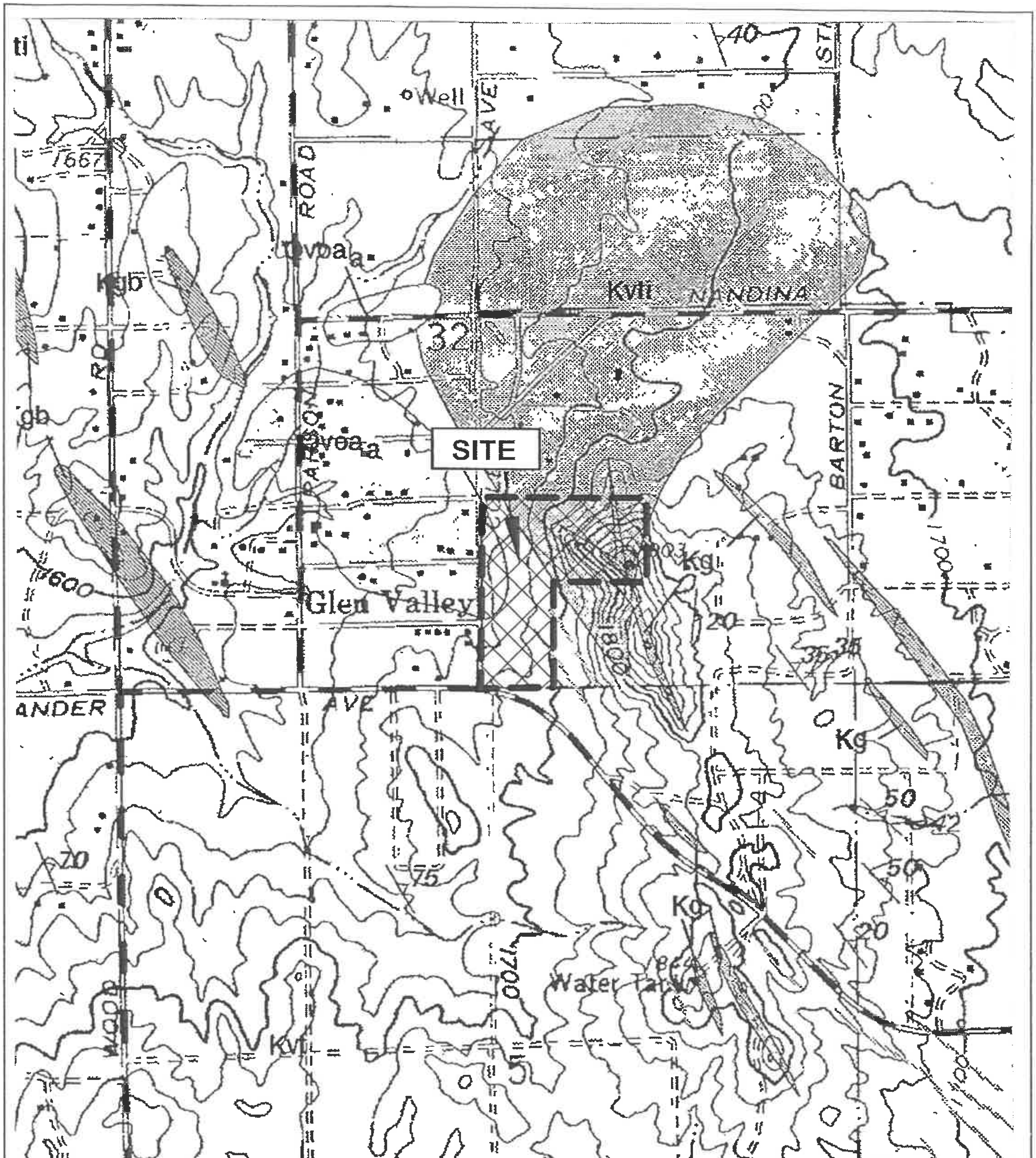
Natural soil (Qs) was encountered within all excavated test pits. As encountered and observed, the onsite natural soil thickness is approximately 2.0 to 9.0 feet thick and consisted predominantly of silty sand (SM) and clayey sand (SC), dark brown and olive brown in color, dry to slightly, and medium dense to very dense. Bedrock of Late Cretaceous Val Verde tonalite (Kvt) was encountered in test pits TP-1, TP-2, TP-3, TP-5 and TP-6. Onsite bedrock consisted of dark olive gray, medium- to coarse-grained, dry to slightly moist, massive and well-foliated, very dense and hard tonalite and granitic rocks. Refusals were encountered within test pits TP-1, TP-2 and TP-3 due to the very dense and tough bedrock material. Based on USGS (2002) the subject site is underlain by Late Cretaceous Val Verde tonalite, gray weathering, relatively homogenous, massive and well-foliated, medium to coarse grained (Kvt, Figure 3).

3.2 Groundwater

Static ground water levels were not encountered during our subsurface investigation to the maximum explored depth of 10.0 feet below the existing ground surface. Groundwater is therefore not expected to be a significant constraint during the construction. However, groundwater may be a significant constraint if grading is completed during the rainy season when perched water is more likely to occur.

4.0 CONCLUSIONS

Based on the results of our subsurface investigation, it is our opinion that the proposed construction is feasible from a geotechnical standpoint, provided the recommendations contained herein are incorporated in the design and construction. The following is a summary of the geotechnical design and construction factors that may affect the development of the site:



Kvt	Late Cretaceous Val Verde tonalite. Grey weathering, relatively homgenous, massive, well foliated, medium- to coarse-grained, hypautomorphoic-granular biotite-hornblende tonalite
Kvti	Late Cretaceous Val Verde tonalite. Tonalite contains abundant melanocratic inclusions, most with compositionally gradtional borders, medium- and small-masses
Kg	Late Cretaceous generic granitic rocks. Granitic dikes, includes texturally diverse group of leucocratic (quartzo-and alkali feldspathic) granitic dikes, few centimeter to over a meter thick and several hundred meters long

Base map adopted from USGS "Geologic Maps of Steel Peak and Riverside East 7.5' Quads, Riverside County, California"; OFR 01-449 and 01-452, 2002; Scale 1"=2,000'

N

Scale: 1" = 1,000'

ENVIRONMENTAL GEOTECHNOLOGY LABORATORY	EGL Proj. No.: 19-283-003 Cole Avenue and Landin Lane Glen Valley, California

REGIONAL (GEOLOGY) MAP

12/19

Figure 3

11819 Goldring Road, Unit A, Arcadia, California 91006; Phone (626) 263-3588; Fax (626) 263-3599

4.1 Seismicity

Our studies of regional and local seismicity indicate that there are no known active faults crossing the property. However, the site is located in a seismically active region and is subject to seismically induced ground shaking from nearby and distant faults, which is a characteristic of all Southern California communities.

4.2 Seismic Induced Hazards

Based on our review of the "*Public Safety Element, City of Riverside General Plan, Liquefaction Zones, Figure PS-2*" (Reference #4), it is concluded that the site is not located within the mapped potential liquefaction area. It is our understanding that a liquefaction study is not required by the city for the subject site.

4.3 Excavatability

Excavation of the subsurface materials should be able to be accomplished with conventional earthwork equipment. However, the bedrock material is very hard and the excavation may become difficult.

4.4 Surficial Soil Removal and Recompaction

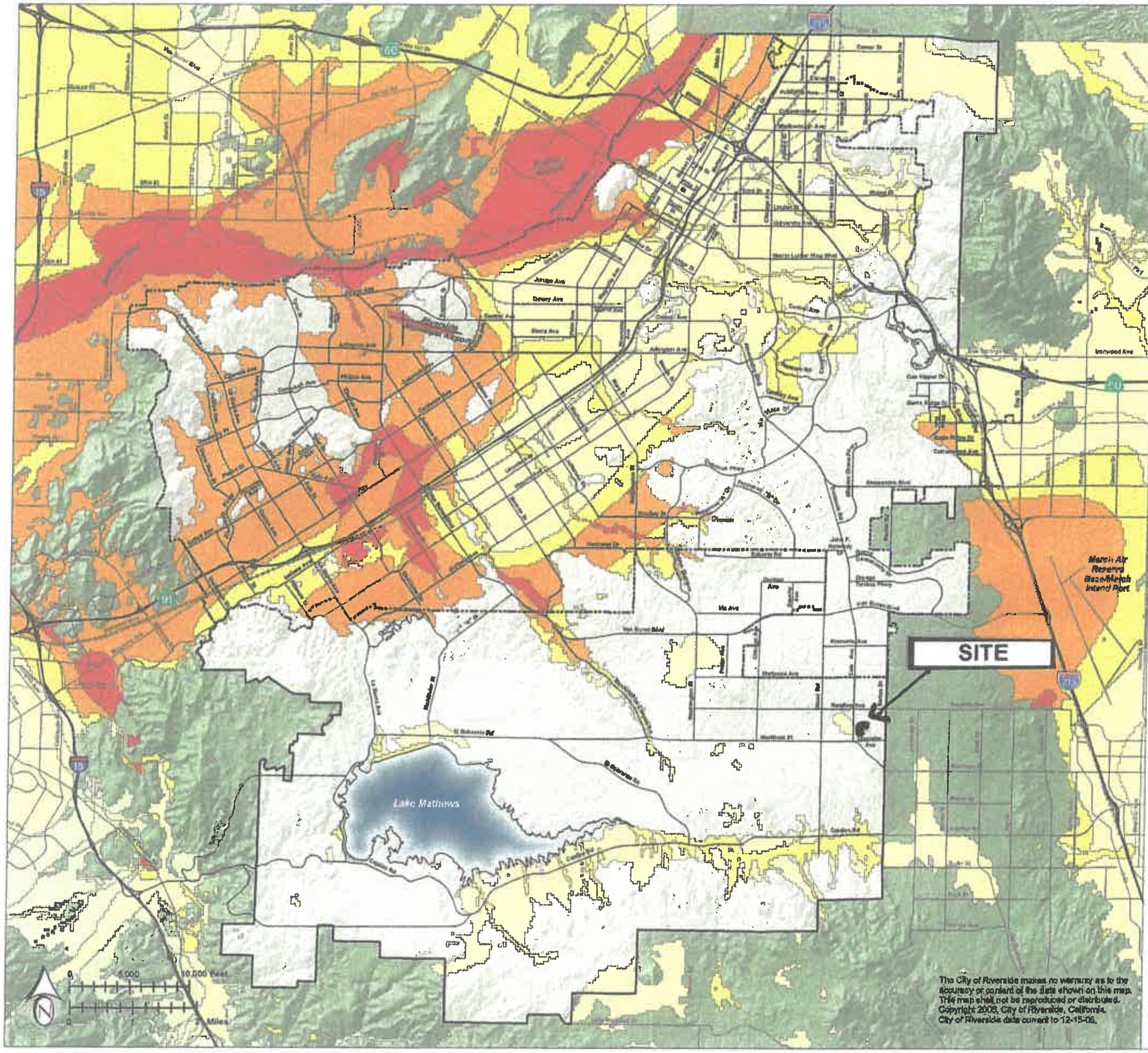
Based on our investigation, it is concluded that the existing surficial soils may not be suitable for structure support as they presently exist and will require remedial grading as discussed herein.

4.5 Groundwater

Static ground water levels were not encountered during our subsurface investigation to the maximum explored depth of 10.0 feet below the existing ground surface. Groundwater is therefore not expected to be a significant constraint during the construction. However, groundwater may be a significant constraint if grading is completed during the rainy season when perched water is more likely to occur.

5.0 RECOMMENDATIONS

Based on the subsurface conditions exposed during field investigation and laboratory testing program, it is recommended that the following recommendations be incorporated in the design and construction phases of the project.



RIVERSIDE GENERAL PLAN 2025

LEGEND

- VERY LOW
- LOW
- MODERATE
- HIGH
- VERY HIGH
- RIVERSIDE CITY BOUNDARY
- RIVERSIDE PROPOSED SPHERE OF INFLUENCE

SOURCE: TRANSPORTATION AND LAND MANAGEMENT AGENCY (TLMA) GEOGRAPHIC INFORMATION SERVICES COUNTY OF RIVERSIDE, JANUARY 1, 2005
http://www.tlma.co.riverside.ca.us/index.html

The City of Riverside makes no warranty as to the accuracy or content of the data shown on this map. This map shall not be reproduced or distributed. Copyright 2005, City of Riverside, California. City of Riverside data current to 12-15-05.

Figure PS-2

LIQUEFACTION ZONES

5.1 Grading

5.1.1 Site Preparation

Prior to initiating grading operations, any existing vegetation, trash, debris, over-sized materials (greater than 6 inches), and other deleterious materials within construction areas should be removed from the subject site.

5.1.2 Surficial Soil Removals

No detailed grading plan was available at the time of preparing this report however, based on our field exploration and laboratory data obtained to date, it is recommended that the surficial soils be removed to a depth of at least three (3) feet below existing grade or one (1) foot below the bottom of the footing, whichever is deeper. Removal depth should be a minimum of three (3) feet below proposed footings' bottom for any cut and fill transition building pads. The recommended removal should be extended at least 5 feet beyond proposed building lines. Existing near surface soils should also be removed at least one foot within proposed concrete slab and driveway areas. The construction areas should be excavated and then observed by a representative of this office to verify the soil conditions for any potential needs of removal of loose soils and replacement with compacted fill. This may also be necessary due to difference in expansion characteristics of foundation materials beneath a structure.

Locally deeper removals may be necessary to expose competent natural ground. The actual removal depths should be determined in the field as conditions are exposed. Visual inspection and/or testing may be used to define removal requirements.

5.1.3 Treatment of Removal Bottoms

Soils exposed within areas approved for fill placement should be scarified to a depth of 12 inches, conditioned to near optimum moisture content, then compacted in-place to minimum project standards.

5.1.4 Structural Backfill

The onsite soils may be used as compacted fill, provided they are free of organic materials and debris. It is recommended that the allowable size of cobbles to be used as fill material should not be greater than 6 inches within the building pad area and 10 inches within the landscape area. Cobble and boulder should not exceed 20% by dry weight. Soils imported from offsite sources should be similar to and/or sandier than the onsite soils and should be approved by the soil engineer prior to transporting to the site. Fills should be placed in relatively thin lifts (6 to 8 inches), brought to near optimum moisture content then compacted to at least 90 percent relative compaction based on laboratory standard ASTM D-1557-12.

5.1.5 Fill Slopes

Permanent fill slopes should be constructed no steeper than 2:1 (horizontal to vertical) and should be keyed and benches into competent natural soils materials if placed on slopes steeper than 5:1 (H:V). Clean, cohesionless sand should not be used for fill slopes; some selective grading may be required in this regard. Minimum of 90 percent relative compaction is recommended for competent fill slope construction.

5.1.6 Cut Slopes

Permanent cut slopes should be no steeper than 2:1 (H:V) slope gradient, which is anticipated to be grossly stable. However, field observation will be necessary during grading, by the project geologist, to determine the need for slope stabilization.

5.1.7 Fill Key

Fill key's dimension should be a minimum of ten (10) feet wide and excavated a minimum of two (2) feet into competent natural soils materials, measured from the downslope side. Fill key bottom should also be constructed with a minimum inclined slope of two (2) percent dipping upslope. Subdrains consisting of perforated pipe should be installed in the heel of the key or bench and sloped to discharge to a suitable collection facility. Project engineering geologist and/or geotechnical engineer representatives should observe and approved all fill key excavation and subdrain system prior to fill placement.

5.1.8 Benching

Fills placed on slopes steeper than 5:1 should be keyed and benched into competent natural soils materials as the fill is placed. Project geotechnical engineer and engineering geologist should observe all fill keys and bench cut excavations. Removal and deep benching on side hill slopes may be necessary prior to placement of fills on slopes where creep or slopewash exist.

5.2 Shallow Foundation Design

5.2.1 Bearing Value

An allowable bearing value of 1800 pounds per square foot (psf) may be used for design of the footings placed at a depth of at least 18 inches below the lowest adjacent ground and founded on the new certified compacted fill. Single spread footings should be at least 24 inches square and continuous footings should be at least 12 inches wide. This bearing value may be increased by 200 psf for each additional foot of depth or width to a maximum value of 2500 psf. The above recommended value may be increased by one third (1/3) when considering short duration seismic or wind loads.

5.2.2 Settlement

Settlement of the footings placed as recommended and subject to no more than allowable loads is not anticipated to exceed 3/4 inch. Differential settlement between adjacent columns is not anticipated to exceed 1/4 inch.

5.2.3 Lateral Pressures

Active earth pressure for static conditions from horizontal backfill may be computed as an equivalent fluid weighting of 30 pcf. Walls that are restrained against lateral movement or rotation at the top may be designed for the at-rest equivalent fluid pressure. An at-rest fluid weighting of 55 pcf may be used for level backfill under static condition. Retaining walls greater than 6' should be designed for an additional seismic lateral force of 30 pcf. The above values assume free-draining conditions with a subdrain system installed behind the walls as recommended.

Passive earth pressure may be computed as an equivalent fluid pressure of 300 pcf, with a maximum earth pressure of 2000 psf. An allowable coefficient of friction between soil and concrete of 0.35 may be used with the dead load forces. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one third (1/3).

5.3 Foundation Construction

It is anticipated that the entire structure will be underlain by onsite soils of very low expansion potential. Following presented our recommendations for the foundation construction. All footings should be founded at a minimum depth of 18 inches below the lowest adjacent ground surface and founded into new certified compacted fill. All continuous footings should have at least one No. 4 reinforcing bar placed both at the top and one No. 4 reinforcing bar placed at the bottom of the footings. A grade beam of at least 12 inches square, reinforced as recommended above for footings, should be utilized across the garage entrance. Base of the reinforced beam should be at the same elevation as the bottom of the adjoining footings.

5.4 Concrete Slab

Concrete slabs should be a minimum of 4 inches thick and reinforced with a minimum of #3 rebar spaced at 24" on center each way, or its equivalent. All slab reinforcement should be supported to ensure proper positioning during placement of concrete. Concrete slabs in moisture sensitive areas should be underlain with a vapor barrier consisting of a minimum of six-mil polyethylene membrane with all laps sealed. A minimum of two inches of sand should be placed over the membrane to aid in uniform curing of concrete.

5.5 Retaining Wall

Wall should be provided with subdrains to reduce the potential for the buildup of hydrostatic pressure. Backdrains could consist of free drainage materials (SE of 30 or greater) or CalTrans Class 2 permeable materials immediately behind the wall and extending to within 18 inches of the ground surface. A 4-inch diameter perforated pipe wrapped in gravel and geofabric should be installed at the base of the wall and sloped to discharge to a suitable collection facility or through weep holes. Alternatively, commercially available drainage fabric could be used. The fabric manufacturer's recommendations should be followed in the installation of the drainage fabric backdrain.

5.6 Temporary Excavation and Backfill

All trench excavations should conform to CAL-OSHA and local safety codes. All utilities trench backfill should be brought to near optimum moisture content and then compacted to obtain a minimum relative compaction of 90 percent of ASTM D-1557-12. All temporary excavations should be observed by a field engineer of this office so as to evaluate the suitability of the excavation to the exposed soil conditions.

6.0 SEISMIC DESIGN

Based on our studies on seismicity, there are no known active faults crossing the property. However, the subject site is located in Southern California, which is a tectonically active area. The following CBC 2019 (Chapter 16) & ASCE 7-16 (Chapter 20) seismic related values may be used:

Site Classification: (ASCE, Table 20.3-1)	D
Spectral Response Accelerations (g):	
(CBC, Figure 1613.3.1 (1) 0.2-Second, S_S	1.500
(CBC, Figure 1613.3.1 (2)) 1-Second, S_1	0.556

Site Coefficient:	
(CBC, Table 1613.3.3 (1)) F_a	1.0
(CBC, Table 1613.3.3 (2)) F_v	1.7

Based on the U.S. Seismic Design Maps (USGS, updated January 2019), the proposed structures may be designed to accommodate up to a maximum site horizontal acceleration of 0.500g with 2% probability of being exceeded in 50 years. However, the Project Structural Engineer should be aware of the information provided to determine if any additional structural strengthening is warranted.

7.0 CORROSION POTENTIAL

Chemical laboratory tests were conducted on the existing onsite near surface materials sampled during EGL's field investigation to aid in evaluation of soil corrosion potential and the attack on concrete by sulfate in the soils. The test results are presented in the Appendix B.

According to ACI 318-14 Table 19.3.1.1, a sulfate content of 0.006 percent by weight in soils is assigned to Class "S0" and the severity of exposure to sulfate for concrete placed in contact with the onsite soil is considered "Not Applicable". Based on the testing results and ACI 318-14 Table 19.3.2.1, it is concluded that there is no restriction on the type of cement ("No Type Restriction") to be used at the site; however EGL recommends that Type II cement be used.

Based on the minimum resistivity test results, the subsurface soils are moderately corrosive to buried metal pipe. Any underground steel utilities should be blasted and given protective coating. Should additional protective measures be warranted, a corrosion specialist should be consulted.

8.0 INSPECTION

As a necessary requisite to the use of this report, the following inspection is recommended:

* Temporary excavations.
* Removal of surficial and unsuitable soils.
* Backfill placement and compaction.
* Utility trench backfill.
* Foundation excavation.

The geotechnical engineer should be notified at least 1 day in advance of the start of construction. A joint meeting between the client, the contractor, and the geotechnical engineer is recommended prior to the start of construction to discuss specific procedures and scheduling.

9.0 PERCOLATION TEST

In order to evaluate the feasibility of the proposed infiltration system, EGL has performed a total of two (2) percolation tests at the subject site based on the *Low Impact Development BMP Design Handbook* (Riverside County, 2011). Approximate locations of the test borings are shown on the Site Plan (Figure 2). The percolation tests at this time were performed on test pits TP-5 and TP-6 at depths of 5' and 9' below existing ground surface, respectively, for the proposed infiltration/detention systems. The test borings TP-5 and TP-6 were presoaked and tested on November 22, 2019. The test procedures are described as following:

- 8"-diameter × 20"-deep perforated pipes were placed in the bottom of test pits TP-5 and TP-6 for the percolation test. The bottoms of test borings were also covered with 2 inches of gravel.
- The test borings were filled with a depth of 20 inches of water multiple times for presoak and allowed to completely drain prior to refilling for the percolation test.
- For the percolation test, a depth of 20 inches of water was placed within the test borings. The test time interval between readings used was 10 minutes due to more than 6 inches of water drop two consecutive times in less than 25 minutes during the first two tests.
- Additional six (6) 10-minute increment percolation tests were performed for test borings TP-5 and TP-6, respectively. Field data of two (2) 25 minutes readings and six (6) 10 minutes readings are presented in Appendix C. The last measured drop was used to calculate the design infiltration rate of the soil. Design Infiltration rate calculations are presented in Appendix C.

Based on the soil material encountered and past experience with similar soils the absorption rate of the soil should be adequate for the proposed infiltration system for rainwater runoff at the site. Based on the results of our preliminary percolation tests of the material, the design infiltration rate is 1.18 in/hr. Reduction factor of 2.0 has been applied to our design infiltration rate. It is our opinion that dispersal of on-site storm water runoff by infiltration system is considered feasible from a geotechnical engineering standpoint. The infiltration system and the final plumbing plans should be designed and prepared by the project Civil Engineer.

Based on the consolidation test results presented in the Appendix B all the samples collected below 5 feet showed a deformation of less than 1.0% at the time of saturation. It is EGL's opinion that hydro-consolidation of the soil due to the proposed infiltration system is negligible and should not impact the proposed structure.

Based on our review of the "*Public Safety Element, City of Riverside General Plan, Liquefaction Zones, Figure PS-2*" (Reference #4), it is concluded that the site is not located within the mapped potential liquefaction area. It is EGL's opinion that the proposed infiltration system will not increase the potential for liquefaction to occur at the site.

Due to the high percentage of sandy materials at the site it is EGL's opinion that infiltration system may be placed at the site. The infiltration system should be a minimum of 10 feet away from the building foundation and should not be surcharged by the building foundation. It is also recommended that the infiltration system be placed within natural soil and not compacted fill material. The infiltration system should also have an overflow or bypass to protect the site from flooding.

10.0 DRAINAGE

The pad should be properly drained toward the street away from the slope and structure via swales or area drains. Positive pad drainage shall be incorporated into the final plans. In no case should water be allowed to pond within the site, impound against structures, or flow in a concentrated and/or uncontrolled manner down the descending slope areas.

11.0 ASPHALT PAVEMENT

Preliminary structural pavement sections are designed according to the CalTrans Highway Design Manual and an assumed "R"-value of 40.

Location	Traffic Index	AC Thickness (inches)	Class 2 Aggregate Base Thickness (inches)	Compacted Subgrade (inches)
Parking Areas	4.5	3	5	12
Driveways	5.0	4	6	12

A traffic index of 4.5 is typically used for parking area for passenger vehicles with an average daily traffic of less than 200 trips. A traffic index of 5.0 is used for drive areas with an average daily traffic of less than 1,200 passenger vehicles with minor truck traffic. These pavement sections are considered preliminary and may be revised after the grading is completed provided additional testing is performed on the subgrade soil.

12.0 106 STATEMENT

Based on our field investigation and the laboratory testing results, it is our opinion that the grading and proposed structures will be safe against hazard from landslide, settlement, or slippage and the proposed construction will have no adversely affect on the geotechnical stability of the adjacent properties provided our recommendations are followed

13.0 REMARKS

The conclusions and recommendations contained herein are based on the findings and observations at the exploratory locations. However, soil materials may vary in characteristics between locations of the exploratory locations. If conditions are encountered during construction which appear to be different from those disclosed by the exploratory work, this office shall be notified so as to recommend the need for modifications. This report has been prepared in accordance with generally accepted professional engineering principles and practice. No warranty is expressed or implied. This report is subject to review by controlling public agencies having jurisdiction.

REFERENCES

1. American Concrete Institute, (2014), "Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary", Chapter 19: Durability Requirements, Sections 19.3.1: Exposure Categories and Classes & 19.3.2: Requirements for Concrete Mixtures; pages 317 to 323, Tables 19.3.1.1 and 19.3.2.1".
2. ASCE, (2010), "ASCE/SEI 7-10, Minimum Design Loads for Buildings and Other Structures: Third Printing, Errata incorporated, Includes Supplement No. 1; prepared and published by American Society of Civil Engineers.
3. CBC, (2019), "California Building Code: California Code of Regulations, Title 24, Part 2, Volume 2 of 2, California Building Standards Commission"; Section 1613 Earthquake Loads.
4. City of Riverside, (2012), "Public Safety Element amended November 2012", https://www.riversideca.gov/planning/gp2025program/GP/10_Public_Safety_Element.pdf
5. Creative Design Associates Inc., (2019) "Site Plan, Corner of Markham Street and Cole Avenue , Riverside, California", scale: 1" = 80', date: November, 2019, CDA project No: 1921, drawing No: AS-101.
6. RCIT, (2019), "Map My County Version 8.1, Riverside County, California", https://gis.countyofriverside.us/Html5Viewer/?viewer=MMC_Public
7. Riverside County, (2011), "Low Impact Development BMP Design Handbook, Appendix A - Infiltration testing"; revised September, 2011, Page 34.
8. USGS, (2002), "Geologic Map of Riverside East 7.5' Quadrangle, Riverside, Riverside County, California"; OFR 01-449 and 01-452; scale 1" = 2000'
9. USGS, (2014), "US Seismic Design Maps"; updated January 2019; prepared by United States Geological Survey; https://earthquake.usgs.gov/ws/designmaps/asce7-10.html

APPENDIX A

FIELD INVESTIGATION

Our field exploration was performed at the subject property on November 22, 2019 with the aid of a rubber-tired backhoe equipped with a 36"-wide bucket of Best Bobcat Backhoe Services. A total of seven (7) test pits were excavated to a maximum depth of 10.0 feet below the existing ground surface. Upon completion of excavation and percolation testing, all test pits were backfilled with onsite soil removed from excavations and tamped. The purpose of the excavation was to investigate the engineering characteristics of the onsite soils with respect to the proposed development.

The test pits were supervised and logged by EGL's engineer. Relatively undisturbed ring samples and bulk samples were collected during excavation for laboratory testing. The approximate locations of these test pits are shown on the Site Plan (Figure 2). Ring samples were taken at frequent intervals. The samples, advanced by hand-auger, were obtained by driving a split-tube ring sampler with successive blows of a 32-pound hammer dropping from a height of 48 inches.

Representative undisturbed samples of the subsurface soils were retained in a series of brass rings, each having an inside diameter of 2.42 inches and a height of 1.00 inch. All ring samples were transported to our laboratory. Bulk surface soil samples were also collected for additional classification and testing.

EGL

TEST PIT LOG: TP-1

PROJECT LOCATION: APN: 266-320-025; Cole Avenue & Landin Lane, Riverside

PROJECT NO: 19-283-003GE

DATE DRILLED:	11/22/2019
DATE LOGGED:	11/22/2019
EXCAVATION METHOD:	Backhoe
SAMPLE METHOD:	Split-Tube
ELEVATION:	N/A
LOGGED BY:	KY

S: Standard Penetration Test B: Bulk Sample R: Ring Sample

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Earth Material Descriptions
0							*Natural Soil (Qs; 0' - 2'):* @ 0.0' Clayey sand, fine to coarse grained, dark brown, dry, dense.
2		R	90	SM	114.8	5.8	@ 2.0' Silty sand, fine to coarse grained, olive brown, slightly moist, very dense.
4	B						*Bedrock of Late Cretaceous Val Verde Tonalite (kvt; 2' - 5'):*
5		R	150/5"	Bedrock	124.4	2.6	@ 5.0' Late Cretaceous Val Verde tonalite, dark olive gray, dry, medium to coarse grained, massive and well foliated, very dense and hard.
6							
8							Refusal @ 5.0 feet Total Depth = 5.0 feet No Caving; No Groundwater Test Pit Backfilled and Tamped Hammer Driving Weight = 32 lbs Hammer Driving Height = 48 inches
10							
12							
14							
16							
18							

TEST PIT LOG: TP-2

ELEVATION:	N/A
LOGGED BY:	KY

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Earth Material Descriptions
0							*Natural Soil (Qs; 0' - 2'):*
2		R	150/8"	SC	106.8	4.9	@ 2.0' Clayey sand, fine to coarse grained, dark brown, slightly moist, very dense.
4							*Bedrock of Late Cretaceous Val Verde Tonalite (kvt; 2' - 3'):*
5		R	150/0"	Bedrock	-	-	@ 3.0' Late Cretaceous Val Verde tonalite, dark olive gray, dry, medium to coarse grained, massive and well foliated, very dense and hard; no sample was able to taken due to very tough bedrock.
6							
8							Refusal @ 3.0 feet Total Depth = 3.0 feet No Caving; No Groundwater Test Pit Backfilled and Tamped Hammer Driving Weight = 32 lbs Hammer Driving Height = 48 inches
10							
12							
14							
16							
18							

EGL

TEST PIT LOG: TP-3

PROJECT LOCATION: APN: 266-320-025; Cole Avenue & Landin Lane, Riverside

PROJECT NO: 19-283-003GE

DATE DRILLED: 11/22/2019
DATE LOGGED: 11/22/2019
EXCAVATION METHOD: Backhoe
SAMPLE METHOD: Split-Tube
ELEVATION: N/A
LOGGED BY: KY

S: Standard Penetration Test B: Bulk Sample R: Ring Sample

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Earth Material Descriptions
							Natural Soil (Qs; 0' - 9'):
0		R	45	SM	106.1	0.7	@ 0.0' Silty sand, fine to coarse grained, light olive brown, dry, medium dense
2	B	R	20	SM	102.3	2.0	@ 2.0' Silty sand, fine to coarse grained, olive brown, dry, medium dense
4							
5		R	22	SM	106.1	1.5	@ 5.0' Silty sand, fine to coarse grained, olive brown, dry, medium dense
6							
8							*Bedrock of Late Cretaceous Val Verde Tonalite (kvt; 9' - 10'):*
10		R	150/0"	Bedrock	-	-	@ 10.0' Late Cretaceous Val Verde tonalite, dark olive gray, dry, medium to coarse grained, massive and well foliated, very dense and hard; no sample was able to taken due to very tough bedrock.
12							
14							Refusal @ 10.0 feet Total Depth = 10.0 feet No Caving; No Groundwater Test Pit Backfilled and Tamped
16							
18							Hammer Driving Weight = 32 lbs Hammer Driving Height = 48 inches
20							

TEST PIT LOG: TP-4

ELEVATION: N/A
LOGGED BY: KY

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Earth Material Descriptions
							Natural Soil (Qs; 0' - 2'):
0		R	150/10"	SM	119.2	1.1	@ 0.0' Silty sand, fine to coarse grained, light olive brown, dry, very dense.
2		R	80	SC	110.0	2.5	@ 2.0' Clayey sand, fine to coarse grained, olive brown, dry, very dense
4							
5		R	150/10"	SM	115.9	3.2	@ 5.0' Silty sand, fine to coarse grained, dark olive brown, dry, very dense, granitic rocks were commonly encountered
6							
8							Total Depth = 5.0 feet No Caving; No Groundwater Test Pit Backfilled and Tamped
10							
12							Hammer Driving Weight = 32 lbs Hammer Driving Height = 48 inches
14							
16							

EGL

TEST PIT LOG: TP-5 (Perc)

PROJECT LOCATION: APN: 266-320-025; Cole Avenue & Landin Lane, Riverside

PROJECT NO: 19-283-003GE

DATE DRILLED: 11/22/2019
DATE LOGGED: 11/22/2019
EXCAVATION METHOD: Backhoe
SAMPLE METHOD: Split-Tube
ELEVATION: N/A
LOGGED BY: KY

S: Standard Penetration Test B: Bulk Sample R: Ring Sample

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Earth Material Descriptions
							Natural Soil (Qs; 0' - 2'):
0		R	120	SM/SC	115.5	1.4	@ 0.0' Silty clayey sand, fine to coarse grained, brown, dry, very dense.
2		R	120/10"	SM/SC	111.6	5.3	@ 1.0' Silty clayey sand, fine to coarse grained, brown, slightly moist, very dense.
4							*Bedrock of Late Cretaceous Val Verde Tonalite (kvt; 2' - 5'):*
		R	150/8"	Bedrock	117.4	2.2	@ 5.0' Late Cretaceous Val Verde tonalite, dark olive gray, dry, medium to coarse grained, massive and well foliated, very dense and hard.
6							
8							Total Depth = 5.0 feet No Caving; No Groundwater Test Pit Backfilled and Tamped After Percolation Test
10							
12							Hammer Driving Weight = 32 lbs Hammer Driving Height = 48 inches
14							
16							
18							

TEST PIT LOG: TP-6 (Perc)

ELEVATION: N/A
LOGGED BY: KY

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Earth Material Descriptions
							Natural Soil (Qs; 0' - 8.5'):
0		R	60/10"	SC	107.3	2.5	@ 0.0' Clayey sand, fine to coarse grained, olive brown,dry, dense to very dense.
2	B	R	15	SM	103.6	3.1	@ 2.0' Silty sand, fine to coarse grained, olive brown, dry, medium dense.
4							
		R	20	SM	100.9	6.7	@ 5.0' Silty sand, fine to coarse grained, olive brown, slightly moist, medium dense.
6							
8							*Bedrock of Late Cretaceous Val Verde Tonalite (kvt; 8.5' - 9'):* @ 8.5' Late Cretaceous Val Verde tonalite, dark olive gray, dry, medium to coarse grained, massive and well foliated, very dense and hard.
10							
12							Total Depth = 9.0 feet No Caving; No Groundwater Test Pit Backfilled and Tamped After Percolation Test
14							
16							Hammer Driving Weight = 32 lbs Hammer Driving Height = 48 inches
18							

EGL

TEST PIT LOG: TP-7

PROJECT LOCATION: APN: 266-320-025; Cole Avenue & Landin Lane, Riverside

PROJECT NO: 19-283-003GE

DATE DRILLED: 11/22/2019
DATE LOGGED: 11/22/2019
EXCAVATION METHOD: Backhoe
SAMPLE METHOD: Split-Tube
ELEVATION: N/A
LOGGED BY: KY

S: Standard Penetration Test B: Bulk Sample R: Ring Sample

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Earth Material Descriptions
							Natural Soil (Qs; 0' - 5'):
0		R	60/10"	SM	113.1	1.1	@ 0.0' Silty sand, fine to coarse grained, brown, dry, dense.
2		R	45/10"	SM	108.0	2.5	@ 2.0' Silty clayey sand, fine to coarse grained, olive brown, dry, dense.
4							
		R	45	SM	105.9	5.0	@ 5.0' Silty clayey sand, fine to coarse grained, olive brown, slightly moist, dense.
6							
8							Total Depth = 5.0 feet
							No Caving; No Groundwater
10							Test Pit Backfilled and Tamped
12							Hammer Driving Weight = 32 lbs
							Hammer Driving Height = 48 inches
14							
16							
18							

APPENDIX B

LABORATORY TESTING

During the subsurface exploration, EGL personnel collected relatively undisturbed ring samples and bulk samples. The following tests were performed on selected soil samples:

Moisture-Density

The moisture content and dry unit weight were determined for each relatively undisturbed soil sample obtained in the test pits in accordance with ASTM D2937 standard. The results of these tests are shown on the test pit logs in Appendix A.

Shear Tests

Shear tests were performed in a direct shear machine of strain-control type in accordance with ASTM D3080 standard. The rate of deformation was 0.025 inch per minute. Selected samples were sheared under varying confining loads in order to determine the Coulomb shear strength parameters: internal friction angle and cohesion. The shear test results are presented in the attached plates.

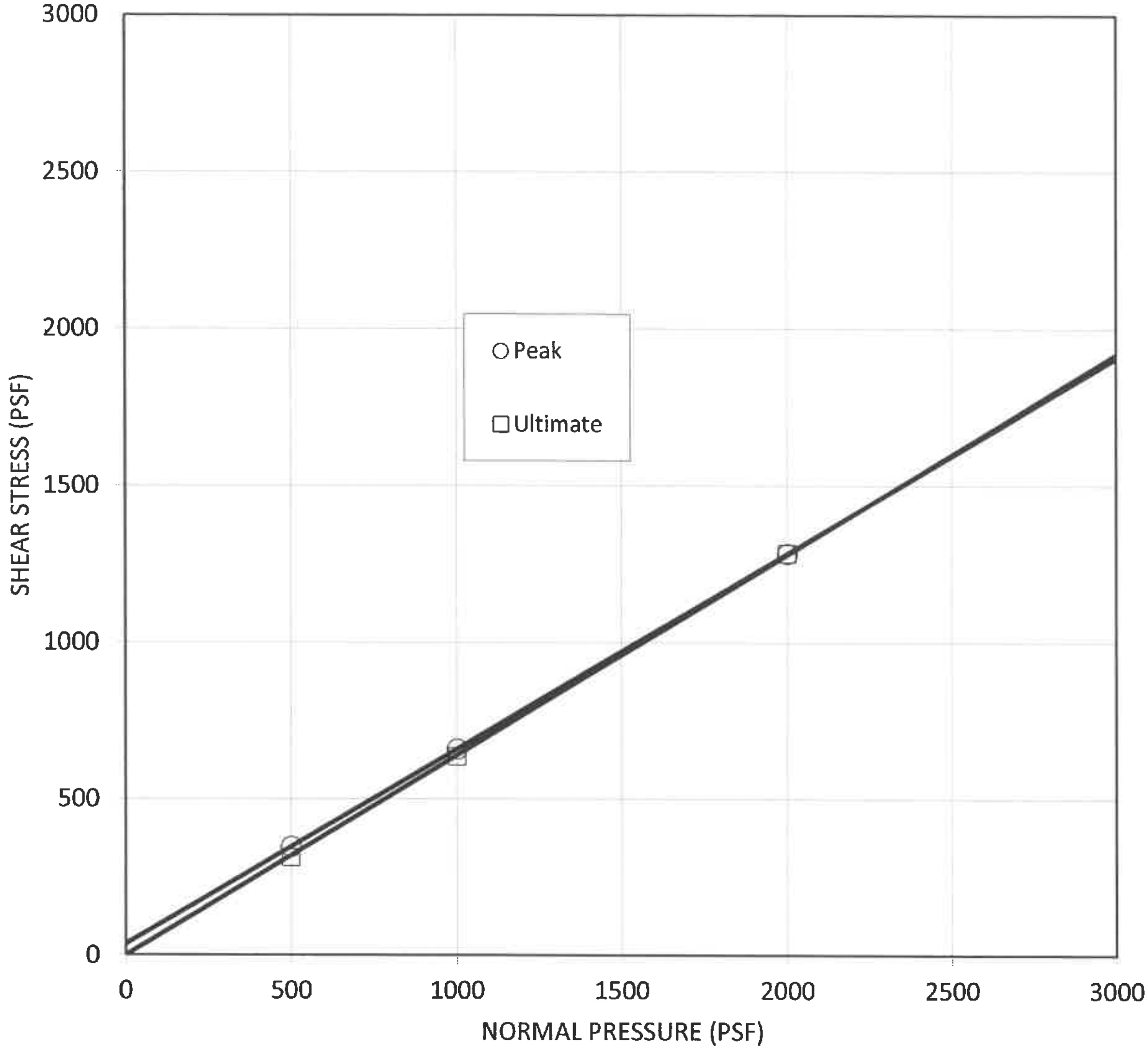
Consolidation Tests

Consolidation tests were performed on selected undisturbed soil samples in accordance with ASTM D2435 standard. The consolidation apparatus is designed for a one-inch high soil filled brass ring. Loads are applied in several increments in a geometric progression and the resulting deformations are recorded at selected time intervals. Porous stones are placed in contact with the top and bottom of each specimen to permit addition and release of pore fluid. The samples were inundated with water at a load of one kilo-pounds (kips) per square foot, and the test results are shown on the attached Figures.

Corrosion Test

Corrosion series of bulk sample was tested in accordance with Caltrans test methods. The series consist of Chloride Content, Sulfate Content, pH, and Minimum Resistivity tests. The methods used and test results are as follows:

Sample Location	pH	CT-412 Chloride (ppm)	CT-417 Sulfate (% by weight)	CT-643 Min. Resistivity (ohm-cm)
TP-3 @ 0-5'	7.29	183	0.006	4,500



Boring No.:	Sample No.	Depth (ft)	Sample Type	Soil Type	Symbol	Cohesion (PSF)	Friction Angle
TP-2	1	2.0	Ring	SC	○	36	32
					□	0	32

Normal Stress (psf)	Initial Moisture (%)	Final Moisture (%)	γ_d (pcf)	S (%)
500	4.9	20.6	105.1	92.4
1000	4.9	20.7	105.4	93.5
2000	4.9	19.5	107.9	94.1

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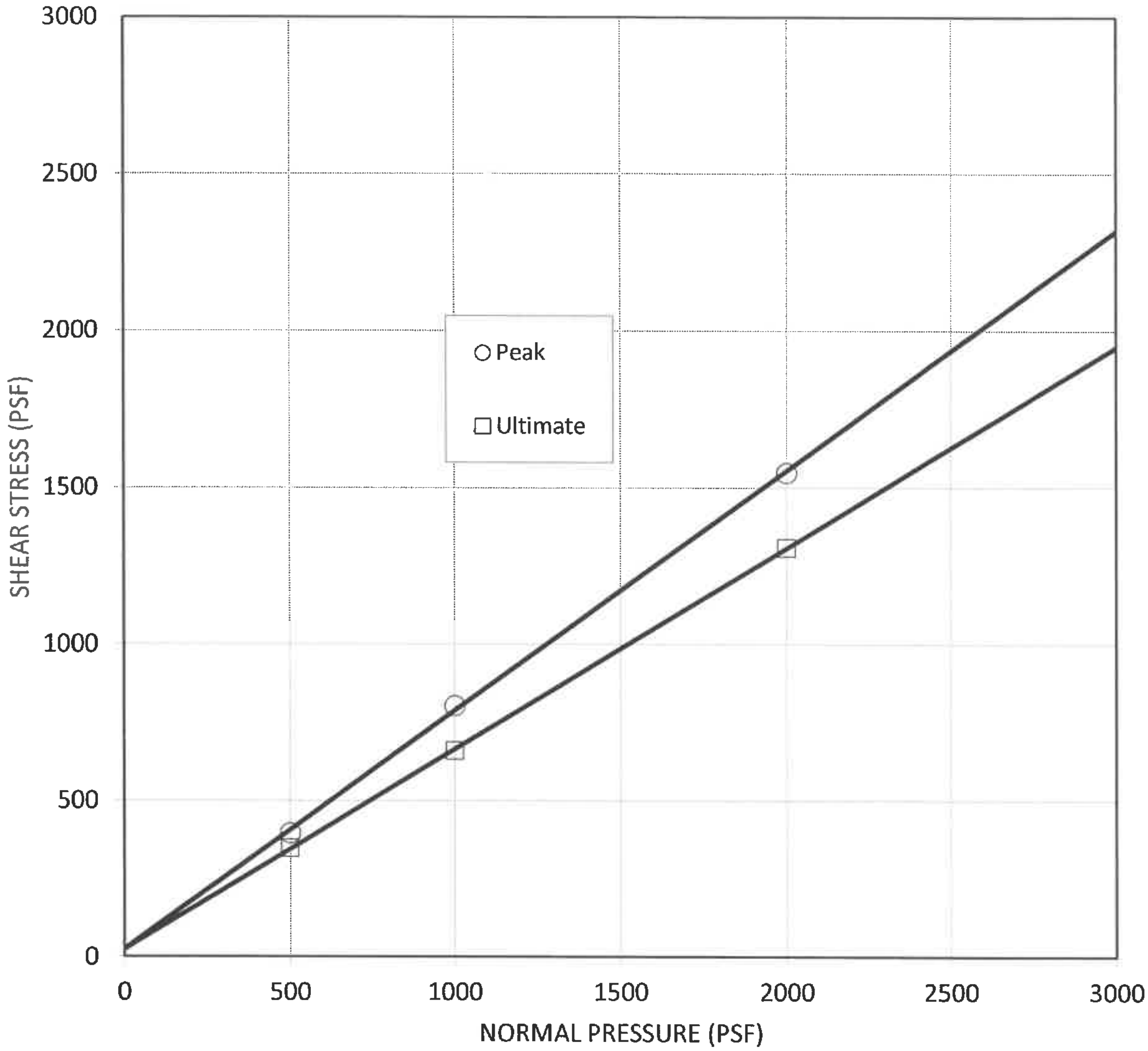
Riverside, California

DIRECT SHEAR

01/20 (ASTM D3080) Figure



Boring No.:	Sample No.	Depth (ft)	Sample Type	Soil Type	Symbol	Cohesion (PSF)	Friction Angle
TP-3	3	5.0	Ring	SM	○	24	37
					□	24	33

Normal Stress (psf)	Initial Moisture (%)	Final Moisture (%)	γ_d (pcf)	S (%)
500	1.5	19.7	106.4	91.2
1000	1.5	19.1	107.8	91.6
2000	1.5	19.4	107.8	92.9

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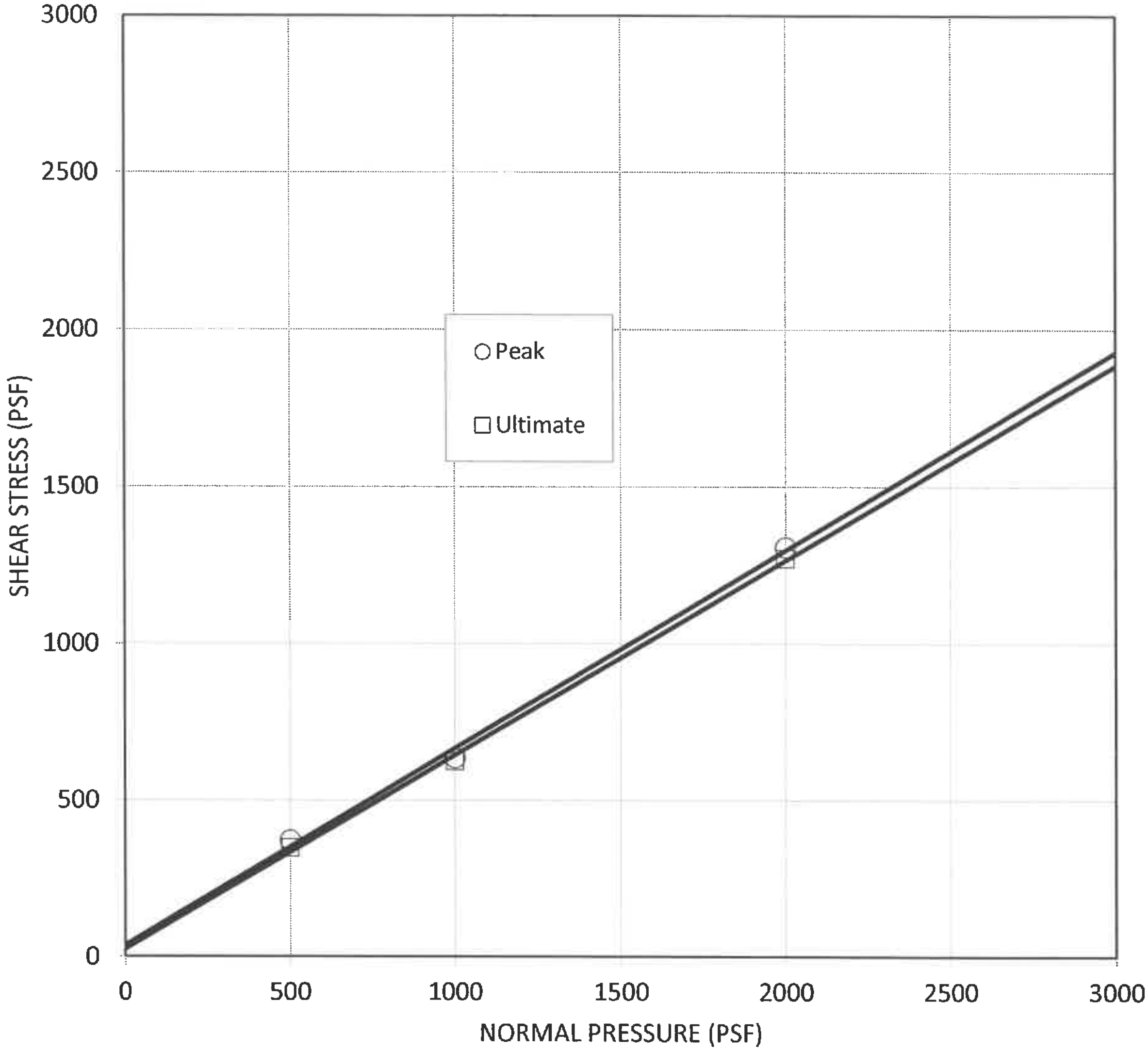
Riverside, California

DIRECT SHEAR

01/20 (ASTM D3080) Figure



Boring No.:	Sample No.	Depth (ft)	Sample Type	Soil Type	Symbol	Cohesion (PSF)	Friction Angle
TP-7	2	2.0	Ring	SM	○	36	32
					□	24	32

Normal Stress (psf)	Initial Moisture (%)	Final Moisture (%)	γ_d (pcf)	S (%)
500	2.5	19.2	107.4	91.3
1000	2.5	19.0	107.6	91.0
2000	2.5	18.6	108.7	91.3

ENVIRONMENTAL GEOTECHNOLOGY LABORATORY

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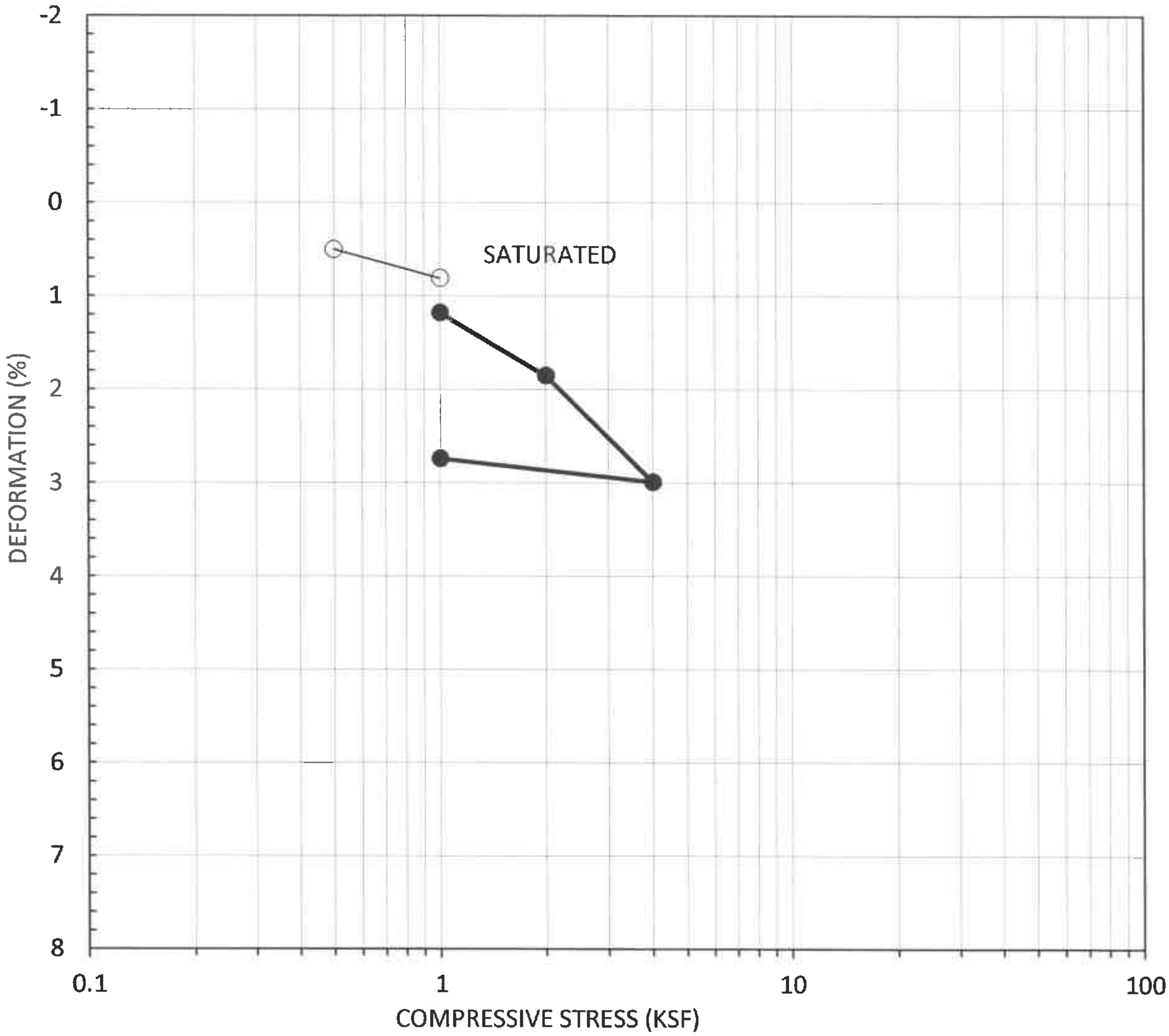
DIRECT SHEAR

01/20 (ASTM D3080) Figure



Symbol	Boring No.	Sample No.	Depth (Ft.)	Soil Type	Init. Moisture Content (%)	Init. Dry Density	Init. Void Ratio
○	TP-1	2	5.0	Bedrock	2.6	124.8	0.350

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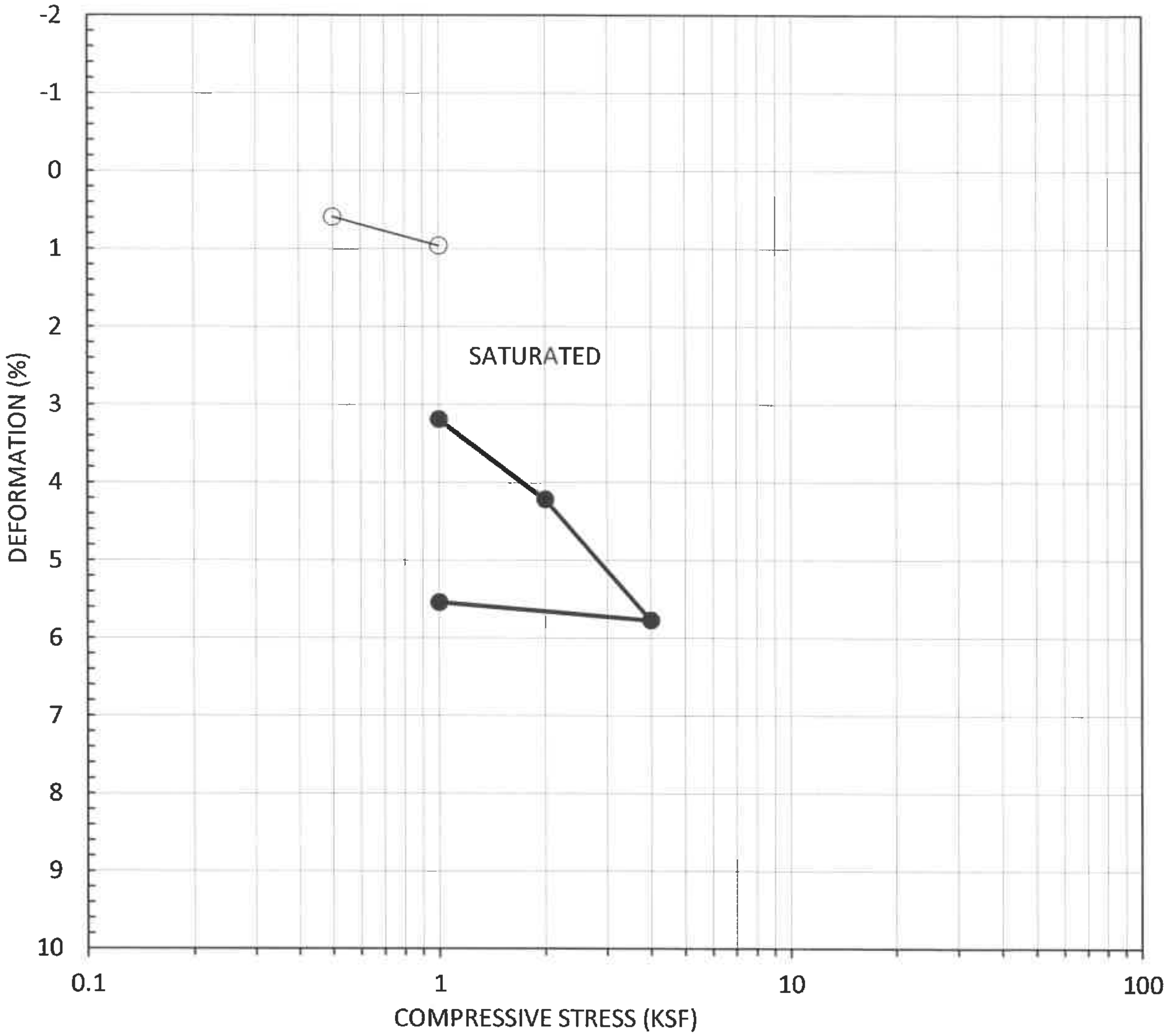
CONSOLIDATION

01/20 (ASTM D2435) Figure



Symbol	Boring No.	Sample No.	Depth (Ft.)	Soil Type	Init. Moisture Content (%)	Init. Dry Density	Init. Void Ratio
○	TP-4	3	5.0	SM	3.2	116.6	0.445

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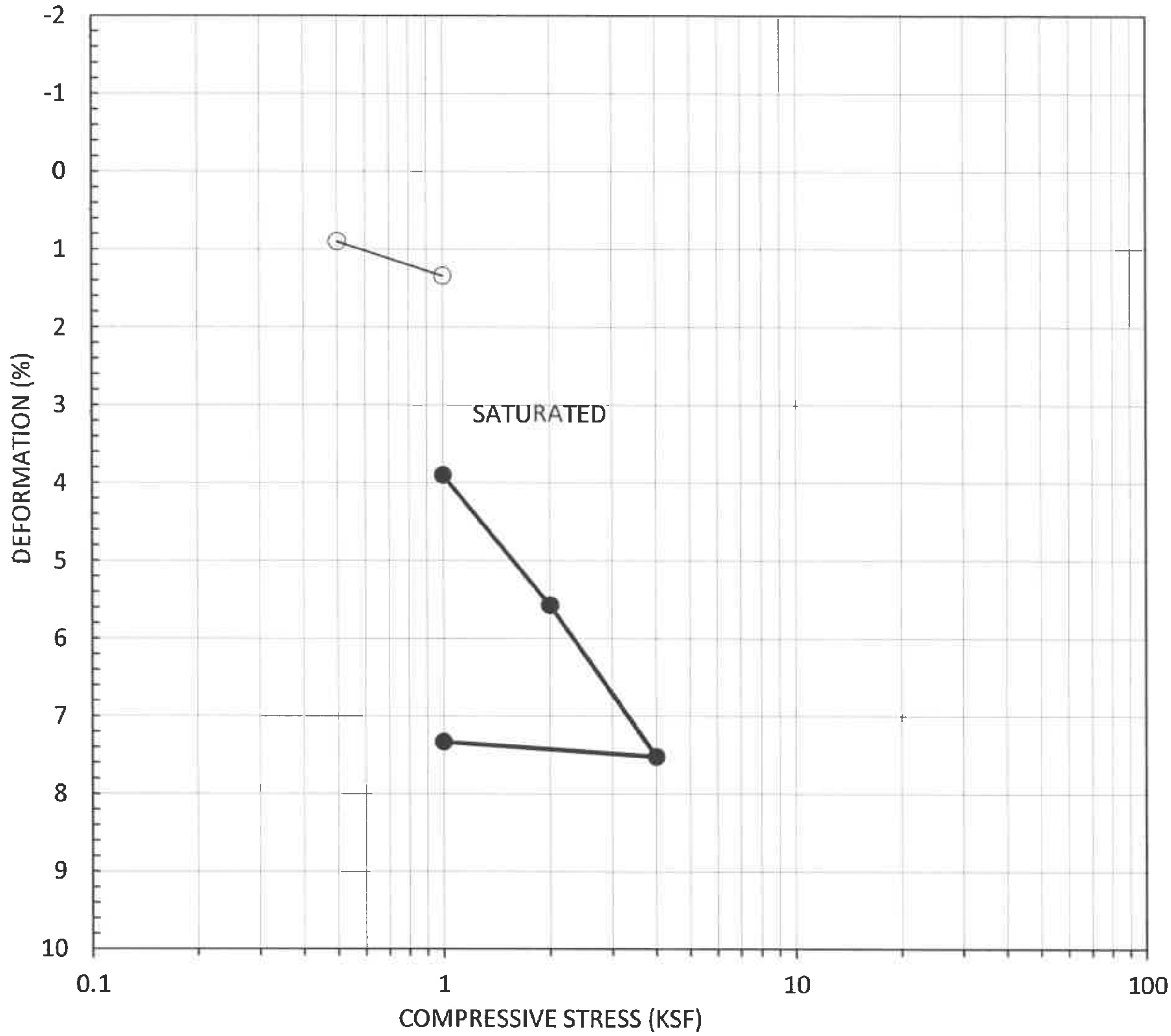
CONSOLIDATION

01/20 (ASTM D2435) Figure



Symbol	Boring No.	Sample No.	Depth (Ft.)	Soil Type	Init. Moisture Content (%)	Init. Dry Density	Init. Void Ratio
○	TP-6	2	2.0	SM	3.1	106.1	0.589

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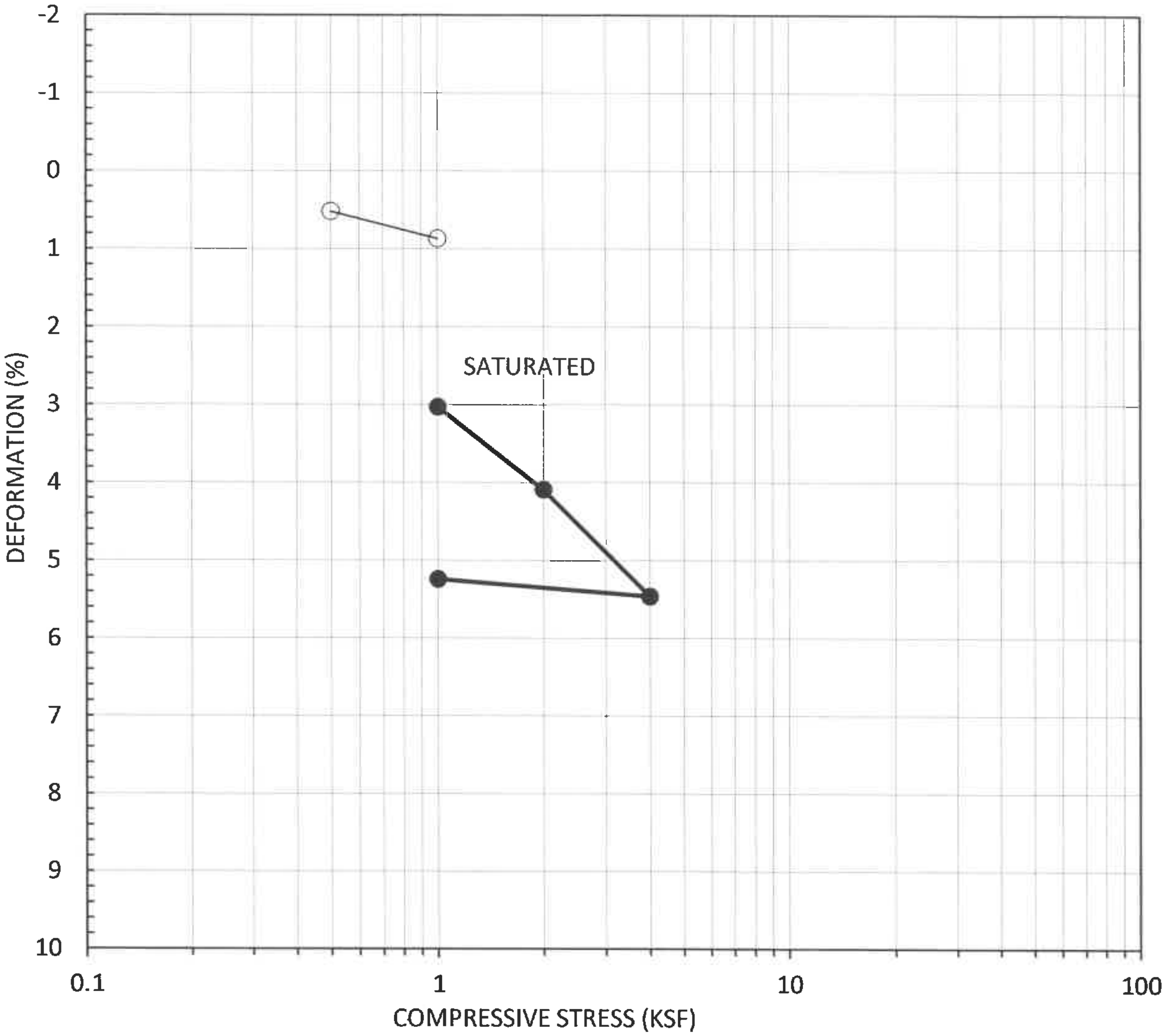
CONSOLIDATION

01/20 (ASTM D2435) Figure



Symbol	Boring No.	Sample No.	Depth (Ft.)	Soil Type	Init. Moisture Content (%)	Init. Dry Density	Init. Void Ratio
○	TP-7	1	0.0	SM	1.1	113.9	0.479

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Project Address: (APN: 266-320-025)
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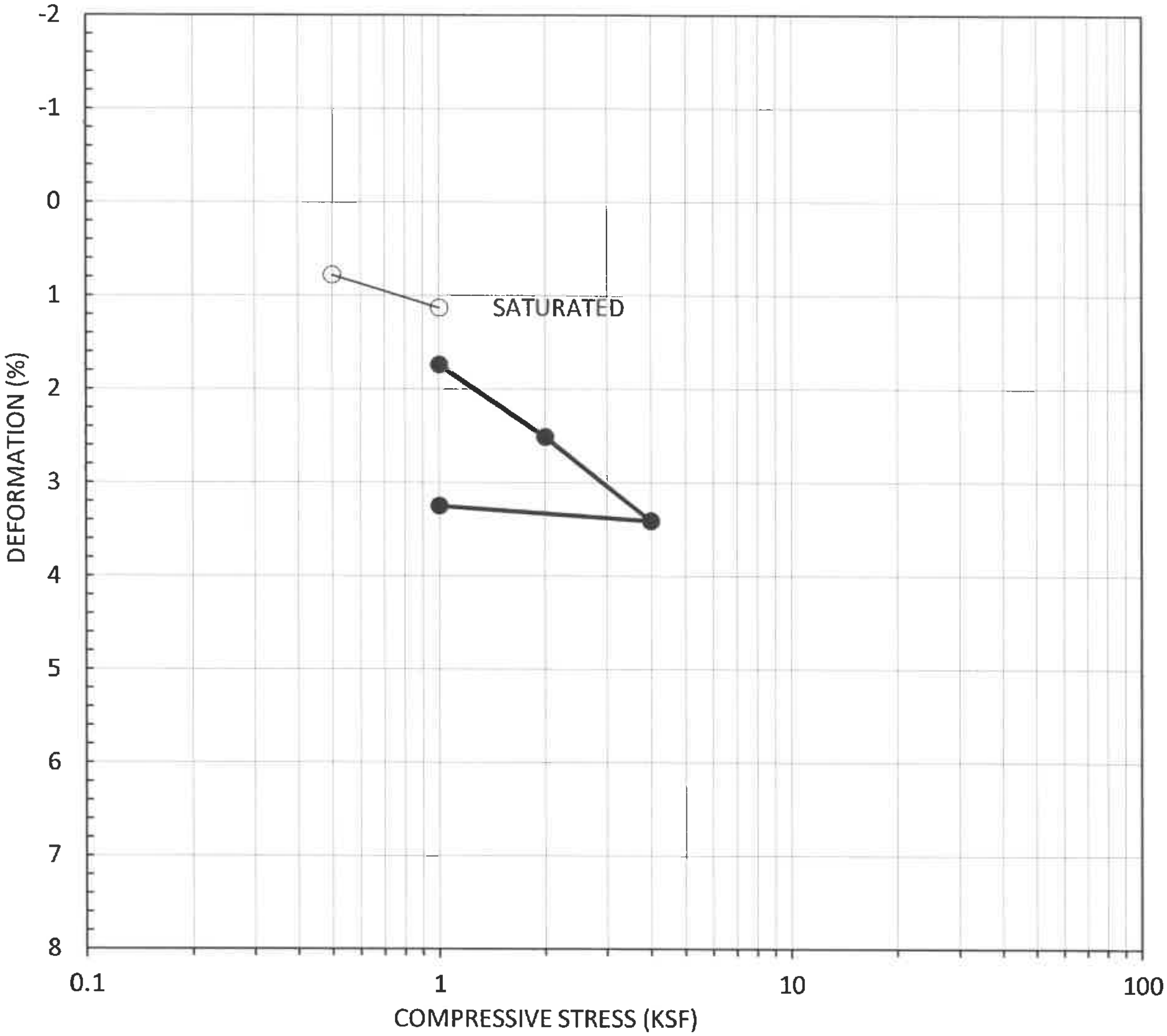
01/20 (ASTM D2435) Figure



Symbol	Boring No.	Sample No.	Depth (Ft.)	Soil Type	Init. Moisture Content (%)	Init. Dry Density	Init. Void Ratio
○	TP-7	3	5.0	SM	5.0	107.3	0.570

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CONSOLIDATION

01/20 (ASTM D2435) Figure

APPENDIX C: PERCOLATION TEST RESULTS

Infiltration Testing per Riverside County Technical Guidance Document

r (in) = radius hole

t_i (hr:min) = intial time after filling or refilling

t_f (hr:min) = final time

d_b (ft) = depth to bottom

d_i (ft) = depth to water surface at ti

d_f (ft) = depth to water surface at tf

ΔH (in) = change in height over time

Have = average head height over the time interval

t (hr) = Time reading interval

It (in/hr) = (ΔHxr)/(Δt(r+2Havg)) tested infiltration rate

TP-5									
r (in)	t_i (hr:min)	t_f (hr:min)	Δt (hr)	d_b (in)	d_i (in)	d_f (in)	ΔH (in)	H_{ave} (ft)	It (in/hr)
4	10:24	10:49	0.42	20.0	0.0	12.0	12.0	14.0	3.57
4	10:50	11:15	0.42	20.0	0.0	9.0	9.0	15.5	2.45
4	11:16	11:26	0.17	20.0	0.0	5.0	5.0	17.5	3.02
4	11:26	11:36	0.17	20.0	0.0	4.0	4.0	18.0	2.35
4	11:37	11:47	0.17	20.0	0.0	4.0	4.0	18.0	2.35
4	11:47	11:57	0.17	20.0	0.0	4.0	4.0	18.0	2.35
4	11:58	12:08	0.17	20.0	0.0	4.0	4.0	18.0	2.35
4	12:10	12:20	0.17	20.0	0.0	4.0	4.0	18.0	2.35

Factor of Safety based on the Technical Guidance Document for
WQMP, Worksheet H & Tables VII.3 & VII.4

FS = 2

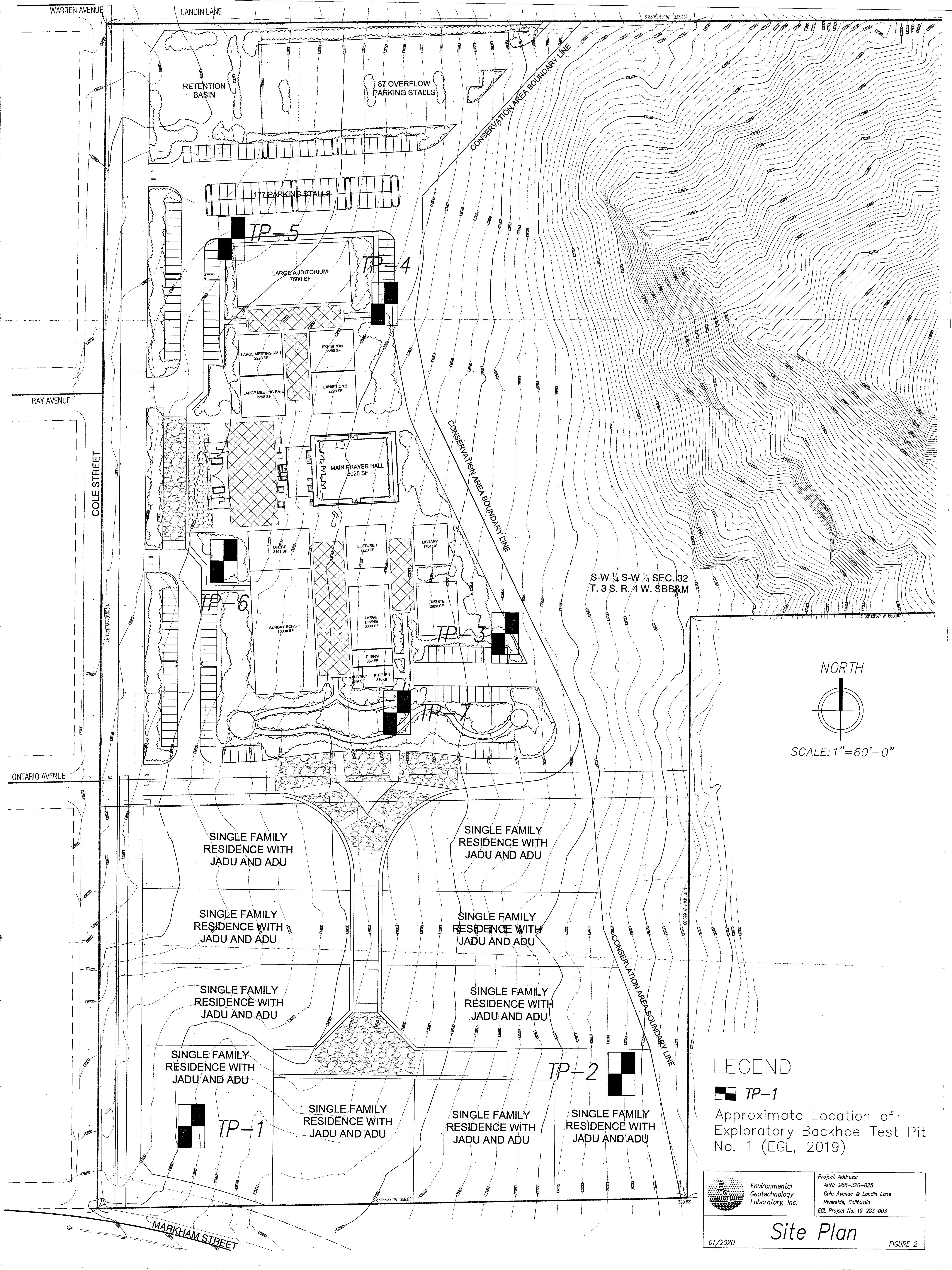
Design Infiltration Rate = Tested Infiltration Rate / FS (in/hour) = **1.18**

TP-6									
r (in)	t_i (hr:min)	t_f (hr:min)	t (hr)	d_b (in)	d_i (in)	d_f (in)	ΔH (in)	H_{ave} (ft)	It (in/hr)
4	11:02	11:27	0.42	20.0	0.0	13.0	13.0	13.5	3.99
4	11:41	12:06	0.42	20.0	0.0	9.0	9.0	15.5	2.45
4	12:07	12:17	0.17	20.0	0.0	5.0	5.0	17.5	3.02
4	12:19	12:29	0.17	20.0	0.0	4.0	4.0	18.0	2.35
4	12:33	12:43	0.17	20.0	0.0	4.0	4.0	18.0	2.35
4	12:47	12:57	0.17	20.0	0.0	4.0	4.0	18.0	2.35
4	12:58	13:08	0.17	20.0	0.0	4.0	4.0	18.0	2.35
4	13:10	13:20	0.17	20.0	0.0	4.0	4.0	18.0	2.35

Factor of Safety based on the Technical Guidance Document for
WQMP, Worksheet H & Tables VII.3 & VII.4

FS = 2

Design Infiltration Rate = Tested Infiltration Rate / FS (in/hour) = **1.18**


WARREN AVENUE
LANDIN LANE
RETENTION BASIN
87 OVERFLOW PARKING STALLS
CONSERVATION AREA BOUNDARY LINE
177 PARKING STALLS
TP-5
TP-4
LARGE AUDITORIUM 7500 SF
LARGE MEETING RM 1 2298 SF
LARGE MEETING RM 2 2298 SF
EXHIBITION 1 2298 SF
EXHIBITION 2 2298 SF
RAY AVENUE
COLE STREET
MAIN PRAYER HALL 5025 SF
CONSERVATION AREA BOUNDARY LINE
OFFICE 3151 SF
LECTURE 1 2220 SF
LIBRARY 1784 SF
ENSUITE 2820 SF
S-W ¼ S-W ¼ SEC. 32
T. 3 S. R. 4 W. SBB&M
TP-6
SUNDAY SCHOOL 10000 SF
LARGE DINING 3388 SF
DINING 852 SF
LAUNDRY 249 SF
KITCHEN 816 SF
TP-3
TP-7
NORTH
SCALE: 1"=60'-0"
ONTARIO AVENUE
SINGLE FAMILY RESIDENCE WITH JADU AND ADU
SINGLE FAMILY RESIDENCE WITH JADU AND ADU
SINGLE FAMILY RESIDENCE WITH JADU AND ADU
SINGLE FAMILY RESIDENCE WITH JADU AND ADU
SINGLE FAMILY RESIDENCE WITH JADU AND ADU
SINGLE FAMILY RESIDENCE WITH JADU AND ADU
CONSERVATION AREA BOUNDARY LINE
SINGLE FAMILY RESIDENCE WITH JADU AND ADU
TP-2
TP-1
SINGLE FAMILY RESIDENCE WITH JADU AND ADU
SINGLE FAMILY RESIDENCE WITH JADU AND ADU
SINGLE FAMILY RESIDENCE WITH JADU AND ADU
MARKHAM STREET
LEGEND
TP-1
Approximate Location of Exploratory Backhoe Test Pit No. 1 (EGL, 2019)
Environmental Geotechnology Laboratory, Inc.
Project Address:
APN: 266-320-025
Cole Avenue & Landin Lane
Riverside, California
EGL Project No. 19-283-003
Site Plan
01/2020
FIGURE 2