Appendix E
Geotechnical Studies

GEOTECHNICAL EVALUATION REPORT

TRAVEL PLAZA
PERRIS

AT

CORNER OF TRUMBLE ROAD &
ETHANAC ROAD
PERRIS, CALIFORNIA

PREPARED FOR:

BROADBENT, INC.
WEST PACIFIC AVENUE
HENDERSON, NEVADA, 89015

PROJECT NO: G-5908-01

JUNE 11, 2021

PREPARED BY:

GEOTECHNICAL SOLUTIONS, INC.
GEOTECHNICAL & ENVIRONMENTAL
ENGINEERING

Geotechnical Solutions, Inc.
Geotechnical, Structural & Environmental Engineering

AASHTO ACCREDITED

June 11, 2021

Project No: G-5908-01

Broadbent, Inc.
8 West Pacific Avenue
Henderson, Nevada, 89015

Attention: Mr. Mark E. Kazelskis, PG, CHG, CEM
Principal Geologist

Via Email: mkazelskis@broadbentinc.com

Re: Geotechnical Engineering Evaluation Report
Travel Plaza Perris
Corner of Trumble Road &
Ethanac Road
Perris, California

Gentlemen:

Submitted herewith is the report of the Geotechnical Engineering evaluation study conducted by this office for Perris Travel Plaza at the referenced vacant site.

The project site is located just northwest corner of Trumble Road and Ethanac Road Intersection, and east of Freeway 215 in Perris, San Bernardino County, California as shown on Vicinity Map (Plate A) and Google Map (Plate D).

Based on our study findings, it is our opinion that the site is suitable for the proposed development from a geotechnical-engineering standpoint, provided that the recommendations of this report are successfully implemented.

The closest known active faults capable of producing major earthquakes are the Elsinore (GI) (6.89 Mw) and Elsinore (W + GI) (7.27 Mw) faults, which are located approximately 9.56 miles (15.3 km) away from the project site.

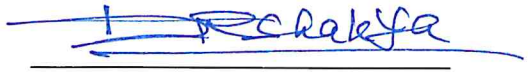
The site does not lie within Alquist-Priolo Earthquake Fault Zone as designated by the California Geological Survey (CGS). The potential for direct surface fault rupture at the site is considered unlikely.

The investigation was made in accordance with generally accepted geotechnical engineering principles and procedures and included such field and laboratory tests considered necessary under the circumstances.

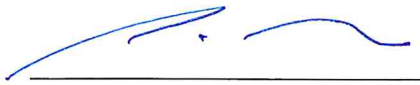
In the opinion of the undersigned, the accompanying report has been substantiated by mathematical and other data and presents fairly the design information requested by your organization.

Respectfully Submitted,

Geotechnical Solutions, Inc.



Dharma Shakya, PhD, PE, GE
Principal Geotechnical Engineer



Abraham S. Baha, PE, M. ASCE
Sr. Principal

Distribution: (3+pdf) Addressee

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Purpose and Scope

The primary objectives of this study were to explore subsurface conditions beneath the project site and evaluate the existing earth materials relative to foundation support and lateral pressure design factors, seismic conditions and earthquake-induced liquefaction potential.

In general, the study objectives were met by a visual reconnaissance of the site and vicinity, review of available tentative development plans, exploratory drilling and sampling of earth materials, laboratory testing, seismic evaluations, geologic hazards study, and engineering analysis. The general scope and objectives of the study were established in collaboration with the client/project team. Items considered in our study relevant to this site included the following:

- Near surface and subsurface soil types,
- Expansion potential,
- Settlement and hydro-collapse potential,
- Bearing capacity and Foundation Design Parameters,
- Slabs-on-grade,
- Lateral earth pressures,
- Drainage considerations,
- Temporary excavation support,
- Corrosion potential,
- Groundwater conditions,
- Likely excavation conditions,
- Seismic Conditions,
- Earthquake induced liquefaction potential,

- Pavements,
- Grading considerations, and
- Construction observation and testing considerations.

To address these, the following scope of work was executed:

1. Review of preliminary project plans, available documents, and coordination with the owner's representatives and project design professionals.
2. Site reconnaissance.
3. Evaluation of seismic conditions for the subject location.
4. Excavator and Backhoe drilling, sampling and logging twelve (11) test holes to investigate subsurface conditions.
5. Laboratory testing of soil samples obtained from subsurface explorations, to determine their physical and engineering properties.
6. Geotechnical analysis of the data obtained.
7. Developing conclusions and recommendations for foundation design.
8. Preparation of this report.

1.2 Project Description

Based on the information provided, the proposed Travel Plaza Perris will have total site area of 14.67 acres including 0.9 acre for the pond area and will consist mainly of constructing the Auto Fueling Island / Canopy, Truck Fueling Island / Canopy, Cat Scale, Aboveground (AST's) and underground (UST's) storage tanks, store building, shop building, pond area, and truck approaches at the location shown on Plot Plan and Boring Location Map (Plate B in Appendix A).

Also, the project consists of heavy-duty asphalt pavement for parking and driveways with some rigid concrete pavement sections to accommodate 98 auto parking and 135 truck parking.

1.3 Site Description and Topography

The project site is located just northwest of Trumble Road and Ethanac Road Intersection and just east of freeway 215 as shown on Vicinity Map (Plate A) and Google Map (Plate D) in Appendix A. At the time of our field exploration, the site was vacant and covered mostly with grass and weeds all around.

The site is relatively flat at an elevation of 1,426 feet above the sea level. No hilly terrain or drainage problems exist at the subject property.

1.4 Site Geologic Setting

The Peninsular Ranges province is one of the largest geomorphic units in western North America. Basically, it extends from the Tranverse Ranges geomorphic province and the Los Angeles Basin, roughly 900 miles south to the tip of Baja California. This province varies in width from about 30 to 100 miles. It is bounded on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province. The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Three major fault zones are found in this province. The Elsinore Fault zone and the San Jacinto Fault zones trend northwest-southeast and are found in the near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province.

The Perris Block is a large mass of granitic rock generally bounded by the San Jacinto Fault, the Elsinore Fault, the Santa Ana River and a non-defined southeast boundary. The Perris Block has had a history of vertical land movements of several thousand feet due to shifts in the Elsinore and San Jacinto Faults. The primary source of strong seismic ground shaking in the project area is the Elsinore Fault Zone and San Jacinto Fault Zone. Other

regional fault zone of significance that could affect the project area is the San Andreas. The Site Regional Geology Map is shown on the enclosed Plate D.

The site is underlain by alluvial soils over Cretaceous aged igneous rocks (Val Verde Tonalite). The materials encountered onsite generally consist of alluvial soils consist of dense to very dense silty sand to sand. The tonalite bedrock is grey in color and moderately weathered and becomes harder with depth. It should be noted that Special handling and coring could be required during the caisson excavation.

The most significant geologic hazard to the project is the potential for moderate to severe ground shaking resulting from earthquakes generated on the faults close to the site. The site is not located in an Alquist-Priolo Special Studies zone for earthquake rupture hazard. The potential for direct surface fault rupture in the project area is considered very low.

1.5 Other Geologic Hazards

Since the site is located in a relatively flat area, we do not consider landslides or other forms of natural slope instability to represent a hazard to the project. The site is not located near any impounded bodies of water therefore tsunamis and seiches are not considered a potential hazard to the project. The proposed project is an area of stable soil conditions with low shrink-swell potential; hence, no impact is anticipated.

In addition to possible strong earthquake ground motion at the site, the secondary effects of earthquake-induced liquefaction, and earthquake-induced landsliding, were considered. Guidelines for evaluating and mitigation seismic hazards in California (CGS, 2008, SP-117A) summarize procedures for evaluating the earthquake-induced landslide and liquefaction potential.

1.5.1 Earthquake-Induced Liquefaction

The site has not been evaluated for earthquake-induced liquefaction potential as per

California Geologic Survey (Plate F, Appendix A). Liquefaction is discussed in more detail in the proceeding sections.

1.5.2 Induced Flooding

The site lies far and/or high enough from the coast or large inland body of water to preclude the hazards of tsunami or seiche waves or inundation from the rupture of an up-gradient reservoir.

1.5.3 Eathquake-Induced Landsliding

The site has not been evaluated by California Geologic Survey (CGS) for earthquake-induced landsliding potential. Since the site is far enough from steep slopes, landsliding will be unlikely.

2.0 FIELD EXPLORATION

2.1 Scope

Hollow Stem auger was used to drill. Eleven (11) borings were drilled to get soil samples from the depths varying from 10- to 51.5-feet below the existing ground level in the proposed development areas. The Boring Logs, B-1 through B-11 are shown on the Plot Plan and Boring Location Map (Plate B) in Appendix A.

2.2 Drilling and Sampling Procedures

A continuous record of the materials encountered during the drilling was made by our field engineer and Log of all the borings are presented on Appendix A The lines designating the interface between soil strata on the log of Test Holes represent approximate boundaries. The transition between strata may be gradual. Undisturbed samples were secured at frequent intervals from various locations for laboratory testing.

Core samples and bulk samples were secured at frequent depth intervals for laboratory examination and testing. Both California standard ring samples (CA) and split spoon

samples with Penetration test (SPT) blow counts were obtained for further evaluation. Disturbed bulk samples, representative of the surficial subgrade materials were also obtained.

The relative sampler penetration resistance (SPT) exhibited by the deposits sample is tabulated in the Blow per Foot column of the pertinent test hole log. Recorded blow counts for 12 inches of sampler penetration were generally indicative of medium to high shear resistance (140 pounds hammer at a 30-inch drop).

2.3 Field Tests and Measurements

The drilled holes were examined and logged in the field. Representative samples were obtained to classify the soils. The Unified Soil Classification System (USCS) was used to classify the soils. The soil classification symbols appear on the boring logs and are briefly described in Appendix A. Local and regional geologic characteristics were used to estimate the seismic design criteria.

In addition, relatively undisturbed California ring samples were obtained for laboratory testing. The attached logs tabulate data based on laboratory classification tests and visual observation by the field geologist at the site.

2.4 Standard Penetration Resistance

A sediment is considered to be susceptible to transformation to a fluid mass during a strong seismic event only if the packing of the grains (relative density) is relatively low. Sediments with high relative densities cannot reduce their total volume through the compactive effort induced by the ground shaking.

The number of blows necessary to drive a standard sampler (1½" I.D.)-12 inches into the individual stratum is a measurement of a specific property that has been correlated to relative density. The sampling (penetration) resistance offered by sediment from

successive blows delivered by a 140-pound hammer falling 30 inches is counted. The number of blows to drive the standard sampler full 12 inches is recorded as the N-Value.

The on-site material yielded penetration resistance which indicates dense to very dense alluvial soils, fine to coarse grained, dry to slightly moist with trace of silt were encountered within the boring depth. The standard penetration resistances of the on-site materials at 5-feet intervals are presented on the boring logs (Appendix A).

3.0 LABORATORY TESTING AND SUMMARY METHODS

Laboratory testing was programmed following a review of field investigation data and after considering the various foundations, floor slabs, and grading elements to be evaluated. In general, this includes physical testing to establish foundation-bearing characteristics, and classification tests.

A. In-Place Moisture & Density (ASTM D2216 & D2937)

In-situ moisture content and density were determined for all the undisturbed core samples obtained during test boring drilling operations. Test results are tabulated on Plates I-1 through I-11, Log of Test Holes.

B. Mechanical Analysis (ASTM D-422)

The texture composition of a selected typical sample determined by the hydrometer test method was as follows:

Boring No.	Depth (Feet)	Percent Sand	Percent Silt	Percent Clay
B-2	0-3	72	10	18
B-7	0-3	61	17	22
B-8	0-3	56	22	22

B-9	0-3	68	12	20

C. Direct Shear (ASTM D-3080)

Direct shear test was performed on the representative sample of native soil and was considered most pertinent in the design of mat/ spread footings, and moderately deep pier. Tests were performed in the saturated condition at the field density. Individual test results are shown on Plate J.

D. Expansion (ASTM D-4829)

Expansion characteristics were determined by the Expansion Index test on a typical bulk sample considered to be generally representative of the near subgrade soils. Test results were as follows:

Test Boring No.	Moisture Content (%)	Dry Density (pcf)	Expansion Index	Remarks
B-8	8.6	115.2	18	Very Low Expansive

According to the test results, the underlying soils generally exhibit very low expansive potential.

E. Consolidation (ASTM D-2435)

Consolidation (load deformation) tests were performed on undisturbed samples at selected depths. Plotted test results are presented on Plates K, L, and M.

F. Chemical Sulfate Analysis (CAL 417-A Method)

Chemical sulfate analysis was performed on a representative sample by the CAL 417-A method. A soluble sulfate of 390 parts per million was indicated, which is negligible exposure to concrete, however we recommend using Type II Portland cement for the foundation elements in contact with the underlying soil.

G. R-Value Test (ASTM D-2844)

Representative samples of the subgrade soils were obtained and tested to determine the R-value. The material is thought to be typical and presumed to be representative of the subgrade soils. Testing was performed in general accordance with the latest revisions to the Department of Transportation, State of California, Material & Research Test Method No. 301. Pavement design recommendations are based on the latest Traffic Indices (TI's) and recently tested R-value.

An R-Value test was conducted on a representative sample of the near surface soil consisting of clayey sand with trace of silt. The specimens were tested in a state as near to full saturation as possible to simulate the condition the soil might attain at typical field density and under adverse moisture conditions. The R-Value for a representative soil was determined to be 30. Test results are as follows:

The R-Value for a representative soil was determined to be 40. Test results are as follows:

Test Number	Moisture @ Compaction (%)	Density (pcf)	Exudation Pressure (psi)	Stabilometer "R"-Value
a	7.4	120.5	200	37
b	7.1	122.0	350	42
c	6.7	123.8	450	47

* Interpolated 300 psi by Exudation , Rv = 40

4.0 SUBSURFACE DISCUSSION

4.1 General

The recommendations presented are based on entirely upon data derived from a limited number of samples obtained from widely spaced borings. The attached logs, B-1 through

B-11 presented in Appendix A are indicators of subsurface conditions only at the specific locations and times noted. This report assumes the uniformity of the geology and soil structure between the borings, however variations can and often do exist. Whenever there is any deviation, difference or change is encountered or becomes known, we should be contacted.

4.2 Material and Soil Conditions Summary

No appreciable artificial fill was encountered at the boring locations during the exploratory drilling. The upper and underlying natural soils are older alluvium, light brown to dark brown, dry to slightly moist, generally fine to coarse grained, medium dense to very dense, sand with gravel, and some rock fragments as well. A more detailed soil profiles are shown on Plates I-1 through I-11, Log of Test Hole (Appendix A).

4.3 Groundwater

Surface water on this site is the likely result of precipitation or surface run-off from surrounding sites. Overall site drainage is in a north and northwesterly direction. Provisions for surface drainage will need to be accounted for by the project civil engineer.

We recommend that all surface runoff should not be allowed to pond above or flow freely over adjacent slope surfaces. Collected water should be conveyed via a non-erosive device to a suitable storm drain system.

Groundwater was not encountered at a drilled hole depth of 51.5-feet during the field study. No springs or perennial stream flow in local drainages exist based on older topographic maps.

The nearest well, 05S03W10N0015 as shown on Closest Well Groundwater Data (Plate H-1) and groundwater well data (Plate H-2) indicated the highest groundwater elevation to be 1331.86 above mean sea level. The elevation of our project area is about 1,426 feet.

Thus we believe the historic groundwater depth was around 95-feet below the existing ground surface.

Groundwater is not anticipated to affect the site adversely. However, these observations reflect site conditions at the time of the investigation and do not preclude changes in local groundwater conditions, localized seepage due to variations in rainfall, heavy irrigation, damaged structure (pipes, etc.), or altered site drainage pattern(s).

Proper surface drainage is imperative to collect and convey any surface water off site to a suitable storm drain system.

4.4 Faulting and Seismicity

The project site is located in the highly seismic Southern California region within the influence of several fault systems that are considered to be active or potentially active. An active fault is defined by the State of California as a "sufficiently active and well-defined fault" that has exhibited surface displacement within the Holocene time (about the last 11,000 years).

A potentially active fault is defined by the State as a fault with a history of movement within Pleistocene time (between 11,000 and 1.6 million years ago).

No faults have been mapped trending towards or through the site area. The site area does not lie within an Alquist-Priolo Earthquake Fault Zone as designated by the California Geological Survey (CGS) (Hart, 1997). For this reason, the potential for direct surface rupture is considered unlikely.

4.4.1 Faults Close to the Site

USGS National Seismic Hazard Maps for Source parameters interactive query has been used to determine the closest fault to the site within 50 miles and has been tabulated on Table – 1 in Appendix B.

The closest known active faults capable of producing major earthquakes are the Elsinore (GI) and Elsinore (W + GI) Faults, which are both located approximately 9.56 miles (15.3 km) away from the project site. The Elsinore (GI) Fault has been assigned to 6.89 Mw magnitude and slip rate of 5 mm/year and Elsinore (W + GI) Fault has been assigned to 7.27 Mw magnitude and slip rate of N/A.

4.4.2 U.S.G.S. Earthquake Hazard Program

Latest Interactive U.S.G.S. Earthquake Hazard Program using Unified Hazard Tool has been utilized for Conterminous U.S. 2008 (v3.2.x) and peak ground acceleration.

Peak Horizontal Ground Acceleration for 10% probability of exceedance in 50 years i.e. return period of 475 years	0.4423g
Peak Horizontal Ground Acceleration for 5% probability of exceedance in 50 years i.e. return period of 975 years	0.5487g
Peak Horizontal Ground Acceleration for 2% probability of exceedance in 50 years i.e. return period of 2,475 years	0.6906g

Interactive **Hazard Curve** and **Uniform Hazard Response Spectrum** have been plotted and presented in Appendix B.

4.4.3 Seismic Factors

The following are the geotechnical parameters for earthquake design data in accordance with ASCE 7-16 and the latest CBC 2019. The details are presented in Appendix B:

Latitude: **33.7441^0** and Longitude: **-117.1658^0**

NO.	PARAMETERS	VALUES	REFERENCE
1	0.2-Second Mapped Spectral Response Accelerations, **S_s (MCE_R Ground Motion)**	**1.428g**	ASCE 7-16
2	1-Second Mapped Spectral Response Accelerations, **S_1 (MCE_R Ground Motion)**	**0.532g**	ASCE 7-16
3	Site Class	**D**	ASCE 7-16
4	Site Amplification Factor at 0.2 sec, **F_a** According to Section 11.4.4, F_a should not be less than 1.2	**1.0** 1.2	ASCE 7-16 Use
5	Site Amplification Factor at 1.0 sec, **F_v,** however, according to Table 11.4.2, **F_v should be 1.77**	**Null** 1.77	ASCE 7-16 Use
6	Site Modified Spectral Acceleration Value, **S_{MS}** $S_{MS} = F_a S_s = 1.2 \times 1.428 = 1.714$	**1.714g** 1.714g	ASCE 7-16 Use
7	Site Modified Spectral Acceleration Value, **S_{M1}** **$SM_1 = F_v S_1 = 1.77 \times 0.532 = 0.942$**	**Null** 0.942g	ASCE 7-16 Use
8	Numeric Seismic Design value at 0.2 sec SA, **S_{DS} = 2/3 of S_{MS} = 2/3 x 1.714 = 1.143**	**1.143g** 1.143g	ASCE 7-16 Use
9	Numeric Seismic Design value at 1.0 sec SA, **S_{D1} = 2/3 of SM_1 = 2/3 x 0.942 = 0.628**	**Null** 0.628g	ASCE 7-16 Use

Other seismic parameters are as follows:

Closest Fault Distance	9.56 miles (15.3 km)
Fault Name	Elsinore (GI) & Elsinore (W + GI) Faults
Earthquake Magnitude	6.89 M_w & 7.27 Mw
Slip Rate (mm/year)	5.0 & N/A
PGA_M Site Modified Peak Ground Acceleration	**0.600g**
5% Damped Design Spectral Acceleration at short period, S_{DS}	**1.143g**
5% Damped Design Spectral Acceleration at 1-sec period, S_{D1}	**0.628g**
Seismic Design Category	D
Risk Category	II
Soil Site Class	D

4.5 <u>Design Values</u>

Representative values were selected from the test data and other sources for design and is tabulated below:

Field Density	120 pcf
Expansion Index	0 & 18
Angle of Internal Friction (Ult/Peak)	32/33 & 34/35 deg.
Cohesion (Ult/Peak) Remolded	200/250 & 200/250 psf
Subgrade K-Value	100 pci

5.0 SITE CONSIDERATIONS

5.1 Site Preparation

5.1.1 General

It is our professional opinion that the proposed construction will not be subject to geologic hazard from settlement, slippage, or landslide, provided the recommendations of this report are incorporated into the proposed construction. It is also our opinion that the proposed construction will not adversely affect the geologic stability of the site or adjacent properties provided the recommendations contained in this report are incorporated into the proposed construction.

The validity of the conclusions contained in this report is based on compliance with the recommendations presented in this section. Any excavating, trenching, or disturbances that occur after completion of the earthwork must be backfilled, compacted and tested in accordance with the recommendations contained herein. If any unobserved and untested earthwork, trenching, or backfilling occurs, then the conclusions and recommendations in this report may not be relied on.

5.1.2 Site Clearing

Prior to grading, all grasses, bushes, shrubs and debris including construction materials should entirely be removed from the site and disposed of off-site. Existing any undesirable materials should also be removed and hauled off-site. Existing utilities (if Any) should be removed and relocated as required. Any construction debris or ant buried or other contaminated exposed during site clearance should be removed and hauled away from the site. The resulting excavation from any removal should be cleared of loose material then backfilled with compacted soil. Oversized rocks greater than 6 inches should be removed.

5.1.3 Excavation

Excavations into the on-site soils may encounter a variety of challenges for example, firm alluvium, gravels, some fragments of rocks etc. Caving on clean sands may be encountered. The contractor should be made responsible for designing and constructing stable, temporary excavations as required to maintain stability of the excavation sides. All excavations should be sloped or shored in the interest of safety following local and federal regulations including current OSHA excavation and trench safety standards.

Heavy equipment for breaking the very dense and firm alluvium may be required for the excavations for shallow foundations, drilled shafts, and utility trenches for the proposed construction. The speed and ease of excavation are dependent on the nature of the deposit, the type of equipment used, and the skill and experience of the equipment operator.

5.1.4 ASTs Pad Preparation

At the locations where Above Ground Storage tanks (ASTs) are located, proof-roll the exposed subgrade to observe for any loose or disturbed soils that may remain. Remove and replace any loose or disturbed soils prior to placing any additional fill materials required to reach the finished subgrade elevation.

5.1.5 Compliance

Recommendations for foundations and slabs-on-grade supported on compacted fills or prepared subgrade depend upon compliance with the **Site Preparation recommendations** and Recommended Earthwork Specifications in Appendix C.

To assess compliance, observation and testing should be performed under the direction of a geotechnical engineer. Please contact us to provide observation and testing services.

5.2 Lateral Earth Pressures

5.2.1 Lateral Passive Resistance

Horizontal forces may be resisted by passive pressure acting on the side and sliding resistance. The passive pressure may be 300 psf per foot of embedment from the lowest adjacent grade up to a maximum of 4,500 psf.

Friction between base of footings and/or floor slabs, and the underlying soils may be assumed to be 40 percent of the dead loads.

The allowable bearing capacity and the allowable resistance of horizontal forces may be increased one-third for transient forces.

Friction and lateral pressure may be combined, but not to exceed two-thirds of the allowable lateral pressure.

5.2.2 Retaining Wall Recommendations (If Any)

The retaining wall structures may be supported by shallow footings bearing on compacted fill or competent subgrade soil. Following bearing values may be used for foundation design.

Shallow footings for the wall and/or secondary structure may be designed for an allowable bearing value of 1,500 pounds per square foot (psf) embedded at least 18 inches, a minimum width of 12 inches, placed over a minimum of 12-inches thick engineered fill compacted to 90% relative density or over a competent subgrade soil. This basic bearing value may be increased by 200 psf for each one-foot increase in depth, and by 100 psf for each additional 12 inches in width to a maximum value of 2,500 psf.

Recommended bearing values are for dead plus live loads and may be increased by one-third for combined dead, live, and transient forces such as wind load and seismic forces.

It is recommended that all foundations be reinforced per structural design, but no less than a minimum reinforcement of 2#5 bars top and 2#5 bars at the bottom.

It is estimated that total settlement will be less than 0.50" and differential settlement will be less than 0.25" over a horizontal distance of 30 feet.

5.2.3 Active Pressure

Recommended active lateral soil pressure values for design of drained retaining wall are as follows:

Surface Slope of Retained Material (Horizontal:Vertical)	Equivalent Fluid Weight (pcf) (Native Backfill)	Allowable Bearing Capacity
Level	35	1,500 psf

A Pipe and gravel drain (4" perforated PVC embedded in at least three cubic feet of gravel per lineal foot of pipe wrapped with Mirafi geofabric 10N or equivalent) should be provided on the retained earth side and near the base of all the retaining walls. Backfill should consist of sand and/or gravel. While all backfills should be compacted to the required degree, care should be taken when working close to the walls to prevent excessive pressure.

5.2.4 At-Rest Earth Pressure (If Any)

Retaining walls (basement walls, underground vault, if applicable) should be designed for at-rest conditions. The recommended earth pressure for at-rest conditions is an equivalent fluid density of 60 pounds per cubic foot without surcharge loading.

Note:

The equivalent fluid pressures presented herein do not include the lateral pressures arising from the presence of the following:

- Hydrostatic conditions, submergence or partial submergence
- Sloping backfill, positively or negatively
- Surcharge loading, permanent or temporary
- Seismic or dynamic conditions

5.2.5 Seismic Force on Wall

Lateral forces on retaining walls (exceeding 6 feet in height) due to earthquake movements in accordance with Section 1803A.5.12 of the 2019 CBC for active and at-rest conditions may be calculated as follows:

Seismic active Force = 13 H^2 pounds/ft of wall (Inverted triangular distribution, acting at 0.6H from bottom).

Seismic at-rest Force = 24 H^2 pounds/ft of wall (Rectangular Distribution, acting at 0.6H from bottom).

Where, H = Height of the retaining wall in feet

5.3 On-Site Fill Soils

5.3.1 Materials

On-site clean sand (after removing rocks, sizes greater than 6 inches), low-expansive potential soils, or imported materials may be used as fill material for the following:

- Foundation Areas
- Interior Slab Areas
- Pavement Areas
- Backfill

Any earth materials imported or excavated on the property may be utilized in the fill provided that each material has been determined to be suitable by the soil engineer. These materials should be free of roots, tree branches, other organic matter or other deleterious materials. Soils of poor gradation, undesirable expansion potential, or substandard strength characteristics may be designated by the consultant as unsuitable and may require blending with other soils to serve as a satisfactory fill material.

Gradation (as per ASTM C136) should be as follows:

Size	% by Weight
6"	100
4"	85-100
¾"	70-100
No 4 Sieve	50-100
No. 200 Sieve	15 (max)

Any import material should have an expansion Index, EI less than 20.

5.3.2 Placement and Compaction

a. Place and compact approved fill material in nearly horizontal layers that when compacted should not exceed 6 inches in thickness.

b. Use appropriate equipment and procedures that will produce recommended densities and water contents throughout the lift. Moisture condition, blending, and mixing of the fill layer should continue until the fill materials have a uniform moisture content at or above optimum moisture.

c. Uncompacted fill lifts should not exceed 8 inches.

d. Materials should be compacted to the following:

- On-site or imported soil, reworked and fill:

	Minimum % (ASTM D-1557 Laboratory Standard)
Subgrade Below Footings	90
Subgrade Below Slab-on Grade	90
Subgrade Below Pavement	90
Crush Rock Below Slab-on-Grade	95
Aggregate Base below pavement	95

5.4 Soil Corrosivity

5.4.1 Corrosion and Sulfate Attack Protection

A major factor in determining soil corrosivity is electrical Resistivity. The electrical Resistivity of a soil is a measure of its resistance to the flow of electrical current. Corrosion of buried metal is an electrochemical process in which the amount of metal loss due to corrosion is directly proportional to the flow of electrical current (DC) from the metal into the soil. Corrosion currents, following Ohm's Law, are inversely proportional to soil Resistivity. Lower electrical resistivities result from higher moisture and chemical contents and indicate corrosive soil. Other soil characteristics that can influence corrosivity toward metals are pH, chemical content, soil types and site drainage.

Based on test results and our past experience at this site, soils are classified as slightly corrosive to ferrous metals and negligible sulfate exposure to concrete. The type of alluvial deposits encountered at this site and in this area in general is known to cause corrosion problems. Ferrous metals and pipes should be properly coated and wrapped. Please be advised that this firm does not practice corrosion engineering; therefore, we recommend that upon completion of precise grading, onsite soils be

analyzed by a qualified corrosion engineer to evaluate the impact of chemical activity of these soils on buried metallic pipes and other underground structures. If necessary, more elaborate corrosion protection systems may be considered as may be recommended by a corrosion expert.

5.4.2 Concrete

Concrete for foundation where in contact with the underlying soils should be designed in accordance with the 2019 CBC, ACI 318 Section 4.3, Table 4.3.1 (2005). As the potential for sulfate attack on concrete appears negligible, however, we recommend that the use of type II Portland cement, with a maximum water-cement ratio of 0.50, and a minimum compressive strength of 3,000 psi should be taken into consideration for the foundation elements in contact with the soil.

For all concrete in contact with soil, concrete cover over rebar should be maintained per California Building Code (CBC 2019).

5.5 Building Foundation Recommendations

Based upon results of the field explorations, laboratory testing and engineering analysis, it is concluded that the site is suitable for the proposed development at the subject site. The site is subject to ground shaking typical of the Southern California area, any construction should conform to the current seismic design provision of the California Building Code (2019), and/or other regulatory codes.

Following are more specific recommendations:

5.5.1 Conventional/Spread Foundations

The planned ASTs and the proposed building may be supported by conventional continuous and/or isolated shallow spread pad footings, bearing on certified compacted fill. The foundations should bear on engineered fills achieved by removal and re-compaction of the soils below foundation and slab elements.

Footings placed at least 18 inches below finish subgrade and 3 feet x 3 feet spread footings, 24 inches deep may be designed for an allowable bearing value of 1,500 pounds per square foot (psf). The footing width should be a minimum of 18 inches. An increase of 100 psf and 200 psf are allowed for each additional foot of increase in width and depth, respectively to a maximum value of 2,000 psf.

This allowable bearing value is for dead plus live load and may be increased by one-third for combined dead, live, and transient loads such are wind or seismic forces.

All footings at minimum shall be incorporated with 2#5 bars at top and 2#5 bars at the bottom.

Isolated column footings should be connected to other foundation elements with reinforced grade beams.

Total settlement is estimated to be less than ½ inch for loading of 2 kips per square foot. Differential settlement will be 1/3 of an inch maximum for a horizontal distance of 30 feet. Additional foundation movements could occur if water from any source infiltrates the foundation soils. Therefore, proper drainage should be provided in the final design and during construction.

All footings, stem walls, and masonry walls should be steel-reinforced to reduce the potential for distress caused by differential foundation movements. The use of joints at openings or other discontinuities in masonry walls is recommended.

We recommend that geotechnical engineer, or his representative thereof, observe the footing excavations before reinforcing steel and concrete are placed. This observation is to assess whether the soils exposed are similar to those anticipated based on our exploration. Any soft, loose, or otherwise unacceptable soils should be undercut to suitable materials and backfilled with approved fill materials, or

controlled density fill (i.e., lean concrete). Soil backfill should be properly placed and compacted.

5.5.2 Mat Foundation (Alternate Foundation for ASTs)

Alternatively, above ground storage tanks (ASTs) and proposed building may be supported on the mat foundation. The semi-rigid mat foundation should be at least 4-feet or more below the finish grade and may be designed for an allowable bearing capacity of 2,000 pounds per square foot. This basic allowable bearing value is for dead load plus live load and may be increased by one-third for short duration loading, such as wind or seismic forces. Modulus of subgrade reaction, k value may be taken as 150 pci for subgrade soil at 4 feet depth.

For lateral support, an average passive capacity of 300 pounds per square foot per foot to a maximum of 4,500 psf may be used for mat footing.

Minimum thickness of mat footing should be 24 inches. The bottom of excavation at 4 feet below the finish grade should be compacted to 90 % of the maximum density as per ASTM D-1557 Laboratory Standard, certified by the Geotechnical Engineer of record prior to pouring concrete. Other aspects of the design including reinforcement and the thickness of the mat should be determined by the project structural engineer. The mat may be buried and should be backfilled with on-site material compacted to 90 percent.

5.5.3 Drilled Shafts for Canopy Foundation

Proposed truck diesel and gas canopies may be supported by moderately deep cast-in-place concrete caisson bearing into natural subgrade materials. Very hard drilling may be encountered because of the presence of dense to very dense alluvial soils. Heavy-duty equipment may be required.

The lateral forces will be the controlling element in this case depending on the height of the canopies, wind load, and/or seismic loads. Therefore, it is

recommended that the minimum pier diameter should be 36 inches and should be extended to a minimum depth of 10 feet into the native material.

The pier may be designed for an allowable end bearing of 3,000 pounds per square foot or for an average frictional resistance of 300 pounds per square foot. Either skin resistance or end bearing or combined will provide adequate foundation support for the proposed canopies. The uppermost length of the drilled shaft foundation equal to the diameter of the shaft should be ignored when evaluating allowable capacities.

For lateral support, a passive capacity of 350 pounds per square foot per foot to a maximum of 5,000 psf may be used.

It is recommended that concrete be placed immediately after drilling. The concrete for the pier should be placed through tremmie or other directional devices. Pier drilling operations should be subject to observation by this office to confirm the conditions encountered are consistent with the conclusions and recommendations of this report and/or to make any appropriate modifications, if necessary. Please note that caving is very likely to be encountered during caisson drilling. The contractor should be ready to provide either casing or other methods to prevent caving. The contractor should bring the heavy duty equipment because very difficult drilling are anticipated due to presence of boulders and rocks.

We anticipate that total settlement of the proposed structures, supported by drilled shaft foundations as recommended, should be less than ½-inch. Additional foundation could occur if water from any source infiltrates the foundation soils. Therefore, proper drainage should be provided in the final design and during construction.

In case, caisson drilling is not feasible for the canopies, mat foundation as explained on 5.5.2 for the support of the canopies may be anticipated.

5.6 Slab Design Recommendation

Based on test results, the underlying surface soils are very low expansive, therefore it is recommended to maintain subgrade soil at near optimum moisture content during precise grading and / or by periodic watering following grading and incorporated slab reinforcement of No. 3 bars 16 inches center to center cross pattern. The slab thickness should be 5 inches minimum. However, the thickness and reinforcement requirements of the slab should be evaluated by the project structural engineer.

It is further recommended that moisture retarder (Stego 15 mil or approved equivalent) be provided over a minimum of 6 inches of ¾" aggregate rock rolled and compacted to 95% relative compaction, with the gradation (90-100% passing on sieve ¾" size, 1-10% passing on No. 4 sieve, and 0-3% passing on No. 100 sieve) over the compacted fill subgrade compacted to 90% relative compaction.

The modulus of subgrade reaction (k) is estimated to be 125 pounds per cubic inch (pci). All concrete placement and curing operations should follow the American Concrete Institute (ACI 318-19) manual recommendations. Improper curing techniques, high slump (high water-cement ratio), or both, could cause excessive shrinkage, cracking, or curling. Concrete slabs should be allowed to cure properly before placing vinyl or other moisture-sensitive floor coverings.

5.7 General Drainage and Moisture Protection

It is recommended to provide positive surface drainage systems consisting of a combination of sloped concrete flatwork, sheet flow gradients, swales, surface area drains (where needed) around the structures. Ground surface should have a minimum gradient of 2 percent away from any building foundations and similar structures. Surface waters should not be allowed to collect or pond against building foundations and within the level areas of the site. Buildings should be provided with gutters and downspouts. Downspouts shall be connected to area drains by pipes.

Planters near the building should be avoided if possible and if used, they should be water proofed. Irrigation should be controlled and an area drain system should be provided to avoid water intrusion beneath the structure.

5.8 Volume Changes

Based on our experience, there is typically a reduction in soil volume when the native soils are excavated and then compacted. Typical shrinkage percentages are usually in the range of 5 to 10 percent when the soils are compacted depending on the native in-place density.

5.9 Underground Utilities

Utility backfill should be placed and compacted by mechanical means as recommended in this report. Testing of the backfill should be conducted to verify conformance to the required specifications. Ponding or water jetting of the backfill should not be conducted.

Exterior trenches adjacent to, and within areas extending below a 1:1 plane projected from the outside bottom edge of the footing, and all trenches beneath hardscape features should be compacted to at least 90% of the laboratory standard. Sand backfill, unless excavated from the trench, should not be used in these backfill areas. Compaction testing and observations, along with probing, should be accomplished to verify the desired results.

All trench excavations should conform to CAL_OSHA and local safety codes.

5.10 Pavement Design

5.10.1 Pavement Section

The pavement sections presented on the following page are based on the R-value data tested, the assumed TI values, and the guidelines presented in the latest revision to the California Department of Transportation "Highway Design Manual," latest edition.

Typical categories of paved areas with corresponding traffic indices are listed as follows:

T.I. 5.0 Parking Stalls

T.I. 6.0 Driveways

T.I. 8.0 Trucks Route, Fire Lane, Truck Parking

The recommended pavement sections provided below are intended as a minimum guideline. If thinner or highly variable pavement sections are constructed, increased maintenance and repair could be expected.

If the ADT (average daily traffic) or ADTT (average daily truck traffic) increases beyond that intended, as reflected by the TI used for design, increased maintenance and repair could be required for the pavement sections.

Consideration should be given to the increased potential for distress from overuse of paved areas by heavy equipment and/or construction related traffic (e.g., concrete trucks, loaded supply trucks, etc.), particularly when the final section is not in place (i.e., topcoat). Best management construction practices should be followed at all times, especially during inclement weather.

Based on an "R" Value of 40, the following thickness of aggregate base was determined for vehicular and non-vehicular areas.

Asphalt Concrete Pavement Section Design Table

Pavement Areas	Traffic Index, TI	Asphalt Concrete AC (inch)	Aggregate Base AB (inch)
Truck Route, Fire lane Truck Parking	8	4"	12"
Driveway/Under Canopy	6	4"	8"
Parking Stall	5	4"	6"

Rigid Concrete Pavement Section Design Table

Pavement Areas	Traffic Index, TI	Concrete (inch)	Aggregate Base AB (inch)
Heavy Truck Vehicular Areas	6	6"	10"
Walkways	-	4"	4"

For concrete section, #4 reinforcement 12-inch center to center each way cross pattern are recommended. However structural design by structural engineer will suffix.

5.10.2 Pavement Grading Recommendations

5.10.3 General

A representative of Geotechnical Solutions, Inc. (GSI) should be present for the preparation of subgrade, aggregate base, and asphalt concrete for flexible pavement and concrete for rigid pavement.

5.10.4 Subgrade Preparation

After removing the existing deleterious materials on the pavement areas and hauled offsite, all surficial deposits of loose soil material should be removed and excavate 12 inches below the base and recompacted as recommended. The bottom is further scarified to a depth of at least 6 inches; moisture conditioned as necessary and compacted to 90 percent of the maximum laboratory density as determined by ASTM Test Method D-1557.

Deleterious material, grass/weeds, excessively wet or dry pockets, concentrated zones of oversized rock fragments, and any other unsuitable materials encountered during excavation or grading should be removed. The compacted fill material should then be brought to the elevation of the proposed subgrade for the pavement.

The subgrade should be proof-rolled in order to ensure a uniform, firm and unyielding surface. All grading and fill placement should be observed by the project soils engineer and/or his representative.

5.10.5 Aggregate Base

Compaction and rolling are required for the recommended base section. Minimum relative compaction required will be 95 percent of the laboratory maximum density as determined by ASTM Test Designation D-1557. Aggregate base should be in accordance with Crush Rock Class II aggregate base (minimum R-value=78) and sample should be brought for testing and approval prior to delivery to the site. Please note that crush miscellaneous base is not allowed.

5.10.6 Asphalt Concrete Pavement

Asphalt concrete pavement should be Performance Grade PG 64-10 1/2" maximum aggregate size and should be placed and compacted in two layers. Asphalt concrete shall be compacted to 95 percent of the Hveem Laboratory Standard.

5.10.7 Concrete Pavement Areas:

Concrete flatwork including sidewalks, patio-type slabs and concrete sub-slabs to be covered with decorative pavers should be at least 4 inches thick and provided with construction joints or expansion joints every 6 feet or less.

Concrete driveway slabs should be at least 6 inches thick over 6 inches of aggregate base or native base (for vehicular areas) and 4" of concrete over 4" of aggregate base or native base (Non-vehicular areas) over approved subgrade, providing #4 reinforcement 12" center to center each way cross pattern and provided with construction joints or expansion joints every 10 feet or less.

At the driveway areas, the top 12 inches of subgrade should be excavated; moisture conditioned and recompacted with minimum 90% compaction immediately prior to placing the rock base and asphalt concrete. Rock-base material shall be class II aggregate base and to be compacted to 95 percent minimum.

Design section must be verified during site grading, based on R value test and appropriate modifications shall be made, if required.

5.11 Exterior Concrete Flatwork

In order to reduce the potential for unsightly cracking, concrete sidewalks, deck and patio slabs and concrete sub-slabs to be covered with decorative pavers should be at least 4 inches thick and provided with construction joints or expansion joints every 6 feet or less. Concrete driveway slabs should be at least 5 inches thick and provided with construction joints or expansion joints every 10 feet or less.

5.12 Temporary Excavations

Temporary excavations may not be required but in case it is needed then the Contractor should be made fully responsible for adequate support of the excavation at all times. Temporary support of excavation structures plans should be designed by a Professional Engineer licensed in the State of California and experienced in such work and these plans should be reviewed by us and approved by the City of Perris, if necessary.

Since the site has adequate room to lay back with temporary excavation slopes, shoring may not be needed, but this should be evaluated based on field conditions.

The stability of temporary excavations depends on many factors, including the slope angle, the shearing strength of the existing material, orientation and inclination of geologic structure, the height of the slope and the length of time the excavation remains

unsupported and exposed to equipment vibrations and rainfall. All excavations should be observed by the engineering geologist during excavation.

The possibility of temporary excavations failing may be minimized by: 1) keeping the time between cutting and filling operations to a minimum; 2) limiting excavation length exposed at any one time; and, 3) cutting no steeper than a 1:1 (horizontal to vertical [h:v]) inclination and no steeper for false cuts along the toe for key excavations, cleanouts, etc.

Following is the temporary excavation recommendation, subject to field verification by the geotechnical consultant.

Excavation up to 4 feet	Vertical
Excavation over 4' but not to exceed 10'	1:1 (H: V)
Excavation from 10' to 20'	1½:1 (H: V)

6.0 GENERAL COMMENTS AND LIMITATIONS

6.1 Plan Review

Final project plans should be reviewed by this office prior to construction, so that construction is in accordance with the conclusions and recommendations of this report. Based on our review, supplemental recommendations and/or further geotechnical studies may be warranted.

6.2 Geotechnical Observation and Testing

All footing trenches for the proposed structure should be observed by a representative of this firm to verify that they were excavated into competent bearing soils per the recommendations of this report as well as to the minimum depths recommended above. These observations should be performed prior to the placement of forms or reinforcement. The excavations should be trimmed neat, level and square. All loose, sloughed or moisture softened soil should be removed prior to placing concrete.

6.3 Construction Verification Procedure

Construction of foundations and placement of engineered fill should be done under the observation and documentation of a representative of the project Geotechnical Engineer. The following are noted as items requiring verification during construction.

Pre-Grading Meeting:

A pre-grading meeting should be held prior to the start of any grading activities. Attendees of this meeting should include the Owner, the Architect, the Geotechnical Engineer, and the Contractor, to review procedures and scheduling.

Footing Observations:

Construction of foundation and slab should be performed under inspection of the Geotechnical Engineer. Footings should be observed and certified by Geotechnical Engineer of Record after excavation and prior to placement of reinforcing bars.

Earthwork Observations:

Relative compaction of all fill materials placed on site should be tested in accordance with ASTM D6938. All new fill shall be brought to near optimum moisture, placed in layers not exceeding six inches in thickness, and compacted to at least 90 percent relative compaction for subgrade and 95 percent relative compaction for aggregate base. No jetting or water tamping of fill soils shall be permitted. All imported soil for engineered fill should be pre-approved by the Geotechnical Engineer and consist of clean, granular, non-expansive soil, free of vegetation and other debris with an Expansion Index of 20 or less.

At all times, the contractor should have a responsible field superintendent on the project in full charge of the work, with authority to make decisions. He should cooperate fully with the Geotechnical Engineer in carrying out the work.

All footing trenches for continuous and spread footings and subgrade for the slab areas should be observed by the project Geotechnical Engineer to verify that over-excavation and re-compaction operations of adequate depth, thickness, and compaction have been performed as specified. All footing excavations should be trimmed neat, level and square. All loose, sloughed or moisture softened soil should be removed and replaced with properly compacted soil.

6.4 Recommendations for Construction

Surveying: The contractor shall set necessary stakes to verify lines and grades as shown on the plan.

Changed Conditions: Any changed conditions not found during exploration should be brought to the attention of the soil engineer. As a result of the changed conditions, the soil engineer will provide further recommendations.

Site Drainage: The site should be sloped to direct water away from all structures and divert to a positive drainage device at the street. Roof gutters and down spouts shall be provided for roof drainage. Down spouts shall be connected to the positive area drains.

Footing and Utilities Trenches. All the Footing excavations as well as utility trenches should be observed by a representative of Geotechnical Solutions, prior to placement of steel.

6.5 Limitations

This report is issued with the understanding that it is the responsibility of the owner or his representative to see that the information and recommendations contained herein are called to the attention of the other members of the design team for the project and that the applicable information is incorporated into the plans, and that the necessary steps are taken to see that the contractors and the subcontractors carry out such recommendations. The findings of this report are valid as of the present date. However, changes in the

conditions of a property can occur with the passage of time, whether due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated, wholly or in part, by changes outside of our control. The validity of the recommendations of this report assumes that Geotechnical Solutions, Inc. will be retained to provide construction monitoring services. The scope of our services did not include any investigation for the presence or absence of hazardous or toxic materials.

6.6 Closure

The Conclusions and recommendations contained herein are based on the findings and observations made at the test boring locations. It is not unusual to find conditions between and beyond such locations, which differ from the conditions encountered. If conditions are encountered during construction, which appear to differ from those previously disclosed, this office should be notified so as to consider the need for modifications. On-site construction observations and wherever appropriate, tests should be performed during the course of construction by a representative of this office to evaluate compliance with the design concepts, specifications, and recommendations contained herein.

This report has been compiled for the exclusive use of our client, it shall not be transferred to, or used by, other parties, or applied to any project on this site other than described herein without consent and /or thorough review by this office.

Geotechnical Solutions, Inc.

References

California Department of Water Resources groundwater well data http://wdl.water.ca.gov.

California Division of Mines and Geology, 1997, Fault-Rupture Hazard Zones in California, Special Publication 42.

California, Division of Mines and Geology, 2008, Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards.

International Conference of Building Officials (ICBO), 2019, California Building Code, California Code of Regulations, Title 24, Part 2, Volume 2.

Jennings, C.W., 1994, Preliminary Fault Activity Map of California, Scale 1:750,000, DMG Open File Report 92-03.

Morton, D.M. and F.K. Miller, 2006, "Geologic Map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California: U.S. Geological Survey, Open-File Report OF-2006-1217, Scale 1:100,000.

Thomas W. Dibblee, Jr., 2003," Geologic Map of the Devore Quadrangle, San Bernardino County, California", Edited by John A. Minch.

U.S. Seismic Design Maps Summary & Detailed Report (SEAOC/OSHPOD)

2008 National Seismic Hazard Maps – Source Parameters.
https://earthquake.usgs.gov/cfusion/hazfaults_2008_search/query_results.cfm

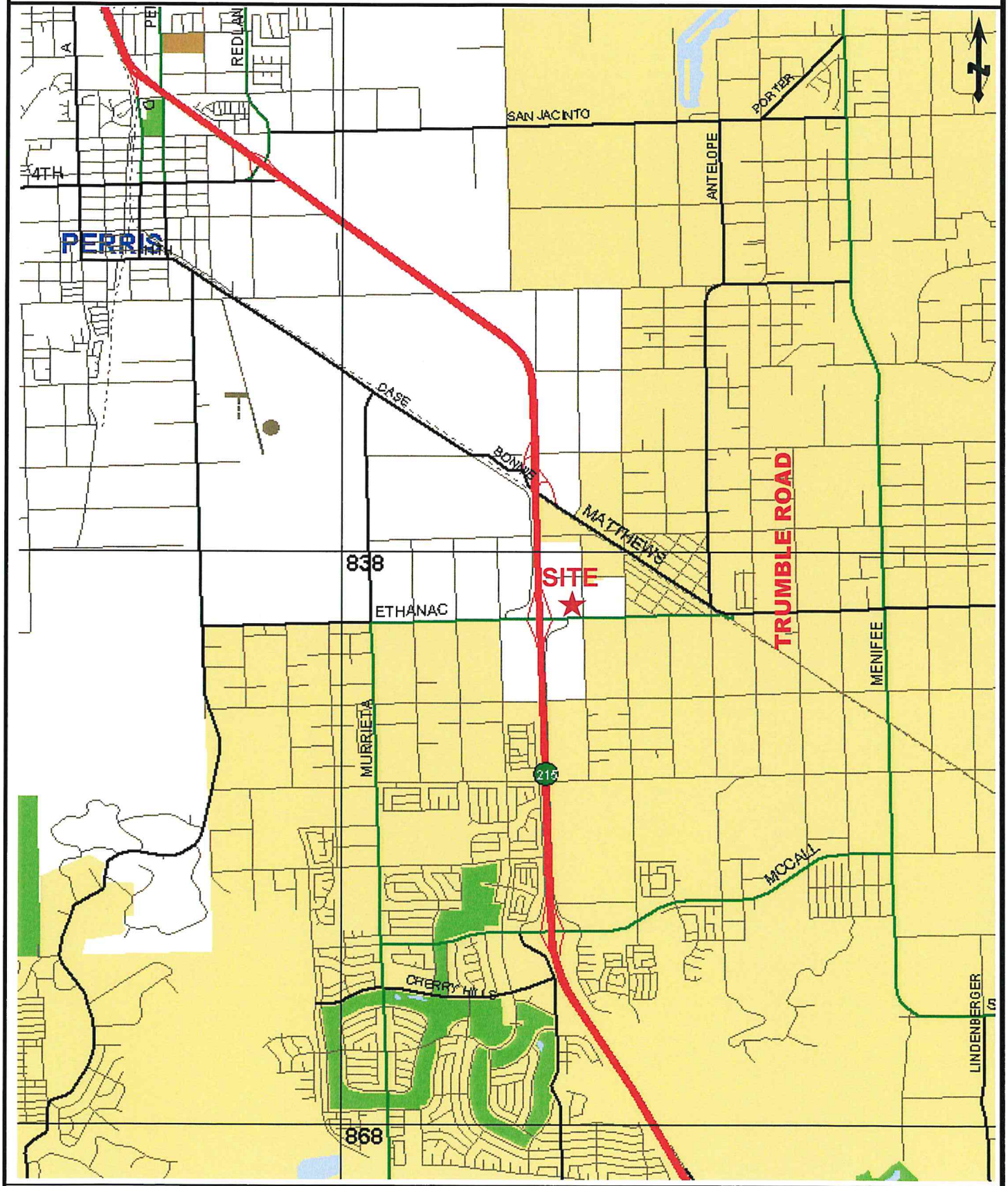
U.S.G.S., Earthquake Hazards Program, Unified Hazard Tool – Interactive Hazard Curve and Interactive Deaggregation web Site.
https://earthquake.usgs.gov/hazards/interactive/

Appendix A

Plates:

- Vicinity Map
- Plot Plan and Boring Location Map
- Topographic Map
- Google Map
- Site Regional Geology Map
- Seismic Hazard Map – CGS
- Fault, Liquefaction and Flood Zones
- Groundwater Closest Well Data
- Groundwater Map – Well Data
- Log of Test Borings
- Direct Shear Tests
- Consolidation Tests

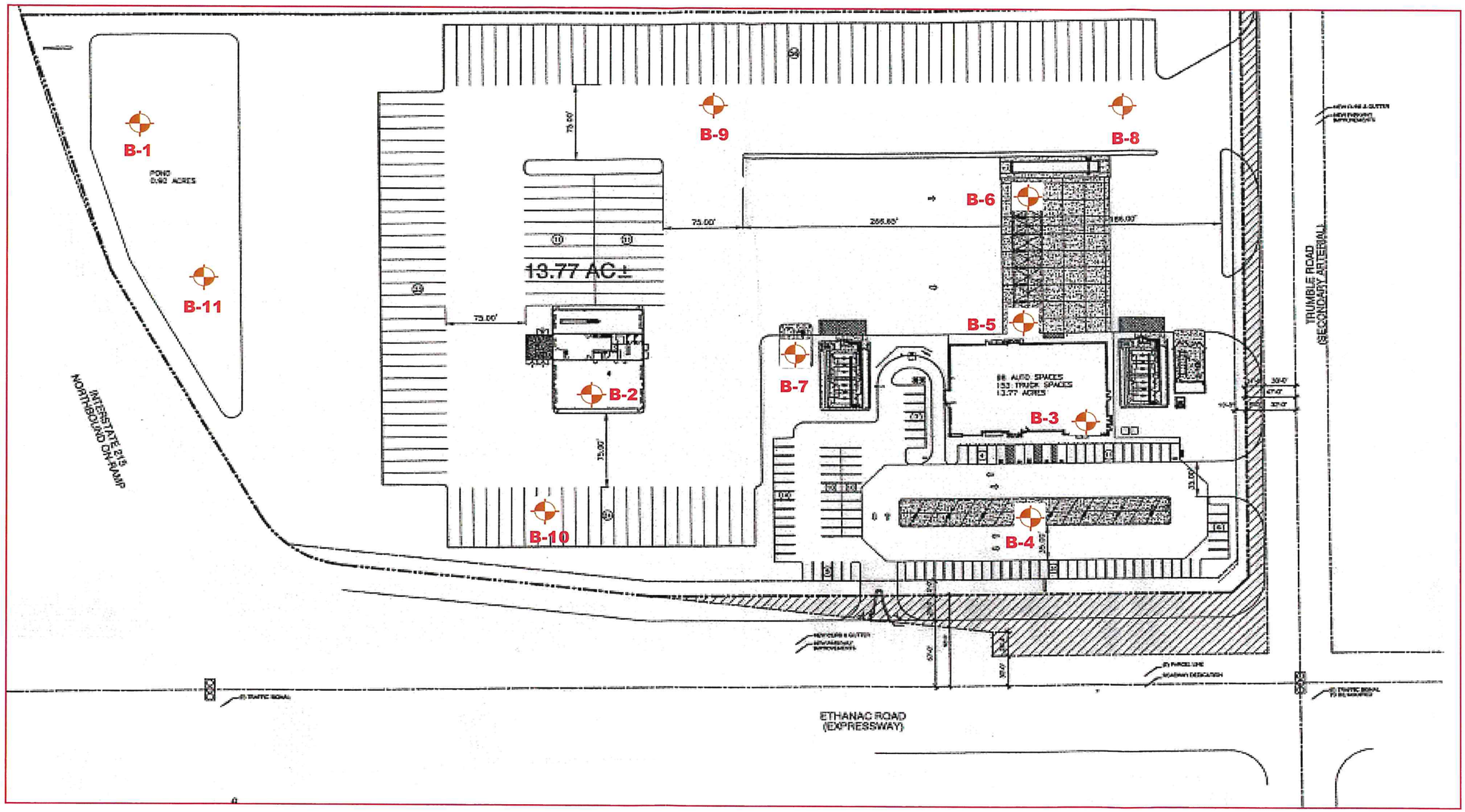
VICINITY MAP



Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	A

Geotechnical Solutions, Inc.

PLOT PLAN & BORING LOCATION MAP



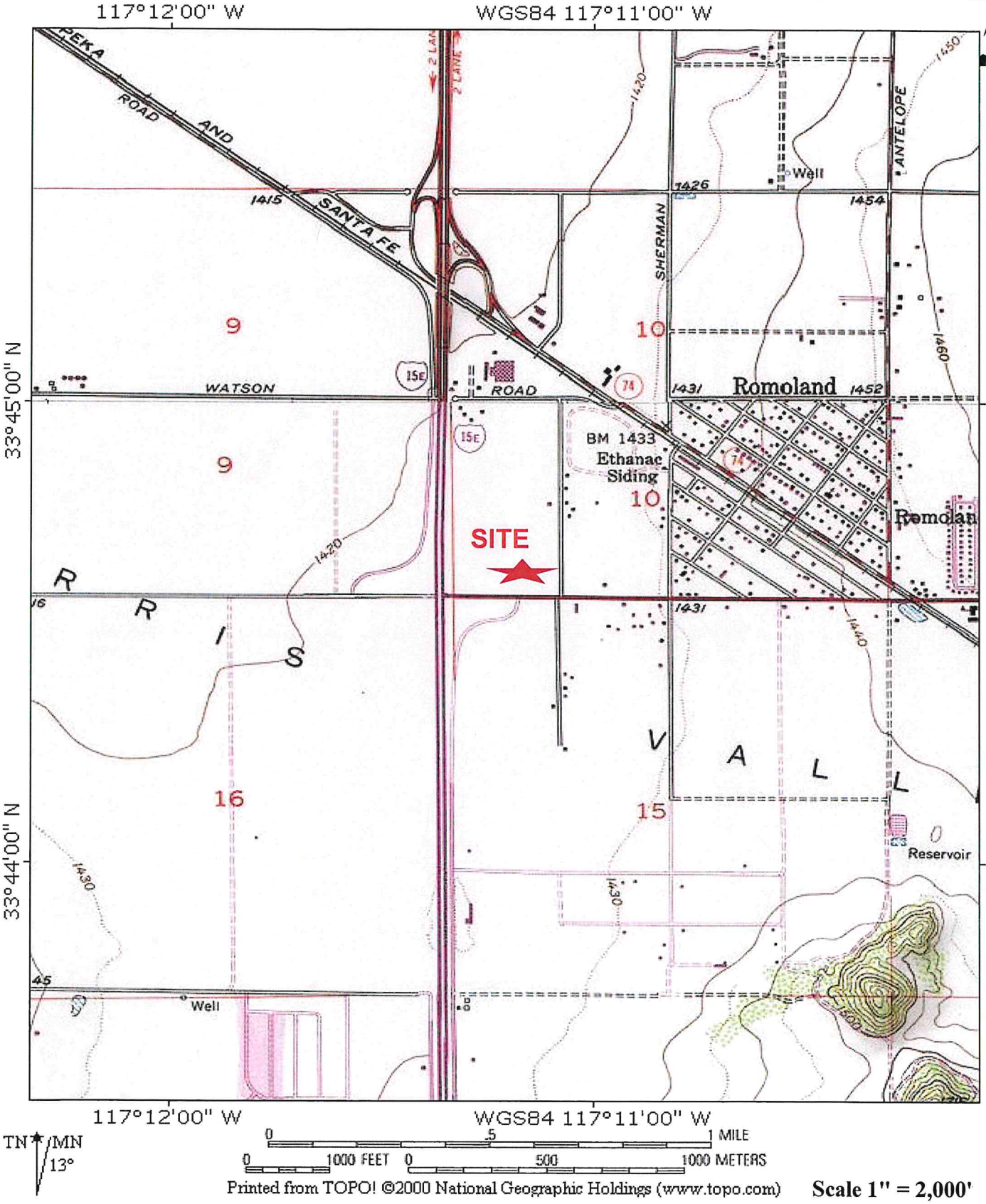
HSA Borings (2021)
B-11

APPROX. SCALE: 1" = 100'

Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	B

Geotechnical Solutions, Inc.

TOPOGRAPHIC MAP



Scale 1" = 2,000'

Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	C

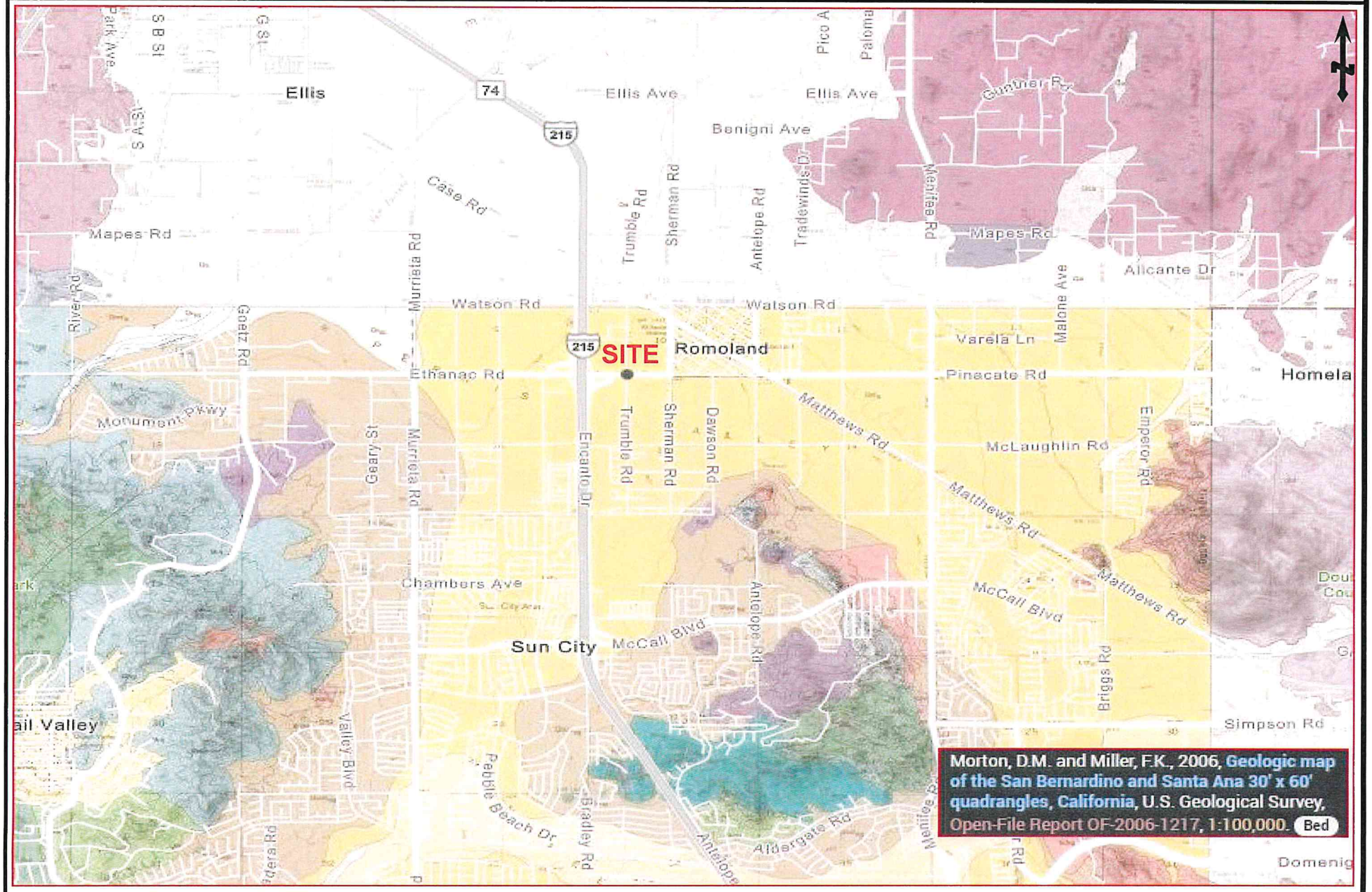
Geotechnical Solutions, Inc.

GOOGLE MAP

Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	D

Geotechnical Solutions, Inc.

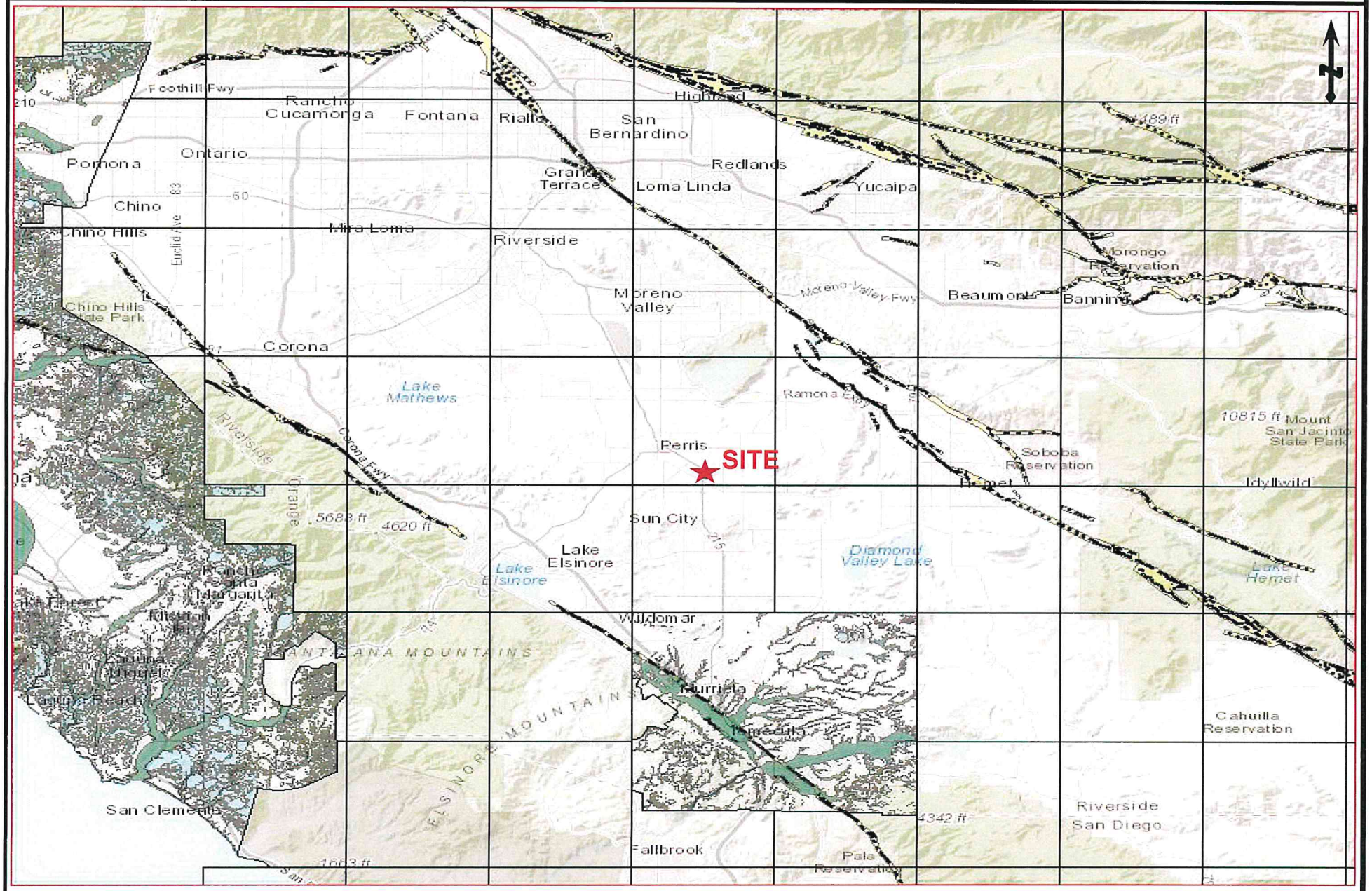
Site Regional Geologic Map



Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	E

Geotechnical Solutions, Inc.

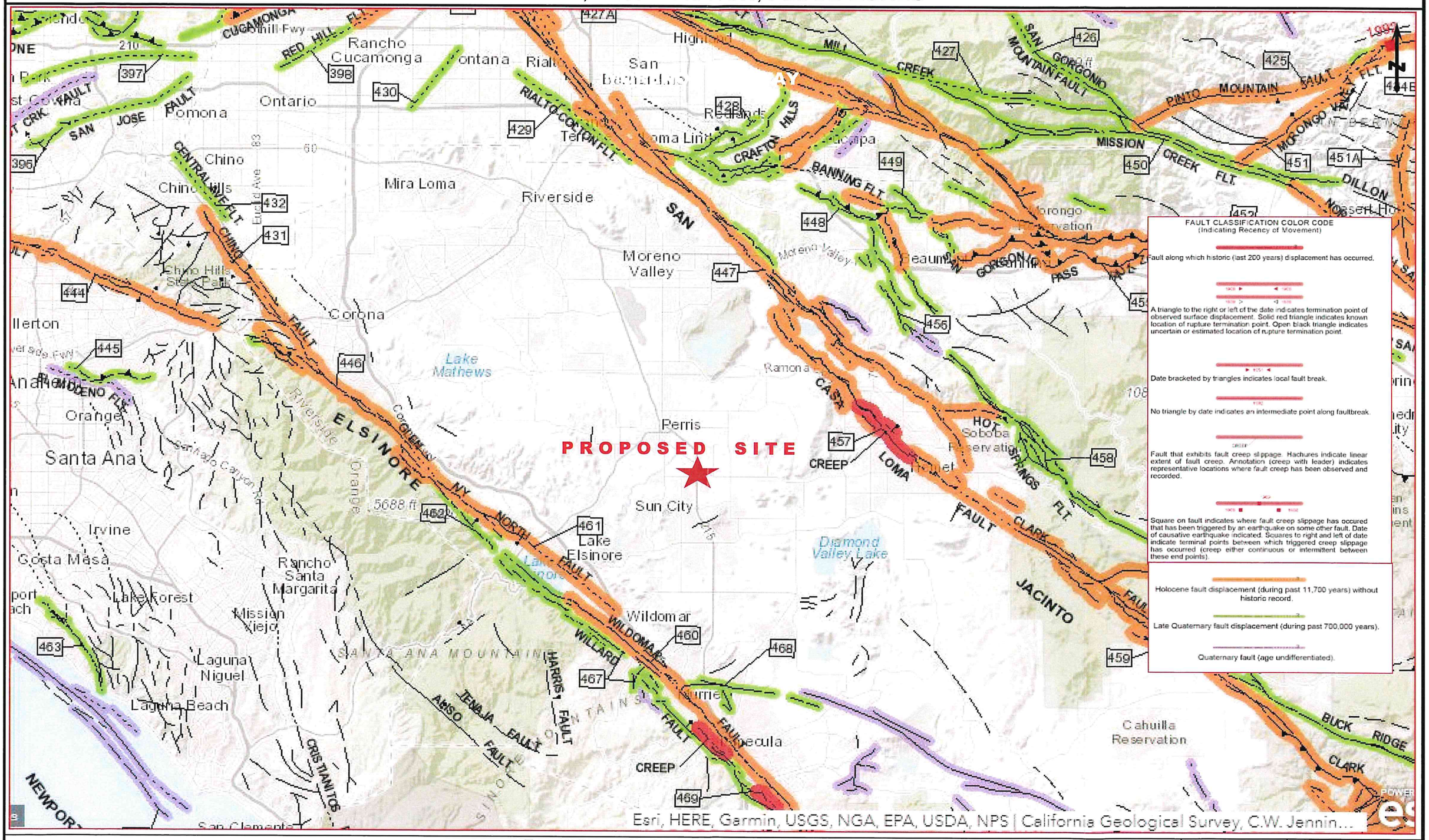
Seismic Hazard Map



Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	F

Geotechnical Solutions, Inc.

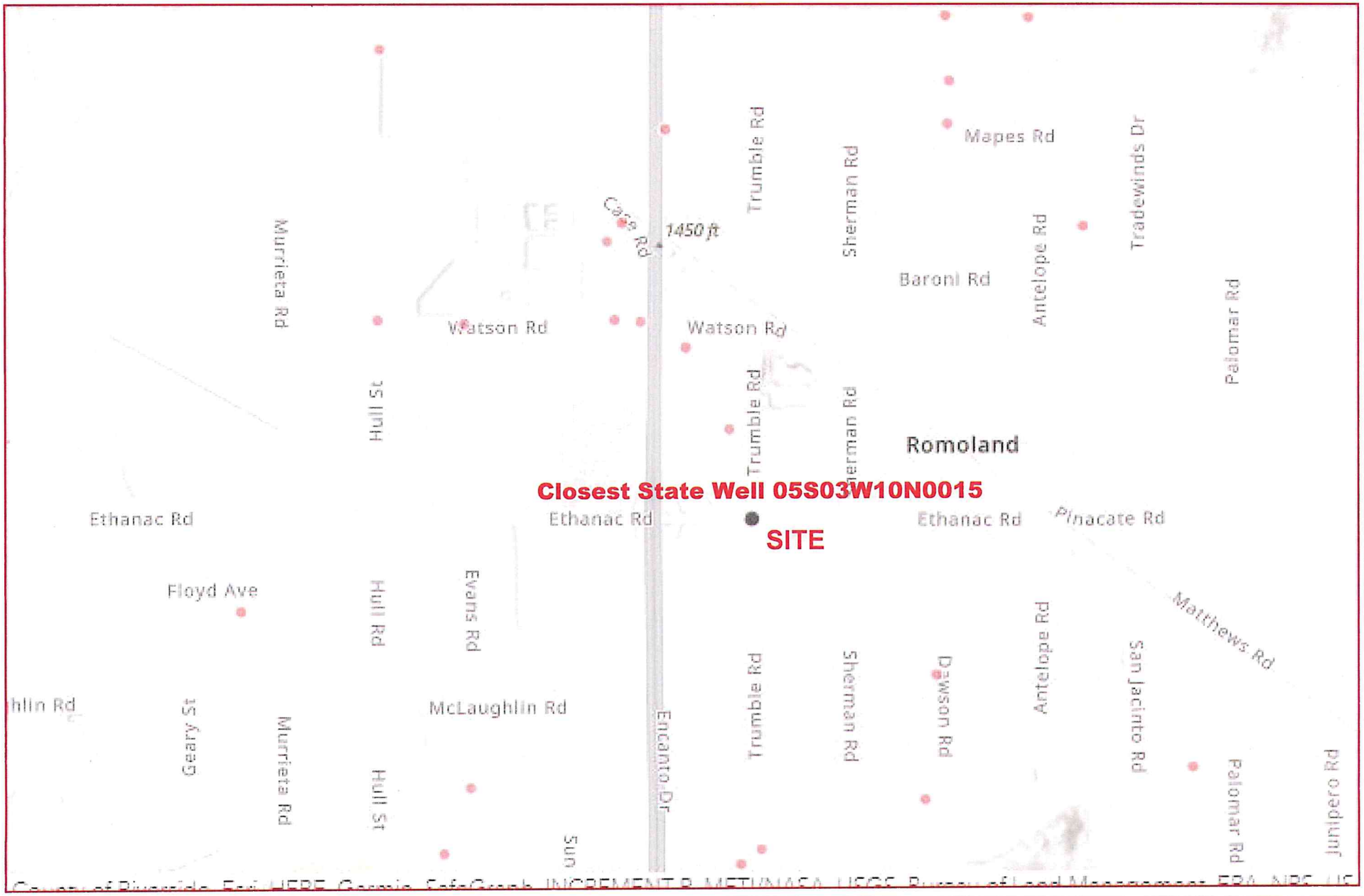
FAULT, LIQUEFACTION, FLOOD ZONES



Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	G

Geotechnical Solutions, Inc.

GROUNDWATER MAP - CLOSEST WELL DATA



Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	H-1

Geotechnical Solutions, Inc.

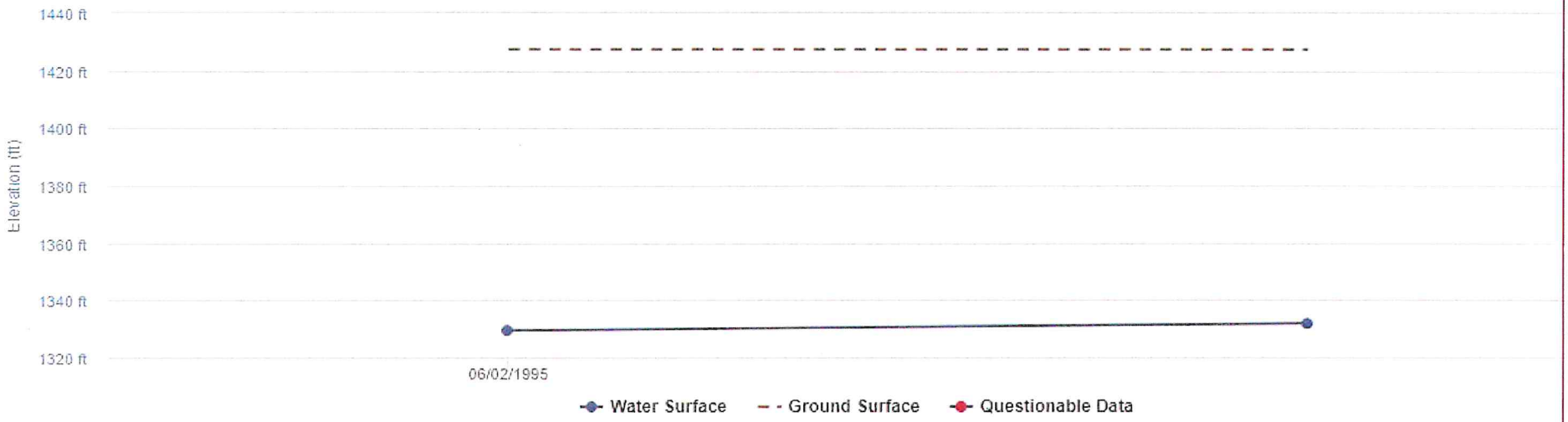
GROUNDWATER MAP - WELL DATA

Groundwater Level Report

Station 337464N1171859W001

Station Data | Groundwater Level Data

Groundwater Levels for Well 337464N1171859W001 (Site Code)



Measurement Date (PST)	Reference Point Elevation	Ground Surface Elevation	Distance from RP to WS	Groundwater Elevation	Ground Surface to Water Surface	Measurement Issue	Collecting Agency	W M C
06/02/1995 00:00:00	1427.490	1427.490	97.98	1329.51	97.98		Department of Water Resou...	
09/13/1995 00:00:00	1427.490	1427.490	95.63	1331.86	95.63		Department of Water Resou...	

Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	H-2

Geotechnical Solutions, Inc.

Project :	Travel Plaza - Perris	LOG OF TEST HOLE	Borehole No. B-1
Project Location :	Corner of Trumble Road and Ethanac, Perris, California		Plate No. I-1
Project Number :	G-5908-01		Page 1 of 1

Date(s) Drilled :	May 24, 2021	Logged By :	BA/AB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	10
Drill Rig Type :	B-61	Drilling Contractor :	Whitecomb Drilling	Approx. Surface Elevation, feet :	1426 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location;		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
1426	0						**Covered with dry weeds**				
			Bag #1				Older Alluvium: Silty Sand (SM), light brown, medium dense				
	2		C-1	19-54/6"		> 100	@2': Sand (SP), silty, light brown, slightly moist, very dense	6	127		
1421	5		C-2	20-50/6"		> 100	@5':Sand (SP), poorly graded, very dense, gray, slightly moist, medium to coarse grained	7	122		
1416	10									11	HD: 89(SA) :7(SI) : 4(CL)
1411	15						End of Boring = 10 feet 2" Gravel on Bottom Drilled for Percolation test No groundwater encountered No Caving Backfilled w/Cuttings after percolation test				
1406	20										
1401	25										
1396	30										
1391	35										
1386	40										
1381	45										

Geotechnical Solutions, Inc.

Project :	Travel Plaza - Perris	LOG OF TEST HOLE	Borehole No. B-2
Project Location :	Corner of Trumble Road and Ethanac, Perris, California		Plate No. I-2a
Project Number :	G-5908-01		Page 1 of 2

Date(s) Drilled :	May 24, 2021	Logged By :	BA/AB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	51.5
Drill Rig Type :	B-61	Drilling Contractor :	Whitecomb Drilling	Approx. Surface Elevation, feet :	1426 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location;		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
1426	0						**Bareground**				
			Bag #1				Older Alluvium: Clayey Sand (SC), light brown, medium dense			28	HD:72 SA:10 SI: 18 CL
	2		C-1	50/6"		100	@2': Sand (SP), Silty, light brown, slightly moist, very dense	7	121		
1421	5		C-2	18-37-44		81	@5':Sand (SP), poorly graded, very dense, gray, moist, medium to coarse grained	10	126		
1416	10		C-3	17-32-34		66	@10':Sand (SP), variety of color, moist, very dense, medium to coarse grained	9	95		DS: P=Peak / Ult=Ultimate $\phi = 34^0$, c =250 psf (P) $\phi = 33^0$, c = 200 psf (Ult)
1411	15		S-1	14-28-33		61	@15': Sand (SP), hard to drill, slightly moist, dark gray	5	-		
1406	20		S-2	15-34-39		73	@20': Same as above	5	-		
1401	25		S-3	19-31-37		68	@25': Same as above	5	-		
1396	30		S-4	14-19-27		46	@ 30': Same as above	4	-		
1391	35		S-5	11-18-26		44	@ 35': Sand(SP), poorly graded, dark gray, moist, dense, medium to coarse grained	11	-		
1386	40		S-6	20-27-39		66	@40': Sand(SP), poorly graded, dark gray, slightly moist, very dense, medium to coarse grained	3	-		
1381	45										

Project :	**Travel Plaza - Perris**	**LOG OF TEST HOLE**	Borehole No. B-2
Project Location :	**Corner of Trumble Road and Ethanac, Perris, California**		Plate No. I-2b
Project Number :	**G-5908-01**		Page 2 of 2

Date(s) Drilled :	May 24, 2021	Logged By :	BA/AB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	51.5
Drill Rig Type :	B-61	Drilling Contractor :	Whitecomb Drilling	Approx. Surface Elevation, feet :	1426 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location;		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
1381	45		S-7	21-29-48		77	@45': Sand (SP), poorly graded, dark gray, slightly moist, very dense, coarse grained	4	-		
1376	50		S-8	24-30-61		91	@ 50':Same as above,	3	-		
1371	55						End of Boring = 51.5 feet No groundwater encountered No Caving Backfilled w/Cuttings				
1366	15										
1361	20										
1356	25										
1351	30										
1346	35										
1341	40										
1336	45										

Geotechnical Solutions, Inc.

Project :	**Travel Plaza - Perris**	**LOG OF TEST HOLE**	Borehole No. B-3
Project Location :	**Corner of Trumble Road and Ethanac, Perris, California**		Plate No. I-3
Project Number :	**G-5908-01**		Page 1 of 1

Date(s) Drilled :	May 24, 2021	Logged By :	BA/AB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	16.5
Drill Rig Type :	B-61	Drilling Contractor :	Whitecomb Drilling	Approx. Surface Elevation, feet :	1426 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location;		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
1426	0		Bag #1				**Bareground** Older Alluvium: Silty Sand/ Sand (SM/SP), dark brown, dry				
	2		C-1	50/6"		100	@2': Sand (SP), silty, dark brown, slightly moist, very dense fine to coarse grained	6	127		
1421	5		C-2	20-50/6"		100	@5':Sand (SP), poorly graded, very dense, dark brown, moist, medium to coarse grained	7	122		
1416	10		C-3	8-10-33		43	@10':Same as above, slightly moist	3	-		
1411	15		S-1	10-20-40		60	@10':Same as above	3	-		
1406	20						End of Boring = 16.5 feet No groundwater encountered No Caving Backfilled w/Cuttings				
1401	25										
1396	30										
1391	35										
1386	40										
1381	45										

Geotechnical Solutions, Inc.

Project :	Travel Plaza - Perris	LOG OF TEST HOLE	Borehole No. B-4
Project Location :	Corner of Trumble Road and Ethanac, Perris, California		Plate No. I-4
Project Number :	G-5908-01		Page 1 of 1

Date(s) Drilled :	May 24, 2021	Logged By :	BA/AB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	21.5
Drill Rig Type :	B-61	Drilling Contractor :	Whitecomb Drilling	Approx. Surface Elevation, feet :	1426 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location;		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
1426	0						**Bareground**				
			Bag #1				Older Alluvium: Silty Sand (SM), light brown, dry				
	2		C-1	28-50/6"		100	@2': Sand (SP), Silty, light brown, slightly moist, very dense	8	117		
1421	5		C-2	9-13-16		29	@5':Silty Sand (SM), medium dense, brown, moist, medium to coarse grained	6	113		
1416	10		C-3	10-12-18		30	@10':Silty Sand/Sand (SM/SP), dark brown, moist, medium dense, medium to coarse grained	3	103		
1411	15		S-1	16-26-39		65	@15': Sand (SP), dark brown, slightly moist, very dense, coarse grained	3	-		
1406	20		S-2	20-27-43		70	@20': Same as above	3	-		
1401	25										
1396	30										
1391	35										
1386	40										
1381	45										

Geotechnical Solutions, Inc.

Project :	**Travel Plaza - Perris**	**LOG OF TEST HOLE**	Borehole No. B-5
Project Location :	**Corner of Trumble Road and Ethanac, Perris, California**		Plate No. I-5
Project Number :	**G-5908-01**		Page 1 of 1

Date(s) Drilled :	May 24, 2021	Logged By :	BA/AB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	21.5
Drill Rig Type :	B-61	Drilling Contractor :	Whitecomb Drilling	Approx. Surface Elevation, feet :	1426 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location;		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
1426	0						**covered with dry grass**				
			Bag #1				Older Alluvium: Silty Sand (SM), light brown, dry				
	2		C-1	51-50/1"		>100	@2': Sand (SP), trace Silt, light brown, slightly moist, very dense, medium to coarse grained	10	111		
1421	5		C-2	26-50/5"		>100	@5':Same as Above	11	103		
1416	10		C-3	37-50/4"		>100	@10':Same as above	8	119		
1411	15		S-1	29-36-44		80	@15': Sand (SP), dark brown, slightly moist, very dense, coarse grained	5	-		
1406	20		S-2	30-35-47		82	@20': Same as above	5	-		
1401	25										
1396	30										
1391	35										
1386	40										
1381	45										

Geotechnical Solutions, Inc.

Project :	**Travel Plaza - Perris**	**LOG OF TEST HOLE**	Borehole No. B-6
Project Location :	**Corner of Trumble Road and Ethanac, Perris, California**		Plate No. I-6
Project Number :	**G-5908-01**		Page 1 of 1

Date(s) Drilled :	May 24, 2021	Logged By :	BA/AB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	11.5
Drill Rig Type :	B-61	Drilling Contractor :	Whitecomb Drilling	Approx. Surface Elevation, feet :	1426 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location;		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
1426	0						**Dry grass**				
			Bag #1				Older Alluvium: Silty Sand / Sand (SM/SP), light brown, medium dense				
	2		C-1	26-50/4"		> 100	@2': Sand (SP), silty, light brown, slightly moist, very dense	6	123		
1421	5		C-2	28-50/5"		> 100	@5':Sand (SP), very dense, gray, moist, medium to coarse grained	8	129		DS: P=Peak / Ult=Ultimate $\phi = 33^0$, c =250 psf (P) $\phi = 32^0$, c = 200 psf (Ult)
1416	10		S-1	15-25-30		55	@10':Sand/Silty Sand (SP/SM), light gray, slightly moist, very dense, coarse grained	3	-		
1411	15						End of Boring = 11.5 feet No groundwater encountered No Caving but possible Backfilled w/Cuttings				
1406	20										
1401	25										
1396	30										
1391	35										
1386	40										
1381	45										

Geotechnical Solutions, Inc.

Project :	**Travel Plaza - Perris**	**LOG OF TEST HOLE**	Borehole No. B-7
Project Location :	**Corner of Trumble Road and Ethanac, Perris, California**		Plate No. I-7
Project Number :	**G-5908-01**		Page 1 of 1

Date(s) Drilled :	May 24, 2021	Logged By :	BA/AB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	21.5
Drill Rig Type :	B-61	Drilling Contractor :	Whitecomb Drilling	Approx. Surface Elevation, feet :	1426 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location;		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
1426	0						**covered with dry grass**				
			Bag #1				Older Alluvium: Clayey Sand (SC), light brown, dry			39	HD: 61 SA:17 SI: 22 CL
	2		C-1	50/4"		>100	@2': Clayey Sand (SC), trace Silt, light brown, very moist, very dense, medium to coarse grained	18	95		
1421	5		C-2	24-50/5"		>100	@5':Sand (SP), dark brown, very dense, moist, medium to coarse grained	6	127		
1416	10		C-3	18-24-32		56	@10':Sand with Silt (SP/SM), dense, brown, very moist,	14	114		
1411	15		S-1	15-18-18		36	@15': Sand (SP), dark brown, slightly moist, dense, coarse grained	5	-		
1406	20		S-2	20-20-23		43	@20': Same as above	4	-		
1401	25										
1396	30										
1391	35										
1386	40										
1381	45										

Geotechnical Solutions, Inc.

Project :	Travel Plaza - Perris	LOG OF TEST HOLE	Borehole No. B-8
Project Location :	Corner of Trumble Road and Ethanac, Perris, California		Plate No. I-8
Project Number :	G-5908-01		Page 1 of 1

Date(s) Drilled :	May 24, 2021	Logged By :	BA/AB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	11.5
Drill Rig Type :	B-61	Drilling Contractor :	Whitecomb Drilling	Approx. Surface Elevation, feet :	1426 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location;		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
1426	0						**Covered with dry weeds**				
			Bag #1				Older Alluvium: Clayey Sand (SC), light brown, dry			43	HD: 57 SA:21 SI: 22 CL
	2		C-1	22-50/6"		> 100	@2': Sand (SP), silty, light brown, slightly moist, very dense	5	120		
1421	5		C-2	25-50/6"		> 100	@5':Sand (SP), poorly graded, very dense, gray, slightly moist, medium to coarse grained	4	118		
1416	10		S-1	15-21-26		47	@10':Sand/Silty Sand (SP/SM), light gray, slightly moist, dense	3	-		
1411	15						End of Boring = 11.5 feet No groundwater encountered No Caving but possible Backfilled w/Cuttings				
1406	20										
1401	25										
1396	30										
1391	35										
1386	40										
1381	45										

Geotechnical Solutions, Inc.

Project :	**Travel Plaza - Perris**	**LOG OF TEST HOLE**	Borehole No. B-9
Project Location :	**Corner of Trumble Road and Ethanac, Perris, California**		Plate No. I-9
Project Number :	**G-5908-01**		Page 1 of 1

Date(s) Drilled :	May 24, 2021	Logged By :	BA/AB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	11.5
Drill Rig Type :	B-61	Drilling Contractor :	Whitecomb Drilling	Approx. Surface Elevation, feet :	1426 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location;		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
1426	0						**Covered with dry weeds**				
			Bag #1				Older Alluvium: Clayey Sand (SC), light brown, dry			32	HD: 68 SA :12 SI : 20 CL
	2		C-1	24-50/6"		> 100	@2': Sand (SP), silty, light brown, slightly moist, very dense	4	118		
1421	5		C-2	27-50/6"		> 100	@5':Sand (SP), poorly graded, very dense, gray, slightly moist, medium to coarse grained	3	116		
1416	10		S-1	15-18-21		39	@10':Sand/Silty Sand (SP/SM), light gray, slightly moist, dense	3	-		
1411	15						End of Boring = 11.5 feet No groundwater encountered No Caving but possible Backfilled w/Cuttings				
1406	20										
1401	25										
1396	30										
1391	35										
1386	40										
1381	45										

Geotechnical Solutions, Inc.

Project :	Travel Plaza - Perris	LOG OF TEST HOLE	Borehole No. B-10
Project Location :	Corner of Trumble Road and Ethanac, Perris, California		Plate No. I-10
Project Number :	G-5908-01		Page 1 of 1

Date(s) Drilled :	May 24, 2021	Logged By :	BA/AB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	11.5
Drill Rig Type :	B-61	Drilling Contractor :	Whitecomb Drilling	Approx. Surface Elevation, feet :	1426 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location;		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
1426	0						**Covered with dry weeds**				
			Bag #1				Older Alluvium: Clayey Sand (SC), light brown, dry				
	2		C-1	30-50/6"		100	@2': Sand (SP), silty, light brown, slightly moist, very dense	7	121		
1421	5		C-2	29-50/6"		100	@5':Sand (SP), poorly graded, very dense, gray, slightly moist, medium to coarse grained	6	120		
1416	10		S-1	165-19-23		42	@10':Sand/Silty Sand (SP/SM), light gray, slightly moist, dense	4	-		
1411	15						End of Boring = 11.5 feet No groundwater encountered No Caving but possible Backfilled w/Cuttings				
1406	20										
1401	25										
1396	30										
1391	35										
1386	40										
1381	45										

Geotechnical Solutions, Inc.

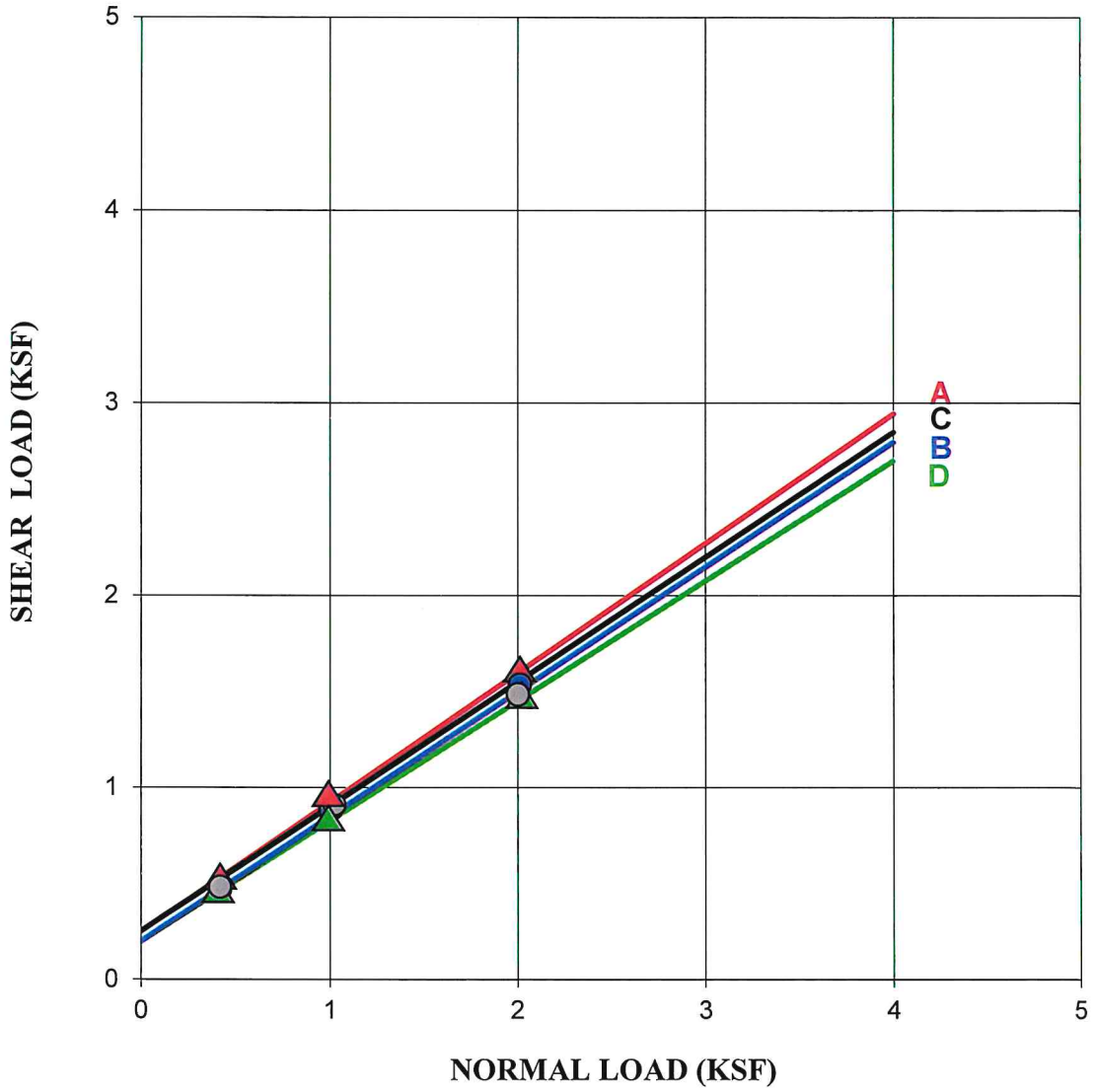
Project :	Travel Plaza - Perris	LOG OF TEST HOLE	Borehole No. B-11
Project Location :	Corner of Trumble Road and Ethanac, Perris, California		Plate No. I-11
Project Number :	G-5908-01		Page 1 of 1

Date(s) Drilled :	May 24, 2021	Logged By :	BA/AB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	10
Drill Rig Type :	B-61	Drilling Contractor :	Whitecomb Drilling	Approx. Surface Elevation, feet :	1426 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location;		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
1426	0						**Covered with dry grass**				
	2						Older Alluvium: Clayey Sand (SC), light brown, dry				
			C-1	32-50/6"		100	@2': Sand (SP), silty, light brown, slightly moist, very dense	6	122		
1421	5										
			C-2	31-50/6"		100	@5':Sand (SP), poorly graded, very dense, gray, slightly moist, medium to coarse grained	5	121		
1416	10						@10': Same as above			10	HD: 90(SA) : 8(SI) : 2(CL)
							End of Boring = 10 feet 2" of Gravel on Bottom Drilled to 10 feet for Percolation Test Backfilled w/ cuttings after the Test				
1411	15										
1406	20										
1401	25										
1396	30										
1391	35										
1386	40										
1381	45										

Geotechnical Solutions, Inc.

DIRECT SHEAR

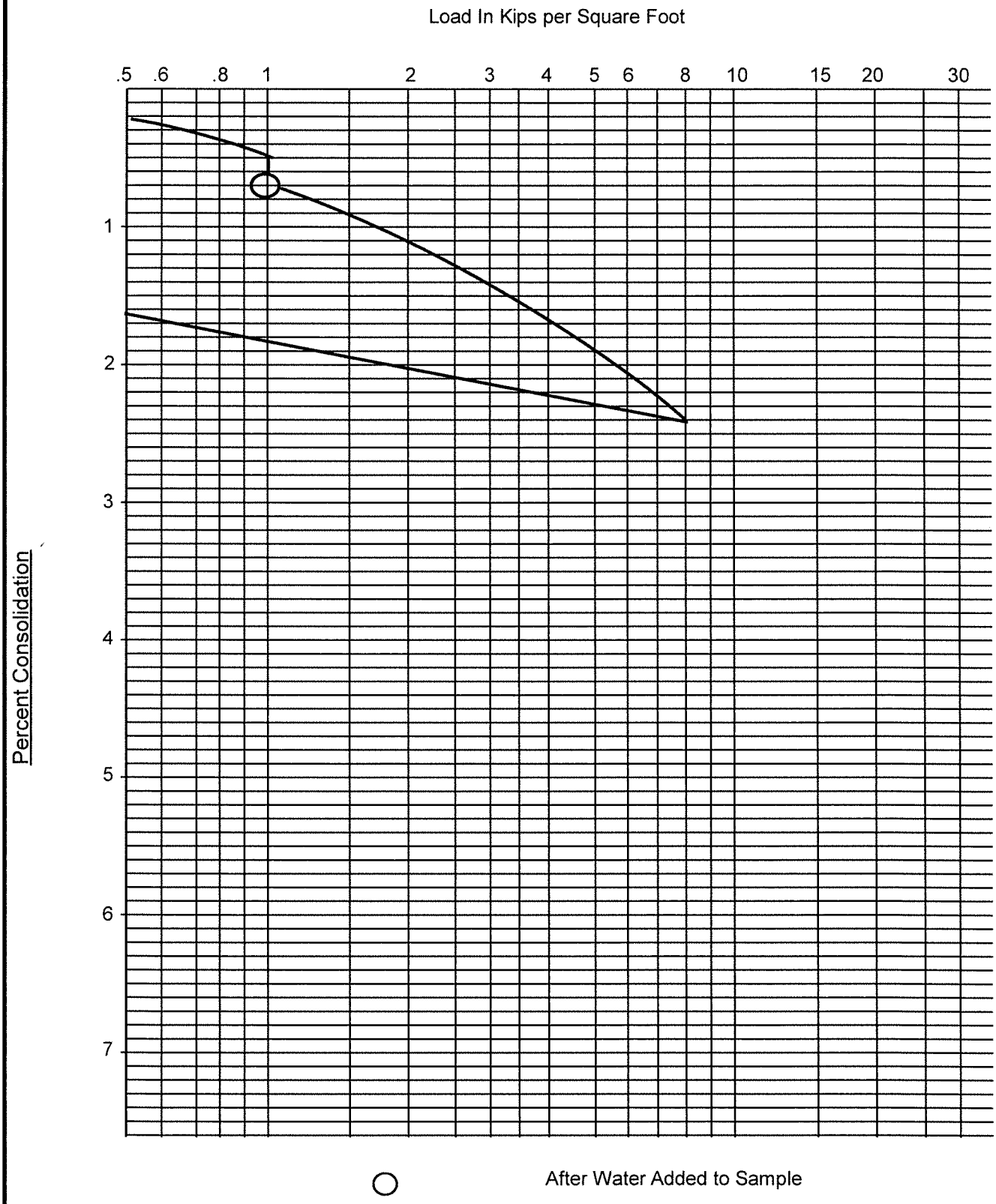


SYMBOL	LOCATION	DEPTH (FT)	TEST CONDITION		COHESION (PSF)	FRICTION (DEG)
A	B-2	10'	Saturated - Drained	Peak	250	34
B	B-2	10'	Saturated - Drained	Ultimate	200	33
C	B-6	5'	Saturated - Drained	Peak	250	33
D	B-6	5'	Saturated - Drained	Ultimate	200	32

Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	J

Geotechnical Solutions, Inc.

CONSOLIDATION

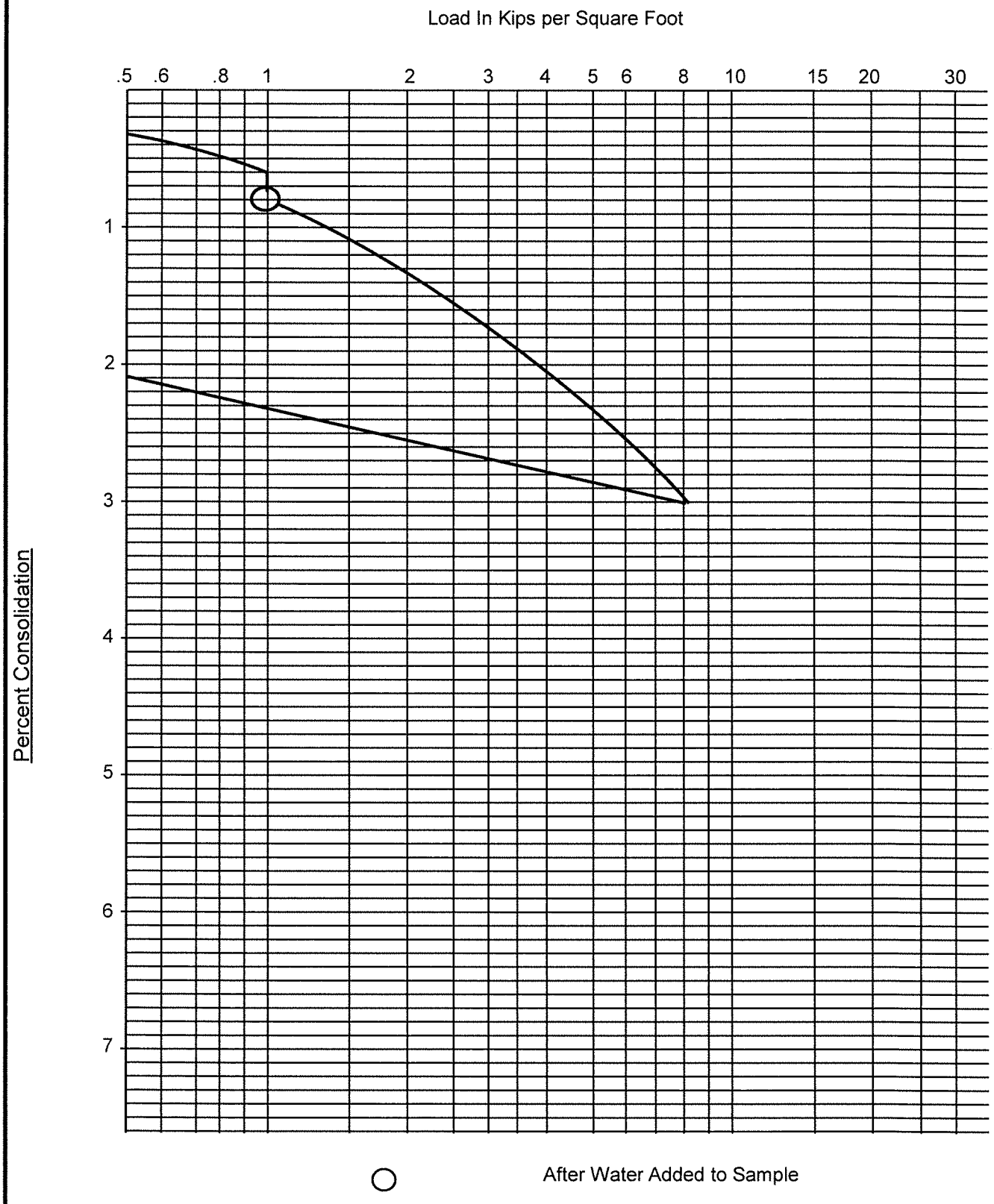


B-2 @ 10'

Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	K

Geotechnical Solutions, Inc.

CONSOLIDATION



B-6 @ 5'

Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	L

Geotechnical Solutions, Inc.

Appendix B

Seismic Data

- Table 1 - Faults Table
- Unified Hazard Tool – Hazard Curve
- U.S. Seismic Design Maps Summary & Detailed Report (SEAOC / OSHPD)

Table - 1
2008 National Seismic Hazard Maps - Source Parameters
Travel Plaza - Perris

Distance in Miles	Name	State	Pref Slip Rate (mm/yr)	Dip (degrees)	Dip Dir	Slip Sense	Rupture Top (km)	Rupture Bottom (km)	Length (km)
9.56	Elsinore;GI	CA	5	90	V	strike slip	0	13	37
9.56	Elsinore;W+GI	CA	n/a	81	NE	strike slip	0	14	83
10.22	San Jacinto;A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	178
10.22	San Jacinto;A+CC+B	CA	n/a	90	V	strike slip	0.1	15	152
10.22	San Jacinto;A+C	CA	n/a	90	V	strike slip	0	17	118
10.22	San Jacinto;A	CA	9	90	V	strike slip	0	17	71
10.22	San Jacinto;A+CC	CA	n/a	90	V	strike slip	0	16	118
10.37	Elsinore;GI+T+J+CM	CA	n/a	86	NE	strike slip	0	16	195
10.37	Elsinore;W+GI+T+J+CM	CA	n/a	84	NE	strike slip	0	16	241
10.37	Elsinore;GI+T	CA	5	90	V	strike slip	0	14	78
10.37	Elsinore;W+GI+T+J	CA	n/a	84	NE	strike slip	0	16	199
10.37	Elsinore;W+GI+T	CA	n/a	84	NE	strike slip	0	14	124
10.37	Elsinore;GI+T+J	CA	n/a	86	NE	strike slip	0	17	153
10.63	Elsinore;T+J	CA	n/a	86	NE	strike slip	0	17	127
10.63	Elsinore;T+J+CM	CA	n/a	85	NE	strike slip	0	16	169
10.63	Elsinore;T	CA	5	90	V	strike slip	0	14	52
11.45	San Jacinto;SBV+SJV+A+CC	CA	n/a	90	V	strike slip	0	16	181
11.45	San Jacinto;SBV+SJV+A+C	CA	n/a	90	V	strike slip	0	17	181
11.45	San Jacinto;SBV+SJV+A	CA	n/a	90	V	strike slip	0	16	134
11.45	San Jacinto;SJV+A+CC	CA	n/a	90	V	strike slip	0	16	136
11.45	San Jacinto;SJV+A+C	CA	n/a	90	V	strike slip	0	17	136
11.45	San Jacinto;SJV+A	CA	n/a	90	V	strike slip	0	17	89
11.45	San Jacinto;SBV+SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	241
11.45	San Jacinto;SBV+SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	215
11.45	San Jacinto;SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	196

11.45	San Jacinto;SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	170
12.01	San Jacinto;SJV	CA	18	90	V	strike slip	0	16	43
12.01	San Jacinto;SBV+SJV	CA	n/a	90	V	strike slip	0	16	88
19.04	San Jacinto;SBV	CA	6	90	V	strike slip	0	16	45
22.54	Chino, alt 2	CA	1	65	SW	strike slip	0	14	29
23.98	Elsinore;W	CA	2.5	75	NE	strike slip	0	14	46
24.79	S. San Andreas;NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	213
24.79	Chino, alt 1	CA	1	50	SW	strike slip	0	9	24
24.79	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	512
24.79	S. San Andreas;SSB+BG	CA	n/a	71		strike slip	0	13	101
24.79	S. San Andreas;NSB+SSB+BG+CO	CA	n/a	79		strike slip	0.2	12	206
24.79	S. San Andreas;CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	322
24.79	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	85		strike slip	0	14	380
24.79	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	449
24.79	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	384
24.79	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0	14	442
24.79	S. San Andreas;NM+SM+NSB+SSB+BG	CA	n/a	83		strike slip	0	14	271
24.79	S. San Andreas;NM+SM+NSB+SSB+BG+CO	CA	n/a	84		strike slip	0.1	13	340
24.79	S. San Andreas;NSB+SSB	CA	n/a	90	V	strike slip	0	13	79
24.79	S. San Andreas;NSB+SSB+BG	CA	n/a	75		strike slip	0	14	136

24.79	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0.1	13	421
24.79	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0.1	13	479
24.79	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	548
24.79	S. San Andreas;SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	176
24.79	S. San Andreas;SM+NSB+SSB+BG	CA	n/a	81		strike slip	0	13	234
24.79	S. San Andreas;SM+NSB+SSB+BG+CO	CA	n/a	83		strike slip	0.1	13	303
24.79	S. San Andreas;SSB	CA	16	90	V	strike slip	0	13	43
24.79	S. San Andreas;SSB+BG+CO	CA	n/a	77		strike slip	0.2	12	170
24.79	S. San Andreas;BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	263
24.79	S. San Andreas;BB+NM+SM+NSB+SSB+BG	CA	n/a	84		strike slip	0	14	321
24.79	S. San Andreas;BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	85		strike slip	0.1	13	390
26.4	S. San Andreas;BG+CO	CA	n/a	72		strike slip	0.3	12	125
26.4	S. San Andreas;BG	CA	n/a	58		strike slip	0	13	56
28.06	S. San Andreas;BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	220
28.06	S. San Andreas;CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	279
28.06	S. San Andreas;NSB	CA	22	90	V	strike slip	0	13	35
28.06	S. San Andreas;SM+NSB	CA	n/a	90	V	strike slip	0	13	133
28.06	S. San Andreas;CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	341
28.06	S. San Andreas;NM+SM+NSB	CA	n/a	90	V	strike slip	0	13	170

28.06	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0.1	13	377
29.62	Elsinore;J	CA	3	84	NE	strike slip	0	19	75
29.62	Elsinore;J+CM	CA	3	84	NE	strike slip	0	17	118
29.9	San Joaquin Hills	CA	0.5	23	SW	thrust	2	13	27
33.36	Cucamonga	CA	5	45	N	thrust	0	8	28
34.27	Pinto Mtn	CA	2.5	90	V	strike slip	0	16	74
36.79	Cleghorn	CA	3	90	V	strike slip	0	16	25
37.33	Newport-Inglewood (Offshore)	CA	1.5	90	V	strike slip	0	10	66
37.33	Newport Inglewood Connected alt 1	CA	1.3	89		strike slip	0	11	208
37.33	Newport Inglewood Connected alt 2	CA	1.3	90	V	strike slip	0	11	208
38.59	San Jose	CA	0.5	74	NW	strike slip	0	15	20
39.78	North Frontal (West)	CA	1	49	S	reverse	0	16	50
40.6	Puente Hills (Coyote Hills)	CA	0.7	26	N	thrust	2.8	15	17
41.18	Sierra Madre	CA	2	53	N	reverse	0	14	57
41.18	Sierra Madre Connected	CA	2	51		reverse	0	14	76
41.65	San Jacinto;CC+B	CA	n/a	90	V	strike slip	0.2	14	77
41.65	San Jacinto;CC+B+SM	CA	n/a	90	V	strike slip	0.2	14	103
41.65	San Jacinto;CC	CA	4	90	V	strike slip	0	16	43
42.56	San Jacinto;C	CA	14	90	V	strike slip	0	17	47
44.04	Newport-Inglewood, alt 1	CA	1	88		strike slip	0	15	65
44.6	S. San Andreas;NM+SM	CA	n/a	90	V	strike slip	0	14	134
44.6	S. San Andreas;PK+CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0.1	13	342
44.6	S. San Andreas;BB+NM+SM	CA	n/a	90	V	strike slip	0	14	184
44.6	S. San Andreas;CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	306
44.6	S. San Andreas;SM	CA	29	90	V	strike slip	0	13	98
44.6	S. San Andreas;CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	243
44.97	Rose Canyon	CA	1.5	90	V	strike slip	0	8	70
45.34	Helendale-So Lockhart	CA	0.6	90	V	strike slip	0	13	114
46.48	North Frontal (East)	CA	0.5	41	S	thrust	0	16	27

47.6	Burnt Mtn	CA	0.6	67	W	strike slip	0	16	21
49.55	Puente Hills (Santa Fe Springs)	CA	0.7	29	N	thrust	2.8	15	11

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

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

Input

Edition

Conterminous U.S. 2008 (v3.2.x)

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

33.7441

Time Horizon

Return period in years

475 Travel Plaza Perris

Longitude

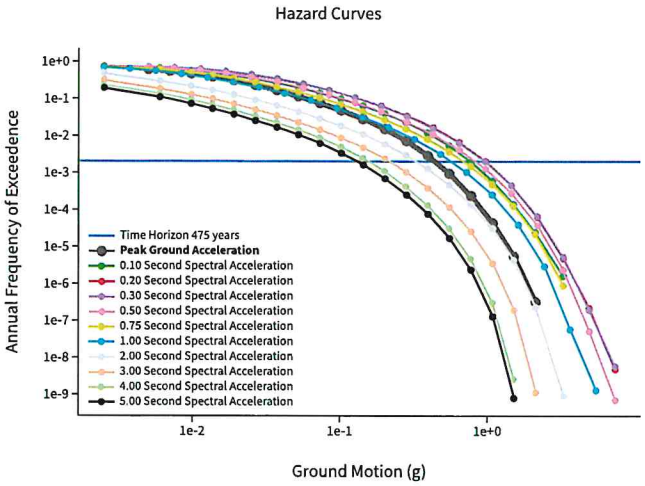
Decimal degrees, negative values for western longitudes

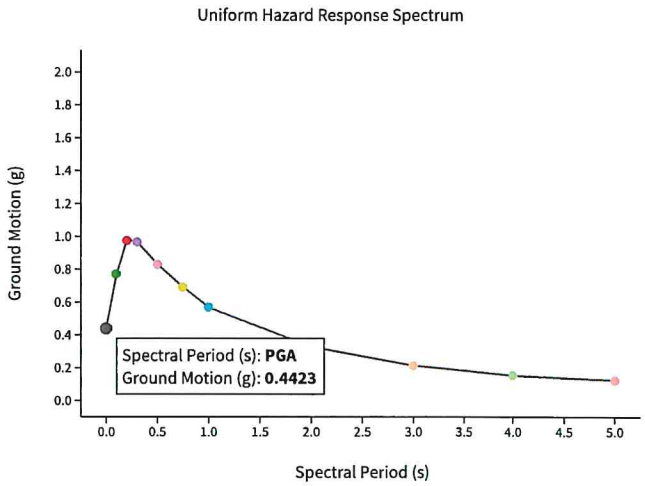
-117.1868

Site Class

259 m/s (Site class D)

Hazard Curve





View Raw Data

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

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

Input

Edition

Conterminous U.S. 2008 (v3.2.x)

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

33.7441

Time Horizon

Return period in years

975 Travel Plaza Perris

Longitude

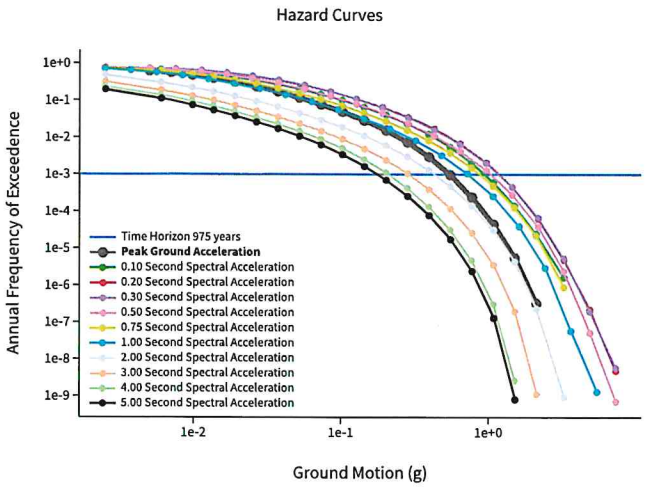
Decimal degrees, negative values for western longitudes

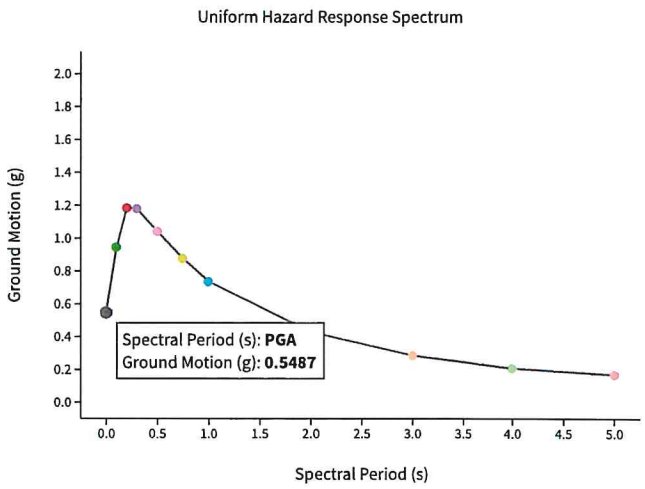
-117.1868

Site Class

259 m/s (Site class D)

Hazard Curve





View Raw Data

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

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

Input

Edition

Conterminous U.S. 2008 (v3.2.x)

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

33.7441

Time Horizon

Return period in years

2475 Travel Plaza Perris

Longitude

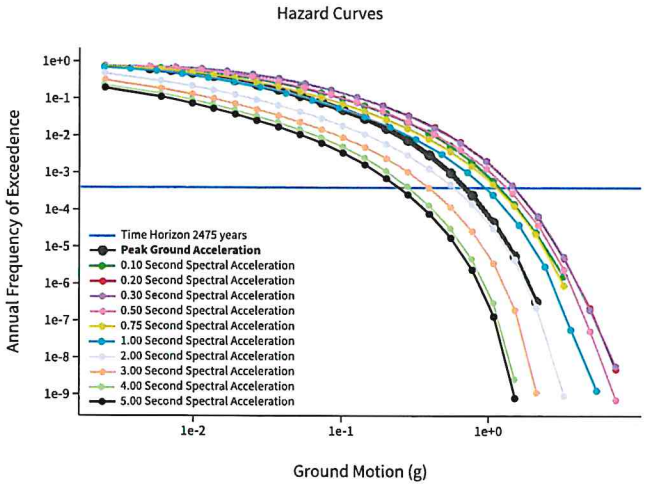
Decimal degrees, negative values for western longitudes

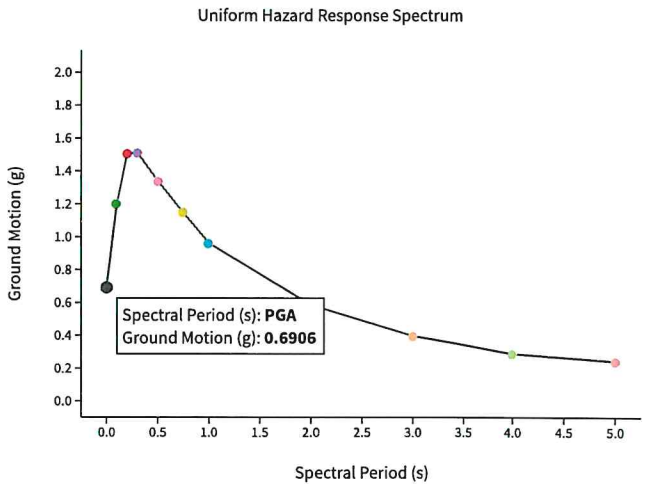
-117.1868

Site Class

259 m/s (Site class D)

Hazard Curve

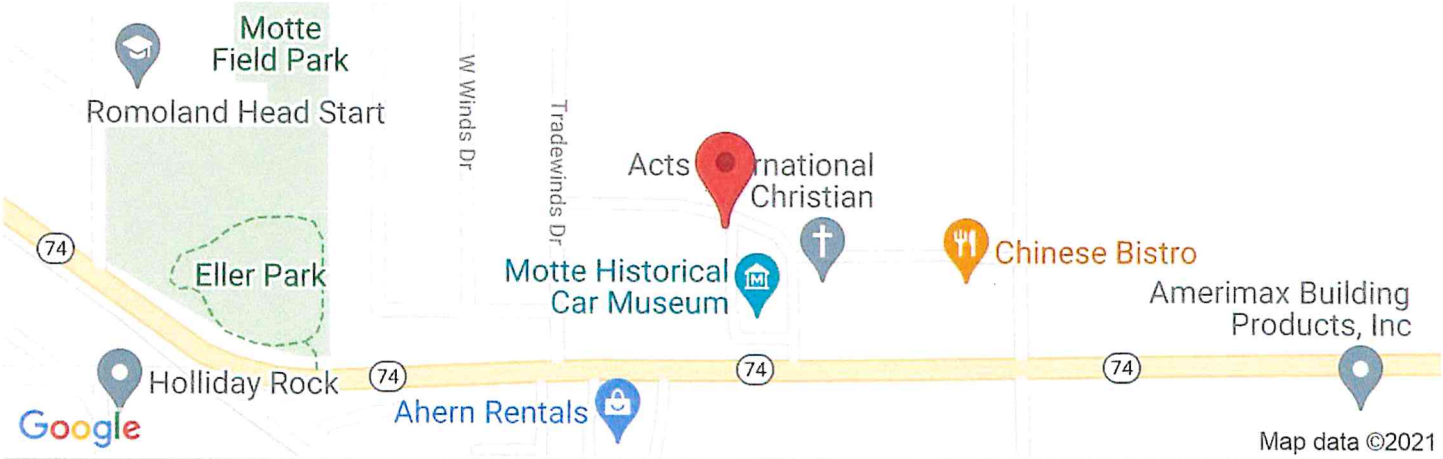




View Raw Data

Travel Plaza Perris

Latitude, Longitude: 33.7441, -117.1658



Date	5/28/2021, 10:30:36 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	1.428	MCE_R ground motion. (for 0.2 second period)
S_1	0.532	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.714	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.143	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	8	Long-period transition period in seconds
SsRT	1.428	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.531	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.532	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.581	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)
C_{RS}	0.933	Mapped value of the risk coefficient at short periods
C_{R1}	0.915	Mapped value of the risk coefficient at a period of 1 s

DISCLAIMER

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

Appendix C

Recommended Earthwork Specifications

RECOMMENDED EARTHWORK SPECIFICATIONS

1.0 General

1.1 Description

1.1.1 These specifications cover preparation of the subject site to receive fills, the type of soils suitable for use in fills, the compaction standards, and the methods of testing compacted fills.

1.1.2 The Contractor shall furnish all labor, supervision, equipment, operations, and materials to excavate to the required grade, support existing underground facilities, stockpile material, compact fill and backfill, and fine grade. The work of the Contractor shall include all clearing and grubbing, removing existing unsatisfactory material, preparing areas to be filled, spreading and compacting of fill in the areas to be filled and all other work necessary to complete the grading of the filled areas. It shall be the Contractor's responsibility to place, spread, moisten or dry, and compact the fill in strict accordance with these specifications to the lines and grades indicated on project plans or as directed in writing by the Civil Engineer.

1.1.3 Deviations from these specifications will be permitted only upon written authorization from the Owner or his representative.

1.2 Role of the Geotechnical Engineer

1.2.1 Construction - The Owner will employ a Geotechnical Consultant to observe and test this work as it is being performed. The Contractor shall cooperate with the Geotechnical Consultant and allow his unrestricted access to the site as required for the performance of his duties.

The Contractor shall provide a minimum notice of 48 hours to the Geotechnical Engineer before beginning or restarting earthwork operations that will require the presence of the Geotechnical Engineer or his representative on site.

1.2.2 Subsurface Investigations - A geotechnical engineering report for design purposes was prepared by Geotechnical Solutions, Inc., Irvine, California. Any recommendations made in the geotechnical report or subsequent reports are made part of these specifications. These reports are available for review upon request to the Owner.

1.2.3 Observation and Testing - The Geotechnical Engineer's representative shall observe the clearing and grubbing, excavation, filling and compacting operations and shall take density tests in the fill material so that he can state his opinion as to whether or not the fill was constructed in accordance with the specifications. All fill will be tested shortly after its placement to ascertain that the required compaction is achieved. A minimum of one density test will be made on each 500 cubic yards of fill placed, with a minimum of at least one test per every 2 feet of vertical height of fill. If the surface is disturbed, the density tests shall be made in the compacted materials below the disturbed zone. When these tests indicate that the density or water content of any layer of fill or portion thereof does not meet the specified density or water content, the particular layer or portions thereof shall be reworked until the specified density and water content have been obtained.

After the completion of grading, the Geotechnical Engineer will prepare a written opinion of grading. Neither the testing performed by the Geotechnical Consultant nor his opinion as to whether or not the fill was constructed in accordance with these Specifications shall relieve the Contractor of his responsibility to construct the fills in accordance with the Contract Documents.

1.3 Reference Standards

The following ASTM (American Society for Testing and Materials) codes and standards shall be used to the extent indicated by references herein. The most recent revision of the standards shall be used.

D 1556 - "Standard Test Method for Density of Soil in Place by the Sand-Cone Method"

D1557 - "Standard Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb (4.54 kg) and 18-inch (457-mm) Drop"

D2216 - "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures"

D4318 - "Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils"

D4718 - "Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles"

D4829 - "Standard Test Method for Expansion Index of Soils"

D4944 - "Standard Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester Method."

D5195 - "Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)"

D6938 - "Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)"

D7928 - "Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis"

1.4 Degree of Fill Compaction

The degree to which fill is to be compacted is expressed in terms of "relative compaction." Relative compaction is defined as the ratio; expressed in percent, of the in-place dry density of the compacted fill to the reference maximum dry density. The reference maximum dry density shall be obtained following ASTM D1557. Optimum water content shall be obtained in the same test used to obtain the reference maximum dry density. Correction of the maximum dry density and optimum water content for

oversize particles of gravel and cobbles shall be made following ASTM D4718 when, in the opinion of the Geotechnical Engineer, such correction is appropriate. The in-place density shall be obtained following ASTM D1556 (sand cone method) or ASTM D6938 (nuclear method-shallow depth) test method. The in-place water content shall be obtained following ASTM D4944 (calcium carbide gas pressure meter), ASTM D5195 (nuclear method-shallow depth), or ASTM D2216 (oven drying). Correction of the in-place density and water content for oversize particles of gravel and cobbles shall be made following ASTM D4718 when, in the opinion of the Geotechnical Engineer, such correction is appropriate.

If any of the test methods specified in this section are judged by the Geotechnical Engineer to be impractical or unreliable because the material has a coarse particle size distribution, or for other reasons, the Geotechnical Engineer shall establish other procedures to obtain the required soil characteristics.

2.0 Products

2.1 Materials

2.1.1 General - During grading operations, soil types other than those identified in the geotechnical investigation report may be encountered by the Contractor. Consult the Geotechnical Consultant for his evaluation of the suitability of using these soils a fill material prior to placement or disposal.

2.1.2 General Fill - Materials for compacted fill shall consist of material imported from outside the site or excavated from the site that, in the opinion of the Geotechnical Engineer, is suitable for use in constructing engineered fills. The material shall not contain rocks or hard lumps greater than 6 inches in maximum dimension, and at least 70 percent (by weight) of its particles shall pass through a U.S. Standard 3/8 inch sieve. Material greater than 3 inches, but less than 6 inches in maximum dimension, shall be placed by the Contractor so that it is completely surrounded by compacted, finer material;

no nesting of rocks shall be permitted. Do not use any perishable, spongy, hazardous, or other undesirable materials as fill.

2.1.3 Select Fill - Select fill shall meet all criteria for general fill but shall also contain no rocks or hard lumps greater than 3 inches in maximum dimension, and at least 80 percent (by weight) shall pass through a U.S. Standard 3/8-inch sieve. The expansion index of select material shall be less than 50 (i.e., 5.0 percent swell) when tested in accordance with ASTM D4829.

3.0 Execution

3.1 Clearing and Grubbing

Within the project limits, tile Contractor shall demolish structures as specified on the Drawings.

Unless otherwise indicated on the Drawings or by the Owner in writing, the Contractor shall clear and grub all trees, stumps, roots, brush, grass, and other vegetation within construction, fill and stockpile areas to a minimum depth of 3 feet below the existing ground surface or below finished grade, whichever is deeper, unless otherwise recommended by the Geotechnical Engineer's Field Representative.

Remove cleared and grubbed materials from the site and dispose of them legally. No onsite burning or burying of cleared and grubbed materials is permitted. No placement of cleared and grubbed materials in topsoil stockpiles is permitted. No mulching of branches or roots is permitted. Incorporating vegetative matter into stockpiled materials, which are to be used in fill, is not permitted.

Stockpile organic-laden topsoil separate from other fill materials.

Remove any remaining vegetative matter from the deeper excavated soils, which may result from roots deeper than those encountered during clearing and grubbing operations.

All material thereby removed shall be piled at a location away from the immediate work area so as to avoid burying of piled material.

3.2 Compacted Fills

3.2.1 Preparing Areas to be Filled - Brush, grass, and other objectionable materials shall be collected, piled, and disposed of as indicated in Section 3.1 by the Contractor so as to leave the areas that have been cleared with a neat and finished appearance, free from unsightly debris.

Remove all loose soil, uncertified fill, landslide debris, and weathered bedrock to firm material or in-situ bedrock, as approved by the Geotechnical Consultant. The Contractor shall obtain approval from the Geotechnical Engineer or his representative of stripping and site preparation before the compaction of any fill subgrade begins. The surface shall then be scarified to a minimum depth of 6 inches until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment used, and shall be brought to the specified water content and relative compaction. Compact scarified materials to a minimum relative compaction of 90 percent, relative to ASTM D1557, prior to placement of any fill material.

3.2.2 Placing, Spreading, and Compacting, Fill Material - Onsite soil obtained from removals, borrow, or cut areas may be reused as compacted fill provided it is free from deleterious debris and meets the other requirements of the "Materials" portion of this Specification Section.

Use of soil containing deleterious debris from the clearing and grubbing operation or from other sources is not permitted. The fill materials shall be placed by the Contractor in horizontal layers not greater than 8 inches thick, measured before compaction. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to obtain uniformity of material and moisture in each layer. The moisture content of material used for compacted fill should be adjusted to be at or above optimum water content as determined by ASTM D1557. When the water content of the fill material is too high, the

fill materials shall be aerated by the Contractor by blading, mixing, or other satisfactory methods until the water content is as specified.

After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent of the maximum dry density as determined by ASTM D1557 for general fill, and 95 percent of the maximum dry density as determined by ASTM D1557 for select fill, compacted fill pads, and the upper 1 foot of pavement subgrade. Compaction shall be accomplished by: sheepsfoot rollers; vibratory rollers; multiple-wheel, pneumatic-tired rollers; or other types of acceptable compacting equipment. Equipment shall be of such design that it is able to compact the fill to the specified density. Compaction shall be continuous over the entire area, and the equipment shall make sufficient passes to obtain the desired density uniformly. All fill placed on site shall be treated in like manner until finished grades are attained. Jetting, puddling, and hydro consolidation techniques shall not be used, including backfill of utility trenches.

The placement of topsoil is subject to the approval of the Geotechnical Engineer. Topsoil shall not be placed beneath concrete flatwork, beneath or behind retaining walls, or within structural fill. All topsoil material is subject to the same moisture conditioning, placement, and compaction requirements as General Fill. Roots, branches and other organic debris are not permitted within the compacted topsoil layer.

When backfilling around footings and compacting behind retaining walls and flexible retaining structures, the Contractor shall use lightweight compaction equipment such as hand-operated equipment, shoring, or other means to avoid over-stressing structural walls. When using lightweight compaction equipment, the fill materials shall be spread in horizontal layers not greater than 6 inches thick, measured before compaction.

As an alternative, sand-cement slurry may be used to backfill trenches. The slurry shall have minimum cement content of 3 sacks per cubic yard within the zone of influence of foundations and other settlement sensitive structures. A minimum of 2 sacks per cubic

yard of slurry shall be used elsewhere within building limits, and a minimum of one sack per cubic yard of slurry shall be used elsewhere. Slurry shall not be used in those areas where such placement would result in the obstruction of water flow, and is subject to the approval of the Geotechnical Engineer.

3.3 Protection of Work and Adjacent Properties

3.3.1 During Construction - The Contractor shall grade all excavated surfaces to provide good drainage away from construction slopes and prevent ponding of water. He shall control surface water and the transport of silt and sediment to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control measures have been installed.

Dispose of all water resulting from dewatering operations legally and in ways that will not cause damage to public or private property, or constitute a nuisance or menace to the public, in accordance with municipal requirements.

The Contractor shall make every effort to minimize the amount of dust raised in excavating, on haul roads and access roads, and all other work areas in the course of construction activities.

Protect benchmarks, monuments, and other reference points against displacement or damage. Repair or replace benchmarks, monuments, and other permanent survey data that become displaced or damaged due to the performance of this work.

3.3.2 After Completion - After earthwork is completed and the, Geotechnical Engineer has finished his observations of the work, no further excavation, filling or backfilling shall be performed except under the observation of the Geotechnical Engineer.

GEOTECHNICAL ENGINEERING
PERCOLATION / INFILTRATION
TEST REPORT

TRAVEL PLAZA
PERRIS

AT

CORNER OF TRUMBLE ROAD &
ETHANAC ROAD
PERRIS, CALIFORNIA

PREPARED FOR:

BROADBENT, INC.
8 WEST PACIFIC AVENUE
HENDERSON, NEVADA 89015

PROJECT NO: G-5908-08

JUNE 11, 2021

GEOTECHNICAL SOLUTIONS, INC.
GEOTECHNICAL & ENVIRONMENTAL
ENGINEERING

Geotechnical Solutions, Inc.
Geotechnical, Structural & Environmental Engineering

AASHTO ACCREDITED

June 11, 2021

Project: G-5908-08

BROADBENT, INC.
8 West Pacific Avenue
Henderson, Nevada 89015

Attention: **Mr. Mark E. Kazelskis, PG, CHG, CEM**
Principal Geologist

Via Email: **mkazelski@broadbentinc.com**

Re: **Geotechnical Engineering Percolation / Infiltration Report**
Travel Plaza - Perris
Corner of Trumble Road & Ethanac Road
Perris, California 92570

Gentlemen:

Per your authorization, we have performed our geotechnical engineering field percolation tests to evaluate the subgrade percolation and infiltration rate at the referenced Travel Plaza - Perris site located at the corner of Trumble Road and Ethanac Road, just west of Trumble Road, Perris, San Bernardino County, California. Proposed development consists of improving or incorporating Storm Water Permanent Best Management Practice (BMP).

The accompanying geotechnical engineering report presents the results of our field borings, sampling of subgrade material, field percolation tests, reviewing site plan, performing laboratory tests, analyzing field and laboratory data and our conclusions and recommendations for the project.

Our services were performed using the standard of care ordinarily exercised in this locality, at the time when the report was prepared.

The investigation was made in accordance with generally accepted geotechnical engineering principles and procedures and included such field and laboratory tests considered necessary in the circumstances.

In the opinion of the undersigned, the accompanying report has been substantiated by data, observations, analysis, and opinions and presents fairly the design information requested by you.

This completes our scope of services for the initial design phase of the project. We have appreciated this opportunity to be of service to you on this project.

Respectfully Submitted,

Geotechnical Solutions, Inc.

Dharma Shakya, PhD, PE, GE
Principal Geotechnical Engineer

Abraham S. Baha, PE, MASCE
Sr. Principal

Distribution: (3 +pdf) Addressee

TABLE OF CONTENTS

Introduction

Geotechnical Solutions, Inc. (GSI) has performed field investigations including borings and sampling of earth material and field percolation tests at the proposed locations as shown on Plot Plan & Percolation Tests Location Map (Plate B in Appendix A) at Travel Plaza, Perris, California.

The main purpose of this study is to provide infiltration rates of subgrade material based on field percolation tests so that an appropriate system incorporating Storm Water permanent best management practice (BMP) to manage surface water into the ground and the appropriate infiltration basin or any other approved system may be designed and existing drainage be improved.

Field Exploration

Field exploration consisted of drilling two borings for percolation tests, B-1 (PC-1) and B-2 (PC-2), 8-inches in diameter and extended to 10-feet below existing ground as shown on Plot Plan and Percolation Tests Location Map (Plate B).. The percolation test logs are presented on Plates D-1 and D-2 in Appendix A.

The attached logs tabulate data based on laboratory classification tests and visual observation by the field engineer at the site. During drilling bulk samples of earth material obtained for further laboratory test.

Groundwater

Groundwater was not encountered in any of our borings. Also, in accordance with the available groundwater well maps data, **http://wdl.water.ca.gov/water_data_library**, historical high groundwater level as shown on Plates C-1 and C-2 presented in Appendix A are much deeper than 50 feet. The potential for ground water to rise to the ground surface in the site area is considered very unlikely.

Laboratory Testing

Laboratory testing was programmed following a review of the field investigation data to be evaluated. Tests included physical testing to determine soil characteristics and selective tests. Test results are presented in Appendix A.

Mechanical Analysis (ASTM D-422)

Mechanical analyses by the hydrometer test method were performed to confirm field classifications. Test results are as follows:

Test Hole No.	Sample Depth (ft)	Sand Percent	Silt Percent	Clay Percent
B-1 (PC-1)	10.0	89	7	4
B-2 (PC-2)	10.0	90	8	2

Field Percolation Tests

We performed field percolation tests at B-1 (PC-1) and B-11 (PC-2) locations as shown on Plot Plan and Percolation Tests Location Map (Plate B). The percolation test procedure performed in accordance with the current acceptable method for shallow percolation test (less than 10 feet) by qualified personnel under the supervision of registered geotechnical engineer as per Technical Guidance Document, Orange County Public Works.

- Borehole diameter was 8 inches.
- Bottom elevation of test holes correspond to bottom elevation of proposed retention basins which are proposed at 10-feet in depth below the ground surface in accordance with the following locations:

B-1 (PC-1) 10 feet below the ground surface

B-11 (PC-2) 10 feet below the ground surface

- The bottom of the test hole was covered with 2 inches of gravel prior to testing.
- Sides of the hole were not smeared after drilling and there was no caving.
- Holes were filled with clear water to appropriate depths from the ground surface (Minimum required is 5 x radius of the hole (5 x 4" = 20 inches) from the bottom.
- On these two locations, two consecutive measurements showed that less than 6 inches of water seeped away in 25 minutes test (Pre-Percolation Data Sheets, Plates 1 and 3 in Appendix B). Thus, pre-soaking overnight for about 24 hours was required.
- The tests were then run the next day for an additional 6-hours duration, measurements being taken every 30 minutes interval (Percolation Test Results).
- The drop that occurs during the final reading is used to calculate the percolation and then infiltration rate.
- Field Percolation Tests for both PC-1 and PC-2 are presented as Plate 2 and 4 in Appendix B.
- Infiltration calculations (Porchet Method) are shown on Plates 5 and 6 and presented in Appendix C.
- Infiltration results using another method, Reduction Factor Method, Rf are presented on Plates 7 and 8 in Appendix D.
- Measurements were taken with a precision of 0.25 inches or better.
- All the field percolation tests are tabulated and are presented in Appendix B.
- The holes were backfilled with soil cuttings.

Percolation Rate Evaluation

To evaluate the percolation rates, testing was performed by filling the borehole with water and observing the rate of water drop from the fixed reference point on the ground surface. The depths of water drop for every 30 minutes intervals were noted and tabulated and plotted as shown on Plates 2 and 4, respectively for PC-1 and PC-2 in Appendix B.

Percolation rate, k can be correlated with the data in the form of the straight line equation as shown below:

$$t/R = b + kt$$

Where, t = average time in minutes

$R = \Delta t / d$

Δt = Time Interval, minutes

d = drop in inch = R1 – R2

R1 = Initial Readings, inch

R2 = Final Readings, inch

k = Percolation Rate inch/minute

R = 1/k at equilibrium rate

t/R is plotted against t as shown on the plots (Plates 2 and 6 for B-1 (PC-1) and B-11 (PC-2), respectively) and the regression analyses were performed to interpolate the data obtained in the field. Straight line interpolation gives the slope as a percolation rate, k.

Results of the Tests

The results obtained from the analyses are as follows:

1. Near surface material consisted of mainly Clayey to Silty Sand (SC/SM), dry to slightly moist, firm, light brown in color having dense to very dense in consistency.

2. Around and below 10 feet, the subgrade materials consisted mainly of the sandy material, Sand (SP) with some gravel, slightly moist to moist, dark brown to gray in color having dense to very dense in consistency.

3. Field Percolation tests were performed at 10-feet depth for both B-1 (PC-1) and B-11 (PC-2) and the results are tabulated as shown on the Table-1 below:

TABLE – 1
Percolation Test Results

Location	Coefficient of Permeability, k			
	Inch/minute	Cm/sec	**Inch/hour Average**	**Inch/hr** based on last 30 Minutes Reading
B-1 (PC-1)	**0.0135**	**6.0 x E-04**	**0.81**	**1.0**
B-11 (PC-2)	**0.0206**	**9.0 x E-04**	**1.236**	**1.5**
Average	**0.0171**	**7.5 x E-04**	**1.023**	**1.25**
		Average:	**1.137 inch/hour**	

4. Based on the data presented in this report and the testing information accumulated, it is our judgment that the percolation rate is an average of **1.137** inch per hour. It takes about **53 minutes to percolate 1 inch**. This conclusion regarding percolation rate is based on the results of our field exploration and testing.

5. General range of permeability for some of the subgrade soils are as follows:

Type of Soil	Permeability (Cm/Sec)
Medium to coarse gravel	$> 10^{-1}$
Coarse sand to fine sand	between $1x10^{-1}$ to $1x10^{-3}$
fine sand and silty sand	between $1x10^{-3}$ to $1x10^{-5}$
silt, clayey silt or silty clay	between $1x10^{-4}$ to $1x10^{-6}$
Clays	$1x10^{-7}$ or less

Since the percolation rate average is **7.5 x E-04 Cm/Sec**, it falls into **fine Sand and silty Sand category** as tabulated above.

As per Technical Guidance Document, Infiltration rate, I_t is calculated based on Percolation Rate Conversion using Porchet Method, aka Inverse Borehole Method.

The bottom of the proposed infiltration basin would be at 10-feet below the existing ground surface. Percolation tests were performed with the depth of the test hole set at the infiltration surface level (bottom of basin).

After the minimum required number of testing intervals, the test was complete. The data collected at the final interval was used to calculate infiltration rates.

The calculations and the results are tabulated and presented on Plates 5 and 6 in Appendix C.

Location	**Percolation Rate inch/hour Based on Average Reading**	**Infiltration Rate Inch/hour Based on Porchet Method aka Inverse Borehole Method**
B-1 (PC-1)	0.810	0.0370

PC-2	1.236	0.0596
Average	**1.137**	**0.0483**

Using factor of safety of 2.0 for uncertainty and bias, **percolation test result is 0.5685 inch per hour** and **Infiltration Rate = 0.0242 "/ hour**, which is less than **0.3"/hour** as per the requirement in accordance with **TGD VII.2.**

Thus, it **does not meet** the standard criteria, hence **FAILED**.

Reduction Factor (R_f) Method

We have used Reduction Factor (R_f) Method which is another acceptable and approved method for calculating Infiltration Rate, I_f.

Infiltration Rates as calculated by this method have been tabulated on Plates 7 and 8 in Appendix D. The results are as follows:

Location	I_f Using (Reduction Factor Method) (inch/hour)
B-1 (PC-1)	0.0559
B-11 (PC-2)	0.0801
AVERAGE:	**0.068**
With FOS = 2	**0.034**
	< 0.3 inch/hour - "FAILED"

Conclusions

The subgrade soils consist entirely of very firm alluvial soils, mainly sand with some gravel, medium to coarse grained, dark brown to gray in color, dry to slightly moist to moist, dense to very dense and hard in consistency. Percolation tests performed at two locations, B-1 (PC-1) and B-11 (PC-2) at 10 feet depth did not meet the prescribed criteria.

Also, since the groundwater is very deep more than 50 feet, there is a room for the basin. However, infiltration rate at both locations indicated that it is much less than the required infiltration rate of 0.3 inch per hour (**TGD VII.2**), hence we conclude that the project is **not feasible.**

Additional Services

This office will be available for further consultation.

Closure

Based on the data presented in this report and the testing information accumulated, it is the judgment of the writers of this report that BMP infiltration system seems to be **not feasible** at these locations. The conclusions presented in this report are based on the results of our field exploration, percolation tests, infiltration tests, and other laboratory tests.

This report has been compiled for the exclusive use on the above referenced site, for the purpose stated above. It should not be transferred to or used by another party, or applied to any other project on this site, other than as described herein, without consent and/or thorough review by this office.

Geotechnical Solutions, Inc.

References

California Building Code, 2019, California Code of Regulations, Title 24, Volume 2 of Part 2.

California Department of Water Resources groundwater well data **http://wdl.water.ca.gov**.

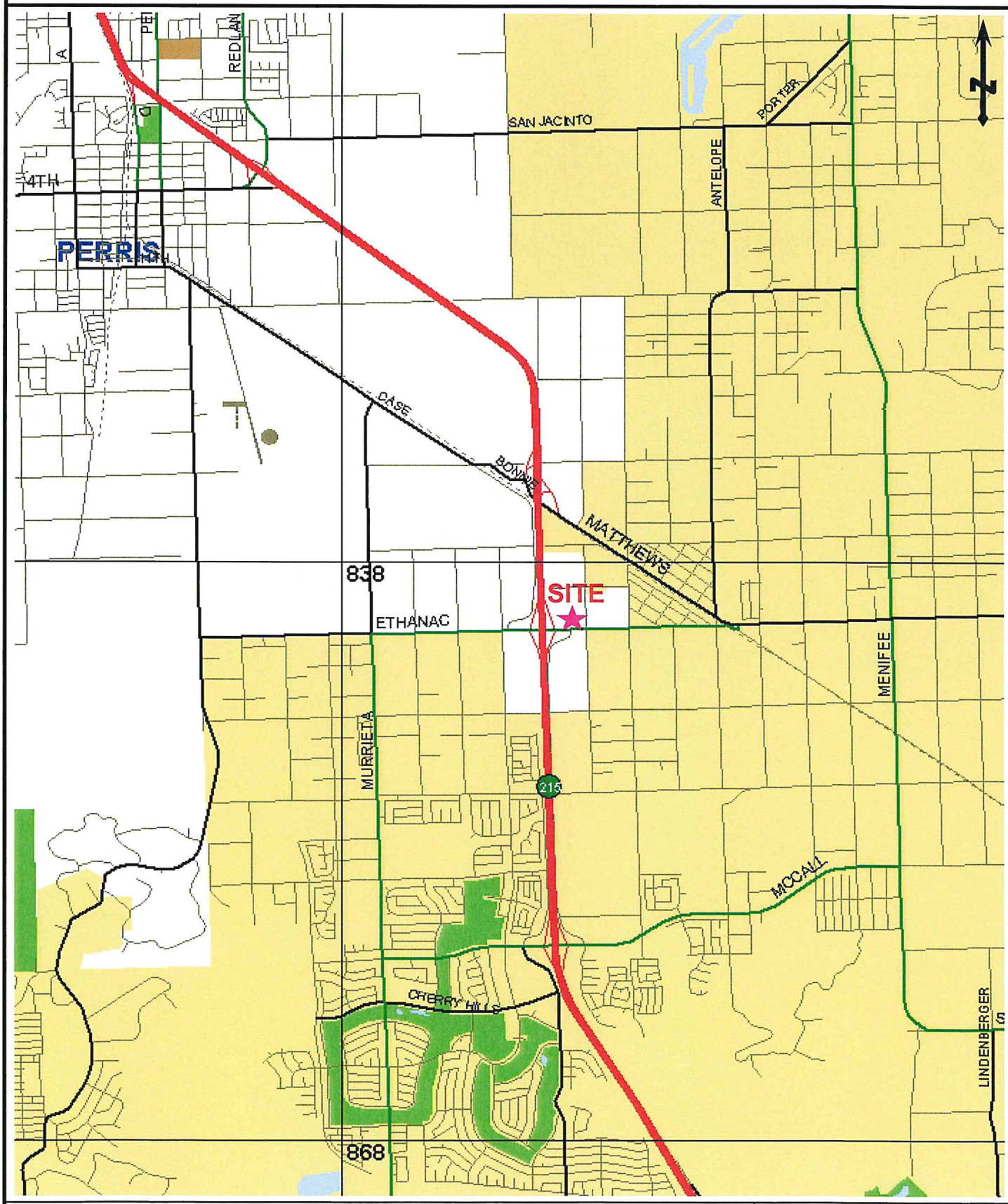
Orange County, Technical Guidance Document (TGD) for the Preparation of Conceptual / Preliminary and/or Project Water Quality Management Plans (WQMPs) dated December, 2013.

Appendix A

Plates:

- Vicinity Map
- Plot Plan & Percolation Tests Location Map
- Groundwater Map (Closest Well Data)
- Groundwater Map – Well Data
- Boring Logs, B-1 (PC-1) & B-11 (PC-2)

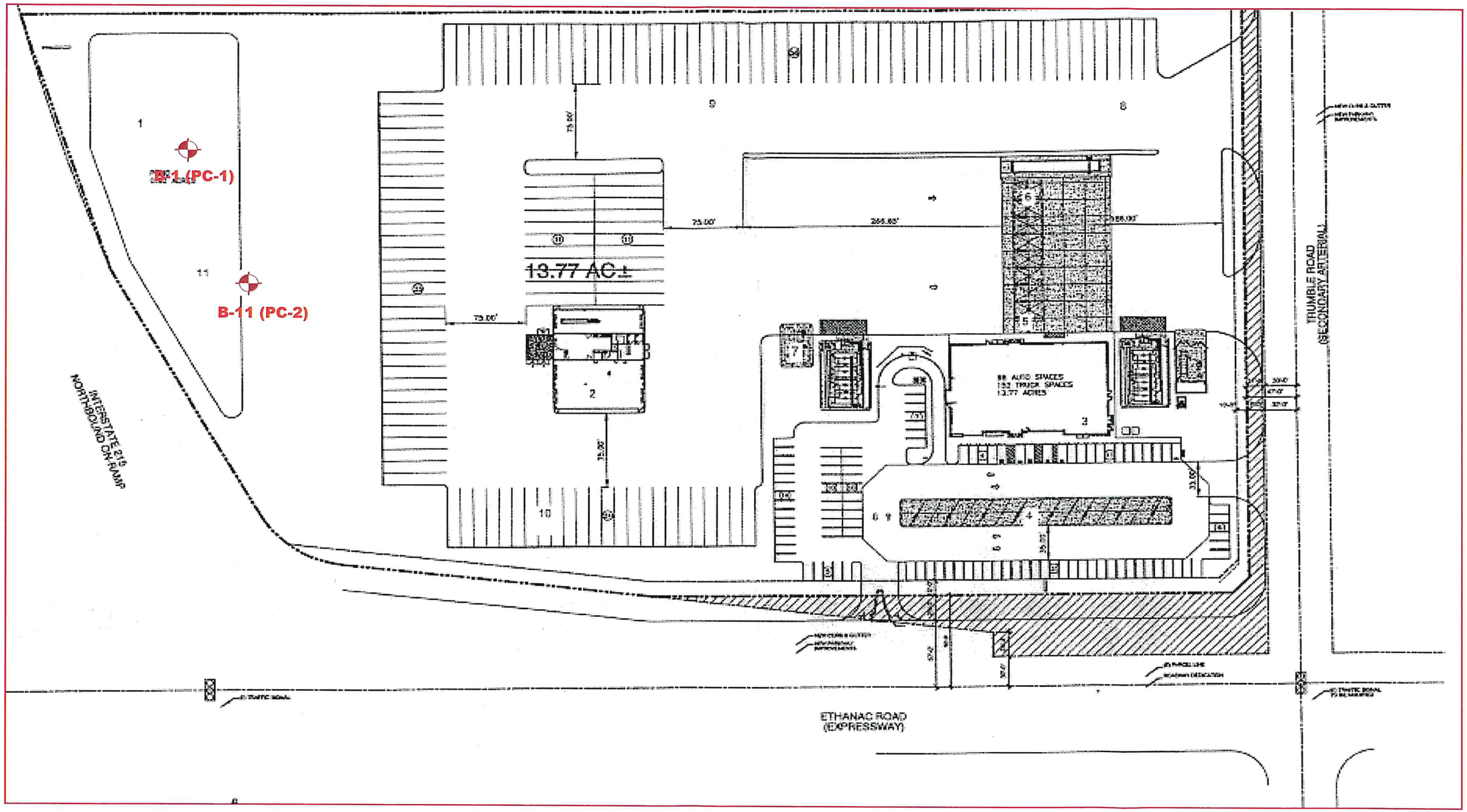
VICINITY MAP



Travel Plaza Perris - Percolation Tests	Project No.	G-5908-08
Corner of Trumble Road and Ethanac Road, Perris, California	Plate:	A

Geotechnical Solutions, Inc.

PLOT PLAN & PERCOLATION TEST LOCATIONS MAP



Percolation Tests

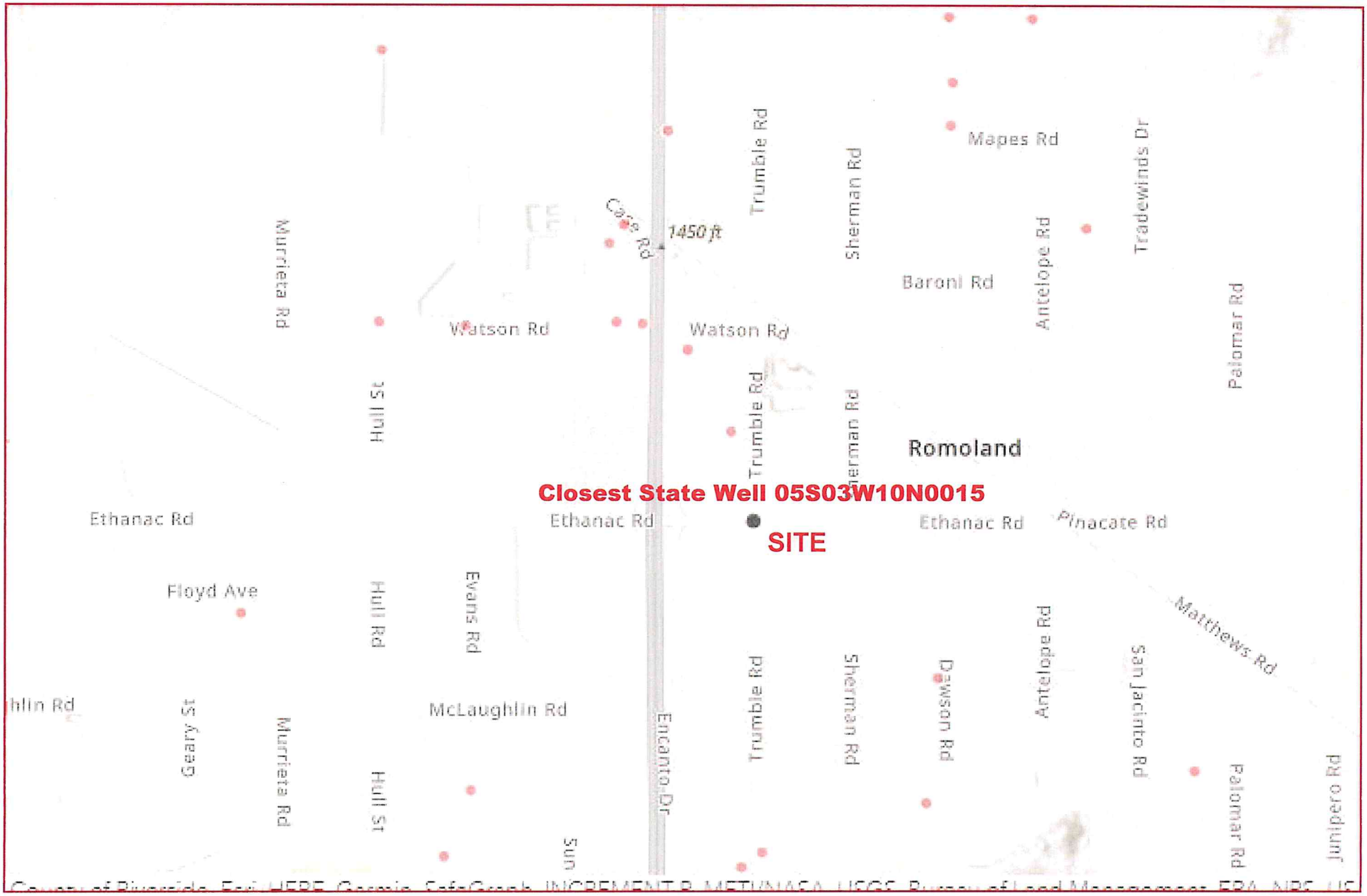
B-11 (PC-2)

Approximate Scale 1" = 100'

Travel Plaza Perris - Percolation Tests	Project No.	G-5908-08
Corner of Trumble Road and Ethanac Road, Perris, California	Plate:	B

Geotechnical Solutions, Inc.

GROUNDWATER MAP - CLOSEST WELL DATA



Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	C-1

Geotechnical Solutions, Inc.

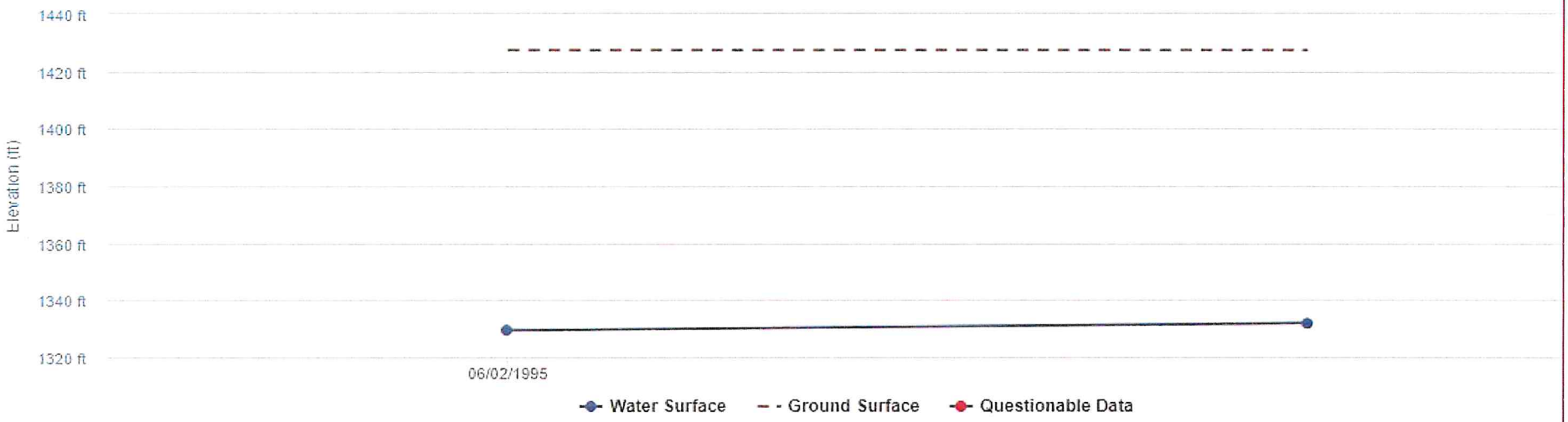
GROUNDWATER MAP - WELL DATA

Groundwater Level Report

Station 337464N1171859W001

Station Data | Groundwater Level Data

Groundwater Levels for Well 337464N1171859W001 (Site Code)



Measurement Date (PST)	Reference Point Elevation	Ground Surface Elevation	Distance from RP to WS	Groundwater Elevation	Ground Surface to Water Surface	Measurement Issue	Collecting Agency
06/02/1995 00:00:00	1427.490	1427.490	97.98	1329.51	97.98		Department of Water Resou...
09/13/1995 00:00:00	1427.490	1427.490	95.63	1331.86	95.63		Department of Water Resou...

Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	C-2

Geotechnical Solutions, Inc.

Project :	**Travel Plaza - Perris**	**LOG OF TEST HOLE**	Borehole No. B-1 (PC-1)
Project Location :	**Corner of Ethanac Road and Trumble Road, Perris, CA**		Plate No. D-1
Project Number :	**G-5908-08**		Page 1 of 1

Date(s) Drilled :	May 24, 2021	Logged By :	BA/AB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	10
Drill Rig Type :	B-61	Drilling Contractor :	Whitecomb Drilling	Approx. Surface Elevation, feet :	1426 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location;		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
1426	0						**Covered with dry weeds**				
			Bag #1				Older Alluvium: Silty Sand (SM), light brown, medium dense				
	2										
			C-1	19-54/6"		> 100	@2': Sand (SP), silty, light brown, slightly moist, very dense	6	127		
1421	5										
			C-2	20-50/6"		> 100	@5':Sand (SP), poorly graded, very dense, gray, slightly moist, medium to coarse grained	7	122		
1416	10						@10': Same as above			11	HD: 89 (SA) : 7(SI) : 4(CL)
							End of Boring = 10 feet 2" Gravel on Bottom Drilled for Percolation test No groundwater encountered No Caving Backfilled w/Cuttings after percolation test				
1411	15										
1406	20										
1401	25										
1396	30										
1391	35										
1386	40										
1381	45										

Geotechnical Solutions, Inc.

Project :	**Travel Plaza**	**LOG OF TEST HOLE**	Borehole No. **B-11 (PC-2)**
Project Location :	**Corner of Ethanac Road and Trumble Road, Perris, CA**		Plate No. D-2
Project Number :	**G-5908-08**		Page 1 of 1

Date(s) Drilled :	May 24, 2021	Logged By :	BA/AB	Checked By :	DXS
Drilling Method :	Hollow Stem Auger	Drill Bit Size / Type :	8-inch	Total Depth of Borehole, feet :	10
Drill Rig Type :	B-61	Drilling Contractor :	Whitecomb Drilling	Approx. Surface Elevation, feet :	1426 feet MSL
Groundwater Level and Date Measured:	No Water encountered at the time of drilling	Sampling Method :	California (ring), bulk, SPT	Hammer Data :	140 lbs dropping 30 inches
Borehole Backfill :	Drill cuttings	Comments :	Refer to plot plan for location;		

Elevation, feet	Depth, feet	SAMPLES Type	Number	Penetration Resistance, Blows / 6"	Graphics	Blows / 12"	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, pcf	Percent Passing No. 200 Sieve (%)	OTHER TESTS AND REMARKS
1426	0						**Covered with dry grass**				
	2						Older Alluvium: Clayey Sand (SC), light brown, dry				
			C-1	32-50/6"		100	@2': Sand (SP), silty, light brown, slightly moist, very dense	6	122		
1421	5										
			C-2	31-50/6"		100	@5':Sand (SP), poorly graded, very dense, gray, slightly moist, medium to coarse grained	5	121		
1416	10						@10': Same as above			10	HD: 90 (SA) : 8(SI) : 2(CL)
							End of Boring = 10 feet 2" of Gravel on Bottom Drilled to 10 feet for Percolation Test Backfilled w/ cuttings after the Test				
1411	15										
1406	20										
1401	25										
1396	30										
1391	35										
1386	40										
1381	45										

Geotechnical Solutions, Inc.

Appendix B

Pre-Test & Percolation Test Results

- Pre-Test Percolation Data Sheet (PC-1)
- Percolation Test Result at Location PC-1
- Pre-Test Percolation Data Sheet (PC-2)
- Percolation Test Result at Location PC-2

PRE- PERCOLATION TEST DATA SHEET

Project:	Travel Plaza - Perris	Project No.:	G-5908-08	Date:	5/24/2021
Test Hole Number:	**PC-1**	Tested By:	BA/AB		
Depth of Test Hole, DT	10'	USCS Soil Classification:	Sand (SP)		

Test Hole Dimensions (inches)			Length	Width	
Diameter (if Round) =	8"	Sides (if Rectangular) =			

Sandy Soil Criteria Test *

Trial No.	Start Time	Stop Time	Time Interval (Min)	Initial Depth to Water (in)	Final Depth to Water (in)	Change in Water Level (in)	Greater than or Equal to 6"? y/n
1	8:30 AM	8:55 AM	25	65	66.25	1.3	< 6"
2	8:55 AM	9:20 AM	25	66.25	67.50	1.25	< 6"

* If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute Intervals) with a precision of at least 0.25".

PERCOLATION TEST

Borehole No. **B-1 (PC-1)** Depth **120** inch

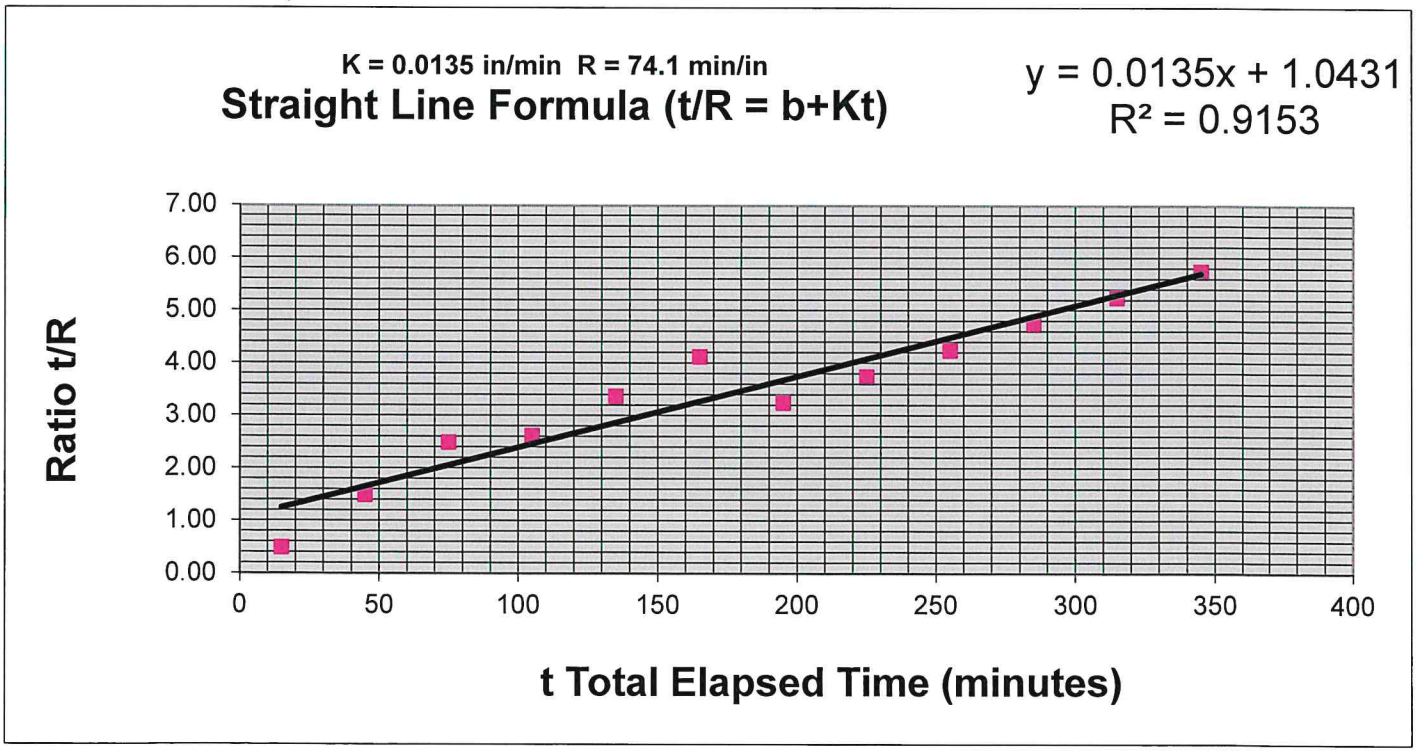
Date	Time of Reading	Δt (min.)	Total Elapsed Time (t)	Average t (minutes)	Reading R_1 (inches)	Reading R_2 (inches)	Drop d (inches)	R=Δt/d (min./in.)	t/R (in.)	k * 1000 (cm/s)
5/25/2021	9:30 AM	0	0							
	10:00 AM	30	30	15	60.00	61.00	1.00	30.00	0.50	1.4
	10:30 AM	30	60	45	61.00	62.00	1.00	30.00	1.50	1.4
	11:00 AM	30	90	75	62.00	63.00	1.00	30.00	2.50	1.4
	11:30 AM	30	120	105	63.00	63.75	0.75	40.00	2.63	1.1
	12:00 PM	30	150	135	63.75	64.50	0.75	40.00	3.38	1.1
	12:30 PM	30	180	165	64.50	65.25	0.75	40.00	4.13	1.1
	1:00 PM	30	210	195	65.25	65.75	0.50	60.00	3.25	0.7
	1:30 PM	30	240	225	65.75	66.25	0.50	60.00	3.75	0.7
	2:00 PM	30	270	255	66.25	66.75	0.50	60.00	4.25	0.7
	2:30 PM	30	300	285	66.75	67.25	0.50	60.00	4.75	0.7
	3:00 PM	30	330	315	67.25	67.75	0.50	60.00	5.25	0.7
	3:30 PM	30	360	345	67.75	68.25	0.50	60.00	5.75	0.7

Plot: t/R as ordinate vs. 't' as abscissa; tanOC = K.

R_1 = Vertical distance from reference point to water level after refilling at beginning of increment period.

R_2 = Vertical distance from reference point to water level at the end of increment period.

R = 1/K at equilibrium rate.



Travel Plaza Perris - Percolation Tests	Project:	G-5908-08
Corner of Trumble Road and Ethanac Road, Perris, California	Plate:	2

GEOTECHNICAL SOLUTIONS, INC.

PRE - PERCOLATION TEST DATA SHEET

Project:	Travel Plaza - Perris	Project No.:	G-5908-08	Date:	5/24/2021
Test Hole Number:	**PC-2**	Tested By:	BA/AB		
Depth of Test Hole, DT	10'	USCS Soil Classification:			
Test Hole Dimensions (inches)			Length	Width	
Diameter (if Round) =	8"	Sides (if Rectangular) =			

Sandy Soil Criteria Test *

Trial No.	Start Time	Stop Time	Time Interval (Min)	Initial Depth to Water (in)	Final Depth to Water (in)	Change in Water Level (in)	Greater than or Equal to 6"? y/n
1	9:35 AM	10:00 AM	25	65	67.0	2	< 6"
2	10:00 AM	10:25 AM	25	67	69.0	2	< 6"

* If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute Intervals) with a precision of at least 0.25".

PERCOLATION TEST

Borehole No. B-11 (**PC-2**) Depth **120** inch

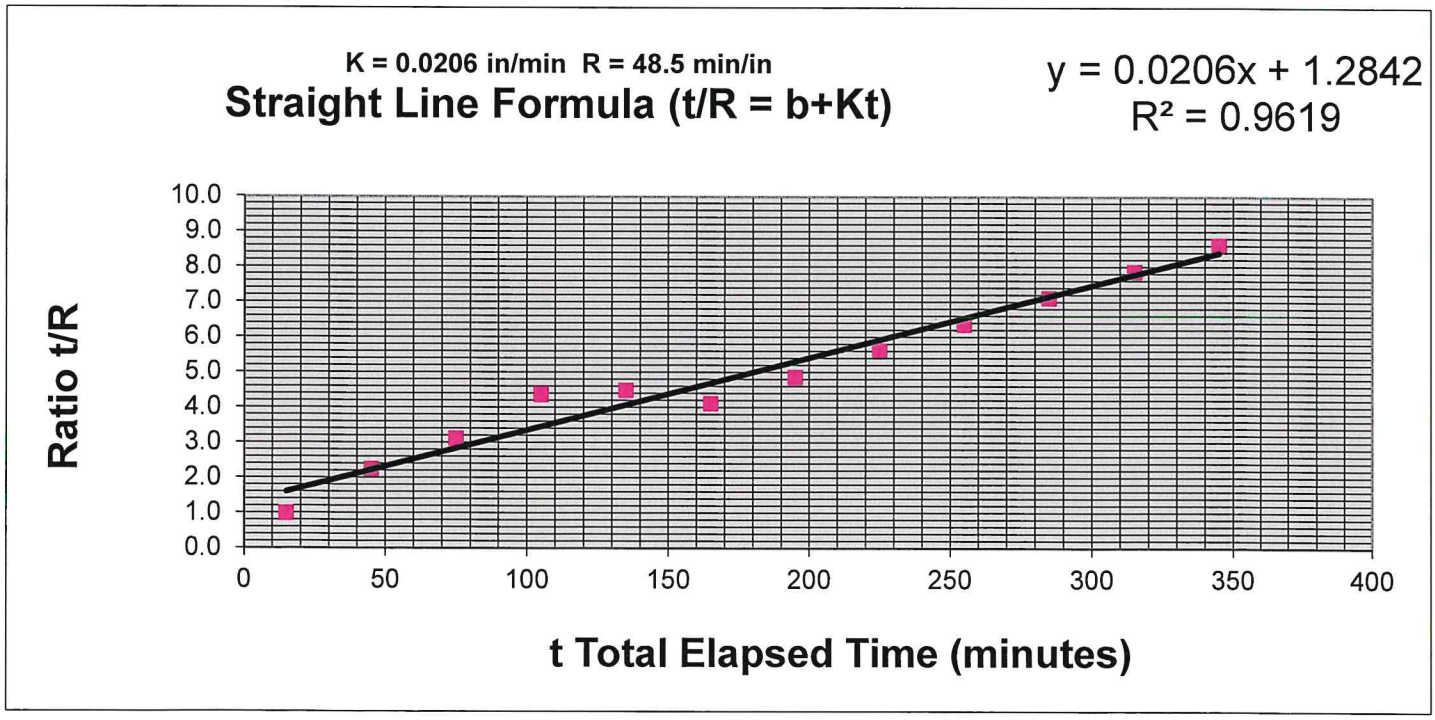
Date	Time of Reading	Δt (min.)	Total Elapsed Time (t)	Average t (minutes)	Reading R_1 (inches)	Reading R_2 (inches)	Drop d (inches)	R=Δt/d (min./in.)	t/R (in.)	k * 1000 (cm/s)
5/25/2021	9:40 AM	0	0							
	10:10 AM	30	30	15	60.00	62.00	2.00	15.00	1.00	2.8
	10:40 AM	30	60	45	62.00	63.50	1.50	20.00	2.25	2.1
	11:10 AM	30	90	75	63.50	64.75	1.25	24.00	3.13	1.8
	11:40 AM	30	120	105	64.75	66.00	1.25	24.00	4.38	1.8
	12:10 PM	30	150	135	66.00	67.00	1.00	30.00	4.50	1.4
	12:40 PM	30	180	165	67.00	67.75	0.75	40.00	4.13	1.1
	1:10 PM	30	210	195	67.75	68.25	0.75	40.00	4.88	1.1
	1:40 PM	30	240	225	68.25	69.00	0.75	40.00	5.63	1.1
	2:10 PM	30	270	255	69.00	69.75	0.75	40.00	6.38	1.1
	2:40 PM	30	300	285	69.75	70.50	0.75	40.00	7.13	1.1
	3:10 PM	30	330	315	70.50	71.25	0.75	40.00	7.88	1.1
	3:40 PM	30	360	345	71.25	72.00	0.75	40.00	8.63	1.1

Plot: t/R as ordinate vs. 't' as abscissa; tanOC = K.

R_1 = Vertical distance from reference point to water level after refilling at beginning of increment period.

R_2 = Vertical distance from reference point to water level at the end of increment period.

R = 1/K at equilibrium rate.



Travel Plaza Perris - Percolation Tests

Corner of Trumble Road and Ethanac Road, Perris, California

Project: G-5908-08

Plate: 4

GEOTECHNICAL SOLUTIONS, INC.

Appendix C – Infiltration Rates

Infiltration Rate I_f Calculations

- PC-1
- PC-2

Percolation Rate Conversion
Infiltration Rate, I_t
Porchet Method, aka Inverse Borehole Method

Travel Plaza - Perris
Project No: G-5908-08

Percolation Test PC-1

As per Test Result, Average Percolation Rate = 0.0135 inch/Min = 0.81 inch/hour

Data collected at the Final Interval analysed: 1.0 inch/hour

Time Interval, Δ t	= 30	Minutes	Initial Depth to Water, D_0	= 67.75	Inches
Total Depth of Test Hole, D_t	= 120	Inches	Final Depth to Water, D_f	= 68.25	Inches
Test Hole Radius, r	= 4	Inches			

Initial Height of Water at the selected time interval, H_0	= 52.25	Inches	$(D_t - D_0)$
Final Height of Water at the Selected time interval, H_f	= 51.75	Inches	$(D_t - D_f)$
Change in Height over the time interval, Δ H	= 0.5	Inches	$(H_0 - H_f)$
Average Head Height over the time interval, H_{avg}	= 52	Inches	$(H_0 + H_f)/2$

Tested Infiltration Rate, $I_t = \Delta H\ (60\ r)\ /((\Delta t)(r + 2\ H_{avg}))$ **in/hr**

Therefore, I_t = **0.037037 inch/hour**

I_t = **0.018519 inch/hour** **FS: 2**

< 0.3 inch/hour requirement
FAILED

Percolation Rate Conversion
Infiltration Rate, I_t
Porchet Method, aka Inverse Borehole Method

Travel Plaza - Perris
Project No: G-5908-08

Percolation Test PC-2

As per Test Result, Average Percolation Rate = 0.0206 inch/Min = 1.236 inch/hour

Data collected at the Final Interval analysed: 1.5 inch/hour

Time Interval, Δt	=	30 Minutes	Initial Depth to Water, D_0	=	71.25 Inches
Total Depth of Test Hole, D_t	=	120 Inches	Final Depth to Water, D_f	=	72.00 Inches
Test Hole Radius, r	=	4 Inches			

Initial Height of Water at the selected time interval, H_0	=	48.75 Inches	$(D_t - D_0)$
Final Height of Water at the Selected time interval, H_f	=	48 Inches	$(D_t - D_f)$
Change in Height over the time interval, ΔH	=	0.75 Inches	$(H_0 - H_f)$
Average Head Height over the time interval, H_{avg}	=	48.375 Inches	$(H_0 + H_f)/2$

Tested Infiltration Rate, $I_t = \Delta H\,(60\,r)\,/((\Delta t)(r + 2\,H_{avg}))$ **in/hr**

Therefore, I_t = **0.0596 inch/hour**

I_t = **0.029777 inch/hour** **FS: 2**

< 0.3 inch/hour- FAILED

Appendix D

Infiltration Rates Using Reduction Factor Method R_f

- PC-1
- PC-2

REDUCTION FACTOR, R_f

Project:	Travel Plaza - Perris	Project No.:	G-5908-08	Date:	5/25/2021
Test Hole Number:	**PC-1**	Tested By:	BA/AB		
Depth of Test Hole, DT	10'	Initial Water Depth (Inches)	67.75		
Test Hole Dimensions (inches)				Length	Width
Diameter (if Round), Dia =	8	Sides (if Rectangular)	=		

Percolation Test	Pre-Adjusted Percolation Rate, in/hr	Initial Depth to Water, **d1** (in)	Water level Drop, Δ**d** (in)	R_f	I_f
PC-1	1	67.75	0.5	17.88	0.0559

The average drop of the stabilized rate over the last three consecutive readings is the pre-adjusted percolation rate at the test location in inches per hour.

The pre-adjusted percolation rate must be reduced to account for the discharge of water from both the sides and bottom of the boring (non-vertical flow).

Use the Formula: Reduction Factor, $R_f = [(2d1 - \Delta d) / Dia] + 1$ where d_1 = Initial water Depth, in

Δ d = Water level drop of Final Period or Stabilized Rate (in)

REDUCTION FACTOR, R_f

Project:	Travel Plaza - Perris	Project No.:	G-5908-08	Date:	5/25/2021
Test Hole Number:	**PC-2**	Tested By:	BA/AB		
Depth of Test Hole, DT	10'	Initial Water Depth (Inches)	71.25		
Test Hole Dimensions (inches)				Length	Width
Diameter (if Round), Dia =	8	Sides (if Rectangular)	=		

Percolation Test	Pre-Adjusted Percolation Rate, in/hr	Initial Depth to Water, **d1** (in)	Water level Drop, Δ**d** (in)	R_f	I_f
PC-2	1.5	71.25	0.75	18.72	0.0801

The average drop of the stabilized rate over the last three consecutive readings is the pre-adjusted percolation rate at the test location in inches per hour.

The pre-adjusted percolation rate must be reduced to account for the discharge of water from both the sides and bottom of the boring (non-vertical flow).

Use the Formula: Reduction Factor, $R_f = [(2d1 - \Delta d) / Dia] + 1$ where d_1 = Initial water Depth, in

Δ d = Water level drop of Final Period or Stabilized Rate (in)

GEOTECHNICAL ADDENDUM REPORT

TRAVEL PLAZA
PERRIS

AT

CORNER OF TRUMBLE ROAD &
ETHANAC ROAD
PERRIS, CALIFORNIA

PREPARED FOR:

BROADBENT, INC.
WEST PACIFIC AVENUE
HENDERSON, NEVADA, 89015

PROJECT NO: G-5908-01

JUNE 11, 2021

PREPARED BY:

GEOTECHNICAL SOLUTIONS, INC.
GEOTECHNICAL & ENVIRONMENTAL
ENGINEERING

June 11, 2021

Project No: G-5908-01

Broadbent, Inc.
8 West Pacific Avenue
Henderson, Nevada, 89015

Attention: Mr. Mark E. Kazelskis, PG, CHG, CEM
Principal Geologist

Via Email: mkazelskis@broadbentinc.com

Re: Geotechnical Engineering Addendum Report
Travel Plaza - Perris
Corner of Trumble Road &
Ethanac Road
Perris, California 92570

Gentlemen:

Submitted herewith is the addendum report to our geotechnical engineering report dated June 11, 2021 conducted by this office for Travel Plaza Perris at the referenced project site.

Recommendations regarding over excavation have been included in this addendum report for the Travel Plaza Perris located just northwest of the intersection of Trumble Road and Ethanac Road, just west of Trumble Road in Perris, San Bernardino County, California as shown on Vicinity Map (Plate A) and Google Map (Plate C).

Site Clearing

Prior to grading, all debris, grass, weeds including construction materials should entirely be removed from the site and disposed of off-site. Existing any undesirable materials

should also be removed and hauled off-site. Existing utilities (if Any) should be removed and relocated as required. Any construction debris or ant buried or other contaminated exposed during site clearance should be removed and hauled away from the site. The resulting excavation from any removal should be cleared of loose material then backfilled with compacted soil. Oversized rocks greater than 6 inches should be removed.

Excavation

Excavations into the on-site soils may encounter a variety of challenges for example, very firm and dense to very dense alluvial soils. Some Caving on clean sands may be encountered. The contractor should be made responsible for designing and constructing stable, temporary excavations as required to maintain stability of the excavation sides. All excavations should be sloped or shored in the interest of safety following local and federal regulations including current OSHA excavation and trench safety standards.

Heavy equipments for breaking the very dense alluvial materials may be required for the excavations for shallow foundations, drilled shafts, and utility trenches for the proposed construction. The speed and ease of excavation are dependent on the nature of the deposit, the type of equipment used, and the skill and experience of the equipment operator.

Building Pad Over-excavation (Above Ground Storage Tanks, AST's)

After removal of existing debris, the above ground storage tank areas should be over-excavated at least 3 feet below the lowest grade or 24 inches below the bottom of the footings whichever is greater. Excavation should be extended 3-feet outside building perimeters. Over-excavation may be hard due to the presence of very dense alluviums, therefore heavy equipments may be required. Remove and replace any loose or disturbed soils prior to placing any additional fill materials required to reach the finished subgrade elevations. The over-excavation should be backfilled to the foundation base elevation with the compacted engineering fill in accordance with the recommendations presented in this report.

Compliance

Recommendations for foundations and slabs-on-grade supported on compacted fills or prepared subgrade depend upon compliance with the General Grading and Recommended Earthwork Specifications in Appendix B.

To assess compliance, observation and testing should be performed under the direction of a geotechnical engineer. Please contact us to provide observation and testing services.

Backfill Materials

On-site clean, low-expansive potential soils, or imported materials may be used as fill material for the following:

- Foundation Areas
- Interior Slab Areas
- Pavement Areas
- Backfill

Any earth materials imported or excavated on the property may be utilized in the fill provided that each material has been determined to be suitable by the soil engineer. These materials should be free of roots, tree branches, other organic matter or other deleterious materials. Soils of poor gradation, undesirable expansion potential, or substandard strength characteristics may be designated by the consultant as unsuitable and may require blending with other soils to serve as a satisfactory fill material. Also, rocks of sizes bigger than 3 inches should be discarded for the site material to be used for backfill.

Gradation (as per ASTM C136) should be as follows:

Size	% by Weight
6"	100

4"	85-100
¾"	70-100
No 4 Sieve	50-100
No. 200 Sieve	15 (max)

Any import material should have an expansion Index, EI less than 20. Import material should also meet the following criteria:

Soil Properties	**Values**
Liquid Limit	35 (Max)
Plastic Limit	6 (Max)

Placement and Compaction

Place and compact approved fill material in nearly horizontal layers that when compacted should not exceed 6 inches in thickness.

Use appropriate equipment and procedures that will produce recommended densities and water contents throughout the lift. Moisture condition, blending, and mixing of the fill layer should continue until the fill materials have a uniform moisture content at or above optimum moisture.

Uncompacted fill lifts should not exceed 8 inches.

Materials should be compacted to the following:

On-site or imported soil, reworked and fill:	Minimum % (ASTM D-1557 Laboratory Standard)
Subgrade Below Footings	90
Subgrade Below Slab-on Grade	90
Subgrade Below Pavement	90
Crush Rock Below Slab-on-Grade	95
Aggregate Base below pavement	95

Excavations at Pavement Areas

Subgrade Preparation

After removing the existing deleterious materials, dense to very dense alluvial materials on the pavement areas and hauled offsite, all surficial deposits of loose soil material should be removed and excavate 12 inches below the base and recompacted as recommended. The bottom is further scarified to a depth of at least 6 inches; moisture conditioned as necessary and compacted to 90 percent of the maximum laboratory density as determined by ASTM Test Method D-1557.

Deleterious material, excessively wet or dry pockets, and any other unsuitable materials encountered during excavation or grading should be removed. The compacted fill material should then be brought to the elevation of the proposed subgrade for the pavement. The subgrade should be proof-rolled in order to ensure a uniform, firm and unyielding surface. All grading and fill placement should be observed by the project soils engineer and/or his representative.

Aggregate Base

Compaction and rolling are required for the recommended base section. Minimum relative compaction required will be 95 percent of the laboratory maximum density as determined by ASTM Test Designation D-1557. Aggregate base should be in accordance with 200-2.2 crushed Aggregate base Class II base (minimum R-value=78) and sample should be brought for testing and approval prior to delivery to the site. No crushed miscellaneous base (CMB) should be accepted.

Asphalt Concrete Pavement

Asphalt concrete pavement should be Performance Grade PG 64-10 1/2" maximum aggregate size and should be placed and compacted in two layers. Asphalt concrete shall be compacted to 95 percent of the Hveem Laboratory Standard.

Earthwork Observations:

Relative compaction of all fill materials placed on site should be tested in accordance with ASTM D6938. All new fill shall be brought to near optimum moisture, placed in layers not exceeding six inches in thickness, and compacted to at least 90 percent relative compaction for subgrade and 95 percent relative compaction for aggregate base. No jetting or water tamping of fill soils shall be permitted. All imported soil for engineered fill should be pre-approved by the Geotechnical Engineer and consist of clean, granular, non-expansive soil, free of vegetation and other debris with an Expansion Index of 20 or less.

At all times, the contractor should have a responsible field superintendent on the project in full charge of the work, with authority to make decisions. He should cooperate fully with the Geotechnical Engineer in carrying out the work.

All footing trenches for continuous and spread footings and subgrade for the slab areas should be observed by the project Geotechnical Engineer to verify that over-excavation and re-compaction operations of adequate depth, thickness, and compaction have been performed as specified. All footing excavations should be trimmed neat, level and square. All loose, sloughed or moisture softened soil should be removed and replaced with properly compacted soil.

General Grading

All grading should conform to the guidelines presented in the California Building Code (CBC, 2019), the City of Perris, San Bernardino County, International Conference of Building Officials (ICBO, 2018), and Appendix B in this report, except where specifically superceded in the text of this report. When code references are not equivalent, the more stringent code should be followed. During earthwork construction, all site preparation and the general grading procedures of the contractor should be observed, and the fill selectively tested by a representative (s) of Geotechnical Solutions, Inc. (GSI). If unusual or unexpected conditions are exposed in the field, they should be

reviewed by this office and if warranted, modified and /or additional recommendations will be offered. All applicable requirements of local and national construction and general industry safety orders, the Occupational Safety and Health Act and the construction Safety Act should be met.

Closure

The Conclusions and recommendations contained herein are based on the findings and observations made at the test boring locations. It is not unusual to find conditions between and beyond such locations, which differ from the conditions encountered. If conditions are encountered during construction, which appear to differ from those previously disclosed, this office should be notified so as to consider the need for modifications. On-site construction observations and wherever appropriate, tests should be performed during the course of construction by a representative of this office to evaluate compliance with the design concepts, specifications, and recommendations contained herein.

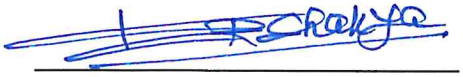
This report has been compiled for the exclusive use of our client, it shall not be transferred to, or used by, other parties, or applied to any project on this site other than described herein without consent and /or thorough review by this office.

The investigation was made in accordance with generally accepted geotechnical engineering principles and procedures and included such field and laboratory tests considered necessary under the circumstances.

In the opinion of the undersigned, the accompanying report has been substantiated by mathematical and other data and presents fairly the design information requested by your organization.

Respectfully Submitted,

Geotechnical Solutions, Inc.



Dharma Shakya, PhD, PE, GE
Principal Geotechnical Engineer

Abraham S. Baha, PE, M. ASCE
Sr. Principal

Distribution: (3+pdf) Addressee

References

Geotechnical Solutions, Inc., 2021, "Geotechnical Evaluation Report for Travel Plaza Perris, Located at the corner of Trumble Road and Ethanac Road, Perris, California", Project Number G-5908-01, dated June 11.

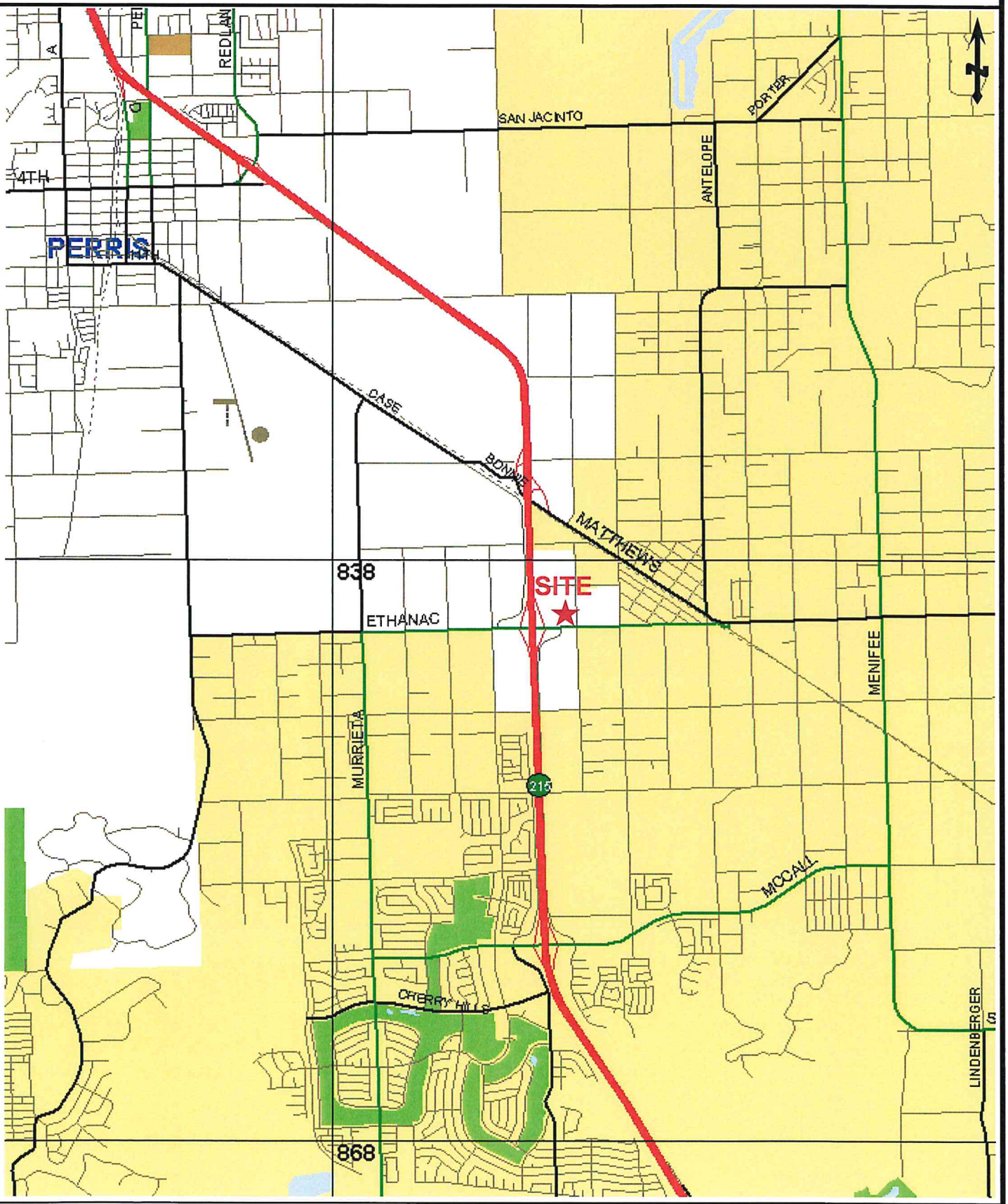
International Conference of Building Officials (ICBO), 2019, California Building Code, California Code of Regulations, Title 24, Part 2, Volume 2.

Appendix A

Plates

- **Vicinity Map**
- **Plot Plan**
- **Google Map**

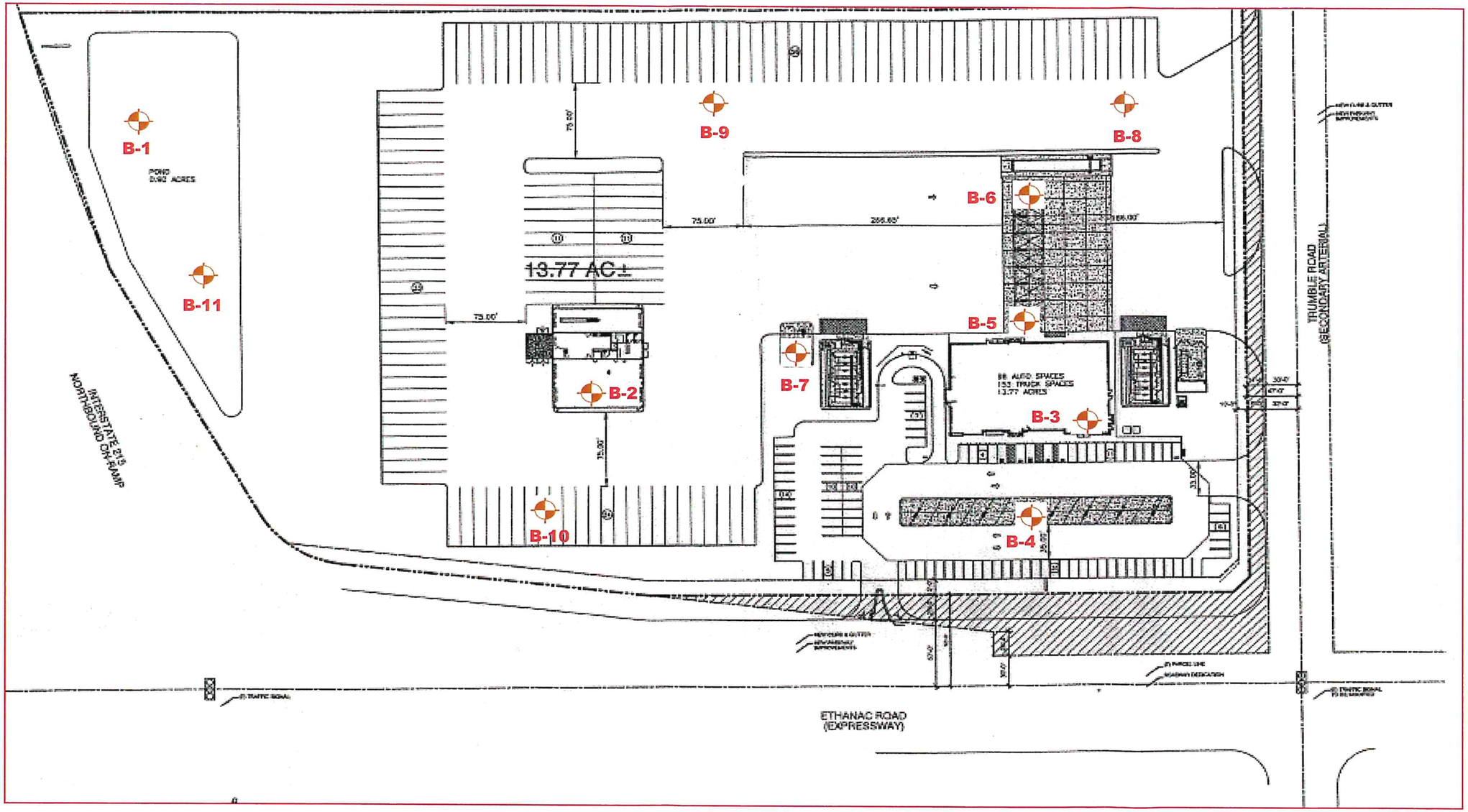
VICINITY MAP



Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	A

Geotechnical Solutions, Inc.

PLOT PLAN & BORING LOCATION MAP



B-11 HSA Borings (2021)

INTERSTATE 215 NORTHBOUND OFF-RAMP

APPROX. SCALE: 1" = 100'

Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	B

Geotechnical Solutions, Inc.

GOOGLE MAP

Travel Plaza - Perris	Project No.	G-5908-01
Corner of Trumble Road and Ethanac, Perris, California	Plate:	C

Geotechnical Solutions, Inc.

Appendix B

Recommended Earthwork Specifications

RECOMMENDED EARTHWORK SPECIFICATIONS

1.0 General

1.1 Description

1.1.1 These specifications cover preparation of the subject site to receive fills, the type of soils suitable for use in fills, the compaction standards, and the methods of testing compacted fills.

1.1.2 The Contractor shall furnish all labor, supervision, equipment, operations, and materials to excavate to the required grade, support existing underground facilities, stockpile material, compact fill and backfill, and fine grade. The work of the Contractor shall include all clearing and grubbing, removing existing unsatisfactory material, preparing areas to be filled, spreading and compacting of fill in the areas to be filled and all other work necessary to complete the grading of the filled areas. It shall be the Contractor's responsibility to place, spread, moisten or dry, and compact the fill in strict accordance with these specifications to the lines and grades indicated on project plans or as directed in writing by the Civil Engineer.

1.1.3 Deviations from these specifications will be permitted only upon written authorization from the Owner or his representative.

1.2 Role of the Geotechnical Engineer

1.2.1 Construction - The Owner will employ a Geotechnical Consultant to observe and test this work as it is being performed. The Contractor shall cooperate with the Geotechnical Consultant and allow his unrestricted access to the site as required for the performance of his duties.

The Contractor shall provide a minimum notice of 48 hours to the Geotechnical Engineer before beginning or restarting earthwork operations that will require the presence of the Geotechnical Engineer or his representative on site.

1.2.2 Subsurface Investigations - A geotechnical engineering report for design purposes was prepared by Geotechnical Solutions, Inc., Irvine, California. Any recommendations made in the geotechnical report or subsequent reports are made part of these specifications. These reports are available for review upon request to the Owner.

1.2.3 Observation and Testing - The Geotechnical Engineer's representative shall observe the clearing and grubbing, excavation, filling and compacting operations and shall take density tests in the fill material so that he can state his opinion as to whether or not the fill was constructed in accordance with the specifications. All fill will be tested shortly after its placement to ascertain that the required compaction is achieved. A minimum of one density test will be made on each 500 cubic yards of fill placed, with a minimum of at least one test per every 2 feet of vertical height of fill. If the surface is disturbed, the density tests shall be made in the compacted materials below the disturbed zone. When these tests indicate that the density or water content of any layer of fill or portion thereof does not meet the specified density or water content, the particular layer or portions thereof shall be reworked until the specified density and water content have been obtained.

After the completion of grading, the Geotechnical Engineer will prepare a written opinion of grading. Neither the testing performed by the Geotechnical Consultant nor his opinion as to whether or not the fill was constructed in accordance with these Specifications shall relieve the Contractor of his responsibility to construct the fills in accordance with the Contract Documents.

1.3 Reference Standards

The following ASTM (American Society for Testing and Materials) codes and standards shall be used to the extent indicated by references herein. The most recent revision of the standards shall be used.

D 1556 - "Standard Test Method for Density of Soil in Place by the Sand-Cone Method"

D1557 - "Standard Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb (4.54 kg) and 18-inch (457-mm) Drop"

D2216 - "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures"

D4318 - "Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils"

D4718 - "Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles"

D4829 - "Standard Test Method for Expansion Index of Soils"

D4944 - "Standard Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester Method."

D5195 - "Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)"

D6938 - "Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)"

D7928 - "Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis"

1.4 Degree of Fill Compaction

The degree to which fill is to be compacted is expressed in terms of "relative compaction." Relative compaction is defined as the ratio; expressed in percent, of the in-place dry density of the compacted fill to the reference maximum dry density. The reference maximum dry density shall be obtained following ASTM D1557. Optimum water content shall be obtained in the same test used to obtain the reference maximum dry density. Correction of the maximum dry density and optimum water content for

oversize particles of gravel and cobbles shall be made following ASTM D4718 when, in the opinion of the Geotechnical Engineer, such correction is appropriate. The in-place density shall be obtained following ASTM D1556 (sand cone method) or ASTM D6938 (nuclear method-shallow depth) test method. The in-place water content shall be obtained following ASTM D4944 (calcium carbide gas pressure meter), ASTM D5195 (nuclear method-shallow depth), or ASTM D2216 (oven drying). Correction of the in-place density and water content for oversize particles of gravel and cobbles shall be made following ASTM D4718 when, in the opinion of the Geotechnical Engineer, such correction is appropriate.

If any of the test methods specified in this section are judged by the Geotechnical Engineer to be impractical or unreliable because the material has a coarse particle size distribution, or for other reasons, the Geotechnical Engineer shall establish other procedures to obtain the required soil characteristics.

2.0 Products

2.1 Materials

2.1.1 General - During grading operations, soil types other than those identified in the geotechnical investigation report may be encountered by the Contractor. Consult the Geotechnical Consultant for his evaluation of the suitability of using these soils a fill material prior to placement or disposal.

2.1.2 General Fill - Materials for compacted fill shall consist of material imported from outside the site or excavated from the site that, in the opinion of the Geotechnical Engineer, is suitable for use in constructing engineered fills. The material shall not contain rocks or hard lumps greater than 6 inches in maximum dimension, and at least 70 percent (by weight) of its particles shall pass through a U.S. Standard 3/8 inch sieve. Material greater than 3 inches, but less than 6 inches in maximum dimension, shall be placed by the Contractor so that it is completely surrounded by compacted, finer material;

no nesting of rocks shall be permitted. Do not use any perishable, spongy, hazardous, or other undesirable materials as fill.

2.1.3 Select Fill - Select fill shall meet all criteria for general fill but shall also contain no rocks or hard lumps greater than 3 inches in maximum dimension, and at least 80 percent (by weight) shall pass through a U.S. Standard 3/8-inch sieve. The expansion index of select material shall be less than 50 (i.e., 5.0 percent swell) when tested in accordance with ASTM D4829.

3.0 Execution

3.1 Clearing and Grubbing

Within the project limits, tile Contractor shall demolish structures as specified on the Drawings.

Unless otherwise indicated on the Drawings or by the Owner in writing, the Contractor shall clear and grub all trees, stumps, roots, brush, grass, and other vegetation within construction, fill and stockpile areas to a minimum depth of 3 feet below the existing ground surface or below finished grade, whichever is deeper, unless otherwise recommended by the Geotechnical Engineer's Field Representative.

Remove cleared and grubbed materials from the site and dispose of them legally. No onsite burning or burying of cleared and grubbed materials is permitted. No placement of cleared and grubbed materials in topsoil stockpiles is permitted. No mulching of branches or roots is permitted. Incorporating vegetative matter into stockpiled materials, which are to be used in fill, is not permitted.

Stockpile organic-laden topsoil separate from other fill materials.

Remove any remaining vegetative matter from the deeper excavated soils, which may result from roots deeper than those encountered during clearing and grubbing operations.

All material thereby removed shall be piled at a location away from the immediate work area so as to avoid burying of piled material.

3.2 Compacted Fills

3.2.1 Preparing Areas to be Filled - Brush, grass, and other objectionable materials shall be collected, piled, and disposed of as indicated in Section 3.1 by the Contractor so as to leave the areas that have been cleared with a neat and finished appearance, free from unsightly debris.

Remove all loose soil, uncertified fill, landslide debris, and weathered bedrock to firm material or in-situ bedrock, as approved by the Geotechnical Consultant. The Contractor shall obtain approval from the Geotechnical Engineer or his representative of stripping and site preparation before the compaction of any fill subgrade begins. The surface shall then be scarified to a minimum depth of 6 inches until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment used, and shall be brought to the specified water content and relative compaction. Compact scarified materials to a minimum relative compaction of 90 percent, relative to ASTM D1557, prior to placement of any fill material.

3.2.2 Placing, Spreading, and Compacting, Fill Material - Onsite soil obtained from removals, borrow, or cut areas may be reused as compacted fill provided it is free from deleterious debris and meets the other requirements of the "Materials" portion of this Specification Section.

Use of soil containing deleterious debris from the clearing and grubbing operation or from other sources is not permitted. The fill materials shall be placed by the Contractor in horizontal layers not greater than 8 inches thick, measured before compaction. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to obtain uniformity of material and moisture in each layer. The moisture content of material used for compacted fill should be adjusted to be at or above optimum water content as determined by ASTM D1557. When the water content of the fill material is too high, the

fill materials shall be aerated by the Contractor by blading, mixing, or other satisfactory methods until the water content is as specified.

After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent of the maximum dry density as determined by ASTM D1557 for general fill, and 95 percent of the maximum dry density as determined by ASTM D1557 for select fill, compacted fill pads, and the upper 1 foot of pavement subgrade. Compaction shall be accomplished by: sheepsfoot rollers; vibratory rollers; multiple-wheel, pneumatic-tired rollers; or other types of acceptable compacting equipment. Equipment shall be of such design that it is able to compact the fill to the specified density. Compaction shall be continuous over the entire area, and the equipment shall make sufficient passes to obtain the desired density uniformly. All fill placed on site shall be treated in like manner until finished grades are attained. Jetting, puddling, and hydro consolidation techniques shall not be used, including backfill of utility trenches.

The placement of topsoil is subject to the approval of the Geotechnical Engineer. Topsoil shall not be placed beneath concrete flatwork, beneath or behind retaining walls, or within structural fill. All topsoil material is subject to the same moisture conditioning, placement, and compaction requirements as General Fill. Roots, branches and other organic debris are not permitted within the compacted topsoil layer.

When backfilling around footings and compacting behind retaining walls and flexible retaining structures, the Contractor shall use lightweight compaction equipment such as hand-operated equipment, shoring, or other means to avoid over-stressing structural walls. When using lightweight compaction equipment, the fill materials shall be spread in horizontal layers not greater than 6 inches thick, measured before compaction.

As an alternative, sand-cement slurry may be used to backfill trenches. The slurry shall have minimum cement content of 3 sacks per cubic yard within the zone of influence of foundations and other settlement sensitive structures. A minimum of 2 sacks per cubic

yard of slurry shall be used elsewhere within building limits, and a minimum of one sack per cubic yard of slurry shall be used elsewhere. Slurry shall not be used in those areas where such placement would result in the obstruction of water flow, and is subject to the approval of the Geotechnical Engineer.

3.3 Protection of Work and Adjacent Properties

3.3.1 During Construction - The Contractor shall grade all excavated surfaces to provide good drainage away from construction slopes and prevent ponding of water. He shall control surface water and the transport of silt and sediment to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control measures have been installed.

Dispose of all water resulting from dewatering operations legally and in ways that will not cause damage to public or private property, or constitute a nuisance or menace to the public, in accordance with municipal requirements.

The Contractor shall make every effort to minimize the amount of dust raised in excavating, on haul roads and access roads, and all other work areas in the course of construction activities.

Protect benchmarks, monuments, and other reference points against displacement or damage. Repair or replace benchmarks, monuments, and other permanent survey data that become displaced or damaged due to the performance of this work.

3.3.2 After Completion - After earthwork is completed and the, Geotechnical Engineer has finished his observations of the work, no further excavation, filling or backfilling shall be performed except under the observation of the Geotechnical Engineer.