INLAND FOUNDATION ENGINEERING, INC.
Consulting Geotechnical Engineers and Geologists
www.inlandfoundation.com

February 27, 2020
Revised: March 4, 2020
Project No. R351-011

Attention: Bart Doering, Facilities Development Director
RIVERSIDE COMMUNITY COLLEGE DISTRICT
Facilities Planning and Development
3801 Market Street, Riverside, California 92501

Re: Geotechnical Investigation, Geologic Hazards Evaluation, and Infiltration Testing
RCCD Ben Clark Training Center
Phase I: Education Center
16791 Davis Avenue, Riverside, California

Dear Mr. Doering:

We are pleased to submit this geologic hazards evaluation and geotechnical investigation report conducted for the referenced project.

It is our opinion that the proposed development is feasible from a geological and geotechnical engineering standpoint. Our report includes design recommendations along with the field and laboratory data. We have also included recommendations for site grading.

We appreciate the opportunity of being of service to you on this project. If there are any questions, please contact our office.

Respectfully,
INLAND FOUNDATION ENGINEERING, INC.

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INTRODUCTION

This report presents the findings of the geotechnical investigation and geologic hazards evaluation conducted for the proposed classroom and administration building to be located at the Ben Clark Training Center at 16791 Davis Avenue in Riverside, California. The following reference was provided for our use during this study.

- Conceptual Site Plan, Ben Clark Training Center, Phase 1, dated August 28, 2019.

Additional references used during this study are listed in the *References* section of this report.

SCOPE OF SERVICE

The purpose of this study was to conduct a geologic hazards evaluation and to provide geotechnical parameters for design and construction of the proposed project. Our scope of service included:

- *Review of the general geologic and subsurface conditions at the project site.*
- *Evaluation of the engineering and geologic data collected for the project site.*
- *Preparation of this report with geotechnical engineering conclusions and recommendations for design and construction.*

The tasks performed to achieve these objectives included:

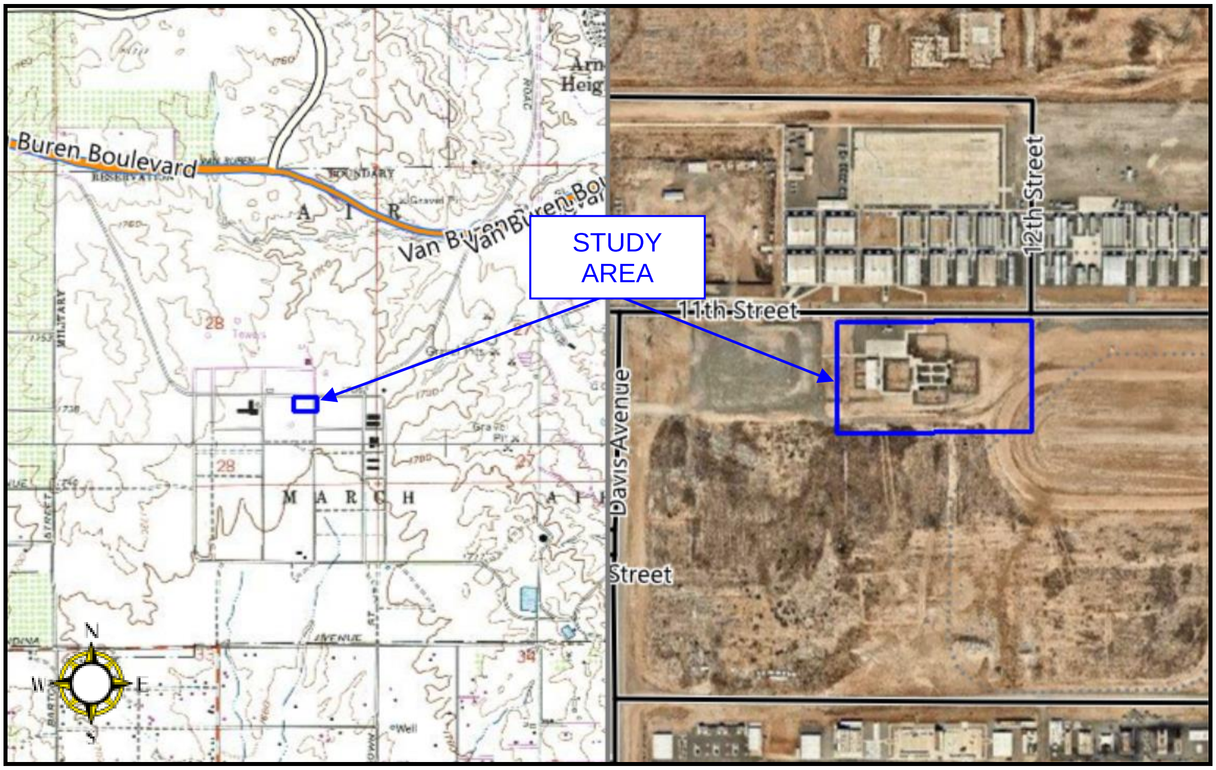
- *Review of available geologic data pertinent to the site.*
- *Photogeologic analysis of stereo pairs of aerial photographs.*
- *Field reconnaissance of the site and surrounding area by an engineering geologist to ascertain the existence of unstable or adverse geologic conditions.*
- *Geoseismic analysis and computation of 2019 California Building Code (CBC) seismic parameters.*
- *Subsurface sampling and laboratory testing.*
- *Infiltration testing.*
- *Analysis of the data collected and the preparation of this report with our geotechnical conclusions and recommendations.*

Evaluation of hazardous waste was not within the scope of services provided.

SITE AND PROJECT DESCRIPTION

The site is located in the southeasterly portion of Section 28, Township 3 South, Range 4 West, S.B.B.&M. The location of the project site is shown on Figure 1 below.

FIGURE 1: USGS Topographic Map, Riverside East 7.5' Quadrangle and Satellite Imagery

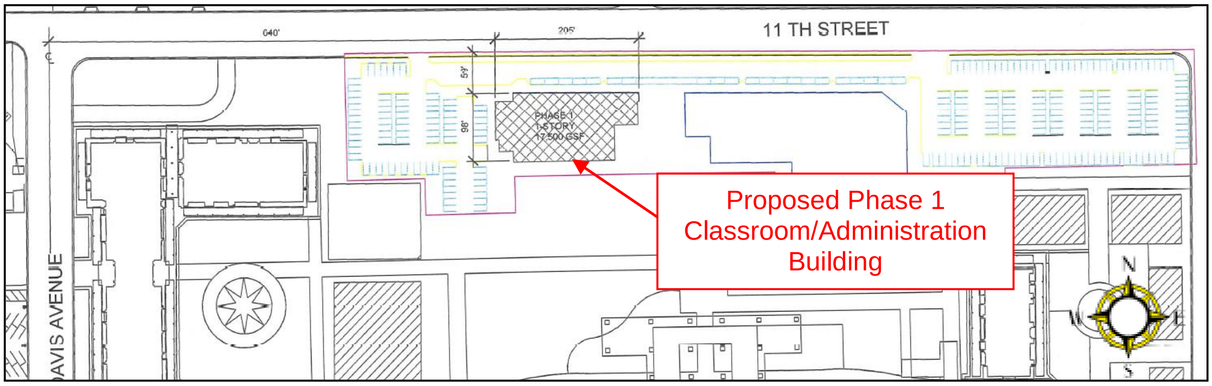


We understand the proposed Phase 1 construction will consist of a 17,500 max. gross square feet one-story classroom and administration building. We understand that the building will be Type V construction. The proposed development will include driveways, parking, and exterior covered and uncovered walkways.

Grading for the proposed improvements is expected to consist of cuts and fills of less than two feet. This is exclusive of the remedial over-excavation recommended in this report.

Figure 2 below is a portion of the provided conceptual site plan showing the approximate location of the proposed classroom and administration building.

FIGURE 2: Facilities Location Map



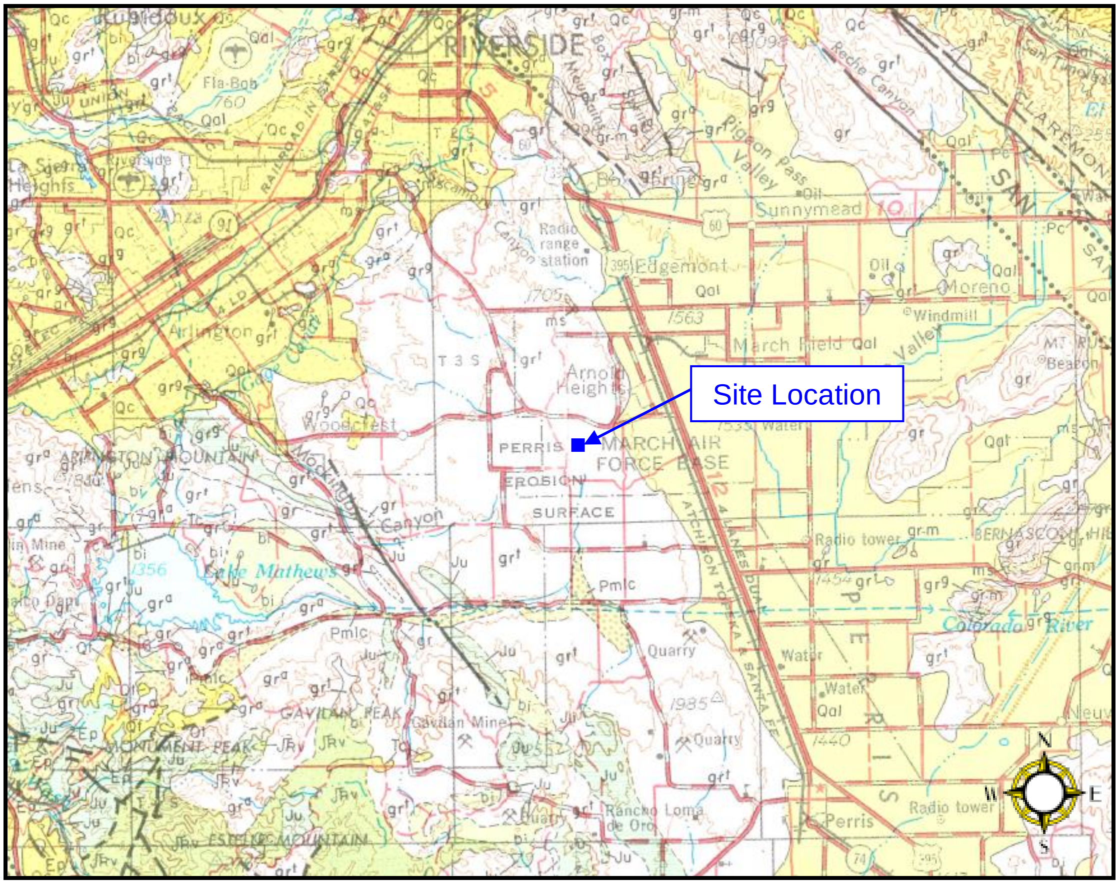
The site is currently vacant. The site is bounded on the north by 11th Street, west by a gravel parking lot area, and vacant undeveloped land to the south. Remnants of previous structures, courtyard area, and a concrete sidewalk are present on the site. A portion of an oval dirt running track is present on the east side of the site. The topography on the project site is generally planar with a slight gradient to the southwest. Vegetation consists of a light growth of seasonal grasses and weeds near the southwestern portion of the site.

GEOLOGIC SETTING

Regional Geology: The subject site is situated within the northern portion of a natural geomorphic province in southwestern California known as the Peninsular Ranges, which is characterized by steep, elongated ranges and valleys that trend northwesterly. This geomorphic province encompasses an area that extends 125 miles, from the Transverse Ranges and the Los Angeles Basin, south to the Mexican border, and beyond another 795 miles to the tip of Baja California (Norris & Webb, 1990; Harden, 1998). This province is believed to have originated as a thick accumulation of predominantly marine sedimentary and volcanic rocks during the late Paleozoic and early Mesozoic. Following this accumulation, in mid-Cretaceous time, the province underwent a pronounced episode of mountain building. The accumulated rocks were then complexly metamorphosed and intruded by igneous rocks, known locally as the Southern California Batholith. A period of erosion followed the mountain building, and during the late Cretaceous and Cenozoic time, sedimentary and subordinate volcanic rocks were deposited upon the eroded surfaces of the batholithic and pre-batholithic rocks.

Figure 3 below shows a portion of the CDMG Geologic Map of California, Santa Ana Sheet, (Scale 1:250,000), Southern California (Rogers, 1966) depicting the approximate location of the project site.

<u>FIGURE 3</u>: CDMG, 1966, Geologic Map of California, Santa Ana Sheet, Scale 1:250,000.

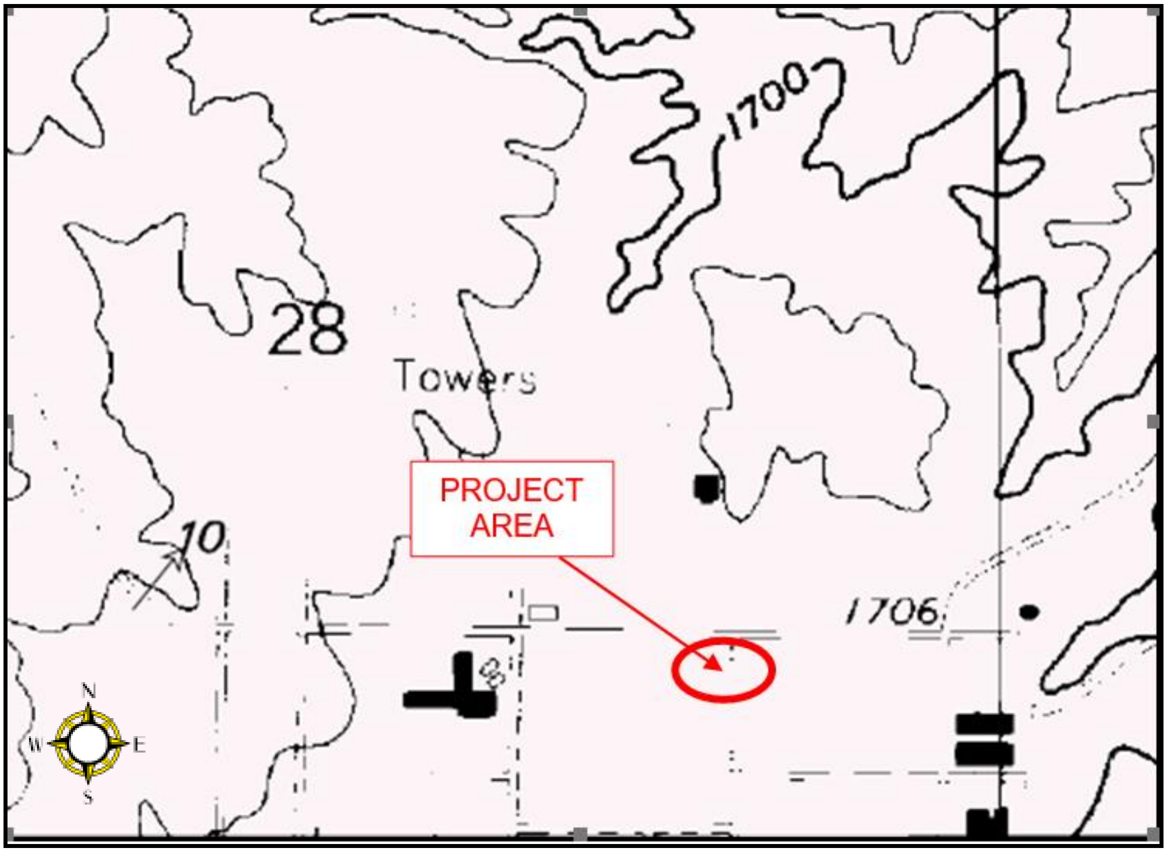


Local Geology: More specifically, the site is situated within the central portion of the Perris Block, an eroded mass of Cretaceous and older crystalline rock. Thin sedimentary and volcanic units mantle the bedrock in a few places with alluvial deposits filling in the lower valley areas. The Perris Block is a structurally stable, internally unfaulted mass of crustal rocks bounded on the west by the Elsinore-Chino fault zones, on the east by the San Jacinto fault zone, and on the north by the Cucamonga fault zone (Woodford, et al., 1971). On the south, the Perris Block is bounded by a series of sedimentary basins that lie between Temecula and Anza (Morton and Matti, 1989).

The site is located on the Perris Erosional Surface (general elevation range of 1,600 to 1,800 feet) and is underlain by biotite-hornblende tonalite of the Valle Verde pluton. The Perris Erosional Surface consists of crystalline igneous and metamorphic bedrock. In most places this tonalite has a northwest oriented crude to well-developed planar fabric produced by oriented biotite and hornblende (U.S. Dept. of Air Force, 1996).

Figure 4 below shows a portion of the USGS Preliminary Geologic Map of the Riverside East 7.5’ Quadrangle, Riverside County, California (Morton & Cox, 2001) depicting the mapped geologic units in the vicinity of the subject property:

FIGURE 4: USGS Preliminary Geologic Map of the Riverside East 7.5’ Quadrangle (Morton & Cox, 2001)



Kvt	**Val Verde tonalite**—Gray-weathering, relatively homogeneous, massive- to well-foliated, medium- to coarse-grained, hypautomorphic-granular biotite-hornblende tonalite; principal rock type of Val Verde pluton.

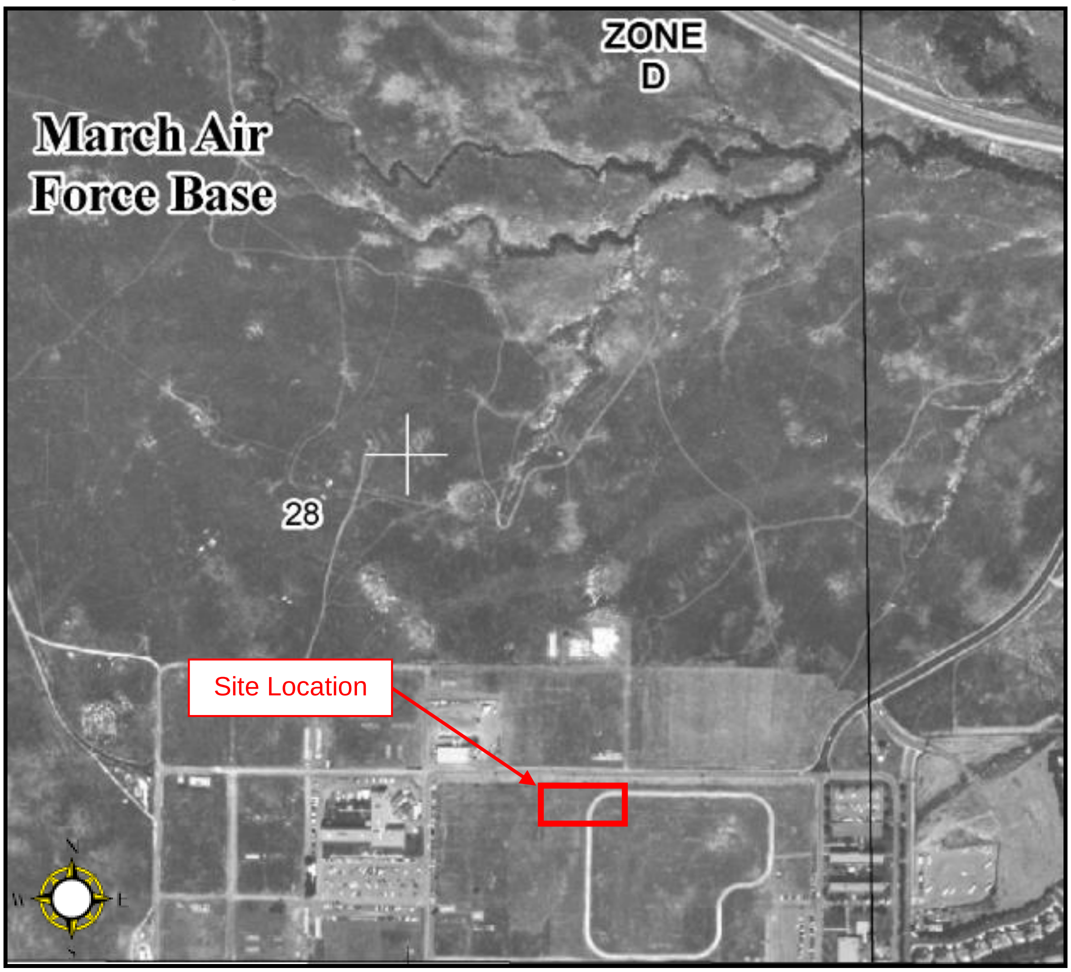
Materials encountered within all exploratory borings on February 5, 2020 predominantly consisted of highly to moderately weathered granitic bedrock (tonalite) to the depths drilled, 15 to 40 feet below the existing ground surface. The surface of the site is covered with up to 3.5 feet of native soil and artificial fill, generally consisting of silty clayey sand (SC-SM), silty sand (SM) and clayey sand (SC).

Groundwater: The site is located along the western fringe of the Perris Valley hydrologic sub-area of the Santa Ana hydrologic basin in Riverside County, California. The site is underlain by granitic rock (tonalite) that is not typically considered a water-bearing portion of the groundwater basin. Groundwater was encountered within our exploratory boring B-04 (drilled February 5, 2020) at a depth of approximately 25 feet below the existing ground surface. Groundwater is considered to occur in limited quantities in the shallow weathered bedrock zone and possibly in fractures and joint systems within the bedrock (USAF, 1990).

Based on the encountered groundwater levels and groundwater data reviewed, we estimate a high groundwater level at the site of 15 feet beneath the existing ground surface.

Surface Water: A review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) website (FEMA, 2020) indicates that the site is located within FIRM Map No. 06065C0745G, dated August 28, 2008. This map indicates that the project site is located in an area designated as “Zone D” described as “Areas in which flood hazards are undetermined, but possible”. Figure 5 below shows a portion of the referenced FIRM Map.

FIGURE 5: FEMA Map No. 06065C0745G, FEMA, 2008



ZONE D Areas in which flood hazards are undetermined, but possible.

Faulting: There are at least 38 major late Quaternary active/potentially active faults that are within 100 kilometers of the site. Of these, there are no faults known to traverse the site, nor is there any photogeologic or surficial geomorphic evidence suggestive of faulting. In addition, the site is not located within a State of California

"Alquist-Priolo Earthquake Fault Zone" for fault rupture hazard (CGS, 2020). Current mapping by the Riverside County Land Information System indicates that the site does not lie within a mapped County fault zone.

The nearest known active fault is the San Jacinto Fault (San Jacinto Valley Segment) located approximately 15.5 kilometers to the northeast of the project site. The San Jacinto Fault (San Jacinto Valley Segment, USGS, 2008) is a right-lateral, strike-slip fault, approximately 43 kilometers in length, with an estimated maximum moment magnitude (M_w) earthquake of 7.0 and an associated slip-rate of 18 mm/year.

As tabulated by Blake (2000) and based on our review of the USGS 2008 National Seismic Hazard Maps - Source Parameters (USGS, 2008), the major faults influencing the site, distances and maximum earthquake magnitudes are presented in Table 1.

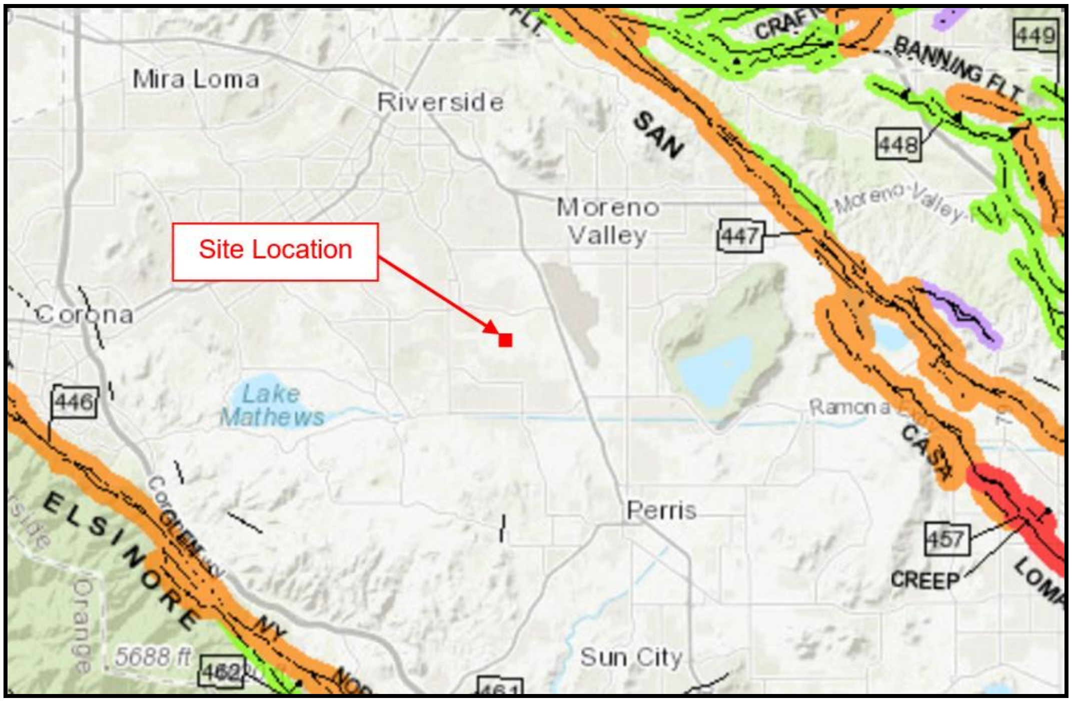
TABLE 1: Fault Zone, Distances and Maximum Earthquake Magnitudes

Fault Zone	Approximate Distance (Km)	Earthquake Magnitude (M_w)
San Jacinto - San Jacinto Valley	15.5	7.0
San Jacinto - San Bernardino	20.3	7.0
Elsinore - Glen Ivy	21.0	6.8
Elsinore - Chino-Central Ave. (Elsinore)	26.5	6.8

Our review of other applicable references (listed) did not reveal any mapped faults or fault zones in the near vicinity of the subject property.

Figure 6 is a portion of the CGS 2010 Fault Activity Map of California showing the location of the site and mapped earthquake fault zones in the vicinity of the site.

<u>FIGURE 6</u>: 2010 Fault Activity Map of California, CGS, 2010



Fault along which historic (last 200 years) displacement has occurred.

Holocene fault displacement (during past 11,700 years) without historic record.

Late Quaternary fault displacement (during past 700,000 years).

Quaternary fault (age undifferentiated).

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement.

Our review of the potential for surface fault rupture included an examination of one non-stereo and ten stereo pairs of vertical black and white and color aerial photographs dating from 1948 to 2018 (see References for a listing). The photogeologic analysis did not reveal observed indicators suggestive of active fault-related features. This included the lack of photolineations and/or no consistent tonal variations observed across the site, or trending toward the site. Our review indicates that no documented active faults are known to traverse toward the subject site, based on published literature, and no surficial indications or geomorphic features were observed within the aerial photographs or field reconnaissance that are suggestive of active faulting.

Ground rupture is generally considered most likely to occur along pre-existing faults. Based on our review of published geologic maps, aerial photograph review, and site reconnaissance, the potential for ground rupture at the site is considered to be low.

Geologic Hazard Zones (Liquefaction & Landsliding): The site does not lie within a State or County mapped landslide hazard area. A review of the Riverside County RCIT GIS map (RCIT, 2020) for this area indicates that the site does not lie within mapped Riverside County Liquefaction Potential area.

Historic Seismic Activity: We performed an historical seismicity search, based on the USGS Earthquake Hazards Program earthquake catalog, accessed through the USGS Earthquake Hazards Program earthquake catalog web application (USGS, 2020). Table 2 and the following discussion summarize the known historic seismic events (≥M4.0) that have been estimated and/or recorded from 1932 to February 2020, within a 100 kilometer (62 mile) radius of the site.

TABLE 2: Historic Seismic Events; 1932-2020 (100 Kilometer Radius)

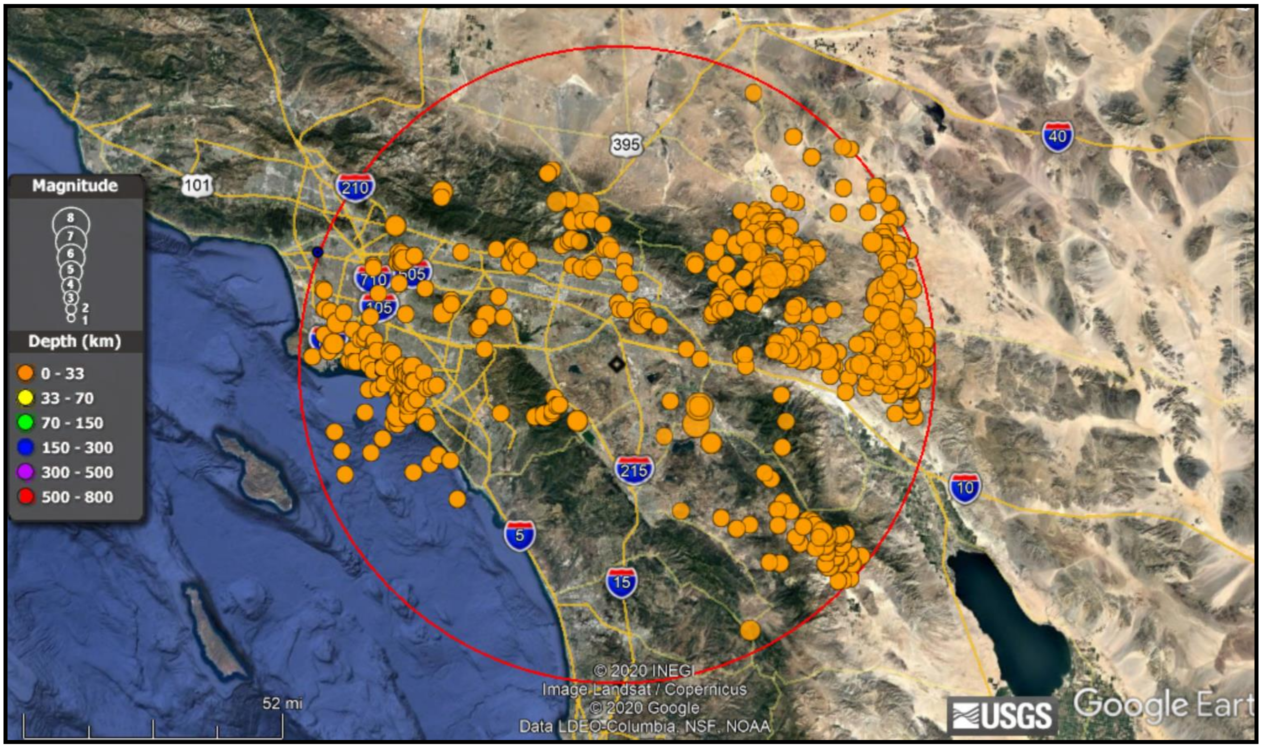
Richter Magnitude	No. of Events
4.0 - 4.9	421
5.0 - 5.9	43
6.0 - 6.9	5
7.0 - 7.9	1
8.0+	0

A summary of the historic earthquake data is as follows:

- The nearest recorded significant historic earthquake epicenter (≥M5.0) was approximately 23.75 miles southeast of the site (September 23, 1963, M5.3).
- The largest recorded historical earthquake was the M7.6 (M_W 7.3) Landers event, located approximately 55 miles to the northeast (June 28, 1992).
- The nearest estimated significant earthquake epicenter (pre-1932) was located approximately 20 miles to the southeast, being a M6.8 event (April 21, 1918).
- The largest estimated historical earthquake magnitude (pre-1932) within a 62 mile radius is the M6.8 event of April 21, 1918 located approximately 20 miles to the southeast.

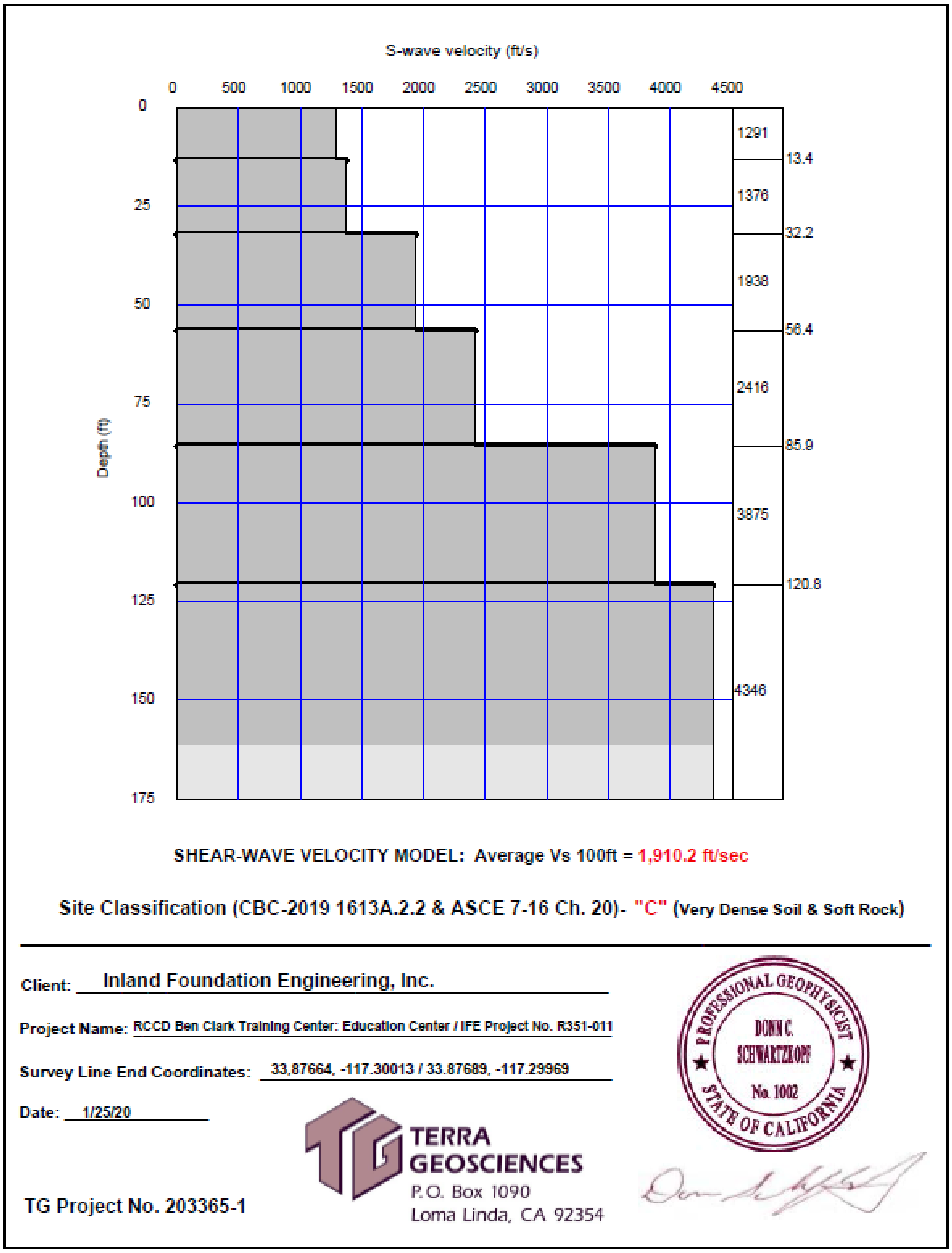
An earthquake epicenter map (USGS, 2020), showing plotted earthquakes with magnitudes greater than M4.0 within a 100 kilometer radius of the site is shown on Figure 7 for reference purposes. This map was prepared using the ANSS Comprehensive Earthquake Catalog (USGS, 2020) of instrumentally recorded events from 1932 to February 2020, overlain on Google Earth® imagery (2020).

FIGURE 7: Earthquake Epicenter Map showing events of M4.0+ within a 100 kilometer radius



Seismic Parameters: The site coordinates (WGS 84) are 33.8768°N / -117.3000°W. The site is underlain by weathered granitic bedrock with less than approximately four feet of soil mantling the bedrock. A geophysical seismic shear-wave survey was conducted for this study by our subconsultant, Terra Geosciences, for the purposes of evaluating the Site Classification for this project. The results of the shear-wave survey indicate a shear wave velocity of 1,910 feet per second, corresponding to a Site Class C. Figure 8 below is the graphical representation of the shear-wave survey conducted for this site.

FIGURE 8: Shear Wave Velocity Model



On the basis of the Site Classification and subsurface conditions, a site-specific ground motion analysis is not required for this project. The web application U.S. Design Maps (OSHPD, 2020), was used to evaluate the seismic parameters for this project. Table 3 below summarizes the 2019 California Building Code (CBC) seismic design criteria, which is based on ASCE 7-16.

Table 3: 2019 CBC Seismic Design Parameters

Seismic Parameter	Value
S_s - MCE_R Ground Motion for 0.2-sec Period	1.5 g
S_1 - MCE_R Ground Motion for 1-sec Period	0.572 g
F_a - Site Amplification Factor at 0.2-sec Period	1.2
F_v - Site Amplification Factor at 1.0-sec Period	1.428
SM_S - Site-Modified Spectral Acceleration Value	1.8 g
SM_1 - Site-Modified Spectral Acceleration Value	0.817 g
SD_S - Numeric Seismic Design Value at 0.2-sec period	1.2 g
SD_1 - Numeric Seismic Design Value at 1.2-sec period	0.545
PGA - MCE_g Peak Ground Acceleration	0.5
F_{PGA} - Site Amplification Factor at PGA	1.2
PGA_M - Site Modified Peak Ground Acceleration	0.6
T_L - Long-Period Transition Period (s)	8
SsRT - Probabilistic Risk-Targeted Ground Motion (0.2s)	1.552
SsUH - Factored Uniform-Hazard Spectral Acceleration (2% probability of exceedance in 50 years)	1.654
SsD - Factored Deterministic Acceleration Value (0.2s)	1.5
S1RT - Probabilistic Risk-Targeted Ground Motion (1.0s)	0.572
S1UH - Factored Uniform-Hazard Spectral Acceleration (2% probability of exceedance in 50 years)	0.624
S1D - Factored Deterministic Acceleration Value (1.0s)	0.6
PGA_d - Factored Deterministic Acceleration Value (1.0-sec)	0.5
CR_S - Coefficient of Risk (0.2-sec)	0.939
CR_1 - Coefficient of Risk (1.0-sec)	0.916
Site Class	C

Secondary Seismic Hazards: The primary geologic hazard affecting the project is that of ground shaking. Secondary permanent or transient seismic hazards generally associated with severe ground shaking during an earthquake include, but are not necessarily limited to; ground rupture, liquefaction, seiches or tsunamis, landsliding, rockfalls, and seismically-induced settlement. These are discussed below:

Ground Rupture - Ground rupture is generally considered most likely to occur along pre-existing faults. Since no known faults are believed to traverse the site, the probability of ground rupture is considered very low.

Liquefaction: In general, liquefaction is a phenomenon that occurs where there is a loss of strength or stiffness in the soil that can result in the settlement of buildings, ground failure, or other hazards. The main factors contributing to this phenomenon are: 1) cohesionless, granular soils with relatively low density (usually of Holocene age); 2) shallow groundwater (generally less than 50 feet); and 3) moderate to high seismic ground shaking.

Based on the presence of shallow granitic bedrock below the site, the potential for liquefaction is not significant.

Seiches/Tsunamis: A seiche is a standing wave in an enclosed or partially enclosed body of water. In order for a seiche to form, the body of water needs to be at least partially bounded, allowing the formation of the standing wave. Tsunamis are very large ocean waves that are caused by an underwater earthquake or volcanic eruption, often causing extreme destruction when they strike land.

There are no bodies of water on or adjacent to the project site. Based on the distance to large, open bodies of water and the elevation of the site with respect to sea level, the potential for seiches/tsunamis does not present a hazard to this project.

Landsliding - Due to the low-lying relief of the site and adjacent areas, landsliding due to seismic shaking is considered nil.

Rockfalls - Since no large rock outcrops are present at or adjacent to the site, the possibility of rockfalls during seismic shaking is nil.

Seismically-Induced Settlement: Seismically-induced settlement generally occurs within areas of loose granular soil and consists of both liquefaction settlement below groundwater and dry-sand settlement above groundwater. Based on the presence of shallow granitic bedrock below the site, the potential for seismically induced settlement is nil.

Debris Flows: Debris flows are composed of a slurry-like mass of liquefied debris (including boulders) that moves downhill under the force of gravity. Such slurries are dense enough to support very large particles but not solid enough to resist flowing downhill. Debris flows are most common in steep mountain canyons when a mass of mud and debris becomes saturated during a heavy rainstorm and suddenly begins to flow down the canyons (Prothero & Schwab, 1996). Based on the location of the site and the relatively planar topography of the property up-gradient of the site, the hazard of debris flow is low.

Flooding (Water Storage Facility Failure): A review of the State of California California Department of Water Resources, Division of Safety of Dams, 2020, California Dam Breach Inundation Maps, indicates that the subject site is not located within the limits of a dam inundation area. This includes the inundation limits of the Mockingbird Canyon and Lake Perris dams.

Erosion: No indication of wind or water surface erosion was observed on the site at the time of our study. The hazard of erosion is considered low.

Other Geologic Hazards: There are other geologic hazards not necessarily associated with seismic activity that occur statewide. These hazards include methane gas, hydrogen-sulfide gas, tar seeps, Radon-222 Gas, regional subsidence, and naturally occurring asbestos. Of these hazards, there are none that appear to impact the site.

ENGINEERING GEOLOGY REVIEW CONCLUSIONS AND RECOMMENDATIONS

Conclusions:

1. Earth Materials

As mapped, the site is underlain by biotite-hornblende tonalite of the Valle Verde pluton (map symbol Kvt). Materials encountered within our exploratory borings on February 5, 2020 predominantly consisted of highly- to moderately weathered granitic bedrock (tonalite) to the depths drilled, 15 to 40 feet below the existing ground surface. The surface of the site is covered with up to 3.5 feet of native soil and artificial fill, generally consisting of silty clayey sand (SC-SM), silty sand (SM) and clayey sand (SC).

2. Faulting

Ground rupture is generally considered most likely to occur along pre-existing faults. Since no known faults are believed to traverse the site, the probability of ground rupture is considered very low. The nearest known active fault is the San Jacinto Fault (San Jacinto Valley Segment) located approximately 15.5 kilometers to the northeast of the project site.

3. Seismicity

The primary geologic hazard that exists at the site is that of ground shaking. Several factors determine the severity of ground shaking at a given location, such as size of earthquake, length of fault rupture (if any), depth of hypocenter, type of faulting (dip slip/strike slip), directional attenuation, amplification, earth materials, and others. Due to the location of the site with respect to regional faulting and the recorded historical seismic activity, moderate to severe ground shaking should be anticipated during the life of the proposed project.

4. Groundwater

Groundwater was encountered within our exploratory boring B-04 (drilled February 5, 2020) at a depth of approximately 25 feet below the existing ground surface. Groundwater is considered to occur in limited quantities in the shallow weathered bedrock zone and possibly in fractures and joint systems within the bedrock. Based on the encountered groundwater levels and groundwater data reviewed, we estimate a high groundwater level at the site of 15 feet beneath the existing ground surface.

5. Secondary Seismic Hazards

Based on our study and review of available literature, no permanent or transient secondary seismic hazards are expected to affect the subject property.

***Recommendations*:**

1. For seismic design purposes, we considered a cascading effect of rupture along the entire length of the San Jacinto Fault Zone (six main segments collectively). This type of cascading rupture has an associated Maximum Moment Magnitude (Mw) of 7.8 (Peterson, et al, 2014).

2. All structures should be designed to at least meet the current California Building Code provisions in the latest CBC edition (2019); however, it should be noted that the building code is described as a minimum design condition and is often the maximum level to which structures are designed. Structures that are built to minimum code requirements are designed to remain standing after an earthquake in order for occupants to safely evacuate, but then may have to ultimately be demolished (Larson and Slosson, 1992). It is the responsibility of both the property owner and project structural engineer to determine the risk factors with respect to using CBC minimum design values for the facility.

SUBSURFACE CONDITIONS

The proposed classroom and administration building site is underlain by highly to moderately weathered granitic bedrock (tonalite) to a depth of at least 40 feet, the maximum depth drilled for this investigation. The weathered bedrock is mantled with as much as 3.5 feet of native soil and artificial fill. Approximately two inches of gravel are present on the ground surface at the location of boring B-04.

Laboratory testing of bedrock drilling spoils indicates that the weathered bedrock degrades into sand with silty clay (SW-SC) when disturbed. The surficial soil mantle generally consists of silty clayey sand (SC-SM), silty sand (SM) and clayey sand (SC).

Although not encountered in our borings, cobble and boulder size particles may be present in the weathered bedrock that will not become known until project excavation. Such materials, if encountered, may required screening prior to placement as compacted fill.

The granitic bedrock encountered in our borings is generally slightly moist and very dense. The overlying soil mantle is generally slightly moist to moist and loose to medium dense.

Analytical testing indicates that sulfate concentrations are very low. In accordance with ACI 318, Table 4.2.1, the soil is classified as Class S0 with respect to sulfate exposure. Chloride concentrations are 330 to 360 parts per million and indicate that the soil is generally not corrosive with respect to ferrous metal. It is, however, at levels high enough to be of concern with respect to corrosion of reinforcing steel. The soil is slightly acidic with an average pH value of slightly less than 7.0 Tested saturated resistivity values of 2,800 and 7,200 ohm-cm were obtained, indicating the soil is moderately corrosive to buried ferrous metal. Inland Foundation Engineering, Inc. does not practice corrosion engineering. We recommend that a qualified corrosion engineer be consulted for additional guidance.

Groundwater was encountered within exploratory boring B-04 at a depth of approximately 25 feet. The estimated historical high groundwater level is 15 feet below the existing ground surface.

CONCLUSIONS AND RECOMMENDATIONS

On the basis of our field and laboratory exploration and testing, construction of the proposed classroom and administration building is feasible from a geotechnical engineering standpoint. The primary issues requiring mitigation are undocumented artificial fill soil and variable density conditions to a depth of approximately 3.5 feet within the building pad and parking areas. This soil is not suitable for support of foundations or pavement in its existing condition.

To mitigate the potential for settlement, we recommend that the building pad and pavement areas be over-excavated and recompacted. These and other geotechnical engineering recommendations for project design and construction are presented below.

Foundation Design: The proposed classroom and administration building may be supported by shallow continuous and isolated spread footings designed with an allowable bearing pressure of 2,100 pounds per square foot. Footings should have a minimum width of 12 inches and be founded a minimum depth of 12 inches below the lowest adjacent grade. The allowable bearing pressure may be increased by 1,400 psf for each additional foot of depth and by 600 psf for each additional foot of width, to a maximum allowable bearing pressure of 4,200 psf. The allowable bearing capacity may also be increased by ⅓ for short-term transient wind and seismic loads. All footings should be supported by a minimum thickness of compacted fill of at least 12 inches.

<u>Static</u> settlement of foundations properly designed and constructed as recommended herein is expected to be less than one inch total. Potential seismically-induced settlement of existing site soil is estimated to be negligible. The total differential settlement between foundations of similar size and load is expected to be less than one inch vertical in 40 feet horizontal.

The on-site soil has a very low expansion potential. Expansive soil design criteria are not necessary for foundations and concrete slabs-on-grade.

Lateral Resistance: Resistance to lateral loads will be provided by a combination of friction acting at the base of the slab or foundation and passive earth pressure. A coefficient of friction of 0.50 between soil and concrete may be used with dead load forces only. A passive earth pressure of 250 psf/ft, may be used for the sides of footings poured against recompacted or dense native material. These values may be increased by 33 percent for lateral loads of short duration, such as those caused by wind or seismic forces. Passive earth pressure should be ignored within the upper one foot, except where confined as beneath a floor slab, for example.

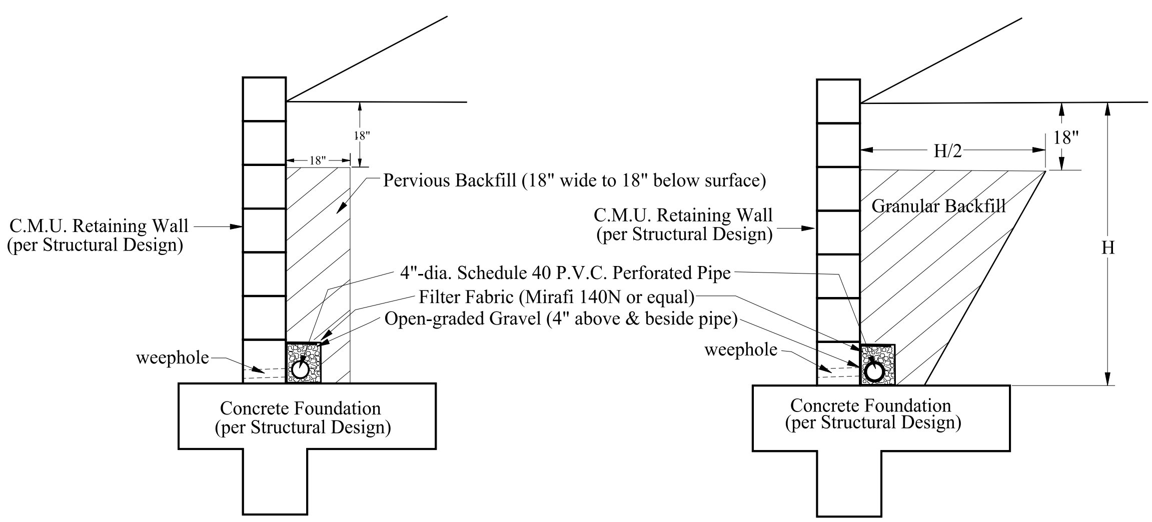
Excavation Stability: All excavations should be configured per with the requirements of CalOSHA. We recommend that the site soils be classified as Type C, per CalOSHA criteria. The classification of the soil and the shoring and/or slope configuration should be the responsibility of the contractor on the basis of the excavation depth and the soil encountered. The contractor should have a "competent person" on-site for the purpose of assuring safety within and about all construction excavations.

Retaining Walls: Retaining walls may be necessary during construction and/or landscaping. For on-site soils, the retaining walls should be designed for an active earth pressure equivalent to that exerted by a fluid weighing not less than 37 psf/ft.

For walls that are restrained, an "at-rest" lateral equivalent fluid pressure of 55 psf/ft is recommended, with the resultant applied at mid-height of the wall.

Any applicable construction and seismic surcharges should be added to the above pressures.

RETAINING WALL - TYPICAL PROFILE



Native Backfill

Imported Granular Backfill

At least 12 inches of granular material should be used in the backfill behind the walls and water pressure should not be permitted to build up behind retaining walls. The upper 12 to 18 inches of the backfill should consist of soil having a low permeability (less than 10^{-6} cm/sec). All backfill should be non-expansive. A subdrain should be constructed along the base of the backfill. Typical recommended retaining wall backfill and drainage details are shown in the detail above.

Concrete Slabs-on-Grade: All concrete slabs-on-grade should have a minimum thickness of four inches. During final grading and prior to the placement of concrete, all surfaces to receive concrete slabs-on-grade should be compacted to maintain a minimum compacted fill thickness of 12 inches.

Load bearing slabs may be designed using a modulus of subgrade reaction not exceeding 125 pounds per square inch per inch.

Slabs that are designed and constructed per the provisions of the American Concrete Institute (ACI) as a minimum will perform much better and will be more pleasing in appearance. Shrinkage of concrete should be anticipated. This will result in cracks in all concrete slabs-on-grade. Shrinkage cracks may be directed to saw-cut "control joints" spaced on the basis of slab thickness and reinforcement. ACI typically recommends control joint spacing in unreinforced concrete at maximum intervals equal to the slab thickness times 24. A level subgrade is also an important element in achieving some “control” in the locations of shrinkage cracks. Control joints should be cut immediately following the finishing process and prior to the placement of the curing cover or membrane. Control joints that are cut on the day following the concrete placement are generally ineffective. The placement of reinforcing steel will help in reducing crack width and propagation as-well-as providing for an increase in the control joint spacing. The use of welded wire mesh has typically been observed to be of limited value due to difficulties and lack of care in maintaining the level of the steel in the concrete during placement. The addition of water to the mix to enhance placement and workability frequently results in an excessive water-cement ratio that weakens the concrete, increases drying times and results in more cracking due to concrete shrinkage during the initial cure.

Slabs to receive moisture sensitive floor coverings should be provided with a moisture vapor retarder. Moisture vapor retarders should be designed and constructed in accordance with the manufacturer’s recommendations and in accordance with ACI 302.2R, which addresses below-slab vapor retarders/barriers. Vapor retarders should comply with ASTM E1745 and have a nominal thickness of 15 mils.

If concrete is to be placed on a dry absorptive subgrade in hot and dry weather, the subgrade should be dampened but not to a point that there is freestanding water prior to placement. The formwork and reinforcement should also be dampened.

Preliminary Pavement Design: Recommended structural pavement sections are shown below in Table 4. The recommended sections are based on an estimated R-value of 20, current Caltrans design procedures and the traffic index (T.I.) values shown.

TABLE 4: Preliminary AC Pavement Designs

Service	Asphalt Concrete Thickness (ft.)	Base Course Thickness (ft.)
Light traffic (autos, parking areas, T.I. = 5.0)	0.20	0.65
Heavy traffic (trucks, driveways, bus lanes, T.I. =7.0)	0.30	1.0

At the completion of rough grading, additional samples of the actual pavement subgrade soil should be obtained for R-value testing to confirm that the recommended pavement sections are appropriate.

Infiltration: Infiltration testing was performed at the three locations shown on Figure A-5. The testing procedures and test results are described in Appendix C. Table 5 below provides a summary of the test data with values for I_c. Note that the values shown do not include safety factors.

Table 5: Percolation Test Data and Infiltration Rates

Percolation Test No.	Percolation Rate (Min./Inch)	Depth Below Existing Ground Surface (In.)	Infiltration Rate (I_c) (In./Hr.)
P-01	20.0	96	0.24
P-02	9.2	96	0.53
P-03	8.6	98	0.53

General Site Grading: All grading should be performed per the applicable provisions of the 2019 California Building Code. The following recommendations have been developed on the basis of our field and laboratory testing:

1. **Clearing and Grubbing:** All building, slab and pavement areas and all surfaces to receive compacted fill should be cleared of existing loose soil, artificial fill, vegetation, debris, and other unsuitable materials. All remnants of former structures and pavements, all organic matter and any other unsuitable material should be removed and disposed of outside the project area. Based on the conditions encountered in our borings, excavation to depths of approximately three to four feet will be necessary to remove loose native and undocumented fill soil over most of the site.

   Abandoned underground utility lines should be traced out and completely removed from the site. Each end of the abandoned utility line should be securely capped at the entrance and exit to the site to prevent any water from entering the site. Soil loosened due to the removal of structures or large vegetation should be removed and replaced as controlled compacted fill.

2. **Preparation of Surfaces to Receive Compacted Fill:** All surfaces to receive compacted fill should be subjected to compaction testing prior to processing. Testing should indicate a relative compaction of at least 85 percent within the unprocessed native soils. If undocumented fill, loose soil, roots or other deleterious materials are encountered or if the relative compaction fails to meet the acceptance criterion, additional over-excavation should be performed until satisfactory conditions are encountered. Upon approval, surfaces to receive fill should be scarified, brought to near optimum moisture content, and compacted to a minimum of 90 percent relative compaction.

3. **Placement of Compacted Fill:** Fill materials consisting of on-site soil or approved imported granular soil, should be spread in shallow lifts and compacted at near optimum moisture content to a minimum of 90 percent relative compaction.

   Although not encountered in our borings, cobble and boulder size particles may be present in the weathered bedrock that will not become known until project excavation. Such materials, if encountered, may require screening prior to placement as compacted fill. Compacted fill should not contain any particles larger than 12 inches.

4. **Preparation of Building Area:** The proposed classroom and administration building should be underlain entirely by a uniform fill mat. The fill mat should extend below the deepest footing to a depth of at least 12 inches, or to the depth necessary to remove all existing fill and loose native soil in the building area. The fill mat should extend horizontally beyond the edge of exterior footings for a distance of at least five (5) feet.

5. **Preparation of Slab and Paving Areas:** During final grading and immediately prior to placement of concrete or aggregate base, all surfaces to receive asphalt concrete paving or concrete slabs-on-grade should be processed and tested to assure compaction for a depth of at least of 12 inches. This may be accomplished by a combination of overexcavation, scarification and recompaction of the surface, and replacement of the excavated material as controlled compacted fill. Compaction of the slab areas should be to a minimum of 90 percent relative compaction. Compaction within the proposed pavement areas should be to a minimum of 95 percent relative compaction for both the subgrade and base course.

6. **Utility Trench Backfill:** Utility trench backfill consisting on-site soil should be placed by mechanical compaction to a minimum of 90 percent relative compaction. This is with the exception of the upper 12 inches under pavement areas where the minimum relative compaction should be 95 percent. Jetting of the native soils is not recommended.

7. **Testing and Observation:** During grading, tests and observations should be performed by the project geotechnical engineer or his/her representative to verify that the grading is being performed per the project specifications. Field density testing should be performed per the current ASTM D1556 or ASTM D6938 test methods. The minimum acceptable degree of compaction should be 90 percent of the maximum dry density as obtained by the ASTM D1557 test

method except where superseded by more stringent requirements, such as beneath pavement or in deep fills. Where testing indicates insufficient density, additional compactive effort should be applied until retesting indicates satisfactory compaction.

GENERAL

The findings and recommendations presented in this report are based upon an interpolation of the soil conditions between boring locations. Should conditions be encountered during grading that appears to be different than those indicated by this report, this office should be notified.

We recommend that a pre-job conference be held on the site prior to the initiation of site grading. The purpose of this meeting will be to assure a complete understanding of the recommendations presented in this report as they apply to the actual grading performed.

This report was prepared for Riverside Community College District for their use in the design of the the proposed new classroom and administration building at the Ben Clark Training Center. This report may only be used by Riverside Community College District for this purpose. The use of this report by parties or for other purposes is not authorized without written permission by Inland Foundation Engineering, Inc. Inland Foundation Engineering, Inc. will not be liable for any projects connected with the unauthorized use of this report.

The recommendations of this report are considered to be preliminary. The final design parameters may only be determined or confirmed at the completion of site grading on the basis of observations made during the site grading operation. To this extent, this report is not considered to be complete until the completion of both the design process and the site preparation.

REFERENCES

ASCE/SEI, 2017, ASCE Standard 7-16, Minimum Design Loads for Buildings and Other Structures.

Blake, T.F. 1989-2000a, EQSEARCH, A Computer Program for the Estimation of Peak Horizontal Acceleration from Southern California Historical Earthquake Catalog, Version 3.00b.

Blake, T.F. 1998-2000, UBCSEIS, A Computer Program for the Estimation of Uniform Building Code Coefficients Using 3-D Fault Sources, Version 1.03.

California Building Standards Commission, 2019, California Building Code (CBC), California Code of Regulations, Title 24, Part 2, Volume 2.

California Department of Water Resources, Division of Safety of Dams, 2020, California Dam Breach Inundation Maps, https://fmds.water.ca.gov/maps/damim/

California Division of Mines & Geology (C.D.M.G.), 2000, Digital Images of Official Maps of Alquist-Priolo Earthquake Fault Zones of California, Southern Region, DMG CD 2000-003.

California Geological Survey (CGS), 2007, "Guidelines to Geologic/Seismic Reports," Note No. 42, Interim Revision 2007.

California Geological Survey (CGS), 2008, Guidelines for Evaluating and Mitigating Seismic Hazards in California, CGS Special Publication 117A.

California Geological Survey (CGS), 2002, “California Geomorphic Provinces”, Note 36.
California Geological Survey (CGS), 2013, Checklist for the Review of Engineering.

California Geological Survey (CGS), 2020, California Official Tsunami Inundation Maps, California Department of Conservation, https://www.conservation.ca.gov/cgs/tsunami/maps.

Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings, Note 48, November 2019.

California Geological Survey (CGS), 2010, 2010 Fault Activity Map of California, Geologic Map No. 6.

California Institute of Technology, Southern California Earthquake Data Center, 2013, Significant Earthquakes and Faults, San Jacinto Fault Zone:
http://scedc.caltech.edu/significant/sanjacinto1899.html

Coduto, Donald, 2001, Foundation Design: Principles and Practice, Second Edition, Prentice Hall.

Dudley, Paul H., 1936, Physiographic History of a Portion of the Perris Block, Southern California, from "Journal of Geology," 1936, Volume 44, pp. 358-378.

Federal Emergency Management Agency (2020), FEMA Flood Map Service Center, http://msc.fema.gov/portal

Harden, D.R., 1998, California Geology: Prentice Hall, Inc.

Hart, E.W. and Bryant W., 1997, "Fault Rupture Hazard Zones in California," California Division of Mines & Geology Special Publication 42.

Idriss, I.M. and Boulanger, R.W., 2008, “Soil Liquefaction During Earthquakes”, Earthquake Engineering Research Institute.

Ishihara, K., 1985, “Stability of Natural Deposits During Earthquakes”, 11th International Conference on Soil Mechanics and Foundation Engineering, pp. 321-376.

Jennings, C.W., 1992, Preliminary Fault Activity Map of California, Scale 1:750,000, C.D.M.G. Open File Report 92-03.

Jennings, C.W., 1994, Fault Activity Map of California and Adjacent Areas, C.D.M.G. Geologic Data Map No. 6, 1:750,000 scale.

Larson, R., and Slosson, J., 1992, The Role of Seismic Hazard Evaluation in Engineering Reports, *in* Engineering Geology Practice in Southern California, AEG Special Publication No. 4, pp. 191-194.

Morton, D.M. and Cox, B., 2001, Preliminary Geologic Map of the Riverside East 7.5’ Quadrangle, U.S.G.S. Open File Report 01-452.

Morton, D.M. and Matti, J.C., 1989, A Vanished late Pliocene to early Pleistocene alluvial-fan complex in the north Perris block, southern California. In Conglomerates in Basin Analysis: A symposium Dedicated to A.O. Woodford, Pacific Section S.E.P.M., Vol. 62, pp. 73-80.

Norris, R.M. and R.W. Webb, 1990, Geology of California (second edition).

Peterson, et al, 2014, Documentation for the 2014 update of the U.S. national seismic maps, U.S. Geological Survet Open File Report 2014-1091.

Prothero, D.R., & Schwab, F., 1996, Sedimentary Geology, an Introduction to Sedimentary Rocks and Stratigraphy.

Riverside County Land Information System GIS Maps, 2020.

Rodgers, T.H., 1966, Geologic Map of California, Santa Ana Sheet, Scale 1:250,000 (Second Printing 1973).

Toppozada, T.R., et al., 2000, Epicenters of and Areas Damaged by M≥4 California Earthquakes, Map Sheet 49, Scale 1”=25 Miles.

U.S. Department of the Air Force, 1996, Final Environmental Impact Statement, Volume 1, Disposal of Portions of March Air Force Base, California.

U.S. Department of the Air Force, 1990, Draft Environmental Impact Statement, Proposed Closure of Los Angeles AFB, California and Restoration of Space Systems Division.

U.S.G.S., 2020, Earthquake Hazards Program Earthquake Catalog, https://earthquake.usgs.gov/earthquakes/search/

Woodford, A., Shelton, J., Doehring, D., and Morton, R., 1971, Pliocene-Pleistocene History of the Perris Block, Southern California, Geological Society of America Bulletin, V. 82, pp. 3421-3448, 18 Figures, December, 1971.

Ziony, J.I., and Yerkes, R.F., 1985, Evaluating Earthquake and Surface Faulting Potential, in Evaluating Earthquake Hazards in the Los Angeles Region, U.S.G.S. Professional Paper 1360.

AERIAL PHOTOGRAPHS UTILIZED

Riverside County Flood Control District, 1948, Photo Nos. 1-33 and 1-34, Scale 1”= 2,600’, January 14, 1948.

Riverside County Flood Control District, 1962, Photo Nos. 1-140, 1-141, and 1-142, Scale 1" = 2,000', January 28, 1962.

Riverside County Flood Control District, 1974, Photo Nos. 305 and 306, Scale 1" = 2,000', May 24, 1974.

Riverside County Flood Control District, 1980, Photo Nos. 241 and 242, Scale 1" = 2,000', February 1, 1980.

Riverside County Flood Control District, 1984, Photo Nos. 1337 and 1338, Scale 1" = 2,000', February 7, 1984.

Riverside County Flood Control District, 1990, Photo Nos. 6-26 and 6-27, Scale 1" = 2,000', January 23, 1990.

Riverside County Flood Control District, 1995, Photo Nos. 6-23 and 6-24, Scale 1" = 1,600', January 30, 1995.

Riverside County Flood Control District, 2000, Photo Nos. 6-23, 6-24, and 6-25, Scale 1" = 1,600', March 11, 2000.

Riverside County Flood Control District, 2005, Photo Nos. 6-23 and 6-24, Scale 1" = 1,600', April 14, 2005.

Riverside County Flood Control District, 2010, Photo Nos. 6-23 and 6-24, Scale 1" = 1,600', March 14, 2010.

Terrain Navigator, Orthophoto Map, Riverside East SE, CA, USGS Ref. Code 33117-H3-TF-012, dated 2018.

APPENDIX A – Field Exploration

APPENDIX A

FIELD EXPLORATION

For our field exploration, six exploratory borings were excavated by means of a truck mounted rotary auger rig at the approximate locations shown on Figure No. A-9. Logs of the materials encountered were made on the site by a staff geologist. The boring logs are shown on Figures A-3 through A-8.

Representative relatively undisturbed samples were obtained within our borings by driving a thin-walled steel penetration sampler with successive 30-inch drops of a 140-pound hammer. The number of blows required to achieve each six inches of penetration were recorded on our boring logs and used for estimating the relative consistency of the soil. Two different samplers were used. The first sampler used was a Standard Penetration Test sampler for which published correlations relating the number of hammer blows to the strength of the soil are available. The second sampler type was a modified California split barrel sampler with 2.41 inch diameter brass sample rings. Samples were placed in moisture sealed containers and transported to our laboratory for further observations and testing.

Representative bulk samples were obtained and returned to our laboratory for further testing and observations. The results of this testing are discussed and presented in Appendix B.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487)

PRIMARY DIVISIONS			GROUP SYMBOLS	SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIALS IS LARGER THAN #200 SIEVE SIZE	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN #4 SIEVE	CLEAN GRAVELS (LESS THAN) 5% FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVEL WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN #4 SIEVE	CLEAN SANDS (LESS THAN) 5% FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN HALF OF MATERIALS IS SMALLER THAN #200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT IS LESS THAN 50	ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT IS GREATER THAN 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
	HIGHLY ORGANIC SOILS		PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS
TYPICAL FORMATIONAL MATERIALS	SANDSTONES		SS	
	SILTSTONES		SH	
	CLAYSTONES		CS	
	LIMESTONES		LS	
	SHALE		SL	

CONSISTENCY CRITERIA BASES ON FIELD TESTS

RELATIVE DENSITY – COARSE – GRAIN SOIL

RELATIVE DENSITY	SPT * (# BLOWS/FT)	RELATIVE DENSITY (%)
VERY LOOSE	<4	0-15
LOOSE	4-10	15-35
MEDIUM DENSE	10-30	35-65
DENSE	30-50	65-85
VERY DENSE	>50	85-100

CONSISTENCY – FINE-GRAIN SOIL

CONSISTENCY	SPT* (# BLOWS/FT)	TORVANE UNDRAINED SHEAR STRENGTH (tsf)	POCKET ** PENETROMETER UNCONFINED COMPRESSIVE STRENGTH (tsf)
Very Soft	<2	<0.13	<0.25
Soft	2-4	0.13-0.25	0.25-0.5
Medium Stiff	4-8	0.25-0.5	0.5-1.0
Stiff	8-15	0.5-1.0	1.0-2.0
Very Stiff	15-30	1.0-2.0	2.0-4.0
Hard	>30	>2.0	>4.0

* NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1 3/8 INCH I.D.) SPLIT BARREL SAMPLER (ASTM -1586 STANDARD PENETRATION TEST)

** UNCONFINED COMPRESSIVE STRENGTH IN TONS/SQ.FT. READ FROM POCKET PENETROMETER

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
DRY	Absence of moisture, dusty, dry to the touch
MOIST	Damp but no visible water
WET	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbled or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

EXPLANATION OF LOGS

LOG OF BORING B-01

DRILLING RIG	Mobile B-61	DATE DRILLED	2/5/20	HAMMER TYPE	Auto-Trip
DRILLING METHOD	Rotary Auger			HAMMER WEIGHT	140-lb.
LOGGED BY	FWC			HAMMER DROP	30-inches
GROUND ELEVATION	+/-			BORING DIAMETER	8-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	BULK SAMPLE	DRIVE SAMPLE	SAMPLE TYPE	BLOW COUNTS /6"	MOISTURE (%)	DRY UNIT WT. (pcf)
0	SC-SM		**SILTY, CLAYEY SAND,** fine- to medium, olive-brown, moist, medium dense.						
	SW-SC		**GRANITE,** highly to moderately weathered, olive. - Degrades to SAND with SILTY CLAY when disturbed, slightly moist, very dense -						
					X	SS	28 50	5	121
5									
					X	SS	15 50	3	123
10					X	SS	50 50	2	120
					X	SS	50	2	122
15					X	SS	50		
			End of boring at 15.5 feet. No groundwater encountered. Backfilled with native soils.						

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FIGURE NO. A-3

LOG OF BORING B-02

DRILLING RIG	**Mobile B-61**	DATE DRILLED	**2/5/20**	HAMMER TYPE	**Auto-Trip**
DRILLING METHOD	**Rotary Auger**			HAMMER WEIGHT	**140-lb.**
LOGGED BY	**FWC**			HAMMER DROP	**30-inches**
GROUND ELEVATION	**+/-**			BORING DIAMETER	**8-inches**

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	DESCRIPTION	BULK SAMPLE	DRIVE SAMPLE	SAMPLE TYPE	BLOW COUNTS /6"	MOISTURE (%)	DRY UNIT WT. (pcf)
0	SM		**ARTIFICIAL FILL,** SILTY SAND, with trace clay, fine- to medium, olive-brown, moist, medium dense.						
	SC-SM		**SILTY, CLAYEY SAND,** fine- to medium, olive-brown, moist, medium dense.			AU			
						SS	8 10	8	126
5	SW-SC		**GRANITE,** moderately to slightly weathered, olive. - Degrades to SAND with SILTY CLAY when disturbed, slightly moist to moist, very dense -			SS	50	4	112
						SS	38 50	3	124
10						SS	50	4	113
15						SS	50	4	117
20			- mottled -			SPT	18 50	7	
			End of boring at 23 feet. Auger refusal. No groundwater encountered. Mottling encountered at 20 feet. Backfilled with native soils.						

LOG OF BORING B-03

DRILLING RIG	Mobile B-61	DATE DRILLED	2/5/20
DRILLING METHOD	Rotary Auger	HAMMER TYPE	Auto-Trip
LOGGED BY	FWC	HAMMER WEIGHT	140-lb.
GROUND ELEVATION	+/-	HAMMER DROP	30-inches
		BORING DIAMETER	8-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	BULK SAMPLE	DRIVE SAMPLE	SAMPLE TYPE	BLOW COUNTS /6"	MOISTURE (%)	DRY UNIT WT. (pcf)
0	SM		**SILTY SAND,** with trace clay, very fine- to fine, olive-brown, moist, loose to medium dense.			AU			
3	SW-SC		**GRANITE,** moderately to slightly weathered, olive. - Degrades to SAND with SILTY CLAY when disturbed, slightly moist, very dense -			SS AU	11 14	6	117
5						SS	50	4	108
						SS	50	2	117
10						SS	50	2	114
15						SS	50	3	115
20						SPT	50	2	
21			End of boring at 21 feet. Auger refusal. No groundwater or mottling encountered. Backfilled with native soils.						

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FIGURE NO.

A-5

LOG OF BORING B-04

DRILLING RIG	Mobile B-61	DATE DRILLED	2/5/20	HAMMER TYPE	Auto-Trip
DRILLING METHOD	Rotary Auger			HAMMER WEIGHT	140-lb.
LOGGED BY	FWC			HAMMER DROP	30-inches
GROUND ELEVATION	+/-			BORING DIAMETER	8-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	U.S.C.S.	DESCRIPTION	SAMPLE TYPE	BLOW COUNTS /6"	MOISTURE (%)	DRY UNIT WT. (pcf)
0	GW	**ARTIFICIAL FILL,** GRAVEL (2 inches)	AU			
	SC-SM	**SILTY, CLAYEY SAND,** fine- to medium, olive-brown, slightly moist, medium dense.	SS	9 10	8	128
5		**GRANITE,** highly to slightly weathered, olive. - Degrades to SAND with SILTY CLAY when disturbed, slightly moist to wet, very dense -	AU			
			SS	18 50	9	125
			SS	50	1094	10
10			SS	50	2	115
15			SS	50	2	118
20	SW-SC	- light gray, highly weathered, mottled -	SPT	50	4	
25		∇	SPT	50	6	
30			SPT	50	14	
35			SPT	50	13	
40			SPT	50		

End of boring at 40.5 feet. Auger refusal. Groundwater encountered at 25 feet. Mottling encountered at 20 feet. Backfilled with native soils.

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FIGURE NO. A-6

LOG OF BORING B-05

DRILLING RIG	**Mobile B-61**	HAMMER TYPE	**Auto-Trip**
DRILLING METHOD	**Rotary Auger**	HAMMER WEIGHT	**140-lb.**
LOGGED BY	**FWC**	HAMMER DROP	**30-inches**
GROUND ELEVATION	**+/-**	BORING DIAMETER	**8-inches**

DATE DRILLED **2/5/20**

DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.	BULK SAMPLE	DRIVE SAMPLE	SAMPLE TYPE	BLOW COUNTS /6"	MOISTURE (%)	DRY UNIT WT. (pcf)
0	SC-SM		**SILTY, CLAYEY SAND,** very fine- to fine, olive-brown, moist, loose.			AU			
	SC		**CLAYEY SAND,** very fine- to fine, red-brown, moist, loose.			AU			
						SS	2 4	9	123
	SW-SC		**GRANITE,** highly to moderately weathered, olive. - Degrades to SAND with SILTY CLAY when disturbed, slightly moist to moist, very dense -			AU			
						SS	50	4	120
5									
						SS	50	8	116
10									
15			End of boring at 15 feet. No groundwater or mottling encountered. Backfilled with native soils.						

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PROJECT NAME	**Ben Clark Training Center**
PROJECT LOCATION	**16791 Davis Avenue** **Riverside, CA**
PROJECT NUMBER	**R351-011**

FIGURE NO. A-7

LOG OF BORING B-06

DRILLING RIG	Mobile B-61	HAMMER TYPE	Auto-Trip
DRILLING METHOD	Rotary Auger	HAMMER WEIGHT	140-lb.
LOGGED BY	FWC	HAMMER DROP	30-inches
GROUND ELEVATION	+/-	BORING DIAMETER	8-inches

DATE DRILLED 2/5/20

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	U.S.C.S.	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	BULK SAMPLE	DRIVE SAMPLE	SAMPLE TYPE	BLOW COUNTS /6"	MOISTURE (%)	DRY UNIT WT. (pcf)
0	SC-SM		**SILTY, CLAYEY SAND,** very fine- to fine, olive-brown, moist, loose.						
	SC		**CLAYEY SAND,** very fine- to fine, dark brown, very moist, loose.		X	SS	3 3	12	118
	SW-SC		**GRANITE,** highly to moderately weathered, olive. - Degrades to SAND with SILTY CLAY when disturbed, slightly moist to moist, very dense -						
5					X	SS	18 50	7	125
					X	SS	18 50	5	123
10									
15			End of boring at 15 feet. No groundwater or mottling encountered. Backfilled with native soils.						

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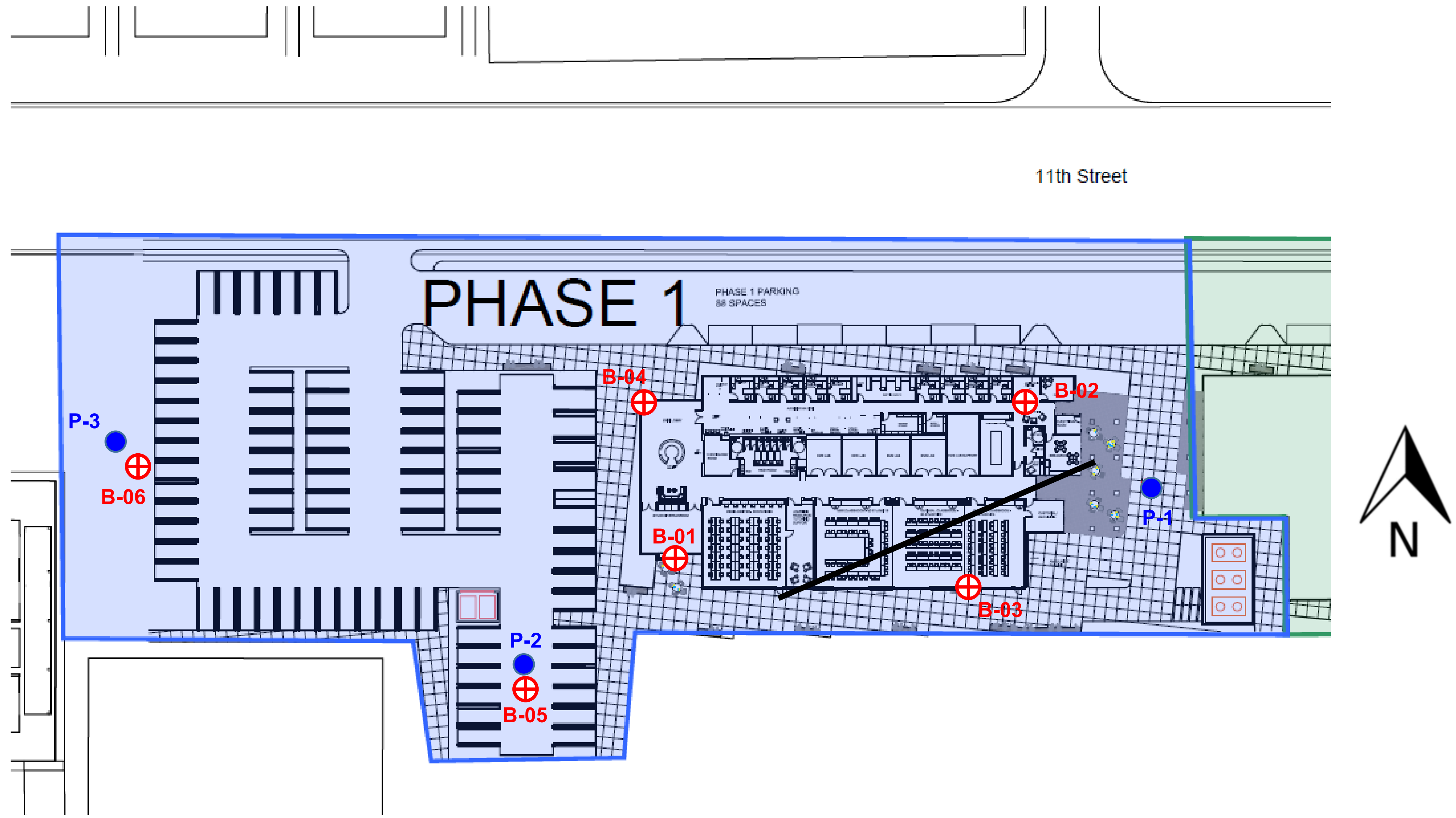
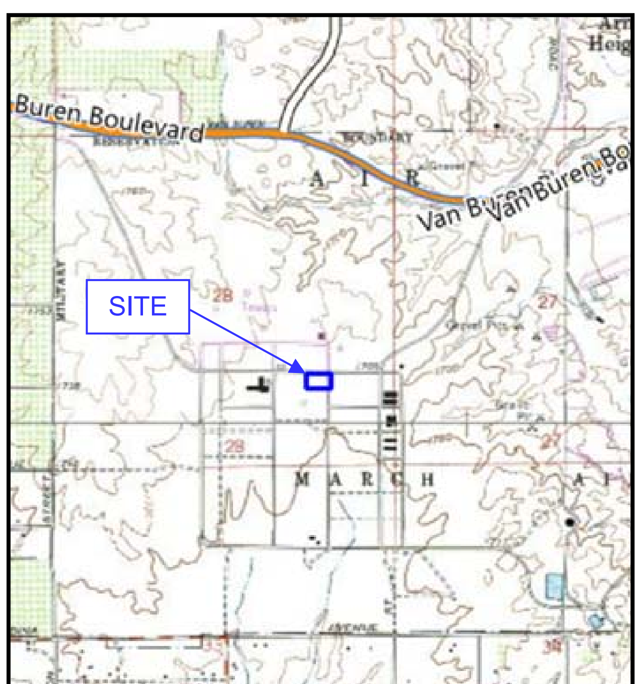
FIGURE NO. A-8

SITE PLAN





Vicinity Map

⊕ Approximate Location of Exploratory Boring

● Approximate Location of Infiltration Test

Approximate Location of Shear Wave Survey

INLAND FOUNDATION ENGINEERING, INC. *Consulting Geotechnical Engineers and Geologists* *www.inlandfoundation.com* *(951) 654-1555*		
A-9	Geotechnical Investigation RCCD Ben Clark Training Center: Education Center	
	Drawn By: DRL	Project No. R351-011
	Scale: 1" = 60' ±	Date: Feb. 2020

APPENDIX B – Laboratory Testing

APPENDIX B

LABORATORY TESTING

Representative soil samples obtained from our borings were returned to our laboratory for additional observation and testing. Descriptions of the tests performed are provided below.

Unit Weight and Moisture Content: Ring samples were weighed and measured to evaluate their unit weight. A small portion of each sample was then tested for moisture content. The testing was performed per ASTM D2937 and D2216. The results of the testing are shown on the boring logs (Figure Nos. A-3 through A-8).

Sieve Analysis: Three soil samples were selected for sieve analysis testing in accordance with ASTM D6913. These tests provide information for classifying the soil in accordance with the Unified Classification System. This classification system categorizes the soil into groups having similar engineering characteristics. The results of this testing are shown on Figure No. B-3.

Plastic Index: Three samples were selected for plastic index testing in accordance with ASTM D4318. These tests provide information regarding soil plasticity and are also used for developing classifications for the soil in accordance with the Unified Classification System. The results are shown on Figure No. B-3.

Direct Shear Strength: One sample was selected for direct shear strength testing in accordance with ASTM D3080. This testing measures the shear strength of the soil under various normal pressures and is used to develop parameters for foundation bearing capacity and lateral earth pressure. Test results are shown on Figure No. B-4.

Analytical Testing: Two samples were selected to evaluate the concentration of soluble sulfates and chlorides, pH level, and resistivity of the soil. The test results are shown in the following table.

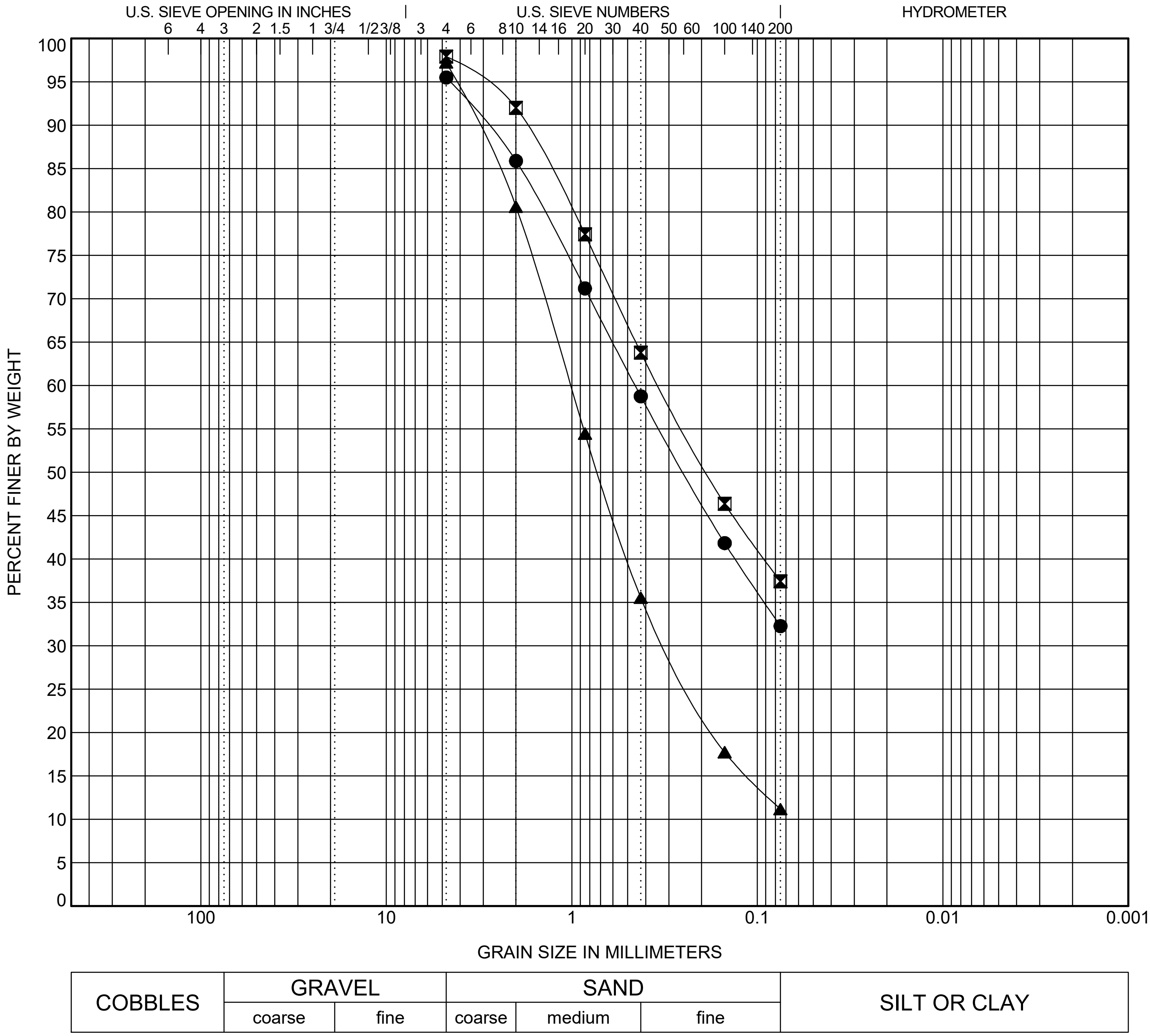
Sample Location	Sample Depth (ft.)	Water-Soluble Sulfates (%)	Chlorides (ppm)	Minimum Resistivity (ohm-cm)	pH
B-03	0.0 – 3.0	<0.001	360	2,800	7.1
B-04	3.5 - 40.5	<0.001	330	7,200	6.8

Expansion Index: One sample was selected for expansion index testing in accordance with ASTM D4829. This test provides information regarding the expansive characteristics of soil under standardized test conditions. The test results are shown in the following table.

Sample Location	Sample Depth (ft)	Initial Dry Density (pcf)	Initial Moisture Content (%)	Expansion Index	Expansion Class
B-03	0.0 – 3.0	118.3	8.0	6	Very Low

GENERAL

All laboratory testing has been conducted in conformance with the applicable ASTM test methods by personnel trained and supervised in conformance with our QA/QC policy. Our test data only relates to the specific soils tested. Soil conditions typically vary and any significant variations should be reported to our laboratory for review and possible testing. The data presented in this report are for the use of Riverside Community College District only and may not be reproduced or used by others without written approval of Inland Foundation Engineering, Inc.



	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**B-02**	**1.8**	**SILTY, CLAYEY SAND(SC-SM)**	**25**	**19**	**6**		
⊠	**B-03**	**0.0**	**SILTY SAND(SM)**	**22**	**19**	**3**		
▲	**B-04**	**3.5**	**WELL-GRADED SAND with SILTY CLAY(SW-SC)**	**28**	**22**	**6**	**1.40**	**15.37**

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-02**	**1.8**	**4.75**	**0.456**				**63.2**	**32.3**	
⊠	**B-03**	**0.0**	**4.75**	**0.339**				**60.5**	**37.4**	
▲	**B-04**	**3.5**	**4.75**	**1.019**	**0.308**			**86.1**	**11.2**	

GRADATION CURVES (ASTM D422, ASTM D4318)

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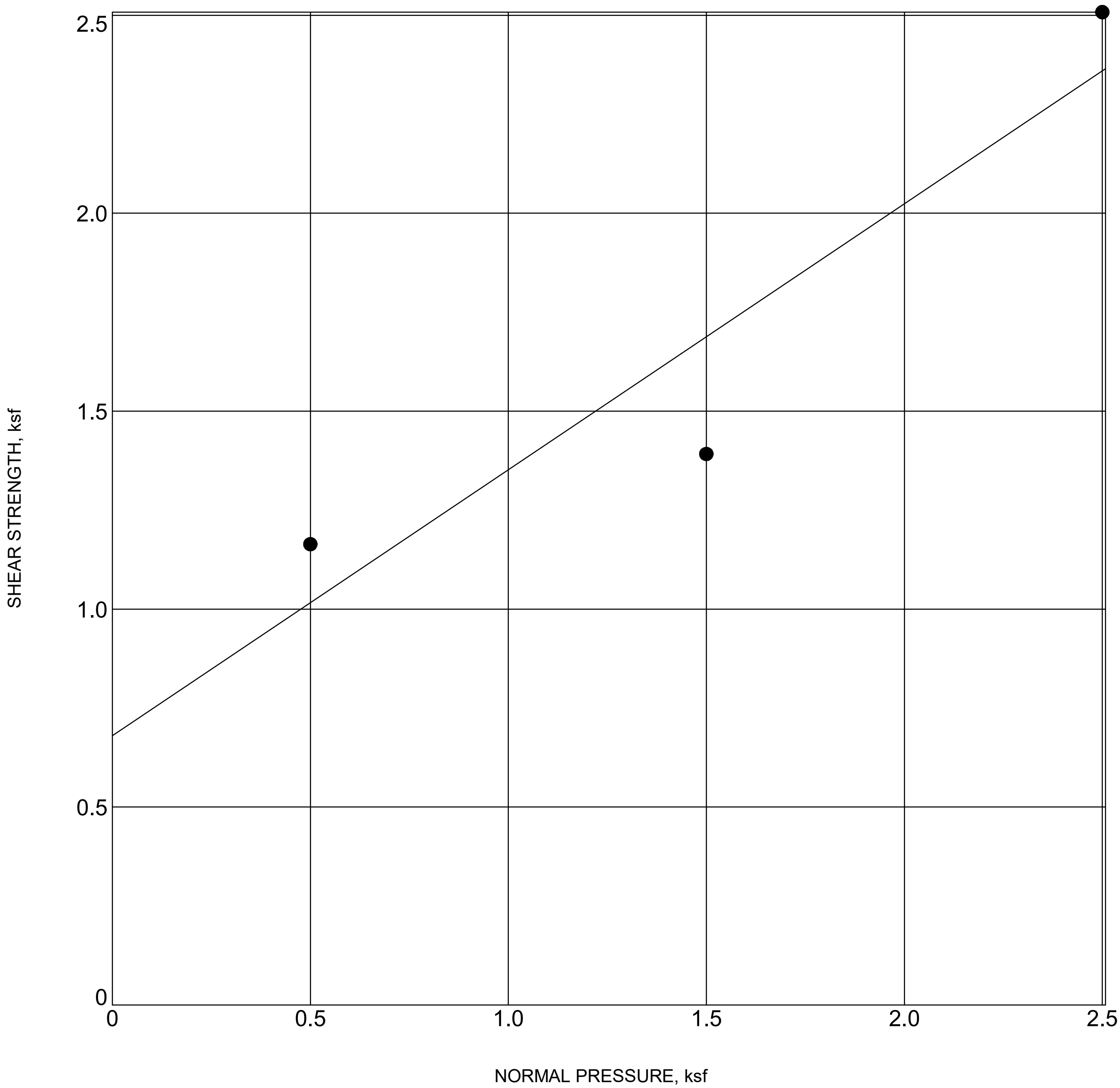
FIGURE NO. B-3

CLIENT Riverside Community College District

PROJECT NAME Ben Clark Training Center

PROJECT NUMBER R351-011

PROJECT LOCATION 16791 Davis Avenue
Riverside, CA



BOREHOLE	DEPTH	Classification	γ_d	MC%	c	ϕ		
B-02	**2.5**	**SILTY, CLAYEY SAND (SC-SM)**	**118**	**10**	**0.7**	**34**	Residual	●
							Peak	

DIRECT SHEAR TEST (ASTM D3080)

FIGURE NO. B-4

Inland Foundation Engineering, Inc.

CLIENT Riverside Community College District

PROJECT NAME Ben Clark Training Center

PROJECT NUMBER R351-011

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Riverside, CA

APPENDIX C – Infiltration Testing

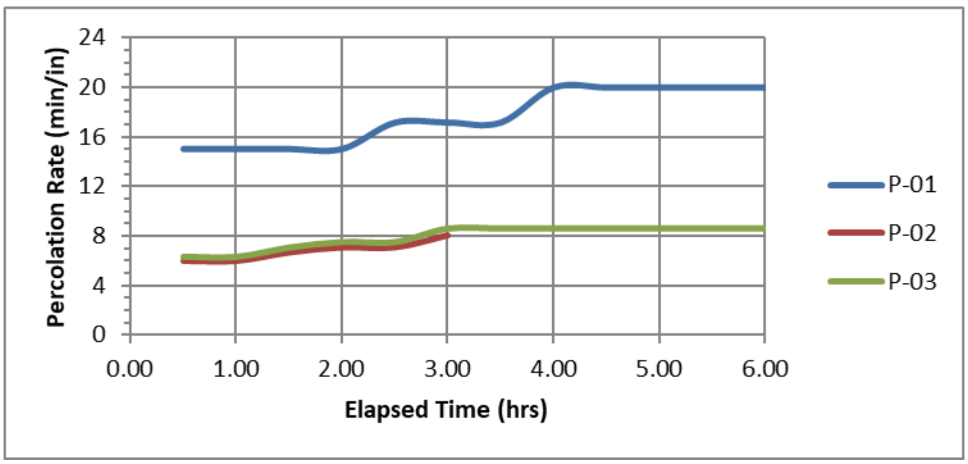
APPENDIX C

INFILTRATION TESTING

Infiltration testing was conducted in general accordance with Appendix A - Infiltration Testing of Riverside County - Low Impact Development BMP Handbook. We performed shallow percolation testing per the Riverside County Department of Environmental Health test procedure. A staff geologist conducted the actual percolation testing with equipment and procedures outlined in the Riverside County Technical Guidance Manual.

Three percolation tests were performed at the locations shown on Figure No. A-9. The tests were performed at depths of approximately 96 and 98 inches below the existing ground surface. The test holes were excavated approximately eight (8) inches in diameter. Per the specified percolation test procedure, the test holes were filled with water to a depth of at least five (5) times the radius of the test holes. A two-inch thick layer of gravel was placed in the bottom of each test hole. In this case, the test holes were excavated and filled to a depth of at least 20 inches above the top of the gravel.

The test holes were presoaked prior to actual testing. The measured percolation rates ranged from 8.8 to 20.0 minutes per inch.



Percolation test rates were converted to infiltration rates (I_c) using the Porchet method and the following equation:

$$I_c = \Delta H 60r/\Delta t(r+2H_{avg})$$

Where:

r = Test Hole Radius (in.)
H_{avg} = Average Height of Water during Test Interval (in.)
ΔH = Change in Water Height during Test Interval (in.), and
Δt = Time Interval (in.)

The corresponding calculated infiltration rates (I_c) ranged from 0.24 to 0.53 inches per hour. These values exclude factors of safety. The table below provides a summary of the test data with values for (I_c):

Percolation Test No.	Percolation Rate (Min./Inch)	Depth Below Existing Ground Surface (In.)	Infiltration Rate (I_c) (In./Hr.)
P-01	20.0	96	0.24
P-02	9.2	96	0.53
P-03	8.6	98	0.53