GEOTECHNICAL INVESTIGATION

SOBOBA COMMUNITY SERVICES CENTER
SWC SOBOBA ROAD AND LAKE PARK DRIVE
SAN JACINTO, CALIFORNIA

GEOCON
WEST, INC.

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

SOBOBA BAND OF LUISEÑO INDIANS
14099 SOBOBA ROAD
SAN JACINTO, CALIFORNIA

OCTOBER 3, 2017
PROJECT NO. T2718-22-04

Project No. T2718-22-04
October 3, 2017

Soboba Band of Luiseño Indians
24099 Soboba Road
San Jacinto, California 92583

Attention: Mr. Kenneth McLaughlin

Subject: GEOTECHNICAL INVESTIGATION
SOBOBA COMMUNITY SERVICES CENTER
SOUTHWEST CORNER OF SOBOBA ROAD AND LAKE PARK DRIVE
SOBOBA NATION, SAN JACINTO, CALIFORNIA

Dear Mr. McLaughlin:

Per authorization of Geocon Proposal IE-1648 dated April 15, 2016, by Soboba Band of Luiseño Indians, Geocon West, Inc. (Geocon) herein submits the results of our geotechnical investigation for the subject community services center. The accompanying report presents our findings, conclusions and recommendations pertaining to the geotechnical aspects of the proposed development. The study also includes an evaluation of the geologic units and geologic hazards. Based on the results of this study, it is our opinion the site is considered suitable for the proposed development provided the recommendations of this report are followed.

Geocon is concurrently performing a Surface Fault Rupture Hazard Evaluation for the project which will be issued in a separate report.

Should you have any questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON WEST, INC.

Paul D. Theriault
CEG 2377

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of our geotechnical investigation for the proposed Soboba Community Services Center project located southwest of the intersection of Lake Park Drive and Soboba Road in San Jacinto, California (see *Vicinity Map*, Figure 1). The site includes approximately 64 acres, of which approximately 30 acres will be used for the subject project. The project is located at latitude 33.7878 and longitude -116.9256.

The purpose of the investigation was to evaluate subsurface soil and geologic conditions at the site and, based on the conditions encountered, to provide recommendations pertaining to the geotechnical aspects of developing the property. A conceptual site plan was provided in the request for proposal (RFP); however, the buildings may have to be reconfigured to avoid any recommended building setback zones in Geocon's forthcoming fault rupture hazard evaluation. We utilized a Google Earth Pro image as the base image for our *Geotechnical Map*, Figure 2.

The scope of our investigation included a site reconnaissance, stereoscopic aerial photograph review, subsurface exploration, laboratory testing, engineering analyses, and the preparation of this report. A summary of the information reviewed for this study is presented in the *List of References*.

Our field investigation was performed on August 28 and 29, and included the excavation of 15 small diameter geotechnical borings. *Appendix A* presents a discussion of the field investigation and includes logs of the borings. The approximate locations of the exploratory excavations are presented on the *Geotechnical Map* (Figure 2). We performed laboratory tests on soil samples obtained from the exploratory excavations to evaluate pertinent physical and chemical properties for engineering analysis. The results of the laboratory testing are presented in *Appendix B*.

Geocon is performing a surface fault rupture hazard evaluation of the property at the time of this report. A separate report will be issued to address the surface fault rupture hazard and recommended building setback zones, if any.

References to elevations presented in this report are based on the elevations provided by the On Point topographic map. Geocon does not practice in the field of land surveying and is not responsible for the accuracy of such topographic information.

2. SITE AND PROJECT DESCRIPTION

The site is a horseshoe shaped parcel bounded on the northeast by Soboba Road, on the northwest by Lake Park Drive, on the southeast by an existing residence, and on the southwest by the San Jacinto River. The middle of the horseshoe is occupied by an existing mobile home park. The western half of the site was not evaluated as part of the scope of this report as it was deemed a habitat for the endangered San Bernardino Kangaroo Rat and no development is currently planned for this area.

The site is currently vacant and covered with a moderate growth of weeds and grass. The site was partially graded in 2002. Remnants of the grading operation include unpaved streets, sheet graded pads, and a detention basin along the eastern boundary near the intersection of Soboba Road and Lake Park Drive. Documentation for the fill has not been provided for our review, as such the fill is considered undocumented. Topographically, the site has a gentle slope towards the west, with elevations along Soboba Road ranging from 1,652 feet MSL in the south to 1,632 MSL in the north, and the western edge ranges from approximately 1,608 feet MSL in the south to approximately 1,598 feet MSL in the north. Google and historic aerial images indicate the site was unoccupied from at least 1948 to the present day. As previously stated, the San Jacinto River is located along the western perimeter of the site at an elevation of 1,600 feet mean sea level (MSL) in the south to an approximate elevation of 1,595 feet MSL in the north. A 16-foot-high levee is present along the river between the channel and western site perimeter.

The community service development, as indicated in the RFP, includes a fire station, a convenience store, and a medical center. Additional future development will include a movie theater, bowling alley, arcade, restaurants and retail space. It is assumed that proposed structures will be three stories or less and constructed at or near existing grade. Associated parking lots, site retaining walls, flatwork, and utility improvements are also proposed. At this time the building locations are unknown.

Due to the preliminary nature of the design at this time, wall and column loads were not available for the proposed structures. It is anticipated that column loads for the structures will be up to 300 kips, and wall loads will be up to 3 kips per linear foot. Once the design phase and foundation loading configuration proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary.

Final design and building placement should be reviewed by this office. The final structure placement may require additional exploration and testing to be performed as well as the preparation of an addendum report.

Once the design phase proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary. Geocon should be contacted to determine the necessity for review and possible revision of this report.

3. GEOLOGIC SETTING

The project site is located in the San Jacinto Valley at the margin between the San Jacinto Mountains and the valley floor within the Peninsular Ranges Geomorphic Province (Province). The Province is bounded on the north by the Transverse Ranges (San Gabriel and San Bernardino Mountains) and on the east by the San Andreas fault. The Province extends southward into Mexico and westward past the Channel Islands. Geologic units within the Peninsular Ranges consist of granitic and metamorphic bedrock highlands and deep, broad alluvial valleys. The Province is characterized by northwest tending faulting of the San Andreas system which includes, from east to west, the: San Andreas, San Jacinto, Elsinore, and Newport-Inglewood faults. Of these faults, the San Jacinto fault is considered the most active and youngest of the system. Dextral offset of 24 kilometers has been measured along the 244-kilometer-long fault which extends from where it joins the San Andreas fault in the Cajon Pass southeast to Imperial County. Seven main fault segments have been noted: San Bernardino, San Jacinto Valley, Anza, Coyote Creek, Borrego Mountain, Superstition Hills, and Superstition Mountain sections. Slip rates in the northern sections are as much as 12 mm/year with slip rates of 4 mm/year along the southern sections. Several recent earthquakes have occurred along the San Jacinto fault: 1968 M6.6 Borrego Mountain earthquake; 1987 M6.6 Superstition Hills earthquake; and 1987 M6.2 Elmore Ranch earthquake.

More specifically, the site lies along the Claremont branch of the San Jacinto Valley segment of the San Jacinto fault which separates the San Jacinto Mountains from the San Jacinto Valley. The Claremont fault is a right-lateral strike-slip fault with a dip-slip component that extends 59 kilometers. It typically strikes 70 degrees northeast and dips 35 to 53 degrees northeast. The earthquake reoccurrence interval is 65 to 98 years and the slip rate is estimated at 12 mm/year in the vicinity of the site. The main splay is geologically mapped crossing the northern corner of the site near the intersection of Soboba Road and Lake Park Drive, and parallels the site at the eastern boundary running along Soboba Road (see *Geotechnical Map*, Figure 2).

Based on a review of aerial photographs, the northwestern portion of the site was graded in 2002. The southeastern portion of the site was sheet graded in 2011. Young (Holocene-age) alluvial deposits underlie the undocumented fill. Older alluvium underlies the younger alluvium at depth.

4. GEOLOGIC MATERIALS

4.1 General

During our field investigation, we encountered undocumented fill underlain by Holocene-age Younger Alluvium throughout the majority of the site. In deeper excavations, we encountered older alluvium. Plio-Pleistocene Bautista Beds (arkosic sandstone) likely underlie the site at depth. The descriptions of the soil and geologic conditions are shown on the excavation logs located in *Appendix A* and described herein in order of increasing age.

4.2 Artificial Fill (afu)

We observed undocumented fill to depths ranging from two to six feet throughout the site. As encountered, the undocumented fill consisted predominately of silty sand that was medium dense, dry to slightly moist, brown to grayish brown, fine to medium sand. Deeper fill may exist between borings and in areas of the site not directly explored.

4.3 Holocene Younger Alluvium (Qa)

Quaternary-age (Holocene) fluvial deposits are present throughout the site below the undocumented fill and extend to depths of 44½ to 48 feet below the existing ground surface. The alluvium consisted of layers of silty, poorly graded and well graded sands with layers of silt.

4.4 Older Alluvium (Qoa)

Late Pleistocene-age older alluvium was encountered underlying the younger alluvium to the maximum depths explored of 51½ feet. The older alluvium consisted predominately of silty sand that was dense, moist brown, and fine to medium sand with lesser amounts of sandy silt.

5. GROUNDWATER

Groundwater was not encountered during our investigation, drilled to a maximum depth of 51½ feet. Based on previous studies and well data (Watermaster Support Services, 2017 and California Department of Water Resources, 2017) groundwater is in excess of 150 feet below ground at the site. During the rainy season, localized perched water conditions may develop above less permeable units that may require special consideration during grading operations. Groundwater elevations are dependent on seasonal precipitation, irrigation and land use, among other factors, and vary as a result.

6. GEOLOGIC HAZARDS

6.1 Surface Fault Rupture

The site is located within the State of California Fault Hazard Zone along the Claremont fault (a branch of the San Jacinto Valley segment of the San Jacinto). A forthcoming surface fault rupture hazard evaluation will be presented under separate cover. The Claremont fault has been mapped in the northernmost corner of the site and along the northeastern boundary of the site, coincident with Soboba Road. The principal source of seismic activity is movement along the northwest-trending regional faults such as the San Andreas, San Jacinto and Elsinore fault zones. These fault systems are estimated to produce up to approximately 55 millimeters of slip per year between the plates (Harden, 1998). The Claremont fault is an active fault with as much as 12 mm/year right lateral movement and as much as 4 feet of vertical movement (down on the southwest).

Faults within a 50-mile radius of the site are listed in Table 6.1.1. Historic earthquakes in southern California of magnitude 6.0 and greater, their magnitude, distance, and direction from the site are listed in Table 6.1.2.

Table 6.1.1
Active Faults within 50 Miles of the Site

Fault Name	Fault Number	Maximum Magnitude (Mw)	Geometry (Slip Character)	Slip Rate (mm/yr)	Information Source	Distance from Site (mi)	Direction from Site
San Jacinto (Claremont)	447	6.7	RL-SS	12.0	a	0	NE
Hot Springs Fault	458	6.9	RL-SS	12.0	a	1	N
San Jacinto (Casa Loma)	457	6.9	RL-SS	12.0	a	2.5	SW
San Jacinto (Clark)	459	7.2	RL-SS	12.0	a	5.9	SE
San Gorgonio Pass (West)	448	n/a	THRUST	n/a	a	13.1	NE
San Gorgonio Pass	455	n/a	THRUST	n/a	a	14.2	NE
Crafton Hills	428	n/a	n/a	n/a	n/a	18.8	NW
San Andreas (South Branch)	452	7.5	RL-SS	24.0	a	19.4	ENE
Pinto Mountain	425	7.2	LL-SS	2.5	a	21.8	NE
Wolf Valley	469	6.8	RL-SS	5.0		21.9	SW
San Andreas (North Branch)	453	7.4	RL-SS	30.0	a	22.6	ENE
Elsinore (Wildomar)	460	6.8	RL-SS	5.0	a	22.9	SW
Elsinore (Glen Ivy North)	461	6.8	RL-SS	5.0	a	23.0	WSW
Morongo Valley	451	7.2	LL-SS	2.5	a	24.1	NE
San Andreas (Cajon Canyon to Burro Flats)	427A	7.5	Rl-SS	24.0	a	26.8	NNW
Elsinore (Tin Mine)	446	6.8	RL-SS	5.0		30.2	WSW
Long Canyon	451A	na	na	na	na	30.2	NE
Burt Mountain (East Wide Canyon)	535	6.5	RL-SS	0.6	a	32.8	NE
San Jacinto	401	6.7	RL-SS	12.0	a	34.4	NW
San Jacinto (Glenn Helen)	402	6.7	RL-SS	12.0	a	34.8	NW
Lytle Creek	400	6.7	RL-SS	12.0	a	34.8	NW
Burt Mountain	424B	6.5	RL-SS	0.6	a	35.8	NE
Elsinore (Julian)	483	7.1	RL-SS	5.0	a	38.3	SSE
Eureka Peak	424A	6.4	RL-SS	0.6		38.7	NE
Johnson Valley	415	6.7	RL-SS	0.6	a	38.7	NE
Homestead Valley	421	n/a	n/a	n/a	n/a	38.8	NE
Chino	431	6.7	RL-R-O	1.0	a	39.9	WNW
North Frontal	407	7.2	R	1.0	a	39.9	NE

Whittier	444	6.8	RL-R-O	2.5	a	42.6	WNW
Cucamonga	399	6.9	R	5.0	a	42.9	NW
Old Woman Springs	414	7.5	RL-SS	0.6	a	45.3	NE
Ord Mountain	405	7.2	R	1.0	a	45.3	NNW
Lenwood	381	7.2	R	1.0	a	45.9	NE

Geometry: BT = blind thrust, LL = left lateral, N = normal, O = oblique, R = reverse, RL = right lateral, SS = strike slip.

Information Sources: a = Cao, T., Bryant, W.A., Rowshandel, B., Branum, D., and Wills, C.J., 2003, The Revised 2002 California Probabilistic Seismic Hazard Maps, including Appendices A, B, and C, dated June; b = online Fault Activity Map of California website, maps.conservation.ca.gov/cgs/fam/, as of 1/2017.

n/a = data not available

Table 6.1.2
Historic Earthquake Events with Respect to the Site

Earthquake (Oldest to Youngest)	Date of Earthquake	Magnitude	Distance to Epicenter (Miles)	Direction to Epicenter
San Jacinto	April 21, 1918	6.8	5	SW
Loma Linda Area	July 22, 1923	6.3	23	NW
Long Beach	March 10, 1933	6.4	61	W
Buck Ridge	March 25, 1937	6.0	47	SE
Imperial Valley	May 18, 1940	6.9	41	ENE
Desert Hot Springs	December 4, 1948	6.0	32	ENE
Arroyo Salada	March 19, 1954	6.4	59	SE
Borrego Mountain	April 8, 1968	6.5	65	SE
San Fernando	February 9, 1971	6.6	102	WNW
Joshua Tree	April 22, 1992	6.1	40	ENE
Landers	June 28, 1992	7.3	41	NE
Big Bear	June 28, 1992	6.4	29	NNE
Northridge	January 17, 1994	6.7	105	WNW
Hector Mine	October 16, 1999	7.1	69	NE

6.2 Seismic Design Criteria

The following table summarizes summarizes site-specific design criteria obtained from the 2016 California Building Code (CBC; Based on the 2015 International Building Code [IBC] and ASCE 7-10), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The data was calculated using the computer program *U.S. Seismic Design Maps*, provided by the USGS. The short spectral response uses a period of 0.2 second. We evaluated the Site Class based on the discussion in Section 1613.3.2 of the 2016 CBC and Table 20.3-1 of ASCE 7-10. The values presented below are for the risk-targeted maximum considered earthquake (MCE_R).

TABLE 6.2.1
2016 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2016 CBC Reference
Site Class	D	Section 1613.3.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	2.466g	Figure 1613.3.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	1.046g	Figure 1613.3.1(2)
Site Coefficient, F_A	1.0	Table 1613.3.3(1)
Site Coefficient, F_V	1.5	Table 1613.3.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	2.466g	Section 1613.3.3 (Eqn 16-37)
Site Class Modified MCE_R Spectral Response Acceleration (1 sec), S_{M1}	1.586g	Section 1613.3.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	1.644g	Section 1613.3.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	1.046g	Section 1613.3.4 (Eqn 16-40)

Table 6.2.2 presents additional seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-10 for the mapped maximum considered geometric mean (MCE_G).

TABLE 6.2.2
ASCE 7-10 SITE ACCELERATION DESIGN PARAMETERS

Parameter	Value	ASCE 7-10 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.951g	Figure 22-7
Site Coefficient, F_{PGA}	1.0	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.951g	Section 11.8.3 (Eqn 11.8-1)

The Maximum Considered Earthquake Ground Motion (MCE) is the level of ground motion that has a 2 percent chance of exceedance in 50 years, with a statistical return period of 2,475 years. According to the 2016 California Building Code and ASCE 7-10, the MCE is to be utilized for the evaluation of liquefaction, lateral spreading, seismic settlements, and it is our understanding that the intent of the Building code is to maintain "Life Safety" during a MCE event. The Design Earthquake Ground Motion (DE) is the level of ground motion that has a 10 percent chance of exceedance in 50 years, with a statistical return period of 475 years.

Deaggregation of the MCE peak ground acceleration was performed using the USGS online BETA Unified Hazard Tool, 2008 Conterminous U.S. Dynamic edition. The result of the deaggregation analysis indicates that the predominant earthquake contributing to the MCE peak ground acceleration is characterized as a 7.2 magnitude event occurring at a hypocentral distance of 3 kilometers from the site.

Deaggregation was also performed for the Design Earthquake (DE) peak ground acceleration, and the result of the analysis indicates that the predominant earthquake contributing to the DE peak ground acceleration is characterized as a 7.2 magnitude occurring at a hypocentral distance of 5.1 kilometers from the site.

Conformance to the criteria in the above tables for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

6.3 Liquefaction

Liquefaction is a phenomenon in which loose, saturated, relatively cohesionless soil deposits lose shear strength during strong ground motions. Primary factors controlling liquefaction include intensity and duration of ground motion, gradation characteristics of the subsurface soils, in-situ stress conditions, and the depth to groundwater. Liquefaction is typified by a loss of shear strength in the liquefied layers due to rapid increases in pore water pressure generated by earthquake accelerations. Seismically induced settlement may occur whether the potential for liquefaction exists or not.

The current standard of practice, as outlined in the "Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California" and "Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California" requires liquefaction analysis to a depth of 50 feet below the lowest portion of the proposed structure. Liquefaction typically occurs in areas where the soils below the water table are composed of poorly consolidated, fine to medium-grained, primarily sandy soil. In addition to the requisite soil conditions, the ground acceleration and duration of the earthquake must also be of a sufficient level to induce liquefaction.

The Riverside County RCIT GIS mapping indicates the site is in a zone of moderate liquefaction potential.

As discussed in the Groundwater Section of this report (Section 6), groundwater is in excess of 150 feet below the ground surface. Based on the absence of groundwater, it is our opinion that the potential for liquefaction and associated ground deformations beneath the site is negligible. However, the site may be subject to dry-dynamic settlement of loose sands, which is discussed below.

6.4 Seismically-Induced Settlement

Dynamic compaction of dry and loose sands may occur during a major earthquake. Typically, settlements occur in thick beds of such soils. The seismically-induced settlement calculations were performed in accordance with the American Society of Civil Engineers, Technical Engineering and Design Guides as adapted from the US Army Corps of Engineers, No. 9.

Analysis of seismically-induced settlement was performed for a Design Earthquake level by a magnitude 7.2 earthquake and a peak horizontal acceleration of 0.634g (⅔PGA_M). The predominate earthquake magnitude was determined as the mean value for a probability of exceedance of 10 percent in 50 years from the USGS Interactive Deaggregation website.

The enclosed analyses, included herein for borings B-2 and B-9, indicate that the alluvial soils could be prone to approximately 0.37 and 0.5 inches of settlement, respectively, as a result of the Design Earthquake peak ground acceleration (see enclosed calculation sheets, *Appendix C*).

It is our understanding that the intent of the Building Code is to maintain "Life Safety" during Maximum Considered Earthquake level events. Therefore, additional analysis was performed to evaluate the potential for liquefaction during a MCE event. The structural engineer should evaluate the proposed structure for the anticipated MCE seismically-induced settlements and verify that anticipated deformations would not cause the foundation system to lose the ability to support the gravity loads and/or cause collapse of the structure.

Analysis of seismically-induced settlement was performed for a Maximum Considered Earthquake level by a magnitude 7.2 earthquake and a peak horizontal acceleration of 0.951 (PGA_M). The predominate earthquake magnitude was determined as the mean value for a probability of exceedance of 2 percent in 50 years from the USGS Interactive Deaggregation website.

The enclosed analyses, included herein for borings B-2 and B-9, indicate that alluvial soils could be prone to approximately 0.88 and 1.2 inches of settlement as a result of the Maximum Considered Earthquake peak ground acceleration (see enclosed calculation sheets, *Appendix C*).

6.5 Expansive Soil

The geologic units generally consist of sands, silts, and a lesser amount of clays. Laboratory testing results indicate the near surface soils exhibit very low expansion potential with expansion indices of 3 and 5 (at depths of 0 to 5 feet) as defined by ASTM D4829. Atterberg Limit test results for three soil samples were 25 and 32 at depths of 8.5 feet and 6 for a silt obtained from 20-foot depth.

6.6 Collapsible Soils

Hydroconsolidation is the tendency of unsaturated soil structure to collapse upon saturation resulting in the overall settlement of the effected soil and overlying foundations or improvements supported thereon. Potentially compressible soils underlying the site are typically removed and recompacted during remedial site grading. However, if compressible soil is left in-place, a potential for settlement due to hydroconsolidation of the soil exists.

Fill and alluvial soils obtained during our investigation were tested for consolidation and hydrocollapse potential. The undocumented artificial fill soils exhibited a collapse potential of 0.93 to 1.08 percent while the alluvial soils exhibited a collapse potential of 0.02 to 1.9 percent when loaded to the anticipated post-grading pressures. The test results indicate that the undocumented artificial fill and alluvial soils are classified as having up to a slight (0.1 to 2.0%) degree of specimen collapse in accordance with ASTM D5333.

6.7 Landslides

The toe of the San Jacinto Mountains is located immediately east of Soboba Road. There are no landslides mapped (Dibblee, 2003) in the vicinity of the site. We did not observe evidence of landslide activity which would pose a hazard to the site during our aerial photograph review. Therefore, the landslide hazard is not a design consideration.

6.8 Rock Fall Hazards

Due to the gentle sloping nature of the site and nature of the mountains (sandstone) in the vicinity of the site, rock falls are not a design consideration for the site.

6.9 Slope Stability

Grading plans have not been made available as of the time of this report. We have assumed cut and fill slopes of maximum heights of 10 feet to perform our slope stability analysis. Based on those assumptions, it is our opinion that permanent slopes constructed with on-site soils inclined no steeper than 2:1 (h:v) as shown on the grading plans will possess Factors of Safety of 1.5 or greater under static loading and 1.1 or greater under seismic loading (see Figures 3 and 4). Fill keys should be constructed in accordance with the standard grading specifications in *Appendix D*. Grading of cut and fill slopes should be designed in accordance with the requirements of the local building codes of the County of Riverside and the 2016 CBC.

6.10 Tsunamis and Seiches

A tsunami is a series of long period waves generated in the ocean by a sudden displacement of large volumes of water. Causes of tsunamis include underwater earthquakes, volcanic eruptions, or offshore slope failures. The first order driving force for locally generated tsunamis offshore southern California is expected to be tectonic deformation from large earthquakes (Legg, et al., 2002). The site is located approximately 48 miles from the nearest coastline with the Santa Ana Mountains between the coast and the site. Therefore, the risk associated with tsunamis is not a design consideration.

A seiche is a run-up of water within a lake or embayment triggered by fault- or landslide-induced ground displacement. Although the site is located within 1,800 feet of San Jacinto River, the seasonal nature of the water way makes a seiche an unlikely hazard. Therefore, inundation from a seiche is not a design consideration.

6.11 Dam Inundation

Dam inundation is the flooding of an area downstream of a dam as the result of dam failure. Causes of inundation include earthquakes or over filling of a dam. The east dam of Diamond Valley Reservoir is approximately 7.4 miles southwest of the site and Lake Perris dam is approximately 15 miles to the northwest. In the unlikely event of a dam failure at either of these lakes, the site is not with in the inundation zones of these lakes. Lake Hemet is located approximately 15.3 miles to the southeast. Based on a review of the undated inundation map for Lake Hemet, in the unlikely event of a dam failure, the site will be inundated to the peak water level approximately 46 minutes after the breech. Levee improvements along the San Jacinto River may have been undertaken after the issuance of the inundation map. The civil engineer should determine if inundation will affect the site and provide possible mitigation measures.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 General

7.1.1 It is our opinion that neither soil or geologic conditions were encountered during the investigation that would preclude the proposed development of the project provided the recommendations presented herein are followed and implemented during construction.

7.1.2 Potential geologic hazards at the site include ground rupture and displacement, strong seismic shaking, seismically induced settlement, compressible near surface soils, and possible inundation due to the failure of the Lake Hemet dam.

7.1.3 Building set back zones may be required. They are currently being evaluated based on our Surface Fault Rupture Hazard Evaluation and will be detailed in a separate report.

7.1.4 The enclosed seismically-induced settlement analysis indicate that the alluvial soils underlying the site could be prone to up to ½ inch of total settlement as a result of the Design Earthquake peak ground acceleration (⅔PGA_M). The resulting differential settlement is anticipated to be less than ¼ inch over a distance of 50 feet. The grading and foundation design recommendations provided herein are intended to minimize the effects of differential settlement on the proposed structures and improvements.

7.1.5 Undocumented artificial fill was observed to depths ranging between two and six feet across the site. Deeper fill may exist in other areas of the site that were not directly explored. Based on our site exploration and laboratory testing, the undocumented artificial fill, and upper portion of the alluvium is not considered suitable for the support of additional fill or proposed structures. The existing fill and site soils are suitable for re-use as engineered fill provided the recommendations in the *Grading* section of this report are followed (see Section7.4).

7.1.6 Although groundwater was not encountered during our subsurface investigation, it is possible that perched water will be encountered during grading, in particular during the rainy seasons.

7.1.7 The majority of on-site soils consist of silty sands; however, granular material, having little to no cohesion and subject to caving in un-shored excavations, should be anticipated at the site. It is the responsibility of the contractor to ensure that excavations and trenches are properly shored and maintained in accordance with OSHA rules and regulations to maintain the stability of adjacent existing improvements.

7.1.8 Based on these considerations, as a minimum, it is recommended that the upper 6 feet of existing soil within building footprint areas be excavated and properly compacted for foundation and slab support. The excavations should extend laterally a minimum distance of 6 feet beyond the building footprint areas, including building appurtenances, or a distance equal to the depth of fill below the foundation, whichever is greater. The limits of existing fill and/or soft soil removal will be verified by the Geocon representative during site grading activities. Recommendations for earthwork are provided in the *Grading* section of this report (see Section 7.4).

7.1.9 Excavations on the order of 6 feet in vertical height are anticipated during construction. Based on the vacant nature of the subject site, it is anticipated that stable excavations for the recommended grading and construction can be achieved with sloping measures. Recommendations for temporary excavations are provided in Section 7.15.

7.1.10 It is suggested that flexible utility connections be considered for all rigid utilities in order to minimize or prevent damage to utilities from minor differential movements subsequent to an earthquake event.

7.1.11 Proposed fill slopes should be properly benched and keyed into competent native soils prior to the placement of engineered fill. Proposed cut slopes should be excavated into competent native soils or constructed with a stability fill. All slope and back cut excavations must be observed and approved in writing by the Geotechnical Engineer prior to placement of additional engineered fill.

7.1.12 Foundations for small outlying structures, such as block walls up to 6 feet high, planter walls or trash enclosures, which will not be tied to the proposed structure, may be supported on conventional foundations bearing on a minimum of 24 inches of newly placed engineered fill which extends laterally at least 24 inches beyond the foundation area. Where excavation and proper compaction cannot be performed or is undesirable, foundations may derive support directly in the undisturbed alluvial soils generally found at or below a depth of 2 feet, and should be deepened as necessary to maintain a minimum 12 inch embedment into the recommended bearing materials. If the soils exposed in the excavation bottom are soft or loose, compaction of the soils will be required prior to placing steel or concrete. Compaction of the foundation excavation bottom is typically accomplished with a compaction wheel or mechanical whacker and must be observed and approved by a Geocon representative.

7.1.13 Where new paving is to be placed, it is recommended that all existing fill and soft alluvial soils be excavated and properly compacted for paving support. The client should be aware that excavation and compaction of all existing fill and soft alluvial soils in the area of new paving is not required; however, paving constructed over existing undocumented fill or unsuitable alluvial soil may experience increased settlement and/or cracking, and may therefore have a shorter design life and increased maintenance costs. As a minimum, the upper 24 inches of subgrade soil should be scarified and properly compacted for paving support. Paving recommendations are provided in *Preliminary Pavement Recommendations* section of this report (see Section 7.15).

7.1.14 Proper drainage should be maintained in order to preserve the engineering properties of the fill. Recommendations for site drainage are provided herein in Section 7.16.

7.1.15 Once the design and foundation loading configuration for the proposed structure proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary. Based on the final foundation loading configurations, the potential for settlement should be re-evaluated by this office.

7.1.16 Any changes in the design, location or elevation of improvements, as outlined in this report, should be reviewed by this office. Geocon should be contacted to determine the necessity for review and possible revision of this report.

7.2 Soil and Excavation Characteristics

7.2.1 The in-situ soils can be excavated with moderate effort using conventional excavation equipment. Caving should be anticipated in unshored excavations, especially where granular soils are encountered. The contractor should be aware that formwork may be required to prevent caving of shallow spread foundation excavations, and casing will likely be required in drilled excavations.

7.2.2 It is the responsibility of the contractor to ensure that all excavations and trenches are properly sloped, shored and maintained in accordance with applicable OSHA rules and regulations to maintain safety and maintain the stability of adjacent existing improvements.

7.2.3 All onsite excavations must be conducted in such a manner that potential surcharges from existing structures, construction equipment, and vehicle loads are resisted. The surcharge area may be defined by a 1:1 projection down and away from the bottom of an existing foundation or vehicle load. Penetrations below this 1:1 projection will require special excavation measures such as sloping or shoring. Excavation recommendations are provided in the *Temporary Excavations* section of this report (see Section 7.15).

7.2.4 The near surface site soils encountered in the field investigation are generally considered to be "non-expansive" (Expansion Index [EI] of 20 or less) as defined by 2016 CBC Section 1803.5.3. Table 7.2.4 presents soil classifications based on the EI.

TABLE 7.2.4
SOIL CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	Expansion Classification	2016 CBC Expansion Classification
0 – 20	**Very Low**	**Non-Expansive**
21 – 50	Low	Expansive
51 – 90	Medium	
91 – 130	High	
Greater Than 130	Very High	

7.2.5 Based on the material classifications and laboratory testing, the near surface site soils are generally anticipated to possess a very low expansion potential (EI of 20 or less). However, isolated areas of expansive soils may be encountered at the site, such as the material observed in boring B-12. If soils with an expansion index of 21 or greater are encountered or imported to the site, they should not be placed within 4 feet of the proposed foundations, flatwork or paving improvements. Additional testing for expansion potential should be performed once final grades are achieved.

7.3 Minimum Resistivity, pH, and Water-Soluble Sulfate

7.3.1 Potential of Hydrogen (pH) and resistivity testing as well as chloride content testing were performed on representative samples of soil to generally evaluate the corrosion potential to surface utilities. The tests were performed in accordance with California Test Method Nos. 643 and 422 and indicate that the soils are considered "corrosive" with respect to corrosion of buried ferrous metals on site. The results are presented in *Appendix B* (Figures B-1 and B-2) and should be considered for design of underground structures.

7.3.2 Laboratory tests were performed on representative samples of the site materials to measure the percentage of water-soluble sulfate content. Results from the laboratory water-soluble sulfate tests are presented in *Appendix B* (Figures B-1 and B-2) and indicate that the on-site materials at the locations tested possess a sulfate content of 0 to 0.005% equating to a S0 or negligible sulfate exposure to concrete structures as defined by 2016 CBC Section 1904.3 and ACI 318. Table 7.3.2 presents a summary of concrete requirements set forth by 2016 CBC Section 1904.3 and ACI 318. The presence of water-soluble sulfates is not a visually discernible characteristic; therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e., addition of fertilizers and other soil nutrients) may affect the concentration.

TABLE 7.3.2
REQUIREMENTS FOR CONCRETE
EXPOSED TO SULFATE-CONTAINING SOLUTIONS

Sulfate Exposure	Exposure Class	Water-Soluble Sulfate Percent by Weight	Cement Type	Maximum Water to Cement Ratio by Weight	Minimum Compressive Strength (psi)
Negligible	**S0**	**0.00-0.10**	**--**	**--**	**2,500**
Moderate	S1	0.10-0.20	II	0.50	4,000
Severe	S2	0.20-2.00	V	0.45	4,500
Very Severe	S3	> 2.00	V+ Pozzolan or Slag	0.45	4,500

7.3.3 Laboratory testing indicates the site soils have a pH range of 8.5 to 8.6, possess 35 to 2,552 parts per million (ppm) chloride, possess 0.000% to 0.005% (1 to 51 ppm) sulfate, and have a minimum electrical resistivity of 620 to 4,300 ohm-cm. Based on the test results, the site would be classified as "corrosive" to metallic improvements, in accordance with the Caltrans Corrosion Guidelines (Caltrans, 2012), as shown in Table 7.3.3 below.

TABLE 7.3.3
CALTRANS CORROSION GUIDELINES

Corrosion Exposure	Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)	pH
Corrosive	<1,000	500 or greater	2,000 or greater	5.5 or less

7.3.4 Geocon West, Inc. does not practice in the field of corrosion engineering and mitigation. If corrosion sensitive improvements are planned, it is recommended that a corrosion engineer be retained to evaluate corrosion test results and incorporate the necessary precautions to avoid premature corrosion of buried metal pipes and concrete structures in direct contact with the soils.

7.4 Grading

7.4.1 Grading should be performed in accordance with the *Recommended Grading Specifications* contained in *Appendix D* and the Riverside County Grading Ordinance.

7.4.2 Earthwork should be observed, and compacted fill tested by representatives of Geocon West, Inc. The existing fill and alluvial soils encountered during exploration are suitable for re-use as an engineered fill, provided any encountered oversize material (greater than 6 inches) and any encountered deleterious debris is removed.

7.4.3 Prior to commencing grading, a preconstruction conference should be held at the site with the agency inspector, owner or developer, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.

7.4.4 Site preparation should begin with the removal of deleterious material, debris and vegetation from the area to be graded. The depth of removal should be such that material exposed in cut areas or soil to be used as fill is relatively free of organic matter. Material generated during stripping and/or site demolition should be exported from the site. Deleterious debris such as wood and root structures should also be exported from the site and should not be mixed with the fill soils. Asphalt and concrete should not be mixed with the fill soils unless approved in writing by the Geotechnical Engineer. All existing underground improvements planned for removal should be completely excavated and the resulting depressions properly backfilled in accordance with the procedures described herein. Once a clean excavation bottom has been established it must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon West, Inc.).

7.4.5 As a minimum, it is recommended that the upper 6 feet of existing soil within building footprint areas be excavated and properly compacted for foundation and slab support. The excavation should extend laterally a minimum distance of 6 feet beyond the building footprint areas, including building appurtenances, or a distance equal to the depth of fill below the foundation, whichever is greater. The limits of existing fill and/or soft soil removal will be verified by the Geocon representative during site grading activities.

7.4.6 The excavation bottom should be observed and approved by the engineering geologist during grading operations. Alluvium with in the excavation bottom should have a relative density of at least 85 percent (ASTM D1557). Geocon should observe the removal bottoms to check the competency of the bottom of the removal. Deeper excavations may be required if dry, loose, or soft materials are present at the base of the removals. Excavation bottoms require written approval by a Geocon representative

7.4.7 Removals in pavement and sidewalk areas should extend at least 2 feet beneath the pavement or flatwork subgrade elevation. The bottom of the excavations should be scarified to a depth of at least 1 foot, moisture conditioned as necessary, and properly compacted.

7.4.8 The site should be brought to finish grade elevations with fill compacted in layers. Fill derived from the site soils should be free of deleterious material and rock fragments larger than 6 inches. Layers of fill should be no thicker than will allow for adequate bonding and compaction. Fill, including backfill and scarified ground surfaces, should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density at optimum moisture content as determined by ASTM D 1557. Fill materials placed below optimum moisture content may require additional moisture conditioning prior to placing additional fill.

7.4.9 The fill placed within 4 feet of proposed foundations should possess an expansion potential of 20 or less.

7.4.10 Although not anticipated for this project, all imported fill shall be observed, tested, and approved by Geocon West, Inc. prior to bringing soil to the site. Rocks larger than 6 inches in diameter shall not be used in the fill. If necessary, import soils used as structural fill should have an expansion index less than 20 and soil corrosivity properties that are equally or less detrimental to that of the existing onsite soils (see Figures B-1 and B-2). Geocon should be notified of the import soil source and should perform laboratory testing of import soil to evaluate its suitability prior to its arrival at the site for use as fill material.

7.4.11 Utility trenches should be properly backfilled in accordance with the requirements of the County of Riverside and the latest edition of the *Standard Specifications for Public Works Construction* (Greenbook). The pipes should be bedded with well graded crushed rock or clean sands (Sand Equivalent greater than 30) to a depth of at least one foot over the pipe. The bedding material must be inspected and approved in writing by the Geotechnical Engineer (a representative of Geocon). We recommend that jetting only be performed if trench wall soils have an SE of 15 or greater. The use of well graded crushed rock is only acceptable if used in conjunction with filter fabric to prevent the gravel from having direct contact with soil. The remainder of the trench backfill may be derived from onsite soil or approved import soil, compacted as necessary, until the required compaction is obtained. The use of 2-sack slurry and controlled low strength material (CLSM) are also acceptable as backfill. However, consideration should be given to the possibility of differential settlement where the slurry ends and earthen backfill begins. These transitions should be minimized and additional stabilization should be considered at these transitions.

7.4.12 All trench and foundation excavation bottoms must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon), prior to placing bedding sands, fill, steel, gravel, or concrete.

7.5 Earthwork Grading Factors

7.5.1 Estimates of shrinkage factors are based on empirical judgments comparing the material in its existing or natural state as encountered in the exploratory excavations to a compacted state. Variations in natural soil density and in compacted fill density render shrinkage value estimates very approximate. As an example, the contractor can compact the fill to a dry density of 90 percent or higher of the laboratory maximum dry density. Thus, the contractor has an approximately 10 percent range of control over the fill volume. Based on our experience and the densities measured during our investigation, the shrinkage of onsite fill and alluvium is anticipated to be 15 to 20 percent when compacted to at least 90 percent of the laboratory maximum dry density. Please note that this estimate is for preliminary quantity estimates only. Due to the variations in the actual shrinkage/bulking factors, a balance area should be provided to accommodate variations.

7.6 Foundations and Concrete Slabs-On-Grade Recommendations

7.6.1 Subsequent to recommended grading, a conventional spread foundation system may be utilized for support of the proposed structures provided foundations derive support in newly placed engineered fill.

7.6.2 The structural engineer should evaluate the anticipated static and seismic settlements for tolerance with the foundation design. Where the settlement exceeds the tolerable limits for shallow foundations, a grade beam system (waffle slab) or a mat foundation may be needed to accommodate the anticipated settlement. Geocon should be contacted for additional recommendations should the expected settlement exceed the tolerable levels for shallow foundations.

7.6.3 The foundation recommendations presented herein are for the proposed community service and commercial structures. We separated the foundation recommendations into three categories based on either the maximum and differential fill thickness or Expansion Index. We anticipate most structures will be Category I due to the low expansion potential and anticipated geometry of the planned fill and underlying alluvial materials. However, the category may be increased to Category II or III where expansion potential or fill geometry dictates based on as-graded conditions. The foundation category criteria for the anticipated conditions are presented in Table 7.6.3. Final foundation categories will be evaluated once site grading has been completed.

TABLE 7.6.3
FOUNDATION CATEGORY CRITERIA

Foundation Category	Maximum Fill Thickness, T (Feet)	Differential Fill Thickness, D (Feet)	Expansion Index (EI)
I	T<20	D<10	EI≤50
II	20≤T<50	10≤D<20	50<EI≤90
III	T≥50	D≥20	EI>90

7.6.4 Foundations for the structures may consist of either continuous strip footings and/or isolated spread footings. Conventionally reinforced continuous footings should be at least 12 inches wide, and isolated spread footings should have a minimum width of 24 inches. Footings should extend to the minimum footing embedment in Table 7.6.4. A wall/column footing dimension detail is provided on Figure 5.

TABLE 7.6.4
CONVENTIONAL FOUNDATION RECOMMENDATIONS BY CATEGORY

Foundation Category	Minimum Footing Embedment Depth (inches)	Continuous Footing Reinforcement	Interior Slab Reinforcement
I	18	Two No. 4 bars, one top and one bottom	6 x 6 - 10/10 welded wire mesh at slab mid-point
II	24	Four No. 4 bars, two top and two bottom	No. 3 bars at 24 inches on center, both directions
III	30	Four No. 5 bars, two top and two bottom	No. 3 bars at 18 inches on center, both directions

7.6.5 As an alternative to the conventional foundation recommendations, consideration should be given to the use of post-tensioned concrete slab and foundation systems for the support of the proposed structures. The post-tensioned systems should be designed by a structural engineer experienced in post-tensioned slab design and design criteria of the Post-Tensioning Institute (PTI) DC 10.5-12 *Standard Requirements for Design and Analysis of Shallow Post-Tensioned Concrete Foundations on Expansive Soils* or *WRI/CRSI Design of Slab-on-Ground Foundations*, as required by the 2016 CBC Section 1808.6.2. Although this procedure was developed for expansive soil conditions, it can also be used to reduce the potential for foundation distress due to differential fill settlement. The post-tensioned design should incorporate the geotechnical parameters presented in Table 7.6.5 for the particular Foundation Category designated. The parameters presented in Table 7.6.5 are based on the guidelines presented in the PTI DC 10.5 design manual.

TABLE 7.6.5
POST-TENSIONED FOUNDATION SYSTEM DESIGN PARAMETERS

Post-Tensioning Institute (PTI) DC 10.5-12 Design Parameters	Foundation Category		
	I	II	III
Thornthwaite Index	-20	-20	-20
Equilibrium Suction	3.9	3.9	3.9
Edge Lift Moisture Variation Distance, e_M (feet)	5.3	5.1	4.9
Edge Lift, y_M (inches)	0.61	1.10	1.58
Center Lift Moisture Variation Distance, e_M (feet)	9.0	9.0	9.0
Center Lift, y_M (inches)	0.30	0.47	0.66

7.6.6 The foundations for the post-tensioned slabs should be embedded in accordance with the recommendations of the structural engineer. If a post-tensioned mat foundation system is planned, the slab should possess a thickened edge with a minimum width of 12 inches and extend below the clean sand or crushed rock layer.

7.6.7 If the structural engineer proposes a post-tensioned foundation design method other than the PTI DC 10.5:

- The deflection criteria presented in Table 7.6.5 are still applicable.
- Interior stiffener beams should be used for Foundation Category II and III.
- The width of the perimeter foundations should be at least 12 inches.
- The perimeter footing embedment depths should be at least 12, 18, and 24 inches for Foundation Categories I, II, and III, respectively. The embedment depths should be measured from the lowest adjacent pad grade.

7.6.8 Our experience indicates post-tensioned slabs may be susceptible to excessive edge lift, regardless of the underlying soil conditions. Placing reinforcing steel at the bottom of the perimeter footings and the interior stiffener beams may mitigate this potential. The structural engineer should design the foundation system to reduce the potential of edge lift occurring for the proposed structures.

7.6.9 During the construction of the foundation system, the concrete should be placed monolithically. Under no circumstances should cold joints form between the footings/grade beams and the slab during the construction of the post-tension foundation system unless specifically designed by the structural engineer.

7.6.10 Category I, II, or III foundations may be designed for an allowable soil bearing pressure of 4,000 pounds per square foot (psf) (dead plus live load). This bearing pressure may be increased by one-third for transient loads due to wind or seismic forces. We estimate the total settlements under the imposed allowable loads to be up to ¾ inch with differential settlements on the order of ½ inch over a horizontal distance of 40 feet.

7.6.11 Based on the seismically induced settlement analyses, differential settlement at the ground surface due to a seismic event is anticipated to be on the order of ¼ inch over a horizontal distance of 50 feet. These settlements are in addition to the static settlements indicated above and should be considered for design purposes. Based on seismic considerations, the proposed site structures should be designed for a combined static and seismically induced differential settlement of ¾ inch over a horizontal distance of 40 feet.

7.6.12 The structural engineer should evaluate the anticipated static and seismic settlement and determine if foundations for the structures can consist of a post tensioned foundation system or a shallow foundation system consisting of continuous strip footings and/or isolated spread footings. If an alternate foundation system such as grade beams or a mat foundation is needed, Geocon should be contacted for additional recommendations.

7.6.13 Isolated footings, if present, should have the minimum embedment depth and width recommended above for a particular foundation category. Where this condition cannot be avoided, the isolated footings should be connected to the building foundation system with grade beams.

7.6.14 Slabs-on-grade that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder placed directly beneath the slab. The vapor retarder and acceptable permeance should be specified by the project architect or developer based on the type of floor covering that will be installed. The vapor retarder design should be consistent with the guidelines presented in Section 9.3 of the American Concrete Institute's (ACI) Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials (ACI 302.2R-06) and should be installed in general conformance with ASTM E1643 (latest edition) and the manufacturer's recommendations. A minimum thickness of 15 mils extruded polyolefin plastic is recommended; vapor retarders which contain recycled content or woven materials are not recommended. The vapor retarder should have a permeance of less than 0.01 perms demonstrated by testing before and after mandatory conditioning. The vapor retarder should be installed in direct contact with the concrete slab with proper perimeter seal. If the California Green Building Code requirements apply to this project, the vapor retarder should be underlain by 4 inches of clean aggregate. It is important that the vapor retarder be puncture resistant since it will be in direct contact with angular gravel. As an alternative to the clean aggregate suggested in the Green Building Code, it is our opinion that the concrete slab-on-grade may be underlain by a vapor retarder over 4 inches of clean sand

(sand equivalent greater than 30), since the sand will serve as a capillary break and will minimize the potential for punctures and damage to the vapor barrier.

7.6.15 The bedding sand thickness should be determined by the project foundation engineer, architect, and/or developer. However, we should be contacted to provide recommendations if the bedding sand is thicker than 4 inches. Placement of 3 inches and 4 inches of sand is common practice in southern California for 5-inch and 4-inch thick slabs, respectively. The foundation engineer should provide appropriate concrete mix design criteria and curing measures that may be utilized to assure proper curing of the slab to reduce the potential for rapid moisture loss and subsequent cracking and/or slab curl.

7.6.16 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisture conditioned, as necessary, to maintain a moist condition as would be expected in such concrete placement.

7.6.17 Where buildings or other improvements are planned near the top of a slope steeper than 3:1 (horizontal to vertical), special foundations and/or design considerations and possible building set backs are recommended due to the tendency for lateral soil movement to occur.

- Building footings should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.
- Geocon should be contacted to review the pool plans and the specific site conditions to provide additional recommendations, if necessary.
- Swimming pools located within 7 feet of the top of cut or fill slopes are not recommended. Where such a condition cannot be avoided, the portion of the swimming pool wall within 7 feet of the slope face be designed assuming that the adjacent soil provides no lateral support
- Although other improvements, which are relatively rigid or brittle, such as concrete flatwork or masonry walls, may experience some distress if located near the top of a slope, it is generally not economical to mitigate this potential. It may be possible, however, to incorporate design measures that would permit some lateral soil movement without causing extensive distress. Geocon should be consulted for specific recommendations.

7.6.18 The recommendations of this report are intended to reduce the potential for cracking of slabs and foundations due to expansive soil (if present) or differential settlement of fill soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

7.6.19 Geocon should be consulted to provide additional design parameters as required by the structural engineer.

7.6.20 Foundation excavations should be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon), prior to the placement of reinforcing steel and concrete to verify that the excavations and exposed soil conditions are consistent with those anticipated. If unanticipated soil conditions are encountered, foundation modifications may be required.

7.6.21 This office should be provided a copy of the final grading and foundation plans so that the excavation recommendations presented herein can be properly reviewed and revised if necessary.

7.7 Miscellaneous Foundations

7.7.1 Foundations for small outlying structures, such as block walls up to 6 feet in height, planter walls or trash enclosures which will not be tied to the proposed structure may be supported on conventional foundations bearing on a minimum of 12 inches of newly placed engineered fill which extends laterally at least 12 inches beyond the foundation area. Where excavation and compaction cannot be performed or is undesirable, such as adjacent to property lines, foundations may derive support in the undisturbed alluvial soils found at or below a depth of 24 inches, and should be deepened as necessary to maintain a minimum 12-inch embedment into undisturbed alluvial soils and must be observed and approved by a Geocon representative.

7.7.2 Miscellaneous foundations deriving support in newly placed engineered fill may be designed for a bearing value of 1,500 psf, and should be a minimum of 12 inches in width, 18 inches in depth below the lowest adjacent grade and 12 inches into the recommended bearing material. The allowable bearing pressure may be increased by up to one-third for transient loads due to wind or seismic forces.

7.7.3 Foundation excavations should be observed by the Geotechnical Engineer (a representative of Geocon West, Inc.), prior to the placement of reinforcing steel and concrete to verify that the excavations and exposed soil conditions are consistent with those anticipated.

7.8 Exterior Concrete Flatwork

7.8.1 Exterior concrete flatwork not subject to vehicular traffic should be constructed in accordance with the recommendations herein assuming the subgrade materials possess an Expansion Index of 20 or less. Subgrade soils should be compacted to 90 percent relative compaction at optimum moisture. Slab panels should be a minimum of 4 inches thick and when in excess of 8 feet square should be reinforced with No. 3 reinforcing bars spaced 18 inches center-to-center in both directions to reduce the potential for cracking. In addition, concrete flatwork should be provided with crack control joints to reduce and/or control shrinkage cracking. Crack control spacing should be determined by the project structural engineer based upon the slab thickness and intended usage. Criteria of the American Concrete Institute (ACI) should be taken into consideration when establishing crack control spacing. Subgrade soil for exterior slabs not subjected to vehicle loads should be compacted in accordance with criteria presented in the grading section prior to concrete placement. Subgrade soil should be properly compacted and the moisture content of subgrade soil should be verified prior to placing concrete. Base materials will not be required below concrete improvements.

7.8.2 Even with the incorporation of the recommendations of this report, the exterior concrete flatwork has a potential to experience some uplift due to expansive soil beneath grade or differential settlement. The steel reinforcement should overlap continuously in flatwork to reduce the potential for vertical offsets within flatwork.

7.8.3 Where exterior flatwork abuts the structure at entrant or exit points, the exterior slab should be dowelled into the structure's foundation stem wall. This recommendation is intended to reduce the potential for differential elevations that could result from differential settlement or minor heave of the flatwork. Dowelling details should be designed by the project structural engineer.

7.8.4 The recommendations presented herein are intended to reduce the potential for cracking of exterior slabs as a result of differential movement. However, even with the incorporation of the recommendations presented herein, slabs-on-grade will still crack. The occurrence of concrete shrinkage cracks is independent of the soil supporting characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, the use of crack control joints and proper concrete placement and curing. Crack control joints should be spaced at intervals no greater than 12 feet. Literature provided by the Portland Concrete Association (PCA) and American Concrete Institute (ACI) present recommendations for proper concrete mix, construction, and curing practices, and should be incorporated into project construction.

7.9 Conventional Retaining Walls

7.9.1 The recommendations presented herein are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 5 feet. If walls higher than 5 feet or other types of walls are planned, Geocon should be consulted for additional recommendations.

7.9.2 Retaining walls not restrained at the top and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid density of 30 pounds per cubic foot (pcf). Where the backfill will be inclined at no steeper than 2:1 (horizontal to vertical), an active soil pressure of 55 pcf is recommended. These soil pressures assume that the backfill materials within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall possess an EI of 40 or less. For walls where backfill materials do not conform to the criteria herein, Geocon should be consulted for additional recommendations.

7.9.3 Unrestrained walls are those that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall in feet) at the top of the wall. Where walls are restrained from movement at the top, walls with a level backfill surface should be designed for a soil pressure equivalent to the pressure exerted by a fluid density of 50 pcf.

7.9.4 The structural engineer should determine the seismic design category for the project in accordance with Section 1613 of the CBC. If the project possesses a seismic design category of D, E, or F, proposed retaining walls in excess of 6 feet in height should be designed with seismic lateral pressure (Section 1803.5.12 of the 2016 CBC).

7.9.5 A seismic load of 10 pcf should be used for design of walls that support more than 6 feet of backfill in accordance with Section 1803.5.12 of the 2016 CBC. The seismic load is applied as an equivalent fluid pressure along the height of the wall and the calculated loads result in a maximum load exerted at the base of the wall and zero at the top of the wall. This seismic load should be applied in addition to the active earth pressure. The earth pressure is based on half of two-thirds of PGA_M calculated from ASCE 7-10 Section 11.8.3.

7.9.6 Unrestrained walls will move laterally when backfilled and loading is applied. The amount of lateral deflection is dependent on the wall height, the type of soil used for backfill, and loads acting on the wall. The retaining walls and improvements above the retaining walls should be designed to incorporate an appropriate amount of lateral deflection as determined by the structural engineer.

7.9.7 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and waterproofed as required by the project architect. The soil immediately adjacent to the backfilled retaining wall should be composed of free draining material completely wrapped in Mirafi 140N (or equivalent) filter fabric for a lateral distance of 1 foot for the bottom two-thirds of the height of the retaining wall. The upper one-third should be backfilled with less permeable compacted fill to reduce water infiltration. Alternatively, a drainage panel, such as a Miradrain 6000 or equivalent, can be placed along the back of the wall. A typical drain detail for each option is shown on Figure 6. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The recommendations herein assume a properly compacted backfill (EI of 40 or less) with no hydrostatic forces or imposed surcharge load. If conditions different than those described are expected or if specific drainage details are desired, Geocon should be contacted for additional recommendations.

7.9.8 Wall foundations should be designed in accordance with the above foundation recommendations.

7.10 Lateral Design

7.10.1 Resistance to lateral loading may be provided by friction acting at the base of foundations, slabs and by passive earth pressure. A passive pressure exerted by an equivalent fluid weight of 200 pounds per cubic foot (pcf) with a maximum earth pressure of 2,000 psf should be used for the design of footings or shear keys poured neat against newly compacted fill or competent alluvium. The allowable passive pressure assumes a horizontal surface extending at least 5 feet, or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material in areas not protected by floor slabs or pavement should not be included in design for passive resistance.

7.10.2 If friction is to be used to resist lateral loads, an allowable coefficient of friction between newly compacted fill soil and concrete of 0.35 should be used for design

7.11 Preliminary Pavement Recommendations

7.11.1 The final pavement sections for roadways should be based on the R-Value of the subgrade soils encountered at final subgrade elevation. Roads should be designed in accordance with the City of San Jacinto *Improvement Standard Drawings*, when final Traffic Indices and R-Value test results of subgrade soil are completed. Based on our onsite observations, we have assumed an R-value of 35 for the site. Preliminary flexible pavement sections are presented in Table 7.11.1. We have provided pavement thicknesses for typical roadway classifications and minimum structural sections from the City of San Jacinto *Improvement Standard Drawings*. The civil engineer should select the appropriate roadway classification and traffic index based on the anticipated traffic. Geocon should be contacted for additional recommendations if other traffic indices are appropriate for the site roadways.

TABLE 7.11.1
PRELIMINARY FLEXIBLE PAVEMENT SECTIONS

Roadway Classification	Assumed Traffic Index	Assumed Subgrade R-Value	Asphalt Concrete (inches)	Crushed Aggregate Base (inches)
Parking Lots and Roadways Servicing Light-Duty Vehicles - Local Streets	5.0	35	3.0	4.5
Roadways Servicing Moderate Truck Vehicles	6.0	35	3.5	6.5
Roadways Servicing Heavy Truck Vehicles – Industrial/Commercial	7.0	35	4.0	8.0
Collector Industrial/Commercial Roadways	8.0	35	4.5	10.0

7.11.2 The upper 12 inches of the subgrade soil should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density at optimum moisture content beneath pavement sections.

7.11.3 The crushed aggregated base and asphalt concrete materials should conform to Section 200-2.2 and Section 203-6, respectively, of the *Standard Specifications for Public Works Construction* (Greenbook) and the latest edition of the City of San Jacinto *Improvement Standard Drawings*. Base materials should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density at optimum moisture content. Asphalt concrete should be compacted to a density of 95 percent of the laboratory Hveem density in accordance with ASTM D 1561.

7.11.4 A rigid Portland cement concrete (PCC) pavement section should be placed in driveway aprons and cross gutters and where desired to support heavy vehicle loads. We calculated the rigid pavement section in general conformance with the procedure recommended by the American Concrete Institute report ACI 330R, *Guide for Design and Construction of Concrete Parking Lots* using the parameters presented in Table 7.11.4.

TABLE 7.11.4
RIGID PAVEMENT DESIGN PARAMETERS

Design Parameter	Design Value
Modulus of subgrade reaction, k	150 pci
Modulus of rupture for concrete, M_R	550 psi
Traffic Category, TC	C and D
Average daily truck traffic, ADTT	100 and 700

7.11.5 Based on the criteria presented herein, the PCC pavement sections should have a minimum thickness as presented in Table 7.11.5.

TABLE 7.11.5
RIGID PAVEMENT RECOMMENDATIONS

Roadway Classification	Portland Cement Concrete (inches)
Roadways (TC=C)	6.5
Truck Areas (TC=D)	7.5

7.11.6 The PCC pavement should be placed over subgrade soil that is compacted to a dry density of at least 95 percent of the laboratory maximum dry density at optimum moisture content. This pavement section is based on a minimum concrete compressive strength of approximately 3,500 psi (pounds per square inch). Base material will not be required beneath concrete improvements.

7.11.7 A thickened edge or integral curb should be constructed on the outside of concrete slabs subjected to wheel loads. The thickened edge should be 1.2 times the slab thickness or a minimum thickness of 2 inches, whichever results in a thicker edge, and taper back to the recommended slab thickness 4 feet behind the face of the slab (e.g., a 9-inch-thick slab would have an 11-inch-thick edge). Reinforcing steel will not be necessary within the concrete for geotechnical purposes with the possible exception of dowels at construction joints as discussed herein.

7.11.8 In order to control the location and spread of concrete shrinkage cracks, crack-control joints (weakened plane joints) should be included in the design of the concrete pavement slab in accordance with the referenced ACI report.

7.11.9 Performance of the pavements is highly dependent on providing positive surface drainage away from the edge of the pavement. Ponding of water on or adjacent to the pavement surfaces will likely result in pavement distress and subgrade failure. Drainage from landscaped areas should be directed to controlled drainage structures. Landscape areas adjacent to the edge of asphalt pavements are not recommended due to the potential for surface or irrigation water to infiltrate the underlying permeable aggregate base and cause distress. Where such a condition cannot be avoided, consideration should be given to incorporating measures that will significantly reduce the potential for subsurface water migration into the aggregate base. If planter islands are planned, the perimeter curb should extend at least 6 inches below the level of the base materials.

7.12 Temporary Excavations

7.12.1 Excavations up to 6 feet in height are anticipated during construction. The excavations are expected to expose undocumented artificial fill and alluvial soils, which are suitable for vertical excavations up to 5 feet where loose soils or caving sands are not present or where not surcharged by adjacent traffic or structures.

7.12.2 Vertical excavations greater than 5 feet will require sloping measures in order to provide a stable excavation. Where sufficient space is available, temporary unsurcharged embankments could be sloped back at a uniform 1.5:1 (H:V) slope gradient, up to a maximum of 12 feet in height. A uniform slope does not have a vertical portion.

7.12.3 Where there is insufficient room for sloping excavations, shoring may be used to support the excavations. Shoring may also be necessary where excavations could remove vertical or lateral support of existing improvements, including existing utilities and adjacent structures. If needed, recommendations for shoring design can be provided under separate cover.

7.12.4 Where sloped embankments are utilized, the top of the slope should be barricaded to prevent vehicles and storage loads at the top of the slope within a horizontal distance equal to the height of the slope. If the temporary construction embankments are to be maintained during the rainy season, berms are suggested along the tops of the slopes where necessary to prevent runoff water from entering the excavation and eroding the slope faces. The contractor’s personnel should inspect the soil exposed in the cut slopes during excavation so that modifications of the slopes can be made if variations in the soil conditions occur. Excavations should be stabilized within 30 days of initial excavation.

7.13 Surface Drainage and Moisture Protection

7.13.1 Proper site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2016 CBC 1804.4 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

7.13.2 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

7.13.3 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. We recommend that area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes be used. In addition, where landscaping is planned adjacent to the pavement, we recommend construction of a cutoff wall along the edge of the pavement that extends at least 6 inches below the bottom of the base material.

7.13.4 If not properly constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to infiltration areas. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeology study at the site. Down-gradient and adjacent structures may be subjected to seeps, movement of foundations and slabs, or other impacts as a result of water infiltration.

7.14 Plan Review

7.14.1 Grading, foundation, and shoring plans should be reviewed by the Geotechnical Engineer (a representative of Geocon West, Inc.), prior to finalization to verify that the plans have been prepared in substantial conformance with the recommendations of this report and to provide additional analyses or recommendations.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous materials was not part of the scope of services provided by Geocon.

2. This report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

3. The findings of this report are valid as of the date of this report. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or 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 partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

4. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

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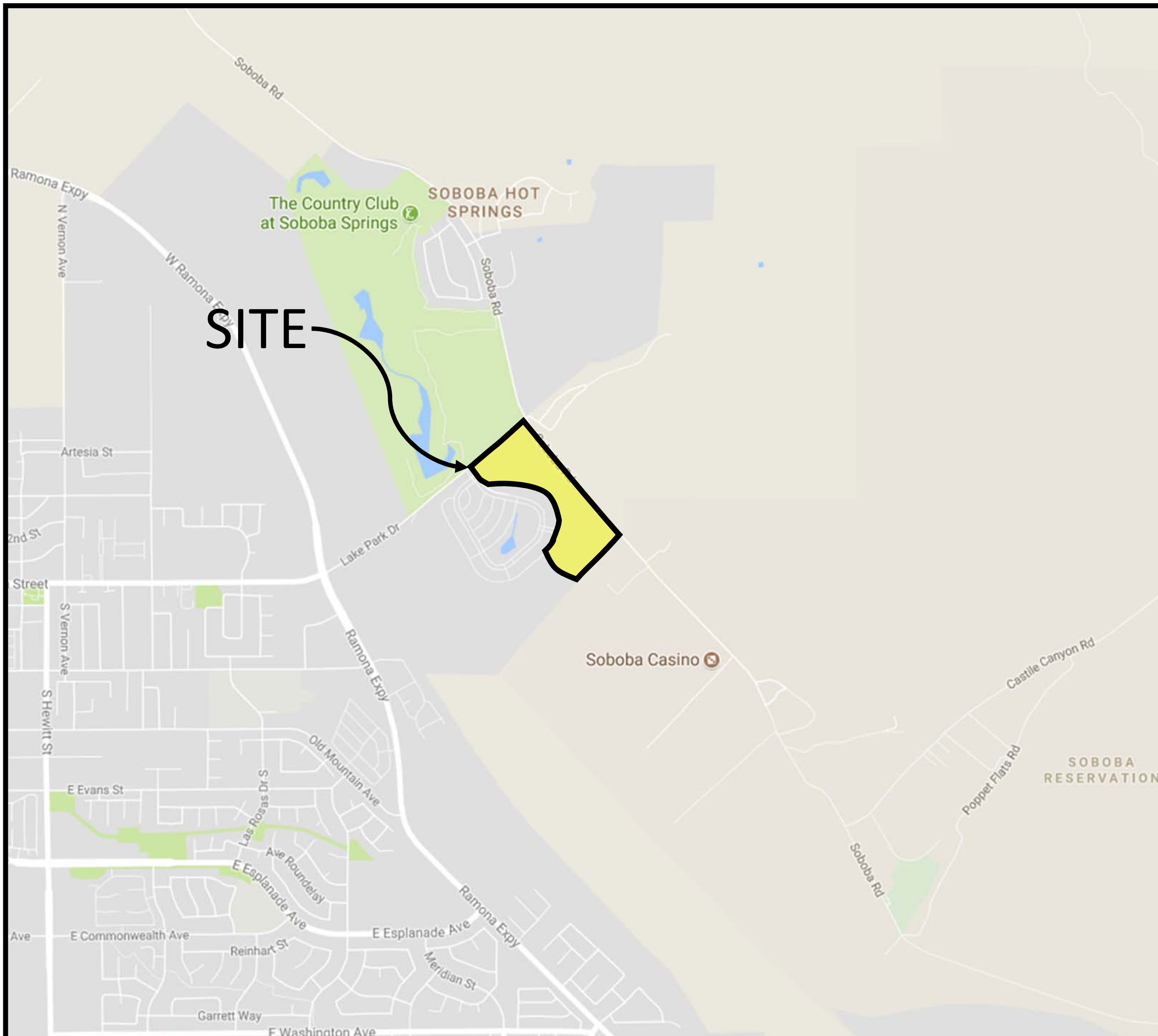
AERIAL PHOTOGRAPHIC STEREO PAIRS REVIEWED

DATE	NEGATIVE NO.	SCALE
1-6-1949	AXM-12F-158, 159, 160	1”=2,400’
5-9-1967	AXM-1HH274, 275, 276	1”=2,400’
2-15-1977	RIV 5-13, -13	1”=4,150’
7/31/1986	86184-79, -80	1”=2,400’
8/21/1991	91130-22, -23	1”=2,000’
6/24/1993	C94-12-44, -45	1”=2,000’
10/4/1995	EMWD 79, 80	1”=2,000’
10/15/1997	C117-36-188, -189	1”=2,000’
3/2/1999	C-135-36-36, -37	1”=2,000’



N

0 2000

SOURCE: Google Maps, 2017

VICINITY MAP

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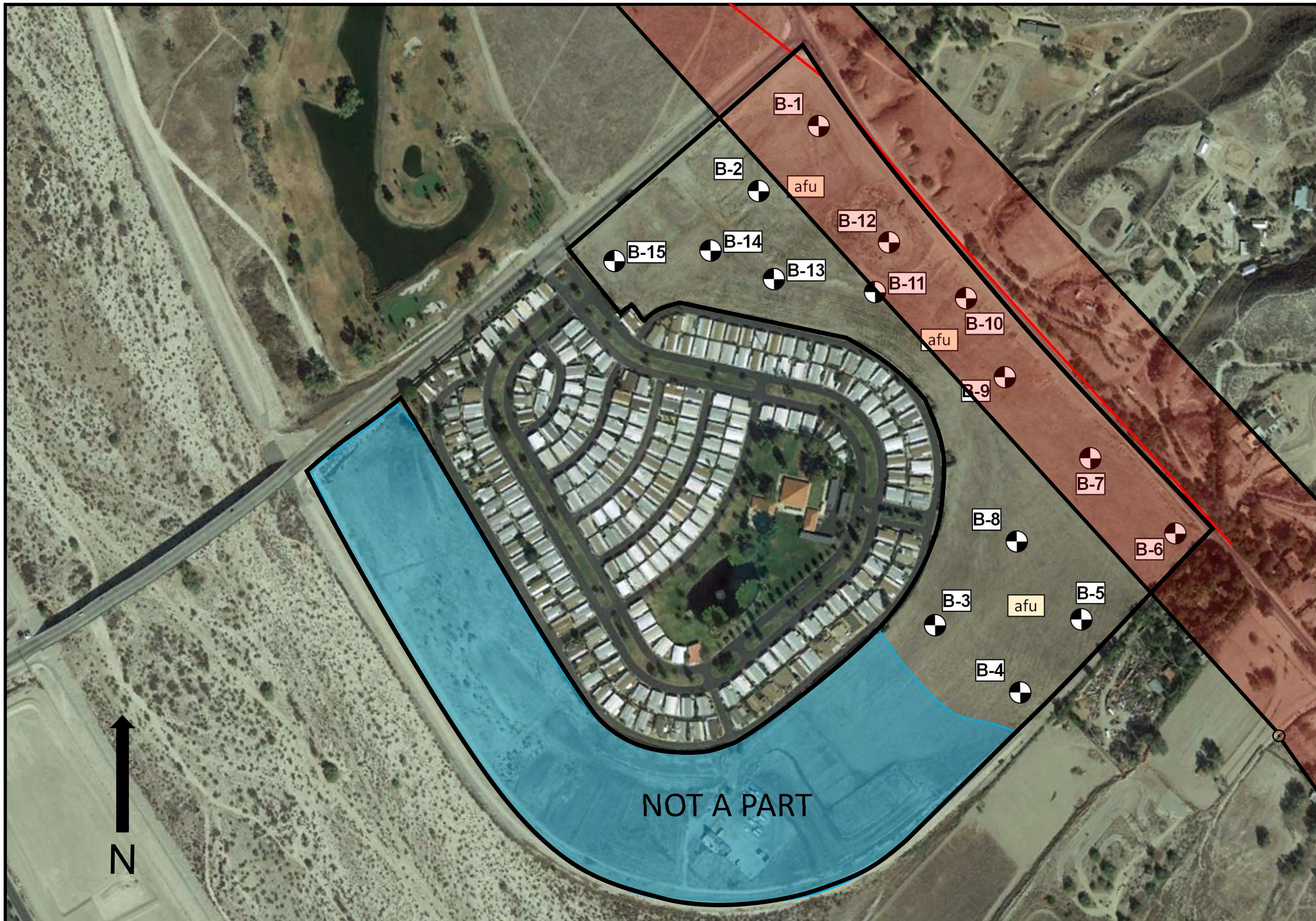
PHONE 951-304-2300 FAX 951-304-2392

PDT		

SOBOBA COMMUNITY SERVIES CENTER
SWC SOBOBA ROAD AND LAKE PARK DRIVE
SAN JACINTO, CALIFORINA

OCTOBER, 2017	PROJECT NO. T2718-22-04	FIG. 1



GEOCON LEGEND

Locations are approximate

.... PROJECT BOUNDARY

.... CLAREMONT FAULT (MAPPED FAULT TRACE)

B-15 .... BORING LOCATION

afu .... UNDOCUMENTED FILL

.... NOT A PART

.... ALQUIST-PRIOLO EARTQUAKE FAULT ZONE

NOTE: FORTHCOMING FAULT RUPTURE HAZARD REPORT WILL SHOW BUILDING SETBACK ZONES.

0 400 800

SCALE 1" = 400'

Source: Google Earth Pro, Accessed September, 2017.

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PDT			OCTOBER, 2017	PROJECT NO. T2718-22-04	FIG. 2

GEOTECHNICAL MAP

SOBOBA COMMUMITY SERVICES
SWC SOBOBA ROAD AND LAKE PARK DRIVE
SAN JACINTO, CALIFORNIA

ASSUMED CONDITIONS:

SLOPE HEIGHT	H = 10 feet
SLOPE INCLINATION	2.0 : 1.0 (Horizontal : Vertical)
TOTAL UNIT WEIGHT OF SOIL	γ_t = 120 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ = 27 degrees
APPARENT COHESION	C = 210 pounds per square foot
NO SEEPAGE FORCES	

ANALYSIS:

$$\lambda_{cf} = \frac{\gamma H \tan\phi}{C}$$ EQUATION (3-3), REFERENCE 1

$$FS = \frac{NcfC}{\gamma H}$$ EQUATION (3-2), REFERENCE 1

λ_{cf}	=	2.9	CALCULATED USING EQ. (3-3)
Ncf	=	15	DETERMINED USING FIGURE 10, REFERENCE 2
FS	=	2.7	FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES:

1……Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics Series No. 46,1954

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CER

SLOPE STABILITY ANALYSIS

SOBOBA COMMUNITY SERVICES CENTER
SWC SOBOBA ROAD AND LAKE PARK DRIVE
SAN JACINTO, CALIFORNIA

OCTOBER, 2017 | PROJECT NO. T2718-22-04 | FIG. 3

ASSUMED CONDITIONS:

SLOPE HEIGHT	H = 10 feet
SLOPE INCLINATION	2.0 : 1.0 (Horizontal : Vertical)
TOTAL UNIT WEIGHT OF SOIL	γ_t = 120 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ = 27 degrees
APPARENT COHESION	C = 210 pounds per square foot
PSEUDOSTATIC COEFFICIENT	k_h = 0.15
PSEUDOSTATIC INCLINATION	1.4 : 1.0 (Horizontal : Vertical)
PSEUDOSTATIC UNIT WEIGHT	γ_{ps} = 121 pounds per cubic foot

NO SEEPAGE FORCES

ANALYSIS:

$\lambda_{c\phi} = \dfrac{\gamma H \tan\phi}{C}$ EQUATION (3-3), REFERENCE 1

$FS = \dfrac{NcfC}{\gamma H}$ EQUATION (3-2), REFERENCE 1

$\lambda_{c\phi}$ = 2.9 CALCULATED USING EQ. (3-3)

Ncf = 13 DETERMINED USING FIGURE 10, REFERENCE 2

FS = 2.2 FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES:

1……Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics Series No. 46,1954

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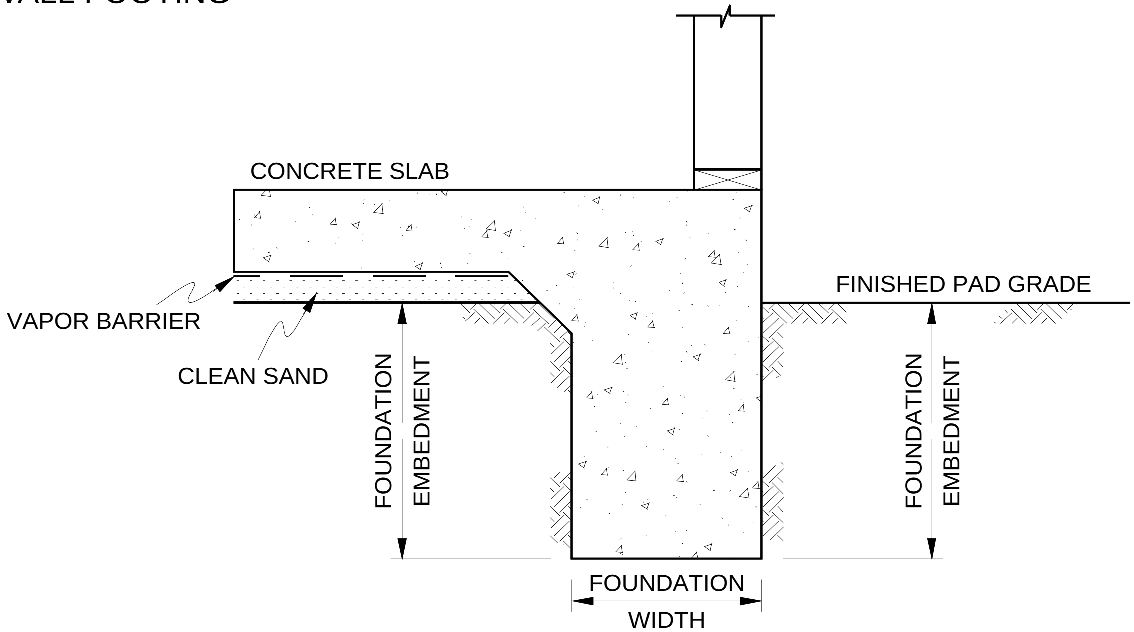
CER

SLOPE STABILITY ANALYSIS - WITH SEISMIC

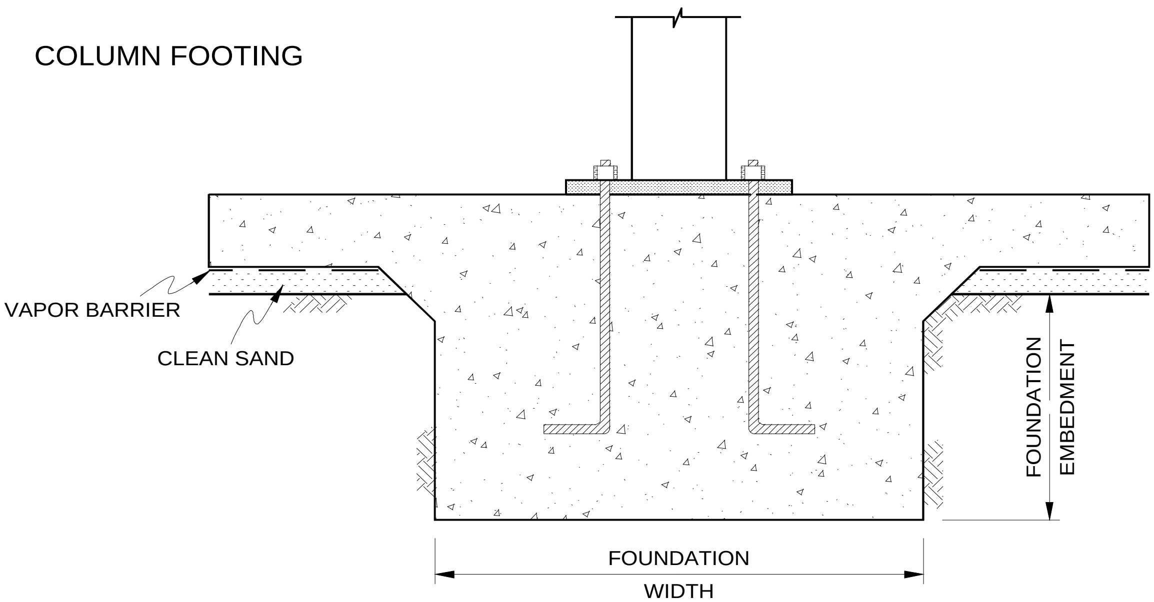
SOBOBA COMMUNITY SERVICES CENTER
SWC SOBOBA ROAD AND LAKE PARK DRIVE
SAN JACINTO, CALIFORNIA

OCTOBER, 2017 | PROJECT NO. T2718-22-04 | FIG. 4

WALL FOOTING



COLUMN FOOTING



NOTE: SEE REPORT FOR FOUNDATION WIDTH AND DEPTH RECOMMENDATION

NO SCALE

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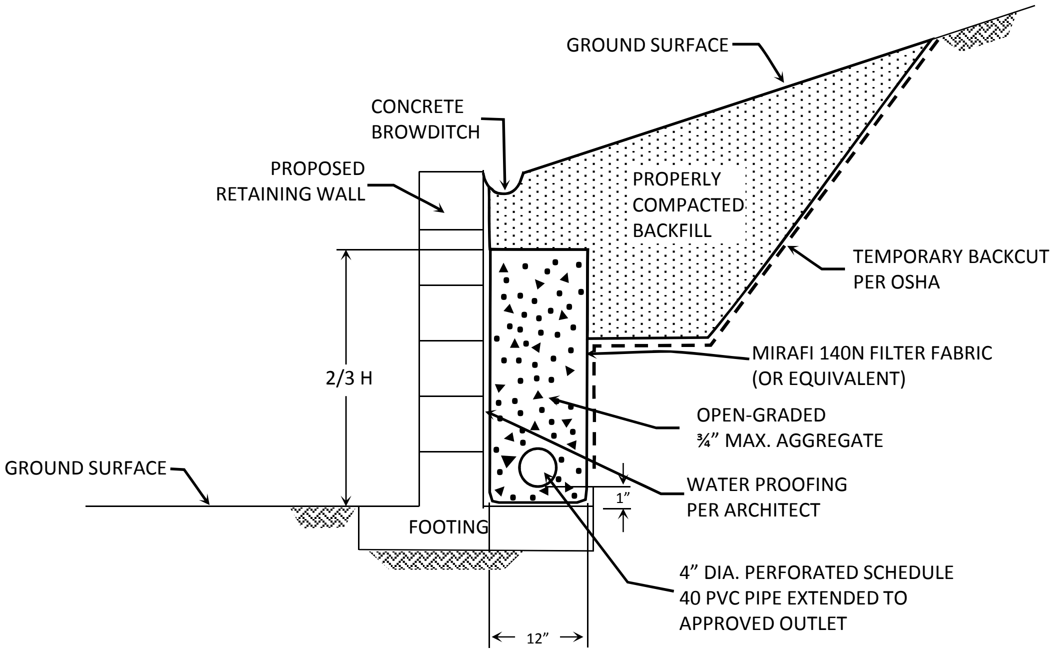
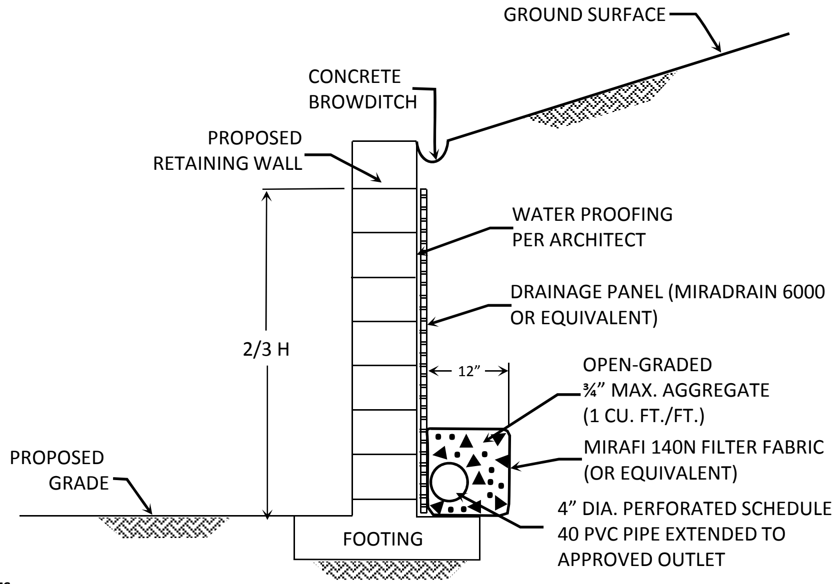
WALL / COLUMN FOOTING DETAIL

SOBOBA COMMUNITY SERVICES
SWC SOBOBA ROAD AND LAKE PARK DRIVE
SAN JACINTO, CALIFORNIA

OCTOBER, 2017	PROJECT NO. T2718-22-04	FIG. 5





NOTES:

DRAIN SHOULD BE UNFORMLY SLOPED TO GRAVITY OUTLET OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPIMG

CONCRETE BROW DITCH RECOMMENDED FOR SLOPE HEIGHTS GREATER THAN 6 FEET

NO SCALE

TYPICAL RETAINING WALL DRAIN DETAIL

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SOBOBA COMMUNITY SERVICES
SWC SOBOBA ROAD AND LAKE PARK DRIVE
SAN JACINTO, CALIFORNIA

PDT			OCTOBER, 2017	PROJECT NO. T2718-22-04	FIG. 6

APPENDIX A

APPENDIX A

EXPLORATORY EXCAVATIONS

The field investigation was performed on August 28 and 29, 2017, and consisted of excavating 15 small-diameter exploratory borings using truck- and track-mounted hollow-stem auger drilling rigs. The borings were excavated to depths of 26½ and 51½ feet. Representative and relatively undisturbed samples were obtained by driving a 3-inch O. D., California Modified Sampler into the "undisturbed" soil mass with blows from a 140-pound auto hammer falling 30 inches. The California Modified Sampler was equipped with 1-inch high by 2³/₈-inch diameter brass sampler rings to facilitate removal and testing. Standard Penetration (SPT) and bulk samples were also obtained for laboratory testing. The soil conditions encountered in the excavations were visually examined, classified and logged in general accordance with ASTM International (ASTM) practice for Description and Identification of Soils (Visual-Manual Procedure D 2488). The borings were backfill and tamped upon completion.

Logs of the borings are presented on Figures A-1 through A-15. The logs depict the soil and geologic conditions encountered and the depth at which samples were obtained. The approximate locations of the exploratory borings are shown on the *Geotechnical Map*, Figure 2.

PROJECT NO. T2718-22-04

BORING B1

ELEV. (MSL.) 1608 DATE COMPLETED 8/28/2017

EQUIPMENT HOLLOW STEM AUGER BY: P. THERIAULT

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B1@0-5'			SM	**UNDOCUMENTED FILL (afu)** Silty SAND, medium dense, dry, brown; fine sand; trace medium sand; some mica			
2								
4	B1@3.5'				-Becomes moist	11	110.5	10.5
6	B1@6'			SM	**YOUNGER ALLUVIUM (Qa)** Silty SAND, loose, moist, brown; fine sand; trace medium sand; some mica	14	109.9	12.4
8	B1@8.5'				-Increase in fine sand	13	112.3	11.9
10								
12	B1@11'				-Becomes medium dense, silty fine to medium sand	19		
14	B1@32'				-Trace gravel	32	114.1	6.8
16	B1@16'				-Increase in silt; some grayish brown mottling	29	98.3	21.6
18								
20				SP	Poorly graded SAND, medium dense, moist, light brown; fine to medium sand; some coarse sand; micaceous			
22	B1@21'					37		
24				ML	Sandy SILT, very stiff, moist, brown; fine sand; micaceous			
26	B1@26'					30		

Total Depth 26.5 Feet
Groundwater Not Encountered
No Caving
Backfilled With Cuttings 8/28/17
Penetration resistance for 140-lb. hammer falling 30 inches by auto-hammer

Figure A-1,
Log of Boring B1, Page 1 of 1

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T2718-22-04

BORING B2

ELEV. (MSL.) **1605** DATE COMPLETED **8/28/2017**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**UNDOCUMENTED FILL (afu)** Silty SAND, medium dense, dry, grayish brown; fine to medium sand; micaceous			
4	B2@3.5'				-Becomes slightly moist	12	107.0	5.8
	B2@5-10'							
6	B2@6'			SM	**YOUNGER ALLUVIUM (Qa)** Silty SAND, medium dense, moist, brown; fine sand; trace medium sand; some mica	21	105.6	12.2
8	B2@8.5'			CL	Sandy CLAY, firm, moist, brown; fine sand; some silt; some mica	12	92.5	24.6
12	B2@11'			SM	Silty SAND, loose, moist, brown, fine sand; some medium sand	18	94.3	29.1
14	B2@13.5'					16	102.7	13.7
16	B2@16'			SP	Poorly Graded SAND, loose, medium dense, moist, whitish light gray; fine to medium sand; some coarse sand	30	113.8	7.3
20	B2@20'			ML	Sandy SILT, stiff, moist, brown; fine sand	12		
22				SM	Silty SAND, medium dense, moist, brown; fine sand; some medium sand; micaceous			
26	B2@26'				-Increase in silt	35	116.7	8.3
28				ML	Sandy SILT, firm, moist, brown; fine sand			
30	B2@30'					8		
32				SM	Silty SAND, loose, moist, brown; fine sand			
34				ML	SILT, firm, moist, brown; some fine sand; micaceous			

Figure A-2,
Log of Boring B2, Page 1 of 2

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B2 ELEV. (MSL.) 1605 DATE COMPLETED 8/28/2017 EQUIPMENT HOLLOW STEM AUGER BY: P. THERIAULT	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
36	B2@36'			ML	SILT, firm, moist, brown; some fine sand; micaceous	36	99.1	24.7
38				SM	Silty SAND, dense, moist, brown; fine to medium sand; trace coarse sand; micaceous			
40	B2@40'					35		
42				ML	Sandy SILT, hard, moist, brown; fine sand; micaceous			
44								
46	B2@46'			SM	**OLDER ALLUVIUM (Qa)** Silty SAND, dense, moist brown, fine to medium sand; micaceous	60	120.3	14.9
48								
50	B2@50'			ML	Sandy SILT, hard, moist, brown; fine sand; micaceous	70		
				SM	Silty SAND, dense, moist, light brown; fine to medium sand; trace coarse sand; micaceous			

Total Depth 51.5 Feet
Groundwater Not Encountered
No Caving
Backfilled With Cuttings 8/28/17
Penetration resistance for 140-lb. hammer falling 30 inches by auto-hammer

Figure A-2,
Log of Boring B2, Page 2 of 2

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2718-22-04

BORING B3

ELEV. (MSL.) **1613** DATE COMPLETED **8/28/2017**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B3@0-5'			SM	**UNDOCUMENTED FILL (afu)** Silty SAND, loose, dry, light brown; fine to medium sand; micaceous			
2					-Becomes slightly moist, brown			
4	B3@3.5'					9	101.9	7.7
				SM	**YOUNG ALLUVIUM (Qa)** Silty SAND, loose, slightly moist, brown; fine to medium sand; micaceous			
6	B3@6'			SM/ML	Silty SAND to Sandy SILT, medium dense to very stiff, slightly moist, brown; fine to medium sand; micaceous	45	100.8	8.8
8	B3@8.5'				-Becomes grayish light brown; some carbonates	42	95.4	6.9
10	B3@11'				-Becomes moist; decrease in carbonates	31	86.0	13.1
12								
14	B3@13.5'			SP	Poorly Graded SAND, medium dense, slightly moist, whitish light brown; fine to coarse sand; trace silt; micaceous; uncemented	31	113.5	1.4
16	B3@16'				-No silt; trace gravel	26		
18								
20				SM	Silty SAND, medium dense, moist, brown; fine to medium sand, miccaceous			
22	B3@21'					27	104.8	12.4
					-Increase in silt			
24								
26	B3@26'				-Increase in sand	38		

Total Depth 26.5 Feet
Groundwater Not Encountered
No Caving
Backfilled With Cuttings 8/28/17
Penetration resistance for 140-lb. hammer falling 30 inches by auto-hammer

Figure A-3,
Log of Boring B3, Page 1 of 1

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

BORING B4

ELEV. (MSL.) **1623** DATE COMPLETED **8/28/2017**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**UNDOCUMENTED FILL (afu)** Silty SAND, medium dense, dry, brown; fine to medium sand; micaceous			
2				SM	**YOUNG ALLUVIUM (Qa)** Silty SAND, medium dense, moist, brown; micaceous			
4	B4@3.5'					21	84.2	11.2
6	B4@5-10'							
	B4@6'				-Becomes loose, slightly moist, light brown; trace carbonates	16	99.1	3.8
8	B4@8.5'					32	107.4	4.4
10					-Becomes medium dense			
12	B4@11'				-Trace gravel; no carbonates	30	100.1	6.9
14	B4@13.5'					25		
16	B4@16'			SP	Poorly Graded SAND, medium dense, slightly moist, whitish light brown; fine to coarse sand; trace gravel; micaceous; uncemented	26	104.4	0.7
18								
20				ML	Sandy SILT, stiff, moist, brown; fine sand; trace medium sand; trace carbonates; micaceous			
22	B4@21'					14	94.5	27.8
24								
26	B4@26'				Silty SAND, medium dense, moist, brown; fine sand; trace medium sand; micaceous	30		

Total Depth 26.5 Feet
Groundwater Not Encountered
No Caving
Backfilled With Cuttings 8/28/17
Penetration resistance for 140-lb. hammer falling 30 inches by auto-hammer

Figure A-4,
Log of Boring B4, Page 1 of 1

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

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GEOCON

PROJECT NO. T2718-22-04

BORING B5

ELEV. (MSL.) **1626** DATE COMPLETED **8/28/2017**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B5@0-5'	SM	**UNDOCUMENTED FILL (afu)** Silty SAND, medium dense, dry, light brown; fine to medium sand; micaceous			
2		SM	**YOUNG ALLUVIUM (Qa)**			
4	B5@3.5'		Silty SAND, medium dense, slightly moist, light brown; fine to medium sand; trace carbonates	15	108.6	7.3
6	B5@6		-Becomes loose, silty fine to coarse sand	16	112.3	4.5
8	B5@8.5'		-Becomes medium dense, decrease in coarse sand	23	113.5	1.7
10	B5@11			22		
12		SM/SP	Silty SAND to Poorly Graded SAND with silt, medium dense, slightly moist, light brown; fine to medium sand; some coarse sand; micaceous			
14	B5@13.5'	SM	Silty SAND, medium dense, moist, brown; fine sand; micaceous	20	103.7	6.8
16						
18						
20	B5@20'		-Decrease in silt	20	114.9	10.2
22			-Becomes silty fine to medium sand; some carbonate stringers			
24						
26	B5@26'	SP	Poorly Graded SAND, medium dense, slightly moist, light brown; fine to coarse sand; micaceous; uncemented	43		

Total Depth 26.5 Feet
Groundwater Not Encountered
No Caving
Backfilled With Cuttings 8/28/17
Penetration resistance for 140-lb. hammer falling 30 inches by auto-hammer

**Figure A-5,
Log of Boring B5, Page 1 of 1**

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

BORING B6

ELEV. (MSL.) **1643** DATE COMPLETED **8/28/2017**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**UNDOCUMENTED FILL (afu)** Silty SAND, medium dense, slightly moist, light brown; fine to medium sand; trace coarse sand; micaceous			
2								
4	B6@3.5'			SM	**YOUNG ALLUVIUM (Qa)** Silty SAND, loose, slightly moist, brown; fine to medium sand; micaceous	10	108.8	2.2
6	B6@5-10'							
	B6@6'					12	119.8	6.5
8								
	B6@8.5'					13	115.7	2.1
10								
	B6@11'					17	110.0	5.3
12					-Becomes medium dense			
14	B6@13.5'			SP	Poorly Graded SAND, medium dense, slightly moist moist, yellowish brown; fine to coarse sand; some gravel; micaceous	30	114.0	2.9
16	B6@16'			SM	Silty SAND, medium dense, moist, brown; fine to medium sand; micaceous	14		
18								
20								
	B6@21'				-Trace coarse sand	28		
22								
24								
26	B6@26'				-No coarse sand	29		

Total Depth 26.5 Feet
Groundwater Not Encountered
No Caving
Backfilled With Cuttings 8/28/17
Penetration resistance for 140-lb. hammer falling 30 inches by auto-hammer

Figure A-6,
Log of Boring B6, Page 1 of 1

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING B7

ELEV. (MSL.) 1636 DATE COMPLETED 8/28/2017

EQUIPMENT HOLLOW STEM AUGER BY: P. THERIAULT

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B7@0-5'			SM	**UNDOCUMENTED FILL (afu)** Silty SAND, loose, slightly moist, brown; fine to coarse sand; micaceous			
2								
4	B7@3.5'			SM	**YOUNG ALLUVIUM (Qa)** Silty SAND, loose, slightly moist, brown; fine to coarse sand; micaceous	9	112.3	2.6
6	B7@6'				-Becomes moist, light brown	16	108.8	1.7
8	B7@8.5'				-Becomes medium dense	22		
10								
12	B7@11'				-Becomes loose	16	111.8	2.0
14	B7@13.5'				-Decrease in coarse sand	12		
16	B7@16'				-No coarse sand	12	107.2	4.8
18								
20								
22	B7@21'				-Becomes medium dense, some coarse sand	19		
24								
26	B7@26'			SP/SM	Poorly Graded SAND to Silty SAND, medium dense, slightly moist, light brown; fine to coarse sand; micaceous	41	110.1	5.2

Total Depth 26.5 Feet
Groundwater Not Encountered
No Caving
Backfilled With Cuttings 8/28/17
Penetration resistance for 140-lb. hammer falling 30 inches by auto-hammer

Figure A-7,
Log of Boring B7, Page 1 of 1

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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GEOCON

BORING B8

ELEV. (MSL.) 1622 DATE COMPLETED 8/28/2017

EQUIPMENT HOLLOW STEM AUGER BY: P. THERIAULT

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**UNDOCUMENTED FILL (afu)** Silty SAND, medium dense, dry, light brown; fine to medium sand; some coarse sand; micaceous			
2				SM	**YOUNG ALLUVIUM (Qa)** Silty SAND, medium dense, slightly moist, brown; micaceous			
4	B8@3.5'					24	116.2	2.9
	B8@5-10'							
6	B8@6'				-Becomes loose	12	116.6	3.6
8	B8@8.5'				-Becomes silty fine to coarse sand	16	108.2	1.2
10								
12	B8@11'				-Becomes medium dense, no coarse sand; trace carbonate strigers	26		
14	B8@13.5'					27	106.6	6.9
16	B8@16'					24		
18								
20								
22	B8@21'				-Becomes silty fine sand	31	109.0	6.5
24								
26	B8@26'					26		

Total Depth 26.5 Feet
Groundwater Not Encountered
No Caving
Backfilled With Cuttings 8/28/17
Penetration resistance for 140-lb. hammer falling 30 inches by auto-hammer

Figure A-8,
Log of Boring B8, Page 1 of 1

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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PROJECT NO. T2718-22-04

BORING B9

ELEV. (MSL.) **1613** DATE COMPLETED **8/29/2017**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B9@0-5'			SM	**UNDOCUMENTED FILL (afu)** Silty SAND, medium dense, dry, light brown; fine to medium sand; micaceous			
2				SM	**YOUNG ALLUVIUM (Qa)** Silty SAND, medium dense, slightly moist, light brown; fine to mdeium sand; some coarse sand			
4	B9@3.5'					13		
6	B9@6'					15	110.4	3.5
8	B9@8.5'			SM/SP	Silty SAND to Poorly Graded SAND with silt, medium dense, slightly moist, yellowish light brown; fine to coarse sand	18	101.4	1.3
10	B9@11'			SW/SM	Well Graded SAND to Silty SAND, medium dense, slightly moist, light brown; fine to medium sand; some coarse; trace gravel	26		
12								
14	B9@13.5'				-Some gravel	35		
16	B9@16'			SM	Silty SAND, medium dense, moist, brown; fine to medium sand; some coarse sand; micaceous	17		
18								
20	B9@20'					9		
22					-Becomes loose			
24								
26	B9@26'					29		
28				SP	Poorly Graded SAND, medium dense, slightly moist, light brown; fine to coarse sand			
30	B9@30'			SM	Silty SAND, medium dense, moist, brown; fine to medium sand; micaceous	20		
32								
34								

Figure A-9,
Log of Boring B9, Page 1 of 2

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

BORING B9

ELEV. (MSL.) **1613** DATE COMPLETED **8/29/2017**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
36	B9@36'			SM	Silty SAND, medium dense, moist, brown; fine to medium sand; micaceous -Becomes yellowish brown	49		
38								
40	B9@40'				-Minor amount of silt approximately 2 inches thick	28		
42								
44								
46	B9@46'				-Becomes dense, light brown	49		
48					**OLDER ALLUVIUM (Qoa)** Silty SAND, medium dense, moist, light brown; fine to medium sand; micaceous			
50	B9@50'					41		

Total Depth 51.5 Feet
Groundwater Not Encountered
No Caving
Backfilled With Cuttings 8/29/17
Penetration resistance for 140-lb. hammer falling 30 inches by auto-hammer

Figure A-9,
Log of Boring B9, Page 2 of 2

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2718-22-04

BORING B10

ELEV. (MSL.) **1609** DATE COMPLETED **8/29/2017**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**UNDOCUMENTED FILL (afu)** Silty SAND, medium dense, dry, light brown; fine to medium sand; some coarse sand; micaceous			
2								
4	B10@3.5'			SM	**YOUNG ALLUVIUM (Qa)** Silty SAND, medium dense, slightly moist, light brown; fine to medium sand; some coarse sand; micaceous	28		
6	B10@5-10'							
	B10@6'				-Becomes moist	19		
8								
	B10@8.5'				-Increase in coarse sand; decrease in silt	22		
10								
	B10@11'				-Becomes silty fine to medium sand, brown	26	116.4	9.9
12								
14	B10@13.5'				-Becomes light brown; decrease in silt	31		
16	B10@16'					38	120.1	5.1
18								
20								
	B10@21'					45		
22								
24								
26	B10@26'			SM/SP	Silty SAND to Poorly Graded SAND, dense, moist, yellowish brown; fine to medium sand; some coarse sand	60	119.8	7.5

Total Depth 26.5 Feet
Groundwater Not Encountered
No Caving
Backfilled With Cuttings 8/29/17
Penetration resistance for 140-lb. hammer falling 30 inches by auto-hammer

Figure A-10,
Log of Boring B10, Page 1 of 1

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T2718-22-04

BORING B11

ELEV. (MSL.) **1605** DATE COMPLETED **8/29/2017**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B11@0-5'			SM	**UNDOCUMENTED FILL (afu)** Silty SAND medium dense, moist, brown; fine to medium sand; micaceous			
4	B11@3.5'					33	89.5	11.8
6	B11@6'			SM	**YOUNG ALLUVIUM (Qa)** Silty SAND, medium dense, moist, light brown; fine to medium sand; micaceous	36	102.0	7.7
8	B11@8.5'				-Becomes silty fine sand; slightly moist	30	92.9	2.8
11	B11@11'				-Trace porosity	28		
14	B11@13.5'				-Decrease in silt, moist	26	87.9	6.2
16	B11@16'					55		
20				SP	Poorly Graded SAND, medium dense, slighlty moist, light brown; fine to coarse sand			
21	B11@21'			SM	Silty SAND, medium dense, moist, light brown; fine to medium sand; micaceous	18	83.2	21.2
24				ML	Sandy SILT, stiff, moist, brown; fine sand; micaceous			
26	B11@26'					17		

Total Depth 26.5 Feet
Groundwater Not Encountered
No Caving
Backfilled With Cuttings 8/29/17
Penetration resistance for 140-lb. hammer falling 30 inches by auto-hammer

Figure A-11,
Log of Boring B11, Page 1 of 1

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. T2718-22-04

BORING B12

ELEV. (MSL.) **1601** DATE COMPLETED **8/29/2017**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B12@0-5'			CH	**YOUNG ALLUVIUM (Qa)** CLAY, stiff, dry, grayish light brown; trace fine sand; micaceous; detention basin			
4	B12@3.5'				-Becomes moist	26	87.0	19.7
6	B12@6'					26	92.3	29.5
8	B12@8.5'				Becomes very stiff, grayish brown	48		
11	B12@11'			ML	Sandy SILT, very stiff, moist grayish light brown	56	106.0	13.8
14	B12@13.5				-Becomes slightly moist, light brown	62		
16	B12@16'			SP	Poorly Graded SAND, medium dense, slightly moist, light brown; fine to coarse sand; micaceous; uncemented	41	110.1	0.7
20				SM/ML	Silty SAND to Sandy SILT, dense to hard, moist, light brown; fine sand; some medium sand; micaceous			
21	B12@21'					51		
26	B12@26'				-Becomes very dense to hard	71	111.4	7.5

Total Depth 26.5 Feet
Groundwater Not Encountered
No Caving
Backfilled With Cuttings 8/29/17
Penetration resistance for 140-lb. hammer falling 30 inches by auto-hammer

Figure A-12,
Log of Boring B12, Page 1 of 1

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. T2718-22-04

BORING B13

ELEV. (MSL.) **1601** DATE COMPLETED **8/29/2017**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B13@0-5'			SM	**UNDOCUMENTED FILL (afu)** Silty SAND, medium dense, dry, grayish brown; fine sand; micaceous			
4	B13@3.5'			SM	**YOUNG ALLUVIUM (Qa)** Silty SAND, medium dense, slightly moist, light brown; fine to medium sand; trace porosity	31		
6	B13@6'				-Becomes moist	47	106.2	22.0
8	B13@8.5'			SP	Poorly Graded SAND, medium dense, moist, whitish light brown, fine to medium sand; trace silt; micaceous	31		
11	B13@11'			ML	SILT, stiff, moist, brown; some fine sand; micaceous; some light brown mottling	37	103	22.4
13	B13@13.5'			SM	Silty SAND, medium dense, moist, brown, fine to medium sand; micaceous	29		
16	B13@16'				-Becomes slightly moist	32	106.3	4.0
21	B13@21'				-Becomes whitish light brown	25		
26	B13@26'				-Becomes light brown	24		

Total Depth 26.5 Feet
Groundwater Not Encountered
No Caving
Backfilled With Cuttings 8/29/17
Penetration resistance for 140-lb. hammer falling 30 inches by auto-hammer

Figure A-13, Log of Boring B13, Page 1 of 1

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. T2718-22-04

BORING B14

ELEV. (MSL.) **1600** DATE COMPLETED **8/29/2017**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**UNDOCUMENTED FILL (afu)** Silty SAND, medium dense, slightly moist, brown; fine sand; micaceous			
2								
4	B14@3.5'			SM	**YOUNG ALLUVIUM (Qa)** Silty SAND, medium dense, slightly moist, brown, fine sand; trace medium sand; micaceous	46	108.4	5.5
6	B14@5-10'			ML	Sandy SILT, stiff, moist, brown, fine sand; micaceous			
	B14@6'					30	96.1	20.6
8								
	B14@8.5'			SM	Silty SAND, medium dense, moist, brown; micaceous; some calcium carbonate stringers	23	76.3	7.6
10								
	B14@11'			ML	Sandy SILT, very stiff, slightly moist, light brown; fine sand; micaceous	42	108.3	2.3
12								
14	B14@13.5'			SP	Poorly Graded SAND, medium dense, slightly moist, whitish light brown; micaceous; uncecmented	29		
16	B14@16'				-Trace gravel	28		0.9
18								
20								
	B14@21'					27		
22								
				SM	Silty SAND, medium dense, moist, brown; fine to medium sand; micaceous			
24								
26	B14@26'				-Becomes slightly moist	43	97.6	4.0

Total Depth 26.5 Feet
Groundwater Not Encountered
No Caving
Backfilled With Cuttings 8/29/17
Penetration resistance for 140-lb. hammer falling 30 inches by auto-hammer

Figure A-14,
Log of Boring B14, Page 1 of 1

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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PROJECT NO. T2718-22-04

BORING B15

ELEV. (MSL.) **1601** DATE COMPLETED **8/29/2017**

EQUIPMENT **HOLLOW STEM AUGER** BY: **P. THERIAULT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B15@0-5'			SM	**UNDOCUMENTED FILL (afu)** Silty SAND, very dense, dry, brown; fine sand; micaceous			
2								
4	B15@3.5'				-Becomes slightly moist	96	106.6	6.7
6	B15@6'			SM	**YOUNG ALLUVIUM (Qa)** Silty SAND, medium dense, slightly moist, brown; fine sand; micaceous	46	114.9	8.4
8	B15@8.5'					26	90.4	7.0
10								
12	B15@11'				-Increase in silt; some porosity	32		
14	B15@13.5'			SP	Poorly Graded SAND, medium dense, slightly moist, light brown; fine to coarse sand; micaceous; uncemented	26		0.5
16	B15@16'				-Becomes dense; trace cobbles	50		
18								
20								
22	B15@21'			SM	Silty SAND, medium dense, slightly moist, brown; fine to medium sand; micaceous	27		5.5
24				CL	Sandy CLAY, very stiff, wet, brown; fine to coarse sand; micaceous			
26	B15@26'			SM	Silty SAND, medium dense, moist, light brown; fine to coarse sand; micaceous	56		

Total Depth 26.5 Feet
Groundwater Not Encountered
No Caving
Backfilled With Cuttings 8/29/17
Penetration resistance for 140-lb. hammer falling 30 inches by auto-hammer

Figure A-15,
Log of Boring B15, Page 1 of 1

T2718-22-04 BORING LOGS.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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APPENDIX B

APPENDIX B

LABORATORY TESTING

Laboratory tests were performed in general accordance with test methods of ASTM International (ASTM), California test (CT) methods or other suggested procedures. Selected samples were tested for direct shear strength, grain size analysis, consolidation/collapse characteristics, expansion characteristics, moisture density relationships, corrosivity, and Atterberg limits. The results of the laboratory tests are summarized in Figures B-1 through B-20.

SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS ASTM D1557

Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% of dry wt.)
B1 @ 0-5'	Silty SAND (SM), fine sand, brown	128.0	9.5
B7 @ 0-5'	Silty SAND (SM), fine to coarse sand, brown	129.0	8.0
B11 @ 0-5'	Silty SAND (SM), fine sand, brown	127.0	9.5
B15 @ 0-5'	Silty SAND (SM), fine sand, brown	127.0	9.5

SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS ASTM D4829

Sample No.	Moisture Content		After Test Dry Density (pcf)	Expansion Index
	Before Test (%)	After Test (%)		
B1 @ 0-5'	8.7	16.8	114.0	5
B5 @ 0-5'	8.0	14.1	117.2	3

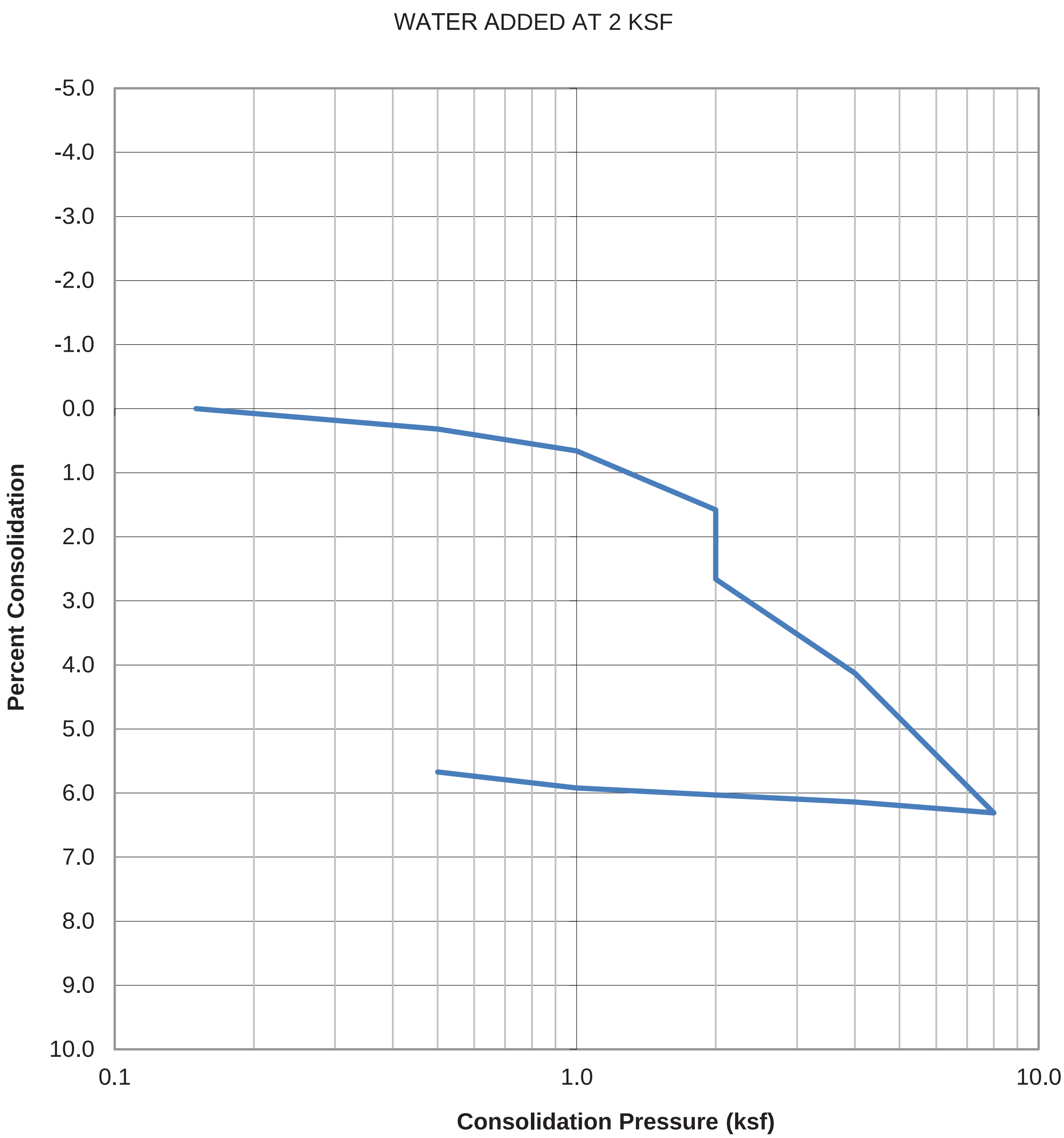
SUMMARY OF CORROSIVITY TEST RESULTS

Sample No.	Chloride Content (ppm)	Sulfate Content (%)	pH	Resistivity (ohm-centimeter)
B3 @ 0-5'	35	0.000	8.6	4,300
B13 @ 0-5'	2,552	0.005	8.5	620

Chloride content determined by California Test 422.
Water-soluble sulfate determined by California Test 417.
Resistivity and pH determined by Caltrans Test 643.

SUMMARY OF ATTERBERG LIMIT TEST RESULTS
ASTM D4318

Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	USCS
B2 @ 8.5’	45	20	25	CL
B2 @ 20’	29	23	6	ML
B12 @ 8.5’	51	19	32	CH



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B2 @ 3.5'	SM	97.7	7.9	21.3

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CONSOLIDATION TEST RESULTS

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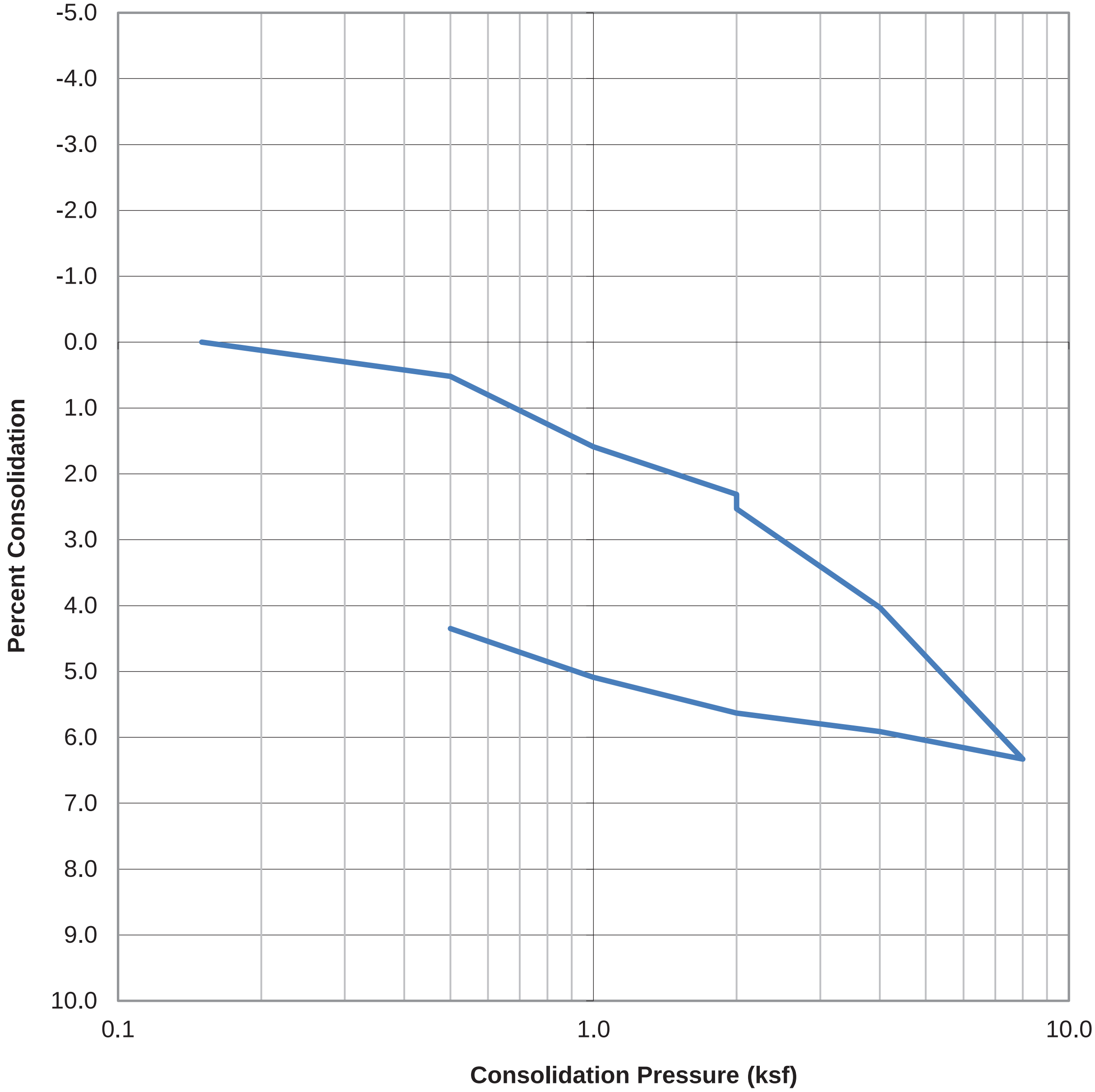
SAN JACINTO CALIFORNIA

OCTOBER, 2017	PROJECT NO. T2718-22-04	FIG B-3

WATER ADDED AT 2 KSF



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B2 @ 8.5'	ML	95.2	24.1	24.2

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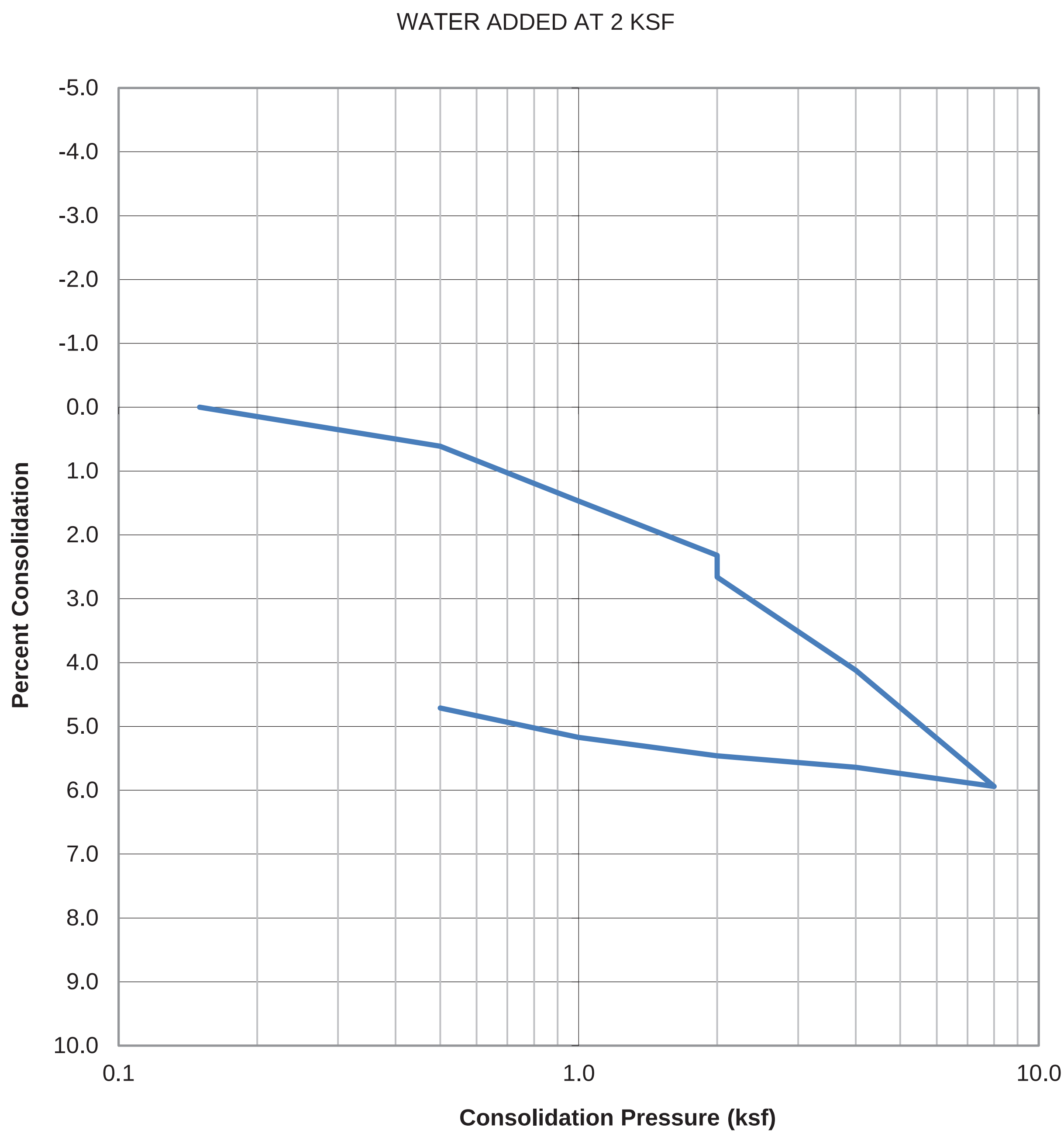
OCTOBER, 2017	PROJECT NO. T2718-22-04	FIG B-4



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B2 @ 13.5'	SM	96.1	18.3	23.1

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CONSOLIDATION TEST RESULTS

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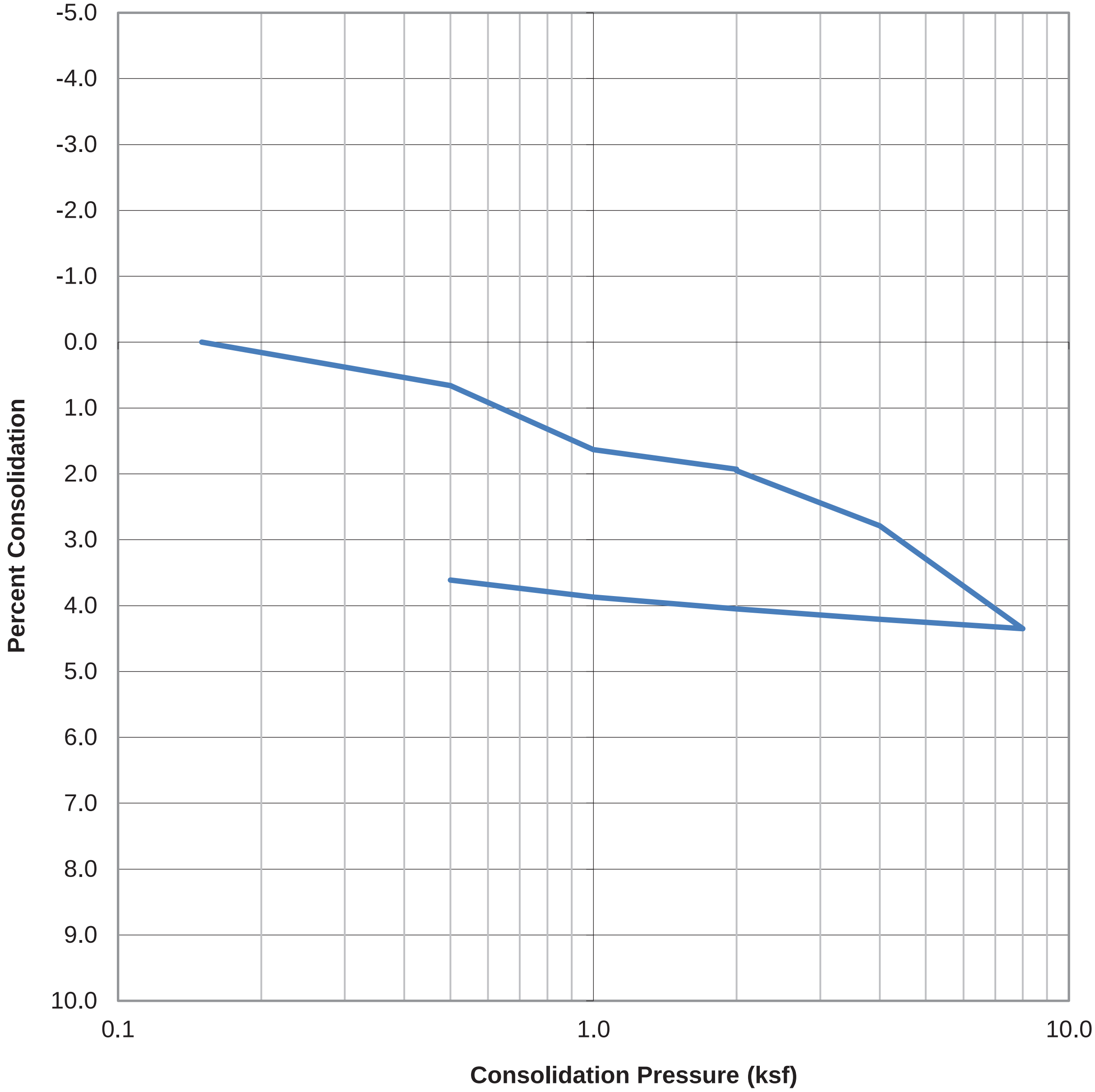
WATER ADDED AT 2 KSF



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B2 @ 26'	SM	117.5	14.8	14.7

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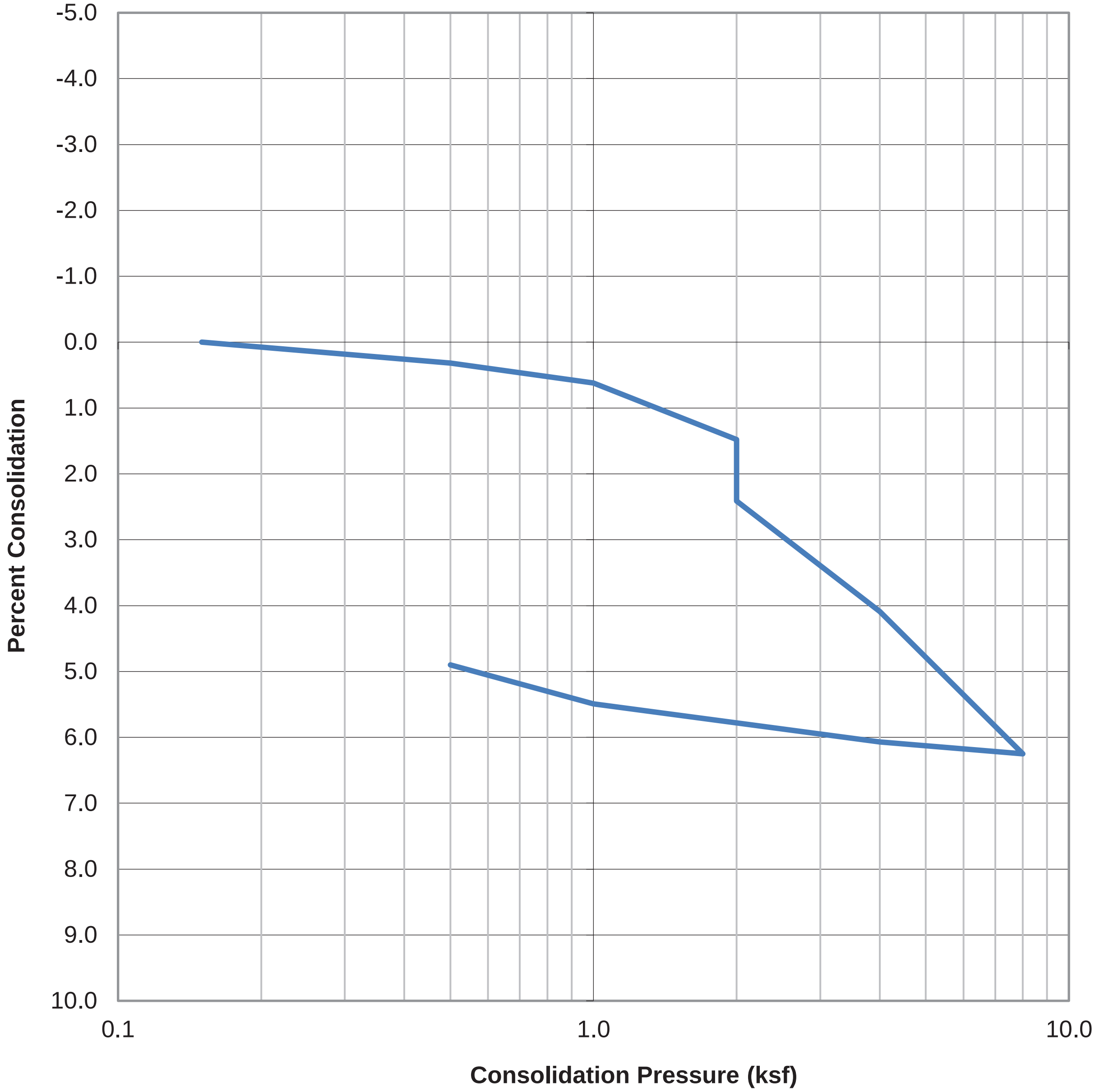
OCTOBER, 2017	PROJECT NO. T2718-22-04	FIG B-6

WATER ADDED AT 2 KSF



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B3 @ 3.5'	SM	100.2	8.3	22.4

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CONSOLIDATION TEST RESULTS

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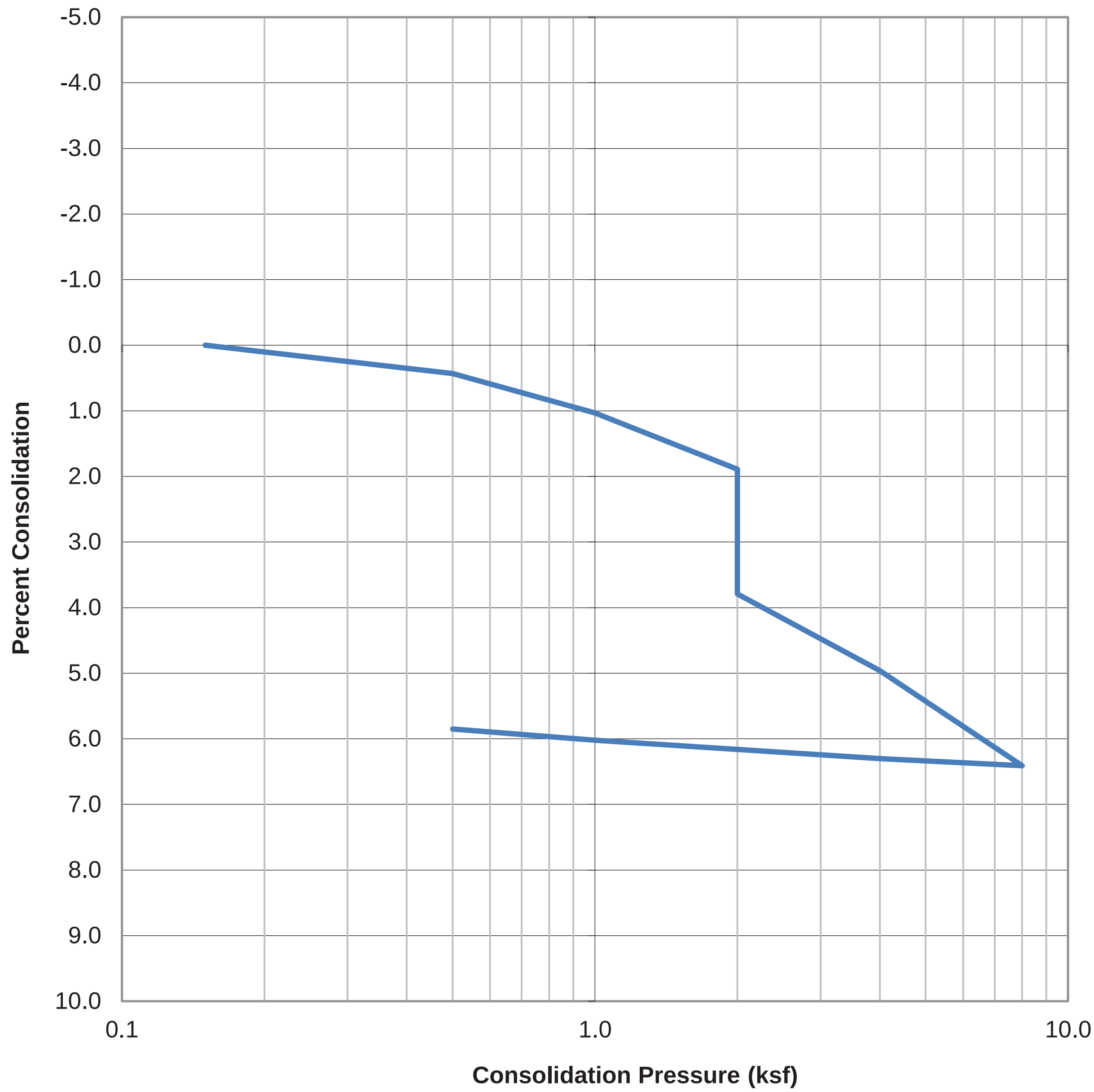
OCTOBER, 2017	PROJECT NO. T2718-22-04	FIG B-7

DDED AT 2 KSF



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B6 @ 3.5'	SM	105.9	3.3	14.0

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CONSOLIDATION TEST RESULTS

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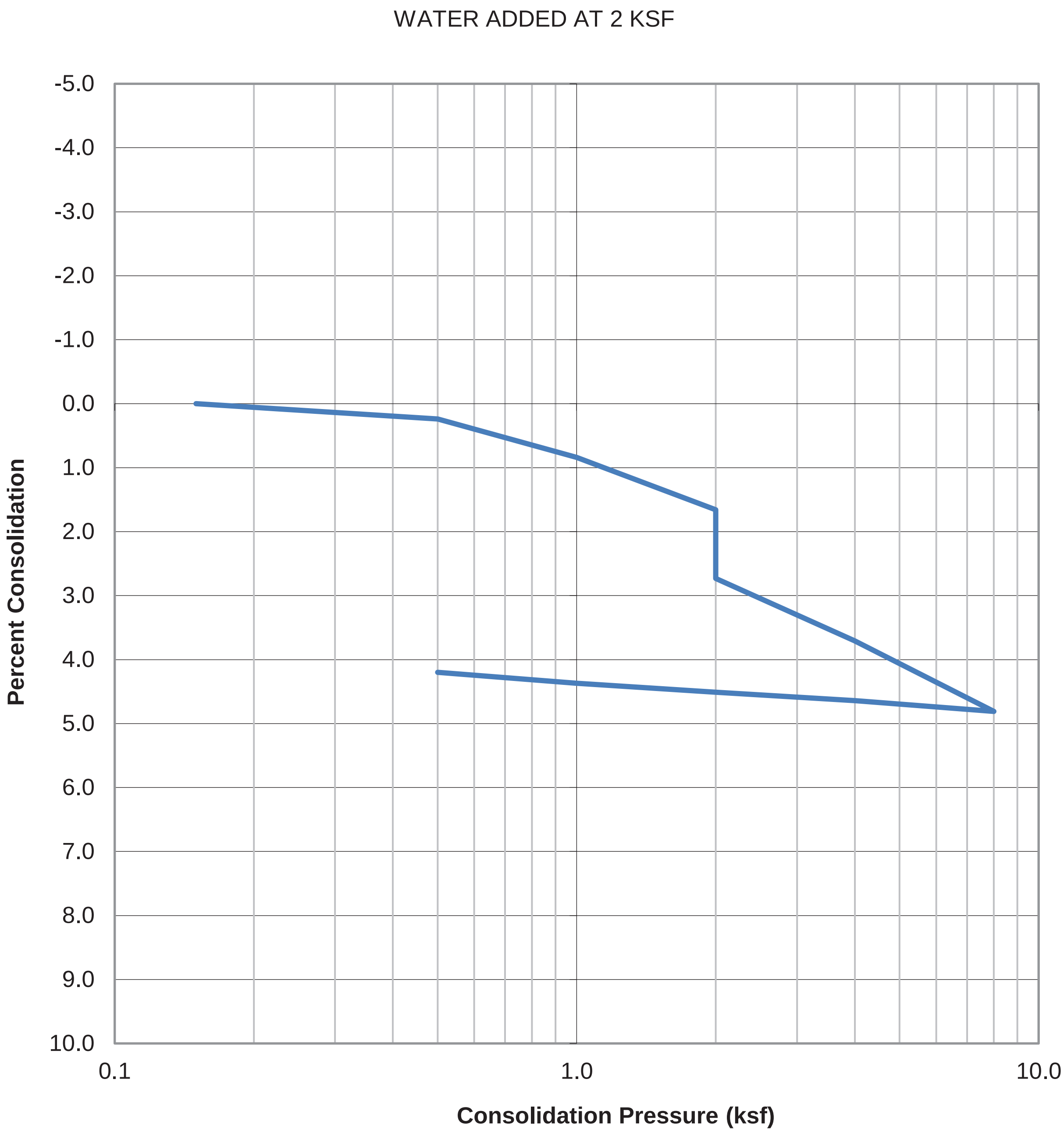
OCTOBER, 2017	PROJECT NO. T2718-22-04	FIG B-8



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B6 @ 8.5'	SM	107.0	4.0	14.6

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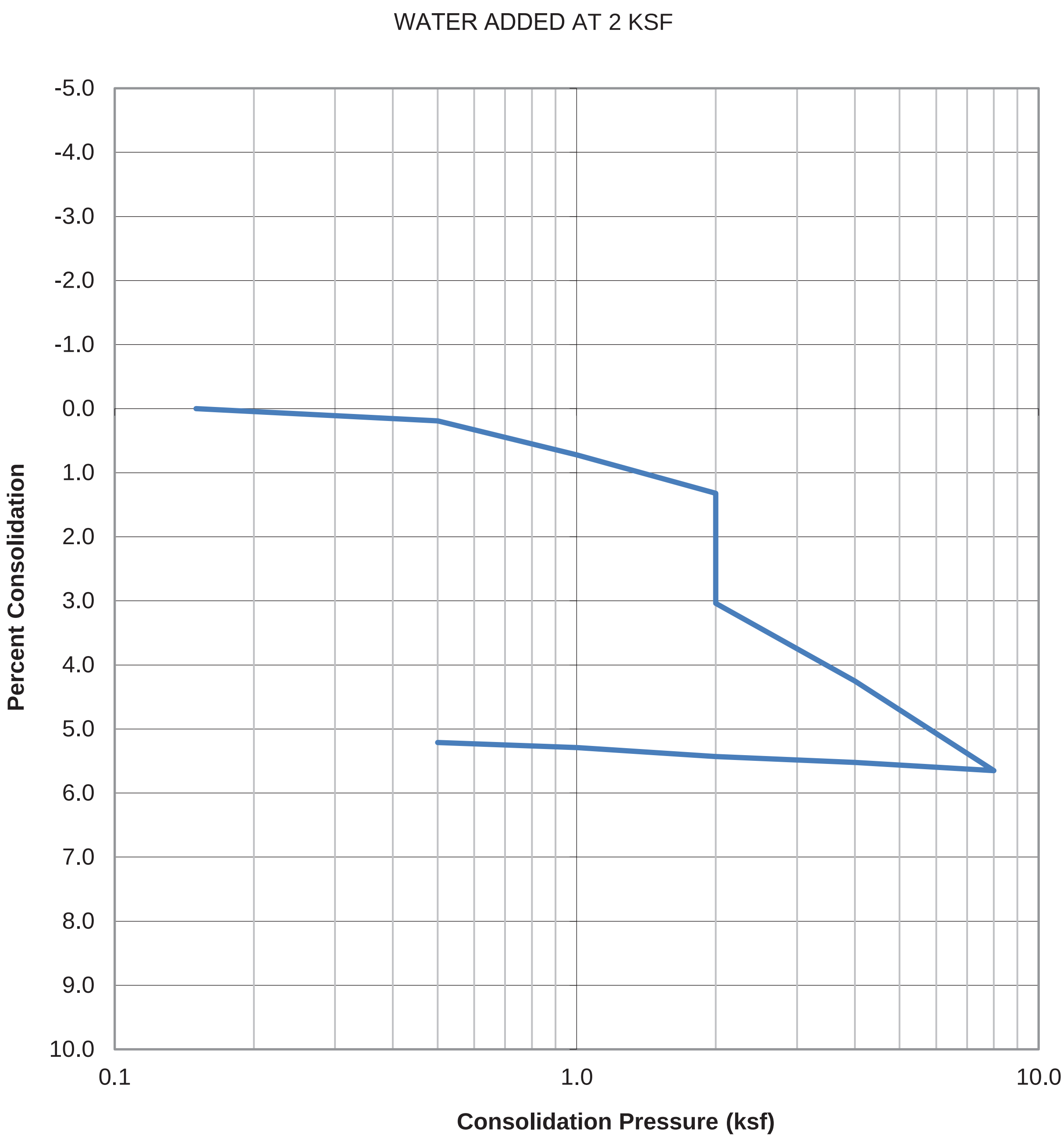
OCTOBER, 2017 | PROJECT NO. T2718-22-04 | FIG B-9



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B8 @ 6'	SM	104.2	4.2	15.1

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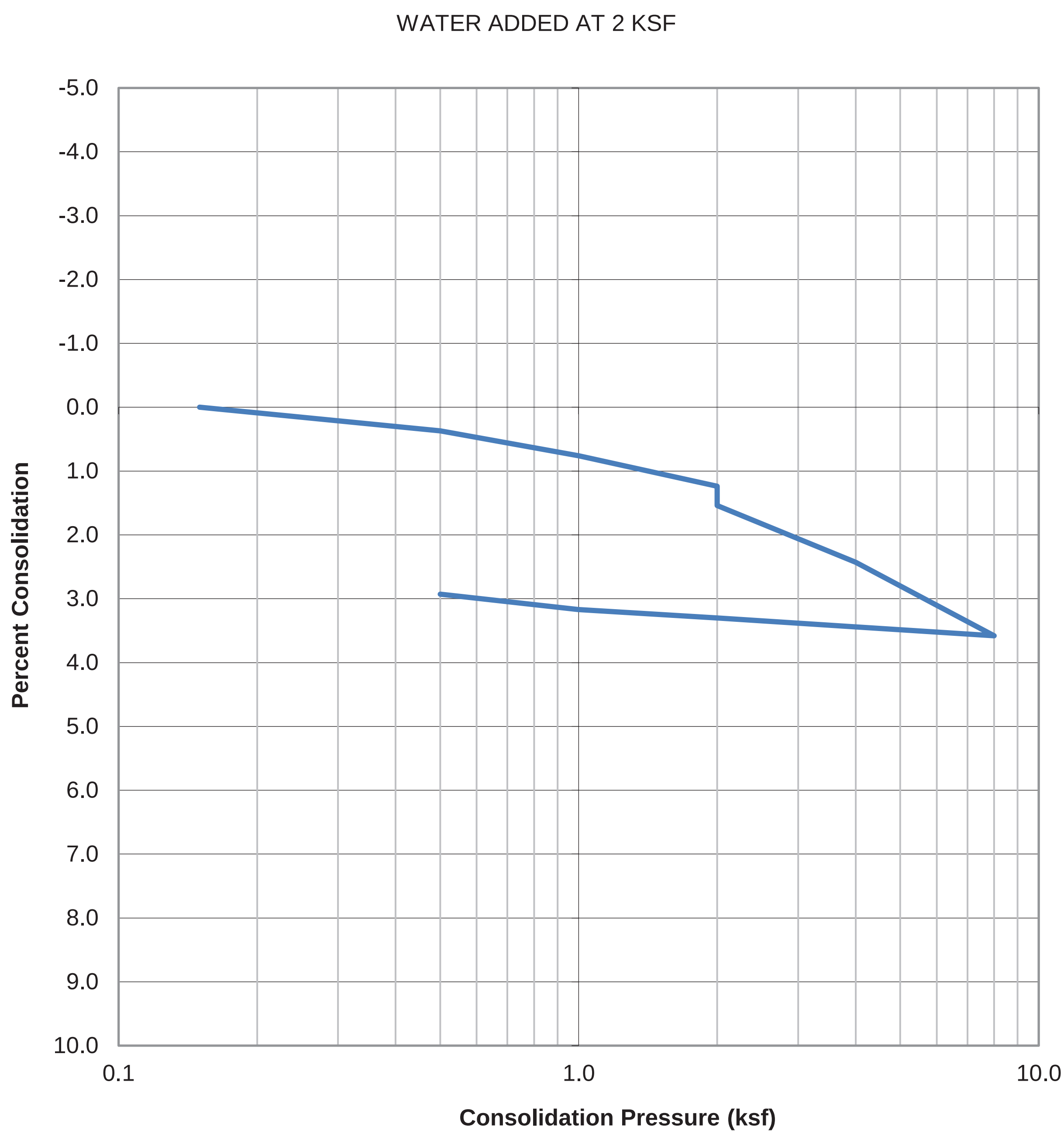
OCTOBER, 2017	PROJECT NO. T2718-22-04	FIG B-10



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B9 @ 6'	SM	111.9	7.0	14.3

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CONSOLIDATION TEST RESULTS

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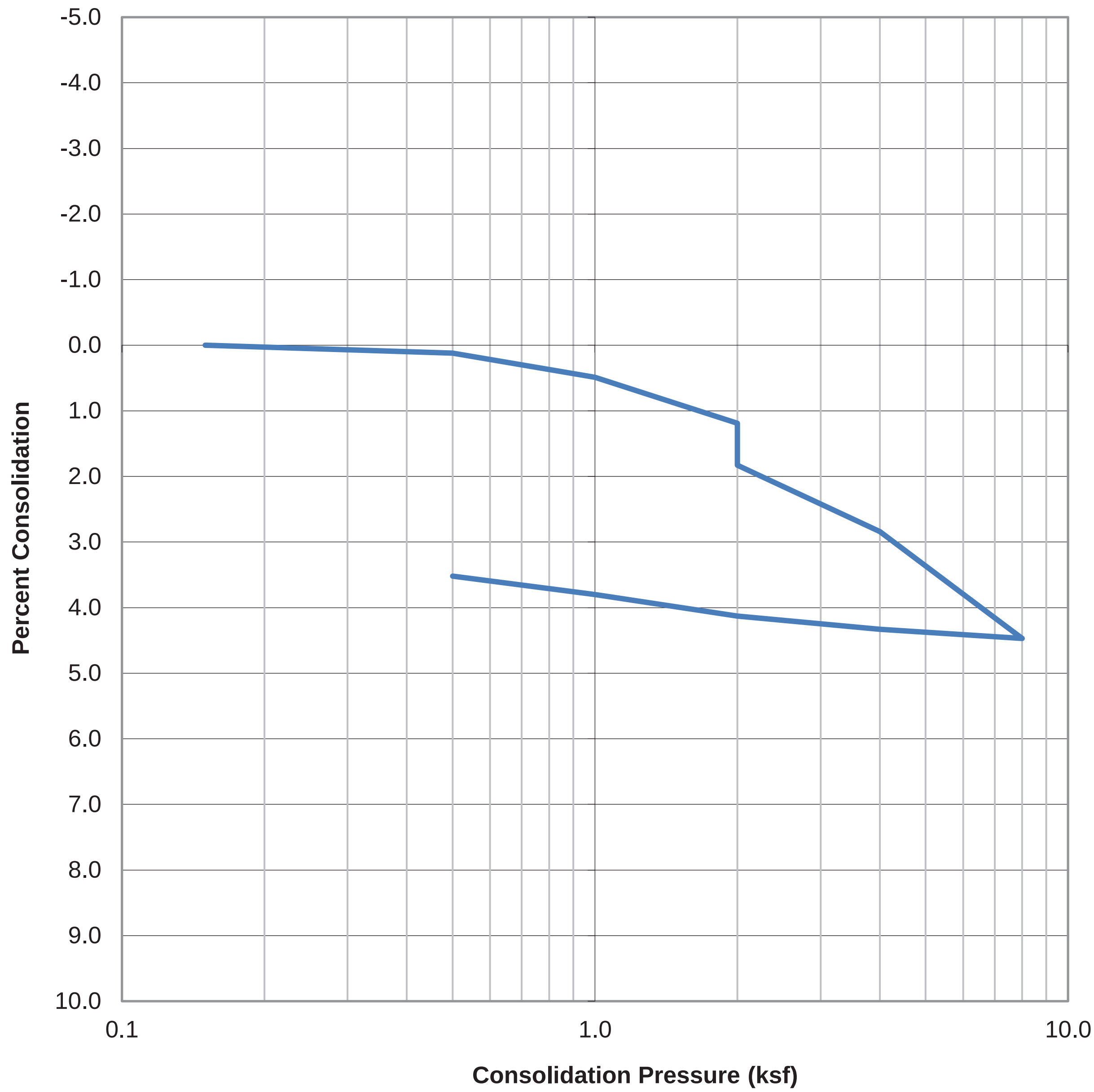
OCTOBER, 2017 | PROJECT NO. T2718-22-04 | FIG B-11

WATER ADDED AT 2 KSF



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B9 @ 16'	SM	109.0	7.6	16.7

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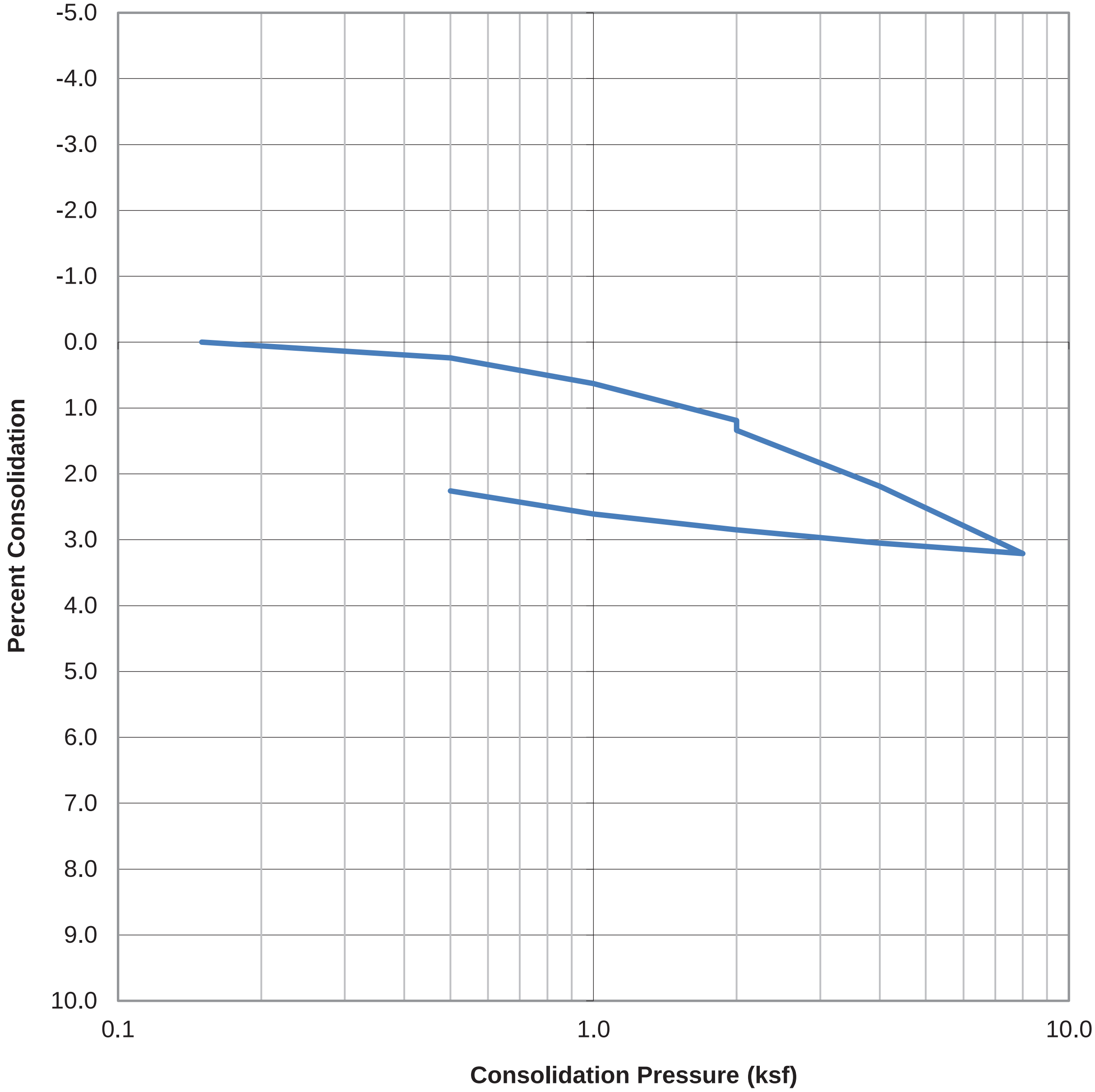
OCTOBER, 2017 | PROJECT NO. T2718-22-04 | FIG B-12

WATER ADDED AT 2 KSF



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B9 @ 26'	SM	113.3	10.4	15.1

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CONSOLIDATION TEST RESULTS

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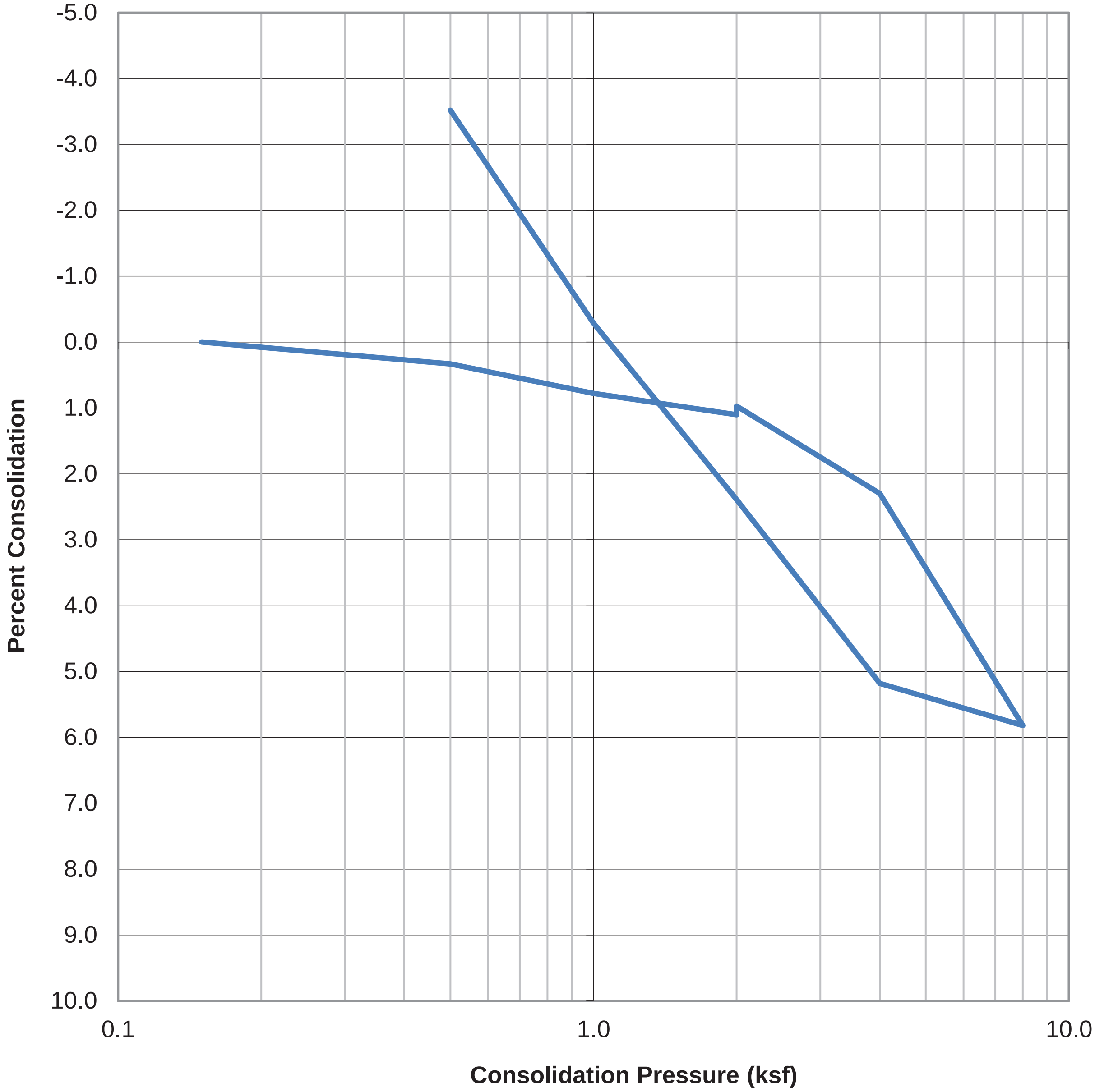
OCTOBER, 2017	PROJECT NO. T2718-22-04	FIG B-13

WATER ADDED AT 2 KSF



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B12@3.5'	CH	97.2	21.6	31.6

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CONSOLIDATION TEST RESULTS

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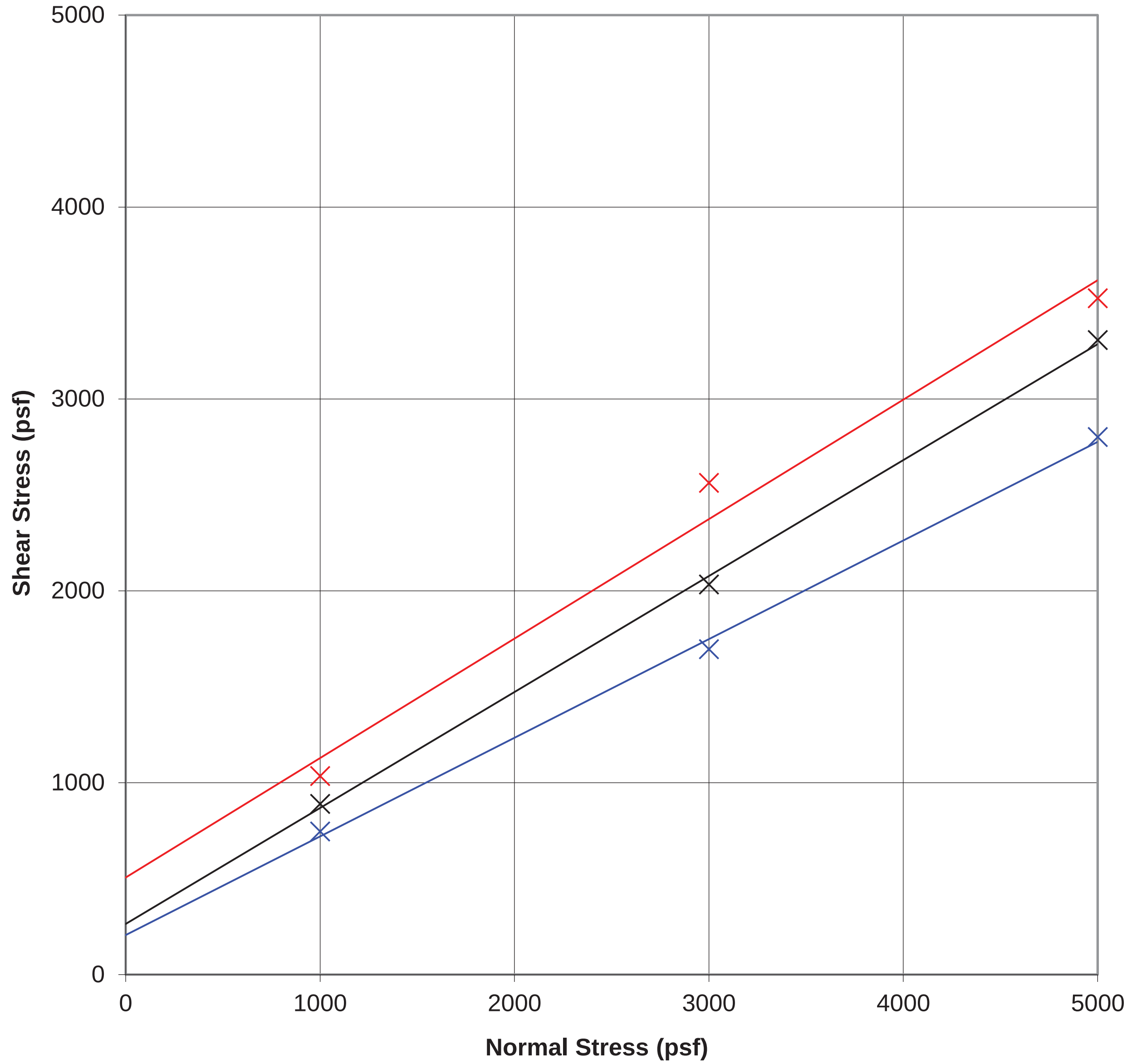
OCTOBER, 2017 | PROJECT NO. T2718-22-04 | FIG B-14



SAMPLE ID	SOIL TYPE	INITIAL DRY DENSITY (pcf)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)	C (psf)	ϕ (deg)
*B1 @ 0-5'	SM	115.0	9.5	14.5	260	31
B2 @ 6'	SM	105.6	12.2	19.1	510	32
B4 @ 3.5'	SM	84.2	11.2	34.4	210	27

*Sample remolded to approximately 90% of the test maximum dry density at optimum moisture content.

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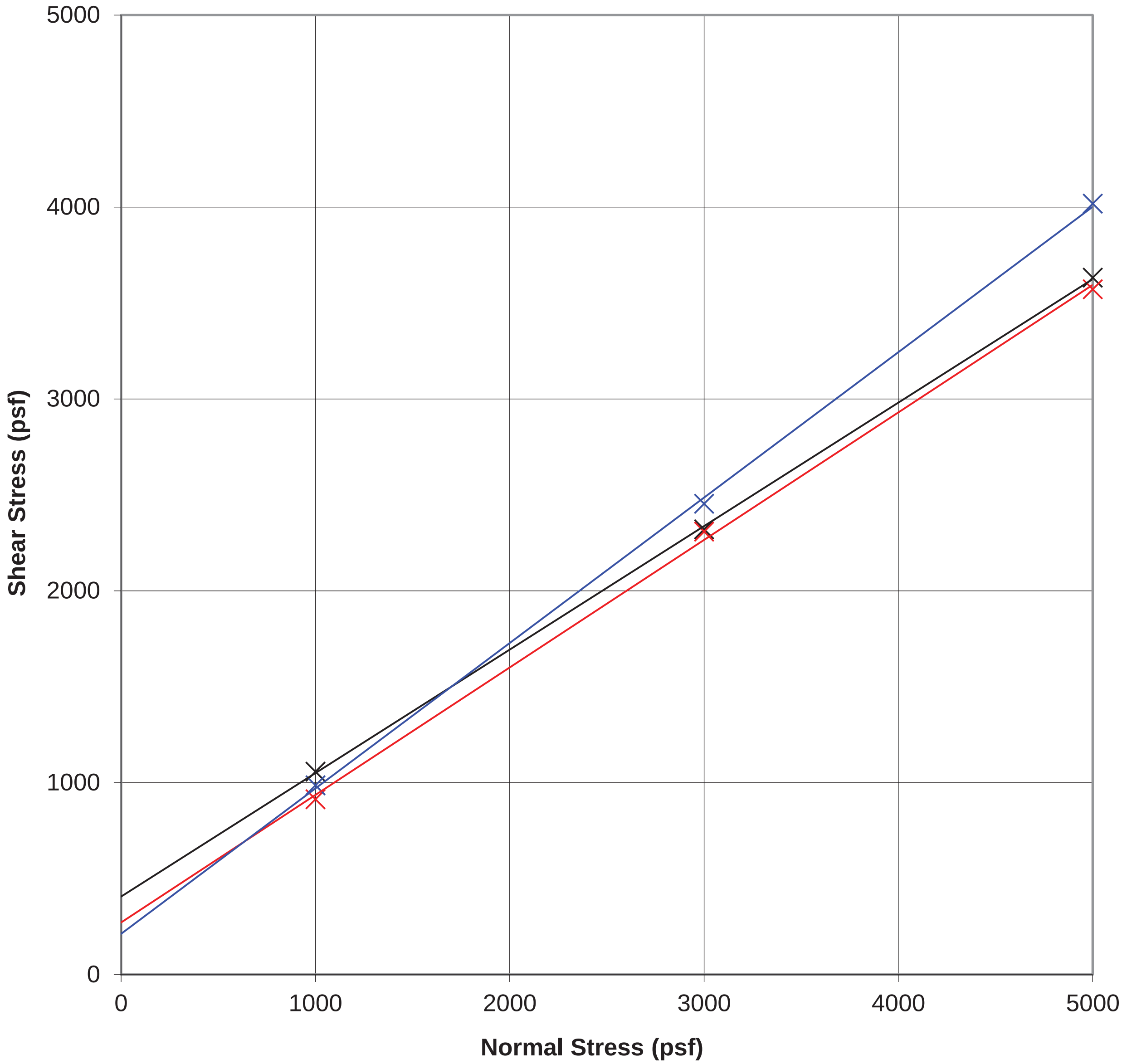
DIRECT SHEAR TEST RESULTS

SOBOBA COMMUNITY SERVICES CENTER
SWC SOBOBA ROAD AND LAKE PARK DRIVE
SAN JACINTO CALIFORNIA

OCTOBER, 2017 | PROJECT NO. T2718-22-04 | FIG B-15



SAMPLE ID	SOIL TYPE	INITIAL DRY DENSITY (pcf)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)	C (psf)	ϕ (deg)
B6 @ 6'	SM	119.8	6.5	16.9	410	33
*B7 @ 0-5'	SM	116.0	8.1	13.1	270	34
B9 @ 3.5'	SM	108.5	5.7	15.9	210	37

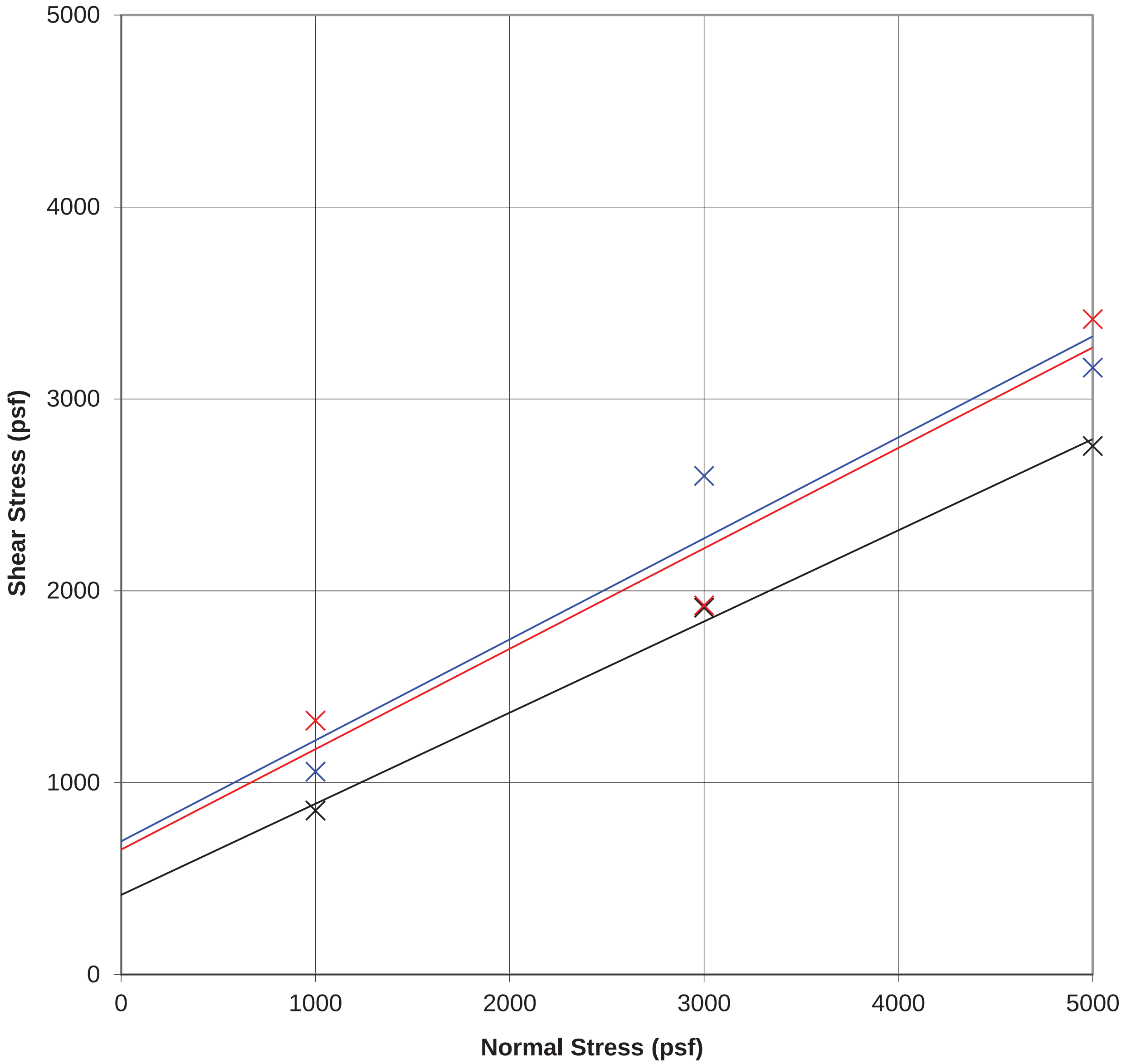
*Sample remolded to approximately 90% of the test maximum dry density at optimum moisture content.

GEOCON
W E S T, I N C.
GEOTECHNICAL ENVIRONMENTAL MATERIALS
41571 CORNING PLACE, SUITE 101, MURRIETA, CA 92562-7065
PHONE 951-304-2300 FAX 951-304-2392

PDT

DIRECT SHEAR TEST RESULTS

SOBOBA COMMUNITY SERVICES CENTER
SWC SOBOBA ROAD AND LAKE PARK DRIVE
SAN JACINTO, CALIFORNIA



SAMPLE ID	SOIL TYPE	INITIAL DRY DENSITY (pcf)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)	C (psf)	ϕ (deg)
*B11 @ 0-5'	SM	114.0	10.1	17.1	420	25
B12 @ 6'	ML	92.3	29.5	35.2	650	28
B13 @ 6	SM	106.2	22.0	22.7	690	28

*Sample remolded to approximately 90% of the test maximum dry density at optimum moisture content.

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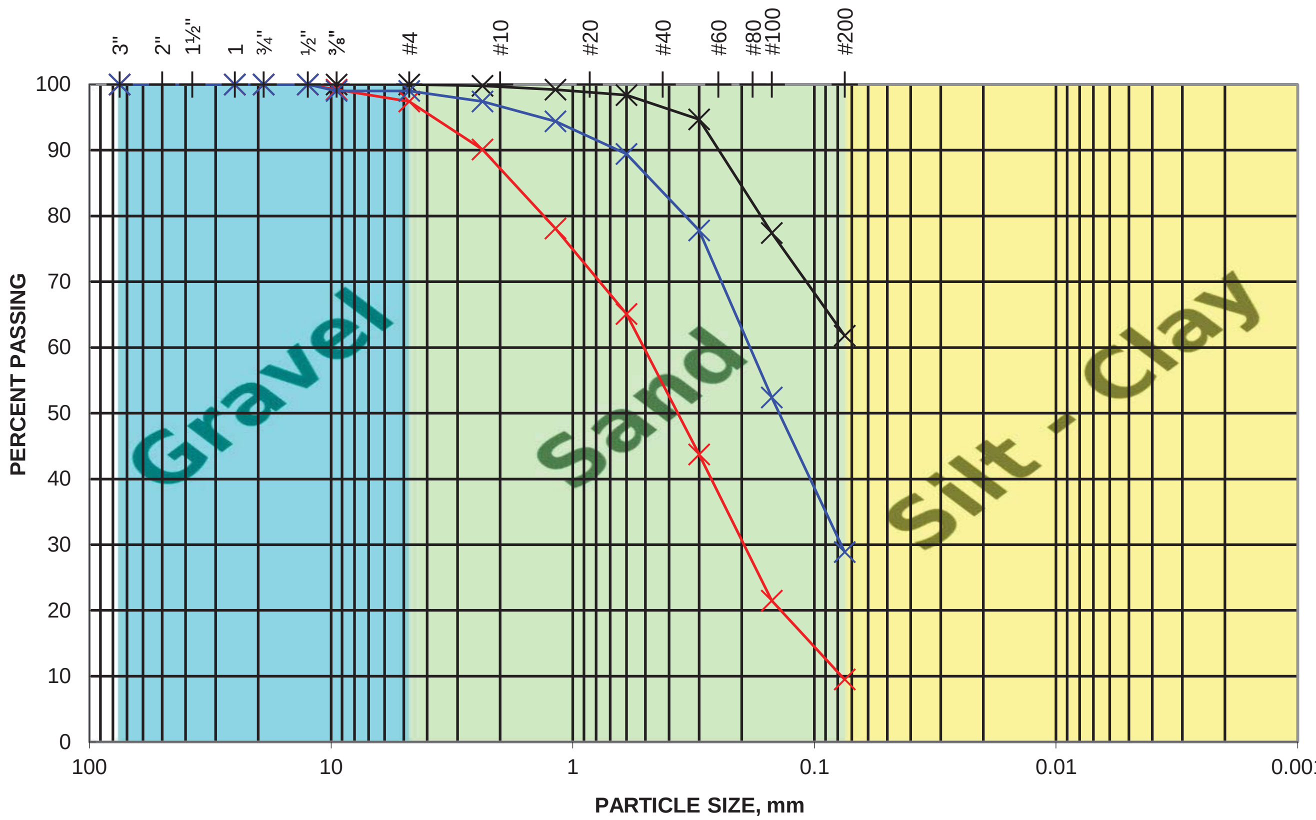
DIRECT SHEAR TEST RESULTS

SOBOBA COMMUNITY SERVICES CENTER
SWC SOBOBA ROAD AND LAKE PARK DRIVE
SAN JACINTO, CALIFORNIA

OCTOBER, 2017 | PROJECT NO. T2718-22-04 | FIG B-17



SAMPLE ID	SAMPLE DESCRIPTION
B2 @ 30'	ML - Sandy SILT
B9 @ 11'	SW/SM - Well Graded SAND with silt
B9 @ 20'	SM - Silty SAND

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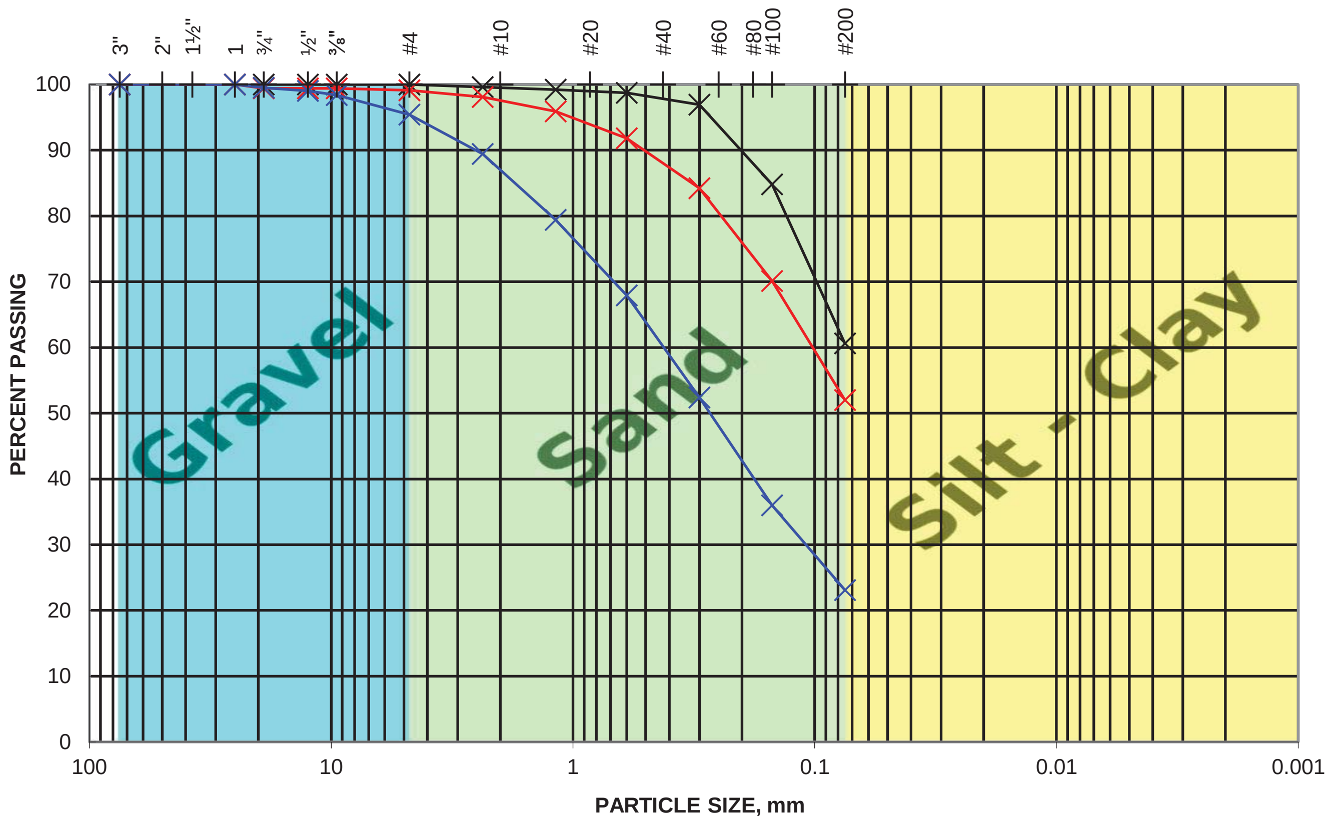
GRAIN SIZE DISTRIBUTION

SOBOBA COMMUNITY SERVICES CENTER
SWC SOBOBA ROAD AND LAKE PARK DRIVE
SAN JACINTO CALIFORNIA

OCTOBER, 2017 | PROJECT NO. T2718-22-04 | FIG B-18



SAMPLE ID	SAMPLE DESCRIPTION
B12 @ 8.5'	ML - Sandy SILT
B2 @ 5-10'	ML - Sandy SILT
B8 @ 5-10'	SM - Silty SAND

GEOCON WEST, INC.
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PDT

GRAIN SIZE DISTRIBUTION

SOBOBA COMMUNITY SERVICES CENTER
SWC SOBOBA ROAD AND LAKE PARK DRIVE
SAN JACINTO CALIFORNIA

OCTOBER, 2017 | PROJECT NO. T2718-22-04 | FIG B-19

APPENDIX C

APPENDIX C

DRY DYNAMIC STTELMENT ANALYSIS

FOR

SOBOBA COMMUNITY SERVICES CENTER
SWC SOBOBA ROAD AND LAKE PARK DRIVE
SAN JACINTO, CALIFORNIA

PROJECT NO. T2718-22-04

Client : Soboba Tribal Improvements
File No. : T2718-22-04
Boring : 2

EMPIRICAL ESTIMATION OF LIQUEFACTION POTENTIAL
DESIGN EARTHQUAKE

NCEER (1996) METHOD

By Thomas F. Blake (1994-1996)

EARTHQUAKE INFORMATION:

Earthquake Magnitude:	7.20
Peak Horiz. Acceleration PGA_M (g):	0.951
2/3 PGA_M (g):	0.634
Calculated Mag.Wtg.Factor:	0.905
Historic High Groundwater:	150.0
Groundwater Depth During Exploration:	150.0

ENERGY & ROD CORRECTIONS:

Energy Correction (CE) for N60:	1.25
Rod Len.Corr.(CR)(0-no or 1-yes):	1.0
Bore Dia. Corr. (CB):	1.15
Sampler Corr. (CS):	1.20
Use Ksigma (0 or 1):	1.0

LIQUEFACTION CALCULATIONS:

Unit Wt. Water (pcf): 62.4

Depth to Base (ft)	Total Unit Wt. (pcf)	Water (0 or 1)	FIELD SPT (N)	Depth of SPT (ft)	Liq.Sus. (0 or 1)	-200 (%)	Est. Dr (%)	CN Factor	Corrected (N1)60	Eff. Unit Wt. (psf)	Resist. CRR	rd Factor	Induced CSR	Liquefac. Safe.Fact.
1.0	120.0	0	8.0	1.0	1		69	2.000	20.7	120.0	0.226	0.998	0.372	--
2.0	120.0	0	8.0	2.0	1	25	67	2.000	25.4	120.0	0.292	0.993	0.371	--
3.0	120.0	0	8.0	3.0	1	25	65	2.000	25.4	120.0	0.292	0.989	0.369	--
4.0	120.0	0	8.0	4.0	1	25	63	2.000	25.4	120.0	0.292	0.984	0.367	--
5.0	120.0	0	8.0	5.0	1	25	62	1.966	25.0	120.0	0.286	0.979	0.366	--
6.0	120.0	0	8.0	6.0	1	25	60	1.779	23.1	120.0	0.256	0.975	0.364	--
7.0	120.0	0	8.0	7.0	1	25	59	1.636	21.6	120.0	0.237	0.970	0.362	--
8.0	120.0	0	8.0	8.0	1	52	58	1.523	22.8	120.0	0.252	0.966	0.360	--
9.0	120.0	0	8.0	9.0	1	52	57	1.431	21.8	120.0	0.240	0.961	0.359	--
10.0	120.0	0	8.0	10.0	1	52	55	1.353	21.0	120.0	0.230	0.957	0.357	--
11.0	120.0	0	8.0	11.0	1	52	54	1.287	20.3	120.0	0.222	0.952	0.355	--
12.0	120.0	0	8.0	11.0	1	52	54	1.230	19.7	120.0	0.215	0.947	0.354	--
13.0	120.0	0	10.0	13.5	1	25	58	1.180	20.4	120.0	0.222	0.943	0.352	--
14.0	120.0	0	10.0	13.5	1	25	58	1.135	19.8	120.0	0.215	0.938	0.350	--
15.0	120.0	0	10.0	13.5	1	25	58	1.095	19.2	120.0	0.209	0.934	0.348	--
16.0	120.0	0	20.0	16.0	1	10	79	1.060	31.4	120.0	Infin.	0.929	0.347	--
17.0	120.0	0	20.0	16.0	1	10	79	1.027	30.5	120.0	Infin.	0.925	0.345	--
18.0	120.0	0	20.0	16.0	1	10	79	0.997	29.6	120.0	0.431	0.920	0.343	--
19.0	120.0	0	20.0	16.0	1	10	79	0.970	28.9	120.0	0.379	0.915	0.342	--
20.0	120.0	0	12.0	20.0	1	52	58	0.945	24.5	120.0	0.273	0.911	0.340	--
21.0	120.0	0	12.0	20.0	1	52	58	0.921	24.1	120.0	0.267	0.906	0.338	--
22.0	120.0	0	12.0	20.0	1	25	58	0.900	21.3	120.0	0.230	0.902	0.337	--
23.0	120.0	0	12.0	20.0	1	25	58	0.879	21.0	120.0	0.226	0.897	0.335	--
24.0	120.0	0	12.0	20.0	1	25	58	0.860	20.6	120.0	0.222	0.893	0.333	--
25.0	120.0	0	12.0	20.0	1	25	58	0.843	20.3	120.0	0.218	0.888	0.331	--
26.0	120.0	0	12.0	20.0	1	25	58	0.826	20.0	120.0	0.214	0.883	0.330	--
27.0	120.0	0	12.0	20.0	1	25	58	0.810	19.7	120.0	0.211	0.879	0.328	--
28.0	120.0	0	8.0	30.0	1	25	42	0.795	15.6	120.0	0.157	0.874	0.326	--
29.0	120.0	0	8.0	30.0	1	25	42	0.781	15.4	120.0	0.155	0.870	0.325	--
30.0	120.0	0	8.0	30.0	1	25	42	0.768	15.3	120.0	0.154	0.865	0.323	--
31.0	120.0	0	8.0	30.0	1	25	42	0.755	15.1	120.0	0.152	0.861	0.321	--
32.0	120.0	0	8.0	30.0	1	25	42	0.743	14.9	120.0	0.150	0.856	0.319	--
33.0	120.0	0	8.0	30.0	1	25	42	0.732	14.8	120.0	0.149	0.851	0.318	--
34.0	120.0	0	8.0	30.0	1	25	42	0.721	14.6	120.0	0.147	0.847	0.316	--
35.0	120.0	0	24.0	36.0	1	52	68	0.710	36.4	120.0	Infin.	0.842	0.314	--
36.0	120.0	0	24.0	36.0	1	52	68	0.700	36.0	120.0	Infin.	0.838	0.313	--
37.0	120.0	0	35.0	40.0	1	25	79	0.690	46.4	120.0	Infin.	0.833	0.311	--
38.0	120.0	0	35.0	40.0	1	25	79	0.681	45.8	120.0	Infin.	0.829	0.309	--
39.0	120.0	0	35.0	40.0	1	25	79	0.672	45.3	120.0	Infin.	0.824	0.308	--
40.0	120.0	0	35.0	40.0	1	25	79	0.664	44.7	120.0	Infin.	0.819	0.306	--
41.0	120.0	0	35.0	40.0	1	52	79	0.655	46.6	120.0	Infin.	0.815	0.304	--
42.0	120.0	0	35.0	40.0	1	52	79	0.648	46.1	120.0	Infin.	0.810	0.302	--
43.0	120.0	0	35.0	40.0	1	52	79	0.640	45.6	120.0	Infin.	0.806	0.301	--
44.0	120.0	0	35.0	40.0	1	52	79	0.632	45.2	120.0	Infin.	0.801	0.299	--
45.0	120.0	0	40.0	46.0	1	25	80	0.625	47.8	120.0	Infin.	0.797	0.297	--
46.0	120.0	0	40.0	46.0	1	25	80	0.618	47.3	120.0	Infin.	0.792	0.296	--
47.0	120.0	0	40.0	46.0	1	25	80	0.612	46.9	120.0	Infin.	0.787	0.294	--
48.0	120.0	0	40.0	46.0	1	25	80	0.605	46.4	120.0	Infin.	0.783	0.292	--
49.0	120.0	0	70.0	50.0	1	25	103	0.599	77.0	120.0	Infin.	0.778	0.290	--
50.0	120.0	0	70.0	50.0	1	25	103	0.593	76.3	120.0	Infin.	0.774	0.289	--

GEOCON

TECHNICAL ENGINEERING AND DESIGN GUIDES AS ADAPTED FROM THE US ARMY CORPS OF ENGINEERS, NO. 9
EVALUATION OF EARTHQUAKE-INDUCED SETTLEMENTS IN DRY SANDY SOILS
DESIGN EARTHQUAKE

DE EARTHQUAKE INFORMATION:

Earthquake Magnitude:	7.20
Peak Horiz. Acceleration (g):	0.634

Fig 4.1 (Relative Density) Fig 4.2 (Correction Factor [Cn]) Fig 4.4 (yeff)

Depth of Base of Strata (ft)	Thickness of Layer (ft)	Depth of Mid-point of Layer (ft)	Soil Unit Weight (pcf)	Overburden Pressure at Mid-point (tsf)	Mean Effective Pressure at Mid-point (tsf)	Average Cyclic Shear Stress [Tav]	Field SPT [N]	Correction Factor [Cer]	Relative Density [Dr] (%)	Correction Factor [Cn]	Corrected [N1]60	rd Factor	Maximum Shear Mod. [Gmax] (tsf)	[yeff]*[Geff] [Gmax]	yeff Shear Strain	[yeff]*100%	Volumetric Strain M7.5 [E15} (%)	Number of Strain Cycles [Nc]	Corrected Vol. Strains [Ec]	Estimated Settlement [S] (inches)
1.0	1.0	0.5	120.0	0.03	0.02	0.012	8	1.25	68.5	2.0	20.7	1.0	174.005	7.04E-05	1.40E-04	0.014	1.34E-02	12.4789	1.24E-02	0.00
2.0	1.0	1.5	120.0	0.09	0.06	0.037	8	1.25	66.6	2.0	25.4	1.0	322.518	1.12E-04	2.30E-04	0.023	1.73E-02	12.4789	1.59E-02	0.00
3.0	1.0	2.5	120.0	0.15	0.10	0.062	8	1.25	64.8	2.0	25.4	1.0	416.369	1.41E-04	1.70E-04	0.017	1.28E-02	12.4789	1.18E-02	0.00
4.0	1.0	3.5	120.0	0.21	0.14	0.086	8	1.25	63.2	2.0	25.4	1.0	492.654	1.64E-04	1.70E-04	0.017	1.28E-02	12.4789	1.18E-02	0.00
5.0	1.0	4.5	120.0	0.27	0.18	0.111	8	1.25	61.7	2.0	25.0	1.0	556.052	1.83E-04	1.70E-04	0.017	1.30E-02	12.4789	1.20E-02	0.00
6.0	1.0	5.5	120.0	0.33	0.22	0.136	8	1.25	60.3	1.8	23.1	1.0	598.394	2.04E-04	4.50E-04	0.045	3.79E-02	12.4789	3.49E-02	0.01
7.0	1.0	6.5	120.0	0.39	0.26	0.160	8	1.25	59.0	1.6	21.6	1.0	636.355	2.23E-04	4.50E-04	0.045	4.10E-02	12.4789	3.78E-02	0.01
8.0	1.0	7.5	120.0	0.45	0.30	0.184	8	1.25	57.7	1.5	22.8	1.0	695.619	2.31E-04	4.50E-04	0.045	3.85E-02	12.4789	3.55E-02	0.01
9.0	1.0	8.5	120.0	0.51	0.34	0.209	8	1.25	56.6	1.4	21.8	1.0	730.024	2.45E-04	4.50E-04	0.045	4.06E-02	12.4789	3.73E-02	0.01
10.0	1.0	9.5	120.0	0.57	0.38	0.233	8	1.25	55.5	1.4	21.0	1.0	762.206	2.57E-04	4.50E-04	0.045	4.24E-02	12.4789	3.91E-02	0.01
11.0	1.0	10.5	120.0	0.63	0.42	0.257	8	1.25	54.5	1.3	20.3	1.0	792.529	2.68E-04	4.50E-04	0.045	4.41E-02	12.4789	4.06E-02	0.01
12.0	1.0	11.5	120.0	0.69	0.46	0.281	8	1.25	54.5	1.2	19.7	0.9	821.271	2.79E-04	4.50E-04	0.045	4.57E-02	12.4789	4.21E-02	0.01
13.0	1.0	12.5	120.0	0.75	0.50	0.304	10	1.25	57.8	1.2	20.4	0.9	865.161	2.82E-04	3.70E-04	0.037	3.62E-02	12.4789	3.33E-02	0.01
14.0	1.0	13.5	120.0	0.81	0.54	0.328	10	1.25	57.8	1.1	19.8	0.9	890.296	2.91E-04	3.70E-04	0.037	3.75E-02	12.4789	3.46E-02	0.01
15.0	1.0	14.5	120.0	0.87	0.58	0.351	10	1.25	57.8	1.1	19.2	0.9	914.361	2.99E-04	3.70E-04	0.037	3.88E-02	12.4789	3.57E-02	0.01
16.0	1.0	15.5	120.0	0.93	0.62	0.374	20	1.25	79.1	1.1	31.4	0.9	1113.344	2.58E-04	3.70E-04	0.037	2.15E-02	12.4789	1.98E-02	0.00
17.0	1.0	16.5	120.0	0.99	0.66	0.397	20	1.25	79.1	1.0	30.5	0.9	1137.237	2.64E-04	3.70E-04	0.037	2.23E-02	12.4789	2.05E-02	0.00
18.0	1.0	17.5	120.0	1.05	0.70	0.420	20	1.25	79.1	1.0	29.6	0.9	1160.203	2.70E-04	3.70E-04	0.037	2.31E-02	12.4789	2.12E-02	0.01
19.0	1.0	18.5	120.0	1.11	0.74	0.443	20	1.25	79.1	1.0	28.9	0.9	1182.331	2.76E-04	3.70E-04	0.037	2.38E-02	12.4789	2.19E-02	0.01
20.0	1.0	19.5	120.0	1.17	0.78	0.465	12	1.25	57.8	0.9	24.5	0.9	1149.455	2.94E-04	3.70E-04	0.037	2.90E-02	12.4789	2.67E-02	0.01
21.0	1.0	20.5	120.0	1.23	0.82	0.487	12	1.25	57.8	0.9	24.1	0.9	1171.589	2.98E-04	3.70E-04	0.037	2.96E-02	12.4789	2.73E-02	0.01
22.0	1.0	21.5	120.0	1.29	0.86	0.508	12	1.25	57.8	0.9	21.3	0.9	1152.537	3.13E-04	7.10E-04	0.071	6.57E-02	12.4789	6.05E-02	0.01
23.0	1.0	22.5	120.0	1.35	0.90	0.530	12	1.25	57.8	0.9	21.0	0.9	1172.094	3.16E-04	7.10E-04	0.071	6.71E-02	12.4789	6.18E-02	0.01
24.0	1.0	23.5	120.0	1.41	0.94	0.551	12	1.25	57.8	0.9	20.6	0.9	1191.144	3.20E-04	7.10E-04	0.071	6.85E-02	12.4789	6.31E-02	0.02
25.0	1.0	24.5	120.0	1.47	0.98	0.572	12	1.25	57.8	0.8	20.3	0.9	1209.722	3.23E-04	7.10E-04	0.071	6.98E-02	12.4789	6.43E-02	0.02
26.0	1.0	25.5	120.0	1.53	1.03	0.592	12	1.25	57.8	0.8	20.0	0.9	1227.859	3.26E-04	5.20E-04	0.052	5.21E-02	12.4789	4.80E-02	0.01
27.0	1.0	26.5	120.0	1.59	1.07	0.613	12	1.25	57.8	0.8	19.7	0.9	1245.583	3.29E-04	5.20E-04	0.052	5.30E-02	12.4789	4.88E-02	0.01
28.0	1.0	27.5	120.0	1.65	1.11	0.632	8	1.25	41.8	0.8	15.6	0.9	1175.440	3.56E-04	5.20E-04	0.052	6.98E-02	12.4789	6.43E-02	0.02
29.0	1.0	28.5	120.0	1.71	1.15	0.652	8	1.25	41.8	0.8	15.4	0.9	1191.646	3.58E-04	5.20E-04	0.052	7.09E-02	12.4789	6.53E-02	0.02
30.0	1.0	29.5	120.0	1.77	1.19	0.671	8	1.25	41.8	0.8	15.3	0.9	1207.531	3.60E-04	5.20E-04	0.052	7.19E-02	12.4789	6.62E-02	0.02
31.0	1.0	30.5	120.0	1.83	1.23	0.690	8	1.25	41.8	0.8	15.1	0.9	1223.112	3.62E-04	5.20E-04	0.052	7.29E-02	12.4789	6.71E-02	0.02
32.0	1.0	31.5	120.0	1.89	1.27	0.709	8	1.25	41.8	0.7	14.9	0.9	1238.405	3.64E-04	5.20E-04	0.052	7.39E-02	12.4789	6.80E-02	0.02
33.0	1.0	32.5	120.0	1.95	1.31	0.727	8	1.25	41.8	0.7	14.8	0.9	1253.424	3.65E-04	5.20E-04	0.052	7.48E-02	12.4789	6.89E-02	0.02
34.0	1.0	33.5	120.0	2.01	1.35	0.745	8	1.25	41.8	0.7	14.6	0.8	1268.184	3.67E-04	5.20E-04	0.052	7.58E-02	12.4789	6.98E-02	0.02
35.0	1.0	34.5	120.0	2.07	1.39	0.763	24	1.25	68.1	0.7	36.4	0.8	1744.625	2.70E-04	3.00E-04	0.030	1.46E-02	12.4789	1.35E-02	0.00
36.0	1.0	35.5	120.0	2.13	1.43	0.780	24	1.25	68.1	0.7	36.0	0.8	1762.944	2.71E-04	3.00E-04	0.030	1.48E-02	12.4789	1.36E-02	0.00
37.0	1.0	36.5	120.0	2.19	1.47	0.797	35	1.25	79.2	0.7	46.4	0.8	1945.019	2.49E-04	3.00E-04	0.030	1.09E-02	12.4789	1.01E-02	0.00
38.0	1.0	37.5	120.0	2.25	1.51	0.813	35	1.25	79.2	0.7	45.8	0.8	1963.517	2.50E-04	3.00E-04	0.030	1.11E-02	12.4789	1.02E-02	0.00
39.0	1.0	38.5	120.0	2.31	1.55	0.829	35	1.25	79.2	0.7	45.3	0.8	1981.709	2.51E-04	3.00E-04	0.030	1.13E-02	12.4789	1.04E-02	0.00
40.0	1.0	39.5	120.0	2.37	1.59	0.845	35	1.25	79.2	0.7	44.7	0.8	1999.606	2.51E-04	3.00E-04	0.030	1.14E-02	12.4789	1.05E-02	0.00
41.0	1.0	40.5	120.0	2.43	1.63	0.861	35	1.25	79.2	0.7	46.6	0.8	2052.080	2.47E-04	3.00E-04	0.030	1.09E-02	12.4789	1.00E-02	0.00
42.0	1.0	41.5	120.0	2.49	1.67	0.876	35	1.25	79.2	0.6	46.1	0.8	2070.103	2.48E-04	3.00E-04	0.030	1.10E-02	12.4789	1.01E-02	0.00
43.0	1.0	42.5	120.0	2.55	1.71	0.891	35	1.25	79.2	0.6	45.6	0.8	2087.863	2.48E-04	3.00E-04	0.030	1.11E-02	12.4789	1.03E-02	0.00
44.0	1.0	43.5	120.0	2.61	1.75	0.905	35	1.25	79.2	0.6	45.2	0.8	2105.370	2.48E-04	3.00E-04	0.030	1.13E-02	12.4789	1.04E-02	0.00
45.0	1.0	44.5	120.0	2.67	1.79	0.919	40	1.25	80.5	0.6	47.8	0.8	2169.947	2.43E-04	3.00E-04	0.030	1.05E-02	12.4789	9.70E-03	0.00
46.0	1.0	45.5	120.0	2.73	1.83	0.933	40	1.25	80.5	0.6	47.3	0.8	2186.876	2.43E-04	3.00E-04	0.030	1.07E-02	12.4789	9.82E-03	0.00
47.0	1.0	46.5	120.0	2.79	1.87	0.946	40	1.25	80.5	0.6	46.9	0.8	2203.572	2.43E-04	3.00E-04	0.030	1.08E-02	12.4789	9.94E-03	0.00
48.0	1.0	47.5	120.0	2.85	1.91	0.959	40	1.25	80.5	0.6	46.4	0.8	2220.043	2.43E-04	3.00E-04	0.030	1.09E-02	12.4789	1.01E-02	0.00
49.0	1.0	48.5	120.0	2.91	1.95	0.971	70	1.25	103.2	0.6	77.0	0.8	2655.258	2.05E-04	3.00E-04	0.030	5.95E-03	12.4789	5.48E-03	0.00
50.0	1.0	49.5	120.0	2.97	1.99	0.984	70	1.25	103.2	0.6	76.3	0.8	2673.937	2.05E-04	3.00E-04	0.030	6.02E-03	12.4789	5.54E-03	0.00

TOTAL SETTLEMENT = **0.37**

Figure C-2

GEOCON

Client : Soboba Tribal Improvements
File No. : T2718-22-04
Boring : 9

EMPIRICAL ESTIMATION OF LIQUEFACTION POTENTIAL
DESIGN EARTHQUAKE

NCEER (1996) METHOD

By Thomas F. Blake (1994-1996)

EARTHQUAKE INFORMATION:

Earthquake Magnitude:	7.20
Peak Horiz. Acceleration PGA_M (g):	0.951
2/3 PGA_M (g):	0.634
Calculated Mag.Wtg.Factor:	0.905
Historic High Groundwater:	150.0
Groundwater Depth During Exploration:	150.0

ENERGY & ROD CORRECTIONS:

Energy Correction (CE) for N60:	1.25
Rod Len.Corr.(CR)(0-no or 1-yes):	1.0
Bore Dia. Corr. (CB):	1.15
Sampler Corr. (CS):	1.20
Use Ksigma (0 or 1):	1.0

LIQUEFACTION CALCULATIONS:

Unit Wt. Water (pcf): 62.4

Depth to Base (ft)	Total Unit Wt. (pcf)	Water (0 or 1)	FIELD SPT (N)	Depth of SPT (ft)	Liq.Sus. (0 or 1)	-200 (%)	Est. Dr (%)	CN Factor	Corrected (N1)60	Eff. Unit Wt. (psf)	Resist. CRR	rd Factor	Induced CSR	Liquefac. Safe.Fact.
1.0	120.0	0	9.0	1.0	1		73	2.000	23.3	120.0	0.259	0.998	0.372	--
2.0	120.0	0	9.0	2.0	1	10	71	2.000	24.5	120.0	0.277	0.993	0.371	--
3.0	120.0	0	9.0	3.0	1	10	69	2.000	24.5	120.0	0.277	0.989	0.369	--
4.0	120.0	0	9.0	4.0	1	10	67	2.000	24.5	120.0	0.277	0.984	0.367	--
5.0	120.0	0	9.0	5.0	1	10	65	1.966	24.1	120.0	0.271	0.979	0.366	--
6.0	120.0	0	9.0	6.0	1	10	64	1.779	21.9	120.0	0.240	0.975	0.364	--
7.0	120.0	0	9.0	7.0	1	10	63	1.636	20.2	120.0	0.220	0.970	0.362	--
8.0	120.0	0	9.0	8.0	1	10	61	1.523	18.9	120.0	0.206	0.966	0.360	--
9.0	120.0	0	9.0	9.0	1	10	60	1.431	17.8	120.0	0.194	0.961	0.359	--
10.0	120.0	0	9.0	10.0	1	10	59	1.353	16.9	120.0	0.184	0.957	0.357	--
11.0	120.0	0	9.0	10.0	1	10	59	1.287	16.2	120.0	0.176	0.952	0.355	--
12.0	120.0	0	9.0	10.0	1	10	59	1.230	15.5	120.0	0.169	0.947	0.354	--
13.0	120.0	0	9.0	10.0	1	10	59	1.180	14.9	120.0	0.162	0.943	0.352	--
14.0	120.0	0	9.0	10.0	1	10	59	1.135	14.4	120.0	0.157	0.938	0.350	--
15.0	120.0	0	9.0	10.0	1	10	59	1.095	13.9	120.0	0.152	0.934	0.348	--
16.0	120.0	0	9.0	10.0	1	10	59	1.060	13.5	120.0	0.147	0.929	0.347	--
17.0	120.0	0	9.0	20.0	1	29	50	1.027	19.9	120.0	0.213	0.925	0.345	--
18.0	120.0	0	9.0	20.0	1	29	50	0.997	19.5	120.0	0.209	0.920	0.343	--
19.0	120.0	0	9.0	20.0	1	29	50	0.970	19.1	120.0	0.204	0.915	0.342	--
20.0	120.0	0	9.0	20.0	1	29	50	0.945	18.7	120.0	0.201	0.911	0.340	--
21.0	120.0	0	9.0	20.0	1	29	50	0.921	18.4	120.0	0.197	0.906	0.338	--
22.0	120.0	0	9.0	20.0	1	29	50	0.900	18.1	120.0	0.194	0.902	0.337	--
23.0	120.0	0	9.0	20.0	1	29	50	0.879	17.8	120.0	0.191	0.897	0.335	--
24.0	120.0	0	9.0	20.0	1	29	50	0.860	17.6	120.0	0.188	0.893	0.333	--
25.0	120.0	0	9.0	20.0	1	29	50	0.843	17.3	120.0	0.185	0.888	0.331	--
26.0	120.0	0	9.0	20.0	1	29	50	0.826	17.1	120.0	0.183	0.883	0.330	--
27.0	120.0	0	9.0	20.0	1	10	50	0.810	12.4	120.0	0.134	0.879	0.328	--
28.0	120.0	0	9.0	20.0	1	10	50	0.795	12.2	120.0	0.132	0.874	0.326	--
29.0	120.0	0	9.0	20.0	1	10	50	0.781	12.0	120.0	0.129	0.870	0.325	--
30.0	120.0	0	20.0	30.0	1	29	66	0.768	32.1	120.0	Infin.	0.865	0.323	--
31.0	120.0	0	20.0	30.0	1	29	66	0.755	31.7	120.0	Infin.	0.861	0.321	--
32.0	120.0	0	20.0	30.0	1	29	66	0.743	31.2	120.0	Infin.	0.856	0.319	--
33.0	120.0	0	20.0	30.0	1	29	66	0.732	30.8	120.0	Infin.	0.851	0.318	--
34.0	120.0	0	20.0	30.0	1	29	66	0.721	30.5	120.0	Infin.	0.847	0.316	--
35.0	120.0	0	28.0	40.0	1	29	71	0.710	39.9	120.0	Infin.	0.842	0.314	--
36.0	120.0	0	28.0	40.0	1	29	71	0.700	39.4	120.0	Infin.	0.838	0.313	--
37.0	120.0	0	28.0	40.0	1	29	71	0.690	38.9	120.0	Infin.	0.833	0.311	--
38.0	120.0	0	28.0	40.0	1	29	71	0.681	38.5	120.0	Infin.	0.829	0.309	--
39.0	120.0	0	28.0	40.0	1	29	71	0.672	38.1	120.0	Infin.	0.824	0.308	--
40.0	120.0	0	28.0	40.0	1	29	71	0.664	37.7	120.0	Infin.	0.819	0.306	--
41.0	120.0	0	28.0	40.0	1	29	71	0.655	37.3	120.0	Infin.	0.815	0.304	--
42.0	120.0	0	28.0	40.0	1	29	71	0.648	36.9	120.0	Infin.	0.810	0.302	--
43.0	120.0	0	28.0	40.0	1	29	71	0.640	36.5	120.0	Infin.	0.806	0.301	--
44.0	120.0	0	28.0	40.0	1	29	71	0.632	36.1	120.0	Infin.	0.801	0.299	--
45.0	120.0	0	28.0	40.0	1	29	71	0.625	35.8	120.0	Infin.	0.797	0.297	--
46.0	120.0	0	28.0	40.0	1	29	71	0.618	35.5	120.0	Infin.	0.792	0.296	--
47.0	120.0	0	28.0	40.0	1	29	71	0.612	35.1	120.0	Infin.	0.787	0.294	--
48.0	120.0	0	41.0	50.0	1	29	79	0.605	48.4	120.0	Infin.	0.783	0.292	--
49.0	120.0	0	41.0	50.0	1	29	79	0.599	48.0	120.0	Infin.	0.778	0.290	--
50.0	120.0	0	41.0	50.0	1	29	79	0.593	47.5	120.0	Infin.	0.774	0.289	--

Client : Soboba Tribal Improvements
File No. : T2718-22-04
Boring : 9

TECHNICAL ENGINEERING AND DESIGN GUIDES AS ADAPTED FROM THE US ARMY CORPS OF ENGINEERS, NO. 9
EVALUATION OF EARTHQUAKE-INDUCED SETTLEMENTS IN DRY SANDY SOILS
DESIGN EARTHQUAKE

DE EARTHQUAKE INFORMATION:

Earthquake Magnitude:	7.20
Peak Horiz. Acceleration (g):	0.634

Fig 4.1 (Relative Density) Fig 4.2 (Correction Factor [Cn]) Fig 4.4 (yeff)

Depth of Base of Strata (ft)	Thickness of Layer (ft)	Depth of Mid-point of Layer (ft)	Soil Unit Weight (pcf)	Overburden Pressure at Mid-point (tsf)	Mean Effective Pressure at Mid-point (tsf)	Average Cyclic Shear Stress [Tav]	Field SPT [N]	Correction Factor [Cer]	Relative Density [Dr] (%)	Correction Factor [Cn]	Corrected [N1]60	rd Factor	Maximum Shear Mod. [Gmax] (tsf)	[yeff]*[Geff] [Gmax]	yeff Shear Strain	[yeff]*100%	Volumetric Strain M7.5 [E15} (%)	Number of Strain Cycles [Nc]	Corrected Vol. Strains [Ec]	Estimated Settlement [S] (inches)
1.0	1.0	0.5	120.0	0.03	0.02	0.012	9	1.25	72.7	2.0	23.3	1.0	180.973	6.77E-05	1.00E-04	0.010	8.33E-03	12.4789	7.67E-03	0.00
2.0	1.0	1.5	120.0	0.09	0.06	0.037	9	1.25	70.6	2.0	24.5	1.0	318.603	1.13E-04	2.30E-04	0.023	1.81E-02	12.4789	1.66E-02	0.00
3.0	1.0	2.5	120.0	0.15	0.10	0.062	9	1.25	68.8	2.0	24.5	1.0	411.315	1.43E-04	1.70E-04	0.017	1.34E-02	12.4789	1.23E-02	0.00
4.0	1.0	3.5	120.0	0.21	0.14	0.086	9	1.25	67.0	2.0	24.5	1.0	486.675	1.66E-04	1.70E-04	0.017	1.34E-02	12.4789	1.23E-02	0.00
5.0	1.0	4.5	120.0	0.27	0.18	0.111	9	1.25	65.4	2.0	24.1	1.0	548.877	1.86E-04	1.70E-04	0.017	1.36E-02	12.4789	1.25E-02	0.00
6.0	1.0	5.5	120.0	0.33	0.22	0.136	9	1.25	63.9	1.8	21.9	1.0	587.847	2.08E-04	4.50E-04	0.045	4.04E-02	12.4789	3.72E-02	0.01
7.0	1.0	6.5	120.0	0.39	0.26	0.160	9	1.25	62.5	1.6	20.2	1.0	622.470	2.28E-04	4.50E-04	0.045	4.44E-02	12.4789	4.09E-02	0.01
8.0	1.0	7.5	120.0	0.45	0.30	0.184	9	1.25	61.2	1.5	18.9	1.0	653.812	2.46E-04	4.50E-04	0.045	4.82E-02	12.4789	4.43E-02	0.01
9.0	1.0	8.5	120.0	0.51	0.34	0.209	9	1.25	60.0	1.4	17.8	1.0	682.571	2.62E-04	4.50E-04	0.045	5.17E-02	12.4789	4.76E-02	0.01
10.0	1.0	9.5	120.0	0.57	0.38	0.233	9	1.25	58.8	1.4	16.9	1.0	709.236	2.76E-04	4.50E-04	0.045	5.50E-02	12.4789	5.06E-02	0.01
11.0	1.0	10.5	120.0	0.63	0.42	0.257	9	1.25	58.8	1.3	16.2	1.0	734.159	2.90E-04	4.50E-04	0.045	5.81E-02	12.4789	5.35E-02	0.01
12.0	1.0	11.5	120.0	0.69	0.46	0.281	9	1.25	58.8	1.2	15.5	0.9	757.609	3.02E-04	1.00E-03	0.100	1.36E-01	12.4789	1.25E-01	0.03
13.0	1.0	12.5	120.0	0.75	0.50	0.304	9	1.25	58.8	1.2	14.9	0.9	779.793	3.13E-04	7.10E-04	0.071	1.01E-01	12.4789	9.30E-02	0.02
14.0	1.0	13.5	120.0	0.81	0.54	0.328	9	1.25	58.8	1.1	14.4	0.9	800.875	3.24E-04	7.10E-04	0.071	1.05E-01	12.4789	9.71E-02	0.02
15.0	1.0	14.5	120.0	0.87	0.58	0.351	9	1.25	58.8	1.1	13.9	0.9	820.986	3.33E-04	7.10E-04	0.071	1.10E-01	12.4789	1.01E-01	0.02
16.0	1.0	15.5	120.0	0.93	0.62	0.374	9	1.25	58.8	1.1	13.5	0.9	840.236	3.42E-04	7.10E-04	0.071	1.14E-01	12.4789	1.05E-01	0.03
17.0	1.0	16.5	120.0	0.99	0.66	0.397	9	1.25	50.1	1.0	19.9	0.9	986.012	3.05E-04	7.10E-04	0.071	7.16E-02	12.4789	6.59E-02	0.02
18.0	1.0	17.5	120.0	1.05	0.70	0.420	9	1.25	50.1	1.0	19.5	0.9	1008.355	3.11E-04	7.10E-04	0.071	7.34E-02	12.4789	6.76E-02	0.02
19.0	1.0	18.5	120.0	1.11	0.74	0.443	9	1.25	50.1	1.0	19.1	0.9	1029.977	3.16E-04	7.10E-04	0.071	7.52E-02	12.4789	6.92E-02	0.02
20.0	1.0	19.5	120.0	1.17	0.78	0.465	9	1.25	50.1	0.9	18.7	0.9	1050.939	3.21E-04	7.10E-04	0.071	7.68E-02	12.4789	7.07E-02	0.02
21.0	1.0	20.5	120.0	1.23	0.82	0.487	9	1.25	50.1	0.9	18.4	0.9	1071.295	3.26E-04	7.10E-04	0.071	7.85E-02	12.4789	7.22E-02	0.02
22.0	1.0	21.5	120.0	1.29	0.86	0.508	9	1.25	50.1	0.9	18.1	0.9	1091.094	3.30E-04	7.10E-04	0.071	8.00E-02	12.4789	7.37E-02	0.02
23.0	1.0	22.5	120.0	1.35	0.90	0.530	9	1.25	50.1	0.9	17.8	0.9	1110.375	3.34E-04	7.10E-04	0.071	8.16E-02	12.4789	7.51E-02	0.02
24.0	1.0	23.5	120.0	1.41	0.94	0.551	9	1.25	50.1	0.9	17.6	0.9	1129.175	3.38E-04	7.10E-04	0.071	8.30E-02	12.4789	7.64E-02	0.02
25.0	1.0	24.5	120.0	1.47	0.98	0.572	9	1.25	50.1	0.8	17.3	0.9	1147.527	3.41E-04	7.10E-04	0.071	8.44E-02	12.4789	7.77E-02	0.02
26.0	1.0	25.5	120.0	1.53	1.03	0.592	9	1.25	50.1	0.8	17.1	0.9	1165.460	3.44E-04	5.20E-04	0.052	6.29E-02	12.4789	5.79E-02	0.01
27.0	1.0	26.5	120.0	1.59	1.07	0.613	9	1.25	50.1	0.8	12.4	0.9	1068.596	3.83E-04	5.20E-04	0.052	9.21E-02	12.4789	8.47E-02	0.02
28.0	1.0	27.5	120.0	1.65	1.11	0.632	9	1.25	50.1	0.8	12.2	0.9	1082.504	3.87E-04	5.20E-04	0.052	9.39E-02	12.4789	8.65E-02	0.02
29.0	1.0	28.5	120.0	1.71	1.15	0.652	9	1.25	50.1	0.8	12.0	0.9	1096.098	3.90E-04	5.20E-04	0.052	9.58E-02	12.4789	8.82E-02	0.02
30.0	1.0	29.5	120.0	1.77	1.19	0.671	20	1.25	66.0	0.8	32.1	0.9	1546.972	2.81E-04	3.00E-04	0.030	1.70E-02	12.4789	1.57E-02	0.00
31.0	1.0	30.5	120.0	1.83	1.23	0.690	20	1.25	66.0	0.8	31.7	0.9	1565.786	2.83E-04	3.00E-04	0.030	1.73E-02	12.4789	1.59E-02	0.00
32.0	1.0	31.5	120.0	1.89	1.27	0.709	20	1.25	66.0	0.7	31.2	0.9	1584.231	2.84E-04	3.00E-04	0.030	1.76E-02	12.4789	1.62E-02	0.00
33.0	1.0	32.5	120.0	1.95	1.31	0.727	20	1.25	66.0	0.7	30.8	0.9	1602.326	2.86E-04	3.00E-04	0.030	1.78E-02	12.4789	1.64E-02	0.00
34.0	1.0	33.5	120.0	2.01	1.35	0.745	20	1.25	66.0	0.7	30.5	0.8	1620.088	2.87E-04	3.00E-04	0.030	1.81E-02	12.4789	1.67E-02	0.00
35.0	1.0	34.5	120.0	2.07	1.39	0.763	28	1.25	70.8	0.7	39.9	0.8	1798.842	2.62E-04	3.00E-04	0.030	1.31E-02	12.4789	1.21E-02	0.00
36.0	1.0	35.5	120.0	2.13	1.43	0.780	28	1.25	70.8	0.7	39.4	0.8	1817.278	2.63E-04	3.00E-04	0.030	1.33E-02	12.4789	1.22E-02	0.00
37.0	1.0	36.5	120.0	2.19	1.47	0.797	28	1.25	70.8	0.7	38.9	0.8	1835.398	2.64E-04	3.00E-04	0.030	1.35E-02	12.4789	1.24E-02	0.00
38.0	1.0	37.5	120.0	2.25	1.51	0.813	28	1.25	70.8	0.7	38.5	0.8	1853.216	2.65E-04	3.00E-04	0.030	1.37E-02	12.4789	1.26E-02	0.00
39.0	1.0	38.5	120.0	2.31	1.55	0.829	28	1.25	70.8	0.7	38.1	0.8	1870.744	2.65E-04	3.00E-04	0.030	1.39E-02	12.4789	1.28E-02	0.00
40.0	1.0	39.5	120.0	2.37	1.59	0.845	28	1.25	70.8	0.7	37.7	0.8	1887.996	2.66E-04	3.00E-04	0.030	1.40E-02	12.4789	1.29E-02	0.00
41.0	1.0	40.5	120.0	2.43	1.63	0.861	28	1.25	70.8	0.7	37.3	0.8	1904.982	2.66E-04	3.00E-04	0.030	1.42E-02	12.4789	1.31E-02	0.00
42.0	1.0	41.5	120.0	2.49	1.67	0.876	28	1.25	70.8	0.6	36.9	0.8	1921.714	2.67E-04	3.00E-04	0.030	1.44E-02	12.4789	1.33E-02	0.00
43.0	1.0	42.5	120.0	2.55	1.71	0.891	28	1.25	70.8	0.6	36.5	0.8	1938.201	2.67E-04	3.00E-04	0.030	1.46E-02	12.4789	1.34E-02	0.00
44.0	1.0	43.5	120.0	2.61	1.75	0.905	28	1.25	70.8	0.6	36.1	0.8	1954.452	2.67E-04	3.00E-04	0.030	1.47E-02	12.4789	1.36E-02	0.00
45.0	1.0	44.5	120.0	2.67	1.79	0.919	28	1.25	70.8	0.6	35.8	0.8	1970.477	2.68E-04	3.00E-04	0.030	1.49E-02	12.4789	1.37E-02	0.00
46.0	1.0	45.5	120.0	2.73	1.83	0.933	28	1.25	70.8	0.6	35.5	0.8	1986.284	2.68E-04	3.00E-04	0.030	1.51E-02	12.4789	1.39E-02	0.00
47.0	1.0	46.5	120.0	2.79	1.87	0.946	28	1.25	70.8	0.6	35.1	0.8	2001.880	2.68E-04	3.00E-04	0.030	1.53E-02	12.4789	1.40E-02	0.00
48.0	1.0	47.5	120.0	2.85	1.91	0.959	41	1.25	79.0	0.6	48.4	0.8	2251.123	2.40E-04	3.00E-04	0.030	1.04E-02	12.4789	9.56E-03	0.00
49.0	1.0	48.5	120.0	2.91	1.95	0.971	41	1.25	79.0	0.6	48.0	0.8	2267.726	2.40E-04	3.00E-04	0.030	1.05E-02	12.4789	9.67E-03	0.00
50.0	1.0	49.5	120.0	2.97	1.99	0.984	41	1.25	79.0	0.6	47.5	0.8	2284.117	2.40E-04	3.00E-04	0.030	1.06E-02	12.4789	9.77E-03	0.00

TOTAL SETTLEMENT = **0.50**

Figure C-4

GEOCON

Client : Soboba Tribal Improvements
File No. : T2718-22-04
Boring : 2

EMPIRICAL ESTIMATION OF LIQUEFACTION POTENTIAL
MAXIMUM CONSIDERED EARTHQUAKE

NCEER (1996) METHOD

EARTHQUAKE INFORMATION:

Earthquake Magnitude:	7.20
Peak Horiz. Acceleration PGA_M (g):	0.951
Calculated Mag.Wtg.Factor:	0.905
Historic High Groundwater:	150.0
Groundwater Depth During Exploration:	150.0

By Thomas F. Blake (1994-1996)

ENERGY & ROD CORRECTIONS:

Energy Correction (CE) for N60:	1.25
Rod Len.Corr.(CR)(0-no or 1-yes):	1.0
Bore Dia. Corr. (CB):	1.15
Sampler Corr. (CS):	1.20
Use Ksigma (0 or 1):	1.0

LIQUEFACTION CALCULATIONS:

Unit Wt. Water (pcf):	62.4

Depth to Base (ft)	Total Unit Wt. (pcf)	Water (0 or 1)	FIELD SPT (N)	Depth of SPT (ft)	Liq.Sus. (0 or 1)	-200 (%)	Est. Dr (%)	CN Factor	Corrected (N1)60	Eff. Unit Wt. (psf)	Resist. CRR	rd Factor	Induced CSR	Liquefac. Safe.Fact.
1.0	120.0	0	8.0	1.0	1	25	69	2.000	25.4	120.0	0.292	0.998	0.558	--
2.0	120.0	0	8.0	2.0	1	25	67	2.000	25.4	120.0	0.292	0.993	0.556	--
3.0	120.0	0	8.0	3.0	1	25	65	2.000	25.4	120.0	0.292	0.989	0.553	--
4.0	120.0	0	8.0	4.0	1	25	63	2.000	25.4	120.0	0.292	0.984	0.551	--
5.0	120.0	0	8.0	5.0	1	25	62	1.966	25.0	120.0	0.286	0.979	0.548	--
6.0	120.0	0	8.0	6.0	1	25	60	1.779	23.1	120.0	0.256	0.975	0.545	--
7.0	120.0	0	8.0	7.0	1	25	59	1.636	21.6	120.0	0.237	0.970	0.543	--
8.0	120.0	0	8.0	8.0	1	52	58	1.523	22.8	120.0	0.252	0.966	0.540	--
9.0	120.0	0	8.0	9.0	1	52	57	1.431	21.8	120.0	0.240	0.961	0.538	--
10.0	120.0	0	8.0	10.0	1	52	55	1.353	21.0	120.0	0.230	0.957	0.535	--
11.0	120.0	0	8.0	11.0	1	52	54	1.287	20.3	120.0	0.222	0.952	0.533	--
12.0	120.0	0	8.0	11.0	1	52	54	1.230	19.7	120.0	0.215	0.947	0.530	--
13.0	120.0	0	10.0	13.5	1	25	58	1.180	20.4	120.0	0.222	0.943	0.528	--
14.0	120.0	0	10.0	13.5	1	25	58	1.135	19.8	120.0	0.215	0.938	0.525	--
15.0	120.0	0	10.0	13.5	1	25	58	1.095	19.2	120.0	0.209	0.934	0.522	--
16.0	120.0	0	20.0	16.0	1	10	79	1.060	31.4	120.0	Infin.	0.929	0.520	--
17.0	120.0	0	20.0	16.0	1	10	79	1.027	30.5	120.0	Infin.	0.925	0.517	--
18.0	120.0	0	20.0	16.0	1	10	79	0.997	29.6	120.0	0.431	0.920	0.515	--
19.0	120.0	0	20.0	16.0	1	10	79	0.970	28.9	120.0	0.379	0.915	0.512	--
20.0	120.0	0	12.0	20.0	1	52	58	0.945	24.5	120.0	0.273	0.911	0.510	--
21.0	120.0	0	12.0	20.0	1	52	58	0.921	24.1	120.0	0.267	0.906	0.507	--
22.0	120.0	0	12.0	20.0	1	25	58	0.900	21.3	120.0	0.230	0.902	0.505	--
23.0	120.0	0	12.0	20.0	1	25	58	0.879	21.0	120.0	0.226	0.897	0.502	--
24.0	120.0	0	12.0	20.0	1	25	58	0.860	20.6	120.0	0.222	0.893	0.499	--
25.0	120.0	0	12.0	20.0	1	25	58	0.843	20.3	120.0	0.218	0.888	0.497	--
26.0	120.0	0	12.0	20.0	1	25	58	0.826	20.0	120.0	0.214	0.883	0.494	--
27.0	120.0	0	12.0	20.0	1	25	58	0.810	19.7	120.0	0.211	0.879	0.492	--
28.0	120.0	0	8.0	30.0	1	25	42	0.795	15.6	120.0	0.157	0.874	0.489	--
29.0	120.0	0	8.0	30.0	1	25	42	0.781	15.4	120.0	0.155	0.870	0.487	--
30.0	120.0	0	8.0	30.0	1	25	42	0.768	15.3	120.0	0.154	0.865	0.484	--
31.0	120.0	0	8.0	30.0	1	25	42	0.755	15.1	120.0	0.152	0.861	0.482	--
32.0	120.0	0	8.0	30.0	1	25	42	0.743	14.9	120.0	0.150	0.856	0.479	--
33.0	120.0	0	8.0	30.0	1	25	42	0.732	14.8	120.0	0.149	0.851	0.476	--
34.0	120.0	0	8.0	30.0	1	25	42	0.721	14.6	120.0	0.147	0.847	0.474	--
35.0	120.0	0	24.0	36.0	1	52	68	0.710	36.4	120.0	Infin.	0.842	0.471	--
36.0	120.0	0	24.0	36.0	1	52	68	0.700	36.0	120.0	Infin.	0.838	0.469	--
37.0	120.0	0	35.0	40.0	1	25	79	0.690	46.4	120.0	Infin.	0.833	0.466	--
38.0	120.0	0	35.0	40.0	1	25	79	0.681	45.8	120.0	Infin.	0.829	0.464	--
39.0	120.0	0	35.0	40.0	1	25	79	0.672	45.3	120.0	Infin.	0.824	0.461	--
40.0	120.0	0	35.0	40.0	1	25	79	0.664	44.7	120.0	Infin.	0.819	0.458	--
41.0	120.0	0	35.0	40.0	1	52	79	0.655	46.6	120.0	Infin.	0.815	0.456	--
42.0	120.0	0	35.0	40.0	1	52	79	0.648	46.1	120.0	Infin.	0.810	0.453	--
43.0	120.0	0	35.0	40.0	1	52	79	0.640	45.6	120.0	Infin.	0.806	0.451	--
44.0	120.0	0	35.0	40.0	1	52	79	0.632	45.2	120.0	Infin.	0.801	0.448	--
45.0	120.0	0	40.0	46.0	1	25	80	0.625	47.8	120.0	Infin.	0.797	0.446	--
46.0	120.0	0	40.0	46.0	1	25	80	0.618	47.3	120.0	Infin.	0.792	0.443	--
47.0	120.0	0	40.0	46.0	1	25	80	0.612	46.9	120.0	Infin.	0.787	0.441	--
48.0	120.0	0	40.0	46.0	1	25	80	0.605	46.4	120.0	Infin.	0.783	0.438	--
49.0	120.0	0	70.0	50.0	1	25	103	0.599	77.0	120.0	Infin.	0.778	0.435	--
50.0	120.0	0	70.0	50.0	1	25	103	0.593	76.3	120.0	Infin.	0.774	0.433	--

Client : Soboba Tribal Improvements
File No. : T2718-22-04
Boring : 2

TECHNICAL ENGINEERING AND DESIGN GUIDES AS ADAPTED FROM THE US ARMY CORPS OF ENGINEERS, NO. 9
EVALUATION OF EARTHQUAKE-INDUCED SETTLEMENTS IN DRY SANDY SOILS
MAXIMUM CONSIDERED EARTHQUAKE

MCE EARTHQUAKE INFORMATION:

Earthquake Magnitude:	7.20
Peak Horiz. Acceleration (g):	0.951

Fig 4.1 (Relative Density) · Fig 4.2 (Correction Factor [Cn]) · Fig 4.4 (yeff)

Depth of Base of Strata (ft)	Thickness of Layer (ft)	Depth of Mid-point of Layer (ft)	Soil Unit Weight (pcf)	Overburden Pressure at Mid-point (tsf)	Mean Effective Pressure at Mid-point (tsf)	Average Cyclic Shear Stress [Tav]	Field SPT [N]	Correction Factor [Cer]	Relative Density [Dr] (%)	Correction Factor [Cn]	Corrected [N1]60	rd Factor	Maximum Shear Mod. [Gmax] (tsf)	[yeff]*[Geff] [Gmax]	yeff Shear Strain	[yeff]*100%	Volumetric Strain M7.5 [E15} (%)	Number of Strain Cycles [Nc]	Corrected Vol. Strains [Ec]	Estimated Settlement [S] (inches)
1.0	1.0	0.5	120.0	0.03	0.02	0.019	8	1.25	68.5	2.0	25.4	1.0	186.206	9.86E-05	1.90E-04	0.019	1.43E-02	12.4789	1.31E-02	Grading
2.0	1.0	1.5	120.0	0.09	0.06	0.056	8	1.25	66.6	2.0	25.4	1.0	322.518	1.67E-04	2.30E-04	0.023	1.73E-02	12.4789	1.59E-02	Grading
3.0	1.0	2.5	120.0	0.15	0.10	0.093	8	1.25	64.8	2.0	25.4	1.0	416.369	2.12E-04	8.10E-04	0.081	6.09E-02	12.4789	5.61E-02	Grading
4.0	1.0	3.5	120.0	0.21	0.14	0.130	8	1.25	63.2	2.0	25.4	1.0	492.654	2.46E-04	8.10E-04	0.081	6.09E-02	12.4789	5.61E-02	Grading
5.0	1.0	4.5	120.0	0.27	0.18	0.167	8	1.25	61.7	2.0	25.0	1.0	556.052	2.75E-04	8.10E-04	0.081	6.19E-02	12.4789	5.70E-02	Grading
6.0	1.0	5.5	120.0	0.33	0.22	0.203	8	1.25	60.3	1.8	23.1	1.0	598.394	3.06E-04	1.00E-03	0.100	8.42E-02	12.4789	7.75E-02	0.02
7.0	1.0	6.5	120.0	0.39	0.26	0.240	8	1.25	59.0	1.6	21.6	1.0	636.355	3.34E-04	1.00E-03	0.100	9.12E-02	12.4789	8.39E-02	0.02
8.0	1.0	7.5	120.0	0.45	0.30	0.277	8	1.25	57.7	1.5	22.8	1.0	695.619	3.46E-04	1.00E-03	0.100	8.56E-02	12.4789	7.88E-02	0.02
9.0	1.0	8.5	120.0	0.51	0.34	0.313	8	1.25	56.6	1.4	21.8	1.0	730.024	3.67E-04	1.00E-03	0.100	9.01E-02	12.4789	8.30E-02	0.02
10.0	1.0	9.5	120.0	0.57	0.38	0.349	8	1.25	55.5	1.4	21.0	1.0	762.206	3.86E-04	1.00E-03	0.100	9.43E-02	12.4789	8.68E-02	0.02
11.0	1.0	10.5	120.0	0.63	0.42	0.385	8	1.25	54.5	1.3	20.3	1.0	792.529	4.02E-04	2.70E-03	0.270	2.65E-01	12.4789	2.44E-01	0.06
12.0	1.0	11.5	120.0	0.69	0.46	0.421	8	1.25	54.5	1.2	19.7	0.9	821.271	4.18E-04	2.70E-03	0.270	2.74E-01	12.4789	2.53E-01	0.06
13.0	1.0	12.5	120.0	0.75	0.50	0.456	10	1.25	57.8	1.2	20.4	0.9	865.161	4.23E-04	1.20E-03	0.120	1.17E-01	12.4789	1.08E-01	0.03
14.0	1.0	13.5	120.0	0.81	0.54	0.492	10	1.25	57.8	1.1	19.8	0.9	890.296	4.37E-04	1.20E-03	0.120	1.22E-01	12.4789	1.12E-01	0.03
15.0	1.0	14.5	120.0	0.87	0.58	0.527	10	1.25	57.8	1.1	19.2	0.9	914.361	4.49E-04	1.20E-03	0.120	1.26E-01	12.4789	1.16E-01	0.03
16.0	1.0	15.5	120.0	0.93	0.62	0.561	20	1.25	79.1	1.1	31.4	0.9	1113.344	3.87E-04	7.10E-04	0.071	4.13E-02	12.4789	3.80E-02	0.01
17.0	1.0	16.5	120.0	0.99	0.66	0.596	20	1.25	79.1	1.0	30.5	0.9	1137.237	3.96E-04	7.10E-04	0.071	4.28E-02	12.4789	3.94E-02	0.01
18.0	1.0	17.5	120.0	1.05	0.70	0.630	20	1.25	79.1	1.0	29.6	0.9	1160.203	4.05E-04	1.20E-03	0.120	7.49E-02	12.4789	6.89E-02	0.02
19.0	1.0	18.5	120.0	1.11	0.74	0.663	20	1.25	79.1	1.0	28.9	0.9	1182.331	4.13E-04	1.20E-03	0.120	7.73E-02	12.4789	7.12E-02	0.02
20.0	1.0	19.5	120.0	1.17	0.78	0.697	12	1.25	57.8	0.9	24.5	0.9	1149.455	4.41E-04	1.20E-03	0.120	9.41E-02	12.4789	8.66E-02	0.02
21.0	1.0	20.5	120.0	1.23	0.82	0.730	12	1.25	57.8	0.9	24.1	0.9	1171.589	4.47E-04	1.20E-03	0.120	9.61E-02	12.4789	8.85E-02	0.02
22.0	1.0	21.5	120.0	1.29	0.86	0.762	12	1.25	57.8	0.9	21.3	0.9	1152.537	4.69E-04	1.20E-03	0.120	1.11E-01	12.4789	1.02E-01	0.02
23.0	1.0	22.5	120.0	1.35	0.90	0.794	12	1.25	57.8	0.9	21.0	0.9	1172.094	4.74E-04	1.20E-03	0.120	1.13E-01	12.4789	1.04E-01	0.03
24.0	1.0	23.5	120.0	1.41	0.94	0.826	12	1.25	57.8	0.9	20.6	0.9	1191.144	4.80E-04	1.20E-03	0.120	1.16E-01	12.4789	1.07E-01	0.03
25.0	1.0	24.5	120.0	1.47	0.98	0.857	12	1.25	57.8	0.8	20.3	0.9	1209.722	4.85E-04	1.20E-03	0.120	1.18E-01	12.4789	1.09E-01	0.03
26.0	1.0	25.5	120.0	1.53	1.03	0.888	12	1.25	57.8	0.8	20.0	0.9	1227.859	4.89E-04	8.10E-04	0.081	8.11E-02	12.4789	7.47E-02	0.02
27.0	1.0	26.5	120.0	1.59	1.07	0.918	12	1.25	57.8	0.8	19.7	0.9	1245.583	4.93E-04	8.10E-04	0.081	8.26E-02	12.4789	7.60E-02	0.02
28.0	1.0	27.5	120.0	1.65	1.11	0.948	8	1.25	41.8	0.8	15.6	0.9	1175.440	5.34E-04	1.30E-03	0.130	1.75E-01	12.4789	1.61E-01	0.04
29.0	1.0	28.5	120.0	1.71	1.15	0.978	8	1.25	41.8	0.8	15.4	0.9	1191.646	5.37E-04	1.30E-03	0.130	1.77E-01	12.4789	1.63E-01	0.04
30.0	1.0	29.5	120.0	1.77	1.19	1.007	8	1.25	41.8	0.8	15.3	0.9	1207.531	5.40E-04	1.30E-03	0.130	1.80E-01	12.4789	1.65E-01	0.04
31.0	1.0	30.5	120.0	1.83	1.23	1.035	8	1.25	41.8	0.8	15.1	0.9	1223.112	5.43E-04	1.30E-03	0.130	1.82E-01	12.4789	1.68E-01	0.04
32.0	1.0	31.5	120.0	1.89	1.27	1.063	8	1.25	41.8	0.7	14.9	0.9	1238.405	5.46E-04	1.30E-03	0.130	1.85E-01	12.4789	1.70E-01	0.04
33.0	1.0	32.5	120.0	1.95	1.31	1.090	8	1.25	41.8	0.7	14.8	0.9	1253.424	5.48E-04	1.30E-03	0.130	1.87E-01	12.4789	1.72E-01	0.04
34.0	1.0	33.5	120.0	2.01	1.35	1.117	8	1.25	41.8	0.7	14.6	0.8	1268.184	5.50E-04	1.30E-03	0.130	1.89E-01	12.4789	1.74E-01	0.04
35.0	1.0	34.5	120.0	2.07	1.39	1.143	24	1.25	68.1	0.7	36.4	0.8	1744.625	4.05E-04	8.10E-04	0.081	3.95E-02	12.4789	3.63E-02	0.01
36.0	1.0	35.5	120.0	2.13	1.43	1.169	24	1.25	68.1	0.7	36.0	0.8	1762.944	4.07E-04	8.10E-04	0.081	4.00E-02	12.4789	3.68E-02	0.01
37.0	1.0	36.5	120.0	2.19	1.47	1.195	35	1.25	79.2	0.7	46.4	0.8	1945.019	3.74E-04	5.20E-04	0.052	1.90E-02	12.4789	1.75E-02	0.00
38.0	1.0	37.5	120.0	2.25	1.51	1.219	35	1.25	79.2	0.7	45.8	0.8	1963.517	3.75E-04	5.20E-04	0.052	1.92E-02	12.4789	1.77E-02	0.00
39.0	1.0	38.5	120.0	2.31	1.55	1.244	35	1.25	79.2	0.7	45.3	0.8	1981.709	3.76E-04	5.20E-04	0.052	1.95E-02	12.4789	1.80E-02	0.00
40.0	1.0	39.5	120.0	2.37	1.59	1.267	35	1.25	79.2	0.7	44.7	0.8	1999.606	3.76E-04	5.20E-04	0.052	1.98E-02	12.4789	1.82E-02	0.00
41.0	1.0	40.5	120.0	2.43	1.63	1.290	35	1.25	79.2	0.7	46.6	0.8	2052.080	3.71E-04	5.20E-04	0.052	1.89E-02	12.4789	1.74E-02	0.00
42.0	1.0	41.5	120.0	2.49	1.67	1.313	35	1.25	79.2	0.6	46.1	0.8	2070.103	3.71E-04	5.20E-04	0.052	1.91E-02	12.4789	1.76E-02	0.00
43.0	1.0	42.5	120.0	2.55	1.71	1.335	35	1.25	79.2	0.6	45.6	0.8	2087.863	3.72E-04	5.20E-04	0.052	1.93E-02	12.4789	1.78E-02	0.00
44.0	1.0	43.5	120.0	2.61	1.75	1.357	35	1.25	79.2	0.6	45.2	0.8	2105.370	3.72E-04	5.20E-04	0.052	1.96E-02	12.4789	1.80E-02	0.00
45.0	1.0	44.5	120.0	2.67	1.79	1.378	40	1.25	80.5	0.6	47.8	0.8	2169.947	3.64E-04	5.20E-04	0.052	1.83E-02	12.4789	1.68E-02	0.00
46.0	1.0	45.5	120.0	2.73	1.83	1.398	40	1.25	80.5	0.6	47.3	0.8	2186.876	3.65E-04	5.20E-04	0.052	1.85E-02	12.4789	1.70E-02	0.00
47.0	1.0	46.5	120.0	2.79	1.87	1.418	40	1.25	80.5	0.6	46.9	0.8	2203.572	3.65E-04	5.20E-04	0.052	1.87E-02	12.4789	1.72E-02	0.00
48.0	1.0	47.5	120.0	2.85	1.91	1.437	40	1.25	80.5	0.6	46.4	0.8	2220.043	3.65E-04	5.20E-04	0.052	1.89E-02	12.4789	1.74E-02	0.00
49.0	1.0	48.5	120.0	2.91	1.95	1.456	70	1.25	103.2	0.6	77.0	0.8	2655.258	3.07E-04	5.20E-04	0.052	1.03E-02	12.4789	9.50E-03	0.00
50.0	1.0	49.5	120.0	2.97	1.99	1.475	70	1.25	103.2	0.6	76.3	0.8	2673.937	3.07E-04	5.20E-04	0.052	1.04E-02	12.4789	9.61E-03	0.00

TOTAL SETTLEMENT = **0.88**

GEOCON

Client : Soboba Tribal Improvements
File No. : T2718-22-04
Boring : 9

EMPIRICAL ESTIMATION OF LIQUEFACTION POTENTIAL
MAXIMUM CONSIDERED EARTHQUAKE

NCEER (1996) METHOD

EARTHQUAKE INFORMATION:

Earthquake Magnitude:	7.20
Peak Horiz. Acceleration PGA_M (g):	0.951
Calculated Mag.Wtg.Factor:	0.905
Historic High Groundwater:	150.0
Groundwater Depth During Exploration:	150.0

By Thomas F. Blake (1994-1996)

ENERGY & ROD CORRECTIONS:

Energy Correction (CE) for N60:	1.25
Rod Len.Corr.(CR)(0-no or 1-yes):	1.0
Bore Dia. Corr. (CB):	1.15
Sampler Corr. (CS):	1.20
Use Ksigma (0 or 1):	1.0

LIQUEFACTION CALCULATIONS:

Unit Wt. Water (pcf):	62.4

Depth to Base (ft)	Total Unit Wt. (pcf)	Water (0 or 1)	FIELD SPT (N)	Depth of SPT (ft)	Liq.Sus. (0 or 1)	-200 (%)	Est. Dr (%)	CN Factor	Corrected (N1)60	Eff. Unit Wt. (psf)	Resist. CRR	rd Factor	Induced CSR	Liquefac. Safe.Fact.
1.0	120.0	0	9.0	1.0	1	10	73	2.000	24.5	120.0	0.277	0.998	0.558	--
2.0	120.0	0	9.0	2.0	1	10	71	2.000	24.5	120.0	0.277	0.993	0.556	--
3.0	120.0	0	9.0	3.0	1	10	69	2.000	24.5	120.0	0.277	0.989	0.553	--
4.0	120.0	0	9.0	4.0	1	10	67	2.000	24.5	120.0	0.277	0.984	0.551	--
5.0	120.0	0	9.0	5.0	1	10	65	1.966	24.1	120.0	0.271	0.979	0.548	--
6.0	120.0	0	9.0	6.0	1	10	64	1.779	21.9	120.0	0.240	0.975	0.545	--
7.0	120.0	0	9.0	7.0	1	10	63	1.636	20.2	120.0	0.220	0.970	0.543	--
8.0	120.0	0	9.0	8.0	1	10	61	1.523	18.9	120.0	0.206	0.966	0.540	--
9.0	120.0	0	9.0	9.0	1	10	60	1.431	17.8	120.0	0.194	0.961	0.538	--
10.0	120.0	0	9.0	10.0	1	10	59	1.353	16.9	120.0	0.184	0.957	0.535	--
11.0	120.0	0	9.0	10.0	1	10	59	1.287	16.2	120.0	0.176	0.952	0.533	--
12.0	120.0	0	9.0	10.0	1	10	59	1.230	15.5	120.0	0.169	0.947	0.530	--
13.0	120.0	0	9.0	10.0	1	10	59	1.180	14.9	120.0	0.162	0.943	0.528	--
14.0	120.0	0	9.0	10.0	1	10	59	1.135	14.4	120.0	0.157	0.938	0.525	--
15.0	120.0	0	9.0	10.0	1	10	59	1.095	13.9	120.0	0.152	0.934	0.522	--
16.0	120.0	0	9.0	10.0	1	10	59	1.060	13.5	120.0	0.147	0.929	0.520	--
17.0	120.0	0	9.0	20.0	1	29	50	1.027	19.9	120.0	0.213	0.925	0.517	--
18.0	120.0	0	9.0	20.0	1	29	50	0.997	19.5	120.0	0.209	0.920	0.515	--
19.0	120.0	0	9.0	20.0	1	29	50	0.970	19.1	120.0	0.204	0.915	0.512	--
20.0	120.0	0	9.0	20.0	1	29	50	0.945	18.7	120.0	0.201	0.911	0.510	--
21.0	120.0	0	9.0	20.0	1	29	50	0.921	18.4	120.0	0.197	0.906	0.507	--
22.0	120.0	0	9.0	20.0	1	29	50	0.900	18.1	120.0	0.194	0.902	0.505	--
23.0	120.0	0	9.0	20.0	1	29	50	0.879	17.8	120.0	0.191	0.897	0.502	--
24.0	120.0	0	9.0	20.0	1	29	50	0.860	17.6	120.0	0.188	0.893	0.499	--
25.0	120.0	0	9.0	20.0	1	29	50	0.843	17.3	120.0	0.185	0.888	0.497	--
26.0	120.0	0	9.0	20.0	1	29	50	0.826	17.1	120.0	0.183	0.883	0.494	--
27.0	120.0	0	9.0	20.0	1	10	50	0.810	12.4	120.0	0.134	0.879	0.492	--
28.0	120.0	0	9.0	20.0	1	10	50	0.795	12.2	120.0	0.132	0.874	0.489	--
29.0	120.0	0	9.0	20.0	1	10	50	0.781	12.0	120.0	0.129	0.870	0.487	--
30.0	120.0	0	20.0	30.0	1	29	66	0.768	32.1	120.0	Infin.	0.865	0.484	--
31.0	120.0	0	20.0	30.0	1	29	66	0.755	31.7	120.0	Infin.	0.861	0.482	--
32.0	120.0	0	20.0	30.0	1	29	66	0.743	31.2	120.0	Infin.	0.856	0.479	--
33.0	120.0	0	20.0	30.0	1	29	66	0.732	30.8	120.0	Infin.	0.851	0.476	--
34.0	120.0	0	20.0	30.0	1	29	66	0.721	30.5	120.0	Infin.	0.847	0.474	--
35.0	120.0	0	28.0	40.0	1	29	71	0.710	39.9	120.0	Infin.	0.842	0.471	--
36.0	120.0	0	28.0	40.0	1	29	71	0.700	39.4	120.0	Infin.	0.838	0.469	--
37.0	120.0	0	28.0	40.0	1	29	71	0.690	38.9	120.0	Infin.	0.833	0.466	--
38.0	120.0	0	28.0	40.0	1	29	71	0.681	38.5	120.0	Infin.	0.829	0.464	--
39.0	120.0	0	28.0	40.0	1	29	71	0.672	38.1	120.0	Infin.	0.824	0.461	--
40.0	120.0	0	28.0	40.0	1	29	71	0.664	37.7	120.0	Infin.	0.819	0.458	--
41.0	120.0	0	28.0	40.0	1	29	71	0.655	37.3	120.0	Infin.	0.815	0.456	--
42.0	120.0	0	28.0	40.0	1	29	71	0.648	36.9	120.0	Infin.	0.810	0.453	--
43.0	120.0	0	28.0	40.0	1	29	71	0.640	36.5	120.0	Infin.	0.806	0.451	--
44.0	120.0	0	28.0	40.0	1	29	71	0.632	36.1	120.0	Infin.	0.801	0.448	--
45.0	120.0	0	28.0	40.0	1	29	71	0.625	35.8	120.0	Infin.	0.797	0.446	--
46.0	120.0	0	28.0	40.0	1	29	71	0.618	35.5	120.0	Infin.	0.792	0.443	--
47.0	120.0	0	28.0	40.0	1	29	71	0.612	35.1	120.0	Infin.	0.787	0.441	--
48.0	120.0	0	41.0	50.0	1	29	79	0.605	48.4	120.0	Infin.	0.783	0.438	--
49.0	120.0	0	41.0	50.0	1	29	79	0.599	48.0	120.0	Infin.	0.778	0.435	--
50.0	120.0	0	41.0	50.0	1	29	79	0.593	47.5	120.0	Infin.	0.774	0.433	--

GEOCON

TECHNICAL ENGINEERING AND DESIGN GUIDES AS ADAPTED FROM THE US ARMY CORPS OF ENGINEERS, NO. 9
EVALUATION OF EARTHQUAKE-INDUCED SETTLEMENTS IN DRY SANDY SOILS
MAXIMUM CONSIDERED EARTHQUAKE

MCE EARTHQUAKE INFORMATION:

Earthquake Magnitude:	7.20
Peak Horiz. Acceleration (g):	0.951

Fig 4.1 Fig 4.2 Fig 4.4

Depth of Base of Strata (ft)	Thickness of Layer (ft)	Depth of Mid-point of Layer (ft)	Soil Unit Weight (pcf)	Overburden Pressure at Mid-point (tsf)	Mean Effective Pressure at Mid-point (tsf)	Average Cyclic Shear Stress [Tav]	Field SPT [N]	Correction Factor [Cer]	Relative Density [Dr] (%)	Correction Factor [Cn]	Corrected [N1]60	rd Factor	Maximum Shear Mod. [Gmax] (tsf)	[yeff]*[Geff] [Gmax]	yeff Shear Strain	[yeff]*100%	Volumetric Strain M7.5 [E15} (%)	Number of Strain Cycles [Nc]	Corrected Vol. Strains [Ec]	Estimated Settlement [S] (inches)
1.0	1.0	0.5	120.0	0.03	0.02	0.019	9	1.25	72.7	2.0	24.5	1.0	183.946	9.98E-05	1.90E-04	0.019	1.49E-02	12.4789	1.37E-02	Grading
2.0	1.0	1.5	120.0	0.09	0.06	0.056	9	1.25	70.6	2.0	24.5	1.0	318.603	1.69E-04	2.30E-04	0.023	1.81E-02	12.4789	1.66E-02	Grading
3.0	1.0	2.5	120.0	0.15	0.10	0.093	9	1.25	68.8	2.0	24.5	1.0	411.315	2.15E-04	8.10E-04	0.081	6.36E-02	12.4789	5.86E-02	Grading
4.0	1.0	3.5	120.0	0.21	0.14	0.130	9	1.25	67.0	2.0	24.5	1.0	486.675	2.49E-04	8.10E-04	0.081	6.36E-02	12.4789	5.86E-02	Grading
5.0	1.0	4.5	120.0	0.27	0.18	0.167	9	1.25	65.4	2.0	24.1	1.0	548.877	2.78E-04	8.10E-04	0.081	6.49E-02	12.4789	5.97E-02	Grading
6.0	1.0	5.5	120.0	0.33	0.22	0.203	9	1.25	63.9	1.8	21.9	1.0	587.847	3.12E-04	1.00E-03	0.100	8.98E-02	12.4789	8.27E-02	0.02
7.0	1.0	6.5	120.0	0.39	0.26	0.240	9	1.25	62.5	1.6	20.2	1.0	622.470	3.41E-04	1.00E-03	0.100	9.87E-02	12.4789	9.09E-02	0.02
8.0	1.0	7.5	120.0	0.45	0.30	0.277	9	1.25	61.2	1.5	18.9	1.0	653.812	3.68E-04	1.00E-03	0.100	1.07E-01	12.4789	9.85E-02	0.02
9.0	1.0	8.5	120.0	0.51	0.34	0.313	9	1.25	60.0	1.4	17.8	1.0	682.571	3.92E-04	1.00E-03	0.100	1.15E-01	12.4789	1.06E-01	0.03
10.0	1.0	9.5	120.0	0.57	0.38	0.349	9	1.25	58.8	1.4	16.9	1.0	709.236	4.14E-04	2.70E-03	0.270	3.30E-01	12.4789	3.04E-01	0.07
11.0	1.0	10.5	120.0	0.63	0.42	0.385	9	1.25	58.8	1.3	16.2	1.0	734.159	4.34E-04	2.70E-03	0.270	3.49E-01	12.4789	3.21E-01	0.08
12.0	1.0	11.5	120.0	0.69	0.46	0.421	9	1.25	58.8	1.2	15.5	0.9	757.609	4.53E-04	2.70E-03	0.270	3.67E-01	12.4789	3.38E-01	0.08
13.0	1.0	12.5	120.0	0.75	0.50	0.456	9	1.25	58.8	1.2	14.9	0.9	779.793	4.70E-04	1.20E-03	0.120	1.71E-01	12.4789	1.57E-01	0.04
14.0	1.0	13.5	120.0	0.81	0.54	0.492	9	1.25	58.8	1.1	14.4	0.9	800.875	4.85E-04	1.20E-03	0.120	1.78E-01	12.4789	1.64E-01	0.04
15.0	1.0	14.5	120.0	0.87	0.58	0.527	9	1.25	58.8	1.1	13.9	0.9	820.986	5.00E-04	1.20E-03	0.120	1.85E-01	12.4789	1.71E-01	0.04
16.0	1.0	15.5	120.0	0.93	0.62	0.561	9	1.25	58.8	1.1	13.5	0.9	840.236	5.13E-04	2.20E-03	0.220	3.52E-01	12.4789	3.24E-01	0.08
17.0	1.0	16.5	120.0	0.99	0.66	0.596	9	1.25	50.1	1.0	19.9	0.9	986.012	4.57E-04	1.20E-03	0.120	1.21E-01	12.4789	1.11E-01	0.03
18.0	1.0	17.5	120.0	1.05	0.70	0.630	9	1.25	50.1	1.0	19.5	0.9	1008.355	4.66E-04	1.20E-03	0.120	1.24E-01	12.4789	1.14E-01	0.03
19.0	1.0	18.5	120.0	1.11	0.74	0.663	9	1.25	50.1	1.0	19.1	0.9	1029.977	4.74E-04	1.20E-03	0.120	1.27E-01	12.4789	1.17E-01	0.03
20.0	1.0	19.5	120.0	1.17	0.78	0.697	9	1.25	50.1	0.9	18.7	0.9	1050.939	4.82E-04	1.20E-03	0.120	1.30E-01	12.4789	1.20E-01	0.03
21.0	1.0	20.5	120.0	1.23	0.82	0.730	9	1.25	50.1	0.9	18.4	0.9	1071.295	4.89E-04	1.20E-03	0.120	1.33E-01	12.4789	1.22E-01	0.03
22.0	1.0	21.5	120.0	1.29	0.86	0.762	9	1.25	50.1	0.9	18.1	0.9	1091.094	4.95E-04	1.20E-03	0.120	1.35E-01	12.4789	1.25E-01	0.03
23.0	1.0	22.5	120.0	1.35	0.90	0.794	9	1.25	50.1	0.9	17.8	0.9	1110.375	5.01E-04	2.20E-03	0.220	2.53E-01	12.4789	2.33E-01	0.06
24.0	1.0	23.5	120.0	1.41	0.94	0.826	9	1.25	50.1	0.9	17.6	0.9	1129.175	5.06E-04	2.20E-03	0.220	2.57E-01	12.4789	2.37E-01	0.06
25.0	1.0	24.5	120.0	1.47	0.98	0.857	9	1.25	50.1	0.8	17.3	0.9	1147.527	5.11E-04	2.20E-03	0.220	2.62E-01	12.4789	2.41E-01	0.06
26.0	1.0	25.5	120.0	1.53	1.03	0.888	9	1.25	50.1	0.8	17.1	0.9	1165.460	5.15E-04	1.30E-03	0.130	1.57E-01	12.4789	1.45E-01	0.03
27.0	1.0	26.5	120.0	1.59	1.07	0.918	9	1.25	50.1	0.8	12.4	0.9	1068.596	5.75E-04	1.30E-03	0.130	2.30E-01	12.4789	2.12E-01	0.05
28.0	1.0	27.5	120.0	1.65	1.11	0.948	9	1.25	50.1	0.8	12.2	0.9	1082.504	5.80E-04	1.30E-03	0.130	2.35E-01	12.4789	2.16E-01	0.05
29.0	1.0	28.5	120.0	1.71	1.15	0.978	9	1.25	50.1	0.8	12.0	0.9	1096.098	5.84E-04	1.30E-03	0.130	2.39E-01	12.4789	2.20E-01	0.05
30.0	1.0	29.5	120.0	1.77	1.19	1.007	20	1.25	66.0	0.8	32.1	0.9	1546.972	4.22E-04	8.10E-04	0.081	4.59E-02	12.4789	4.23E-02	0.01
31.0	1.0	30.5	120.0	1.83	1.23	1.035	20	1.25	66.0	0.8	31.7	0.9	1565.786	4.24E-04	8.10E-04	0.081	4.67E-02	12.4789	4.30E-02	0.01
32.0	1.0	31.5	120.0	1.89	1.27	1.063	20	1.25	66.0	0.7	31.2	0.9	1584.231	4.26E-04	8.10E-04	0.081	4.74E-02	12.4789	4.37E-02	0.01
33.0	1.0	32.5	120.0	1.95	1.31	1.090	20	1.25	66.0	0.7	30.8	0.9	1602.326	4.28E-04	8.10E-04	0.081	4.82E-02	12.4789	4.43E-02	0.01
34.0	1.0	33.5	120.0	2.01	1.35	1.117	20	1.25	66.0	0.7	30.5	0.8	1620.088	4.30E-04	8.10E-04	0.081	4.89E-02	12.4789	4.50E-02	0.01
35.0	1.0	34.5	120.0	2.07	1.39	1.143	28	1.25	70.8	0.7	39.9	0.8	1798.842	3.93E-04	5.20E-04	0.052	2.27E-02	12.4789	2.09E-02	0.01
36.0	1.0	35.5	120.0	2.13	1.43	1.169	28	1.25	70.8	0.7	39.4	0.8	1817.278	3.95E-04	5.20E-04	0.052	2.30E-02	12.4789	2.12E-02	0.01
37.0	1.0	36.5	120.0	2.19	1.47	1.195	28	1.25	70.8	0.7	38.9	0.8	1835.398	3.96E-04	5.20E-04	0.052	2.34E-02	12.4789	2.15E-02	0.01
38.0	1.0	37.5	120.0	2.25	1.51	1.219	28	1.25	70.8	0.7	38.5	0.8	1853.216	3.97E-04	5.20E-04	0.052	2.37E-02	12.4789	2.18E-02	0.01
39.0	1.0	38.5	120.0	2.31	1.55	1.244	28	1.25	70.8	0.7	38.1	0.8	1870.744	3.98E-04	5.20E-04	0.052	2.40E-02	12.4789	2.21E-02	0.01
40.0	1.0	39.5	120.0	2.37	1.59	1.267	28	1.25	70.8	0.7	37.7	0.8	1887.996	3.99E-04	5.20E-04	0.052	2.43E-02	12.4789	2.24E-02	0.01
41.0	1.0	40.5	120.0	2.43	1.63	1.290	28	1.25	70.8	0.7	37.3	0.8	1904.982	3.99E-04	5.20E-04	0.052	2.46E-02	12.4789	2.27E-02	0.01
42.0	1.0	41.5	120.0	2.49	1.67	1.313	28	1.25	70.8	0.6	36.9	0.8	1921.714	4.00E-04	8.10E-04	0.081	3.89E-02	12.4789	3.58E-02	0.01
43.0	1.0	42.5	120.0	2.55	1.71	1.335	28	1.25	70.8	0.6	36.5	0.8	1938.201	4.01E-04	8.10E-04	0.081	3.93E-02	12.4789	3.62E-02	0.01
44.0	1.0	43.5	120.0	2.61	1.75	1.357	28	1.25	70.8	0.6	36.1	0.8	1954.452	4.01E-04	8.10E-04	0.081	3.98E-02	12.4789	3.66E-02	0.01
45.0	1.0	44.5	120.0	2.67	1.79	1.378	28	1.25	70.8	0.6	35.8	0.8	1970.477	4.01E-04	8.10E-04	0.081	4.03E-02	12.4789	3.71E-02	0.01
46.0	1.0	45.5	120.0	2.73	1.83	1.398	28	1.25	70.8	0.6	35.5	0.8	1986.284	4.01E-04	8.10E-04	0.081	4.07E-02	12.4789	3.75E-02	0.01
47.0	1.0	46.5	120.0	2.79	1.87	1.418	28	1.25	70.8	0.6	35.1	0.8	2001.880	4.01E-04	8.10E-04	0.081	4.12E-02	12.4789	3.79E-02	0.01
48.0	1.0	47.5	120.0	2.85	1.91	1.437	41	1.25	79.0	0.6	48.4	0.8	2251.123	3.60E-04	5.20E-04	0.052	1.80E-02	12.4789	1.66E-02	0.00
49.0	1.0	48.5	120.0	2.91	1.95	1.456	41	1.25	79.0	0.6	48.0	0.8	2267.726	3.60E-04	5.20E-04	0.052	1.82E-02	12.4789	1.68E-02	0.00
50.0	1.0	49.5	120.0	2.97	1.99	1.475	41	1.25	79.0	0.6	47.5	0.8	2284.117	3.60E-04	5.20E-04	0.052	1.84E-02	12.4789	1.69E-02	0.00

TOTAL SETTLEMENT = **1.20**

APPENDIX D

APPENDIX D

RECOMMENDED GRADING SPECIFICATIONS

FOR

SOBOBA COMMUNITY SERVICES CENTER
SWC SOBOBA ROAD AND LAKE PARK DRIVE
SAN JACINTO, CALIFORNIA

PROJECT NO. T2718-22-04

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition

4. CLEARING AND PREPARING AREAS TO BE FILLED

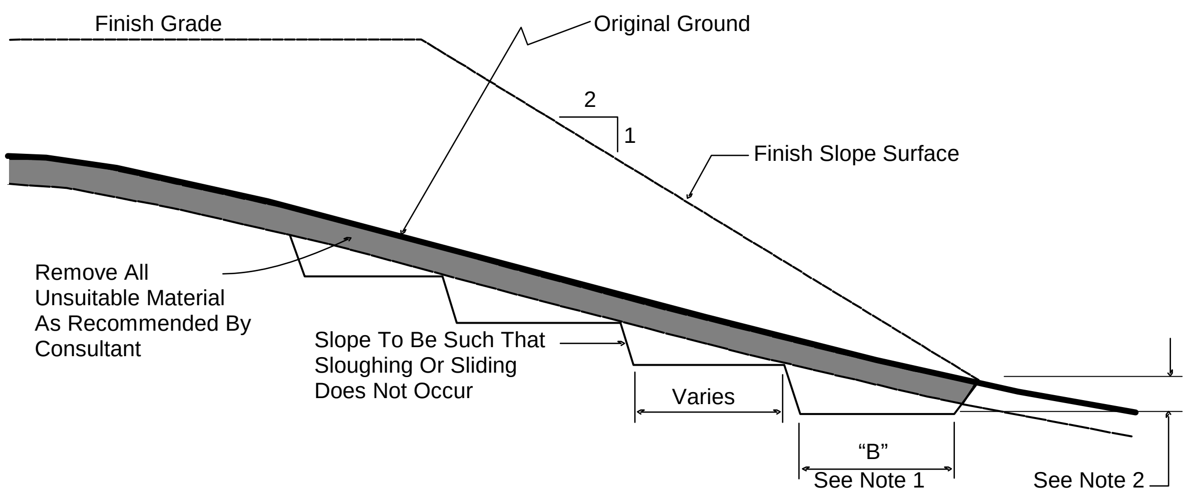
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



No Scale

DETAIL NOTES:

(1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 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. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of “passes” have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

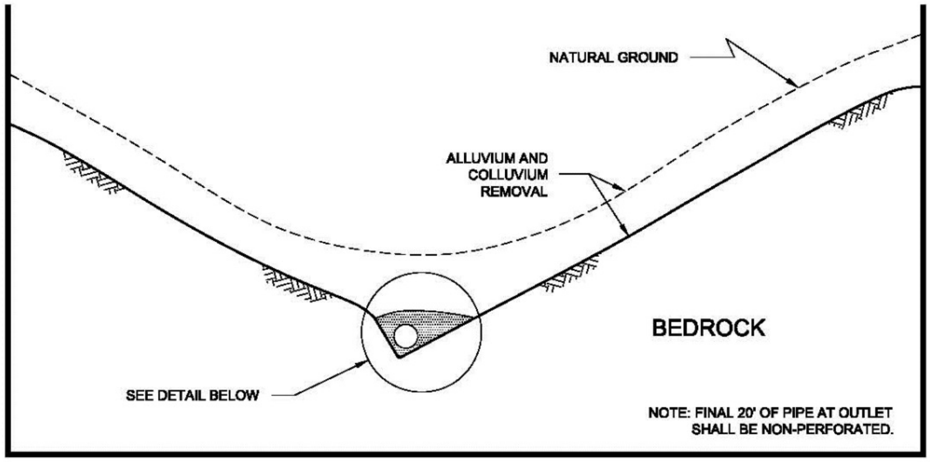
6.3.6 To reduce the potential for “piping” of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

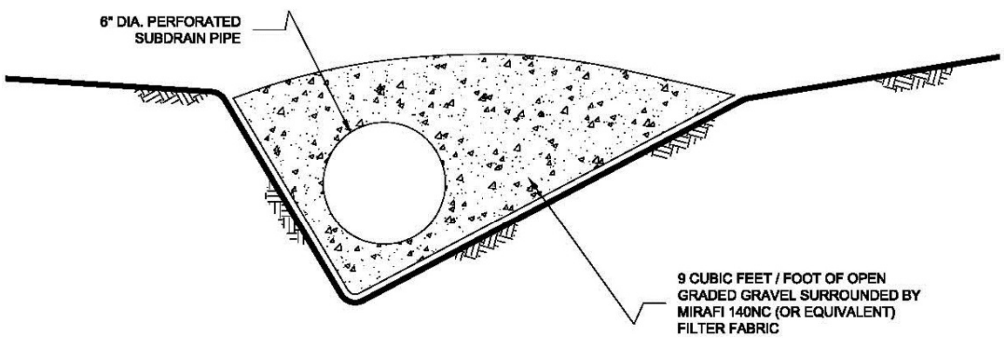
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL





NOTES:

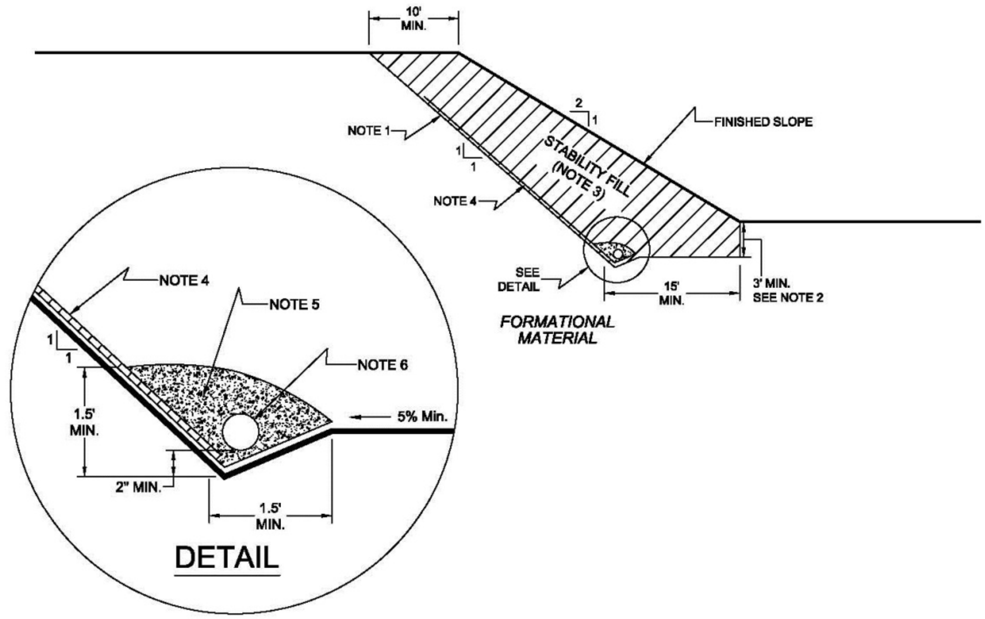
1......6-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

2......6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or lager) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

1.....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).

2.....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.

3.....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.

4.....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.

5.....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

NO SCALE

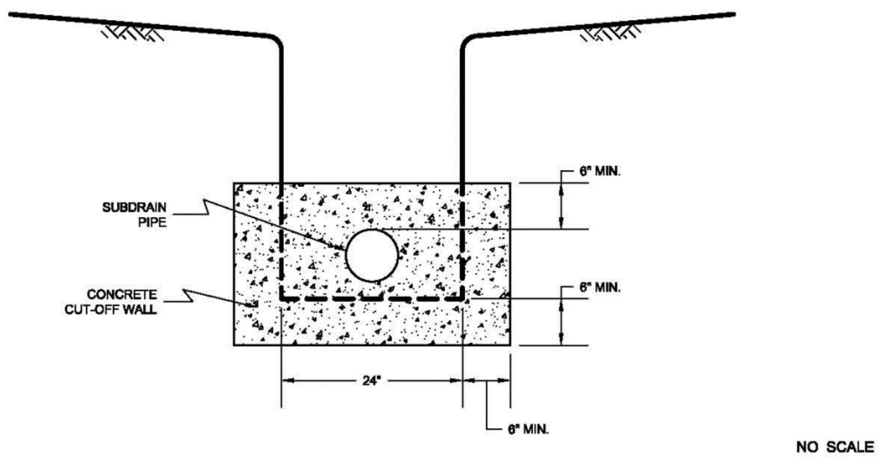
7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock* fill or *soil-rock* fill areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock* fill drains should be constructed using the same requirements as canyon subdrains.

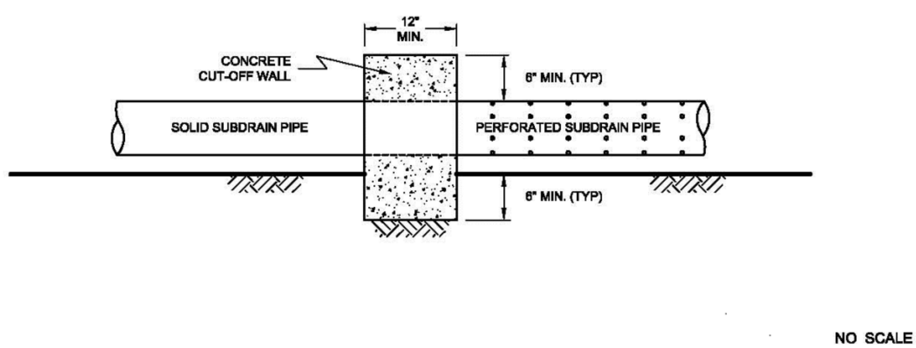
7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

TYPICAL CUT OFF WALL DETAIL

FRONT VIEW

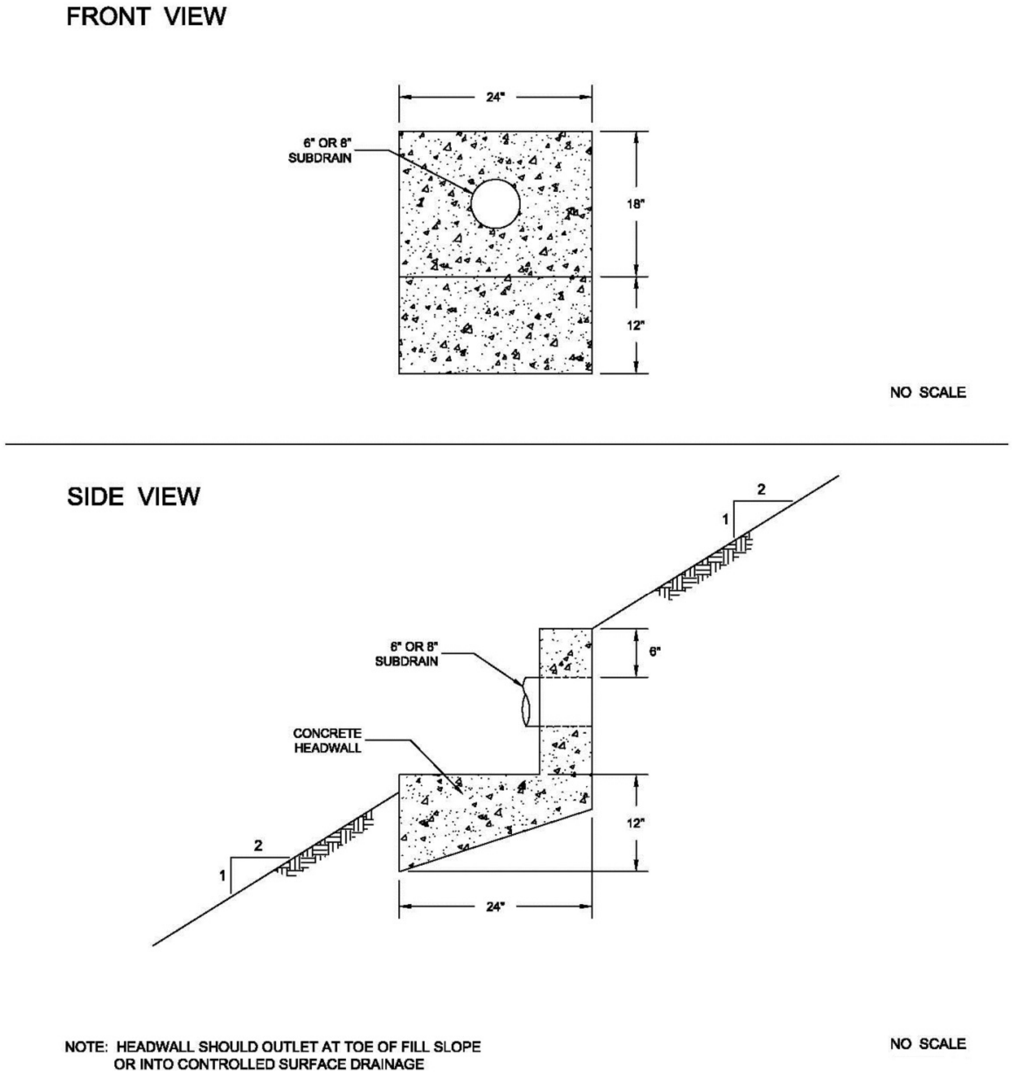


SIDE VIEW



7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

TYPICAL HEADWALL DETAIL



7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an "as-built" map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.

8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 Soil and Soil-Rock Fills:

8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth)*.

8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.

8.6.1.4. Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled 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 features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

10. CERTIFICATIONS AND FINAL REPORTS

10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.