GEOTECHNICAL INVESTIGATION

PREPARED FOR:

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GEOCON

GEOCON PROJECT NO. E9049-04-01

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Project No. E9049-04-01
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AMCAL Multi-Housing, Inc.
30141 Agoura Hills Road, Suite 100
Agoura Hills, California 30141

Attention: Mr. Jay Ross

Subject: EAST 18TH STREET MULTIFAMILY
3560 EAST 18TH STREET
ANTIOCH, CALIFORNIA
GEOTECHNICAL INVESTIGATION

Dear Mr. Ross:

In accordance with your authorization, we have performed a geotechnical investigation for subject apartment community planned in Antioch, California. Our investigation was performed to observe the soil and geologic conditions that may impact site development for the proposed project. The accompanying report presents the results of our investigation and geotechnical conclusions and recommendations. The findings of this study indicate the site is suitable for development as planned provided the recommendations of this report are implemented during design and construction.

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

Sincerely,

GEOCON CONSULTANTS, INC.

DRAFT

Shane Rodacker, PE, GE
Senior Engineer

DRAFT

Jacob Bishop-Moser, EIT
Senior Staff Engineer

(1/e-mail) Addressee
(1/e-mail) BKF Engineers
Attention: Mr. Richard Gonzalez

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GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of a geotechnical investigation for a proposed 394-unit apartment community in Antioch, California (see Vicinity Map, Figure 1). The purpose of this investigation was to evaluate the subsurface soil and geologic conditions in the areas of the planned development and provide conclusions and recommendations pertaining to the geotechnical aspects of project design and construction, based on the conditions encountered during our study.

The scope of this investigation included field exploration, laboratory testing, engineering analysis, and the preparation of this report. Our field exploration was performed on February 20 and 26, 2017 and included four Cone Penetrometer Test (CPT) soundings to maximum depths of approximately 60 ½ feet and 3 hand-auger soil borings and borehole percolation testing. The locations of the soil borings and CPTs and previous subsurface explorations by others are depicted on the Site Plan, Figure 2. A detailed discussion of our field investigation, soil boring logs, CPT profiles, and borehole percolation test results are presented in Appendix A.

Laboratory tests were performed on selected soil samples obtained during the investigation to evaluate pertinent physical properties for engineering analyses. In addition, three soil samples were submitted to our laboratory for screening-level corrosion testing. Laboratory test results are presented Appendix B.

The opinions expressed herein are based on analysis of the data obtained during the investigation and our experience with similar soil and geologic conditions. References reviewed to prepare this report are provided in the *List of References* section.

If project details vary significantly from those described herein, Geocon should be contacted to determine the necessity for review and possible revision of this report.

2. SITE CONDITIONS AND PROJECT DESCRIPTION

The approximately 14 ¾-acre site is comprised of two contiguous parcels (Contra Costa County APN 051-200-025 and 051-200-026) on the south side of East 18th Street in Antioch. The long rectangular-shaped site lies approximately 400 to 700 feet west of mainline SR 160 and is bound by an existing single family residential development to the west. A church is present to the south. Undeveloped land and an existing residence lie to the east. The site is generally undeveloped with no existing site improvements. Web-based mapping indicates the ground surface at the site is generally flat with existing grades on the order of 60 feet MSL at the south end of the property and 40 MSL at East 18th Street.

The conceptual site plan by Architects Orange dated March 15, 2018 indicates the multi-generational community will consist of nine 3-story garden style buildings, with two 3-story u-shaped senior apartment complexes on the southern end. A 3,000 square foot leasing and amenity building with adjacent community pool and playground is also proposed. The buildings will be wood-framed with no subterranean levels. Driveways and surface parking are planned along the entire western margin of the site and in between some of the east-west oriented buildings. A driveway to East 18th Street is at the northeast corner of the site. Another driveway links to Filbert Street at the southwest corner.

A 30-foot-wide utility easement is proposed at the eastern property line. Grading plans were not provided; we understand that cuts and fills to attain design subgrade elevation will be generally on the order of three feet or less.

3. GEOLOGIC SETTING

Antioch is located at the western margin of the Great Valley Geomorphic Province of California, more commonly known as the Central Valley. The valley is a broad lowland between the Sierra Nevada to the east and Coast Ranges to the west. The Central Valley has been filled by a sequence of deep alluvial deposition from weathering processes in the Sierra Nevada and Coast Ranges. The weathering and valley deposition has resulted in alluvial materials that can be hundreds to thousands of feet in thickness. Available geologic mapping by the United States Geological Survey (USGS) indicates the site is underlain by Holocene-age sand dunes. Geologic references indicate the sands are aeolian deposits resulting from geomorphological processes in the San Joaquin Delta.

4. GEOLOGIC HAZARDS

4.1 Faulting and Seismicity

Geologists and seismologists recognize the greater San Francisco Bay Area as one of the most active seismic regions in the United States. The significant earthquakes that occur in the Bay Area are associated with crustal movements along well-defined active fault zones that generally trend in a northwesterly direction.

The San Francisco Bay Area is seismically dominated by the presence of the active San Andreas Fault System. In the theory of plate tectonics, the San Andreas Fault System is a transform fault that forms the boundary between the northward moving Pacific Plate (west of the fault) and the southward moving North American Plate (east of the fault). In the Bay Ares, the movement is distributed across a complex system of strike-slip, right lateral parallel and subparallel faults, which include the San Andreas, Hayward and Calaveras faults, among others. Seismicity at the site is influenced by the San Andreas Fault System, and also the proximate Great Valley Fault System located at the eastern foot of the Coast Ranges.

The table below presents approximate distances to active faults in the vicinity based on web-based mapping by the USGS and California Geological Survey (CGS). Site coordinates are 38.0029° N, 121.7572° W. Active faults within approximately 30 miles of the site are summarized in Table 4.1.

TABLE 4.1
REGIONAL FAULT SUMMARY

Fault Name	Distance to Site (miles)	Maximum Earthquake Magnitude, M_w
Great Valley 5	5	6.6
Great Valley 6	6	6.8
Los Medanos – Roe Island	9 ¼	6.8
Clayton	9 ¼	6.9
Greenville	11 ¾	6.9
Concord	14 ½	6.6
Pleasanton	18 ½	6.6
Calaveras	19	6.9
Green Valley	19 ¼	6.8
Las Positas	22	6.4
Great Valley 4	22	6.7
Contra Costa Shear Zone	22 ¼	6.5
Great Valley 7	22 ½	6.7
Cordelia	24	6.5
Hayward (North)	27 ½	7.3
Hayward (South)	28	7.3
West Napa	28 ½	6.6

The faults tabulated above and numerous other faults in the Bay Area are sources of potential ground motion. However, earthquakes that might occur on other faults within the northern and central California area are also potential generators of significant ground motion and could subject the site to intense ground shaking.

4.2 Surface Fault Rupture

The site is not within a currently established State of California Earthquake Fault Zone for surface fault rupture hazards. No active or potentially-active faults are known to pass directly beneath the site. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low. By definition, an active fault is one with surface displacement within the last 11,000 years. A potentially-active fault has demonstrated evidence of surface displacement with the past 1.6 million years. Faults that have not moved in the last 1.6 million years are typically considered inactive.

4.3 Ground Shaking

We used the USGS *Unified Hazard Tool* to estimate peak ground acceleration (PGA) and mean and modal (most probable) magnitude associated with a 2,475-year return period. This return period corresponds to an event with 2 percent chance of exceedance in a 50-year period. The USGS-estimated PGA is 0.8g and the modal magnitude is 6.9 for Seismic Site Class D (V_s30 of 259 m/sec).

While listing PGA is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including frequency and duration of motion and soil conditions underlying the site.

4.4 Liquefaction

The site is not located within a State of California Seismic Hazard Zone for liquefaction but web-based mapping by USGS indicates the subject site possesses a "moderate" susceptibility to liquefaction. Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary loss of shear strength due to pore pressure buildup under the cyclic shear stresses associated with intense earthquakes. Primary factors that trigger liquefaction are: moderate to strong ground shaking (seismic source), relatively clean, loose granular soils (primarily poorly graded sands and silty sands), and saturated soil conditions (shallow groundwater). Due to the increasing overburden pressure with depth, liquefaction of granular soils is generally limited to the upper 50 feet of a soil profile.

We used the computer software program *CLiq* (Version 2.2.0.35, Geologismiki) and the in-situ soil parameters measured in the CPT soundings to evaluate liquefaction potential at the site. The software utilized the 2014 methodology of Boulanger and Idriss and also considered the potential for dry sand settlements above groundwater. Our evaluation incorporated an earthquake moment magnitude (M_w) of 6.9 and a groundwater depth of 10 feet. Per 2016 CBC, we used a ground motion (peak ground acceleration) of 0.5g in our analysis.

Our liquefaction analysis identified potentially liquefiable layers at each CPT location. In general, these layers are located more than 30 feet below existing grade at the site. Consequences of liquefaction can include ground surface settlement, ground loss (sand boils) and lateral slope displacements (lateral spreading). For liquefaction-induced sand boils or fissures to occur, pore water pressure induced within liquefied strata must exert enough force to break through overlying, non-liquefiable layers. Based on methodology recommended by Youd and Garris (1995), which advanced original research by Ishihara (1985), a capping layer of non-liquefiable soil can prevent the occurrence of sand boils and fissures. Based on the presence of the non-liquefiable layer that mantles the site and the depth to liquefiable layers, the potential for ground loss due to sand boils or fissures in a seismic event is considered low.

The likely consequence of potential liquefaction at the site is settlement. Our analysis estimates that total ground surface settlements of less than ¾ inch may result from liquefaction and/or dry sand settlement after a seismic event. Selected output from our liquefaction analysis is presented in Appendix D.

4.5 Landslides

There are no known landslides near the site, nor is the site in the path of any known or potential landslides. We do not consider the potential for a landslide to be a significant hazard to this project.

4.6 Tsunamis and Seiches

The site is not located within a coastal area. Therefore, tsunamis are not considered a significant hazard at the site.

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No major water-retaining structures are located immediately up gradient from the project site. Flooding from a seismically-induced seiche is considered unlikely.

5. SOIL AND GROUNDWATER CONDITIONS

5.1 Dune Sands

Background geologic mapping indicates the site is underlain by Holocene-age dune sand deposits. As observed in our exploratory borings and those by others, the dune sands are typically loose to dense with variable silt content. Very dense sandy layers and occasional hard clay layers may be present at depths below approximately 20 feet. We encountered dune sands in our CPTs to the maximum depth explored– approximately 60 feet below the existing ground surface. Soils at depth may actually be an older alluvial deposit but the distinction has not been made for the purposes of this study.

5.2 Groundwater

Groundwater level was estimated at a depth of approximately 34 feet by performing a pore pressure dissipation test in one of our CPT soundings. A prior deep soil boring by others in January 2008 encountered groundwater at approximately 32 ½ feet. Actual groundwater levels will fluctuate with variations in rainfall, temperature and other factors and may be higher or lower than observed during our study.

5.3 Soil Corrosion Screening

Soil samples obtained during our field exploration were subjected to laboratory testing for minimum resistivity, pH, and chloride and water-soluble sulfate. The laboratory test results and published screening levels are presented in Appendix B. Soil corrosivity should be considered in the design of buried metal pipes, underground structures, etc.

Water-soluble sulfate test results on selected samples of site soils indicate an S0 exposure classification for sulfate attack on normal portland cement concrete (PCC) as defined in Chapter 318, Table 19.3.1.1 of the ACI *Building Code Requirements for Structural Concrete*. ACI does not set forth requirements for S0 sulfate exposure classification. In addition, none of the three soil samples tested would be classified as corrosive to buried metal improvements based on Caltrans criteria.

Geocon 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.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 General

6.1.1 It is our opinion that neither soil nor geologic conditions were encountered during the investigation that would preclude the project as presently proposed.

6.1.2 Key geotechnical constraints for the project include the potential for liquefaction-induced settlements and the disturbed nature of the near-surface soils. We anticipate that the loose soils can be mitigated through implementation of the grading recommendations herein, and that the estimated seismically-induced settlements can be accommodated in structural design.

6.1.3 Based on the subsurface conditions at the site and the anticipated structural loading, conventional shallow foundation systems, used in conjunction with the remedial grading described herein, can be used to support the planned apartment buildings, leasing and amenity building, and ancillary structures such as screen walls and short retaining walls. Post-construction settlements due to static foundation loads should be ¾ inch or less with differential settlements of ½ inch or less across a horizontal distance of 50 feet or between column supports.

6.1.4 As discussed in Section 4.4, the site is susceptible to liquefaction. Our analysis indicates that, if liquefaction were to occur, total foundation settlements of less than ¾ inch may result. In addition to the post-construction settlements due to foundation loading, structures should be designed to accommodate approximately ½ inch of differential seismic settlement across a horizontal distance of 50 feet or between column supports.

6.1.5 Any changes in the design, location or elevation, 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.

6.1.6 The proposed project redevelops a site with past agricultural use and prior episodes of site development. As such, unknown underground improvements and areas of undocumented fill materials may be present. If encountered, supplemental recommendations will be provided during site development.

6.1.7 All references to relative compaction and optimum moisture content in this report are based on the latest edition of ASTM D 1557.

6.2 Seismic Design Criteria

6.2.1 We anticipate that seismic structural design will be performed in accordance with the provisions of the 2016 CBC which is based on the American Society of Civil Engineers (ASCE) publication *Minimum Design Loads for Buildings and Other Structures* (ASCE 7-10). We used the USGS *US Seismic Design Maps* application to evaluate site-specific seismic design parameters in accordance with the 2016 CBC and ASCE 7-10. Results are summarized in Table 6.2.1. The values presented are for the risk-targeted maximum considered earthquake (MCE_R).

TABLE 6.2.1
2016 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2016 CBC / ASCE 7-10 Reference
Site Class	D	Section 1613.3.2/Table 20.3-1
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	1.500g	Figure 1613.3.1(1) / Figure 22-1
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.517g	Figure 1613.3.1(2) / Figure 22-2
Site Coefficient, F_A	1.0	Table 1613.3.3(1) / Table 11.4-1
Site Coefficient, F_V	1.5	Table 1613.3.3(2) / Table 11.4-2
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	1.5g	Eq. 16-37 / Eq. 11.4-1
Site Class Modified MCE_R Spectral Response Acceleration (1 sec), S_{M1}	0.775g	Eq. 16-38 / Eq. 11.4-2
5% Damped Design Spectral Response Acceleration (short), S_{DS}	1.0g	Eq. 16-39 / Eq. 11.4-3
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.517g	Eq. 16-40 / Eq. 11.4-4

6.2.2 Table 6.2.2 presents additional seismic design parameters for projects with 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
2016 CBC SITE ACCELERATION DESIGN PARAMETERS

Parameter	Value	ASCE 7-10 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.5g	Figure 22-7
Site Coefficient, F_{PGA}	1.0	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.5g	Section 11.8.3 (Eq. 11.8-1)

6.2.3 Conformance to the criteria presented in Tables 6.2.1 and 6.2.2 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a maximum level earthquake occurs. The primary goal of seismic design is to protect life and not to avoid structural damage, since such design may be economically prohibitive.

6.3 Soil and Excavation Characteristics

6.3.1 Based on the soils conditions encountered in our field explorations, we anticipate the onsite soils can be excavated with moderate effort using conventional excavation equipment. We do not

anticipate excavations in the native dune sands at the site will generate oversize material (greater than 6 inches in nominal dimension). Any artificial fills encountered at the site are undocumented and may contain constituents not reported herein.

6.3.2 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable Occupation Safety and Health Administration (OSHA) rules and regulations to maintain safety and maintain the stability of adjacent existing improvements.

6.3.3 The dune sands at the site are not considered expansive as defined by 2016 CBC. The recommendations of this report assume the building foundations will derive support in compacted fill materials or competent dune sand deposits.

6.4 Materials for Fill

6.4.1 Excavated soils generated from cut operations at the site should be suitable for use as engineered fill in structural areas provided they do not contain deleterious matter, organic material, or cementations larger than 6 inches in maximum dimension.

6.4.2 Import fill material should be well-graded with a very low expansion potential (Expansion Index less than 20), a Plasticity Index less than 15, be free of organic material and construction debris, and not contain rock larger than 6 inches in greatest dimension.

6.4.3 Environmental characteristics and corrosion potential of import soil materials may also be considered. Proposed import materials should be sampled, tested, and approved by Geocon prior to its transportation to the site.

6.5 Grading

6.5.1 All clearing operations and earthwork (including over-excavation, scarification, and recompaction) should be observed and all fills tested for recommended compaction and moisture content by representatives of Geocon.

6.5.2 Structural areas should be considered as areas extending a minimum of 5 feet horizontally from a foundation or beyond the outside dimensions of buildings, including footings and overhangs carrying structural loads, and where not restricted by property boundaries.

6.5.3 A preconstruction conference should be held at the site prior to the beginning of grading operations with the owner, contractor, civil engineer and geotechnical engineer in attendance. Special soil handling requirements can be discussed at that time.

6.5.4 After complete demolition and removal of any existing structures, site preparation should commence with the removal of all existing improvements from the area to be developed/graded. All active or inactive utilities within the construction area should be protected, relocated, or abandoned. Any pipelines to be abandoned that are greater than 2 inches and less than 18 inches in diameter should be removed or filled with sand-cement slurry. Utilities larger than 18 inches in diameter should be removed. Excavations or depressions resulting from site clearing

operations, or other existing excavations or depressions, should be restored with engineered fill in accordance with the recommendations of this report.

6.5.5 Following stripping operations, subgrade soils in the proposed building pad areas should be over-excavated to a depth of approximately 2 feet below existing grade or proposed grade, whichever is lower. The resultant over-excavation bottom should then be scarified to a depth of approximately 1 foot, moisture conditioned to near optimum moisture content and recompacted to at least 92% relative compaction. In general, over-excavated materials may be used for engineered fill provided they do not contain deleterious matter, organic material, or cementations larger than 6 inches in maximum dimension. Additional over-excavation may be recommended by our representatives in the field, based on the soils conditions encountered at the time of grading.

6.5.6 If grading commences in winter or spring, or in periods of precipitation, excavated and in-place soils may be wet. Earthwork contractors should be aware of potential compaction/workability difficulties. The most effective site preparation alternatives will depend on site conditions prior to and during grading operations; we should evaluate site conditions at those times and provide supplemental recommendations, if necessary.

6.5.7 All engineered fill should be placed in layers no thicker than will allow for adequate bonding and compaction (typically 8 inches). Fill soils should be placed, moisture conditioned to near optimum moisture content and compacted to at least 92% relative compaction. Fill areas with in-place density tests showing moisture contents below those recommended herein may require additional moisture conditioning, processing and recompaction prior to placing additional fill or constructing overlying improvements.

6.6 Temporary Excavations

6.6.1 We anticipate that the majority of the site dune sands will be classified as Cal-OSHA "Type B" or "Type C" soil when encountered in excavations during site development and construction. If active seepage, loose gravelly or sandy soil, or undocumented fills are encountered, the Cal-OSHA classification should be "Type C". Excavation sloping, benching, the use of trench shields, and the placement of trench spoils should conform to the latest applicable Cal-OSHA standards. The contractor should have a Cal-OSHA-approved "competent person" onsite during excavation to evaluate trench conditions and make appropriate recommendations where necessary.

6.6.2 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 and possibly shoring.

6.6.3 It is the contractor's responsibility to provide sufficient and safe excavation support as well as protecting nearby utilities, structures, and other improvements which may be damaged by earth movements.

6.6.4 Temporary excavations such as utility trench sidewalls within the dune sands should remain near vertical to depths of at least 3 feet below ground surface, although some sloughing and caving may occur, particularly if clean sandy or gravelly soils, undocumented fills or groundwater are encountered. Excavations greater than approximately 3 feet in height or those that are surcharged by adjacent traffic or structures may require sloping or shoring measures in order to provide a stable excavation.

6.6.5 Temporary excavations should be protected from rainfall and erosion. Surface runoff should be directed away from excavations or slopes.

6.7 Underground Utilities

6.7.1 Underground utility trenches should be backfilled with properly compacted material. The material excavated from the trenches should be adequate for use as backfill provided it does not contain deleterious matter, vegetation or rock larger than six inches in maximum dimension. Trench backfill should be placed in loose lifts not exceeding eight inches and compacted to at least 92% relative compaction at near optimum moisture content.

6.7.2 Bedding and pipe zone backfill typically extends from the bottom of the trench excavations to a minimum of six inches above the crown of the pipe. Pipe bedding material should consist of crushed aggregate, clean sand or similar open-graded material. Proposed bedding and pipe zone materials should be reviewed by Geocon prior to construction; materials such as ¾-inch drain rock may require wrapping with filter fabric to mitigate the potential for piping. Bedding and backfill should also conform to the requirements of the governing utility agency.

6.8 Shallow Foundations

6.8.1 The site is suitable for use of conventional foundations consisting of continuous strip or spread column footings founded in competent native alluvial materials or properly compacted fill. The following recommendations are based on the assumption that the soils within 5 feet of finish grade will consist of very low expansive materials (Expansion Index less than 20). Over-excavations may be required if soft or loose soils are encountered in footing excavations.

6.8.2 It is recommended that conventional shallow footings have a minimum embedment depth of 12 inches below lowest adjacent pad grade. Strip footings should be at least 12 inches wide. Spread column footings should be at least 3 feet square.

6.8.3 Footings proportioned as recommended may be designed for an allowable soil bearing pressure of 3,000 pounds per square foot (psf). The allowable bearing pressure is for dead + live loads and may be increased by up to one-third for transient loads due to wind or seismic forces.

6.8.4 The allowable passive pressure used to resist lateral movement may be assumed to be equal to a fluid weighing 300 pounds per cubic foot (pcf) for footings poured neat against properly compacted fills or undisturbed natural soils. The allowable passive pressure assumes a horizontal surface extending at least 5 feet or 3 times the surface generating the passive pressure, whichever is greater. The allowable coefficient of friction to resist sliding is 0.30 for concrete against soil. Combined passive resistance and friction may be utilized for design provided that the frictional

resistance is reduced by 50%. Where not protected by flatwork or pavement, the upper 1 foot of soil should be neglected when calculating passive resistance to lateral loads.

6.8.5 Minimum reinforcement for continuous footings should consist of four No. 4 steel reinforcing bars; two placed near the top of the footing and two near the bottom. Spread column footing reinforcement should be specified by the structural engineer.

6.8.6 The foundation dimensions and minimum reinforcement recommendations presented herein are based upon soil conditions only and are not intended to be used in lieu of those required for structural purposes.

6.8.7 Underground utilities running parallel to footings should not be constructed in the zone of influence of footings. The zone of influence may be taken to be the area beneath the footing and within a 1 ½:1 (horizontal:vertical) plane extending out and down from the bottom edge of the footing.

6.8.8 The use of isolated footings that are located beyond the perimeter of the building and support structural elements connected to the building are not recommended. Where this condition cannot be avoided, the isolated footings should be connected and tied to the building foundation system with grade beams.

6.8.9 The foundation subgrade should be sprinkled as necessary to maintain a moist condition without significant shrinkage cracks as would be expected in any concrete placement. Our representative should observe all footing excavations prior to placing reinforcing steel.

6.9 Retaining Wall Design

6.9.1 Lateral earth pressures may be used in the design of retaining walls and buried structures. Lateral earth pressures against these facilities may be assumed to be equal to the pressure exerted by an equivalent fluid. The unit weight of the equivalent fluid depends on the design conditions. Table 6.9 summarizes the weights of the equivalent fluid based on the different design conditions.

TABLE 6.9
RECOMMENDED LATERAL EARTH PRESSURES

Condition	Equivalent Fluid Density
Active	35 pcf
At-Rest	55 pcf

6.9.2 Unrestrained walls should be designed using the active case. Unrestrained walls are those that are allowed to rotate more than 0.001H (where H is the height of the wall). Walls restrained from movement such as basement walls should be designed using the at-rest case. The above soil pressures assume level backfill under drained conditions within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall and no surcharges within that same area.

6.9.3 Retaining wall foundations should be designed as continuous strip footings in accordance with Section 6.8.

6.9.4 Unless hydrostatic conditions are incorporated into design, retaining walls greater than 2 feet tall (retained height) should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and should be waterproofed as required by the project architect. Positive drainage for retaining walls should consist of a vertical layer of permeable material positioned between the retaining wall and the soil backfill. The permeable material may be composed of a composite drainage geosynthetic or a natural permeable material such as crushed gravel at least 12 inches thick and capped with at least 12 inches of native soil. A geosynthetic filter fabric should be placed between the gravel and the soil backfill. Provisions for removal of collected water should be provided for either system by installing a perforated drainage pipe along the bottom of the permeable material which leads to suitable drainage facilities.

6.10 Concrete Slabs-on-Grade

6.10.1 Concrete slabs-on-grade subject to vehicular loading are pavements should be designed in accordance with the recommendations in Section 6.12 of this report.

6.10.2 Concrete slabs-on-grade for structures should be a minimum of 4 inches thick and minimum slab reinforcement should consist of No. 3 steel reinforcing bars placed 24 inches on center in both horizontal directions. Steel reinforcing should be positioned vertically near the slab midpoint. Concrete slabs-on-grade should be underlain by at least 12 inches of low-expansive fill.

6.10.3 Interior slabs should also be underlain by 3 inches of ½-inch or ¾-inch crushed rock with no more than 5 percent passing the No. 200 sieve to serve as a capillary break. The crushed rock should be subjected to several passes with a walk-behind vibratory compactor or similar equipment prior to placing a vapor barrier or rebar for the slab-on-grade.

6.10.4 The slab-on-grade dimensions and minimum reinforcement recommendations presented herein are based upon soil conditions only and are not intended to be used in lieu of those required for structural purposes.

6.10.5 Crack control joints for slabs-on-grade should be spaced at intervals not greater than 8 feet and should be constructed using saw-cuts or other methods as soon as practical following concrete placement. Crack control joints should extend a minimum depth of one-fourth the slab thickness. Construction joints should be designed by the project structural engineer.

6.10.6 The recommendations of this report are intended to reduce the potential for cracking of slabs due to soil movement. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade may exhibit some cracking due to soil movement. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled 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.

6.11 Moisture Protection Considerations

6.11.1 A vapor barrier is not required beneath slabs-on-grade for geotechnical purposes. Further, the migration of moisture through concrete slabs or moisture otherwise released from slabs is not a geotechnical issue. However, for the convenience of the owner, we are providing the following general suggestions for consideration by the owner, architect, structural engineer, and contractor. The suggested procedures may reduce the potential for moisture-related floor covering failures on concrete slabs-on-grade, but moisture problems may still occur even if the procedures are followed. If more detailed recommendations are desired, we recommend consulting a specialist in this field. If a vapor barrier is used beneath mat slab foundations, we should review the geotechnical design parameters presented herein.

6.11.2 A vapor barrier meeting ASTM E 1745-09 Class C requirements may be placed directly below the slab, without a sand cushion. To reduce the potential for punctures, a higher quality vapor barrier (15 mil, Class A or B) should be used. The vapor barrier, if used, should extend to the edges of the slab, and should be sealed at all seams and penetrations.

6.11.3 The concrete water/cement ratio should be as low as possible. The water/cement ratio should not exceed 0.45 for concrete placed directly on the vapor barrier. Midrange plasticizers could be used to facilitate concrete placement and workability.

6.11.4 Proper finishing, curing, and moisture vapor emission testing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.

6.12 Pavement Recommendations

6.12.1 The upper 12 inches of pavement subgrade should be scarified, moisture conditioned to near optimum and compacted to at least 95% relative compaction. Prior to placing aggregate base, the finished subgrade should be proof-rolled with a laden water truck (or similar equipment with high contact pressure) to verify stability.

6.12.2 Sidewalk, curb and gutter, and driveway encroachments should be designed and constructed in accordance with City of Antioch requirements, as applicable.

6.12.3 We recommend the following asphalt concrete (AC) pavement sections for design to establish subgrade elevations in pavement areas. The project civil engineer should determine the appropriate Traffic Index (TI) based on anticipated traffic conditions. The flexible pavement sections below are based on estimated design TIs. We can provide additional sections based on other TIs if necessary.

TABLE 6.12
FLEXIBLE PAVEMENT SECTION RECOMMENDATIONS

Location	Estimated Traffic Index (TI)	AC Thickness (inches)	Class 2 AB Thickness (inches)
Parking Stalls	4.5	3	4
Driveways	6.0	3½	4
Heavy-Duty	7.0	4	6

Note: The recommended flexible pavement sections are based on the following assumptions:

1. Subgrade soil has an R-Value of 50.
2. AB: Class 2 AB with a minimum R-Value of 78 and meeting the requirements of Section 26 of the latest Caltrans Standard Specifications.
3. AB is compacted to 95% or higher relative compaction at or near optimum moisture content. Prior to placing AB, the subgrade should be proof-rolled with a loaded water truck to verify stability.
4. AC: Asphalt concrete conforming to local agency standards or Section 39 of the latest Caltrans Standard Specifications.

6.12.4 The AC sections in Table 6.12 are final, minimum thicknesses. If staged-pavements are used, the construction bottom AC lift should be at least 2 inches thick. Following construction, the finish top AC lift should be at least 1.5 inches thick

6.12.5 Unless specifically designed and evaluated by the project structural engineer, where concrete paving will be utilized for support of vehicles, we recommend the concrete be a minimum of 6 inches thick and reinforced with No. 3 steel reinforcing bars placed 24 inches on center in both horizontal directions. In addition, doweling, reinforcing steel or other load-transfer mechanism should be provided at joints if desired to reduce the potential for vertical offset. The concrete should have a minimum 28-day compressive strength of 3,500 psi.

6.12.6 We recommend that at least 6 inches of Class 2 Aggregate Base (Class 2 AB) be used below rigid concrete pavements. The aggregate base should be compacted to at least 95% relative compaction near optimum moisture content.

6.12.7 In general, we recommend that concrete pavements be designed, constructed and maintained in accordance with industry standards such as those provided by the American Concrete Pavement Association.

6.12.8 The performance of pavements is highly dependent upon providing positive surface drainage away from the edge of pavements. Ponding of water on or adjacent to the pavement will likely result in saturation of the subgrade materials and subsequent cracking, subsidence and pavement distress. If planters are planned adjacent to paving, it is recommended that the perimeter curb be extended at least 6 inches below the bottom of the aggregate base to minimize the introduction of water beneath the paving. Alternatives such as plastic moisture cut-offs or modified drop-inlets may also be considered in lieu of deepened curbs.

6.12.9 Asphalt pavement section recommendations for driveways and parking areas are based on Caltrans design procedures. It should be noted that most rational pavement design procedures are

based on projected street or highway traffic conditions and, hence, may not be representative of vehicular loading that occurs in parking lots and driveways. Pavement proximity to landscape irrigation, reduced traffic speed and short turning radii increase the potential for pavement distress to occur in parking lots even though the volume of traffic is significantly less than that of an adjacent street. The Caltrans *Highway Design Manual* indicates that the resulting pavement sections for parking lots are minimized to keep initial costs down but are reasonable because additional AC surfacing can be added later, if needed, and generally without incurring traffic hazards or traffic handling problems. It is generally not economically feasible to design and construct the entire parking lot and driveways for the unique loading conditions previously described. Periodic maintenance of the pavement in these areas, therefore, should be anticipated.

6.12.10 We recommend that all retaining wall designs be reviewed by Geocon to confirm the incorporation of the recommendations provided herein. In particular, potential surcharges from adjacent structures and other improvements should be reviewed by Geocon.

6.13 Exterior Slabs

6.13.1 Exterior slabs, not subject to traffic loads, should be at least 4 inches thick and reinforced with No. 3 steel reinforcing bars placed 24 inches on center in both horizontal directions, positioned near the slab midpoint.

6.13.2 A layer of aggregate base beneath exterior flatwork is not required for geotechnical purposes. Consideration may be given to providing at least 4 inches of Class 2 AB beneath exterior flatwork to provide a more uniform support characteristic and reduce cosmetic cracking, consideration. The aggregate base should be compacted to at least 95% relative compaction near optimum moisture content. Prior to placing aggregate base, the subgrade should be moisture conditioned to near optimum and properly compacted to at least 90% relative compaction.

6.13.3 The slab-on-grade dimensions and minimum reinforcement recommendations presented herein are based upon soil conditions only and are not intended to be used in lieu of those required for structural purposes.

6.13.4 Crack control joints for slabs-on-grade should be spaced at intervals not greater than 8 feet for 4-inch slabs and should be constructed using saw-cuts or other methods as soon as practical following concrete placement. Crack control joints should extend a minimum depth of one-fourth the slab thickness. Construction joints should be designed by the project structural engineer.

6.13.5 The recommendations of this report are intended to reduce the potential for cracking of slabs due to soil movement. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade may exhibit some cracking due to soil movement. This is common for project areas that contain expansive soils since designing to eliminate potential soil movement is cost prohibitive. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled 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.

6.14 Surface Drainage

6.14.1 Proper surface drainage is critical to the future performance of the project. Uncontrolled infiltration of irrigation excess and storm runoff into the soils can adversely affect the performance of the planned improvements. Saturation of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change to important engineering properties. Proper drainage should be maintained at all times.

6.14.2 All site drainage should be collected and transferred to the street in non-erosive drainage devices. Drainage should not be allowed to pond anywhere on the site, and especially not against any foundations or retaining walls. Drainage should not be allowed to flow uncontrolled over any descending slope. The proposed structures should be provided with roof gutters. Discharge from downspouts, roof drains and scuppers not permitted onto unprotected soils within five feet of the building perimeter. Planters which are located adjacent to foundations should be sealed or properly drained to prevent moisture intrusion into the materials providing foundation support. Landscape irrigation within five feet of the building perimeter footings should be kept to a minimum to just support vegetative life.

6.14.3 Positive site drainage should be provided away from structures, pavement, and the tops of slopes to swales or other controlled drainage structures. The building pad and pavement areas should be fine graded such that water is not allowed to pond. Final soil grade should slope a minimum of 2% away from structures.

6.14.4 We recommend implemented measures to reduce infiltrating surface water near buildings and slabs-on-grade. Such measures may include:

- Selecting drought-tolerant plants that require little or no irrigation, especially within 3 feet of buildings, slabs-on-grade, or pavements.
- Using drip irrigation or low-output sprinklers.
- Using automatic timers for irrigation systems.
- Appropriately spaced area drains.
- Hard-piping roof downspouts to appropriate collection facilities.

7. FURTHER GEOTECHNICAL SERVICES

7.1 Plan and Specification Review

7.1.1 We should review project plans and specifications prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required.

7.2 Testing and Observation Services

7.2.1 The recommendations provided in this report are based on the assumption that we will continue as Geotechnical Engineer of Record throughout the construction phase and provide compaction testing and observation services and foundation observations throughout the project. It is important to maintain continuity of geotechnical interpretation and confirm that field conditions encountered are similar to those anticipated during design. If we are not retained for these services, we cannot assume any responsibility for others interpretation of our recommendations, and therefore the future performance of the project.

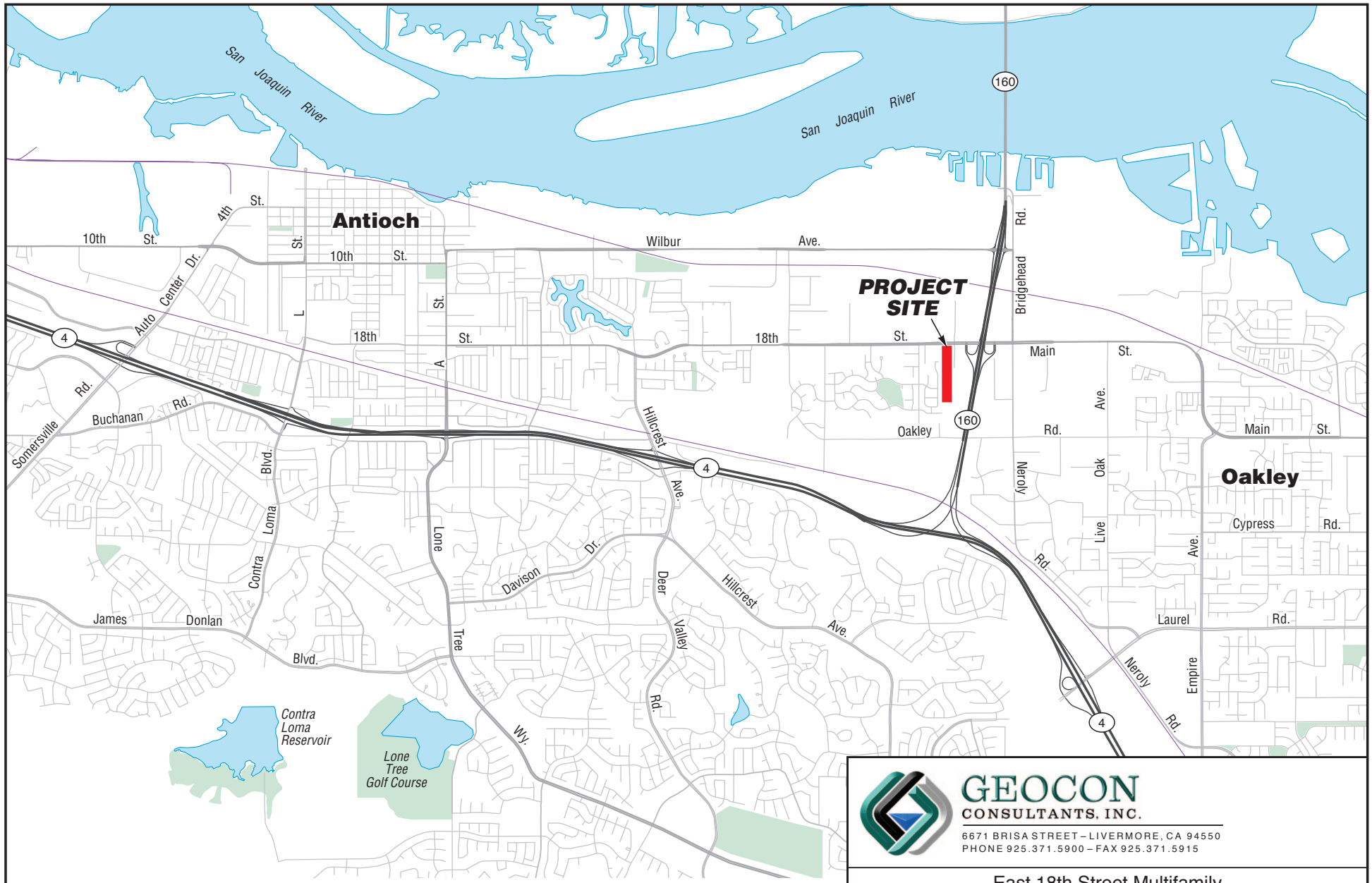
LIMITATIONS AND UNIFORMITY OF CONDITIONS

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 Consultants, Inc. should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the geotechnical scope of services provided by Geocon Consultants, Inc.

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.

The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether 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.

Our professional services were performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices used in the site area at this time. No warranty is provided, express or implied.



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East 18th Street Multifamily

3560 East 18th Street
Antioch, California

VICINITY MAP

E9049-04-01	March 2018	Figure 1

LEGEND:

HA1 Approximate Percolation Test Location

CPT1 Approximate Cone Penetrometer Test (CPT) Location

B1 Approximate Location of Soil Boring by Others (Kleinfelder, 2008)

0 150

Scale in Feet

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SITE PLAN

E9049-04-01	March 2018	Figure 2

APPENDIX A

APPENDIX A
FIELD EXPLORATION

Fieldwork for our investigation included a site visit, subsurface exploration, and soil sampling. The locations of our exploratory borings and CPTs are shown on the Site Plan, Figure 2. Soil boring and CPTs logs for our exploration are presented as figures following the text in this appendix. The exploratory borings and CPTs were located in the field by pacing from existing reference points. Therefore, the exploration locations shown on Figure 2 are approximate. Our subsurface explorations were performed on February 20 and 26, 2018.

Three soil borings were advanced to maximum depths of approximately 4 ½ feet or less using hand augers. Sampling in the borings was accomplished using a downhole-wireline 140-pound hammer with a 30-inch drop. Samples were collected at appropriate intervals, classified by our field engineer, retained in moisture-tight containers, and transported to the laboratory for testing and further classification. Each sampling interval is noted on the exploratory boring logs. Borehole percolation testing was performed in each hand auger boring after excavation. Results of our percolation testing are presented as Figures A9 through A11.

Subsurface conditions encountered in the exploratory boring were visually examined, classified and logged in general accordance with the American Society for Testing and Materials (ASTM) Practice for Description and Identification of Soils (Visual-Manual Procedure D2488). This system uses the Unified Soil Classification System (USCS) for soil designations. The log depicts soil and geologic conditions encountered and depths at which samples were obtained. The log also includes our interpretation of the conditions between sampling intervals. Therefore, the logs contain both observed and interpreted data. We determined the lines designating the interface between soil materials on the logs using visual observations, drill rig penetration rates, excavation characteristics and other factors. The transition between materials may be abrupt or gradual. Where applicable, the field log was revised based on subsequent laboratory testing.

Our field exploration included the advancement of four CPT soundings to maximum depths of approximately 60 ½ feet below the existing ground surface utilizing a truck-mounted CPT rig with a down-pressure capacity of approximately 20 tons. The cone has a tip area of 10 cm^2, a friction sleeve area of 150 cm^2, and a ratio of friction sleeve area to tip end area equal to 0.85. The cone bearing (Q_c) and sleeve friction (F_s) were measured and recorded during tests at approximately 2-inch depth intervals. The CPT data consisting of cone bearing, sleeve friction, friction ratio and equivalent standard penetration blow counts (N) versus penetration depth below the existing ground surface for each location has been recorded and is presented in this appendix. Upon completion, our boreholes were backfilled per Contra Costa County Environmental Health Division permit requirements.

PROJECT NO. **E9049-04-01** PROJECT NAME: **AMCAL Antioch - E. 18th St.**

BORING HA1

ELEV. (MSL.) _____ DATE COMPLETED **2/26/2018**

ENG./GEO. **JBM** DRILLER **Geocon**

EQUIPMENT **Hand Auger** HAMMER TYPE _____

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	HA1-0-1			SM	Dense, damp, light orange-brown to brown, Silty (f) SAND with few (m-c) gravels			7.9
1					-no gravels, less silt			
	HA1-1.5-3			SP-SM	Dense, damp to moist, orange-brown, (f) SAND with few silts			4.1
2								
3								
4								
					END OF HAND AUGER AT APPROXIMATELY 4½ FEET NO FREE WATER ENCOUNTERED BACKFILLED WITH COMPACTED CUTTINGS AFTER PERCOLATION TESTING			

Figure A2, Log of Boring HA1, page 1 of 1

GEOCON BORING LOG E9049-04-01 BORING LOGS 2.28.18.GPJ 03/07/18

GEOCON

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. **E9049-04-01** PROJECT NAME: **AMCAL Antioch - E. 18th St.**

BORING HA2

ELEV. (MSL.) _____ DATE COMPLETED **2/26/2018**

ENG./GEO. **JBM** DRILLER **Geocon**

EQUIPMENT **Hand Auger** HAMMER TYPE _____

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	HA2-0-1			SM	Dense, moist, orange-brown, Silty (f) SAND with trace (m-c) gravels			5.7
1					-less silt, no gravels			
	HA2-1.5-3				-brown			6.5
2					-with trace (m) rounded gravels			
3					END OF HAND AUGER AT APPROXIMATELY 3 FEET NO FREE WATER ENCOUNTERED BACKFILLED WITH COMPACTED CUTTINGS AFTER PERCOLATION TESTING			

Figure A3, Log of Boring HA2, page 1 of 1

GEOCON BORING LOG E9049-04-01 BORING LOGS 2.28.18.GPJ 03/07/18

GEOCON

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. **E9049-04-01** PROJECT NAME: **AMCAL Antioch - E. 18th St.**

BORING HA3

ELEV. (MSL.) _____ DATE COMPLETED **2/26/2018**

ENG./GEO. **JBM** DRILLER **Geocon**

EQUIPMENT **Hand Auger** HAMMER TYPE _____

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	HA3-0-1			SM	Dense, moist, light orange-brown, Silty (f) SAND with few clays and (m-c) gravels			16.3
1					-less silt, no clay -trace to no gravels			
2					-brown			
	HA3-2-4			SP-SM				5.3
3					-tan, less silt			
4								
					END OF HAND AUGER AT APPROXIMATELY 4½ FEET NO FREE WATER ENCOUNTERED BACKFILLED WITH COMPACTED CUTTINGS AFTER PERCOLATION TESTING			

Figure A4, Log of Boring HA3, page 1 of 1

GEOCON BORING LOG E9049-04-01 BORING LOGS 2.28.18.GPJ 03/07/18

GEOCON

SAMPLE SYMBOLS

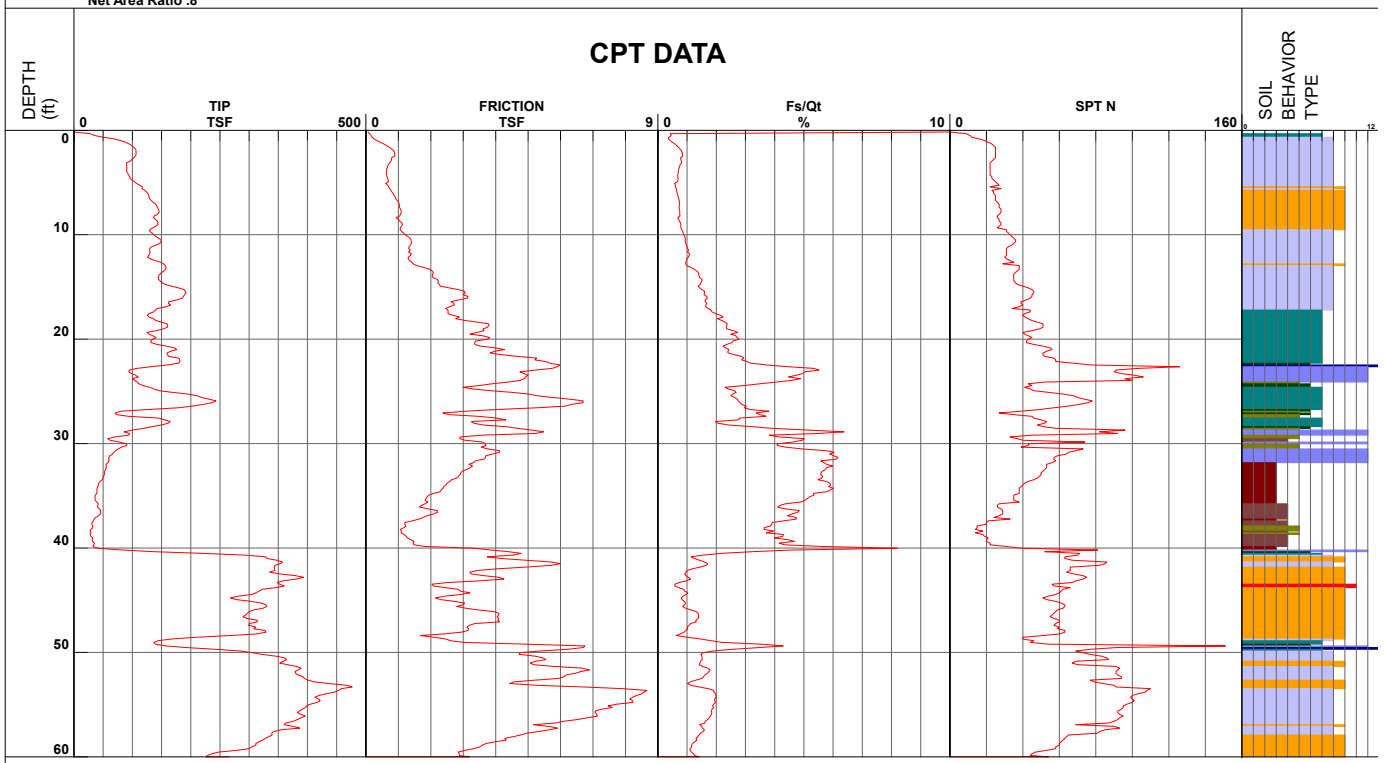
☐ ... SAMPLING UNSUCCESSFUL ◧ ... STANDARD PENETRATION TEST ■ ... DRIVE SAMPLE (UNDISTURBED)

⊠ ... 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	AMCAL Antioch	Operator	RB-JO	Filename	SDF(079).cpt
Job Number	E9049-04-01	Cone Number	DDG1418	GPS	
Hole Number	CPT-01	Date and Time	2/20/2018 7:41:54 AM	Maximum Depth	60.53 ft
EST GW Depth During Test		31.00 ft			

Net Area Ratio .8



Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

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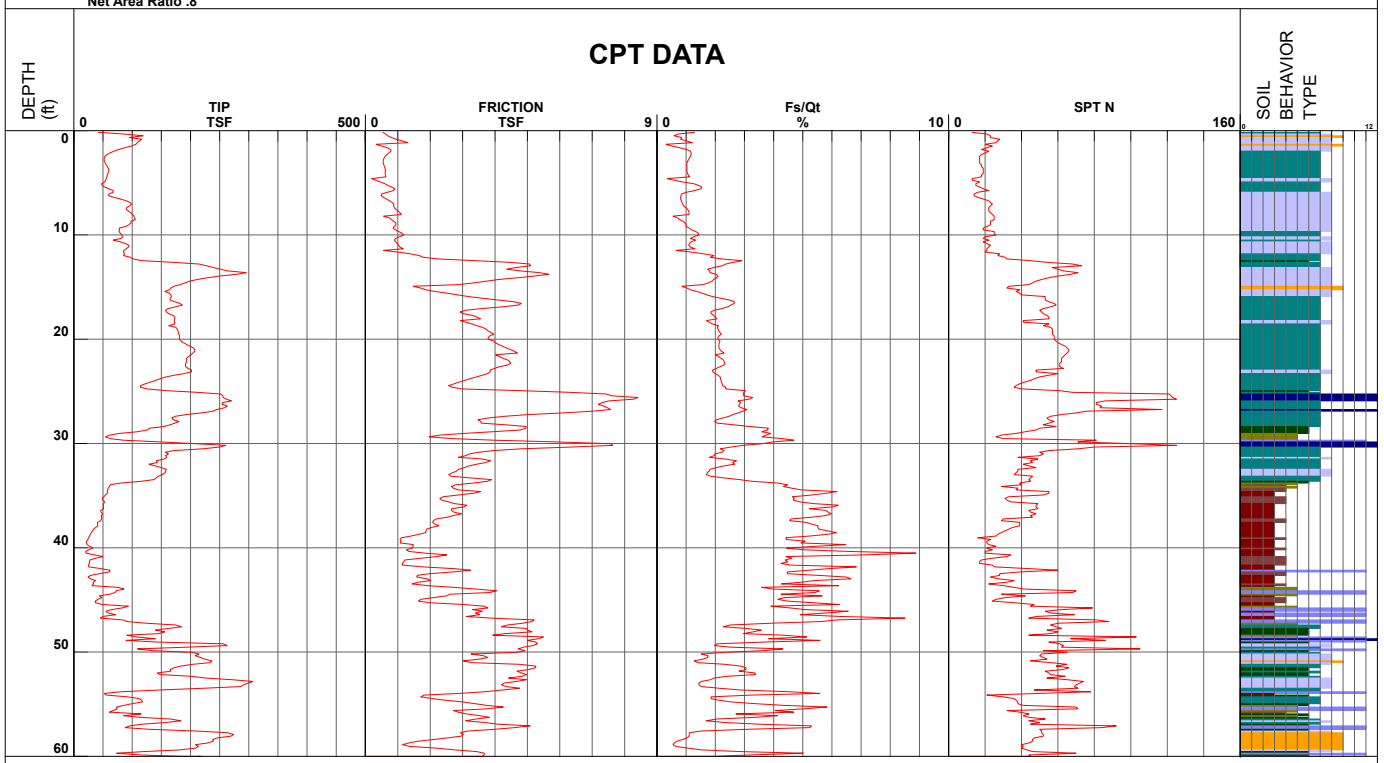
CONE PENETROMETER TEST PROFILE
CPT 1

Project: East 18th Street MF
Location: Antioch, California
Project No. E9049-04-01
Date: March 2018

FIGURE A5

Project	AMCAL Antioch	Operator	RB-JO	Filename	SDF(080).cpt
Job Number	E9049-04-01	Cone Number	DDG1418	GPS	
Hole Number	CPT-02	Date and Time	2/20/2018 9:11:31 AM	Maximum Depth	60.53 ft
EST GW Depth During Test		34.00 ft			

Net Area Ratio .8



Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

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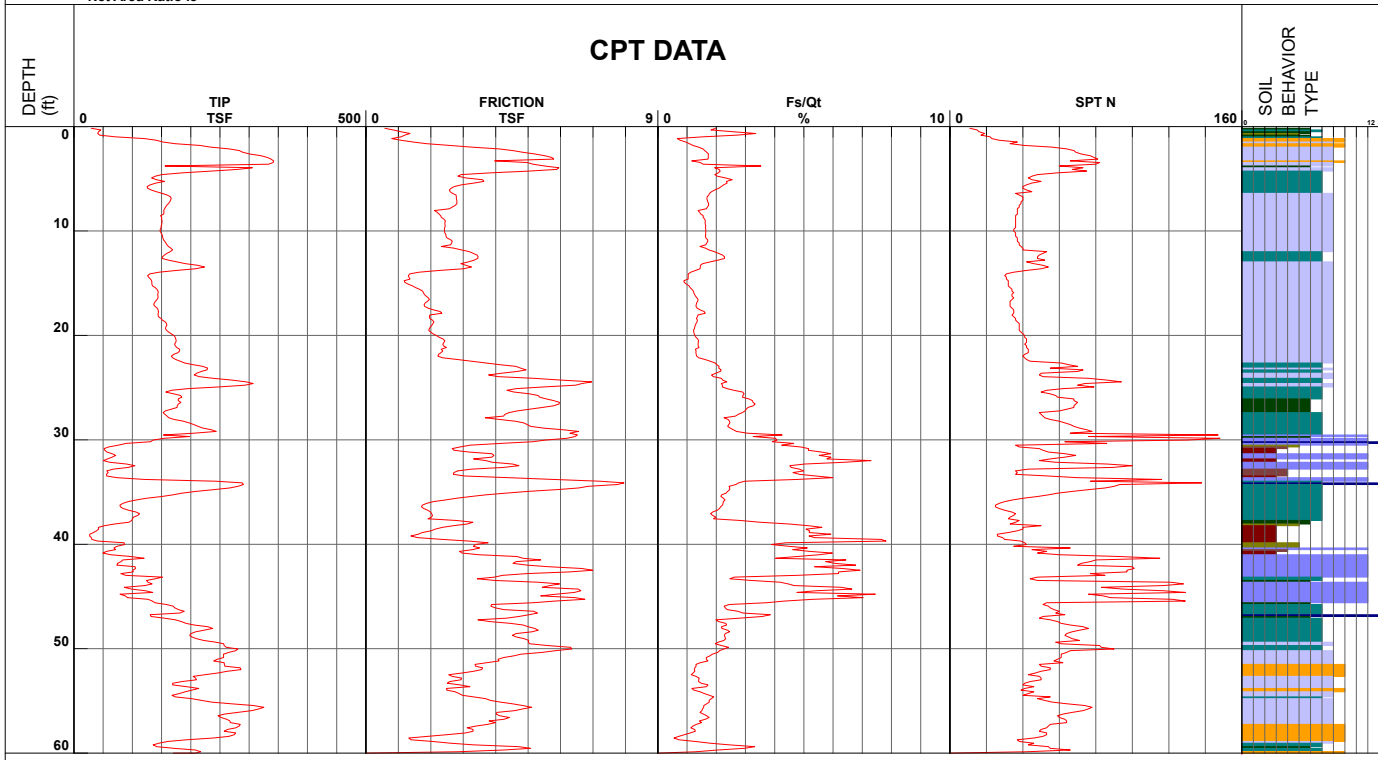
CONE PENETROMETER TEST PROFILE
CPT 2

Project: East 18th Street MF
Location: Antioch, California
Project No. E9049-04-01
Date: March 2018

FIGURE A6

Project	AMCAL Antioch	Operator	RB-JO	Filename	SDF(081).cpt
Job Number	E9049-04-01	Cone Number	DDG1418	GPS	
Hole Number	CPT-03	Date and Time	2/20/2018 10:23:42 AM	Maximum Depth	60.37 ft
EST GW Depth During Test		39.00 ft			

Net Area Ratio .8



Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

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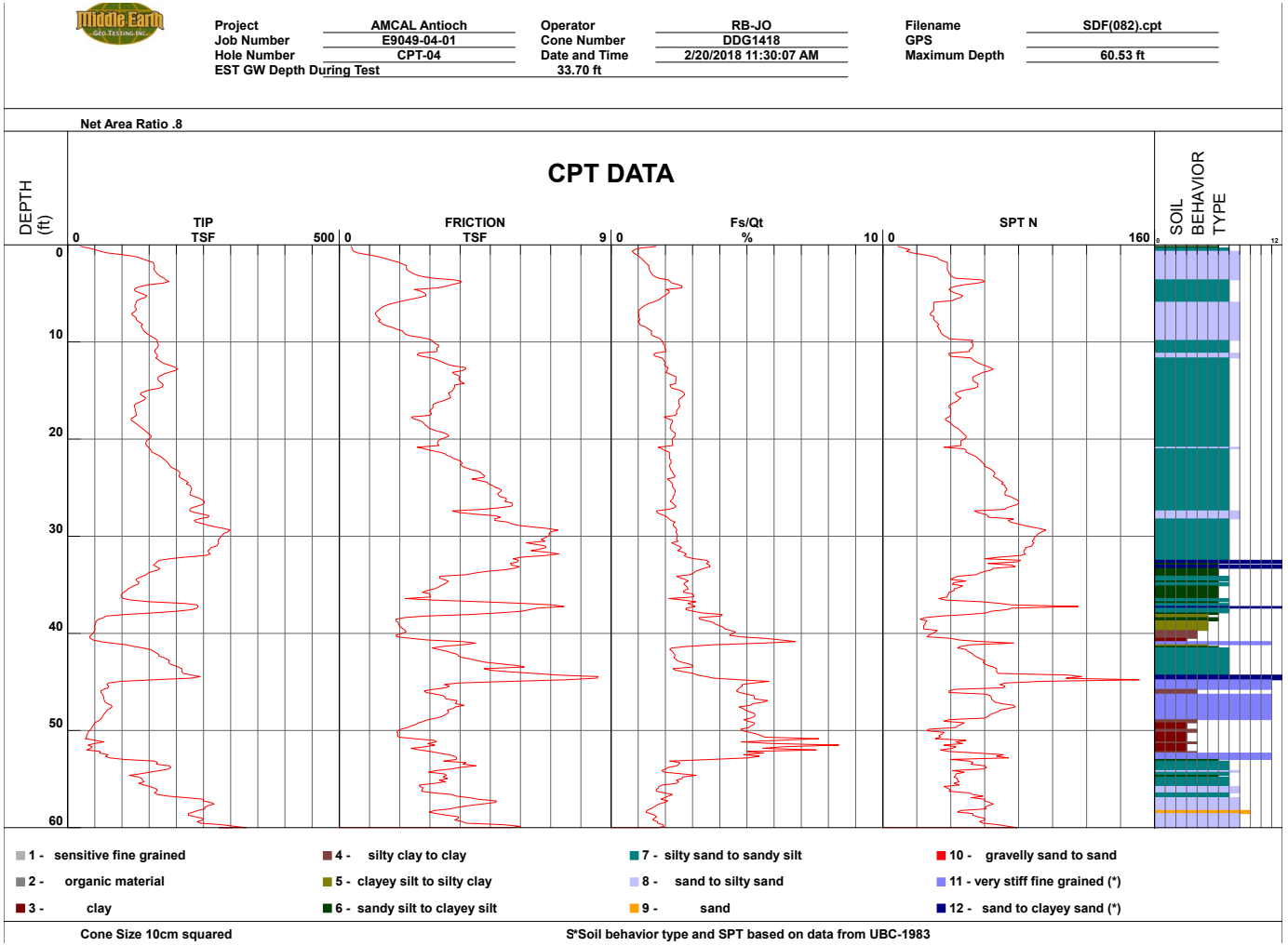
CONE PENETROMETER TEST PROFILE
CPT 3

Project: East 18th Street MF
Location: Antioch, California
Project No. E9049-04-01
Date: March 2018

FIGURE A7



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CONE PENETROMETER TEST PROFILE
CPT 4

Project: East 18th Street MF
Location: Antioch, California
Project No. E9049-04-01
Date: March 2018

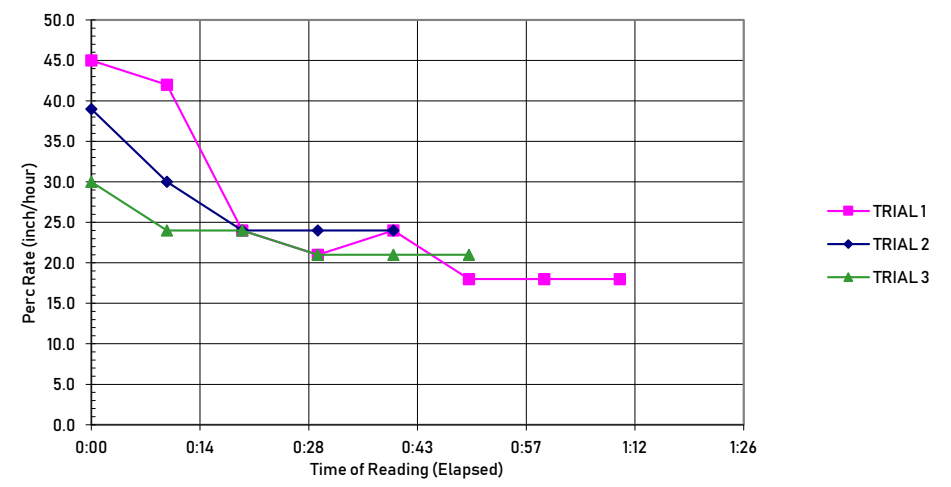
FIGURE A8

Excavation Details

Percolation Hole #:	HA1	Test Duration:	80, 50, 60	minutes
Date Excavated:	2/26/2018	Hole Depth:	4 ½	feet
Date Presaturated:	2/26/2018	Hole Diameter:	3	inch
Date Tested:	2/26/2018	Soil Type:	See Boring Log	USCS

Percolation Measurements

Time	Interval (minute)	Time Elapsed	Recorded Level (inches)	Fall (feet)	Percolation Rate (inch/hour)	Percolation Rate (minute/inch)	Comments
TRIAL 1							
9:44	0:00	0:00	0.00				Begin Test
9:54	0:10	0:10	7.50	0.63	45.0	1.3	
10:04	0:10	0:20	14.50	0.58	42.0	1.4	
10:14	0:10	0:30	18.50	0.33	24.0	2.5	
10:24	0:10	0:40	22.00	0.29	21.0	2.9	
10:34	0:10	0:50	26.00	0.33	24.0	2.5	
10:44	0:10	1:00	29.00	0.25	18.0	3.3	
10:54	0:10	1:10	32.00	0.25	18.0	3.3	
11:04	0:10	1:20	35.00	0.25	18.0	3.3	End Test, refill
TRIAL 2							
11:06	0:00	0:00	0.00				Begin Test
11:16	0:10	0:10	6.50	0.54	39.0	1.5	
11:26	0:10	0:20	11.50	0.42	30.0	2.0	
11:36	0:10	0:30	15.50	0.33	24.0	2.5	
11:46	0:10	0:40	19.50	0.33	24.0	2.5	
11:56	0:10	0:50	23.50	0.33	24.0	2.5	End Test, refill
TRIAL 3							
12:04	0:00	0:00	0.00				Begin Test
12:14	0:10	0:10	5.00	0.42	30.0	2.0	
12:24	0:10	0:20	9.00	0.33	24.0	2.5	
12:34	0:10	0:30	13.00	0.33	24.0	2.5	
12:44	0:10	0:40	16.50	0.29	21.0	2.9	
12:54	0:10	0:50	20.00	0.29	21.0	2.9	
13:04	0:10	1:00	23.50	0.29	21.0	2.9	End Test



Avg. Stabilized Percolation Rate (in/hr)	Avg. Stabilized Percolation Rate (min/in)
21	2.9

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Borehole Percolation Test

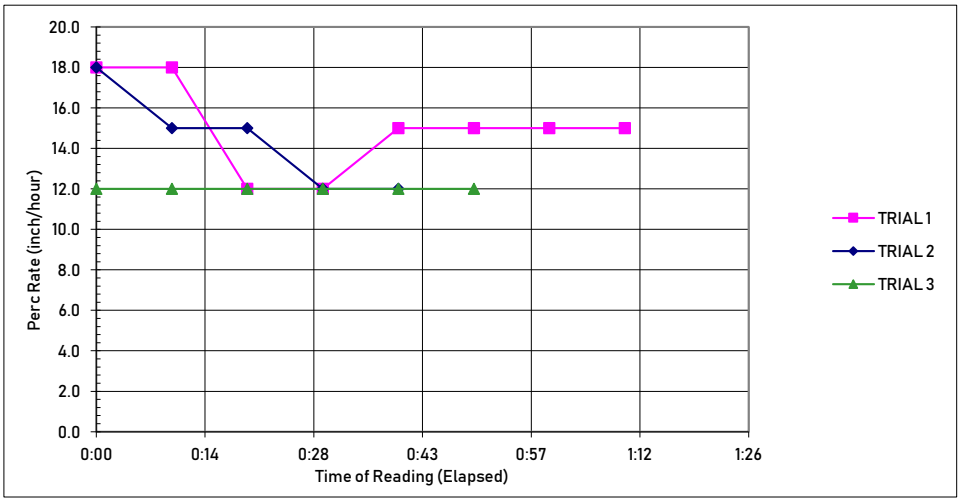
Project: AMCAL Antioch
Location: Antioch, CA
Number: E9049-04-01
Figure: A9

Excavation Details

Percolation Hole #:	HA2	Test Duration:	80, 50, 60	minutes
Date Excavated:	2/26/2018	Hole Depth:	3	feet
Date Presaturated:	2/26/2018	Hole Diameter:	3	inch
Date Tested:	2/26/2018	Soil Type:	See Boring Log	USCS

Percolation Measurements

Time	Interval (minute)	Time Elapsed	Recorded Level (inches)	Fall (feet)	Percolation Rate (inch/hour)	Percolation Rate (minute/inch)	Comments
TRIAL 1							
9:44	0:00	0:00	0.00				Begin Test
9:54	0:10	0:10	3.00	0.25	18.0	3.3	
10:04	0:10	0:20	6.00	0.25	18.0	3.3	
10:14	0:10	0:30	8.00	0.17	12.0	5.0	
10:24	0:10	0:40	10.00	0.17	12.0	5.0	
10:34	0:10	0:50	12.50	0.21	15.0	4.0	
10:44	0:10	1:00	15.00	0.21	15.0	4.0	
10:54	0:10	1:10	17.50	0.21	15.0	4.0	
11:04	0:10	1:20	20.00	0.21	15.0	4.0	End Test, refill
TRIAL 2							
11:06	0:00	0:00	0.00				Begin Test
11:16	0:10	0:10	3.00	0.25	18.0	3.3	
11:26	0:10	0:20	5.50	0.21	15.0	4.0	
11:36	0:10	0:30	8.00	0.21	15.0	4.0	
11:46	0:10	0:40	10.00	0.17	12.0	5.0	
11:56	0:10	0:50	12.00	0.17	12.0	5.0	End Test, refill
TRIAL 3							
12:04	0:00	0:00	0.00				Begin Test
12:14	0:10	0:10	2.00	0.17	12.0	5.0	
12:24	0:10	0:20	4.00	0.17	12.0	5.0	
12:34	0:10	0:30	6.00	0.17	12.0	5.0	
12:44	0:10	0:40	8.00	0.17	12.0	5.0	
12:54	0:10	0:50	10.00	0.17	12.0	5.0	
13:04	0:10	1:00	12.00	0.17	12.0	5.0	End Test



Avg. Stabilized Percolation Rate (in/hr)	Avg. Stabilized Percolation Rate (min/in)
12	5

Geocon Consultants, Inc.
6671 Brisa Street
Livermore, California 94550
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Borehole Percolation Test

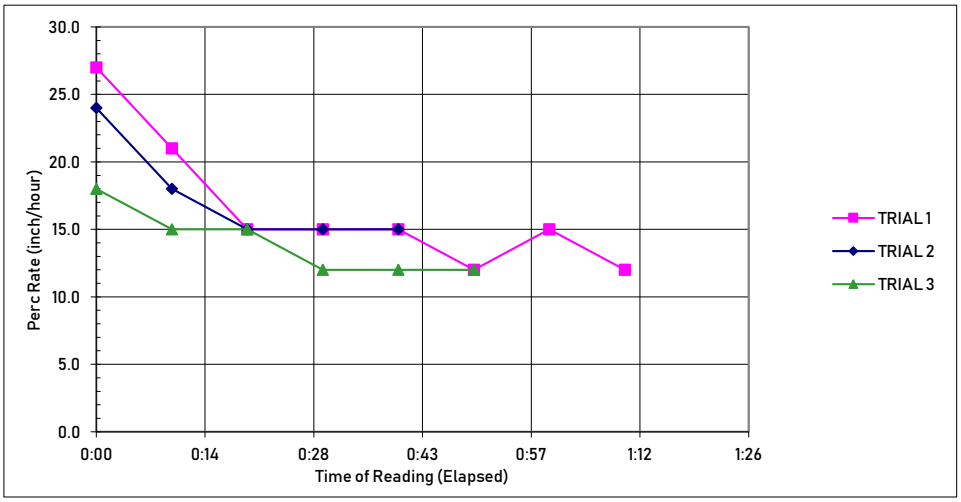
Project: AMCAL Antioch
Location: Antioch, CA
Number: E9049-04-01
Figure: A10

Excavation Details

Percolation Hole #:	HA3	Test Duration:	80, 50, 60	minutes
Date Excavated:	2/26/2018	Hole Depth:	3	feet
Date Presaturated:	2/26/2018	Hole Diameter:	3	inch
Date Tested:	2/26/2018	Soil Type:	See Boring Log	USCS

Percolation Measurements

Time	Interval (minute)	Time Elapsed	Recorded Level (inches)	Fall (feet)	Percolation Rate (inch/hour)	Percolation Rate (minute/inch)	Comments
TRIAL 1							
9:44	0:00	0:00	0.00				Begin Test
9:54	0:10	0:10	4.50	0.38	27.0	2.2	
10:04	0:10	0:20	8.00	0.29	21.0	2.9	
10:14	0:10	0:30	10.50	0.21	15.0	4.0	
10:24	0:10	0:40	13.00	0.21	15.0	4.0	
10:34	0:10	0:50	15.50	0.21	15.0	4.0	
10:44	0:10	1:00	17.50	0.17	12.0	5.0	
10:54	0:10	1:10	20.00	0.21	15.0	4.0	
11:04	0:10	1:20	22.00	0.17	12.0	5.0	End Test, refill
TRIAL 2							
11:06	0:00	0:00	0.00				Begin Test
11:16	0:10	0:10	4.00	0.33	24.0	2.5	
11:26	0:10	0:20	7.00	0.25	18.0	3.3	
11:36	0:10	0:30	9.50	0.21	15.0	4.0	
11:46	0:10	0:40	12.00	0.21	15.0	4.0	
11:56	0:10	0:50	14.50	0.21	15.0	4.0	End Test, refill
TRIAL 3							
12:04	0:00	0:00	0.00				Begin Test
12:14	0:10	0:10	3.00	0.25	18.0	3.3	
12:24	0:10	0:20	5.50	0.21	15.0	4.0	
12:34	0:10	0:30	8.00	0.21	15.0	4.0	
12:44	0:10	0:40	10.00	0.17	12.0	5.0	
12:54	0:10	0:50	12.00	0.17	12.0	5.0	
13:04	0:10	1:00	14.00	0.17	12.0	5.0	End Test



Avg. Stabilized Percolation Rate (in/hr)	Avg. Stabilized Percolation Rate (min/in)
13.3	4.5

Geocon Consultants, Inc.
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Borehole Percolation Test

Project: AMCAL Antioch
Location: Antioch, CA
Number: E9049-04-01
Figure: A11

APPENDIX B

APPENDIX B
LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. Selected samples were tested for grain size distribution and screening-level corrosion parameters.

TABLE B-I
SUMMARY OF LABORATORY GRAIN SIZE ANALYSIS – NO. 200 WASH
ASTM D1140

Boring No.	Sample Depth (feet)	Fraction Passing No. 200 Sieve (%)
HA1	0-1	36
HA1	1.5-3	6
HA2	0-1	30
HA2	1.5-3	16
HA3	0-1	39
HA3	2-4	9

TABLE B-II
SUMMARY OF SOIL CORROSION PARAMETERS
(CTM 643, CTM 417, CTM 422)

Boring No. (sample depth in feet)	Soil Type (USCS Classification)	Resistivity (ohm-cm)	pH	Chloride (ppm)	Sulfate (ppm)
HA1 (0-1)	Silty SAND (SM)	3,200	7.8	66	<10
HA2 (1.5-3)	Silty SAND (SM)	5,900	7.6	66	10
HA3 (0-1)	Silty SAND (SM)	970	8.1	164	840

*Caltrans considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil samples at the site:

- The pH is equal to or less than 5.5.
- Chloride concentration is equal to or greater than 500 parts per million (ppm) or 0.05%.
- Sulfate concentration is equal to or greater than 2,000 ppm (0.2%)

**According to the American Concrete Institute 318 Chapter 19, Type II cement may be used where sulfate levels are below 2,000 ppm (0.2%)

APPENDIX C

APPENDIX C
SOIL BORING LOGS AND LABORATORY TESTING BY OTHERS

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			USCS SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	GRAVELS (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid limit less than 50)		ML	INORGANIC SILTS & VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid limit greater than 50)		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

KLEINFELDER

Drafted By: G. GOMEZ
Date: 2/7/2008
Project No.: 90644.G01
File Number: STO8G006

UNIFIED SOIL CLASSIFICATION SYSTEM
COMMERCIAL DEVELOPMENT
E. 18th STREET & HOLUB LANE
ANTIOCH, CALIFORNIA

PLATE
A-1

KA-USCS STO8G006.GPJ 2/7/08

LOG SYMBOLS

	BULK / BAG SAMPLE	-4	PERCENT FINER THAN THE NO. 4 SIEVE (ASTM Test Method C 136)
	MODIFIED CALIFORNIA SAMPLER (2-1/2 inch outside diameter)	-200	PERCENT FINER THAN THE NO. 200 SIEVE (ASTM Test Method C 117)
	CALIFORNIA SAMPLER (3 inch outside diameter)	LL	LIQUID LIMIT (ASTM Test Method D 4318)
	STANDARD PENETRATION SPLIT SPOON SAMPLER (2 inch outside diameter)	PI	PLASTICITY INDEX (ASTM Test Method D 4318)
	CONTINUOUS CORE	TXCU	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (EM 1110-1-1906)
	SHELBY TUBE	EI	EXPANSION INDEX (UBC STANDARD 18-2)
	ROCK CORE	COL	COLLAPSE POTENTIAL
	WATER LEVEL (level where first encountered)	UC	UNCONFINED COMPRESSION (ASTM Test Method D 2166)
	WATER LEVEL (level after completion)		
	SEEPAGE	MC	MOISTURE CONTENT (ASTM Test Method D 2216)

GENERAL NOTES

1. *Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual.*
2. *No warranty is provided as to the continuity of soil conditions between individual sample locations.*
3. *Logs represent general soil conditions observed at the point of exploration on the date indicated.*
4. *In general, Unified Soil Classification System designations presented on the logs were evaluated by visual methods. Where laboratory tests were performed, the designations reflect the laboratory test results.*

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Drafted By: G. GOMEZ
Date: 2/7/2008
Project No.: 90644.G01
File Number: STO8G006

LOG KEY
COMMERCIAL DEVELOPMENT
E. 18th STREET & HOLUB LANE
ANTIOCH, CALIFORNIA

PLATE
A-2

KA-LOG_KEY STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/16/2008

Logged By: JMY

Total Depth: 16.5 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, medium dense, fine grained
		1-1-1	14		109	5							
		1-3-1	12										Loose to medium dense
5		1-5-1	13										Medium dense
10		1-10-1	17										
15		1-15-1	27										**(SM) SILTY SAND** - Light brown, moist, medium dense, fine grained
													Boring completed at a depth of approximately 16.5 feet below existing site grade.
20													
25													

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Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B- 1

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-3

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/16/2008

Logged By: JMY

Total Depth: 15 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
		2-2-1	8		107	5							**(SM) SILTY SAND** - Light brown, moist, loose, slightly silty, fine grained
5		2-5-1	12										**(SP) SAND** - Light brown, moist, loose to medium dense, fine grained
10													**(SM) SILTY SAND** - Light brown, moist, fine grained
													(SP) SAND - Light brown, moist, fine grained
15													Boring completed at a depth of approximately 15 feet below existing site grade.
20													
25													

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Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-2

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-4

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/16/2008

Logged By: JMY

Total Depth: 5 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SM) SILTY SAND - Light brown, moist, fine grained
													(SP) SAND - Light brown, moist, fine grained
5													Boring completed at a depth of approximately 5 feet below existing site grade.
10													
15													
20													
25													

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Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-3

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-5

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/16/2008

Logged By: JMY

Total Depth: 16.5 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
		4-1-1	9										**(SP) SAND** - Light brown, moist, loose, fine grained
		4-3-1	8		110	15							**(SM) SILTY SAND** - Light brown, moist, loose, fine grained
5		4-5-1	14										**(SP) SAND** - Light brown, moist, medium dense, fine grained
10		4-10-1	15										
15			22										**(SM) SILTY SAND** - Light brown, moist, medium dense, slightly silty, fine grained
													Grades more silty
													Boring completed at a depth of approximately 16.5 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B- 4

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-6

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: Groundwater encountered at a depth of approximately 32.8 feet below existing site grade.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/16/2008

Logged By: JMY

Total Depth: 40 feet

Boring Diameter: 4-1/2"

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, medium dense, fine grained
		5-1-1	27										
		5-3-1	26							20			**(SM) SILTY SAND** - Light brown, moist, medium dense, fine grained
5		5-5-1	11										Loose
													(SP) SAND - Light brown, moist, loose, fine grained
10		5-10-1	11		111	3							
													Medium dense
15		5-15-1	24							6			
													(SM) SILTY SAND - Light brown, moist, dense, fine grained
20		5-20-1	40										
25		5-25-1	39							34			

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Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B- 5

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 2

A-7

SAC 2005 STO8G006.GPJ 2/7/08

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
30													**(CH) SANDY CLAY** - Light brown, moist, hard
		5-30-1	37				55	30					
													(SP) SAND - Light brown, wet, fine grained
35													
		5-35-1	30/4"							23			**(ML) SANDY SILT** - Light brown, wet
													(SM) SAND - Light brown, wet, very dense, fine grained
													(SP) SAND - Light brown, wet, fine grained
40													Boring completed at a depth of approximately 40 feet below existing site grade.
45													
50													
55													
60													

KLEINFELDER

Drafted By: G. GOMEZ
Date: 2/7/2008
Project No.: 90644.G01
File Number: STO8G006

LOG OF BORING B- 5
COMMERCIAL DEVELOPMENT
E. 18th STREET & HOLUB LANE
ANTIOCH, CALIFORNIA

PLATE
2 of 2
A-7

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/17/2008

Logged By: JMY

Total Depth: 21.5 feet

Boring Diameter: 4-1/2"

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Graphic Log	DESCRIPTION
													(SM) SILTY SAND - Light brown, moist, loose, slightly silty, fine grained
		6-1-1	9										
		6-3-1	10										**(SP) SAND** - Light brown, moist, loose, fine grained
5		6-5-1	11		104	5							
													Medium dense
10		6-10-1	16										
													(SM) SILTY SAND - Light brown, moist, loose, fine grained
15		6-15-1	11										Grades more silty
													(SP) SAND - Light brown, moist, medium dense, fine grained
20		6-20-1	21										
													Boring completed at a depth of approximately 21.5 feet below existing site grade.
25													

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Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B- 6

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-8

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/17/2008

Logged By: JMY

Total Depth: 15 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, fine grained
													(SM) SILTY SAND - Light brown, moist, medium dense, trace gravel, fine grained
		7-2-1	12		106	4							
													(SP) SAND - Light brown, moist, medium dense, fine grained
5													Loose
		7-5-1	11										
													(SM) SILTY SAND - Light brown, moist, slightly silty, fine grained
10													
15													Boring completed at a depth of approximately 15 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-7

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-9

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/17/2008

Logged By: JMY

Total Depth: 16.5 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
		8-1-1	25										**(SM) SILTY SAND** - Light brown, moist, medium dense, fine grained
		8-3-1	25										
5		8-5-1	14		110	6							
													(SP) SAND - Light brown, moist, medium dense, fine grained
10		8-10-1	18										
15		8-15-1	25										
													Boring completed at a depth of approximately 16.5 feet below existing site grade.
20													
25													

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Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B- 8

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-10

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/17/2008

Logged By: JMY

Total Depth: 15 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, medium dense, fine grained
		9-1-1	13		111	7							**(SM) SILTY SAND** - Light brown, moist, medium dense, fine grained
													Trace gravel
													No gravel, loose
5		9-4-1	11										
													(SP) SAND - Light brown, moist, fine grained
													(SM) SILTY SAND - Light brown, moist, very silty, fine grained
10													
													Grades less silty
15													Boring completed at a depth of approximately 15 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B- 9

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-11

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/17/2008

Logged By: JMY

Total Depth: 5 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, fine grained
													(SM) SILTY SAND - Dark gray-brown, moist, rotten smell, fine grained
													Light brown
5													Boring completed at a depth of approximately 5 feet below existing site grade.
10													
15													
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-10

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-12

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/17/2008

Logged By: JMY

Total Depth: 15 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, fine grained
													(SM) SILTY SAND - Gray, moist, medium dense, rotten smell, minor organic, fine grained
		11-2-1	26										Light brown, slightly silty
5													**(SP) SAND** - Light brown, moist, loose to medium dense, fine grained
		11-5-1	12		105	5							
													(SM) SILTY SAND - Light brown, moist, slightly silty, fine grained
10													
													(SP) SAND - Light brown, moist, fine grained
15													
													Boring completed at a depth of approximately 15 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-11

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-13

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/17/2008

Logged By: JMY

Total Depth: 16.5 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, medium dense, fine grained
		12-1-1	20										
		12-3-1	35										
5		12-5-1	30										**(SM) SILTY SAND** - Light gray-brown, moist, medium dense, slight rotten smell, fine grained
													Light brown
													(SP) SAND - Light brown, moist, loose, fine grained
10		12-10-1	9		107	6							
													(SM) SILTY SAND - Light brown, moist, loose to medium dense, fine grained
15		12-15-1	12										
													Boring completed at a depth of approximately 16.5 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-12

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-14

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/17/2008

Logged By: JMY

Total Depth: 16.5 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, medium dense, fine grained
		13-1-1	26										
		13-3-1	46										Dense
5													**(SM) SILTY SAND** - Light brown, moist, dense, slightly silty, fine grained
		13-5-1	28										Medium dense
													Grades more silty
10													
		13-10-1	14		102	13							
													Grades less silty
15													
		13-15-1	15										**(SP) SAND** - Light brown, moist, medium dense, fine grained
													Boring completed at a depth of approximately 16.5 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

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LOG OF BORING B-13

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-15

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/17/2008

Logged By: JMY

Total Depth: 15 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, fine grained
		14-2-1	38		131	8							**(SM) SILTY SAND** - Light brown, moist, dense, fine grained
													(SP) SAND - Light brown, moist, dense, fine grained
5		14-5-1	41										**(SM) SILTY SAND** - Light brown, moist, dense, fine grained
													Grades less silty
10													**(SP) SAND** - Light brown, moist, fine grained
15													**(SM) SILTY SAND** - Light brown, moist, slightly silty, fine grained
													Boring completed at a depth of approximately 15 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-14

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-16

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/17/2008

Logged By: JMY

Total Depth: 5 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, fine grained
													(SM) SILTY SAND - Light brown, moist, slightly silty, fine grained
5													Grades more silty
													Boring completed at a depth of approximately 5 feet below existing site grade.
10													
15													
20													
25													

KLEINFELDER

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Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-15

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-17

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/17/2008

Logged By: JMY

Total Depth: 15 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SM) SILTY SAND - Light brown, moist, medium dense, slightly silty, fine grained
		16-2-1	34										
5													**(SP) SAND** - Light brown, moist, medium dense, fine grained
		16-5-1	17		116	10							**(SM) SILTY SAND** - Light brown, moist, medium dense, fine grained
10													**(SP) SAND** - Light brown, moist, fine grained
15													Boring completed at a depth of approximately 15 feet below existing site grade.
20													
25													

KLEINFELDER

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LOG OF BORING B-16

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-18

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/17/2008

Logged By: JMY

Total Depth: 16.5 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, loose, fine grained
		17-1-1	9										
		17-3-1	4		100	7							
5		17-5-1	8										
													(SM) SILTY SAND - Light brown, moist, medium dense, slightly silty, fine grained
10		17-10-1	29										
15		17-15-1	22										**(SP) SAND** - Light brown, moist, medium dense, fine grained
													Boring completed at a depth of approximately 16.5 feet below existing site grade.
20													
25													

SAC 2005 STO8G006.GPJ 2/7/08

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-17

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-19

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/17/2008

Logged By: JMY

Total Depth: 15 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, loose to medium dense, fine grained
		18-2-1	12		102	10							**(SM) SILTY SAND** - Light brown, moist, loose to medium dense, fine grained
5		18-5-1	14										**(SP) SAND** - Light brown, moist, medium dense, fine grained
10													**(SM) SILTY SAND** - Light brown, moist, fine grained
15													Boring completed at a depth of approximately 15 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-18

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-20

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/17/2008

Logged By: JMY

Total Depth: 16.5 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, medium dense, fine grained
													Trace gravel
		19-1-1	27										**(SM) SILTY SAND** - Light brown, moist, medium dense, slightly silty, fine grained
		19-3-1	27										
5													**(SP) SAND** - Light brown, moist, medium dense, fine grained
		19-5-1	15		101	6							**(SM) SILTY SAND** - Light brown, moist, medium dense, slightly silty, fine grained
													Grades more silty
10		19-10-1	24										
													Grades less silty
15		19-15-1	22										
													Boring completed at a depth of approximately 16.5 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

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LOG OF BORING B-19

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-21

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/17/2008

Logged By: JMY

Total Depth: 15 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, medium dense, fine grained
		20-2-1	16										
5													Loose
		20-5-1	9		107	5							
													(SM) SILTY SAND - Light brown, moist, fine grained
10													Grades more silty
													(SP) SAND - Light brown, moist, fine grained
15													Boring completed at a depth of approximately 15 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-20

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-22

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/18/2008

Logged By: JMY

Total Depth: 16.5

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
		21-1-1	21										**(SM) SILTY SAND** - Light brown, moist, medium dense, slightly silty, fine grained
		21-3-1	18										
5		21-5-1	11										Grades more silty, loose
10		21-10-1	13		105	6							Medium dense
15		21-15-1	26										**(SP) SAND** - Light brown, moist, medium dense, fine grained
20													Boring completed at a depth of approximately 16.5 below existing site grade.
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

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LOG OF BORING B-21

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE 1 of 1

A-23

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/18/2008

Logged By: JMY

Total Depth: 15 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, fine grained
													(SM) SILTY SAND - Light brown, moist, medium dense, fine grained
		22-2-1	30										
5		22-5-1	20		103	3							
													(SP) SAND - Light brown, moist, medium dense, fine grained
10													(SM) SILTY SAND - Light brown, moist, fine grained
													Grades less silty
15													Boring completed at a depth of approximately 15 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-22

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-24

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/18/2008

Logged By: JMY

Total Depth: 16.5 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
		23-1-1	13		101	7							**(SP) SAND** - Light brown, moist, medium dense, fine grained
		23-3-1	17										
5		23-5-1	19										**(SM) SILTY SAND** - Light brown, moist, medium dense, fine grained
10		23-10-1	14										**(SP) SAND** - Light brown, moist, medium dense, fine grained
15		23-15-1	16										**(SM) SILTY SAND** - Light brown, moist, medium dense, fine grained
													Boring completed at a depth of approximately 16.5 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

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LOG OF BORING B-23

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-25

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/18/2008

Logged By: JMY

Total Depth: 16.5 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, medium dense, fine grained
		24-1-1	27										**(SM) SILTY SAND** - Light brown, moist, medium dense, slightly silty, fine grained
		24-3-1	12		102	10							Loose to medium dense
5		24-5-1	20										Medium dense
													(SP) SAND - Light brown, moist, fine grained
10		24-10-1	31										**(SM) SILTY SAND** - Light brown, moist, medium dense, fine grained
													(SP) SAND - Light brown, moist, medium dense, fine grained
15		24-15-1	24										Boring completed at a depth of approximately 16.5 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-24

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-26

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/18/2008

Logged By: JMY

Total Depth: 15 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(SP) SAND - Light brown, moist, fine grained
													(SM) SILTY SAND - Light brown, moist, medium dense, fine grained
		25-2-1	26										
5													
		25-5-1	15		99	6							**(SP) SAND** - Light brown, moist, medium dense, fine grained
10													
15													Boring completed at a depth of approximately 15 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-25

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-27

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/18/2008

Logged By: JMY

Total Depth: 16.5 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(FILL) GRAVELLY SANDY SILT - Light brown, moist
		26-1-1	14										**(SM) SILTY SAND** - Light brown, moist, medium dense, slightly silty, fine grained
		26-3-1	5		103	7							Loose
5		26-5-1	6										
													(SP) SAND - Light brown, moist, loose to medium dense, fine grained
10		26-10-1	12										
													(SM) SILTY SAND - Light brown, moist, dense, fine grained
15		26-15-1	44										
													Boring completed at a depth of approximately 16.5 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-26

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-28

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/18/2008

Logged By: JMY

Total Depth: 16.5 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
		27-0-1	9										**(FILL) GRAVELLY CLAYEY SAND** - Light brown, moist, loose, fine grained
													(SP) SAND - Light brown, moist, loose, fine grained
		27-3-1	7										
5		27-5-1	11										
10		27-10-1	15		97	5							**(SM) SILTY SAND** - Light brown, moist, medium dense, slightly silty, fine grained
													(SP) SAND - Light brown, moist, medium dense, fine grained
15		27-15-1	18										**(SM) SILTY SAND** - Light brown, moist, medium dense, fine grained
													Boring completed at a depth of approximately 16.5 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-27

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

A-29

SAC 2005 STO8G006.GPJ 2/7/08

Surface Conditions: Uneven lot

Groundwater: No free groundwater encountered.

Method: Continuous flight solid stem auger

Equipment: Simco 2400 truck mounted drill rig with 140 lb. cathead trip hammer system

Date Completed: 1/18/2008

Logged By: JMY

Total Depth: 15 feet

Boring Diameter: 4-1/2"

Depth (feet)	FIELD: Sample Type	FIELD: Sample No.	FIELD: Blows/ft	FIELD: Pocket Penetrometer (tsf)	LABORATORY: Dry Density (pcf)	LABORATORY: Moisture Content (%)	LABORATORY: Liquid Limit	LABORATORY: Plasticity Index	LABORATORY: Passing #4 Sieve (%)	LABORATORY: Passing #200 Sieve (%)	LABORATORY: Other Tests	Graphic Log	DESCRIPTION
													(FILL) GRAVELLY CLAYEY SAND - Light brown, moist, fine grained
		28-2-1	10		105	7							**(SM) SILTY SAND** - Light brown, moist, loose, slightly silty, fine grained
5		28-5-1	11										**(SP) SAND** - Light brown, moist, loose, fine grained
10													
15													**(SM) SILTY SAND** - Light brown, moist, fine grained
													Boring completed at a depth of approximately 15 feet below existing site grade.
20													
25													

KLEINFELDER

Drafted By: G. GOMEZ Project No.: 90644.G01

Date: 2/7/2008 File Number: STO8G006

LOG OF BORING B-28

COMMERCIAL DEVELOPMENT

E. 18th STREET & HOLUB LANE

ANTIOCH, CALIFORNIA

PLATE

1 of 1

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SAC 2005 STO8G006.GPJ 2/7/08

BORING NO.	SAMPLE DEPTH (ft)	DRY UNIT WEIGHT (pcf)	MOISTURE CONTENT (% of dry weight)	PARTICLE SIZE SIEVE SIZE (percent passing)						ATTERBERG LIMITS		OTHER TESTS
				6"	3"	3/4"	#4	#10	#200	L.L.	P.I.	
B- 1	1.0	109	5									
B- 2	2.0	107	5									
B- 4	3.0	110	15									
B- 5	3.0								20			
B- 5	10.0	111	3									
B- 5	15.0								6			
B- 5	25.0								34			
B- 5	30.0									55	30	
B- 5	35.0								23			
B- 6	5.0	104	5									
B- 7	2.0	106	4									
B- 8	5.0	110	6									
B- 9	1.0	111	7									
B-11	5.0	105	5									
B-12	10.0	107	6									
B-13	10.0	102	13									
B-14	2.0	131	8									
B-16	5.0	116	10									
B-17	3.0	100	7									
B-18	2.0	102	10									
B-19	5.0	101	6									
B-20	5.0	107	5									
B-21	10.0	105	6									
B-22	5.0	103	3									
B-23	1.0	101	7									
B-24	3.0	102	10									
B-25	5.0	99	6									
B-26	3.0	103	7									
B-27	10.0	97	5									
B-28	2.0	105	7									

KA-LAB WITH COBBLE TO 6 INCHES STO8G006.GPJ 2/7/08

Drafted By: G. GOMEZ
Date: 2/7/2008
Project No.: 90644.G01
File Number: STO8G006

SUMMARY OF LABORATORY TESTS
COMMERCIAL DEVELOPMENT
E. 18th STREET & HOLUB LANE
ANTIOCH, CALIFORNIA

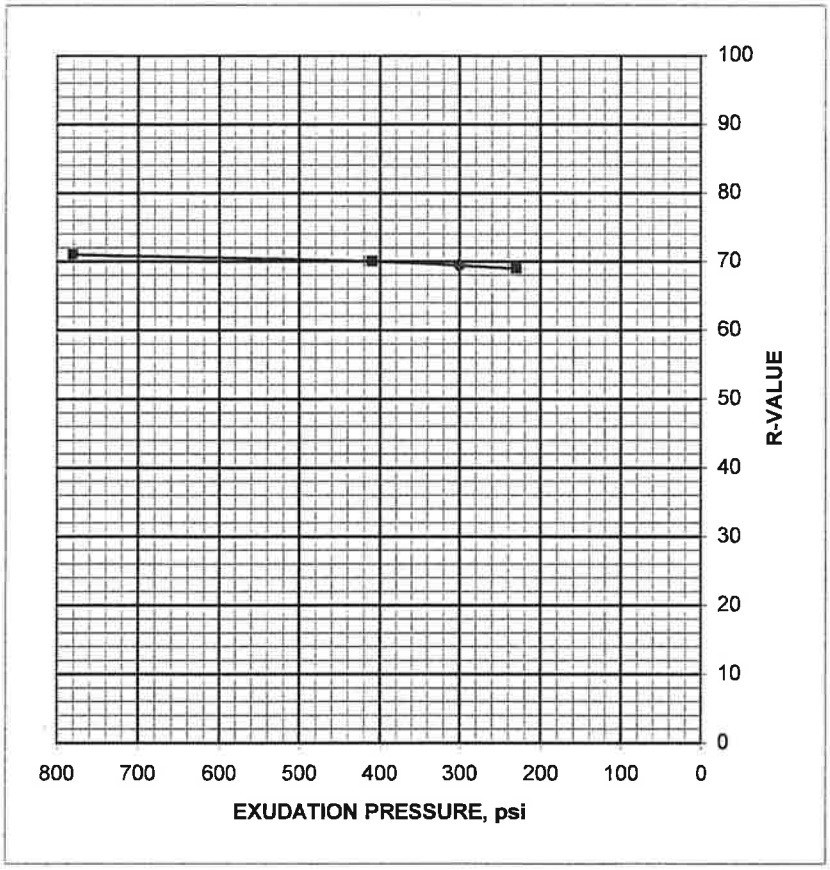
PLATE
1 of 1
A-31

KLEINFELDER
An employee owned company

Plate	A-33

CTM 301, Resistance "R" Value of Treated and Untreated Bases

Project Name: East 18th St. Antioch Improvements
Project Number: 90644.G01
Sample ID.: 0801036
Sample Date: January 16, 2008
Sample Location: RV-1
Sample Description: Brown Sand



LABORATORY DATA

Specimen	A	B	C
Exudation Pressure, psi	780	410	230
Expansion Pressure, psf	0	0	0
Resistance Value, R	71	70	69
Moisture at Test, %	14.4	17.0	18.3
Dry Density at Test, pcf	105.8	103.9	111.5
R-Value at 300 psi Exudation Pressure			**69**

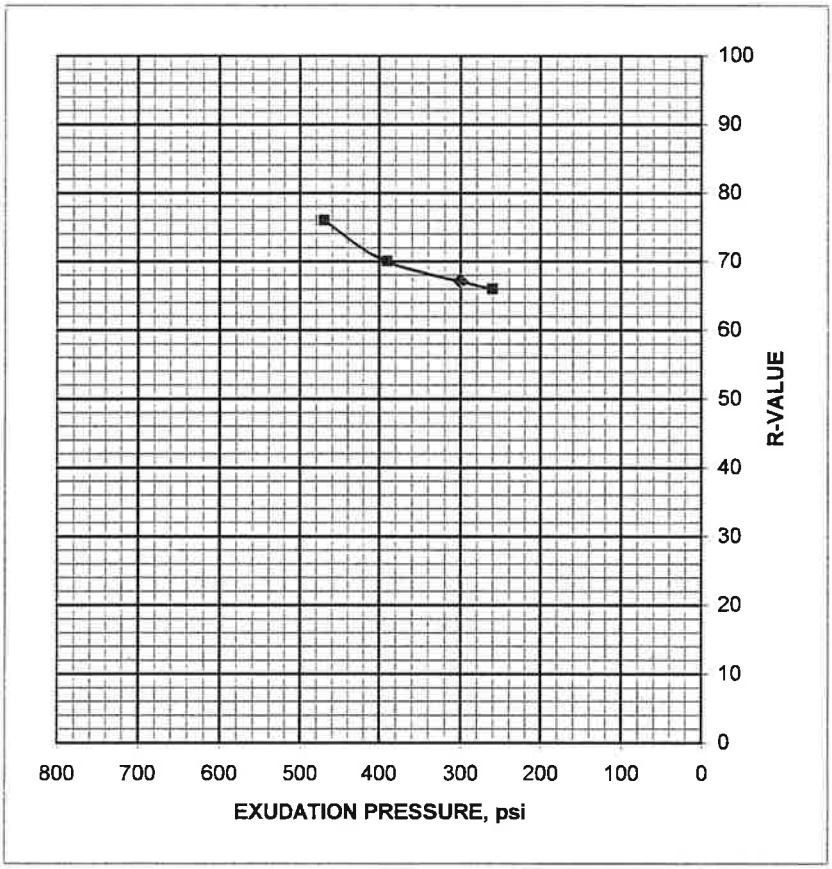
Reviewed By: _____
Benjamin Reeves
Lab Manager

KLEINFELDER
An employee owned company

Plate	A-34

CTM 301, Resistance "R" Value of Treated and Untreated Bases

Project Name: East 18th St. Antioch Improvements
Project Number: 90644.G01
Sample ID.: 0801037
Sample Date: January 16, 2008
Sample Location: RV-2
Sample Description: Brown Sand



LABORATORY DATA

Specimen	A	B	C
Exudation Pressure, psi	260	390	470
Expansion Pressure, psf	0	0	0
Resistance Value, R	66	70	76
Moisture at Test, %	17.0	15.7	14.7
Dry Density at Test, pcf	106.2	107.9	109.3
R-Value at 300 psi Exudation Pressure			**67**

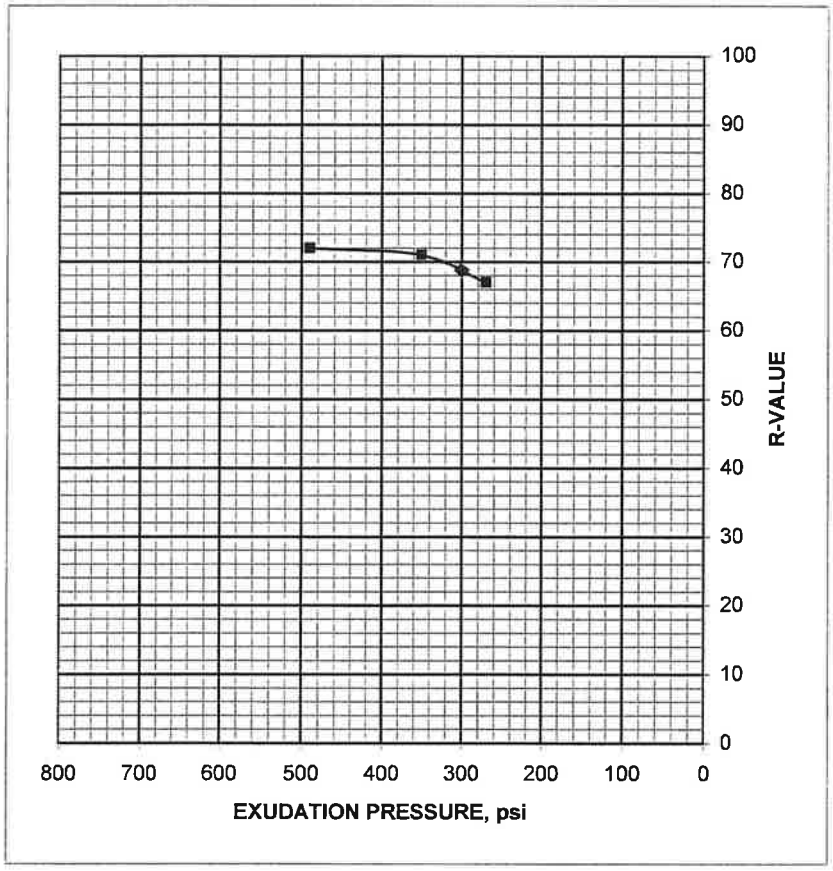
Reviewed By: _____
Benjamin Reeves
Lab Manager

KLEINFELDER
An employee owned company

Plate	A-35

CTM 301, Resistance "R" Value of Treated and Untreated Bases

Project Name: East 18th St. Antioch Improvements
Project Number: 90644.G01
Sample ID.: 0801038
Sample Date: January 16, 2008
Sample Location: RV-3
Sample Description: Brown Sand



LABORATORY DATA

Specimen	A	B	C
Exudation Pressure, psi	490	350	270
Expansion Pressure, psf	0	0	0
Resistance Value, R	72	71	67
Moisture at Test, %	15.5	16.6	17.7
Dry Density at Test, pcf	106.5	103.6	104.9
R-Value at 300 psi Exudation Pressure			**69**

Reviewed By: _____
Benjamin Reeves
Lab Manager

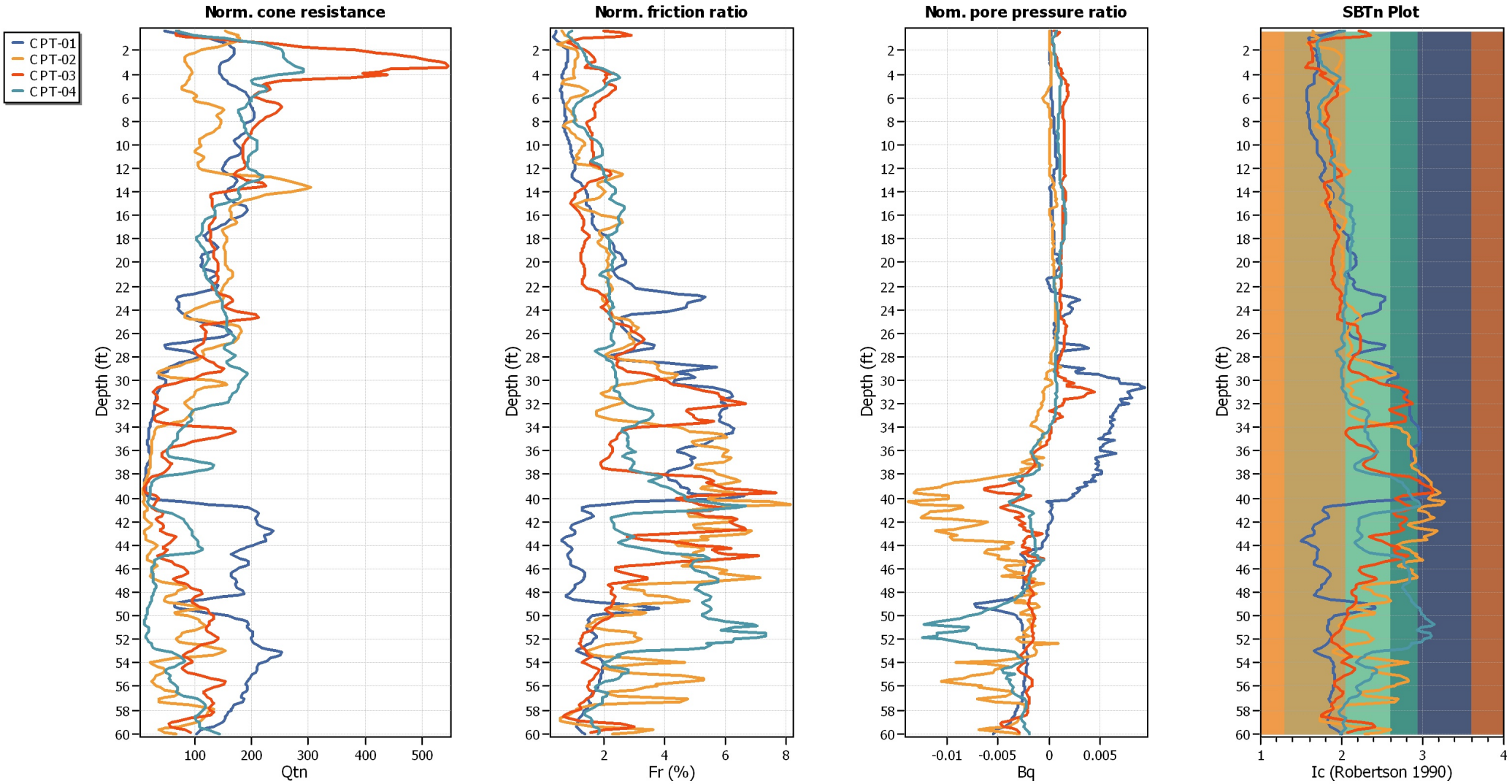
APPENDIX D

APPENDIX D
LIQUEFACTION ANALYSIS

GEOCON
CONSULTANTS, INC.
6671 BRISA STREET – LIVERMORE, CA 94550
PHONE 925.371.5900 – FAX 925.371.5915

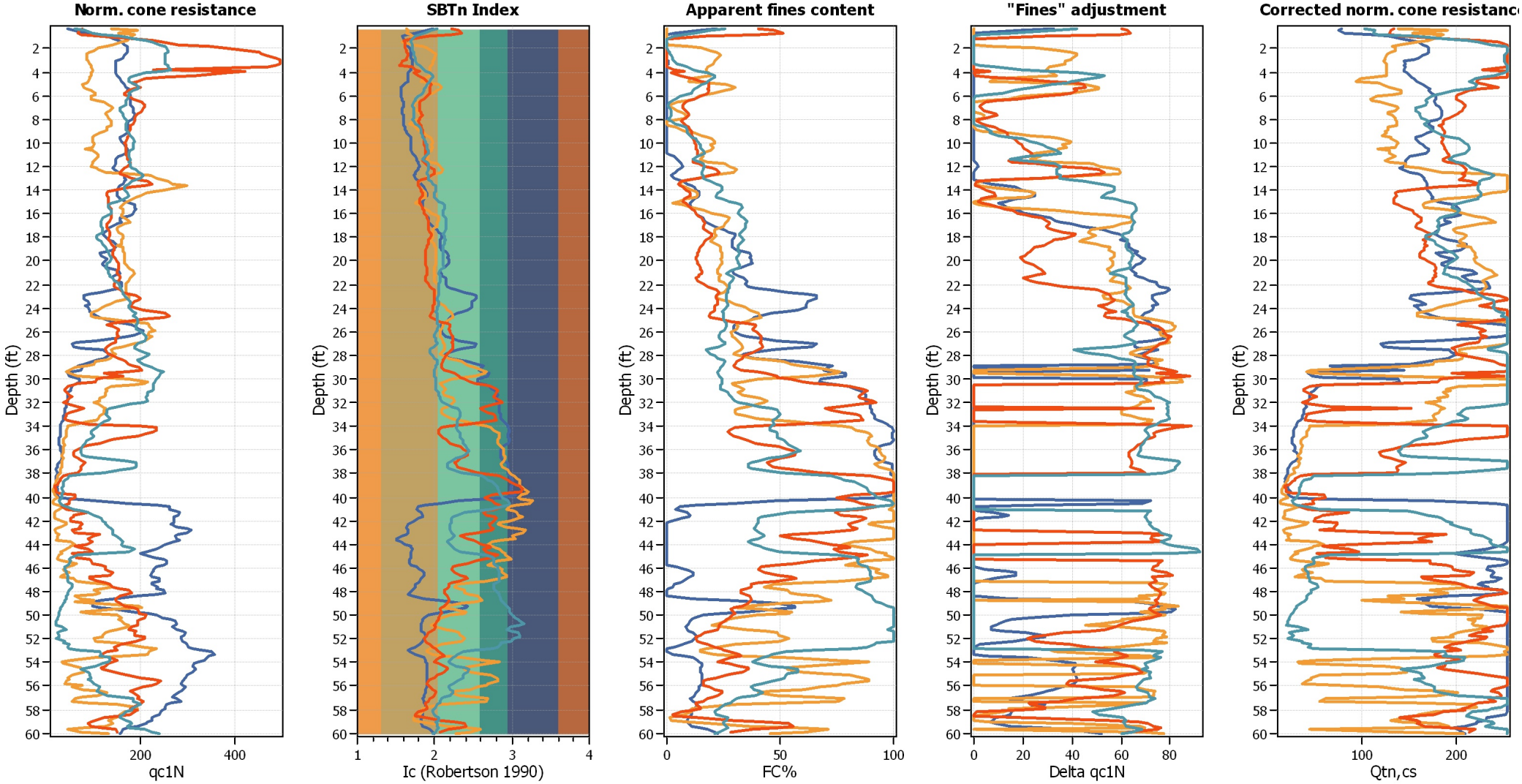
Project: AMCAL Antioch

Overlay Normalized Plots



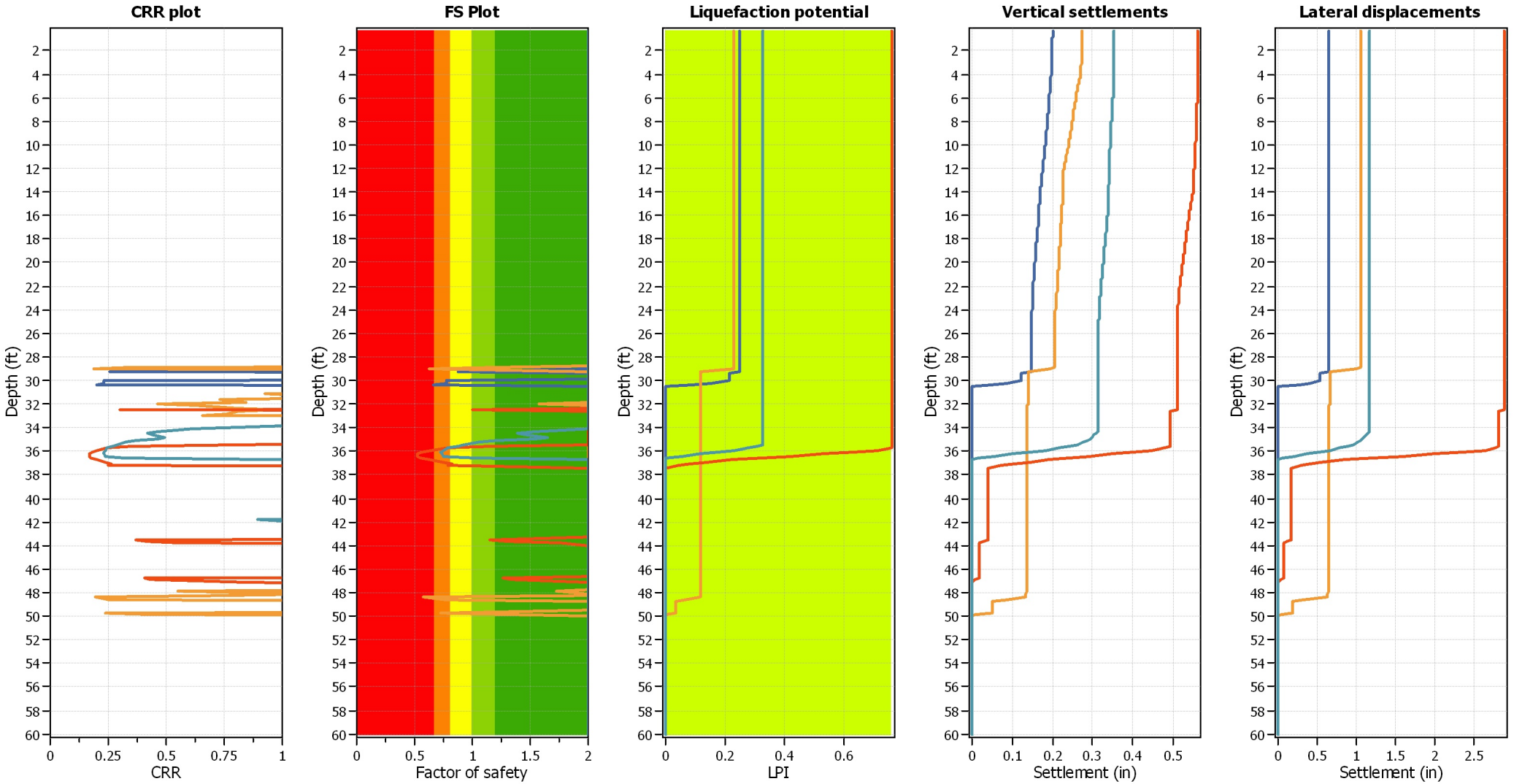
Project: AMCAL Antioch

Overlay Intermediate Results



Project: AMCAL Antioch

Overlay Cyclic Liquefaction Plots



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