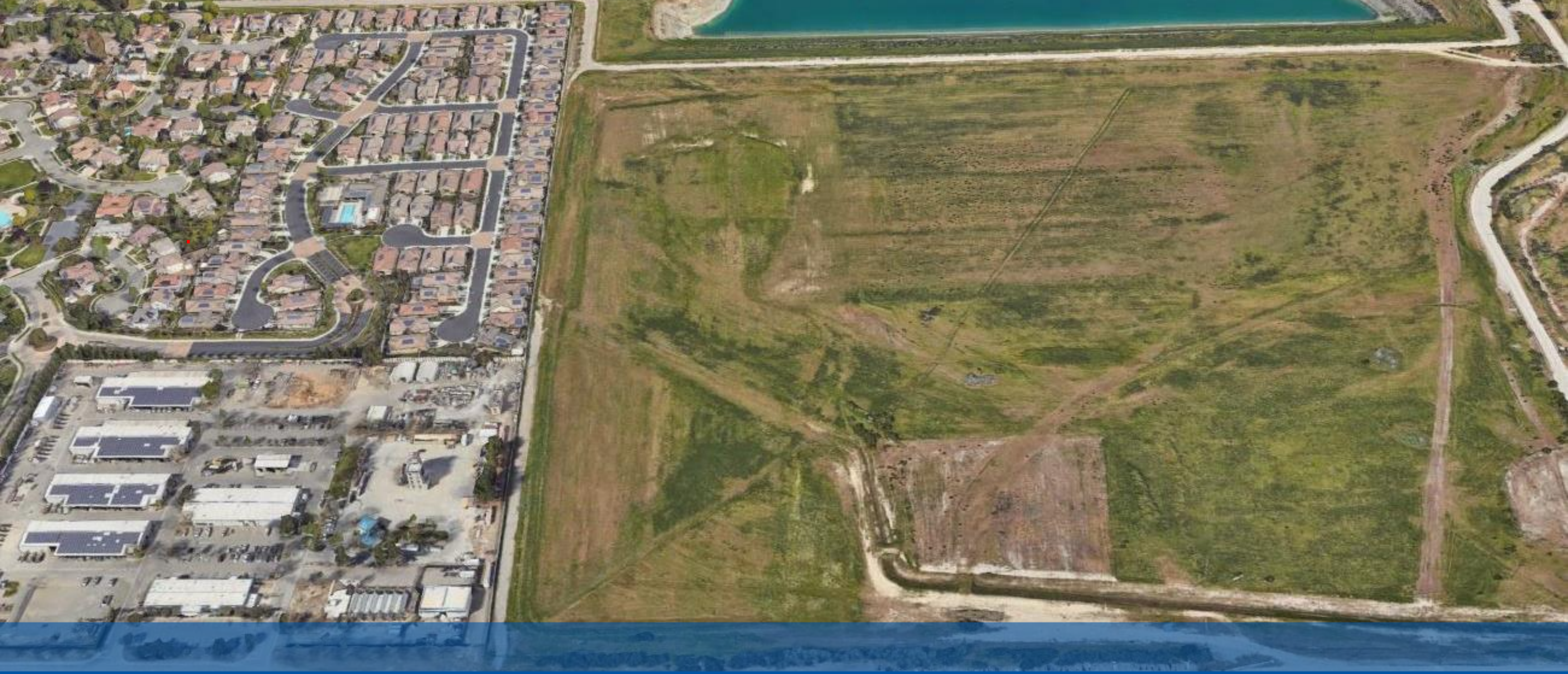
# Appendix E:
# Geology and Soils Supporting Information



# ARROYO LAGO
## PLEASANTON, CALIFORNIA

# PRELIMINARY GEOTECHNICAL REPORT

SUBMITTED TO
Mr. Steve Reilly
330 Land Company, LLC
16381 Scientific Way
Irvine, CA 92618

PREPARED BY
ENGEO Incorporated

May 18, 2023

PROJECT NO.
9785.004.001

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GEOTECHNICAL
ENVIRONMENTAL
WATER RESOURCES
CONSTRUCTION SERVICES
COASTAL/MARINE GEOTECHNICS

Project No.
**9785.004.001**

May 18, 2023

Steve Reilly
330 Land Company, LLC
16381 Scientific Way
Irvine, CA 92618

Subject: Arroyo Lago
Pleasanton, California

**PRELIMINARY GEOTECHNICAL REPORT**

Dear Mr. Reilly:

As requested, we completed this preliminary geotechnical exploration for the proposed Arroyo Lago residential project in Pleasanton, California. The accompanying report presents our field exploration and laboratory testing with our conclusions and preliminary recommendations for the proposed project.

It is our opinion from a geotechnical standpoint that the site is suitable for the proposed development, provided the recommendations and guidelines in this report are implemented during project planning, design, and construction. The main geotechnical considerations at the site include the presence of undocumented fill, settlement of moderately compressible layers due to proposed fill and building loads, and strong ground motions. Our preliminary recommendations to address these constraints are presented in the accompanying report. A design-level geotechnical exploration will be necessary prior to project design.

We are pleased to have been of service to you on this project and are prepared to consult further with you and your design team as the project progresses.

Sincerely,

ENGEO Incorporated

Justin Qiu

Jeanine Ruffoni, PE, GE

REGISTERED PROFESSIONAL ENGINEER
JEANINE RUFFONI
No. 3149
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STATE OF CALIFORNIA

Josef J. Tootle, PE, GE

jq/jtr/jjt/cjn

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# 1.0 INTRODUCTION

## 1.1 PURPOSE AND SCOPE

We prepared this preliminary geotechnical report for the proposed Arroyo Lago residential development project located in Pleasanton, California. We prepared this report as outlined in our agreement dated September 12, 2022. We are authorized to conduct the following scope of services.

- Reviewing published maps, previous reports, and historical information (including historical aerial images and historical topography)
- Analyzing and interpreting the geological and geotechnical data
- Reporting our preliminary findings, conclusions, and recommendations

For our use, we received the following pertinent documents.

- CBG. 2022. Vesting Tentative Map DRAFT, Arroyo Lago, Alameda County, California. August 2022. Job No. 3435-000.
- Haley & Aldrich. 2013. Geotechnical Services During Construction, Filling of Busch Pit, Pleasanton Lakes Development, Pleasanton, California. December 18, 2013. File No. 130540-002
- Haley & Aldrich. 2017. Report on Preliminary Geotechnical Investigation, Unincorporated Alameda County, California. June 1, 2017. File No. 130540-002
- Haley & Aldrich. 2019. Final Grading Summary – Geotechnical Services During Construction, Filling of Busch Pit, Pleasanton Lakes Development, Pleasanton, California. December 12, 2019. File No. 130540
- Haley & Aldrich. 2021. Report on Preliminary Subsurface Conditions Report, Unincorporated Alameda County, California. December 15, 2021. File No. 130540-002
- Treadwell & Rollo. 2007. Due Diligence Investigation – Parcel 2 and Parcels D through G, Hanson Radum Site, Pleasanton, California. May 25, 2007. Project No. 4490.01
- Treadwell & Rollo. 2009. Geotechnical Investigation Pleasanton Land Development Project, Pleasanton, California. September 8, 2009. Project No. 4490.02

Additionally, we previously prepared the following geotechnical report for the property and the greater East Pleasanton Specific Plan (EPSP) area.

- ENGEO. 2020. Ground Improvement Summary, East Pleasanton Specific Plan, Pleasanton, California. October 21, 2020. Project No. 9785.001.001

This report was prepared for the exclusive use of 330 Land Company, LLC and their consultants for the planning and preliminary design of this project. In the event that any changes are made in the character, design or layout of the development, we must be contacted to review the conclusions and recommendations contained in this report to evaluate whether modifications are recommended. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without our express written consent.

## 1.2 PROJECT LOCATION

The project site is generally located northwest of the intersection of Busch Road and El Charro Road in Pleasanton, California (Figure 1). The approximately 26.6-acre site is a portion of the parcel identified by Assessor's Parcel Number 946-1250-6-4. The site is bounded by Busch Road to the south, existing residential properties to the west, an Alameda County Flood Control easement to the north, and vacant open space to the east.

The site is currently occupied by light seasonal vegetation. A PG&E easement extends east-west on the northern side of the site, and a dirt road runs north-south through the center of the site. According to a draft topographic map prepared by CBG dated August 2022, the site gently slopes inwards towards the central-eastern portion of the property, with the high point in the northwest at approximately Elevation 362 feet (datum not identified) and the low point in the central-eastern portion of the site at approximately Elevation 357 feet.

## 1.3 PROJECT DESCRIPTION

Based on our discussions with the project team and review of the provided plans, we understand the site will be redeveloped for residential use. We understand the development will include the following.

- 194 residential units
- Paved drive-lanes and parking areas
- Concrete flatwork
- Underground utilities
- Retaining walls
- Landscaping features

The draft grading plan provided by CBG, dated August 2022, shows anticipated earthwork of up to 8 feet of fill to achieved proposed pad elevations, with an average of 3 to 5 feet of fill across the site.

We anticipate structures will be wood-frame construction and one to two stories in height. Structural loads are yet to be determined; however, we assume that structural loads will be representative for this type of construction.

# 2.0 FINDINGS

## 2.1 HISTORICAL DOCUMENT REVIEW

### 2.1.1 Site History

Based on review of historical aerials, topographic maps, and provided geotechnical reports, we understand the site was historically part of a mining quarry. Open pit excavation operations within site limits began between 1979 and 1982, in which the site was divided into a larger north pit and a smaller south pit (also known as the Busch Pit) at the southwestern end of the site. The remaining area to the east of Busch Pit was quarried and sloped to accommodate vehicular dirt roads along the boundary of the northern pit and Busch Pit. The approximate limits of Busch Pit are shown in Figure 2A; a historical aerial from 1984 depicting the approximate extents of the northern pit and Busch Pit are shown in Figure 2B.

The northern pit appears to have been quarried to at least 100 feet below ground surface (bgs). We understand backfill operations of the north pit were completed by 1993; to our knowledge, there is no documentation of the fill operations. Busch Pit appears to have been quarried to at least 50 to 70 feet bgs for the purposes of a stormwater retention pond.

According to the testing and observation report provided by Haley & Aldrich dated December 18, 2013, Busch Pit was backfilled and compacted to match adjacent site grades in 2013. A historical on-site stockpile located in the northern half of the site was used as backfill material, generally consisting of sandy clay to clayey sand. The approximate extent of the stockpile is shown in Figures 2A and 2B.

From November 2018 to November 2019, rough grading of the overall site occurred under the testing and observation of Haley & Aldrich, encompassing both the Busch Pit and northern pit areas according to the final testing and observation report provided by Haley & Aldrich dated December 12, 2019. Up to approximately 2½ feet of fill was placed and 2 feet of cut was excavated to achieve current grades. The extent of the rough grading activities is shown in Figures 2A and 2B.

The site remained relatively unchanged between the 2020 photograph and our exploration in 2022.

### 2.1.2 Existing and Nearby Geotechnical Data

In 2006 and 2009, Treadwell & Rollo performed a geotechnical investigation throughout the greater East Pleasanton Specific Plan site. The explorations within the site boundary included one hollow-stem auger boring drilled to a depth of 100 feet bgs and four cone penetration tests (CPTs) advanced to depths ranging from approximately 45 feet to 99 feet bgs. The logs and associated laboratory test results from the Treadwell & Rollo investigation are presented in Appendix D. The approximate locations of the previous explorations are shown in Figures 2A and 2B.

In 2013, Haley & Aldrich tested and observed the placement and compaction of backfill for Busch Pit reportedly in accordance with County of Alameda Surface Mining Permit Reclamation Plan (SMP-31) requirements. A subsequent preliminary geotechnical report was prepared by Haley & Aldrich in 2017, providing preliminary discussion on subsurface conditions and seismic hazards. No additional subsurface investigation was included as a part of their scope.

Between November 2018 and November 2019, Haley & Aldrich tested and observed the rough grading activities for the overall site in general conformance with rough grading plans provided by Kier and Wright.

## 2.2 GEOLOGY AND SEISMICITY

### 2.2.1 Regional Geology

The site is located in the California Coast Ranges geomorphic province, which is dominated by a series of northwest-trending mountain ranges that have been folded and faulted in a tectonic regime that involves both translational and compressional deformations. Bedrock in the Coast Ranges consists of igneous, metamorphic, and sedimentary rocks that range in age from Jurassic to Pleistocene. The site is located in the tri-valley basin located near the intersection of Livermore Valley, Amador Valley, and San Ramon Valley. The tri-valley basin is generally regarded as a trough of sediments within the Diablo mountain range. The basin is filled with Quaternary-age sediments derived from erosion of the surrounding highlands. The sediments have been divided into the Plio-Pleistocene Livermore Gravels and younger Pleistocene to Holocene alluvium.

### 2.2.2 Local Geology

Geologic mapping prepared by Dibblee (2005) indicates the site is underlain by alluvial gravel, sand, and clay (Qa), while adjacent EPSP areas were mapped as Gravel Pits (GP) (Figure 3). In the site vicinity, Holocene flood deposits are mapped. In addition, general bedrock mapped in the adjacent hills consists of late-Pliocene to early-Pliocene-age Livermore gravel.

### 2.2.3 Seismicity

The San Francisco Bay Area contains numerous active faults. Figure 4 shows the approximate location of active and potentially active faults and significant historic earthquakes mapped within the San Francisco Bay Region. A Holocene-active fault is defined by the California Geologic Survey as one that has had surface displacement within Holocene time (the last 11,700 years) (CGS, 2018).

To identify nearby active faults that are capable of generating strong seismic ground shaking at the site, we utilized the United States Geological Survey (USGS) Unified Hazard Tool and disaggregated the hazard at peak ground acceleration for a return period of 2,475 years. The nearest active fault with a significant contribution (greater than 1 percent) to the overall seismic hazard at the site is the Northern trace of the Calaveras fault, approximately 4.4 miles to the southwest. Other nearby faults capable of producing significant ground shaking at the site are shown in Table 2.2.3-1.

**TABLE 2.2.3-1: Active Faults Capable of Producing Significant Ground Shaking at the Site, Latitude: 37.6786 Longitude: -121.8563**

| SOURCE | $R_{RUP}$ (KM) | $R_{RUP}$ (MILES) | MOMENT MAGNITUDE $M_W$ |
|---|---|---|---|
| Calaveras (No) [4] | 7.1 | 4.4 | 7.1 |
| Hayward (So) [4] | 2.1 | 1.3 | 7.1 |
| Mount Diablo Thrust [0] | 8.9 | 5.5 | 6.9 |
| Greenville (No) [4] | 14.6 | 9.1 | 7.0 |
| Las Positas [1] | 8.7 | 5.4 | 8.7 |

1. Based on USGS Unified Hazard Tool: Dynamic Conterminous U.S. 2014 (update) (v4.2.0)
2. Fault System (Fault Section) [Fault Subsection assigned by UCERF3]
3. $R_{RUP}$ = closest distance to rupture

These results represent sources contributing at least 1 percent to the seismic hazard at the site for the peak ground acceleration and for the given return period. Gridded or areal sources are not presented; however, these sources did not contribute more than 1 percent to the seismic hazard for the peak ground acceleration and for the given return period.

## 2.3 FIELD EXPLORATION

Our field exploration included advancing five CPTs (including one seismic CPT) and excavating five test pits. We performed our field exploration on the site between November 17 and 18, 2022.

The approximate locations of our explorations are shown in Figures 2A and 2B. We selected the exploration locations to supplement previous explorations to inform preliminary planning. The locations of our explorations are approximately located, and we estimated their locations using consumer-grade global positioning system (GPS) and their proximity to existing site features; therefore, the locations shown should be considered accurate only to the degree implied by the method used. We permitted our explorations with Zone 7 Water Agency.

### 2.3.1 Cone Penetration Tests

We retained the services of a subcontractor operating a CPT rig to perform testing at five locations to a maximum depth of approximately 162½ feet bgs. The CPT has a 20-ton compression-type cone with a 15-square-centimeter ($cm^2$) base area, an apex angle of 60 degrees, and a friction sleeve with a surface area of 225 $cm^2$. The cone, connected with a series of rods, was pushed into the ground at a constant rate. CPT readings were taken at approximately 5-cm intervals with a penetration rate of 2 cm per second in accordance with ASTM D5778. Measurements included the tip resistance to penetration of the cone (Qc), the resistance of the surface sleeve (Fs), and pore pressure (U) (Robertson and Campanella, 1988).

The CPT contractor performed pore pressure dissipation (PPD) tests to measure piezometric water pressure in each CPT at various depths and collected seismic shear-wave velocity ($V_S$) measurements in one of the CPT using the downhole seismic method specified in ASTM D7400. We include the CPT report and logs in Appendix B.

### 2.3.2 Test Pits

We observed excavation of five test pits as shown on the Site Plan (Figure 2A). A representative of our firm observed the test pit excavation and logged the subsurface conditions at each location. We retained the services of a subcontractor operating a backhoe to excavate the test pits using an approximately 2-foot-wide bucket and logged the type, location, and uniformity of the underlying soil. The depth of our test pits ranged from 10 to 10½ feet below the existing ground surface. Once completed, the test pits were backfilled following field exploration activities using nominal compactive effort by the bucket.

We used the field logs to develop the report logs in Appendix A. The logs depict subsurface conditions at the exploration locations for the date of exploration; however, subsurface conditions may vary with time.

## 2.4 SUBSURFACE CONDITIONS

The subsurface conditions in previous and current explorations generally encountered existing fill across the site up to 162½ feet bgs in the northern pit and up to 70 feet bgs in Busch Pit. Subsurface conditions encountered underlying the existing fill were generally interpreted as floodplain deposits.

Further description of subsurface conditions of existing fill materials and native alluvium deposits are provided in the below sections.

### 2.4.1 Existing Fill

Existing fill was encountered between 130 and 162½ feet bgs in our explorations. Previous explorations by Treadwell & Rollo indicated the depth of existing fill up to 100 feet below ground surface. In general, the fill is generally characterized by medium stiff to very stiff sandy and silty clay with varying amounts of gravel. Our CPTs generally terminated in the underlying floodplain deposits. Debris was not encountered in our test pits; however, debris may be encountered at depth given site history and the nature of our CPT explorations. The clayey fill is generally low to medium plasticity within the upper 10 feet, with plasticity indices between 10 to 26.

Moisture content tests from previous and current explorations within the site range between 8.2 to 14.1 percent, which is generally lower than the typical range of moisture contents encountered in the larger EPSP site and similar to a typical moisture content range for native soil or engineered fill. Further moisture content tests should be conducted during the design-level study.

### 2.4.2 Engineered Fill (Busch Pit)

As described in Section 2.2, fill was placed and compacted under the observation of Haley & Aldrich up to approximately 64 feet deep. According to documented fill placement and compaction records, the fill generally consists of brown sandy lean clay from site and import sources compacted to at least 90 percent relative compaction. No moisture content specification was specified for soil placement.

### 2.4.3 Floodplain Deposits

Floodplain deposits were interpreted as directly underlying the existing fill in both areas, and generally consist of dense to very dense clayey sand and gravel and stiff to very stiff lean clay.

## 2.5 GROUNDWATER CONDITIONS

Static groundwater was estimated at approximately 45 feet bgs in 1-CPT2 according to pore pressure dissipation tests. Groundwater was not recorded in prior subsurface explorations. Plate 1.2 of the Seismic Hazard Zone Report for the Livermore Quadrangle (2008) maps the highest historical groundwater within the site vicinity to be approximately between 60 to 70 feet bgs.

A groundwater study was prepared in March 2023 by the Zone 7 Water Agency for the Livermore Valley Groundwater Basin, whose extents include the site within its boundary. According to the Groundwater Gradient Map prepared as a part of this study, the groundwater of the upper aquifer is approximately sloping from Elevation 290 feet (NAVD 88) at the southern end of the site to approximately Elevation 272 feet (NAVD 88) at the northern area of the site.

For analysis purposes, we have considered a design groundwater depth of 50 feet based on current explorations and historical data. Fluctuations in groundwater levels should be expected during seasonal changes or over a period of years because of precipitation changes, perched zones, and changes in irrigation and drainage patterns.

## 2.6 LABORATORY TESTING

We performed laboratory tests on select soil samples recovered from the test pits to evaluate their engineering properties. We present the laboratory test and standard procedures in Table 2.6-1 and the results in Appendix B.

**TABLE 2.6-1: Laboratory Testing**

| SOIL CHARACTERISTIC | TESTING METHOD |
|---|---|
| Natural Unit Weight | ASTM D7263 |
| Natural Moisture Content | ASTM D2216 |
| Plasticity Index (PI) (Wet Method) | ASTM D4318 |

# 3.0 PRELIMINARY CONCLUSIONS

Based on the exploration and laboratory test results, the site is suitable for the proposed residential development provided the preliminary geotechnical recommendations in this report are confirmed by further explorations/evaluations and properly incorporated into the design plans and specifications.

The primary geotechnical concerns for the proposed site redevelopment include:

- Presence of existing undocumented fill
- Settlement of potentially compressible layers due to building loads and fill placement
- Strong ground motions

These and other pertinent design issues are discussed in the following sections.

## 3.1 EXISTING UNDOCUMENTED FILL

Based on review of current and previous subsurface explorations, as well as review of historical aerial photographs, the site is predominately underlain by existing fill presumably used to backfill the historical quarry excavations. With exception to the fill placed on Busch Pit and the surficial fill placed under the observation of Haley and Aldrich in 2018 and 2019, the underlying fill should be considered undocumented due to the lack of placement records. The undocumented fill materials may be highly variable, potentially compressible, and potentially susceptible to seismically induced settlements. Given prior site history, decomposable debris may also be present within undocumented fill materials that can contribute to settlement. We summarize the assumed depth of undocumented fill of select explorations in the table below.

**TABLE 3.1-1: Depth of Fill Observations During Exploration**

| EXPLORATION ID | INTERPRETED BOTTOM OF FILL | |
|---|---|---|
| | DEPTH (feet, bgs) | ELEVATION (feet, Project Datum) |
| 1-CPT1 | 38½ | 321½ |
| 1-CPT2 | 162½ | 198 |
| 1-CPT3 | 116½ | 243 |
| 1-CPT4 | 131½ | 226 |
| 1-CPT5 | 80½ | 280 |

Undocumented fill can undergo excessive settlement, especially under new fill or building loads. Since the existing fill is heterogeneous in its makeup, the predicted differential settlements due to existing fill may be similar, or only slightly less than, predicted total settlements.

We discuss undocumented fill treatment options in Section 4 of this report.

## 3.2 EXPANSIVE SOIL

The existing undocumented fill encountered in our shallow test pits consists primarily of lean clay. Based on our observations of near-surface soil samples collected during the field exploration and historical laboratory testing on the fill material, the existing clayey fill should be considered to have a moderate to high expansive potential.

Expansive soil changes in volume with changes in moisture. It can shrink or swell and cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations. Building damage due to volume changes associated with expansive soil can be reduced by: (1) using a rigid mat foundation that is designed to resist the settlement and heave of expansive soil, (2) deepening the foundations to below the zone of moisture fluctuation, i.e., by using deep footings or drilled piers, and/or (3) using footings at normal shallow depths but bottomed on a layer of select fill having a low expansion potential.

Successful performance of structures on expansive soil requires special attention during construction. It is imperative that exposed soil be kept moist prior to placement of concrete for foundation construction. It can be difficult to remoisturize clayey soil without excavation, moisture conditioning, and recompaction.

## 3.3 SEISMIC HAZARDS

Potential seismic hazards resulting from a nearby moderate to major earthquake can generally be classified as primary and secondary. The primary effect is ground rupture, also called surface faulting. The common secondary seismic hazards include ground shaking, liquefaction, densification due to earthquake shaking, and lateral spreading. The following sections present a discussion of these hazards as they apply to the site. Based on topographic and lithologic data, the risk of regional subsidence or uplift is considered low to negligible at the site.

### 3.3.1 Ground Rupture

Since there are no known active faults crossing the property and the site is not located within an Earthquake Fault Special Study Zone, it is our opinion that ground rupture is unlikely at the subject property.

### 3.3.2 Ground Shaking

An earthquake of moderate to high magnitude generated within the San Francisco Bay region could cause considerable ground shaking at the site, similar to that which has occurred in the past. To mitigate the shaking effects, structures should be designed using sound engineering judgment and the current California Building Code (CBC) requirements, as a minimum. Structures under the CBC should be able to: (1) resist minor earthquakes without damage, (2) resist moderate earthquakes without structural damage but with some nonstructural damage, and (3) resist major earthquakes without collapse but with some structural and nonstructural damage. Conformance to the current building code does not constitute any kind of guarantee that significant structural damage would not occur in the event of a maximum magnitude earthquake; however, it is reasonable to expect that a well-designed and well-constructed structure will not collapse or cause loss of life in a major earthquake (SEAOC, 1996).

### 3.3.3 Liquefaction

The site is not located within a potentially liquefiable zone based on the Seismic Hazards Zone map for the Livermore Quadrangle by the California Geological Survey (CGS, 2008); however, according to mapping prepared by the Association of Bay Area Governments (ABAG, 2001), the site is identified as moderately susceptible to liquefaction.

Soil liquefaction results from loss of strength during cyclic loading, such as imposed by earthquakes. The soil typically considered most susceptible to liquefaction is clean, loose, saturated, uniformly graded sand below the groundwater table.

Based on the soil type and consistency of the soil materials encountered during our exploration and the depth to hydrostatic groundwater of at least 45 feet bgs, the potential for liquefaction of the site soil at the project site is negligible.

### 3.3.4 Lateral Spreading

Lateral spreading is a failure within weak soil, typically due to liquefaction, which causes a soil mass to move along a free face, such as an open channel, or down a gentle slope. Due to the relatively flat site topography and low risk of liquefaction, we consider the potential for lateral spreading at the site to be low.

## 3.4 COMPRESSIBLE SOIL

Compressible soil is subject to consolidation settlement when a new loading scenario is introduced by structures, earthwork, and/or equipment. The amount of settlement is dependent on the magnitude and duration of the applied load, the shape and size of the applied area, and the depth, thickness, and the stress history of the compressible soil. The time required for primary consolidation settlement is highly dependent on the permeability of the deposit. Consequently, sandy soil will settle almost immediately, whereas clayey soil will settle much more slowly.

During our exploration, we encountered predominantly lean clay fill outside of the Busch Pit Area. Based on our review of historical aerial photographs and documents, the existing fill was placed at least 30 years ago. Therefore, we anticipate that settlement due to existing fill loads is essentially complete.

Although we understand the grading plan and site layout is subject to change, it is currently proposed that site grades will be raised up to approximately 8 feet to achieve final design grades. The added fill to be placed above existing grades will result in increased long-term loads. Additionally, the structural loads of the building supported on shallow foundations will impose increased loads. The added grading combined with building structural loads are estimated to result in compression of the fill materials and potentially excessive settlements.

Consolidation testing was not conducted on site soil in our explorations or previous explorations. Considering the preliminary nature of this study and our experience within the greater EPSP area, we opine that the undocumented fill as described in Section 2.4 should be considered potentially compressible when subjected to an anticipated increase in service loads, with exception to the surficial engineered fill observed by Haley & Aldrich in 2018.

We performed preliminary consolidation settlement calculations considering an estimated building load imposed by the proposed wood-frame residential structures of 250 psf with civil fill varying between 0 and 8 feet. Based on our laboratory analysis and the anticipated service loads of the project, we have estimated that the potential primary consolidation settlements from the potentially compressible clay to be between approximately 1½ and 14 inches in the area outside the vicinity of the former fill stockpile area and outside of Busch Pit, shown in Figures 2A and 2B. Within the vicinity of the stockpile area, we estimate potential consolidation settlements to be up to 1 inch, assuming the stockpile was at least 5 feet tall within the site limits.

To mitigate long-term total and differential settlement from compressible soil, “pre-consolidation” of the compressible layers prior to site development can be used to reduce the future long-term settlement. In general, pre-consolidation of compressible soil can be achieved through a surcharge loading program as described in Section 4.2.

The total amount of settlement across the site is expected to vary based on the heterogeneous conditions of the subsurface soil and expected proposed grades.

### 3.5 2022 CBC SEISMIC DESIGN PARAMETERS

Based on the subsurface conditions encountered in our explorations and seismic shear-wave data, we preliminarily characterize the site as Site Class D in accordance with the current CBC. Depending on further characterization of the compressibility and plasticity indices of the existing undocumented fill, the site may have the potential to be characterized as Site Class E. Additional laboratory testing should be performed during the design level study to characterize the properties of the undocumented fill.

## 4.0 PRELIMINARY EARTHWORK RECOMMENDATIONS

The following preliminary recommendations are for estimating and planning purposes. Final recommendations regarding site grading and hazard mitigation will be provided in the design-level geotechnical exploration.

### 4.1 GENERAL DEMOLITION AND SITE CLEARING

Areas containing surface vegetation or organic-laden topsoil within the areas to be improved should be stripped to an appropriate depth to remove these materials. The amount of actual stripping should be determined in the field by our authorized representative at the time of construction. Subject to approval by the Landscape Architect, strippings and organically contaminated soil can be used in landscape areas. Otherwise, such soil should be removed from the project site. Any topsoil that will be retained for future use in landscape areas should be stockpiled in areas where it will not interfere with grading operations.

Excavations resulting from demolition and stripping, which extend below final grades, should be cleaned to firm undisturbed soil as determined by our representative. Once the surface of areas to be graded are prepared as discussed above, the surface should then be scarified, moisture conditioned, and backfilled with suitable material compacted to the recommendations presented in the Fill Placement section.

## 4.2 EXISTING UNDOCUMENTED FILL TREATMENT

### 4.2.1 Preliminary Surcharge Program

To mitigate post-construction primary consolidation settlements, we recommend performing a surcharge program over the site excluding Busch Pit. We also note that recommended surcharge areas should be revisited once a design level geotechnical exploration is performed and land plans have been finalized. Table 4.2.2-1 below presents our preliminary estimated settlements per planned civil fill, considering a surcharge fill mass (unit weight of 120 pcf) of approximately 120 percent of the anticipated service loads of the project. These estimates did not consider settlement due to compressibility and decomposition of debris material that may be present within the undocumented fill. Estimated surcharge heights should be revisited in the design-level study.

**TABLE 4.2.1-1: Estimated Surcharge Height**

| PLANNED THICKNESS OF CIVIL FILL (feet) | SURCHARGE HEIGHT (feet) | CONSOLIDATION SETTLEMENT (inches) | |
|---|---|---|---|
| | | LOWER ESTIMATE | UPPER ESTIMATE |
| 0 to 2 | 0 to 2½ | 1½ | 7½ |
| 2 to 4 | 2½ to 5 | 2¾ | 10½ |
| 4 to 6 | 5 to 7½ | 4 | 13 |
| 6 to 8 | 7½ to 9½ | 5½ | 15½ |

Table 4.2.1-2 presents our preliminary estimated settlements per planned civil fill for the area formerly surcharged with a historical stockpile as shown on Figure 2, considering an assumed former fill stockpile height of 5 feet and surcharge fill mass (unit weight of 120 pcf) of approximately 120 percent of the anticipated service loads of the project. These estimates did not consider settlement due to compressibility and decomposition of debris material that may be present within the undocumented fill. Estimated surcharge heights should be revisited in the design-level study, or when a more accurate estimate of the former fill stockpile height is acquired.

**TABLE 4.2.1-2: Estimated Surcharge Height – Former Fill Stockpile Area**

| PLANNED THICKNESS OF CIVIL FILL (feet) | SURCHARGE HEIGHT (feet) | CONSOLIDATION SETTLEMENT (inches) |
|---|---|---|
| 0 to 2 | 0 to 2½ | ½ |
| 2 to 4 | 2½ to 5 | ½ |
| 4 to 6 | 5 to 7½ | 1 |
| 6 to 8 | 7½ to 9½ | 1 |

The surcharge should be monitored with settlement plates and surface settlement markers, at the least. The surcharge can be removed once settlement has substantially ceased. The settlement-monitoring plates should be installed prior to surcharge placement to monitor consolidation. The number and location of the settlement monitoring plates should be determined by us once the surcharge staging has been determined. To allow for redundancy, no fewer than two settlement plates should be installed in any surcharge phase. The settlement-monitoring plates should be surveyed to determine elevations at least weekly for the first 2 months and then monthly until we have determined that the desired degree of surcharge-driven pre-consolidation has been achieved. All readings of settlement should be tied to benchmarks established well beyond the zone of surcharge influence.

The duration required to achieve the desired degree of settlement based on future loads could vary across the site based on the variability of subsurface conditions. Supplemental explorations should be further conducted during design level study to refine consolidation parameters, including durations and degree of settlement.

We understand the proposed plan development is in the early stages of development. We recommend that ENGEO be retained to prepare remedial grading plans to include the surcharge program for this project.

## 4.3 ACCEPTABLE FILL

### 4.3.1 On-site Existing Fill

On-site soil material may be suitable as fill material provided it is processed to remove concentrations of organic material, debris, and particles greater than 8 inches in maximum dimension.

### 4.3.2 Import Fill

Ideally, imported fill materials should have a plasticity index less than 25 and have at least 20 percent passing the No. 200 sieve. Due to the residential nature of the proposed project, environmental testing should also be performed on imported fill. Import fill containing recycled asphaltic concrete should not be placed in building pad areas. We should be allowed to sample and test the proposed imported fill materials at least 72 hours prior to delivery to the site.

If desirable, ENGEO should be contacted to evaluate the appropriateness of import material that does not meet the above criteria.

## 4.4 OVER-OPTIMUM SOIL MOISTURE CONDITIONS

The contractor should anticipate encountering excessively over-optimum (wet) soil moisture conditions during winter or spring grading, or during or following periods of rain. Wet soil can make proper compaction difficult. Wet soil conditions can be mitigated by:

1. Frequent spreading and mixing during warm dry weather;
2. Mixing with drier materials;
3. Mixing with a lime, lime-fly ash, or cement product; or
4. Stabilizing with aggregate, geotextile stabilization fabric, or both.

Options 3 and 4 should be evaluated and approved by a representative of our firm prior to implementation.

## 4.5 FILL PLACEMENT

### 4.5.1 Undocumented Fill Mitigation

With exception to the Busch Pit area, we recommend removal and recompaction of documented and undocumented fill in the upper portions of the site, such that civil and utility excavations do not extend below the known depth of documented fill. The extent of removal and recompaction, if applicable, should be evaluated during the design-level study.

### 4.5.2 General Fill

After removal and recompaction of undocumented fill, the exposed non-yielding surface of areas to receive fill or to be left at grade, should be scarified to a depth of 12 inches, moisture conditioned, and recompacted to provide adequate bonding with the initial lift of fill. The loose lift thickness should not exceed 8 inches or the depth of penetration of the compaction equipment used, whichever is less. The following compaction control requirements should be applied to all fill, including backfill, except for landscape areas.

**TABLE 4.5.2-1: Compaction Control Requirements**

| FILL LOCATION | MATERIAL TYPE | REQUIRED RELATIVE COMPACTION** (%) | MINIMUM MOISTURE CONTENT (percentage points above optimum) |
|---|---|---|---|
| General Fill | Expansive* | 87 to 92 | 4 |
| | Low-Expansive* | 90 | 2 |
| Pavement and Flatwork Subgrade* | Expansive* | 90 | 4 |
| | Low-Expansive* | 95 | 1 |
| Pavement and Flatwork Aggregate Base | Class 2 Aggregate Base | 95 | 0 |

* Expansive: PI greater than 20
Non- to Low-Expansive: PI less than 20
** Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material.

## 4.6 UNDERGROUND UTILITY BACKFILL

The contractor is responsible for conducting trenching and shoring in accordance with CAL OSHA requirements. Project consultants involved in utility design should specify pipe-bedding materials. Exercise care where utility trenches are located beside foundation areas. Locate utility trenches constructed parallel to foundations entirely above a plane extending down from the lower edge of the footing at an angle of 45 degrees. Provide utility companies and landscape architects with this information.

Where utility trenches cross underneath buildings or cross perimeter building foundations, we recommend that a plug be placed within the trench backfill to prevent the normally granular bedding materials from acting as a conduit for water to enter beneath the building. The plug should be constructed using sand cement slurry (minimum 28-day compressive strength of 500 psi) or relatively impermeable native soil for pipe bedding and backfill. We recommend that the plug extend for a distance of at least 3 feet in each direction from the point where the utility enters the building perimeter.

Use well-graded import less than ¾ inch in maximum dimension for pipe zone backfill (i.e., material beneath and immediately surrounding the pipe). Use fine- to medium-grained sand or a well-graded mixture of sand and gravel for pipe zone backfill import material. Avoid using this material within 2 feet of finish grades. In general, avoid using uniformly graded gravel for pipe or trench zone backfill due to the potential for migration of: (1) soil into the relatively large void spaces present in this type of material; and (2) water along trenches backfilled with this type of material. Native soil for trench zone backfills (i.e., material placed between the pipe zone backfill and the ground surface) should be compacted in accordance with recommendations in Fill Placement in this report.

Jetting of backfill is not an acceptable means of compaction. We may allow thicker loose lift thicknesses, based on acceptable density test results, where increased effort is applied to rocky fill or for the first lift of fill over pipe bedding.

## 4.7 GRADED SLOPES

In general, permanent graded cut or fill slopes less than 10 feet high should be graded no steeper than 2:1 (horizontal:vertical).

## 4.8 STORMWATER BIOTREATMENT AND INFILTRATION

We encountered moderately to highly expansive clay near the ground surface. Thus, the existing site soil is not expected to have adequate permeability for stormwater infiltration, unless subdrains are installed. We recommend assuming little stormwater infiltration will occur through the existing site soil.

If bioretention areas are implemented, we recommend that, when practical, they be planned a minimum of 5 feet away from structural site improvements, such as buildings, streets, retaining walls, and sidewalks/driveways. When this is not practical, bioretention areas located within 5 feet of structural site improvements can either:

1. Be constructed with structural side walls capable of withstanding the loads from the adjacent improvements, or
2. Incorporate filter material compacted to between 85 and 90 percent relative compaction (ASTM D1557, latest edition) and a waterproofing system designed to reduce the potential for moisture transmission into the subgrade soil beneath the adjacent improvement.

In addition, one of the following options should be followed.

1. We recommend that bioretention design incorporate a waterproofing system lining the bioswale excavation and a subdrain, or other storm drain system, to collect and convey water to an approved outlet. The waterproofing system should cover the bioretention area excavation in such a manner as to reduce the potential for moisture transmission beneath the adjacent improvements.
2. Alternatively, and with some risk of movement of adjacent improvements, if infiltration is desired, we recommend the perimeter of the bioretention areas be lined with an HDPE tree root barrier that extends at least 1 foot below the bottom of the bioretention areas/infiltration trenches.

Site improvements located adjacent to bioretention areas that are underlain by base rock, sand, or other imported granular materials, should be designed with a deepened edge that extends to the bottom of the imported material underlying the improvement.

Where adjacent site improvements include buildings greater than three stories, streets steeper than 3 percent, or design elements subject to lateral loads (such as from impact or traffic patterns), additional design considerations may be recommended. If the surface of the bioretention area is depressed, the slope gradient should follow the slope guidelines described in Section 4.5 of this document. In addition, although not recommended, if trees are to be planted within bioretention areas, HDPE tree boxes that extend below the bottom of the bioretention system should be installed to reduce potential impact to subdrain systems that may be part of the bioretention area design. For this condition, the waterproofing system should be connected to the HPDE tree box with a waterproof seal.

Given the nature of bioretention systems and possible proximity to improvements, we recommend ENGEO be retained to review design plans and provide testing and observation services during the installation of linings, compaction of the filter material, and connection of designed drains.

It should be noted that the contractor is responsible for conducting all excavation and shoring in a manner that does not cause damage to adjacent improvements during construction and future maintenance of the bioretention areas. As with any excavation adjacent to improvements, the contractor should reduce the exposure time such that the improvements are not detrimentally impacted.

# 5.0 PRELIMINARY FOUNDATION RECOMMENDATIONS

## 5.1 POST-TENSIONED MAT FOUNDATIONS

After completion of a surcharge program and provided the foundation design can accommodate the estimated seismically induced settlement, the proposed lightly to moderately loaded residential structures may be supported on post-tensioned (PT) mat foundations bearing on prepared engineered fill. PT mats may be designed for an average allowable bearing pressure of up to 1,000 to 1,500 pounds per square foot (psf) for dead-plus-live loads. The allowable bearing pressures can be increased by one-third for wind or seismic loads. PT mats should be designed for the anticipated post-construction differential settlement and the relative expansion potential of the foundation soil following site grading. We would anticipate preliminary foundation thickness on the order 11 to 12 inches.

PT mats should be underlain with a moisture reduction system as recommended in Section 5.2. The subgrade should not be allowed to dry prior to concrete placement.

## 5.2 FOUNDATION SUBGRADE MOISTURE VAPOR REDUCTION

When buildings are constructed with concrete slab-on-grade floors, including PT mats, water vapor from beneath the slab will migrate through the slab and into the building. This water vapor can be reduced but not stopped. Vapor transmission can negatively affect floor coverings and lead to increased moisture within a building. When water vapor migrating through the slab would be undesirable, we recommend the following to reduce, but not stop, water vapor transmission upward through the slab-on-grade.

1. A moisture retarder system should be constructed directly beneath the slab-on-grade that consists of the following.
    a. Vapor retarder membrane sealed at all seams and pipe penetrations and connected to all footings. Vapor retarders should conform to Class A vapor retarder in accordance with ASTM E 1745, latest edition, “Standard Specification for Plastic Water Vapor Retarders used in Contact with Soil or Granular Fill under Concrete Slabs.” The vapor retarder should be **underlain by**
    b. 4 inches of clean crushed rock to act as a capillary break. Crushed rock should have 100 percent passing the ¾-inch sieve and less than 5 percent passing the No. 4 sieve. If a PT mat is used, this capillary break may be omitted.

2. Concrete should have a concrete water-cement ratio of no more than 0.50.
3. Inspection and testing should be performed during concrete placement to check that the proper concrete and water cement ratio are used.
4. The slab should be moist cured for a minimum of 3 days or use of other equivalent curing specified by the structural engineer should be implemented.

The structural engineer should be consulted as to the use of a layer of clean sand or pea gravel (less than 5 percent passing the U.S. Standard No. 200 Sieve) placed on top of the vapor retarder membrane to assist in concrete curing. If sand or pea gravel is used above the vapor retarder membrane along with a PT mat, the edge of the mat should be thickened to cut off water getting in between the slab and the membrane. The thickened edge should be as thick as the sand or pea gravel layer and at least 12 inches wide.

# 6.0 PRELIMINARY RETAINING WALL RECOMMENDATIONS

## 6.1 LATERAL SOIL PRESSURES

For preliminary purposes, unrestrained drained site retaining walls constructed on level ground may be designed using an active equivalent fluid weight of 45 to 55 pounds per cubic foot (pcf) for a level backfill. Walls restrained from movement at the top, such as basement walls, should be designed to resist additional at-rest pressure. The friction factor for sliding resistance may be assumed to range from 0.25 to 0.30.

Seismic conditions also need to be considered in the design of restrained retaining walls and any unrestrained walls greater than 6 feet in height.

Drainage facilities should be constructed behind retaining walls to prevent the build-up of hydrostatic pressures on the walls as recommended in Section 6.3.

## 6.2 FOUNDATIONS

Site retaining walls and sound walls can be supported on continuous footings. Continuous footings should be designed using an allowable bearing pressure of 2,000 to 3,000 pounds per square foot (psf) in engineered fill. The footings should be at least 18 to 24 inches below lowest adjacent grades. If footings are located within 5 feet from nearby tops of slopes or on sloping ground, the footing embedment should be increased to achieve at least 10 horizontal feet to the nearest free slope face.

Passive pressures acting on foundations and keyways may be assumed as 250 to 375 pcf provided that the area in front of the retaining wall is level for a distance of at least 10 feet or three times the depth of foundation and keyway, whichever is greater.

The friction factor for sliding resistance may be assumed to range from 0.25 to 0.30. It is recommended that retaining wall footings be designed using an allowable bearing pressure of 2,000 to 3,000 psf in engineered fill.

### 6.3 RETAINING WALL DRAINAGE

Either graded rock drains or geosynthetic drainage composites should be constructed behind the retaining walls to reduce hydrostatic lateral forces. For rock drain construction, we recommend two types of rock drain alternatives.

1. A minimum 12-inch-thick layer of Class 2 Permeable Filter Material (Caltrans Specification 68-2.02F) placed directly behind the wall, or
2. A minimum 12-inch-thick layer of washed, crushed rock with 100 percent passing the ¾-inch sieve and less than 5 percent passing the No. 4 sieve. Envelop rock in a minimum 6-ounce, nonwoven geotextile filter fabric.

For both types of rock drains:

1. The rock drain should be placed directly behind the walls of the structure.
2. The rock drains should extend from the wall base to within 12 inches of the top of the wall.
3. A minimum of 4-inch-diameter perforated pipe (glued joints and end caps) should be placed at the base of the wall, inside the rock drain and fabric, with perforations placed down.
4. The pipe should be placed at a gradient at least 1 percent to direct water away from the wall by gravity to a drainage facility.

We should review and approve geosynthetic composite drainage systems prior to use.

### 6.4 BACKFILL

Backfill behind retaining walls should be placed and compacted in accordance with Section 4.5. Use light compaction equipment within 5 feet of the wall face. If heavy compaction equipment is used, the walls should be temporarily braced to avoid excessive wall movement.

## 7.0 DESIGN-LEVEL GEOTECHNICAL STUDY

This report presents preliminary geotechnical findings, conclusions, and recommendations intended for preliminary planning purposes only. Once performance criteria for the proposed development is selected, a design-level geotechnical exploration and assessment should be performed. We recommend the design-level exploration and reporting include the following scope items.

- Hollow-stem auger borings, including matched-pair borings
- Soil sample collection at depths relevant to the building-specific foundation design
- Laboratory testing including, but not limited to, moisture content, unit weight, gradation, Atterberg Limits, strength, consolidation, and corrosivity testing
- Design-level assessment of geologic and geotechnical hazards, including, but not limited to:
  - Characterization of subsurface conditions
  - Consolidation of compressible soil based on in situ structural loading
- Design recommendations for foundation system design

- Design-level subexcavation, ground improvement and/or surcharging recommendations
- Foundation constructability recommendations
- Design-level earthwork and improvement design and construction recommendations

## 8.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report presents geotechnical recommendations for design of the improvements discussed in Section 1.3 for the Arroyo Lago project. If changes occur in the nature or design of the project, we should be allowed to review this report and provide additional recommendations, if any. It is the responsibility of the owner to transmit the information and recommendations of this report to the appropriate organizations or people involved in design of the project, including but not limited to developers, owners, buyers, architects, engineers, and designers.

We strived to perform our professional services in accordance with generally accepted principles and practices currently employed in the area; there is no warranty, express or implied. There are risks of earth movement and property damages inherent in building on or with earth materials. We are unable to eliminate all risks; therefore, we are unable to guarantee or warrant the results of our services.

This report is based upon field and other conditions discovered at the time of report preparation. We developed this report with limited subsurface exploration data. Given the highly variable nature of the soils at this site, the subsurface exploration data may not be representative of the actual subsurface conditions across the site. Considering possible underground variability of soil, rock, stockpiled material, and groundwater, additional costs may be required to complete the project. We recommend that the owner establish a contingency fund to cover such costs. If unexpected conditions are encountered, notify us immediately to review these conditions and provide additional and/or modified recommendations, as necessary.

Our services did not include excavation sloping or shoring, flood potential, or a geohazard exploration. In addition, our geotechnical exploration did not include work to determine the existence of possible hazardous materials. If any hazardous materials are encountered during construction, notify the proper regulatory officials immediately.

We determined the lines designating the interface between layers on the exploration logs using visual observations. The transition between the materials may be abrupt or gradual. The exploration logs contain information concerning samples recovered, indications of the presence of various materials such as clay, sand, silt, rock, existing fill, etc., and observations of groundwater encountered. The field logs also contain our interpretation of the subsurface conditions between sample locations. Therefore, the logs contain both factual and interpretative information. Our recommendations are based on the contents of the final logs, which represent our interpretation of the field logs.

# SELECTED REFERENCES

American Concrete Institute. 2005. Building Code Requirements for Structural Concrete (ACI 318-05) and Commentary (ACI 318R-05).

Association of Bay Area Governments. 2001. Liquefaction Hazard Map for Alameda County, Scenario: 1906 San Francisco Earthquake.

California Building Code. 2019.

California Department of Transportation. 2017. Highway Design Manual.

CBG. 2022. Vesting Tentative Map DRAFT, Arroyo Lago, Alameda County, California. August 2022. Job No. 3435-000.

Dibblee, T.W., Jr. 2005. Preliminary Geologic Map of the Livermore Quadrangle, Alameda County, California. U.S. Geological Survey Open-file Report.

Haley & Aldrich. 2013. Geotechnical Services During Construction, Filling of Busch Pit, Pleasanton Lakes Development, Pleasanton, California. December 18, 2013. File No. 130540-002.

Haley & Aldrich. 2017. Report on Preliminary Geotechnical Investigation, Unincorporated Alameda County, California. June 2017. File No. 130540-002

Haley & Aldrich. 2019. Final Grading Summary - Geotechnical Services During Construction, Filling of Busch Pit, Pleasanton Lakes Development, Pleasanton, California. December 12, 2019. File No. 130540

Haley & Aldrich. 2021. Report on Preliminary Subsurface Conditions Report, Unincorporated Alameda County, California. December 2021. File No. 130540-002

Robertson, P. K. and Campanella, R. G. 1998. Guidelines for Geotechnical Design Using CPT and CPTU Data.

Robertson, P. K. and L. Shao. 2010. Estimation of Seismic Compression in Dry Soils Using the CPT, Fifth International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics.

State of California. California Geologic Survey, 2008, Seismic Hazard Zone Report for the Livermore 7.5-Minute Quadrangle, Alameda County, California., Seismic Hazard Zone Report 114.

State of California. California Geologic Survey, 2008, Seismic Hazard Zones, Official Map, Livermore Quadrangle.

State of California. California Geologic Survey, 1982, Earthquake Fault Zones, Official Map, Livermore Quadrangle.

## SELECTED REFERENCES (Continued)

Structural Engineers Association of California (SEAOC). 1996. Recommended Lateral Force Requirements and Tentative Commentary, (“Blue Book”), 6th Edition, Seismology Committee, Structural Engineers Association of California, Sacramento, California.

Treadwell & Rollo. 2007. Due Diligence Investigation – Parcel 2 and Parcels D through G, Hanson Radum Site, Pleasanton, California. May 25, 2007. Project No. 4490.01

Treadwell & Rollo. 2009. Geotechnical Investigation Pleasanton Land Development Project, Pleasanton, California. September 8, 2009. Project No. 4490.02

Working Group on California Earthquake Probabilities. 2015. The Uniform California Earthquake Rupture Forecast, Version 3 (UCERF 3), U.S. Geological Survey Open-File Report 2015.

Zone 7 Water Agency. 2023. Livermore Valley Groundwater Basin, Sustainable Groundwater Management Annual Report, 2022 Water Year (October 2021 – September 2022); March 2023.

# FIGURES

BASEMAP SOURCE: GOOGLE EARTH MAPPING SERVICE, 2022

ENGEO
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VICINITY MAP
ARROYO LAGO
PLEASANTON, CALIFORNIA

PROJECT NO. : 9785.004.001
SCALE: AS SHOWN
DRAWN BY: JV
CHECKED BY: JR
FIGURE NO. 1

PATH: G:\DRAFTING\DRAFTING2_DWG\9785\004\GEOTECH\GEX\9785004001_GEX.APRX
LAYOUT: VICINITY USER: JVERGARA

ORIGINAL FIGURE PRINTED IN COLOR

## EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

- 🔴 CONE PENETRATION TEST (ENGEO, 2023)
- 🟡 CONE PENETRATION TEST (TREADWELL & ROLLO, 2009)
- ⊞ TEST PIT (ENGEO, 2023)
- ⊕ BORING (TREADWELL & ROLLO, 2006)
- ▭ BUSCH PIT
- ▭ APPROXIMATE LIMIT OF GRADING (HALEY & ALDRICH, 2018)
- ━ HISTORIC STOCKPILE AREA (HALEY & ALDRICH, 2013)
- **162.5** ESTIMATED DEPTH TO BOTTOM OF UNDOCUMENTED FILL IN FEET

N

0 125 250

FEET

BASEMAP SOURCE: GOOGLE EARTH MAPPING SERVICE, 2022

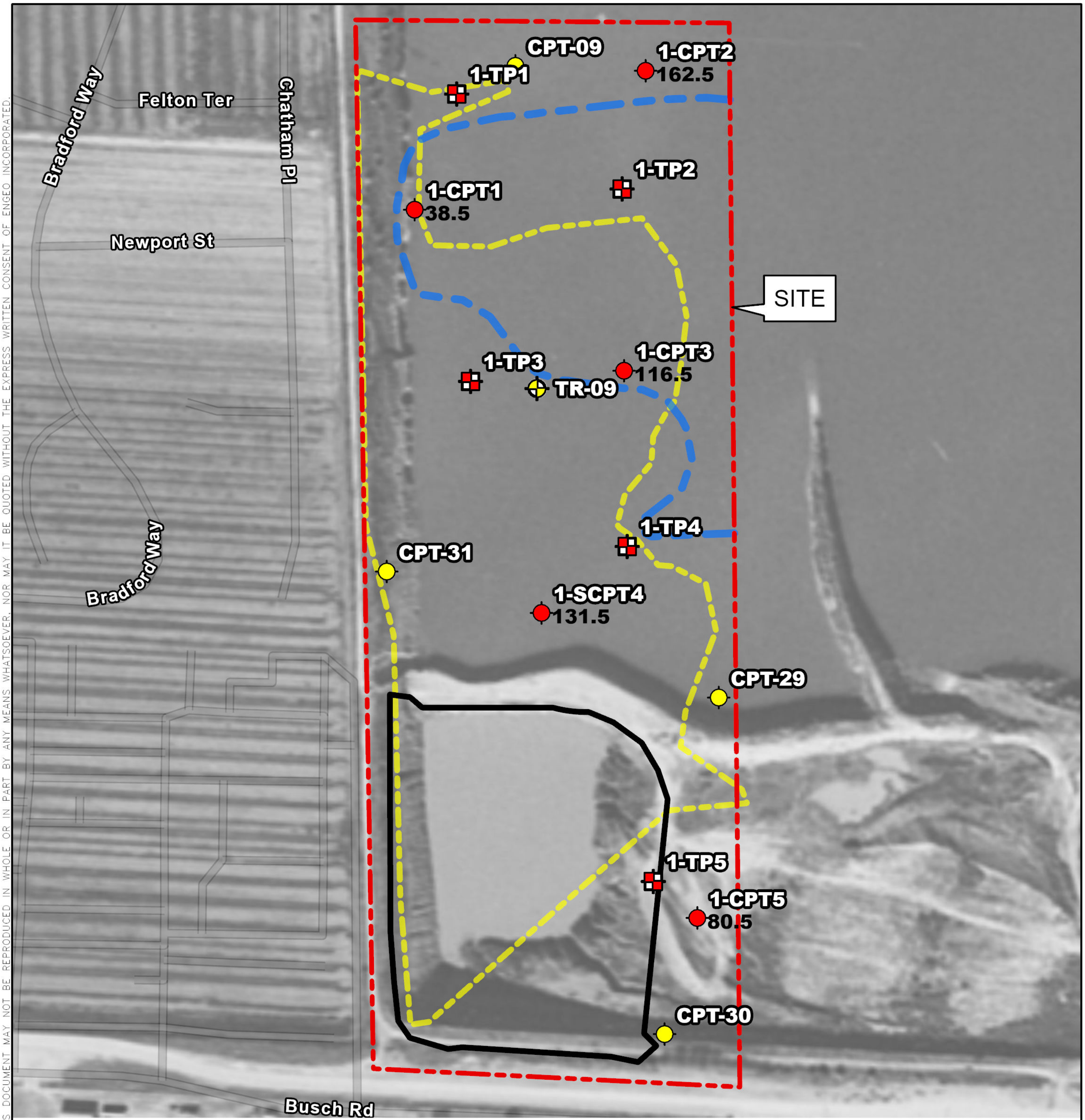
ENGEO
Expect Excellence

SITE PLAN
ARROYO LAGO
PLEASANTON, CALIFORNIA

PROJECT NO. : 9785.004.001
SCALE: AS SHOWN
DRAWN BY: JV
CHECKED BY: JR
FIGURE NO. 2A

PATH: G:\DRAFTING\DRAFTING2_DWG\9785\004\GEOTECH\GEX\9785004001_GEX.APRX
LAYOUT: SITE PLAN 2A USER: NLAMOTTEKERR

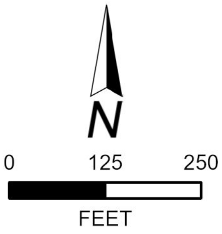
ORIGINAL FIGURE PRINTED IN COLOR



## EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

🔴 CONE PENETRATION TEST (ENGEO, 2023)
🟡 CONE PENETRATION TEST (TREADWELL & ROLLO, 2009)
⊞ TEST PIT (ENGEO, 2023)
⊕ BORING (TREADWELL & ROLLO, 2006)
▭ BUSCH PIT
▭ APPROXIMATE LIMIT OF GRADING (HALEY & ALDRICH, 2018)
━ HISTORIC STOCKPILE AREA (HALEY & ALDRICH, 2013)
**162.5** ESTIMATED DEPTH TO BOTTOM OF UNDOCUMENTED FILL IN FEET



BASEMAP SOURCE: EAST PLEASANTON HISTORICAL AERIALS, 1984

ENGEO
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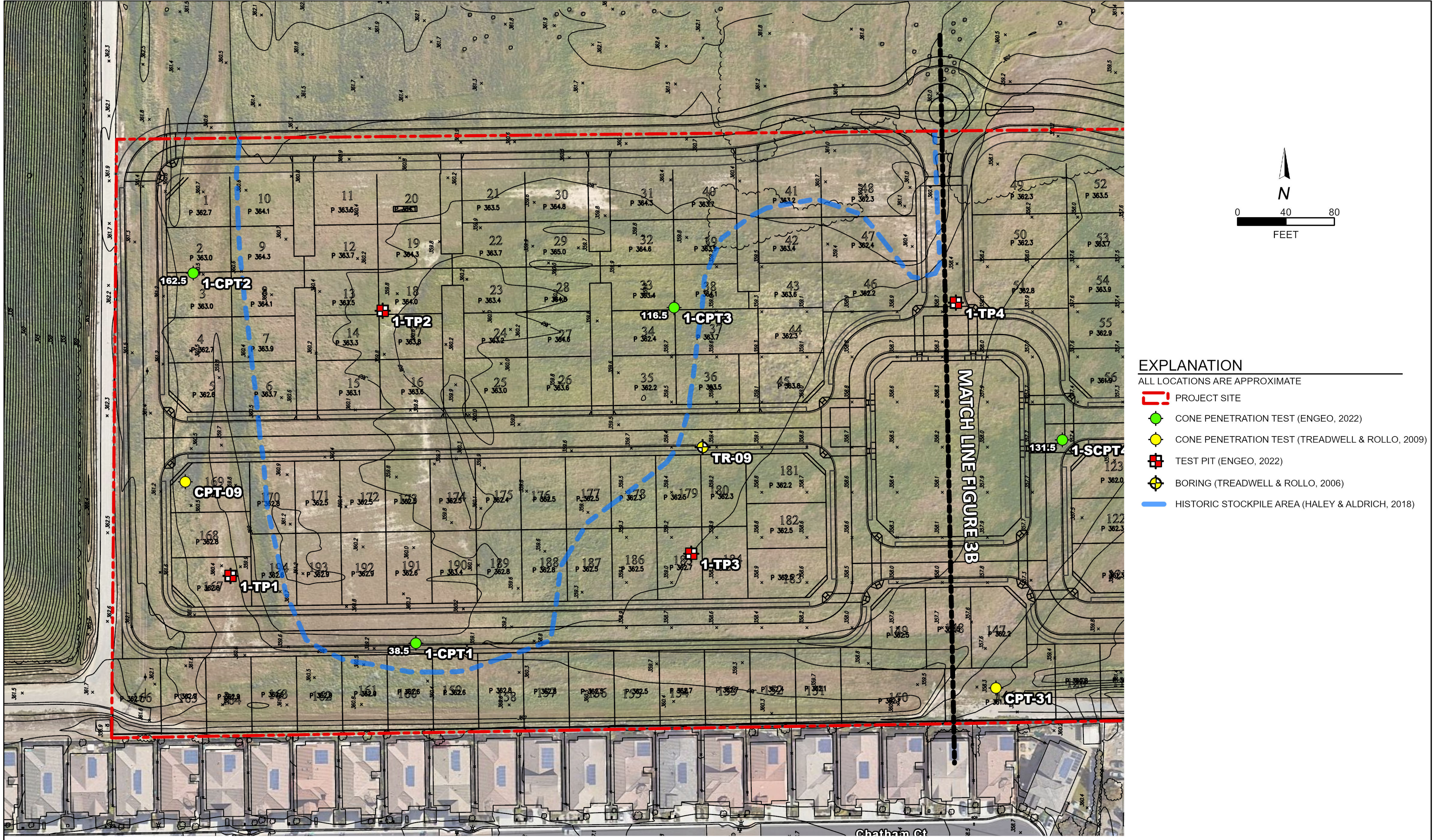
SITE PLAN WITH HISTORICAL AERIAL
ARROYO LAGO
PLEASANTON, CALIFORNIA

PROJECT NO.: 9785.004.001
SCALE: AS SHOWN
DRAWN BY: JV
CHECKED BY: JR
FIGURE NO. 2B

PATH: G:\DRAFTING\DRAFTING2_DWG\9785\004\GEOTECH\GEX\9785004001_GEX.APRX
LAYOUT: SITE PLAN 2B USER: NLAMOTTEKERR

ORIGINAL FIGURE PRINTED IN COLOR



EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

- 🟥 PROJECT SITE
- 🟢 CONE PENETRATION TEST (ENGEO, 2022)
- 🟡 CONE PENETRATION TEST (TREADWELL & ROLLO, 2009)
- ⊞ TEST PIT (ENGEO, 2022)
- ⊕ BORING (TREADWELL & ROLLO, 2006)
- ▬ HISTORIC STOCKPILE AREA (HALEY & ALDRICH, 2018)

BASE MAP SOURCE: ESRI MAPPING SERVICE

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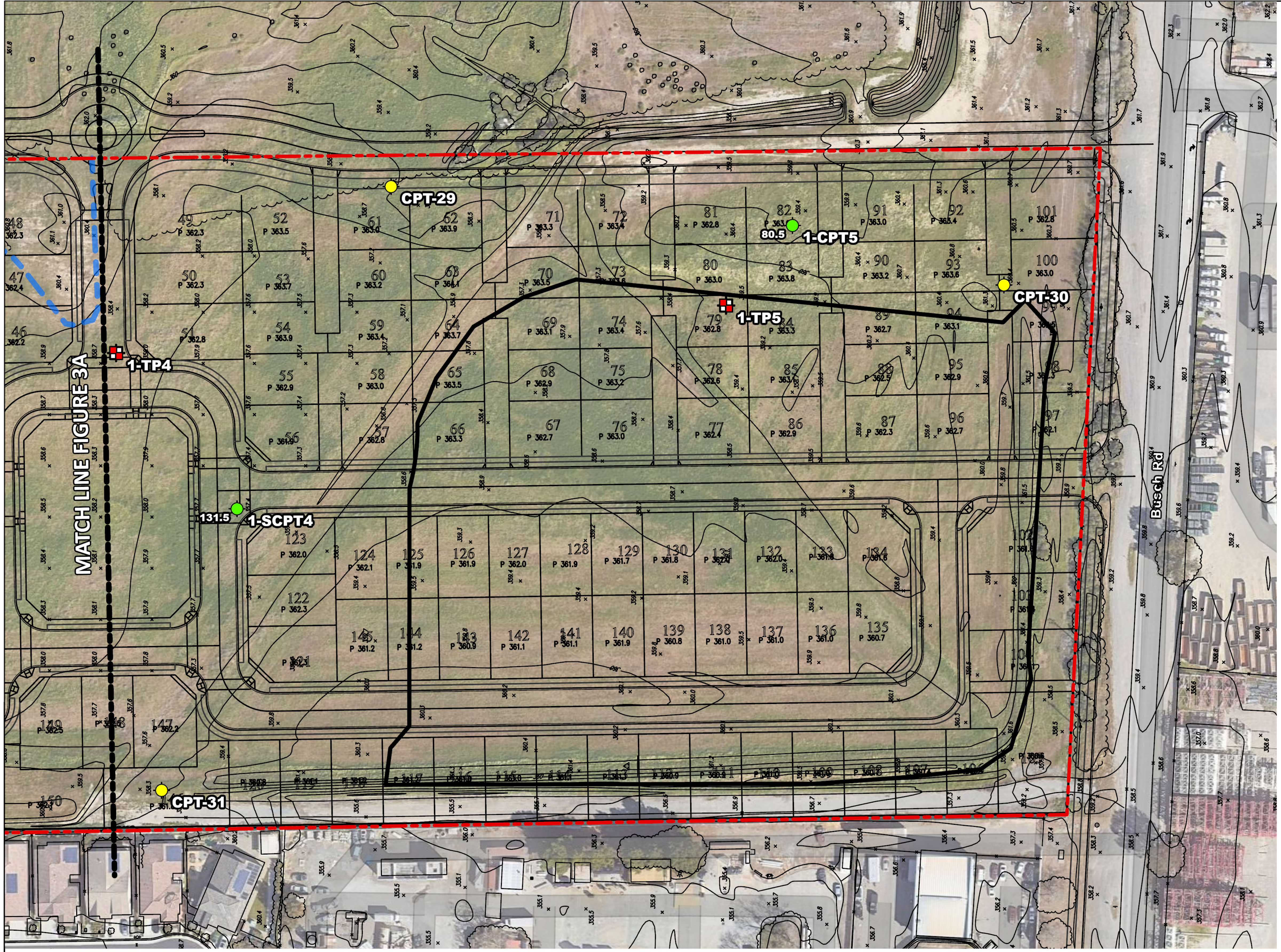
## SITE PLAN WITH PROPOSED GRADING

ARROYO LAGO
PLEASANTON, CALIFORNIA

PROJECT NO. : 9785.004.001
SCALE: AS SHOWN
DRAWN BY: NLK
CHECKED BY: JR
FIGURE NO. 3A

ORIGINAL FIGURE PRINTED IN COLOR

PATH: G:\DRAFTING\DRAFTING2_DWG\9785\004\GEOTECH\GEX\9785004001_GEX.APRX
LAYOUT: B-SIZE LANDSCAPE USER: NLAMOTTEKERR



N

0 40 80

FEET

## EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

| | |
|---|---|
| 🟥 | PROJECT SITE |
| 🟢 | CONE PENETRATION TEST (ENGEO, 2022) |
| 🟡 | CONE PENETRATION TEST (TREADWELL & ROLLO, 2009) |
| 🟥 | TEST PIT (ENGEO, 2022) |
| ⊕ | BORING (TREADWELL & ROLLO, 2006) |
| ▬ | HISTORIC STOCKPILE AREA (HALEY & ALDRICH, 2018) |
| ▭ | BUSCH PIT |

BASE MAP SOURCE: ESRI MAPPING SERVICE

ENGEO
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SITE PLAN WITH PROPOSED GRADING
ARROYO LAGO
PLEASANTON, CALIFORNIA

PROJECT NO. : 9785.004.001
SCALE: AS SHOWN
DRAWN BY: NLK
CHECKED BY: JR
FIGURE NO.
3B

PATH: G:\DRAFTING\DRAFTING2_DWG\9785\004\GEOTECH\GEX\9785004001_GEX.APRX
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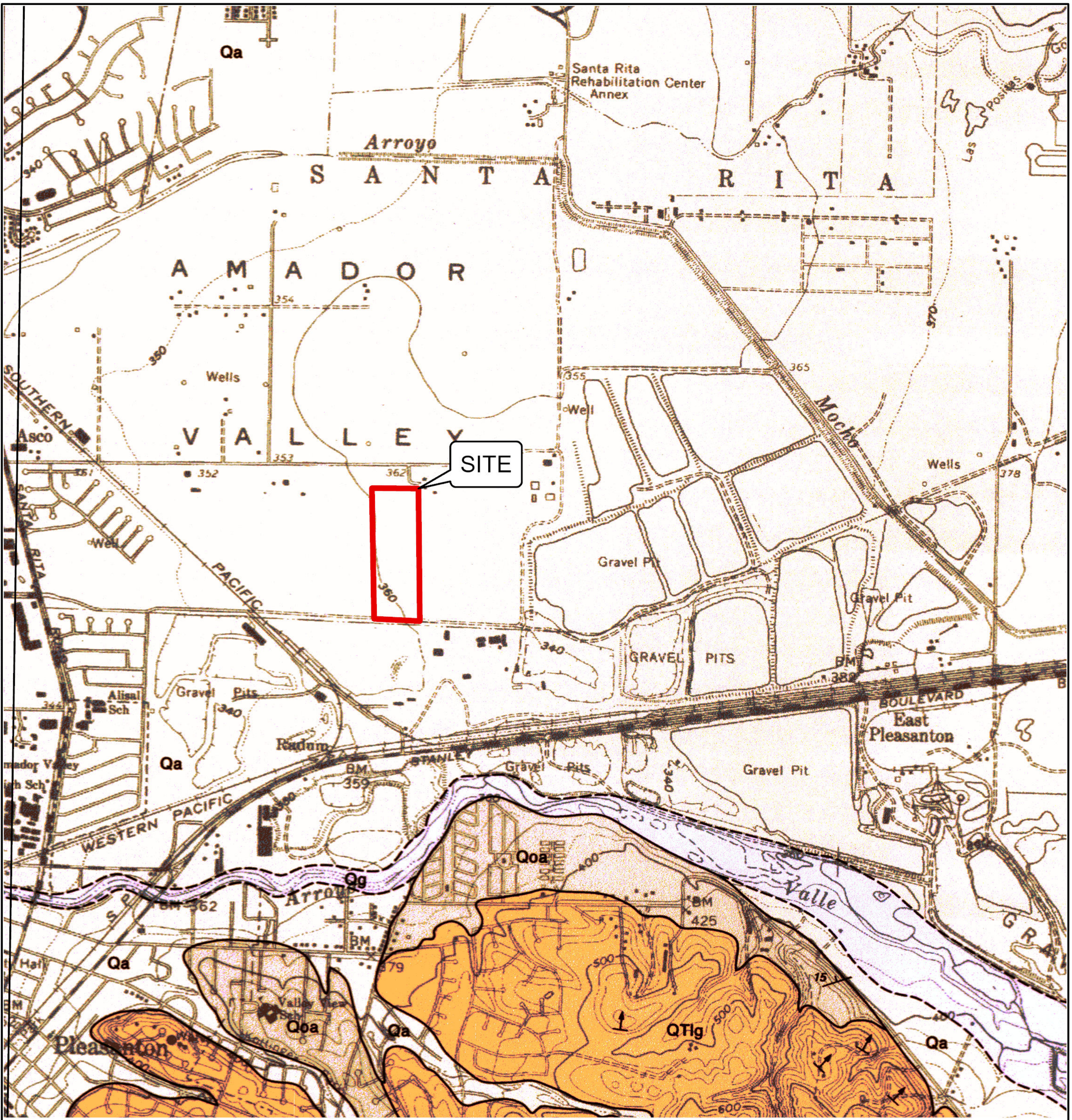
ORIGINAL FIGURE PRINTED IN COLOR



## EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

| | |
|---|---|
| Qa | ALLUVIAL GRAVEL, SAND AND CLAY |
| Qg | SAND AND GRAVEL OF MAJOR STREAM CHANNELS |
| Qoa | ALLUVIAL GRAVEL |
| QTlg | LIVERMORE GRAVEL |

BASEMAP SOURCE: DIBBLEE, 2006

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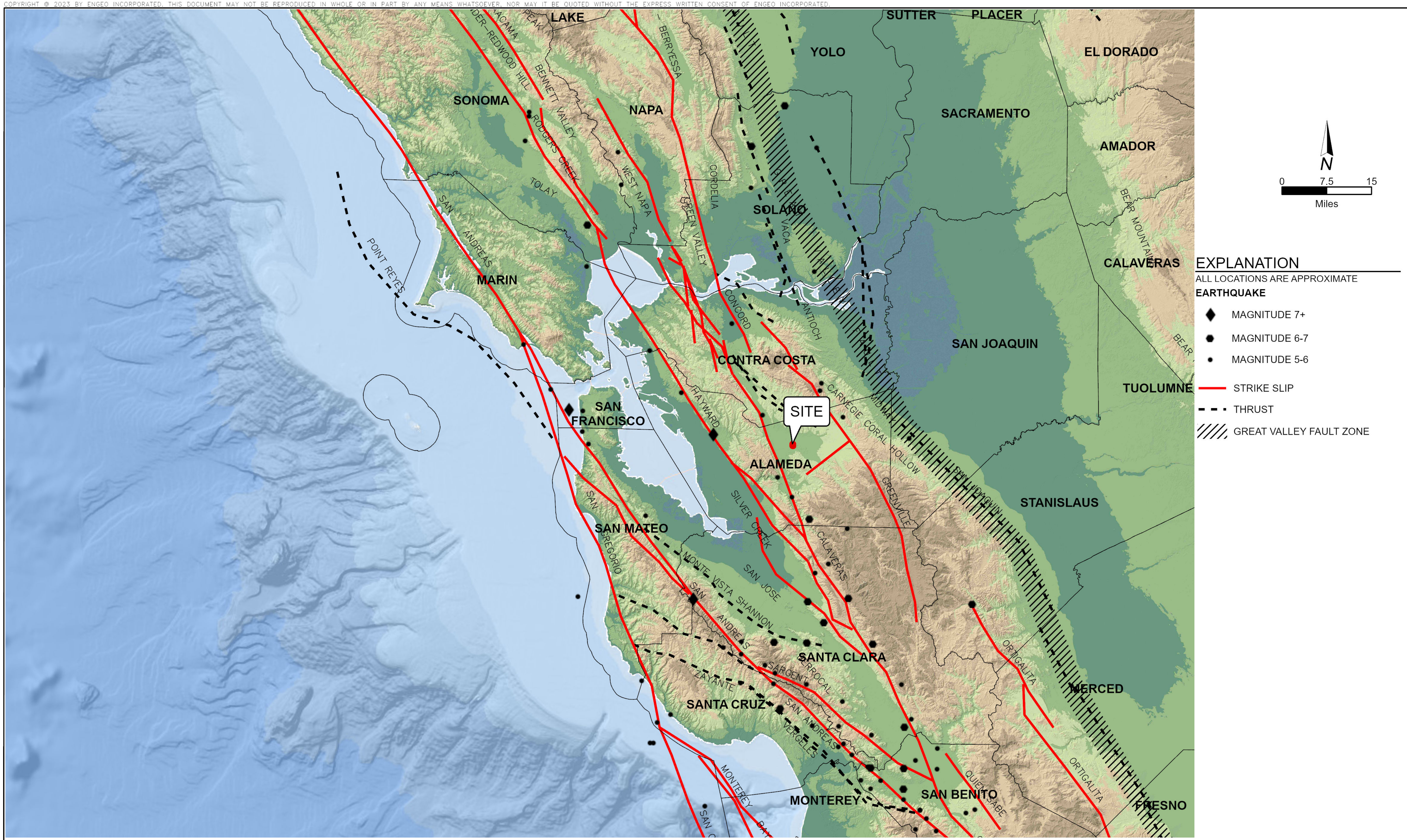
REGIONAL GEOLOGIC MAP
ARROYO LAGO
PLEASANTON, CALIFORNIA

PROJECT NO. : 9785.004.001
SCALE: AS SHOWN
DRAWN BY: NLK
CHECKED BY: JR
FIGURE NO. 4



BASE MAP SOURCE:
COLOR HILLSHADE IMAGE BASED ON THE NATIONAL ELEVATION DATA SET (NED) AT 30 METER RESOLUTION
UNIFORM CALIFORNIA EARTHQUAKE RUPTURE FORECAST, VERSION 3 (UCERF3)

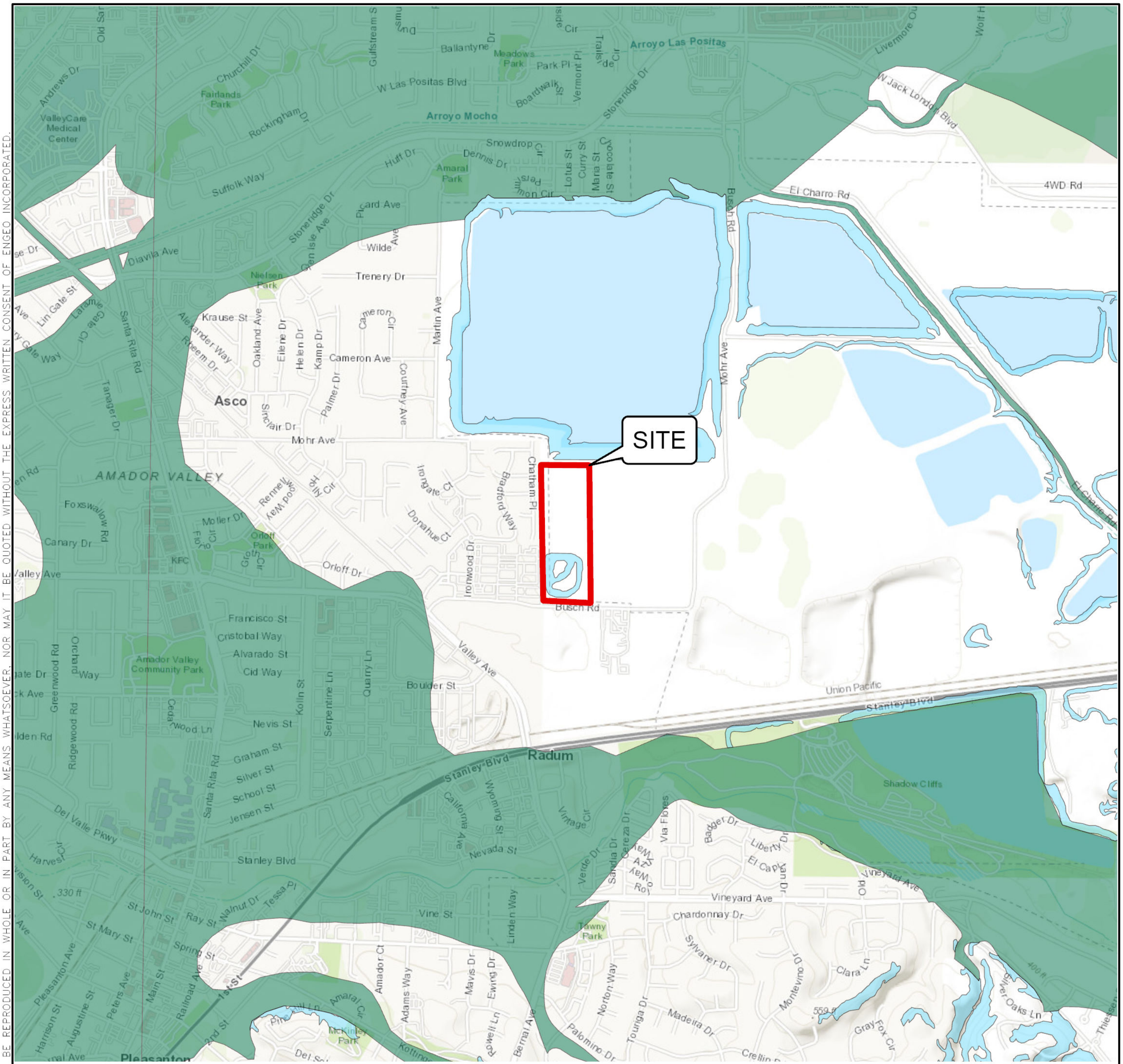
ENGEO
Expect Excellence

REGIONAL FAULTING AND SEISMICITY
ARROYO LAGO
PLEASANTON, CALIFORNIA

PROJECT NO.: 9785.004.001
SCALE: AS SHOWN
DRAWN BY: JV
CHECKED BY: JR
FIGURE NO. 5

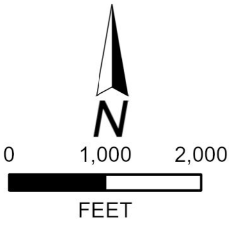
PATH: G:\DRAFTING\DRAFTING2_DWG\9785\004\GEOTECH\GEX\9785004001_GEX.APRX
LAYOUT: FAULT&SEISMICITY USER: NLAMOTTEKERR

ORIGINAL FIGURE PRINTED IN COLOR



# EXPLANATION

ALL LOCATIONS ARE APPROXIMATE



🟦 EARTHQUAKE-INDUCED LANDSLIDE ZONES
AREAS WHERE THE PREVIOUS OCCURRENCE OF LANDSLIDE MOVEMENT, OR LOCAL TOPOGRAPHIC, GEOLOGICAL, GEOTECHNICAL AND SUBSURFACE WATER CONDITIONS INDICATE A POTENTIAL FOR PERMANENT GROUND DISPLACEMENTS SUCH THAT MITIGATION AS DEFINED IN PUBLIC RESOURCES CODE SECTION 2693(C) WOULD BE REQUIRED.

🟩 LIQUEFACTION ZONE
AREAS WHERE THE HISTORICAL OCCURRENCE OF LIQUEFACTION, OR LOCAL GEOLOGICAL, GEOTECHNICAL AND GROUND WATER CONDITIONS INDICATE A POTENTIAL FOR PERMANENT GROUND DISPLACEMENTS SUCH THAT MITIGATION AS DEFINED IN PUBLIC RESOURCES CODE SECTION 2693(C) WOULD BE REQUIRED

BASEMAP SOURCE: ESRI MAPPING SERVICE
CALIFORNIA DEPARTMENT OF CONSERVATION, CALIFORNIA GEOLOGICAL SURVEY

ENGEO
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## SEISMIC HAZARDS ZONE MAP

ARROYO LAGO
PLEASANTON, CALIFORNIA

PROJECT NO. : 9785.004.001
SCALE: AS SHOWN
DRAWN BY: JV
CHECKED BY: JR
FIGURE NO. 6

# APPENDIX A

## TEST PIT LOGS
## ENGEO (2022)

ENGEO
Expect Excellence

# TEST PIT LOG 1-TP1

Latitude: 37.46076 Longitude: -121.85692

Arroyo Lago
Pleasanton, CA
9785.004.001

Logged By: N. Inserra
Logged Date: November 17, 2022
Equipment: CASE 580N Backhoe

| Depth (Feet) | Description | Depth of Test (Feet) | Plasticity Index | Fines Content (% passing #200 sieve) | Moisture Content (% dry weight) |
|---|---|---|---|---|---|
| 0 – 3 | GRAVELLY LEAN CLAY (CL), light grayish brown, moist, stiff, fine to coarse gravel [Fill] | 2 | 14 | 54 | |
| 3 – 10 | SANDY LEAN CLAY (CL), dark brownish gray, moist, stiff, trace fine gravel [Fill] | 7 | | | 13.2 |
| | End of test pit at approximately 10 feet below ground surface. No groundwater encountered. | | | | |

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Expect Excellence

# TEST PIT LOG 1-TP2

Latitude: 37.68031 Longitude: -121.85590

Arroyo Lago
Pleasanton, CA
9785.004.001

Logged By: N. Inserra
Logged Date: November 17, 2022
Equipment: CASE 580N Backhoe

| Depth (Feet) | Description | Depth of Test (Feet) | Plasticity Index | Fines Content (% passing #200 sieve) | Moisture Content (% dry weight) |
|---|---|---|---|---|---|
| 0 – 2 | SANDY LEAN CLAY (CL), light brown, moist, soft, trace fine gravel [Fill] | | | | |
| 2 – 8 | Becomes stiff, contains 10 – 15% dark gray fat clay inclusions [Fill] | 7 | | | 12.9 |
| 8 – 10½ | Becomes dark brownish gray, medium stiff, trace fine gravel [Fill] | 10 | | | 14.1 |
| | End of test pit at approximately 10½ feet below ground surface. No groundwater encountered. | | | | |

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# TEST PIT LOG 1-TP3

Latitude: 37.67936 Longitude: -121.85681

Arroyo Lago
Pleasanton, CA
9785.004.001

Logged By: N. Inserra
Logged Date:  November 17, 2022
Equipment:  CASE 580N Backhoe

| Depth (Feet) | Description | Depth of Test (Feet) | Plasticity Index | Fines Content (% passing #200 sieve) | Moisture Content (% dry weight) |
|---|---|---|---|---|---|
| 0 – ½ | SANDY FAT CLAY (CH), light brown, moist, soft, trace fine gravel [Fill] | | | | |
| ½ – 3 | GRAVELLY LEAN CLAY (CL), light brown, moist, coarse angular gravel [Fill] | | | | |
| 3 – 5½ | SANDY LEAN CLAY (CL), dark brownish gray, very stiff, trace fine gravel [Fill] | 3½ | | | 9.8 |
| 5½ – 10 | Becomes medium stiff | 7 | 12 | | 13.0 |
| | End of test pit at approximately 10 feet below ground surface. No groundwater encountered. | | | | |

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Expect Excellence

# TEST PIT LOG 1-TP4

Latitude: 37.67857 Longitude: -121.85584

Arroyo Lago
Pleasanton, CA
9785.004.001

Logged By: N. Inserra
Logged Date: November 17, 2022
Equipment: CASE 580N Backhoe

| Depth (Feet) | Description | Depth of Test (Feet) | Plasticity Index | Fines Content (% passing #200 sieve) | Moisture Content (% dry weight) |
|---|---|---|---|---|---|
| 0 – 1 | SANDY LEAN CLAY (CL), light brown, moist, soft, trace fine gravel [Fill] | | | | |
| 1 – 3½ | GRAVELLY LEAN CLAY (CL), brown, moist, coarse angular gravel [Fill] | | | | |
| 3½ – 5½ | SANDY LEAN CLAY (CH), dark brownish gray, moist, stiff, contains 5 – 10% fine subangular gravel [Fill] | 4½ | 26 | | 11.3 |
| 5½–10½ | Becomes dark brown to dark grayish brown, decreased gravel content | 7 | | | 13.9 |
| | End of test pit at approximately 10½ feet below ground surface. No groundwater encountered. | | | | |

# TEST PIT LOG 1-TP5

Latitude: 37.67694 Longitude: -121.85565

Arroyo Lago
Pleasanton, CA
9785.004.001

Logged By: N. Inserra
Logged Date: November 17, 2022
Equipment: CASE 580N Backhoe

| Depth (Feet) | Description | Depth of Test (Feet) | Plasticity Index | Fines Content (% passing #200 sieve) | Moisture Content (% dry weight) |
|---|---|---|---|---|---|
| 0 – 1½ | SANDY LEAN CLAY (CL), light brown, moist, soft, trace fine gravel [Fill] | | | | |
| 1½ – 3½ | becomes brown to brownish gray, stiff | 2½ | 18 | 65 | 8.2 |
| 3½ – 5 | Becomes dark brown, contains 10 – 15% dark gray fat clay inclusions [Fill] | | | | |
| 5 – 8 | Becomes dark grayish brown | 6 | | | 9.6 |
| 8 – 10½ | GRAVELLY LEAN CLAY (CL), dark grayish brown, moist, stiff, low PI, gravel is fine to coarse, subangular [Fill] | 10 | | | 13.8 |
| | End of test pit at approximately 10½ feet below ground surface. No groundwater encountered. | | | | |

# APPENDIX B

## CONE PENETRATION TEST LOGS
## (ENGEO, 2022)

|  |  |
|---|---|
| **Job No:** | 22-56-25067 |
| **Client:** | ENGEO Incorporated |
| **Project:** | Arroyo Lago |
| **Start Date:** | 17-Nov-2022 |
| **End Date:** | 18-Nov-2022 |

# CONE PENETRATION TEST SUMMARY

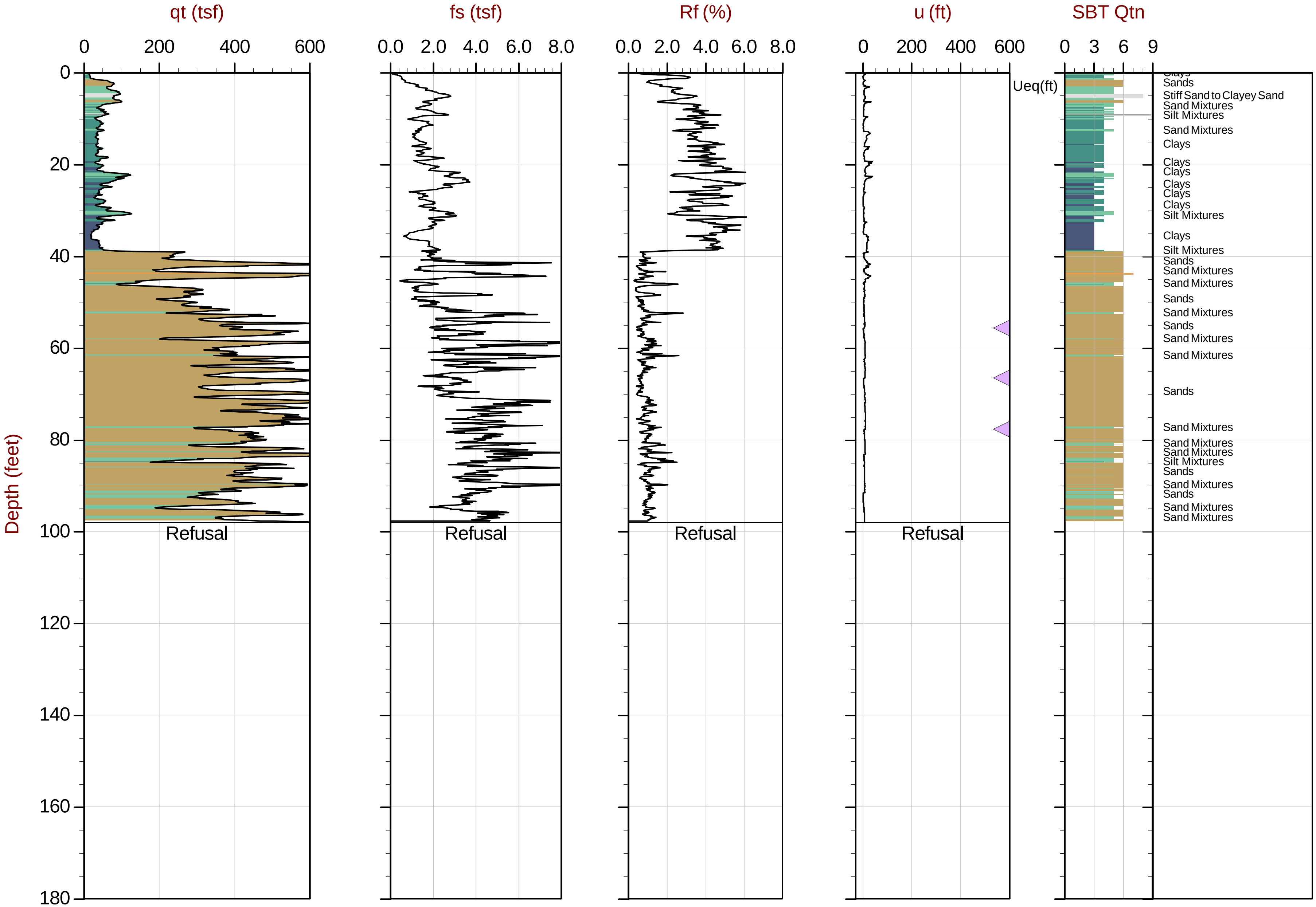
| Sounding ID | File Name | Date | Cone | Cone Area ($cm^2$) | Assumed Phreatic Surface[1] (ft) | Final Depth (ft) | Northing[2] | Easting[2] | Elevation[3] (ft) | Refer to Notation Number |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-CPT1 | 22-56-25067_CP01 | 18-Nov-2022 | EC811:T1500F15U35 | 15 | 100.0 | 98.02 | 4170948 | 600771 | 366 | 4 |
| 1-CPT2 | 22-56-25067_CP02 | 18-Nov-2022 | EC811:T1500F15U35 | 15 | 45.2 | 163.14 | 4171027 | 600900 | 364 |  |
| 1-CPT3 | 22-56-25067_CP03 | 17-Nov-2022 | EC811:T1500F15U35 | 15 | 100.0 | 130.91 | 4170862 | 600890 | 363 | 4 |
| 1-SCPT4 | 22-56-25067_SP04 | 17-Nov-2022 | EC811:T1500F15U35 | 15 | 103.0 | 131.64 | 4170732 | 600851 | 358 |  |
| 1-CPT5 | 22-56-25067_CP05 | 17-Nov-2022 | EC811:T1500F15U35 | 15 | 70.0 | 89.73 | 4170569 | 600934 | 361 | 4 |

1. The assumed phreatic surface was based off the shallowest pore pressure dissipation tests performed within or nearest the sounding. Hydrostatic conditions were assumed for the calculated parameters.
2. The coordinates were collected using consumer grade GPS equipment. EPSG number: 32610 (WGS84 / UTM Zone 10S).
3. Elevations are referenced to the ground surface and were acquired from the Google Earth Elevation for the recorded coordinates.
4. The phreatic surface is based on the pore pressure dissipation test to not reach equilibrium in the sounding, and dynamic pore pressure.

**ENGEO**

Job No: 22-56-25067
Date: 2022-11-18 07:25
Site: Arroyo Lago

Sounding: 1-CPT1
Cone: 811:T1500F15U35



Max Depth: 29.875 m / 98.01 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 22-56-25067_CP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10S N: 4170948m E: 600771m

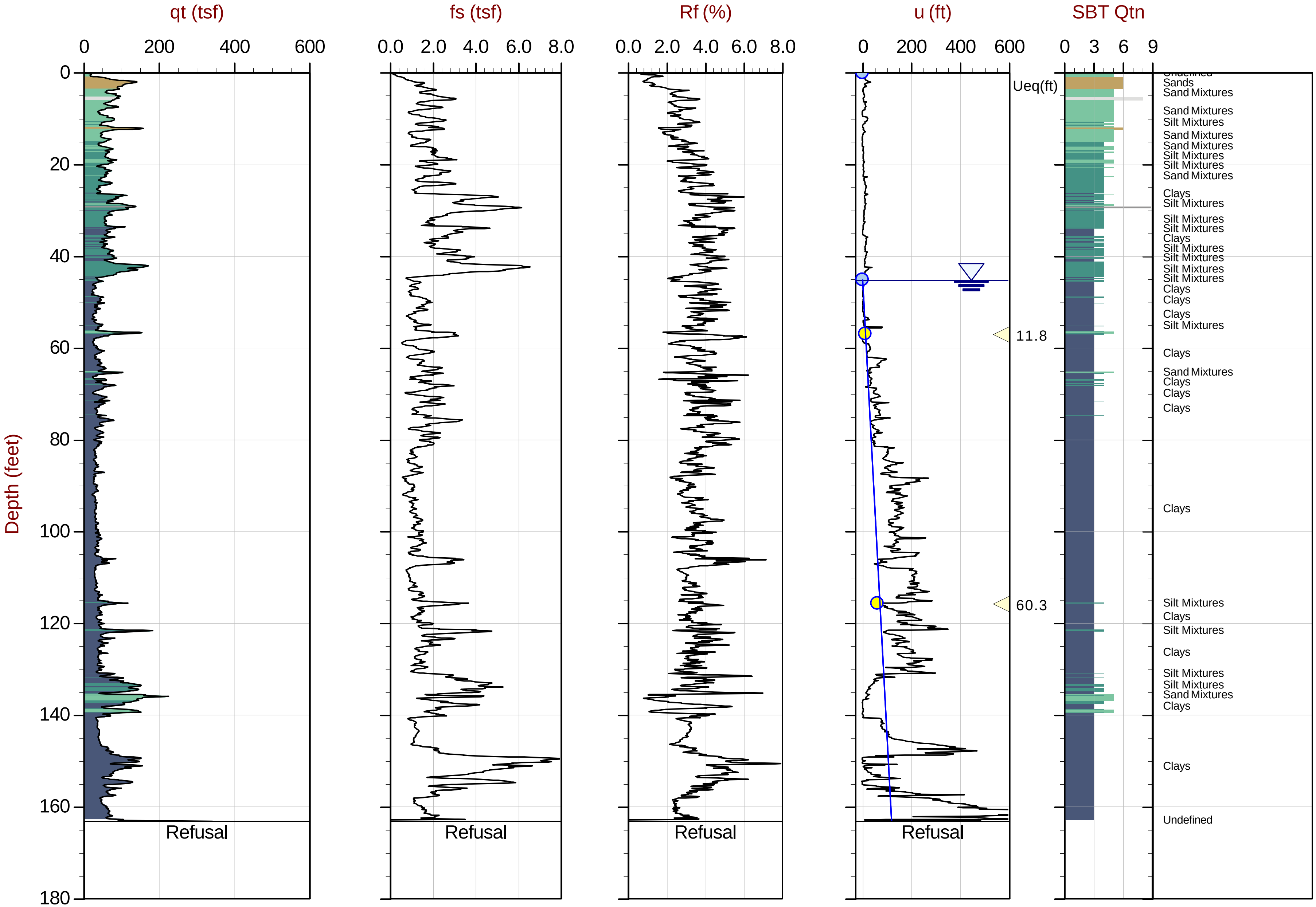
● Equilibrium Pore Pressure (Ueq) ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

**ENGEO**

**Job No:** 22-56-25067
**Date:** 2022-11-18 09:12
**Site:** Arroyo Lago

**Sounding:** 1-CPT2
**Cone:** 811:T1500F15U35



Max Depth: 49.725 m / 163.14 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 22-56-25067_CP02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10S N: 4171027m E: 600900m

● Equilibrium Pore Pressure (Ueq) ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved — Hydrostatic Line

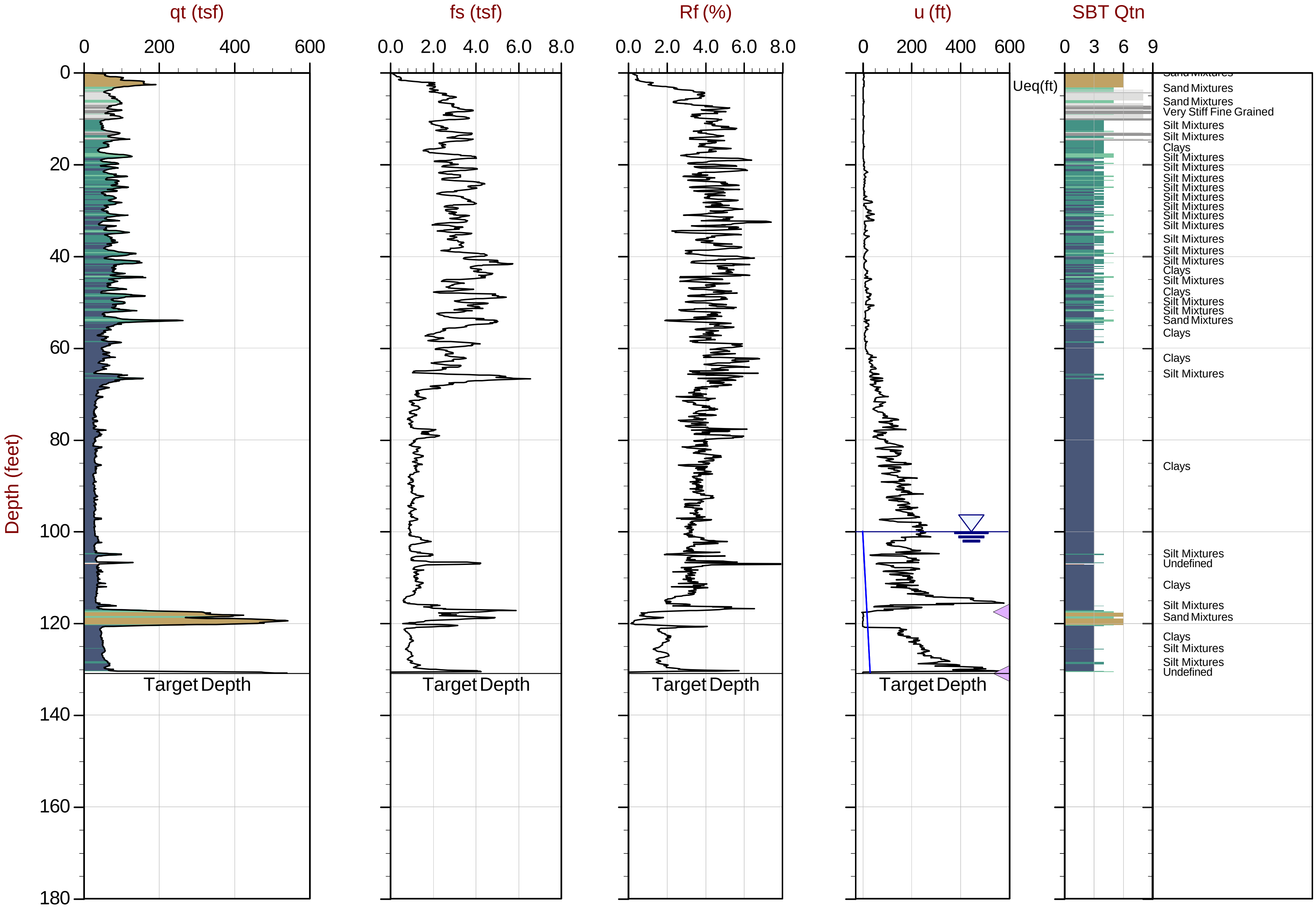
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

**CONETEC**

**ENGEO**

Job No: 22-56-25067
Date: 2022-11-17 09:55
Site: Arroyo Lago

Sounding: 1-CPT3
Cone: 811:T1500F15U35



Max Depth: 39.900 m / 130.90 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 22-56-25067_CP03.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10S N: 4170862m E: 600890m

● Equilibrium Pore Pressure (Ueq) ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved — Hydrostatic Line

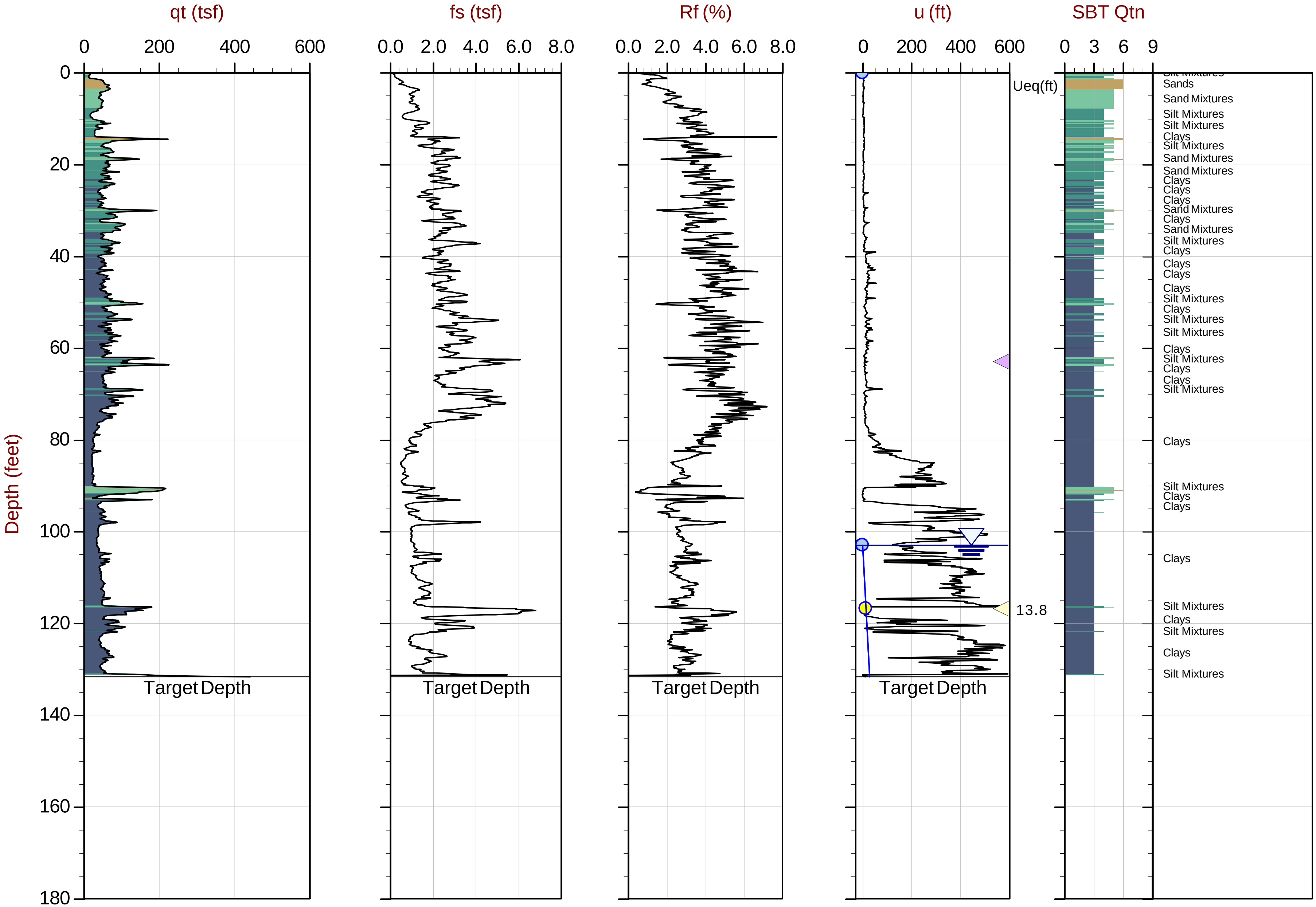
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

**ENGEO**

**Job No:** 22-56-25067
**Date:** 2022-11-17 12:22
**Site:** Arroyo Lago

**Sounding:** 1-SCPT4
**Cone:** 811:T1500F15U35



Max Depth: 40.125 m / 131.64 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 22-56-25067_SP04.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10S N: 4170732m E: 600851m

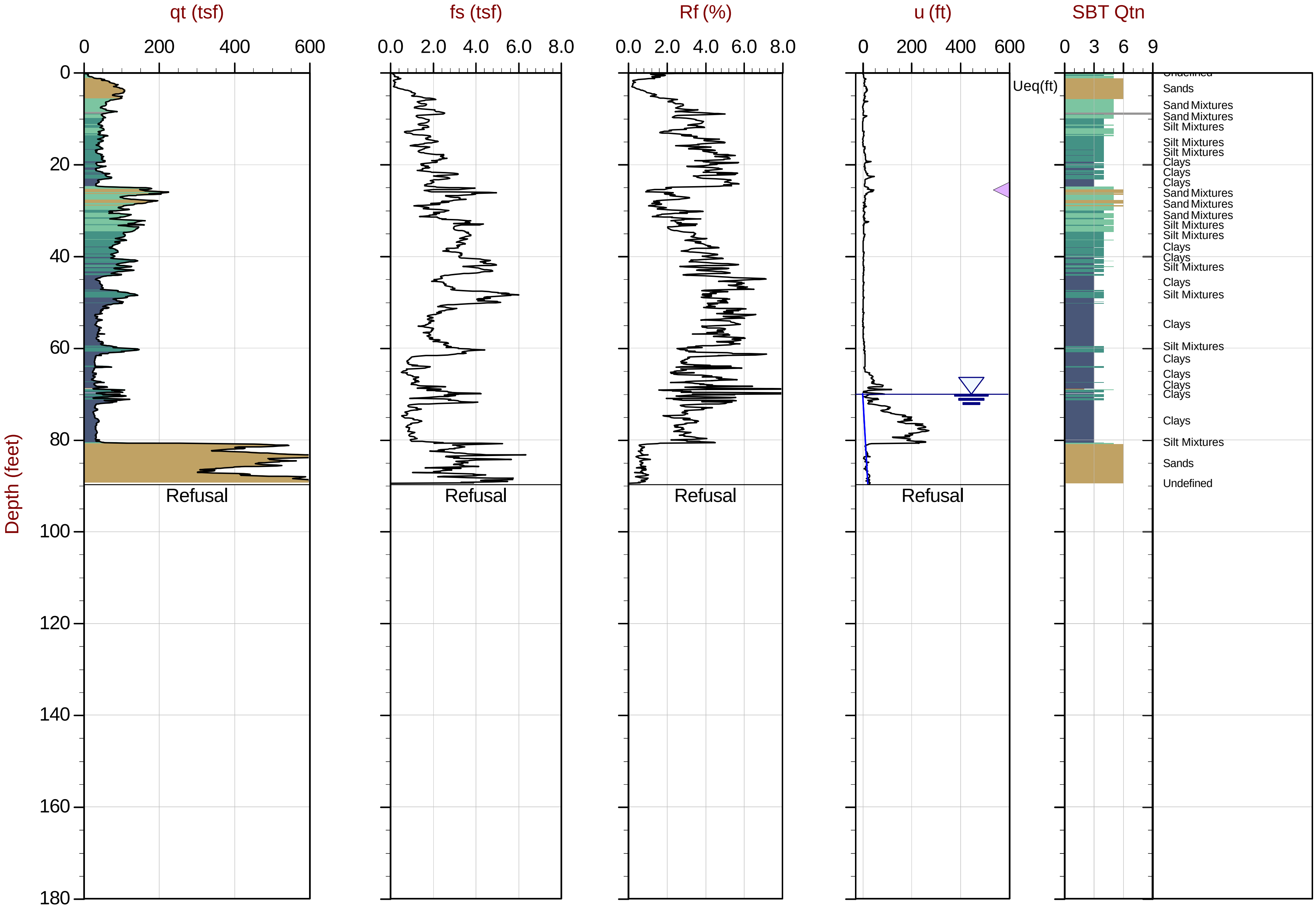
● Equilibrium Pore Pressure (Ueq) ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

**ENGEO**

**Job No:** 22-56-25067
**Date:** 2022-11-17 08:03
**Site:** Arroyo Lago

**Sounding:** 1-CPT5
**Cone:** 811:T1500F15U35



Max Depth: 27.350 m / 89.73 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 22-56-25067_CP05.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10S N: 4170569m E: 600934m

● Equilibrium Pore Pressure (Ueq) ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

# APPENDIX C

## LABORATORY TEST DATA

**Project Name:** Mission Village Phase 3B Improvements
Tract 61105-22 Recycled Water Improvements
**Project #:** 6538.100.301

## Table I
## Laboratory Compaction Test Results (DRAFT)

| Test Method | Test # | Source and Description | Maximum Dry Density PCF | Optimum Moisture % Dry Wt. |
|---|---|---|---|---|
| 1 | 2 | Site - Light olive brown SILT with sand | 127.2 | 9.9 |
| 1 | 3 | Site - Dark yellowish brown SILT with sand and gravel | 128.1 | 9.7 |
| 1 | 4 | Site - Yellowish brown sandy SILT | 120.9 | 10.5 |

**Test Method:**
1 (Standard ASTM Test Procedure D-1557)

# APPENDIX D

## PREVIOUS EXPLORATION LOGS AND LABORATORY DATA
## TREADWELL & ROLLO (2006, 2009)

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

## Log of Boring TR-9

PAGE 1 OF 4

Boring location: See Site Plan, Figure 2
Logged by: A. Scavullo
Date started: 10/4/06
Date finished: 10/4/06
Drilling method: Hollow Stem
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Downhole
Sampler: Sprague & Henwood (S&H)

| DEPTH (feet) | SAMPLES Sampler Type | Sample | Blows/ 6" | SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION Ground Surface Elevation: 371.4 feet[1] | | TEST DATA Type of Strength Test | Confining Pressure Lbs/Sq Ft | Shear Strength Lbs/Sq Ft | Fines % | Natural Moisture Content, % | Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | SANDY CLAY with GRAVEL (CL)<br>yellow-brown, very stiff, dry | | | | | | | |
| 2 | | ■ | | | | | | | | | | | |
| 3 | S&H | ■ | | 15 | | LL = 30, PI = 10, see Figure C-2 | | | | | | | |
| 4 | | | | | | | | | | | | | |
| 5 | | ■ | | | | | | | | | | | |
| 6 | S&H | ■ | | 24 | CL | | | | | | | | |
| 7 | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | |
| 9 | S&H | ■ | | 18 | | | | | | | | | |
| 10 | | ■ | | | | | | | | | | | |
| 11 | | | | | | SANDY CLAY (CL)<br>olive with yellow-brown mottling, very stiff, moist, trace organics | | | | | | | |
| 12 | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | |
| 14 | S&H | ■ | | 21 | | | | | | | 76.9 | 10.7 | 103 |
| 15 | | ■ | | | | | FILL | | | | | | |
| 16 | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | |
| 19 | S&H | ■ | | 24 | | trace coarse, rounded gravel | | | | | | | |
| 20 | | ■ | | | CL | | | | | | | | |
| 21 | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | |
| 24 | S&H | ■ | | 20 | | brown with dark brown mottling, trace fine gravel | | | | | | | |
| 25 | | ■ | | | | | | | | | | | |
| 26 | | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | |
| 29 | S&H | ■ | | 26 | | olive with olive-gray mottling, trace fine gravel | | | | | | | |
| 30 | | ■ | | | | | | | | | | | |

**Treadwell&Rollo**

Project No.: 4490.02
Figure: A-9a

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-9

| DEPTH (feet) | SAMPLES: Sampler Type | SAMPLES: Sample | SAMPLES: Blows/ 6" | SAMPLES: SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA: Type of Strength Test | TEST DATA: Confining Pressure Lbs/Sq Ft | TEST DATA: Shear Strength Lbs/Sq Ft | TEST DATA: Fines % | TEST DATA: Natural Moisture Content, % | TEST DATA: Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  | SANDY CLAY (CL) (continued) |  |  |  |  |  |  |
| 31 |  |  |  |  |  |  |  |  |  |  |  |  |
| 32 |  |  |  |  |  |  |  |  |  |  |  |  |
| 33 |  |  |  |  |  |  |  |  |  |  |  |  |
| 34 |  |  |  |  |  |  |  |  |  |  |  |  |
| 35 |  |  |  |  |  |  |  |  |  |  |  |  |
| 36 |  |  |  |  |  |  |  |  |  |  |  |  |
| 37 |  |  |  |  |  |  |  |  |  |  |  |  |
| 38 |  | ▨ |  |  |  |  |  |  |  |  |  |  |
| 39 | S&H | ▨ |  | 25 |  |  |  |  |  |  |  |  |
| 40 |  |  |  |  |  |  |  |  |  |  |  |  |
| 41 |  |  |  |  |  |  |  |  |  |  |  |  |
| 42 |  |  |  |  |  |  |  |  |  |  |  |  |
| 43 |  |  |  |  | CL | coarse, rounded gravels at 43 feet |  |  |  |  |  |  |
| 44 |  |  |  |  |  |  |  |  |  |  |  |  |
| 45 |  |  |  |  |  | FILL |  |  |  |  |  |  |
| 46 |  |  |  |  |  |  |  |  |  |  |  |  |
| 47 |  |  |  |  |  |  |  |  |  |  |  |  |
| 48 |  |  |  |  |  |  |  |  |  |  |  |  |
| 49 | S&H | ▨ |  | 22 |  |  |  |  |  |  |  |  |
| 50 |  |  |  |  |  |  |  |  |  |  |  |  |
| 51 |  |  |  |  |  |  |  |  |  |  |  |  |
| 52 |  |  |  |  |  |  |  |  |  |  |  |  |
| 53 |  |  |  |  |  |  |  |  |  |  |  |  |
| 54 |  |  |  |  |  |  |  |  |  |  |  |  |
| 55 |  |  |  |  |  |  |  |  |  |  |  |  |
| 56 |  |  |  |  |  |  |  |  |  |  |  |  |
| 57 |  |  |  |  |  | SANDY CLAY (CL) |  |  |  |  |  |  |
| 58 |  |  |  |  | CL | olive with olive-gray mottling, hard, moist, trace gravel |  |  |  |  |  |  |
| 59 | S&H | ▨ |  | 34 |  |  |  |  |  | 78.6 | 15.2 | 119 |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |

**Treadwell&Rollo**

Project No.: 4490.02

Figure: A-9b

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-9

PAGE 3 OF 4

| DEPTH (feet) | SAMPLES | | | | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sampler Type | Sample | Blows/ 6" | SPT N-Value[1] | | | Type of Strength Test | Confining Pressure Lbs/Sq Ft | Shear Strength Lbs/Sq Ft | Fines % | Natural Moisture Content, % | Dry Density Lbs/Cu Ft |
| | | | | | | SANDY CLAY (CL) (continued) | | | | | | |
| 61 | | | | | | | | | | | | |
| 62 | | | | | | | | | | | | |
| 63 | | | | | | | | | | | | |
| 64 | | | | | CL | | | | | | | |
| 65 | | | | | | | | | | | | |
| 66 | | | | | | | | | | | | |
| 67 | | | | | | CLAY with SAND (CL)<br>olive with olive-gray mottling, hard, moist, trace fine and coarse gravel | | | | | | |
| 68 | | | | | | | | | | | | |
| 69 | S&H | ■ | | 38 | | | | | | | | |
| 70 | | | | | | | | | | | | |
| 71 | | | | | | | | | | | | |
| 72 | | | | | | | | | | | | |
| 73 | | | | | | | | | | | | |
| 74 | | | | | | | | | | | | |
| 75 | | | | | | FILL | | | | | | |
| 76 | | | | | CL | | | | | | | |
| 77 | | | | | | | | | | | | |
| 78 | | | | | | | | | | | | |
| 79 | S&H | ■ | | 20 | | very stiff, increased sand content | | | | | | |
| 80 | | | | | | | | | | | | |
| 81 | | | | | | | | | | | | |
| 82 | | | | | | | | | | | | |
| 83 | | | | | | | | | | | | |
| 84 | | | | | | | | | | | | |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | SANDY CLAY (CL)<br>olive with olive-gray mottling, very stiff, moist | | | | | | |
| 87 | | | | | | | | | | | | |
| 88 | | | | | CL | | | | | | | |
| 89 | S&H | ■ | | 15 | | | | | | | | |
| 90 | | | | | | | | | | | | |

**Treadwell&Rollo**

Project No.: 4490.02

Figure: A-9c

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-9

| DEPTH (feet) | SAMPLES: Sampler Type | SAMPLES: Sample | SAMPLES: Blows/ 6" | SAMPLES: SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA: Type of Strength Test | TEST DATA: Confining Pressure Lbs/Sq Ft | TEST DATA: Shear Strength Lbs/Sq Ft | TEST DATA: Fines % | TEST DATA: Natural Moisture Content, % | TEST DATA: Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  | SANDY CLAY (CL) (continued) |  |  |  |  |  |  |
| 91 |  |  |  |  |  |  |  |  |  |  |  |  |
| 92 |  |  |  |  |  |  |  |  |  |  |  |  |
| 93 |  |  |  |  |  |  |  |  |  |  |  |  |
| 94 |  |  |  |  |  |  |  |  |  |  |  |  |
| 95 |  |  |  |  | CL | **FILL** |  |  |  |  |  |  |
| 96 |  |  |  |  |  |  |  |  |  |  |  |  |
| 97 |  |  |  |  |  |  |  |  |  |  |  |  |
| 98 |  |  |  |  |  |  |  |  |  |  |  |  |
| 99 | S&H | ■ |  | 17 |  |  |  |  |  |  |  |  |
| 100 |  |  |  |  |  |  |  |  |  |  |  |  |
| 101 |  |  |  |  |  |  |  |  |  |  |  |  |
| 102 |  |  |  |  |  |  |  |  |  |  |  |  |
| 103 |  |  |  |  |  |  |  |  |  |  |  |  |
| 104 |  |  |  |  |  |  |  |  |  |  |  |  |
| 105 |  |  |  |  |  |  |  |  |  |  |  |  |
| 106 |  |  |  |  |  |  |  |  |  |  |  |  |
| 107 |  |  |  |  |  |  |  |  |  |  |  |  |
| 108 |  |  |  |  |  |  |  |  |  |  |  |  |
| 109 |  |  |  |  |  |  |  |  |  |  |  |  |
| 110 |  |  |  |  |  |  |  |  |  |  |  |  |
| 111 |  |  |  |  |  |  |  |  |  |  |  |  |
| 112 |  |  |  |  |  |  |  |  |  |  |  |  |
| 113 |  |  |  |  |  |  |  |  |  |  |  |  |
| 114 |  |  |  |  |  |  |  |  |  |  |  |  |
| 115 |  |  |  |  |  |  |  |  |  |  |  |  |
| 116 |  |  |  |  |  |  |  |  |  |  |  |  |
| 117 |  |  |  |  |  |  |  |  |  |  |  |  |
| 118 |  |  |  |  |  |  |  |  |  |  |  |  |
| 119 |  |  |  |  |  |  |  |  |  |  |  |  |
| 120 |  |  |  |  |  |  |  |  |  |  |  |  |

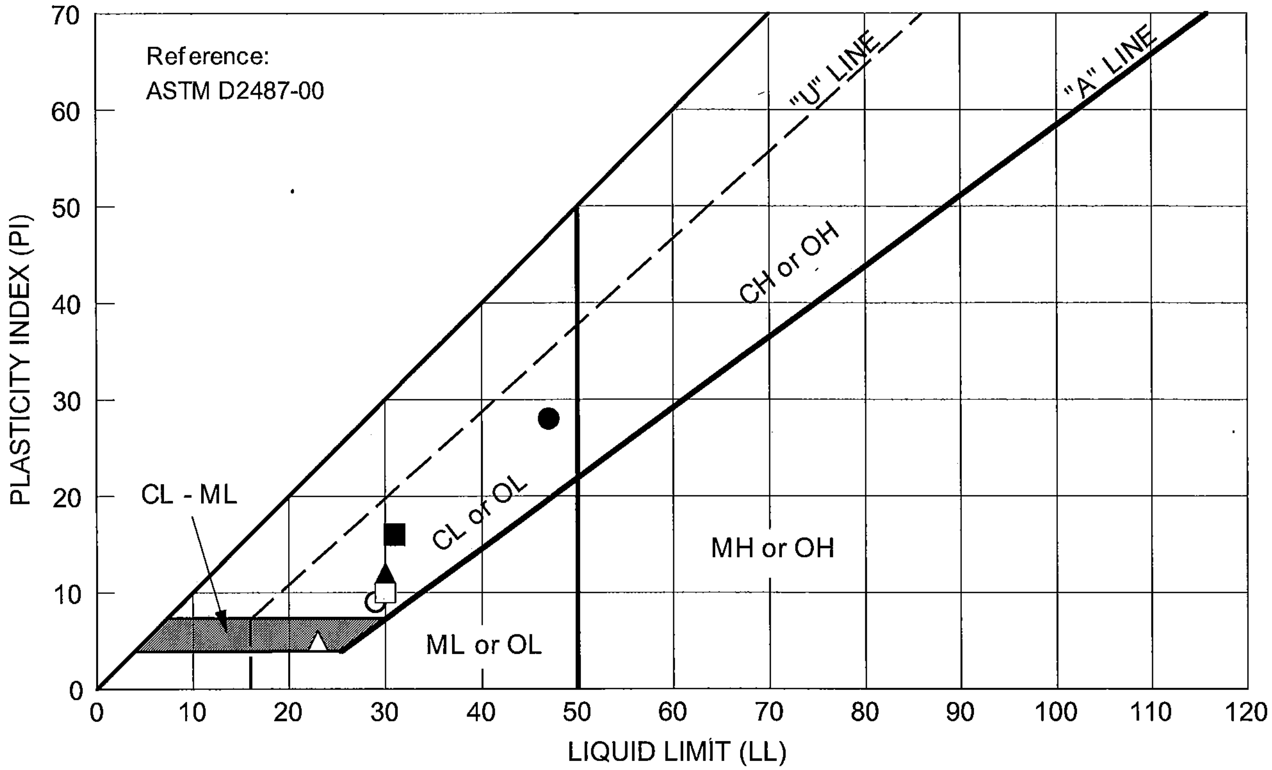
Boring terminated at a depth of 100 feet bgs.
Boring backfilled with cement grout.
Groundwater not encountered at time of drilling.

[1] Elevation based on City of Livermore datum.

**Treadwell&Rollo**

Project No.: 4490.02

Figure: A-9d



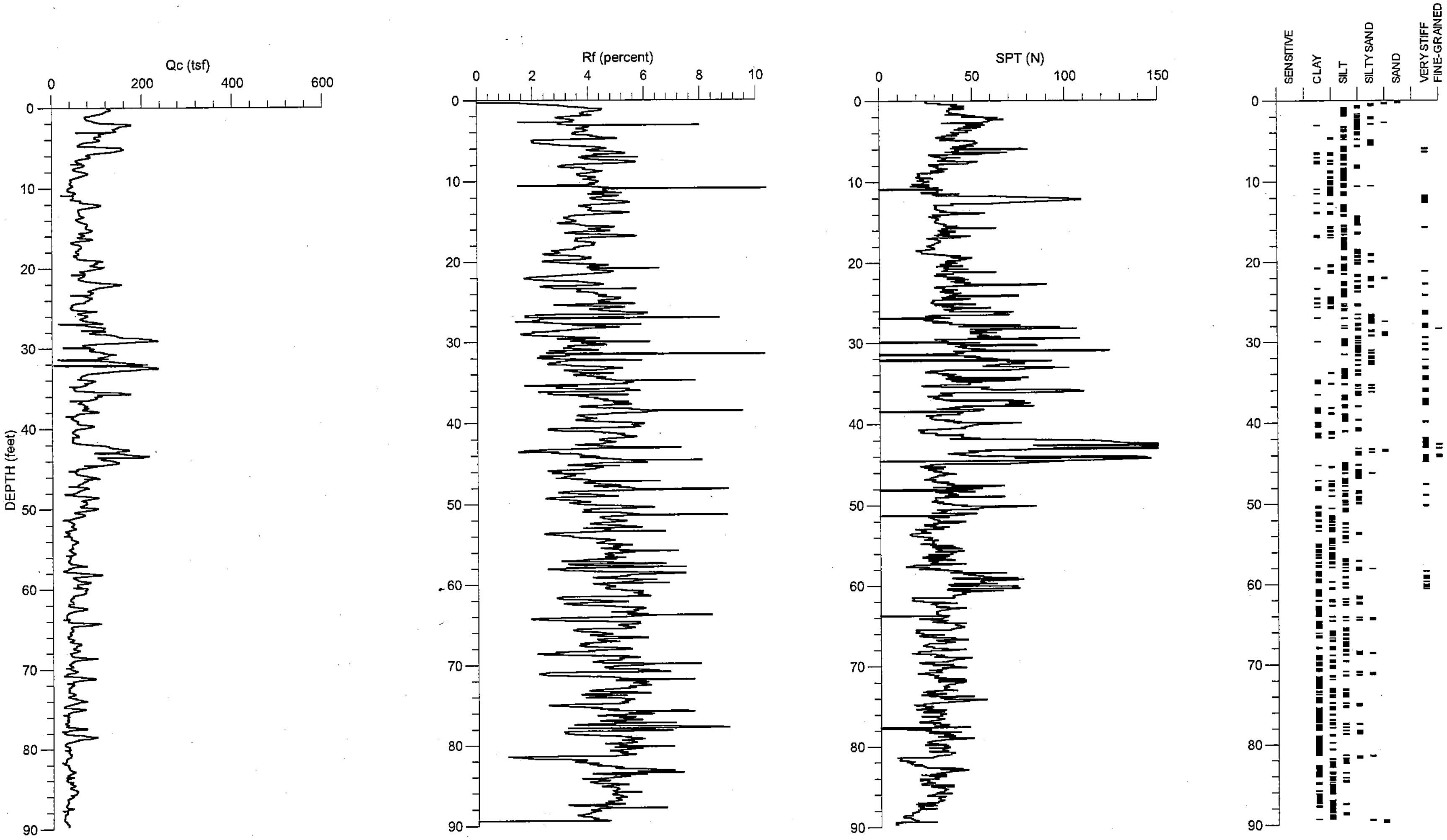
| Symbol | Source | Description and Classification | Natural M.C. (%) | Liquid Limit (%) | Plasticity Index (%) | % Passing #200 Sieve |
|---|---|---|---|---|---|---|
| ● | TR-7 at 2 feet | CLAYEY SAND with GRAVEL (SC), yellow-brown | 6.0 | 47 | 28 | 35.5 |
| ▲ | TR-8 at 2.5 feet | CLAYEY SAND with GRAVEL (SC), olive with olive-gray mottling | 2.4 | 30 | 12 | --- |
| ■ | TR-8 at 14.5 feet | CLAYEY SAND with GRAVEL (SC), gray-brown and dark brown | 6.9 | 31 | 16 | 33.9 |
| ○ | TR-8 at 49.5 feet | SANDY CLAY (CL), dark brown | 15.9 | 29 | 9 | 73.6 |
| △ | TR-8 at 89.5 feet | CLAYEY SILTY SAND with GRAVEL (SC-SM), olive-brown | 12.4 | 23 | 5 | 45.9 |
| □ | TR-9 at 2.5 feet | SANDY CLAY with GRAVEL (CL), yellow-brown | 19.9 | 30 | 10 | --- |

**LEGACY PARTNERS**
**PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

**Treadwell&Rollo**

## PLASTICITY CHART

Date 01/25/07 | Project No. 4490.02 | Figure C-2



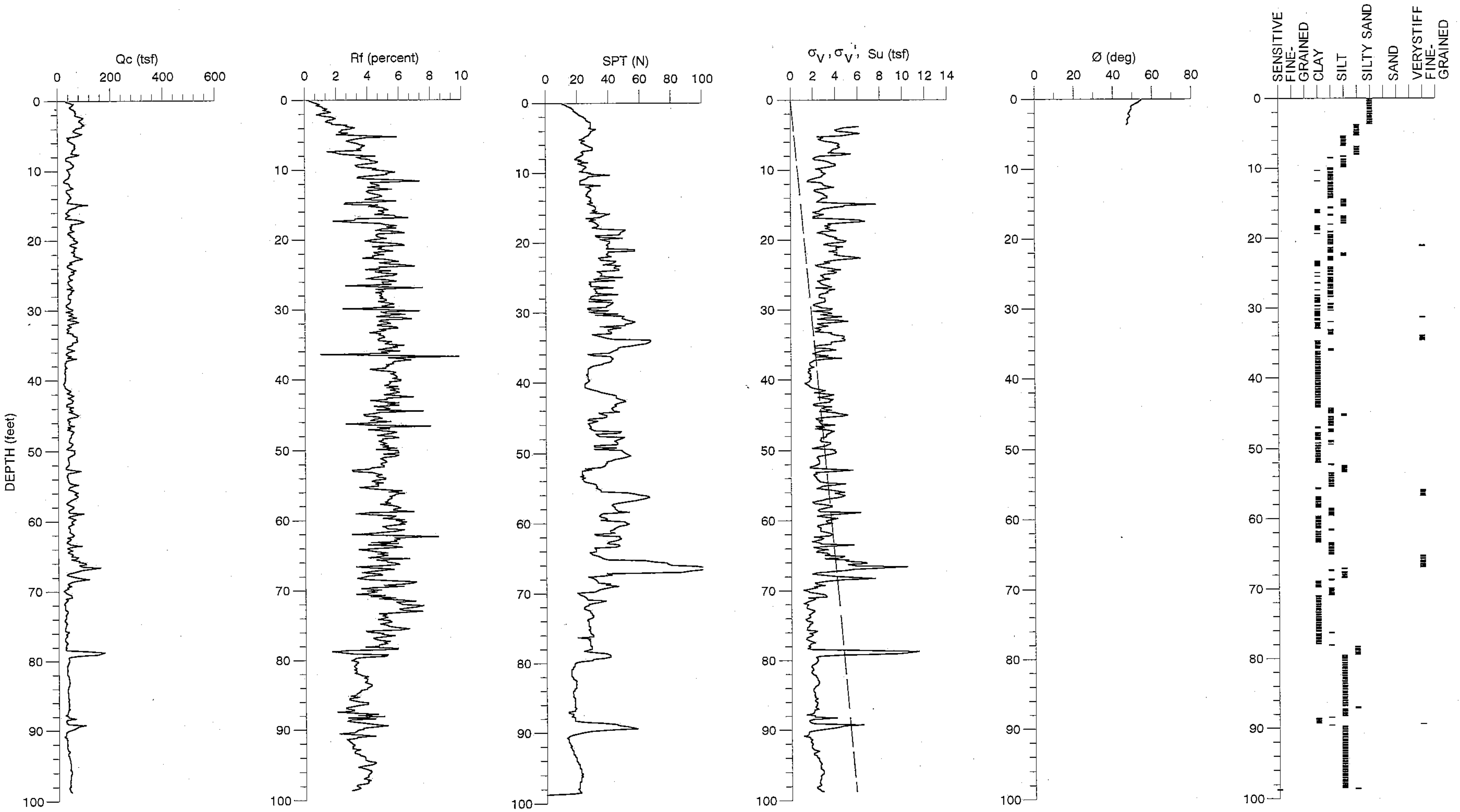
Terminated at 89.7 feet.
Groundwater level not measured.
Date performed: 10/12/06.
Ground surface elevation: 360.5 feet, City of Livermore.

**PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

## CONE PENETRATION TEST RESULTS
## CPT-9

| | | |
|---|---|---|
| Date 01/29/09 | Project No. 4490.02 | Figure B-9 |

**Treadwell&Rollo**



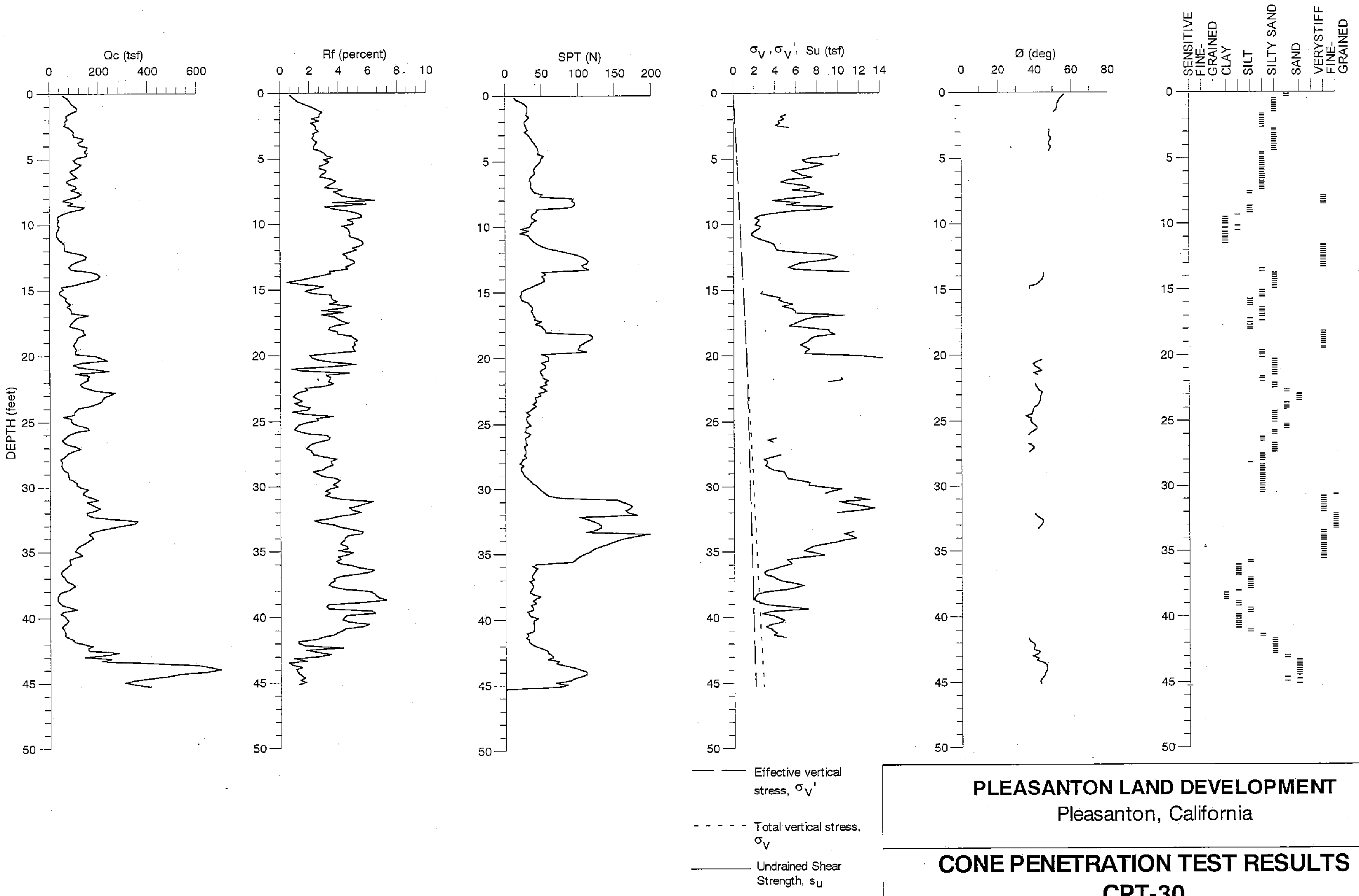
Terminated at 98.8 feet.
Groundwater not measured.
Date performed: 10/28/08.
Approximate Ground Surface Elevation: 357.7 feet, datum: NGVD 1929.

**PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

## CONE PENETRATION TEST RESULTS
## CPT-29

Date 03/16/09 | Project No. 4490.02 | Figure B-29

**Treadwell&Rollo**



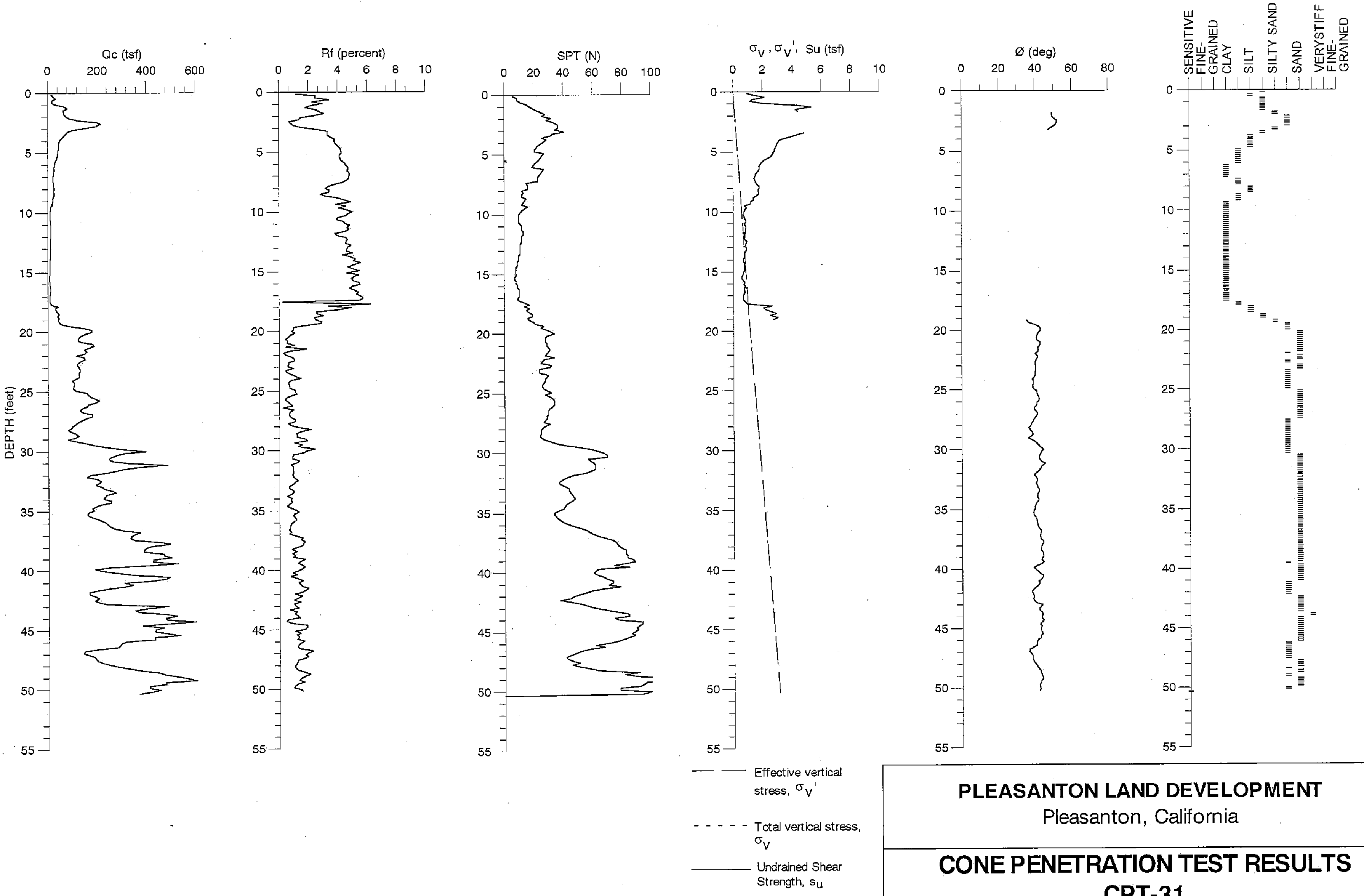
Terminated at 45.3 feet.
Assumed groundwater depth: 20.0 feet.
Date performed: 10/28/08.
Approximate Ground Surface Elevation: 360.6 feet, datum: NGVD 1929.

**PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

## CONE PENETRATION TEST RESULTS
## CPT-30

| Date 03/16/09 | Project No. 4490.02 | Figure B-30 |
|---|---|---|

**Treadwell&Rollo**



Terminated at 50.4 feet.
Groundwater not measured.
Date performed: 10/28/08.
Approximate Ground Surface Elevation: 362.7 feet, datum: NGVD 1929.

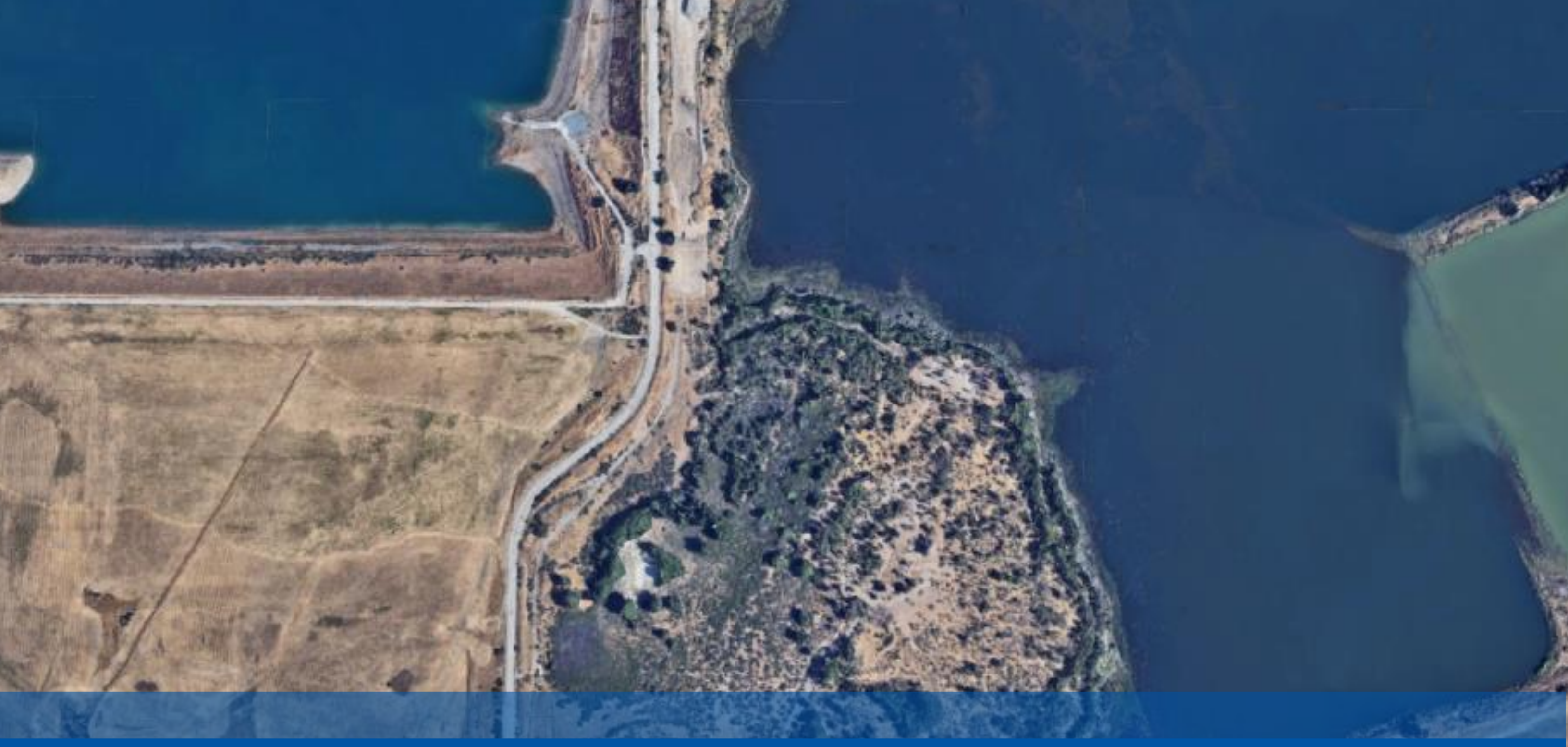
**PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

## CONE PENETRATION TEST RESULTS
## CPT-31

| Date 03/16/09 | Project No. 4490.02 | Figure B-31 |
|---|---|---|

**Treadwell&Rollo**

Expect Excellence



# ARROYO LAGO – OFF-SITE INFRASTRUCTURE AREA
## PLEASANTON, CALIFORNIA

# GEOTECHNICAL FEASIBILITY REPORT

SUBMITTED TO
Mr. Steve Reilly
330 Land Company, LLC
16381 Scientific Way
Irvine, CA 92618

PREPARED BY
ENGEO Incorporated

February 12, 2024
Revised March 12, 2024

PROJECT NO.
9785.004.003

ENGEO
Expect Excellence

ENGEO
Expect Excellence

GEOTECHNICAL
ENVIRONMENTAL
WATER RESOURCES
CONSTRUCTION SERVICES
COASTAL/MARINE GEOTECHNICS

Project No.
**9785.004.003**

February 12, 2024
Revised March 12, 2024

Mr. Steve Reilly
330 Land Company, LLC
16381 Scientific Way
Irvine, CA 92618

Subject: Arroyo Lago – Off-site Infrastructure Area
Pleasanton, California

## GEOTECHNICAL FEASIBILITY REPORT

Dear Mr. Reilly:

We are pleased to present this geotechnical feasibility report for the Arroyo Lago – Off-site Infrastructure Area project located in Pleasanton, California. The accompanying report presents our findings, preliminary conclusions, and planning-level considerations for the proposed development.

Based on the findings of our feasibility study, it is our opinion that the proposed improvements are feasible from a geotechnical standpoint, provided the recommendations contained in this report are incorporated into planning, and that a design-level geotechnical exploration is performed to develop site-specific design recommendations.

We are pleased to have been of service on this project and are prepared to consult further with you and your design team as the project progresses. If you have any questions or comments regarding this feasibility report, please call and we will be glad to discuss them with you.

Sincerely,

ENGEO Incorporated

Lauren Roide
Lauren Roide

Justin Qiu, PE

REGISTERED PROFESSIONAL ENGINEER
JUSTIN QIU
No. 95144
CIVIL
STATE OF CALIFORNIA

Jeanine Ruffoni
Jeanine Ruffoni, GE

lr/jq/jtr/jjt/ca

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# TABLE OF CONTENTS (Continued)

# 1.0 INTRODUCTION

## 1.1 PURPOSE AND SCOPE

We prepared this geotechnical feasibility report for the proposed infrastructure to support the proposed Arroyo Lago residential development in Pleasanton, California. You authorized us to perform the following scope of services.

- Site reconnaissance
- Review of regional and local geologic maps, seismic hazards maps, historical aerial photographs, historical topographic maps, and nearby in-house geotechnical reports
- Suitability of the site for the proposed development
- Preliminary assessment of geologic hazards at the site and in the general project area
- Preliminary discussion of geotechnical constraints
- Preliminary earthwork considerations
- Preliminary foundation options
- Recommendations for design-level study

We reviewed the following pertinent documents.

- CBG. 2023. Vesting Tentative Map Offsite Utility Plan – Sanitary Sewer and Water, Option 1, Bio in APZ, Arroyo Lago, Alameda County, California. September 2023. Job No. 3435-000.
- CBG. 2023. Vesting Tentative Map Offsite Utility Plan – Sanitary Sewer and Water, Option 2, Bio East of El Charo, Arroyo Lago, Alameda County, California. September 2023. Job No. 3435-000.
- Treadwell & Rollo. 2007. Due Diligence Investigation – Parcel 2 and Parcels D through G, Hanson Radum Site, Pleasanton, California. May 25, 2007. Project No. 4490.01
- Treadwell & Rollo. 2009. Geotechnical Investigation Pleasanton Land Development Project, Pleasanton, California. September 8, 2009. Project No. 4490.02

Additionally, we previously prepared the following geotechnical reports for the property and the greater East Pleasanton Specific Plan (EPSP) area.

- ENGEO. 2019. Geotechnical Review, East Pleasanton Specific Plan, Pleasanton, California. March 29, 2019. Project No. 9785.001.001.
- ENGEO. 2020. Generalized Soil Conditions for Ground Improvement Overview, East Pleasanton Specific Plan, Pleasanton, California. May 14, 2020; Revised May 20, 2020. Project No. 9785.001.001.
- ENGEO. 2020. Preliminary Surcharge Program Study and Cost Assessment – Areas 3, 4, and 10, East Pleasanton Specific Plan, Pleasanton, California. July 10, 2020; Revised August 25, 2020. Project No. 9785.001.001.

- ENGEO. 2020. Preliminary Ground Improvement Program Study and Cost Assessment for Areas 1 and 2, East Pleasanton Specific Plan, Pleasanton, California. September 28, 2020. Project No. 9785.001.001.
- ENGEO. 2023. Preliminary Geotechnical Report, Arroyo Lago, Pleasanton, California. May 18, 2023. Project No. 9785.004.001.

We prepared this report for the exclusive use of 330 Land Company, LLC and its consultants for the project. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without our express written consent.

## 1.2 SITE LOCATION AND DESCRIPTION

The site is located east of the larger Arroyo Lago project site, near the intersection of Mohr Avenue and Busch Road in Pleasanton, California (Figure 1). The site is approximately 108.6 acres in area and is identified as Assessor's Parcel Numbers (APNs) 946-4634-2 and 946-1350-3-10.

As shown in Figure 2, the site consists of three non-contiguous areas that border the area of Busch Road that runs from north to south. We refer to the three areas as the Northeast Area, the West Area, and the East Area in this report. We refer to the street bordering the three areas as "El Charro Road" in this report. We describe the general locations of the three areas below.

- West Area – approximately 63.9 acres in size and is bounded by the proposed Arroyo Lago residential development to the west, Lake I to the north, El Charro Road to the east, and Busch Road to the south.
- East Area – approximately 43.1 acres in size and is bounded by El Charro Road to the west, Cope Lake to the north and east, and an unnamed access road to the south.
- Northeast Area – approximately 1.6 acres in size and is bounded by El Charro Road to the west, a paved access road to the north, Lake H further to the north, a Zone 7 Water single-story facility to the east, and Cope Lake to the south.

## 1.3 PROPOSED DEVELOPMENT

Based on our review of the provided documents and discussions with you, we understand the proposed development for the site will consist of utility buildings and infrastructure to support the proposed Arroyo Lago residential development to the west. We describe the proposed infrastructure for each area below. Please refer to Figures 2C and 2D for the general locations of the proposed improvements.

- West Area
  - One 1-acre membrane bioreactor sewer treatment plant with associated flatwork and access roads
  - One 2½-acre recycled water storage pond, cut to a depth of approximately 12½ feet below grade
  - One 1-acre bioretention basin area to be located either in the West Area (Option 1, Figure 2C) or the East Area (Option 2, Figure 2D)

- East Area
    - One 8½-acre spray field for agricultural irrigation and recycled water uses
    - One 1-acre bioretention basin area to be located either in the West Area (Option 1, Figure 2C) or the East Area (Option 2, Figure 2D)
- Northeast Area
    - One water storage and booster pump facility with associated bioretention basins, flatwork, and access roads. The facility will connect to the existing Zone 7 water facility to the east. The water storage tank will have a capacity of 400,000 gallons.
- El Charro Road
    - One “low-pressure” and one “high-pressure” water line running underneath Busch Road that will connect the Arroyo Lago residential development to the existing 36-inch-diameter water main at Valley Avenue and the proposed water storage and booster pump facility in the Northeast Area
    - One 60-inch-diameter storm drain line crossing below El Charro Road from the West Area to the East Area

Structural loads and grading are yet to be determined; however, we assume that structural loads will be representative for this type of construction. We anticipate that site grading will consist of cut and fill to create drainage building pads and bioretention basins.

# 2.0 FINDINGS

## 2.1 SITE HISTORY

Based on review of historical aerials, topographic maps, and provided geotechnical reports, we understand the site was historically part of a large mining quarry. El Charro Road was historically utilized as a vehicular access road for the quarry. We describe our observations in the following sections per area.

### 2.1.1 West Area

The West Area was historically utilized as agricultural land, with a residential property located in the northern portion of the area, as shown in a 1949 photograph. Site conditions remained unchanged until at least 1974, when the alignment of El Charro Road was reconfigured to its current alignment. By 1982, the residential property was demolished, and the area was excavated for quarry use. Backfill operations for the area began in 1993 and appear to have been completed by 2002. Between 2007 and 2013, a stockpile approximately 5 to 15 feet in height was located in the northern portion of the West Area. The West Area remained generally unchanged between photographs in 2012 and our site reconnaissance in 2024.

### 2.1.2 East Area

The majority of the East Area was excavated for quarry use between 1960 and 1966. By 1981, the entirety of the East Area was used as a quarry. Fill placement began in the southeastern portion of the area between 1987 and 1993, and continued until 2010. The East Area generally remained unchanged between the 2010 photograph and our site reconnaissance in 2024.

### 2.1.3 Northeast Area

The Northeast Area historically supported agricultural uses based on a 1949 photograph. By 1974, excavation activities for the quarry extended into the Northeast Area; the remnants of that quarry appear to be what is present-day Cope Lake. The 1987 photograph shows fill placed within the Northeast Area to construct an access road north of Cope Lake. In 2005, grading appears to have begun for the present-day Zone 7 water facility, with construction completed by the 2009 photograph. The Northeast Area generally remained unchanged between the 2009 photograph and our site reconnaissance in 2024.

## 2.2 HISTORICAL GEOTECHNICAL DATA

Various geotechnical subsurface explorations have been performed throughout the East Pleasanton Specific Plan area since 2001, as shown in Figure 2.

In 2006 and 2008, Treadwell & Rollo (TR) performed geotechnical investigations throughout the East Pleasanton Specific Plan. The explorations within the site boundary included six hollow-stem auger borings drilled to a depth of up to 120 feet below ground surface (bgs) and nine cone penetration tests (CPTs) advanced to depths ranging from approximately 30 feet to 125 feet bgs.

The 2007 TR report included explorations performed by Berlogar Geotechnical Consultants in 2001, comprising two CPTs advanced to a depth of up to 82 feet bgs and one boring to a depth of 119½ feet bgs within the site bounds.

In 2019, we completed two borings and two CPTs along El Charro Road. The borings were drilled to a maximum depth of 121 feet bgs and the CPT explorations were advanced to a maximum depth of 40 feet bgs.

The exploration locations are shown in Figure 2. The exploration logs and associated laboratory test results from the previous studies are presented in Appendix A.

## 2.3 REGIONAL GEOLOGY

The site is located in the California Coast Ranges geomorphic province, which is dominated by a series of northwest-trending mountain ranges that have been folded and faulted in a tectonic regime that involves both translational and compressional deformations. Bedrock in the Coast Ranges consists of igneous, metamorphic, and sedimentary rocks that range in age from Jurassic to Pleistocene. The site is located in the tri-valley basin located near the intersection of Livermore Valley, Amador Valley, and San Ramon Valley. The tri-valley basin is generally regarded as a trough of sediments within the Diablo mountain range. The basin is filled with Quaternary-age sediments derived from erosion of the surrounding highlands. The sediments have been divided into the Plio-Pleistocene Livermore gravel and younger Pleistocene to Holocene alluvium.

Geologic mapping prepared by Dibblee (2005) indicate that the West Area is underlain by alluvial gravel, sand, and clay (Qa), and the East Area and Northeast Area are mapped by as Gravel Pits (GP) (Figure 3).

## 2.4 FAULTING AND SEISMICITY

The San Francisco Bay Area contains numerous active faults. Figure 5 shows the approximate location of active and potentially active faults and significant historic earthquakes mapped within the San Francisco Bay Region. An active fault is defined by the State as one that has had surface displacement within Holocene time, about the last 11,700 years (CGS, 2018).

To identify nearby active faults that are capable of generating strong seismic ground shaking at the site, we utilized the United States Geological Survey (USGS) Unified Hazard Tool and disaggregated the hazard at 1 second for a return period of 2,475 years.

The nearest active fault with a significant contribution to the overall seismic hazard at the site is the Calaveras fault, approximately 8.4 miles away. Other nearby faults capable of producing significant ground shaking at the site are shown in Table 2.4-1.

**TABLE 2.4-1: Active Faults Capable of Producing Significant Ground Shaking at the Site**
**Latitude: 37.67823 Longitude: -121.84919**

| SOURCE[a] | $R_{RUP}$[b] | | MOMENT MAGNITUDE[c] $M_W$ |
|---|---|---|---|
| | (km) | (miles) | |
| Calaveras (No) [4] | 8.4 | 5.2 | 7.1 |
| Hayward (So) [4] | 16.0 | 9.9 | 7.1 |
| Mount Diablo (So) [0] | 8.7 | 5.4 | 6.9 |
| Mount Diablo (No) [0] | 12.4 | 7.7 | 7.2 |
| Las Positas [1] | 8.2 | 5.1 | 6.4 |

Notes: a. Fault System (Fault Section) [Fault Subsection assigned by UCERF3]
b. $R_{RUP}$ = nearest fault-to-site rupture distance
c. Fault-to-site distances and maximum moment magnitude based on USGS Unified Hazard Tool - Edition: Dynamic Conterminous U.S. 2018

These results represent sources contributing at least one percent to the seismic hazard at the site for the peak ground acceleration and for the given return period. Gridded or areal sources are not presented; however, these sources did not contribute more than one percent to the seismic hazard for the peak ground acceleration and for the given return period.

## 2.5 SURFACE CONDITIONS

At the time of our site reconnaissance on December 27, 2023, the surface conditions at the site generally consisted of undeveloped land with vegetation.

We observed the following site features during our site reconnaissance.

- Moderate to heavy vegetation (Photo 2.5-1)
- An existing 60-inch-diameter culvert crossing below El Charro Road to the East Area (Photo 2.5-2)
- An approximately 1:1 (horizontal:vertical) slope trends down from El Charro Road to the East Area
- Utility poles parallel to the west side of El Charro Road
- Debris and concrete traffic barriers along El Charro Road

**PHOTO 2.5-1: Vegetation on Western Area; Taken from El Charro Road Looking West**

**PHOTO 2.5-2: Culvert Crossing El Charro Road Looking East**

The West Area is situated on roughly level terrain at approximately Elevation 365 in the northwestern end and Elevation 371 in the southeastern end (WGS84) and is occupied by moderately vegetated land.

The East Area is approximately 15 feet lower than the adjacent El Charro Road. A gravel access road trends parallel to El Charro Road and provides access to the East Area. This area is relatively level, and gradually slopes from approximately Elevation 351 on the western end to Elevation 348 on the eastern end (WGS84). The site is occupied by vacant, moderately to densely vegetated land.

The Northeast Area of the site is situated on relatively level terrain at approximately Elevation 354 (WGS84). The water surface of the adjacent Cope Lake is located at approximately Elevation 320 but varies seasonally. The Northeast Area is currently occupied by vacant space.

## 2.6 SUBSURFACE CONDITIONS

### 2.6.1 West Area

Explorations within the West Area generally encountered existing fill up to 100 feet bgs in the northern portion, and up to 92 feet bgs in the southern portion. The fill generally consists of medium stiff to stiff sandy clay with varying amounts of gravel. The native material consists of dense clayey gravel. In explorations near El Charro Road, fill was encountered up to approximately 60 feet bgs.

### 2.6.2 East Area

Explorations in the East Area encountered existing fill up to 119½ feet bgs. The fill consists of very soft to stiff silty and sandy clay, and very loose to loose silty and clayey sand.

### 2.6.3 Northeast Area

In the Northeast Area of the site, explorations performed along El Charro Road encountered fill up to approximately 22 feet bgs. The fill consisted of medium dense clayey gravel and stiff sandy clay. The native material generally consisted of very dense clayey sand and clayey gravel.

Historical explorations generally terminated within the existing fill layer and the depth and extent of historical fill across the site was not documented as part of historical explorations.

The Site Plan and exploration logs can be reviewed for specific subsurface conditions at each exploratory location. We include select previous exploration logs in Appendix A.

### 2.7 GROUNDWATER CONDITIONS

Plate 1.2 of the Seismic Hazard Zone Report for the Livermore Quadrangle (2008) maps the highest historical groundwater within the site vicinity to be approximately 60 feet bgs.

A groundwater study was prepared in March 2023 by the Zone 7 Water Agency for the Livermore Valley Groundwater Basin, whose extents include the site within its boundary. According to the Groundwater Gradient Map prepared as a part of this study, the groundwater of the upper aquifer is approximately sloping from Elevation 289 feet (NAVD 88) at the northeastern area of the site to approximately Elevation 282 feet (NAVD 88) at the western area of the site.

## 3.0 PRELIMINARY CONCLUSIONS

Based on our desktop review and site reconnaissance, the primary geotechnical concerns that could affect development of the site for the proposed improvements are existing undocumented fill, expansive soil, seismic hazards, slope stability, and compressible soil. We summarize our conclusions below.

### 3.1 EXISTING FILL

Based on review of current and previous subsurface explorations, as well as review of historic aerial photographs, the site is predominately underlain by existing undocumented fill, presumably used to backfill the historic gravel pit operations. The existing undocumented fill materials are considered to be highly variable, potentially compressible, potentially susceptible to seismically induced settlements, and may contain trace amounts of various types of debris. We describe the anticipated characteristics of the fill in each area in the following sections. The composition, depth, and extent of existing fill in each area should be evaluated during a design-level study. We discuss existing fill treatment options in Section 4.2 of this report.

#### 3.1.1 West Area

Previous subsurface explorations encountered existing fill extending up to 94 feet bgs in the West Area. We understand that the existing fill in the West Area may have been placed in a compacted manner in general accordance with the County of Alameda Surface Mining Permit Reclamation Plan (SMP-31). However, there is no documentation of the fill specifications or operations; therefore, we consider this fill to be undocumented in nature.

Undocumented fill can undergo excessive settlement, especially under new fill or building loads. Since the existing fill is heterogeneous in its makeup, the predicted differential settlements due to existing fill may be similar, or only slightly less than, predicted total settlements.

### 3.1.2 East Area

Previous subsurface explorations encountered existing fill extending up to 119½ feet bgs in the East Area. Neither placement records nor reclamation plans were provided to us at the time of this writing; therefore, it is unknown whether the fill was placed in a compacted manner. We considered this fill to be possibly non-engineered and less competent compared to the fill encountered in the West Area.

### 3.1.3 Northeast Area

We understand that the Northeast Area was backfilled sometime between 1987 and 2009 according to site history described in Section 2.1.3; however, historical explorations were not performed within the area to evaluate the extent and engineering characteristics of the undocumented fill.

## 3.2 EXPANSIVE SOIL

The previous geotechnical explorations in the surrounding area indicated near-surface site soil that exhibits moderate to high expansion potential.

Expansive soil changes in volume with changes in moisture. They can shrink or swell and cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations. Building damage due to volume changes associated with expansive soil can be reduced by: (1) using a rigid mat foundation that is designed to resist the settlement and heave of expansive soil, (2) deepening the foundations to below the zone of moisture fluctuation, i.e., by using deep footings or drilled piers, and/or (3) using footings at normal shallow depths but bottomed on a layer of select fill having a low expansion potential.

Successful performance of structures on expansive soil requires special attention during construction. It is imperative that exposed soil be kept moist prior to placement of concrete for foundation construction. It can be difficult to remoisturize clayey soil without excavation, moisture conditioning, and recompaction.

## 3.3 SEISMIC HAZARDS

Potential seismic hazards resulting from a nearby moderate to major earthquake can generally be classified as primary and secondary. The primary effect is ground rupture, also called surface faulting. The common secondary seismic hazards include ground shaking and ground liquefaction. The following sections present a discussion of these hazards as they apply to the site. Based on topographic and lithologic data, the risk of regional subsidence or uplift is considered low to negligible at the site.

### 3.3.1 Ground Rupture

Since there are no known active faults crossing the property and the site is not located within an Earthquake Fault Special Study Zone, it is our opinion that ground rupture is unlikely at the subject property.

### 3.3.2 Ground Shaking

An earthquake of moderate to high magnitude generated within the San Francisco Bay region could cause considerable ground shaking at the site, similar to that which has occurred in the past. To mitigate the shaking effects, structures should be designed using sound engineering judgment and the latest California Building Code (CBC) requirements, as a minimum. Structures should be able to: (1) resist minor earthquakes without damage, (2) resist moderate earthquakes without structural damage but with some non-structural damage, and (3) resist major earthquakes without collapse but with some structural, as well as non-structural damage. Conformance to the current building code recommendations does not constitute any kind of guarantee that significant structural damage would not occur in the event of a maximum magnitude earthquake; however, it is reasonable to expect that a well-designed and well-constructed structure will not collapse or cause loss of life in a major earthquake (SEAOC, 1996).

### 3.3.3 Liquefaction

The site is not located within a potentially liquefiable zone based on the Seismic Hazards Zone map for the Livermore Quadrangle by the California Geological Survey (CGS, 2008); however, according to mapping prepared by the Association of Bay Area Governments (ABAG, 2001), the site is identified as moderately susceptible to liquefaction.

Soil liquefaction results from loss of strength during cyclic loading, such as imposed by earthquakes. Soil most susceptible to liquefaction is clean, loose, saturated, uniformly graded, fine-grained sand below the groundwater table.

Based on the soil type and consistency of the soil materials encountered during historical exploration and the depth to hydrostatic groundwater, the potential for liquefaction of the site soil at the project site is low. Liquefaction potential and liquefaction-induced settlements should be further addressed in a design-level report.

### 3.3.4 Densification Due to Earthquake Shaking

Densification of unsaturated loose granular soil can cause settlement of the ground surface due to earthquake-induced vibrations. Based on the presence of very loose to loose granular material in the East Area and the presence of medium dense clayey gravel in the Northeast Area, the potential for settlement from densification during earthquake shaking is high in those areas.

The densification due to earthquake shaking and associated settlements should be further evaluated during a design-level study.

### 3.3.5 Lateral Spreading

Lateral spreading is a failure within weak soil, typically due to liquefaction, which causes a soil mass to move along a free face, such as an open channel, or down a gentle slope. Due to the low risk of liquefaction, we consider the potential for lateral spreading at the site to be low. The lateral spreading risk should be further evaluated during a design-level study.

## 3.4 COMPRESSIBLE SOIL

Compressible soil is subject to consolidation settlement when a new loading scenario is introduced by structures, earthwork, and/or equipment. The amount of settlement is dependent on the magnitude and duration of the applied load, the shape and size of the applied area, and the depth, thickness, and the stress history of the compressible soil. The time required for primary consolidation settlement is highly dependent on the permeability of the deposit. Consequently, sandy soil will settle almost immediately, whereas clayey soil will settle much more slowly.

Based on our review of historical aerial photographs and documents, the existing fill was placed as recently as 30 years ago in the West Area, 20 years ago in the East Area, and 37 years ago in the Northeast Area. We anticipate that settlement due to existing fill loads in the West Area and Northeast Area is essentially complete, and that settlement due to existing fill loads in the East Area may not yet be completed.

Consolidation and shrink/swell testing were not performed in previous explorations. Considering the preliminary nature of this study and our experience within the greater EPSP area, we opine that the undocumented fill, as described in Section 2.5, should be considered potentially compressible when subjected to an anticipated increase in service loads from the proposed utility facilities. We note that the undocumented fill in the West Area will likely display lower levels of compressibility compared to the East Area and Northeast Area considering site history and strength of subsurface soil in the West Area.

The compressibility of on-site soil should be further analyzed in a design-level report.

## 3.5 LONG-TERM COMPRESSION OF UNDOCUMENTED FILL

Trace amounts of various types of debris, metal, and woody vegetation were encountered in other areas of the greater East Pleasanton Specific Plan project. The potential magnitude of settlement resulting from the decay of organic debris and oxidation of metallic debris is highly dependent on the quantity and the nature of these materials and the assumed project design life over which the predictions are intended to represent.

Given the high variability of the site fills, the exact quantity and nature of the debris cannot be precisely known from historical information and would need to be characterized in a design-level study.

## 3.6 SLOPE STABILITY

During our site reconnaissance, we observed several areas that can pose a slope stability risk for the existing slopes along El Charro Road.

- The approximately 1:1 (horizontal:vertical) eastern-facing slope that trends downward from El Charro Road to the East Area. Various bioretention basins and utilities are planned along the toe of the slope, which, if in cut, can undermine the overall stability of El Charro Road within that area.

- The 400,000-gallon water storage and booster pump facility in the Northeast Area is planned to be constructed at the northwestern corner of Cope Lake. The existing bank may experience failure post-construction given the large vertical and inertial loads induced by the proposed water tank.

The design-level study should assess the global stability of El Charro Road and the Cope Lake bank under static and seismic conditions and considering varying water levels of Cope Lake.

### 3.7 SOIL CORROSION POTENTIAL

We did not evaluate site soil for corrosion potential as part of this study. We recommend that corrosion and sulfate testing be performed during the design-level geotechnical exploration to evaluate the potential impacts of corrosion to site improvements and foundation elements.

## 4.0 PRELIMINARY EARTHWORK RECOMMENDATIONS

The following preliminary recommendations are for estimating and planning purposes. Final recommendations regarding site grading and hazard mitigation will be provided in the design-level geotechnical exploration.

### 4.1 DEMOLITION, UNDOCUMENTED FILL REMOVAL, AND STRIPPING

Areas containing surface vegetation or organic-laden topsoil within the areas to be improved should be stripped to an appropriate depth to remove these materials. The amount of actual stripping should be determined in the field by our authorized representative at the time of construction. Subject to approval by the landscape architect, stripping’s and organically contaminated soil can be used in landscape areas. Otherwise, such soil should be removed from the project site. Any topsoil that will be retained for future use in landscape areas should be stockpiled in areas where it will not interfere with grading operations.

Excavations resulting from demolition and stripping, which extend below final grades, should be cleaned to firm undisturbed soil, as determined by our representative. Once the surface of areas to be graded are prepared as discussed above, the surface should then be scarified, moisture conditioned, and backfilled with suitable material compacted to the recommendations presented in the Fill Placement section.

### 4.2 EXISTING UNDOCUMENTED FILL TREATMENT

#### 4.2.1 Surcharge with Wick Drains

In our experience, a surcharge program potentially with wick drains can reduce the post-construction primary consolidation settlements. Separate surcharge programs should be developed for the West Area, East Area, and Northeast Area due to the unique history of each area, as shown in Figure 2B. We note that the areas delineated within Figure 2 are provided for project planning purposes only; recommended surcharge areas should be revisited once a design-level geotechnical exploration is performed and land plans have been finalized.

The duration required to achieve the desired degree of settlement based on future loads could vary across the site based on the variability of subsurface conditions, including settlement due to compressibility and decomposition of debris material that may be present within the undocumented fill. Supplemental explorations should be performed during design-level study to refine consolidation parameters, including durations and degree of settlement.

We understand the proposed plan development is in the early stages of development. We recommend that ENGEO be retained to prepare remedial grading plans to include the surcharge program for this project.

### 4.2.2 Other Ground Improvement Methods

As an alternative to surcharge, other ground improvement may be performed within the footprint of proposed utility buildings if the proposed structural loads exceed allowable bearing capacities on native soil/engineered fill, and/or if we assess it is necessary to mitigate compressible soil impacts during design level study. From a preliminary standpoint, other ground improvement methods may be more effective for the East Area and Northeast Area given the soil encountered in those areas.

Ground improvement can achieve allowable bearing capacities between 4,500 and 6,000 psf. From a preliminary standpoint, ground improvement methods such as deep soil mixing (DSM), drilled displacement columns (DDC), or rammed/vibro aggregate piers (RAP) are effective to increase allowable bearing pressures and mitigate the effects of potentially liquefiable soil. The depth of ground improvement can be assessed during design-level study, if desired.

Table 4.2.2-1 summarizes advantages and disadvantages of potential ground improvement methods.

**TABLE 4.2.2-1: Ground Improvement Alternatives Comparison**

| TYPE | BENEFITS | DISADVANTAGES |
|---|---|---|
| Drilled Displacement Columns (DDC) | • Minimal noise and vibration<br>• Minimal to no spoils<br>• Compatible with typical environmental oversight agency requirements<br>• Allowable bearing capacity ~5,000 psf to 6,000 psf<br>• Requires improvement of moderate quantity of soil (30 to 35 percent replacement ratio)<br>• Relatively low mobilization and material cost compared to DSM | • Minimal improvement of soil around DDC elements<br>• Requires reinforcing and post-event maintenance if kinematic loading of elements is a concern<br>• Limitation on depth ~80 feet |
| Deep Soil Mixing (DSM) | • Limited noise and vibration<br>• Allowable bearing capacity ~4,500 psf to 5,000 psf<br>• Have been used in environmentally regulated sites<br>• Can extend to deeper strata | • Higher mobilization and mixing cost compared to DDC and RAP<br>• Generates large amounts of spoils<br>• Mixing requires large quantity of water<br>• Requires improvement of large quantity of soil (>40 percent replacement ratio) |

| TYPE | BENEFITS | DISADVANTAGES |
|---|---|---|
| Rammed Aggregate Piers (RAP) | • Improvement of soil around RAP elements<br>• Limited noise and vibration<br>• Allowable bearing capacity ~ 5,000 psf to 6,000psf<br>• Low vibration construction methods are available | • Produces moderate spoils<br>• RAPs may require amendment to comply with environmental agency requirements<br>• Limitation on depth ~30 to 35 feet |

## 4.3 ACCEPTABLE FILL

On-site soil and rock material is suitable as fill material provided it is processed to remove concentrations of organic material, debris, and particles greater than 8 inches in maximum dimension.

Ideally, imported fill materials should have a plasticity index less than 25 and have at least 20 percent passing the No. 200 sieve. Due to the residential nature of the proposed project, environmental testing should also be performed on imported fill. Import fill containing recycled asphaltic concrete should not be placed in building pad areas.

If desirable, ENGEO should be contacted to evaluate the appropriateness of import material that does not meet the above criteria.

## 4.4 UNDERGROUND UTILITIES

The contractor is responsible for conducting trenching and shoring in accordance with Cal/OSHA requirements. Project consultants involved in utility design should specify pipe-bedding materials. Exercise care where utility trenches are located beside foundation areas. Locate utility trenches constructed parallel to foundations entirely above a plane extending down from the lower edge of the footing at an angle of 45 degrees. Provide utility companies and landscape architects with this information.

Where utility trenches cross underneath El Charro Road, we recommend that a plug be placed within the trench backfill to prevent the normally granular bedding materials from acting as a conduit for water to enter beneath the building. The plug should be constructed using sand-cement slurry (minimum 28-day compressive strength of 500 psi) or relatively impermeable native soil for pipe bedding and backfill. We recommend that the plug extend for a distance of at least 3 feet in each direction from the point where the utility enters the building perimeter.

Use well-graded import less than ¾ inch in maximum dimension for pipe zone backfill (i.e., material beneath and immediately surrounding the pipe). Use fine- to medium-grained sand or a well-graded mixture of sand and gravel for pipe zone backfill import material. Avoid using this material within 2 feet of finish grades. In general, avoid using uniformly graded gravel for pipe or trench zone backfill due to the potential for migration of: (1) soil into the relatively large void spaces present in this type of material; and (2) water along trenches backfilled with this type of material. Native soil for trench zone backfills (i.e., material placed between the pipe zone backfill and the ground surface) should be compacted in accordance with recommendations in the Fill Placement section of this report.

### 4.4.1 Trenchless Crossings

If trenching underneath El Charro Road is unfeasible from a constructability standpoint, the proposed utilities can be installed using a trenchless crossing with jacking and receiving shafts. Design-level explorations should be performed at the location of the jacking and receiving shafts to evaluate the feasibility of trenchless crossing, if desired.

## 4.5 CUT SLOPES

We anticipate that excavations on the order of 12½ feet may be necessary for the proposed bioretention basins and recycled water storage tank. Such temporary excavations should be adequately sloped, shored, or braced. At a minimum, all excavations should be constructed in accordance with the current California Division of Occupational Safety and Health (Cal/OSHA) regulations (Title 8, California Code of Regulations) pertaining to excavation safety.

Care should be taken when excavating near El Charro Road and existing utilities and pipelines. Measures should also be taken, as necessary, to prevent bearing failure of any adjacent structure foundations caused by excavations. The contractor should be responsible for assessing locations and grades of adjacent foundations and devise underpinning schemes, as necessary, for temporary support.

Cut slope recommendations should be assessed during the design-level study.

## 4.6 SITE DRAINAGE

The project engineer is responsible for designing surface drainage improvements. With regard to geotechnical engineering issues, we recommend that finish grades be sloped away from buildings and pavements to the maximum extent practical to reduce the potentially damaging effects of expansive soil. As a minimum, we recommend the following.

1. Discharge roof downspouts into closed conduits and direct away from foundations and pavements to appropriate drainage devices.
2. Do not allow water to pond near foundations, pavements, or exterior flat work.

## 4.7 STORMWATER BIORETENTION BASINS AND INFILTRATION

Based on previous exploration logs, we expect to encounter moderately to highly expansive clay near the ground surface. The existing soil is not expected to have adequate permeability for stormwater infiltration, unless subdrains are installed. We recommend assuming little stormwater infiltration will occur through the existing site soil.

We recommend that, when practical, bioretention basins be planned a minimum of 5 feet away from structural site improvements, such as buildings, streets, retaining walls, and sidewalks/driveways. When this is not practical, bioretention areas located within 5 feet of structural site improvements can either:

1. Be constructed with structural side walls capable of withstanding the loads from the adjacent improvements, or
2. Incorporate filter material compacted to between 85 and 90 percent relative compaction (ASTM D1557, latest edition) and a waterproofing system designed to reduce the potential for moisture transmission into the subgrade soil beneath the adjacent improvement.

In addition, one of the following options should be followed.

1. We recommend that bioretention design incorporate a waterproofing system lining the bioswale excavation and a subdrain, or other storm drain system, to collect and convey water to an approved outlet. The waterproofing system should cover the bioretention area excavation in such a manner as to reduce the potential for moisture transmission beneath the adjacent improvements.
2. Alternatively, and with some risk of movement of adjacent improvements, if infiltration is desired, we recommend the perimeter of the bioretention areas be lined with an HDPE tree root barrier that extends at least 1 foot below the bottom of the bioretention areas/infiltration trenches.

Site improvements located adjacent to bioretention areas that are underlain by base rock, sand, or other imported granular materials, should be designed with a deepened edge that extends to the bottom of the imported material underlying the improvement.

Where adjacent site improvements include utility buildings, streets steeper than 3 percent, or design elements subject to lateral loads (such as from impact or traffic patterns), additional design considerations may be recommended. If the surface of the bioretention area is depressed, the slope gradient should follow the slope guidelines described in earlier section(s) of this document. In addition, although not recommended, if trees are to be planted within bioretention areas, HDPE Tree Boxes that extend below the bottom of the bioretention system should be installed to reduce potential impact to subdrain systems that may be part of the bioretention area design. For this condition, the waterproofing system should be connected to the HPDE Tree Box with a waterproof seal.

Given the nature of bioretention systems and possible proximity to improvements, we recommend ENGEO be retained to review design plans and provide testing and observation services during the installation of linings, compaction of the filter material, and connection of designed drains.

It should be noted that the contractor is responsible for conducting all excavation and shoring in a manner that does not cause damage to adjacent improvements during construction and future maintenance of the bioretention areas. As with any excavation adjacent to improvements, the contractor should reduce the exposure time such that the improvements are not detrimentally impacted.

# 5.0 PRELIMINARY FOUNDATION CONSIDERATIONS

From a geotechnical engineering viewpoint, the site is suitable for the proposed development, provided the preliminary geotechnical considerations in this report are thoroughly addressed through design-level study. Based on our preliminary findings, the main geotechnical concerns at the site include the following.

- Potentially expansive soil
- Static consolidation settlement from compressible fill
- Long-term compression from existing fill
- Potential for slope instability along El Charro Road
- Potentially corrosive soil

In order to reduce the effects of the above geotechnical concerns, the foundations for the proposed sewer treatment plant, water pump station, and underground water storage tank should be sufficiently stiff to move as a rigid unit within tolerable differential movements. Foundation alternatives and combinations to be considered include a structural mat foundation system bearing on ground improvement measures, as described in Section 4.2, and deep foundation systems.

## 5.1 FOUNDATIONS

### 5.1.1 Shallow Foundation with Ground Improvement

After completion of a surcharge program or other ground improvement program, as described in Section 4.2, and provided the foundation design can accommodate the estimated settlement, the proposed utility structures may be supported on a rigid mat foundation bearing on prepared engineered fill. Rigid mats should be designed for the anticipated post-construction differential settlement and the relative expansion potential of the foundation soil following site grading. We would anticipate preliminary foundation thickness on the order of 11 to 12 inches.

### 5.1.2 Deep Foundations

A deep foundation may be suitable for the proposed utility systems if a structural system and height option with column loads in excess of what can be supported with ground improvement is selected.

Design for pile-supported structures should consider downdrag from earthquake-induced liquefaction settlement if a significant liquefaction hazard is identified during design-level study. Pile lengths are dependent on the structural loads and the depth of potentially liquefiable material, if any. Specific pile design recommendations for deep foundations can be provided in the design-level report. Table 5.1.2-1 summarizes advantages and disadvantages of potential deep foundation methods.

**TABLE 5.1.2-1: Deep Foundation Alternatives Comparison**

| TYPE | BENEFITS | DISADVANTAGES |
|---|---|---|
| Driven Pre-Cast Concrete Piles (PCCPs) | • Efficient at supporting higher structural loads. Spoils limited to predrilling.<br>• Cost efficient<br>• Efficient to construct<br>• Consistent quality control<br>• Compatible with environmental agency requirements on impacted sites | • Noise and vibration<br>• Limitations for sites with equipment height restrictions<br>• Requires laydown area for piles<br>• Limitation on depth approximately 120 feet<br>• May have challenges driving through refuse or debris. May require additional predrill or debris removal. |
| Driven Steel H-Piles (H-Piles) | • Efficient at supporting higher structural loads<br>• Spoils limited to predrilling<br>• Efficient to construct<br>• Consistent quality control | • Noise and vibration<br>• Limitations for sites with equipment height restrictions<br>• Requires laydown area for piles |

| TYPE | BENEFITS | DISADVANTAGES |
|---|---|---|
| | • Compatible with environmental agency requirements on impacted sites<br>• Can be spliced to go to greater depths<br>• Can penetrate refuse and debris | |
| Cast-in-Drilled-Hole Piers (CIDH) | • Efficient at supporting higher structural loads<br>• Limited noise and vibration<br>• Efficient to construct<br>• Can be spliced to go to greater depths<br>• Can penetrate refuse and debris<br>• Cheaper to mobilize than PCCPs and H-Piles | • Generates large amounts of spoils<br>• Requires laydown area for piles |

### 5.2 2022 CBC SEISMIC DESIGN PARAMETERS

Based on the subsurface conditions encountered in historical explorations, we preliminarily characterize the site as Site Class D in accordance with the current CBC. Depending on further characterization of the compressibility and plasticity indices of the existing undocumented fill, the site may have the potential to be characterized as Site Class E. Additional laboratory testing should be performed during the design-level study to characterize the properties of the undocumented fill.

## 6.0 DESIGN-LEVEL GEOTECHNICAL REPORT

This report presents preliminary geotechnical findings, conclusions, and recommendations intended for preliminary planning purposes only. A design-level geotechnical exploration and assessment should be performed when the development concept is further defined. We recommend the design-level exploration and reporting include the following scope items.

- Exploration program to characterize the engineering characteristics, composition, depth, and extent of undocumented fill.
- Evaluation of groundwater conditions.
- Assessment of site-specific assessments of geologic and geotechnical hazards, including, but not limited to, the following.
    - Liquefaction and cyclic softening
    - Static load-induced settlement
    - Slope stability risk
    - Expansive soil, existing fill, and corrosion potential
- Updated evaluation of seismic site classification and seismic analysis in accordance with CBC 2022 (ASCE 7-16).
- Design recommendations for shallow foundation system, with or without ground improvement, if feasible.
- Design recommendations for ground improvement alternatives and surcharge, if necessary.
- Design recommendations for deep foundation systems, if necessary.

- Design-level earthwork and improvement design and construction recommendations, including trenchless crossing recommendations, if desired.

## 7.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report presents our geotechnical feasibility evaluation of the site, as discussed in Section 1.3. If changes occur in the nature or design of the project, we should be allowed to review this report and provide additional recommendations. It is the responsibility of the owner to transmit the information and recommendations of this report to the appropriate organizations or people involved in design of the project, including but not limited to developers, owners, buyers, architects, engineers, and designers. The conclusions and recommendations contained in this report are solely professional opinions and are valid for a period of no more than 2 years from the date of report issuance.

We strive to perform our professional services in accordance with generally accepted principles and practices currently employed in the area; there is no warranty, express or implied. There are risks of earth movement and property damages inherent in building on or with earth materials. We are unable to eliminate all risks; therefore, we are unable to guarantee or warrant the results of our services.

This document must not be subject to unauthorized reuse, that is, reuse without our written authorization. Such authorization is essential because it requires us to evaluate the document's applicability given new circumstances, not the least of which is passage of time.

# SELECTED REFERENCES

Association of Bay Area Governments. 2001. Liquefaction Hazard Map for Alameda County, Scenario: 1906 San Francisco Earthquake.

CBG. 2023. Vesting Tentative Map Offsite Utility Plan – Sanitary Sewer and Water, Option 1, Bio in APZ, Arroyo Lago, Alameda County, California. September 2023. Job No. 3435-000.

CBG. 2023. Vesting Tentative Map Offsite Utility Plan – Sanitary Sewer and Water, Option 2, Bio East of El Charo, Arroyo Lago, Alameda County, California. September 2023. Job No. 3435-000.

California Geologic Survey. 2018. Special Publication 42, Earthquake Fault Zones, A Guide for Government Agencies, Property Owners/Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California.

Dibblee, T.W., Jr. 2005. Preliminary Geologic Map of the Livermore Quadrangle, Alameda County, California. U.S. Geological Survey Open-file Report.

ENGEO. 2019. Geotechnical Review, East Pleasanton Specific Plan, Pleasanton, California. March 29, 2019. Project No. 9785.001.001.

ENGEO. 2020. Generalized Soil Conditions for Ground Improvement Overview, East Pleasanton Specific Plan, Pleasanton, California. May 14, 2020, Revised May 20, 2020. Project No. 9785.001.001.

ENGEO. 2020. Preliminary Surcharge Program Study and Cost Assessment – Areas 3, 4, and 10, East Pleasanton Specific Plan, Pleasanton, California. July 10, 2020, Revised August 25, 2020. Project No. 9785.001.001.

ENGEO. 2020. Preliminary Ground Improvement Program Study and Cost Assessment for Areas 1 and 2, East Pleasanton Specific Plan, Pleasanton, California. September 28, 2020. Project No. 9785.001.001.

ENGEO. 2023. Preliminary Geotechnical Report, Arroyo Lago, Pleasanton, California. May 18, 2023. Project No. 9785.004.001.

Haley & Aldrich. 2017. Report on Preliminary Geotechnical Investigation, Unincorporated Alameda County, California. June 2017. File No. 130540-002.

Historical Aerials, www.historicaerials.com; website accessed January 2024.

State of California. California Geologic Survey, 2008, Seismic Hazard Zone Report for the Livermore 7.5-Minute Quadrangle, Alameda County, California., Seismic Hazard Zone Report 114.

State of California. California Geologic Survey, 2008, Seismic Hazard Zones, Official Map, Livermore Quadrangle.

# SELECTED REFERENCES (Continued)

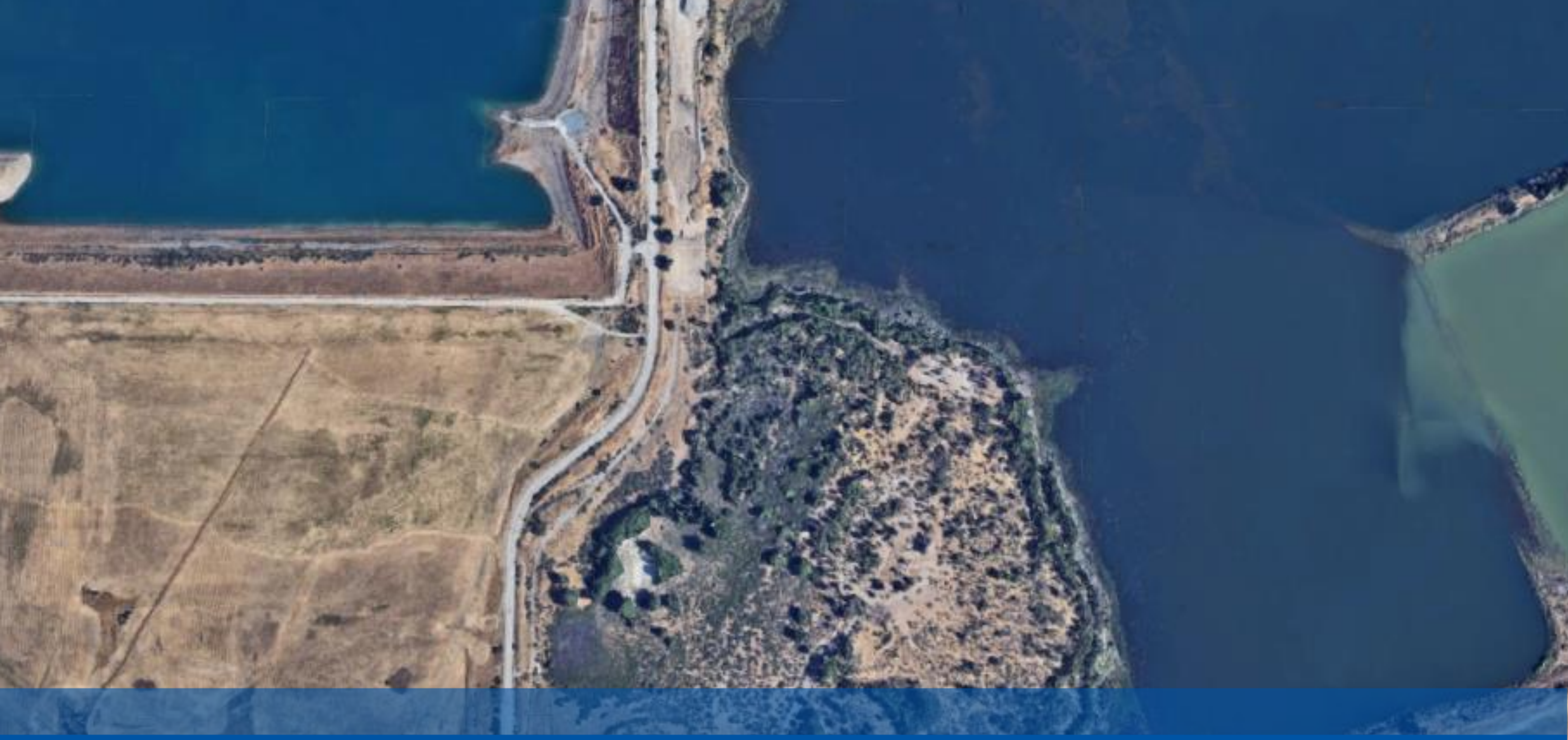
Treadwell & Rollo. 2007. Due Diligence Investigation – Parcel 2 and Parcels D through G, Hanson Radum Site, Pleasanton, California. May 25, 2007. Project No. 4490.01

Treadwell & Rollo. 2009. Geotechnical Investigation Pleasanton Land Development Project, Pleasanton, California. September 8, 2009. Project No. 4490.02

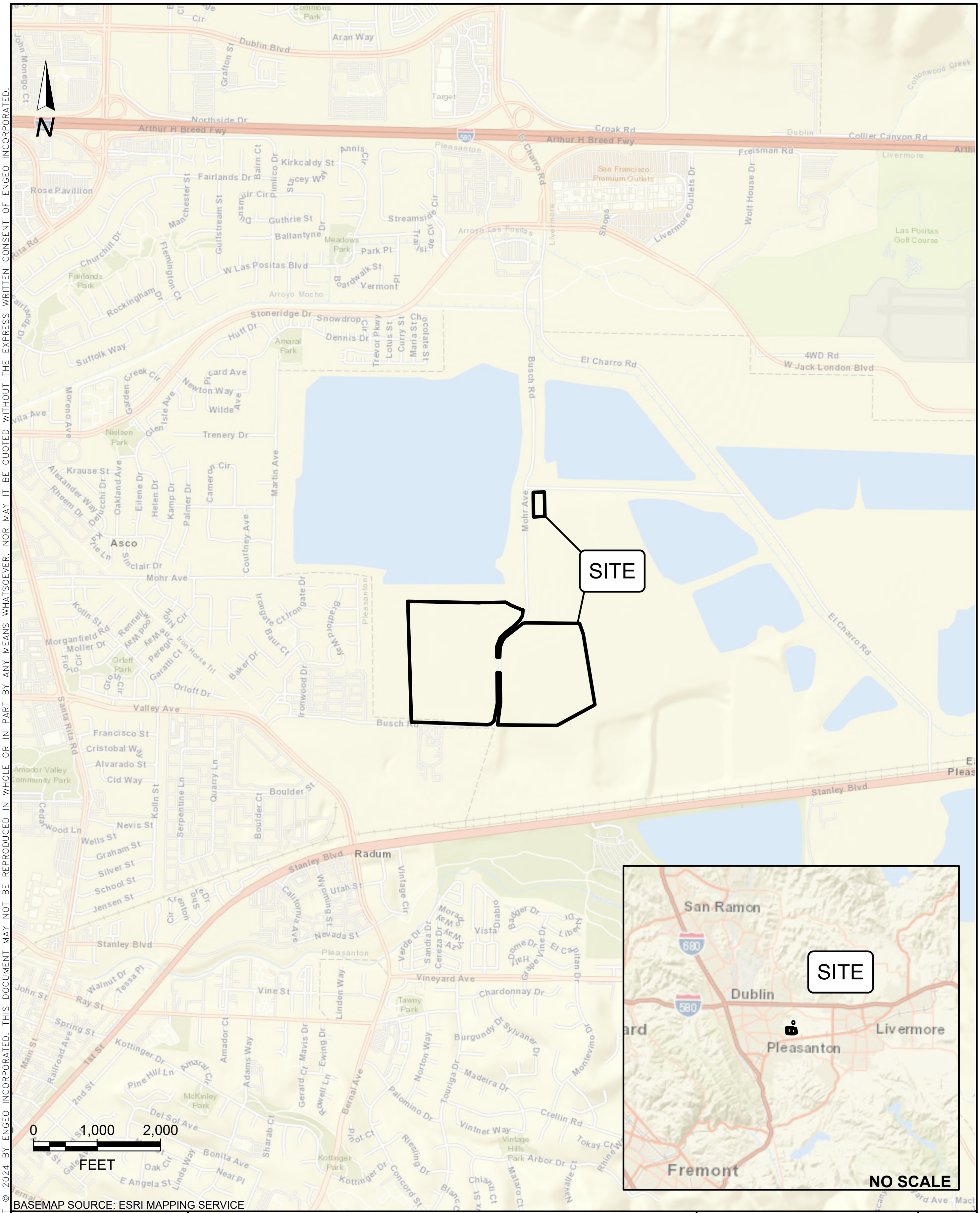
United States Geologic Survey (USGS), 2008, National Seismic Hazard Maps Database.

Working Group on California Earthquake Probabilities. 2015. The Uniform California Earthquake Rupture Forecast, Version 3 (UCERF 3), U.S. Geological Survey Open-File Report 2015.

Zone 7 Water Agency. 2023. Livermore Valley Groundwater Basin, Sustainable Groundwater Management Annual Report, 2022 Water Year (October 2021 – September 2022). March 2023.



# FIGURES



BASEMAP SOURCE: ESRI MAPPING SERVICE

# VICINITY MAP

ARROYO LAGO - INFRASTRUCTURE AREA

PLEASANTON, CALIFORNIA

PROJECT NO. : 9785.004.003

SCALE: AS SHOWN

DRAWN BY: MMH

CHECKED BY: JTR

FIGURE NO.

1

PATH: G:\DRAFTING\PROJECTS\9785\9785004003\GEOTECH\GEX\ARROYO LAGO INFRASTRUCTURE.APRX
LAYOUT: 01. VICINITY 8.5 X 11 PORTRAIT USER: MHAWKINS

ORIGINAL FIGURE PRINTED IN COLOR

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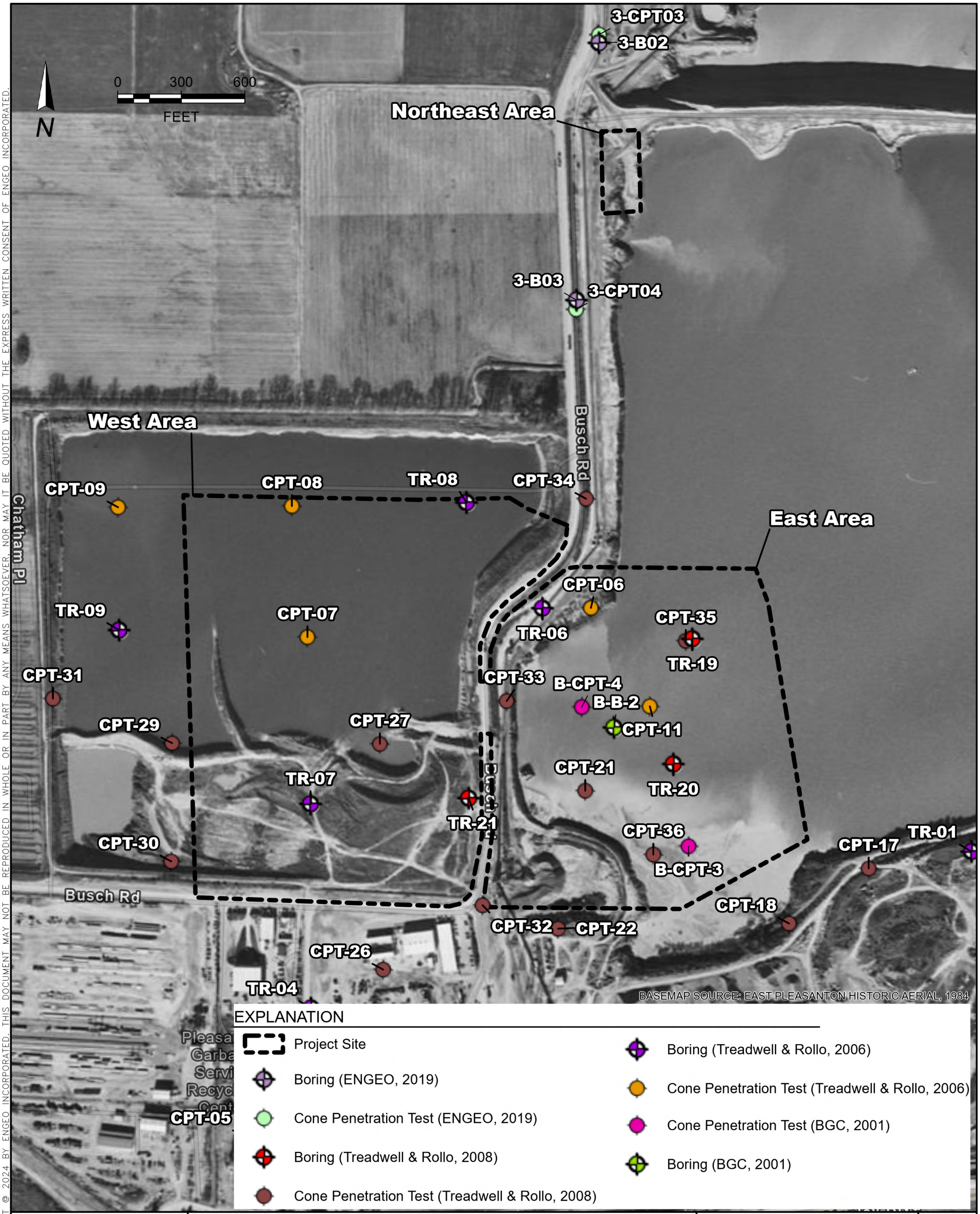
SITE PLAN
ARROYO LAGO - INFRASTRUCTURE AREA
PLEASANTON, CALIFORNIA

| | | |
|---|---|---|
| PROJECT NO. : 9785.004.003 | | FIGURE NO. |
| SCALE: AS SHOWN | | 2A |
| DRAWN BY: MMH | CHECKED BY: JTR | |

PATH: G:\DRAFTING\PROJECTS\9785\9785004003\GEOTECH\GEX\ARROYO LAGO INFRASTRUCTURE.APRX
LAYOUT: 02. SITE PLAN 8.5 X 11 PORTRAIT USER: MHAWKINS

ORIGINAL FIGURE PRINTED IN COLOR



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## SITE PLAN WITH HISTORIC AERIAL
ARROYO LAGO - INFRASTRUCTURE AREA
PLEASANTON, CALIFORNIA

PROJECT NO. : 9785.004.003
SCALE: AS SHOWN
DRAWN BY: MMH
CHECKED BY: JTR
FIGURE NO. 2B

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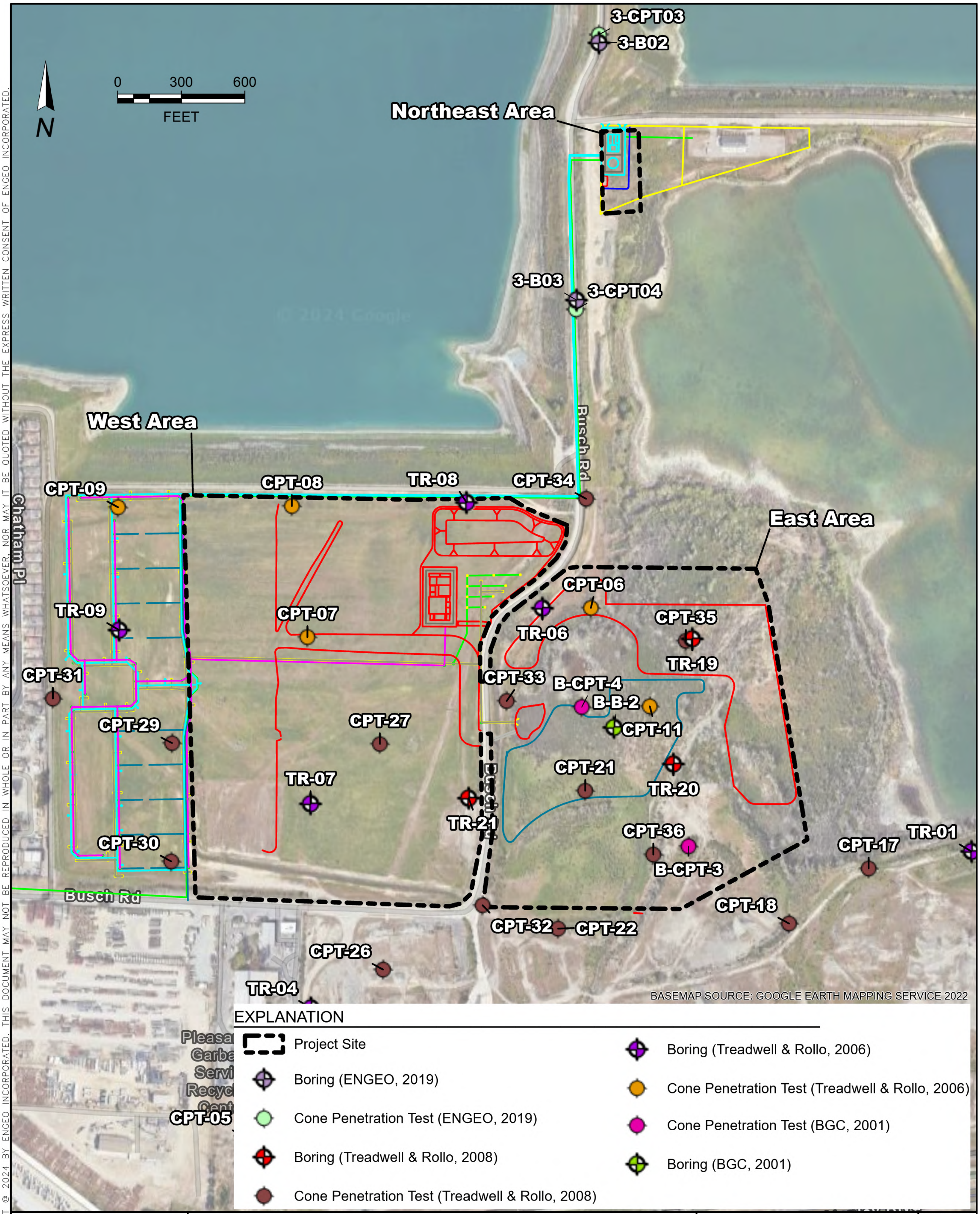
LAYOUT: 02B. SITE PLAN HISTORIC USER: MHAWKINS

ORIGINAL FIGURE PRINTED IN COLOR



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SITE PLAN WITH PROPOSED INFRASTRUCTURE (OPTION 1)
ARROYO LAGO - INFRASTRUCTURE AREA
PLEASANTON, CALIFORNIA

PROJECT NO. : 9785.004.003
SCALE: AS SHOWN
DRAWN BY: MMH
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FIGURE NO.
2C

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LAYOUT: 02. SITE PLAN 2C OPTION 1 USER: MHAWKINS

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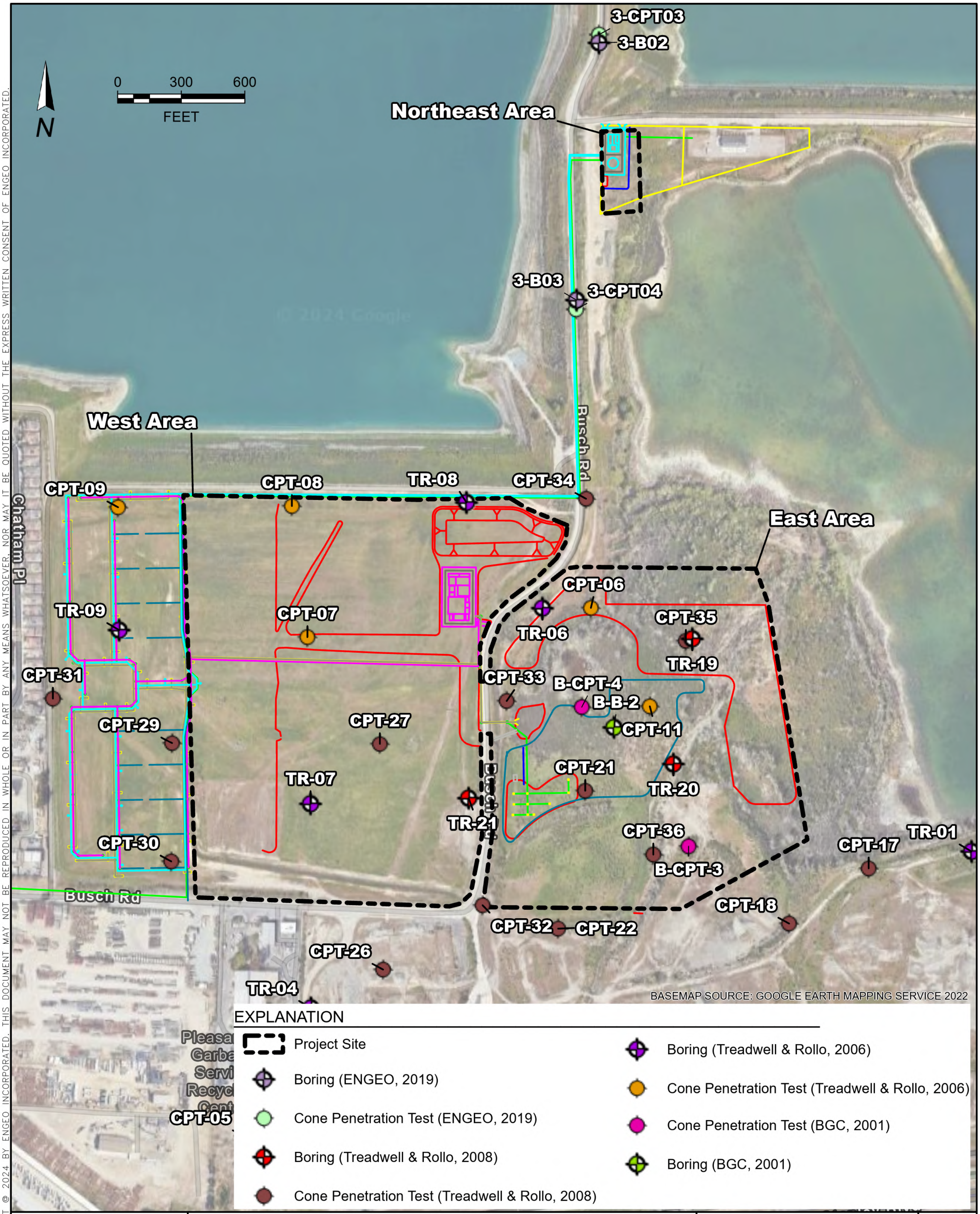

BASEMAP SOURCE: GOOGLE EARTH MAPPING SERVICE 2022

EXPLANATION

- ▭ Project Site
- ⊕ Boring (ENGEO, 2019)
- ● Cone Penetration Test (ENGEO, 2019)
- ⊕ Boring (Treadwell & Rollo, 2008)
- ● Cone Penetration Test (Treadwell & Rollo, 2008)
- ⊕ Boring (Treadwell & Rollo, 2006)
- ● Cone Penetration Test (Treadwell & Rollo, 2006)
- ● Cone Penetration Test (BGC, 2001)
- ⊕ Boring (BGC, 2001)

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SITE PLAN WITH PROPOSED INFRASTRUCTURE (OPTION 2)
ARROYO LAGO - INFRASTRUCTURE AREA
PLEASANTON, CALIFORNIA

PROJECT NO. : 9785.004.003
SCALE: AS SHOWN
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FIGURE NO.
2D

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LAYOUT: 02. SITE PLAN 2D OPTION 2 USER: MHAWKINS

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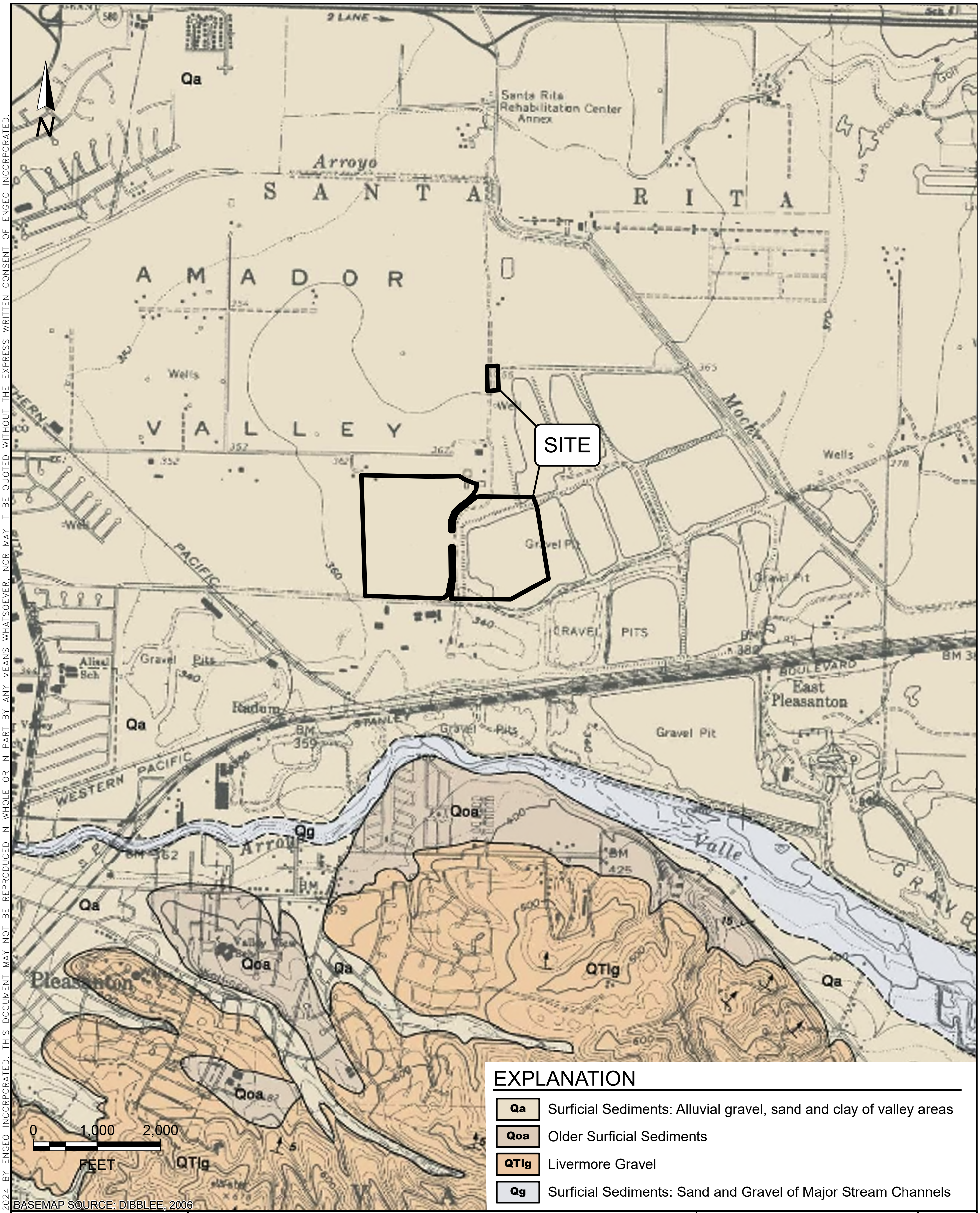

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REGIONAL GEOLOGIC MAP
ARROYO LAGO - INFRASTRUCTURE AREA
PLEASANTON, CALIFORNIA

PROJECT NO.: 9785.004.003
SCALE: AS SHOWN
DRAWN BY: MMH
CHECKED BY: JTR
FIGURE NO. 3

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LAYOUT: 03. GEOLOGIC 8.5 X 11 PORTRAIT USER: MHAWKINS

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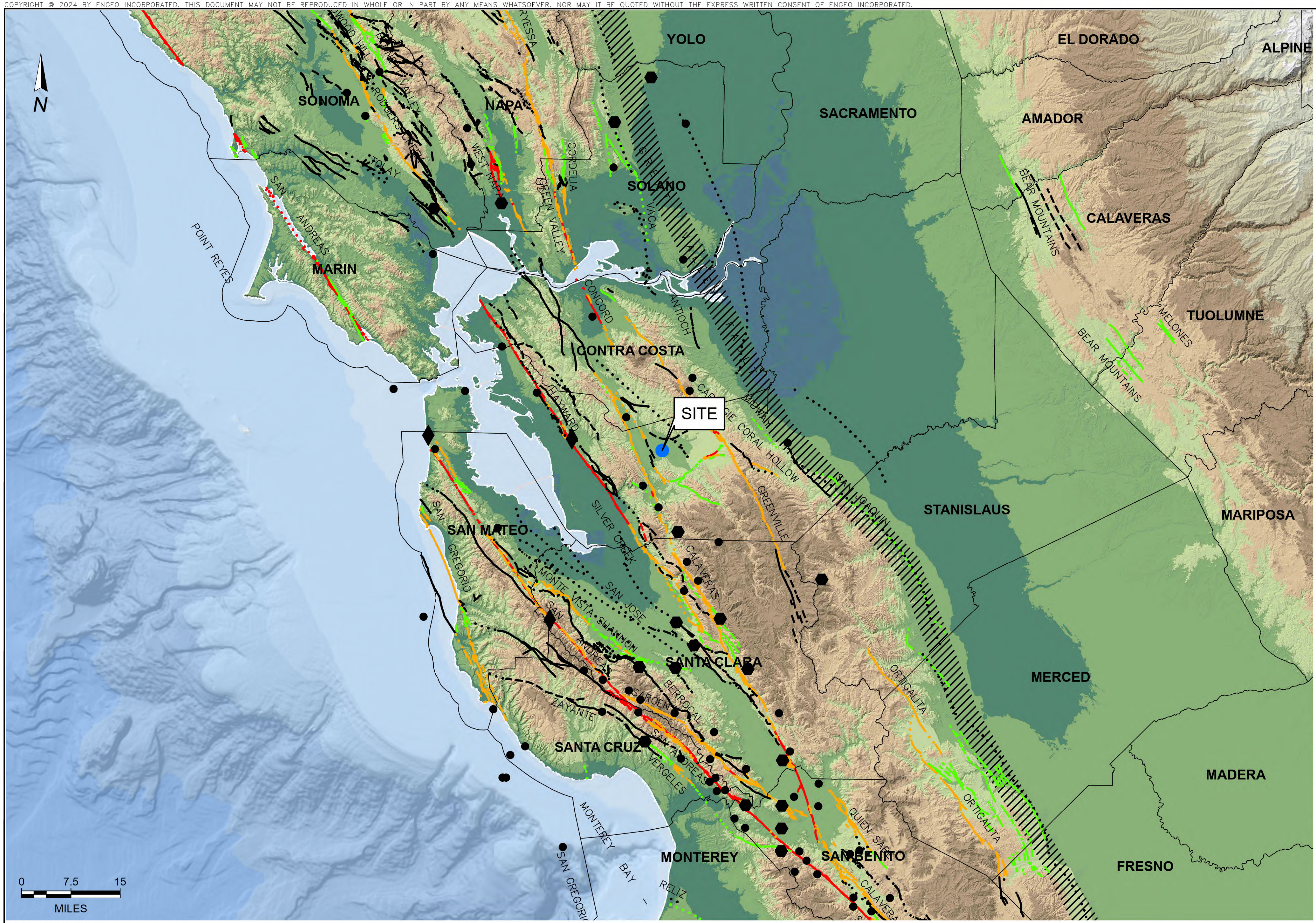

EXPLANATION

● Project Site

**HISTORIC EARTHQUAKE EPICENTERS**

● Magnitude 5-6

⬢ Magnitude 6-7

◆ Magnitude 7+

▨ Historic Blind Thrust Fault Zone

**QUATERNARY FAULTS 2020**

Based on time of most recent surface deformation

- Historical (<150 Years), Well Constrained Location
- Historical (<150 Years), Moderately Constrained Location
- Historical (<150 Years), Inferred Location
- Latest Quaternary (<15,000 Years), Well Constrained Location
- Latest Quaternary (<15,000 Years), Moderately Constrained Location
- Latest Quaternary (<15,000 Years), Inferred Location
- Latest Quaternary (<15,000 Years), Inferred Location
- Late Quaternary (<130,000 Years), Moderately Constrained Location
- Late Quaternary (<130,000 Years), Inferred Location
- Middle And Late Quaternary (<750,000 Years), Well Constrained Location
- Middle And Late Quaternary (<750,000 Years), Moderately Constrained Location
- Middle And Late Quaternary (<750,000 Years), Inferred Location
- Undifferentiated Quaternary(<1.6 Million Years), Well Constrained Location
- Undifferentiated Quaternary(<1.6 Million Years), Moderately Constrained Location
- Undifferentiated Quaternary(<1.6 Million Years), Inferred Location
- Class B (Various Age), Well Constrained Location
- Class B (Various Age), Moderately Constrained Location
- Class B (Various Age), Inferred Location

BASE MAP SOURCE:
CSUMB, ESRI, GARMIN, NATURALVUE, ESRI, GEBCO, GARMIN, NATURALVUE
COLOR HILLSHADE IMAGE BASED ON THE NATIONAL ELEVATION DATA SET (NED) AT 30 METER RESOLUTION
U.S.G.S. QUATERNARY FAULT DATABASE, 2020
C.G.S. HISTORIC EARTHQUAKE DATABASE

ENGEO
Expect Excellence

REGIONAL FAULTING AND SEISMICITY MAP
ARROYO LAGO - INFRASTRUCTURE AREA
PLEASANTON, CALIFORNIA

PROJECT NO.: 9785.004.003
SCALE: AS SHOWN
DRAWN BY: MMH
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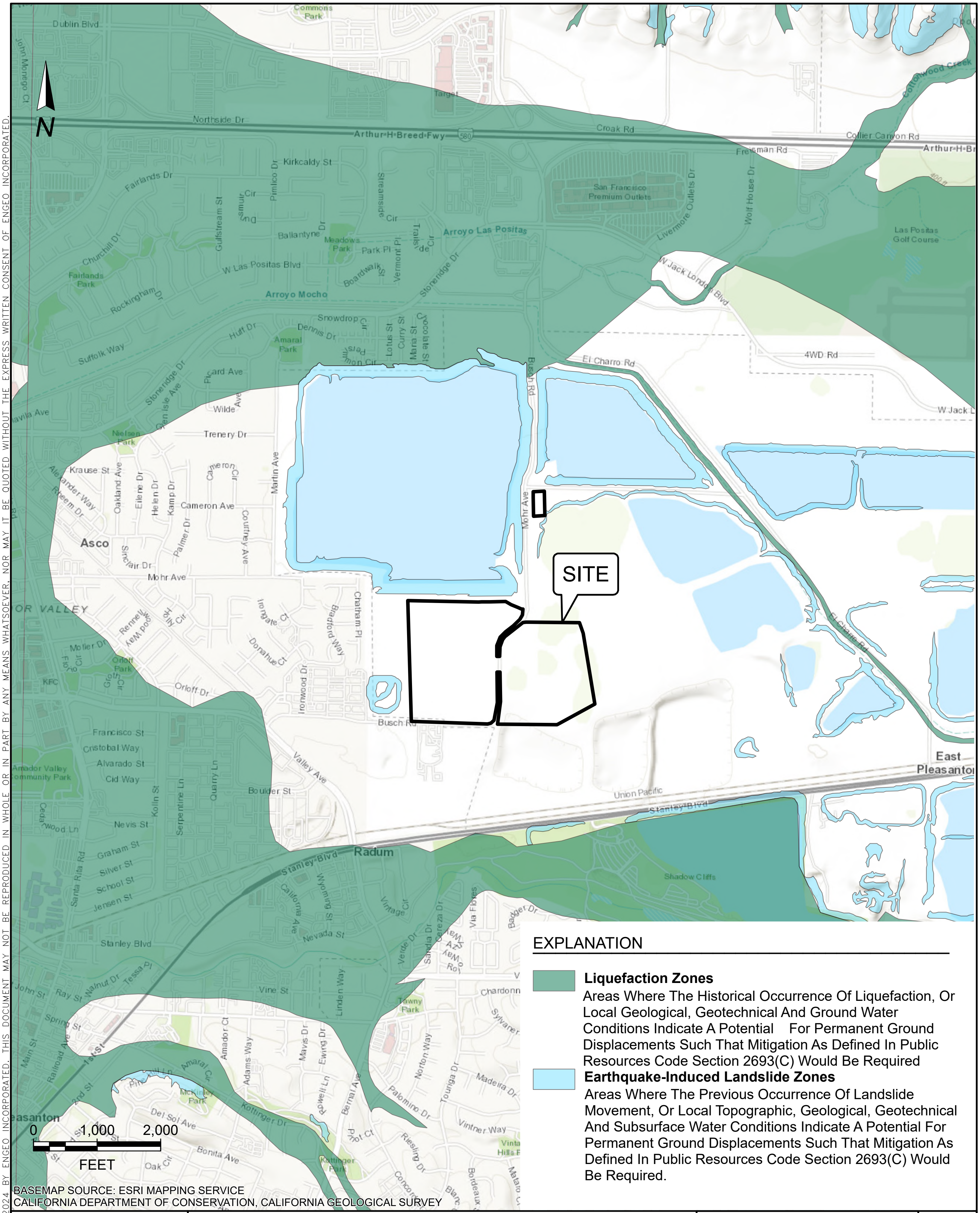
FIGURE NO. 4

PATH: G:\DRAFTING\PROJECTS\9785\9785004003\GEOTECH\GEX\ARROYO LAGO INFRASTRUCTURE.APRX
LAYOUT: 04. FAULT&SEISMICITY 11 X 17 LANDSCAPE USER: MHAWKINS

ORIGINAL FIGURE PRINTED IN COLOR



BASEMAP SOURCE: ESRI MAPPING SERVICE
CALIFORNIA DEPARTMENT OF CONSERVATION, CALIFORNIA GEOLOGICAL SURVEY

## EXPLANATION

🟩 **Liquefaction Zones**
Areas Where The Historical Occurrence Of Liquefaction, Or Local Geological, Geotechnical And Ground Water Conditions Indicate A Potential For Permanent Ground Displacements Such That Mitigation As Defined In Public Resources Code Section 2693(C) Would Be Required

🟦 **Earthquake-Induced Landslide Zones**
Areas Where The Previous Occurrence Of Landslide Movement, Or Local Topographic, Geological, Geotechnical And Subsurface Water Conditions Indicate A Potential For Permanent Ground Displacements Such That Mitigation As Defined In Public Resources Code Section 2693(C) Would Be Required.

ENGEO
Expect Excellence

# SEISMIC HAZARDS ZONE MAP

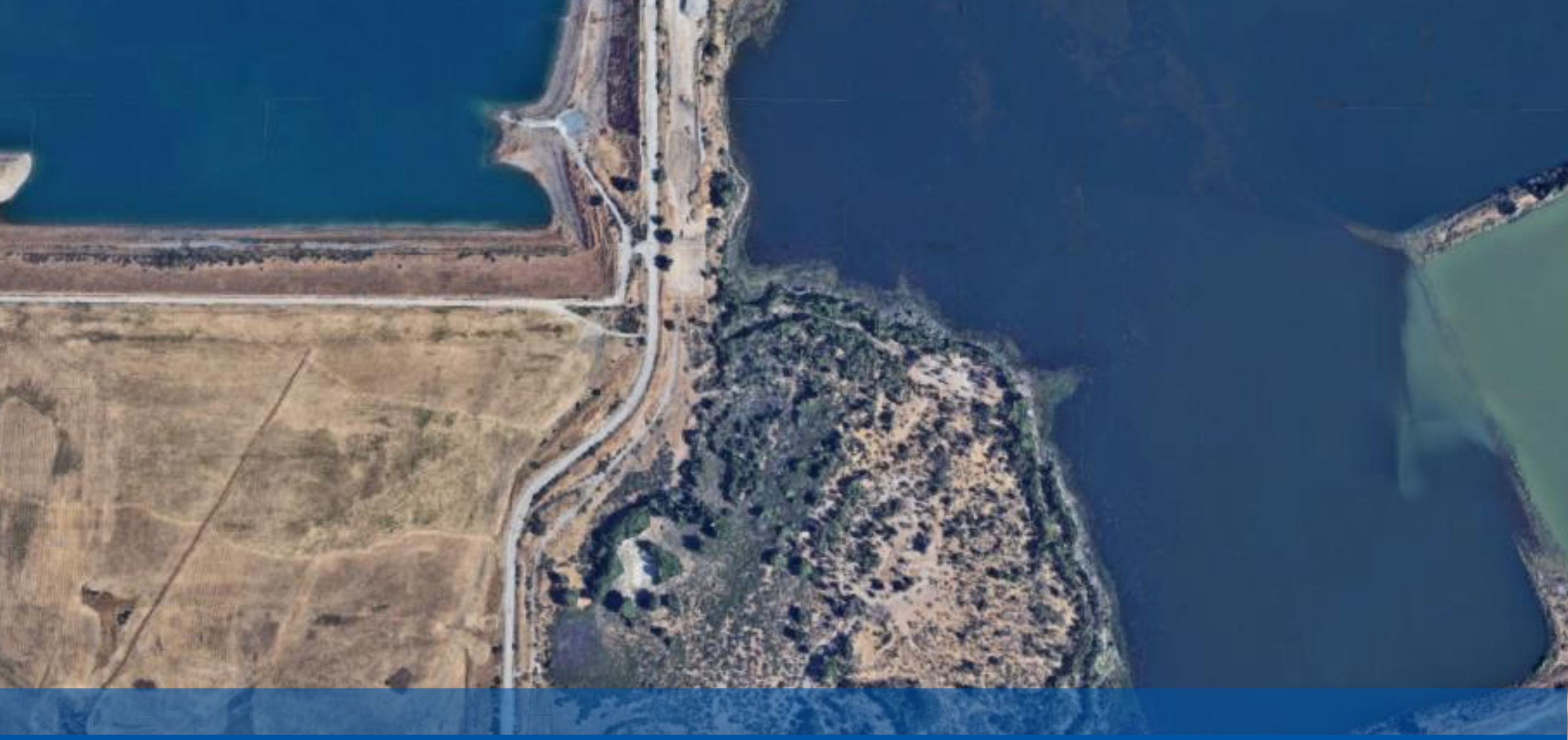
ARROYO LAGO - INFRASTRUCTURE AREA

PLEASANTON, CALIFORNIA

PROJECT NO. : 9785.004.003
SCALE: AS SHOWN
DRAWN BY: MMH
CHECKED BY: JTR
FIGURE NO. 5

PATH: G:\DRAFTING\PROJECTS\9785\9785004003\GEOTECH\GEX\ARROYO LAGO INFRASTRUCTURE.APRX
LAYOUT: 04. SEISMIC HAZARDS ZONE MAP 8.5 X 11 PORTRAIT USER: MHAWKINS

ORIGINAL FIGURE PRINTED IN COLOR



# APPENDIX A

## PREVIOUS AND NEARBY EXPLORATION DATA

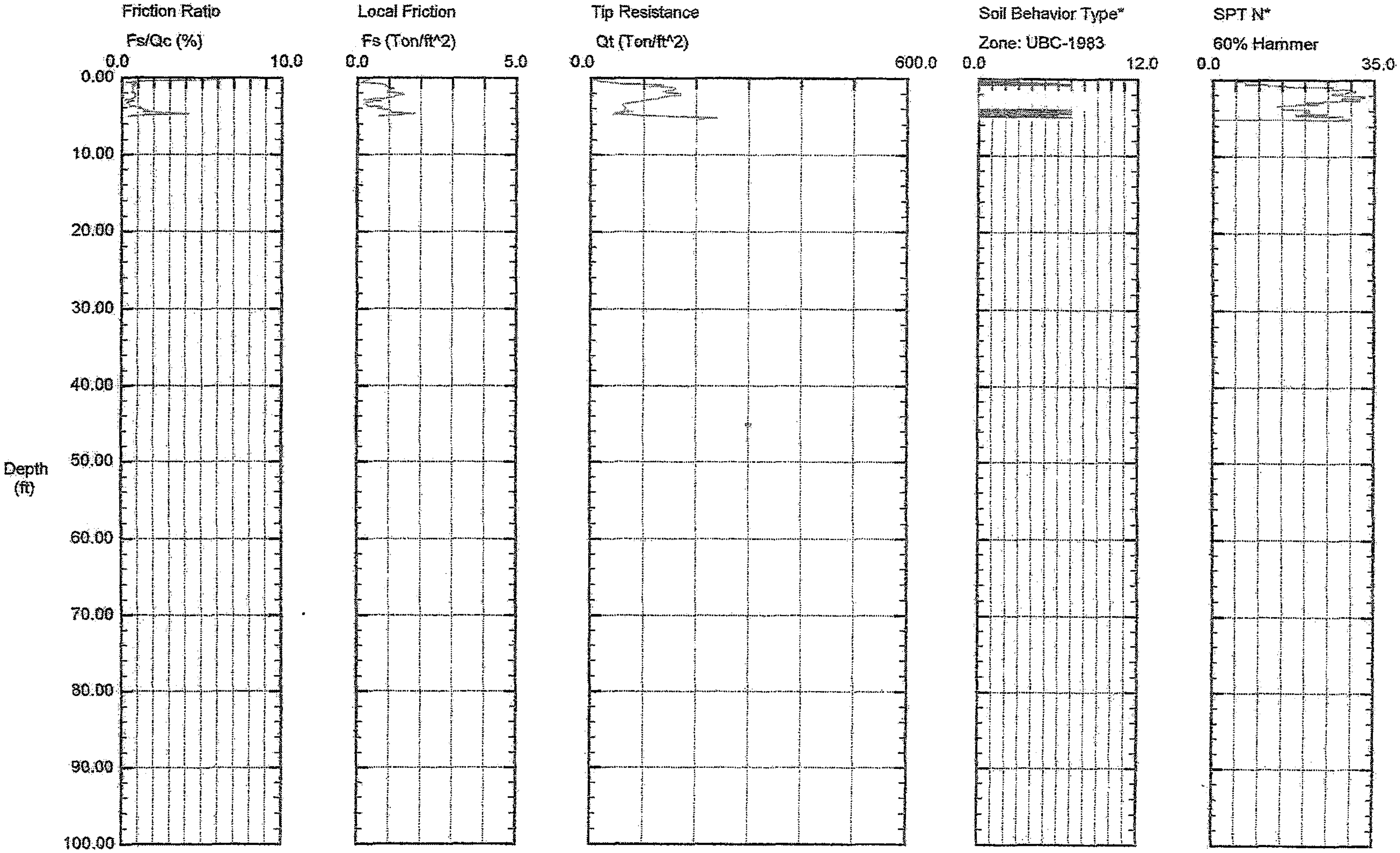
*Soil behavior type and SPT based on data from UBC-1983

# VBI In-Situ Testing

**BGC-CPT-3**

Operator: TIM d'ARCY
Sounding: 01W221
Cone Used: HO738TC U2

CPT Date/Time: 07-19-01 13:09
Location: CPT3
Job Number: 1666.006



Maximum Depth = 5.41 feet

Depth Increment = 0.16 feet

░ 1 sensitive fine grained
▨ 2 organic material
▨ 3 clay
▨ 4 silty clay to clay
▨ 5 clayey silt to silty clay
▨ 6 sandy silt to clayey silt
▨ 7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
░ 11 very stiff fine grained (*)
▨ 12 sand to clayey sand (*)

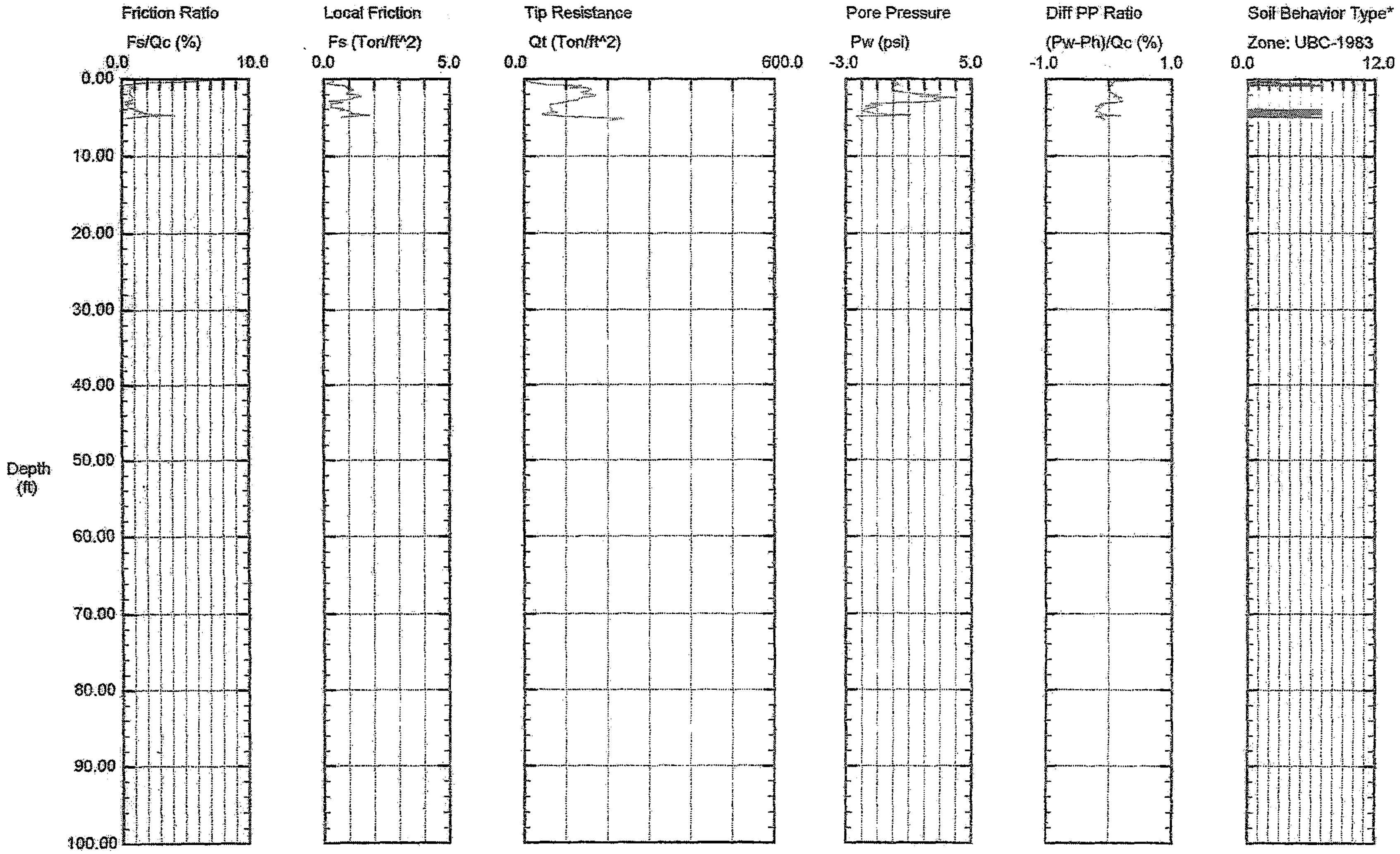
*Soil behavior type and SPT based on data from UBC-1983

# VBI In-Situ Testing

## BGC-CPT-3

Operator: TIM d'ARCY
Sounding: 01W221
Cone Used: HO738TC U2

CPT Date/Time: 07-19-01 13:09
Location: CPT3
Job Number: 1666.006



Maximum Depth = 5.41 feet

Depth Increment = 0.16 feet

▨ 1 sensitive fine grained
▨ 2 organic material
▨ 3 clay
▨ 4 silty clay to clay
▨ 5 clayey silt to silty clay
▨ 6 sandy silt to clayey silt
▨ 7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
▨ 11 very stiff fine grained (*)
▨ 12 sand to clayey sand (*)

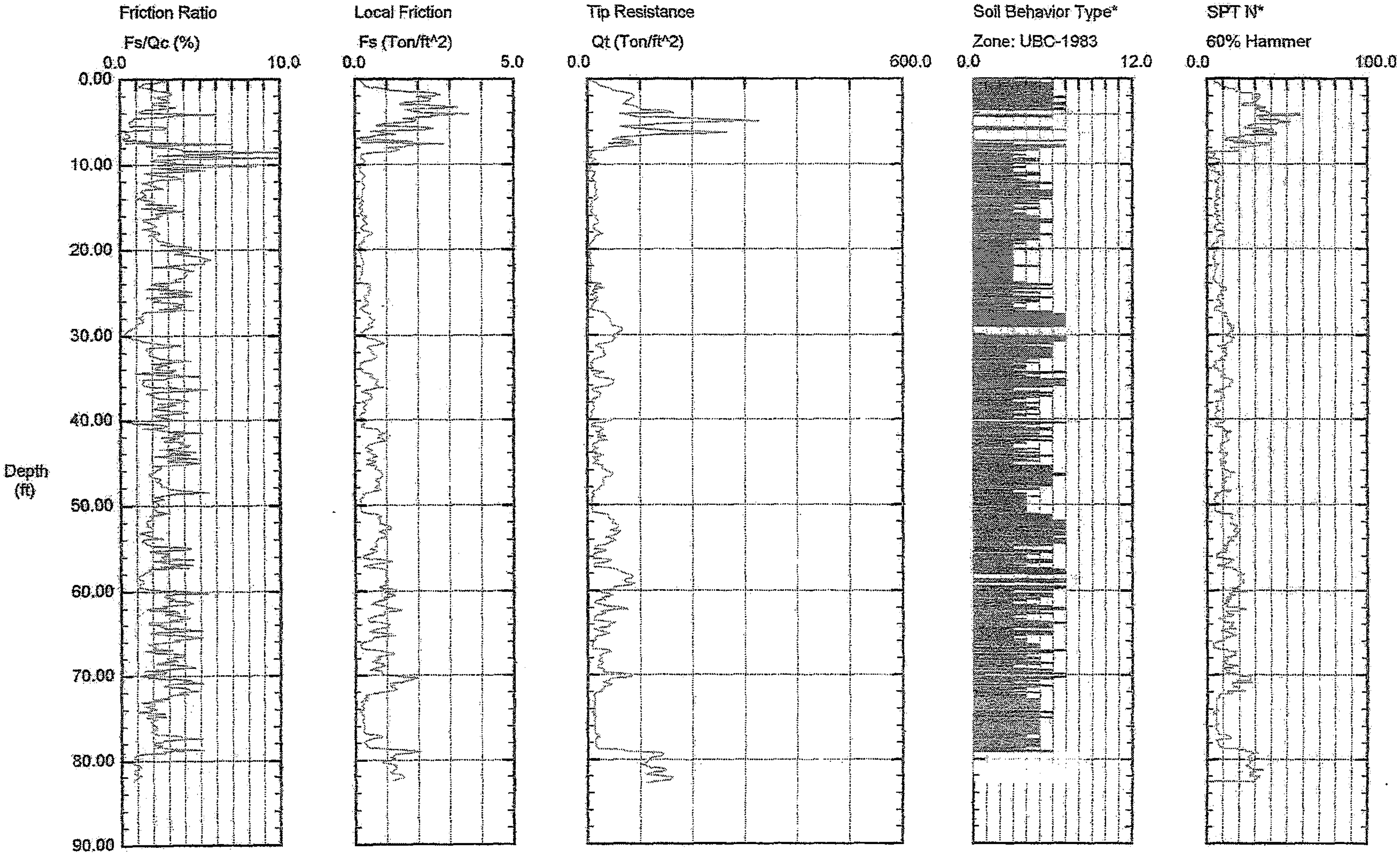
[illegible] avior [illegible] d SP [illegible] d on d [illegible] UBC [illegible]

# VBI In-Situ Testing

Operator: TIM d'ARCY
Sounding: 01W222
Cone Used: HO738TC U2

CPT Date/Time: 07-19-01 13:38
Location: CPT-4
Job Number: 1666.006

**BGC-CPT-4**



Maximum Depth = 82.84 feet

Depth Increment = 0.16 feet

▨ 1 sensitive fine grained
▨ 2 organic material
▨ 3 clay
▨ 4 silty clay to clay
▨ 5 clayey silt to silty clay
▨ 6 sandy silt to clayey silt
▨ 7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
▨ 11 very stiff fine grained (*)
▨ 12 sand to clayey sand (*)

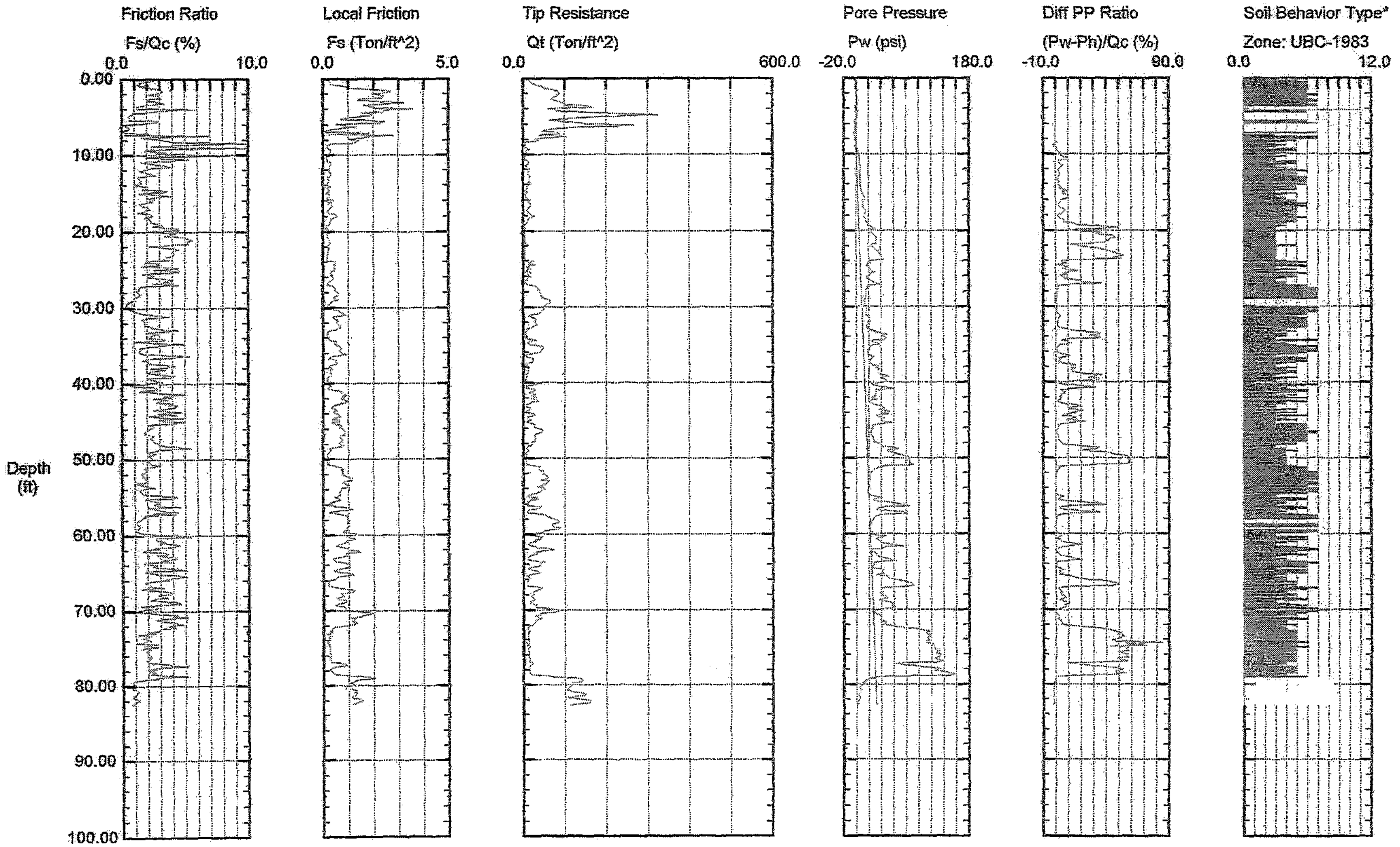
havior d SP d on c n UBC

# VBI In-Situ Testing

Operator: TIM d'ARCY
Sounding: 01W222
Cone Used: HO738TC U2

CPT Date/Time: 07-19-01 13:38
Location: CPT-4
Job Number: 1666.006

**BGC-CPT-4**



Maximum Depth = 82.84 feet

Depth Increment = 0.16 feet

▨ 1 sensitive fine grained
▨ 2 organic material
▨ 3 clay
▨ 4 silty clay to clay
▨ 5 clayey silt to silty clay
▨ 6 sandy silt to clayey silt
▨ 7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
▨ 11 very stiff fine grained (*)
▨ 12 sand to clayey sand (*)

# BORING LOG B-2 BGC-B-2

**JOB NUMBER:** 1666.006 **DATE DRILLED:** 7-23-01

**JOB NAME:** Radum Facility Property **SURFACE ELEVATION:** N/A

**DRILL RIG:** Rotary Wash **DATUM:** Mean Sea Level

| SAMPLER TYPE: | DRIVE WEIGHT - LB | HEIGHT OF FALL - IN |
|---|---|---|
| ■ 2.5 inch I.D. Split Barrel | 140 | 30 |
| ⧄ Standard Penetration Test | 140 | 30 |
| ▩ 2.8 inch I.D. Shelby Tube | - | - |

| BLOWS PER FT. | MOISTURE CONTENT % | DRY UNIT WEIGHT p.c.f. | DEPTH IN FEET | USCS CLASSI-FICATION | DESCRIPTION |
|---|---|---|---|---|---|
| 37 | 13.3 | 96 | | M L | CLAYEY SILT, tan to light gray, dry, very stiff, trace fine-grained sand and gravel (fill) |
| 70 | 14.9 | 92 | | M L/ C L | CLAYEY SILT/SILTY CLAY, mottled tan and dark brown, dry to moist, hard, some fine-grained sand and gravel (fill) |
| | | | 5 | G P | GRAVEL/CONCRETE/ASPHALT RUBBLE, gray to dark gray (fill) |
| | | | | G C | CLAYEY GRAVEL, gray-brown and light brown, medium dense (fill) |
| 27 | - | - | | | |
| 23 | - | - | 10 | C L | SILTY CLAY, light brown, stiff, some gravel (fill) |
| | - | - | | S M | SILTY SAND, brown to gray-brown, saturated, loose, fine-grained sand (fill) |
| 5 | - | - | 15 | | |
| | | | | C L | SILTY CLAY, light brown, saturated, loose, fine-grained sand (fill) |
| | | | | G P | GRAVEL, gray-brown, wet to saturated,very dense, fine to coarse gravel, some clay (fill) |
| 84 | 7.3 | - | 20 | | |

# BORING LOG B-2 **BGC-B-2**

**JOB NUMBER:** 1666.006 **SHEET:** 2 **OF:** 6

**JOB NAME:** Radum Facility Property **DEPTH:** 20 feet **TO** 40 feet

**NOTES:**

| BLOWS PER FT. | MOISTURE CONTENT % | DRY UNIT WEIGHT p.c.f. | DEPTH IN FEET | USCS CLASSI-FICATION | **DESCRIPTION** |
|---|---|---|---|---|---|
| 84 | 7 3 | - | | G P | GRAVEL, gray-brown, wet to saturated,very dense, fine to coarse, some clay (fill) |
| | | | | G C | CLAYEY GRAVEL, gray-brown, wet to saturated, very dense, fine-grained gravel (fill) |
| | | | | | from 24-1/2 to 25 feet, silty clay lense |
| | - | - | 25 | G C | CLAYEY GRAVEL, gray-brown, saturated, medium dense (fill) |
| | | | | G P | GRAVEL, gray-brown, saturated, dense, fine to coarse gravel (fill) |
| 39 | 9.9 | 98 | 30 | | |
| | | | | S P | SAND, gray-brown, saturated, medium dense, fine to coarse-grained sand (fill) |
| 18 | - | - | | G P | GRAVEL, gray-brown, saturated, medium dense, fine to coarse gravel (fill) |
| 21 | 26.6 | 96 | 35 | | |
| | | | | S M/ M L | SILTY SAND/SANDY SILT, brown, saturated, medium dense, fine-grained sand (fill) |
| 17 | - | - | | | |
| 20 | - | - | | | at 38 feet, becomes light brown |
| | | | | | at 39-1/2 feet, some clay |
| | | | 40 | | |

# BORING LOG B-2 **BGC-B-2**

**JOB NUMBER:** 1666.006 **SHEET:** 3 **OF:** 6

**JOB NAME:** Radum Facility Property **DEPTH:** 40 feet **TO** 60 feet

**NOTES:**

| BLOWS PER FT. | MOISTURE CONTENT % | DRY UNIT WEIGHT p.c.f. | DEPTH IN FEET | USCS CLASSI-FICATION | DESCRIPTION |
|---|---|---|---|---|---|
| | | | | S M/ M L | SILTY SAND/SANDY SILT, light brown, saturated, medium dense, fine-grained sand (fill) |
| | | | | C L | SILTY CLAY, light brown to orange-brown, stiff, trace coarse gravel (fill) |
| 22 | - | - | | | |
| | | | 45 | | |
| | - | - | | | |
| | | | | S M | SILTY SAND, gray, wet to saturated, medium dense, fine-grained sand (fill) |
| 21 | 26.5 | 97 | | | |
| 7 | - | - | | | |
| | | | | C L | SILTY CLAY, light brown to orange-brown, saturated, soft to medium stiff (fill) |
| | | | | M L | CLAYEY SILT, olive to gray, saturated, medium stiff (fill) |
| | | | 50 | | |
| 26 | 29.0 | 90 | | S M | SILTY SAND, gray, saturated, medium dense, fine-grained sand (fill) |
| 24 | - | - | | | |
| | | | 55 | | |
| | | | | M L | SANDY SILT, gray to gray-brown, saturated, dense, fine-grained sand, trace clay (fill) |
| 50 | 31.8 | 89 | | | |
| | | | | S M | SILTY SAND, gray-brown, saturated, dense, fine-grained sand (fill) |
| | | | | S W | SAND, gray, saturated, medium dense, fine to medium-grained sand, trace silt (fill) at 59-1/2 feet, becomes brown |
| 26 | - | - | 60 | | |

# BORING LOG B-2 **BGC-B-2**

**JOB NUMBER:** 1666.006 **SHEET:** 4 **OF:** 6

**JOB NAME:** Radum Facility Property **DEPTH:** 60 feet **TO** 80 feet

**NOTES:**

| BLOWS PER FT. | MOISTURE CONTENT % | DRY UNIT WEIGHT p.c.f. | DEPTH IN FEET | USCS CLASSI-FICATION | **DESCRIPTION** |
|---|---|---|---|---|---|
| 26 | - | - | | S W | SAND, brown, saturated, medium dense, fine to medium-grained sand, trace silt (fill) |
| 25 | - | - | | | |
| | - | - | 65 | | |
| 65 | 32.8 | 84 | | C L | SILTY CLAY, light brown to orange-brown, saturated, hard (fill) |
| | | | | S M | SILTY SAND, brown, saturated, very dense, fine-grained sand (fill) |
| | | | 70 | | |
| | | | | C L | SILTY CLAY, light brown to orange-brown, saturated, stiff (fill) |
| 30 | - | - | | S M | SILTY SAND, brown, saturated, dense, fine-grained (fill) |
| | | | 75 | | |
| 75 | 36.6 | 84 | | | |
| | | | 80 | | |

# BORING LOG B-2 **BGC-B-2**

**JOB NUMBER:** 1666.006 . **SHEET:** 5 **OF:** 6

**JOB NAME:** Radum Facility Property **DEPTH:** 80 feet **TO** 100 feet

**NOTES:**

| BLOWS PER FT. | MOISTURE CONTENT % | DRY UNIT WEIGHT p.c.f. | DEPTH IN FEET | USCS CLASSI-FICATION | **DESCRIPTION** |
|---|---|---|---|---|---|
| | | | | S M | SILTY SAND, brown, saturated, dense, fine-grained (fill) |
| 50/6" | 14.1 | 128 | | S W | SAND, gray-brown, saturated, very dense (fill) |
| | | | | G P | GRAVEL, gray (fill) |
| | | | 85 | | |
| 53 | - | - | | S M | SILTY SAND, brown, saturated, very dense, fine-grained sand (fill) |
| | | | 90 | | |
| | | | | G P | GRAVEL, gray (fill) |
| 66 | 22.5 | 102 | | S W | SAND, brown, saturated, dense, fine-grained sand (fill) |
| | | | | S M | SILTY SAND, brown to gray-brown, saturated, medium dense to dense, fine-grained sand (fill) |
| | | | 95 | | |
| 16 | - | - | | | |
| | | | 100 | | |

BERLOGAR GEOTECHNICAL CONSULTANTS

PLATE 13

# BORING LOG B-2 BGC-B-2

**JOB NUMBER:** 1666.006 **SHEET:** 6 **OF:** 6

**JOB NAME:** Radum Facility Property **DEPTH:** 100 feet **TO** 119-1/2 feet

**NOTES:**

| BLOWS PER FT. | MOISTURE CONTENT % | DRY UNIT WEIGHT p.c.f. | DEPTH IN FEET | USCS CLASSI-FICATION | DESCRIPTION |
|---|---|---|---|---|---|
| | | | | S M | SILTY SAND, brown to gray-brown, saturated, dense, fine-grained sand (fill) |
| 48 | - | - | | | |
| 41 | - | - | | | |
| | | | 105 | | |
| 19 | - | - | | C L | SILTY CLAY, light brown to orange-brown, saturated, very stiff, some fine-grained sand (fill) |
| | | | 110 | | |
| | | | | M L | CLAYEY SILT, brown, wet, hard, some fine-grained sand and gravel |
| 46 | 13.3 | 123 | | | |
| | | | 115 | | |
| 32 | 21.1 | 105 | | C L | SANDY/GRAVELLY CLAY, brown to gray-brown, wet to saturated, very stiff |
| | | | 120 | | Boring terminated at 119-1/2 feet.<br>Ground water elevation obscured by Rotary Wash Drilling Method. |

PROJECT: **HANSON RADUM SITE**
Pleasanton, California

# Log of Boring TR-6

PAGE 1 OF 4

Boring location: See Site Plan, Figure 2
Date started: 10/10/06 Date finished: 10/10/06
Drilling method: Hollow Stem
Hammer weight/drop: Hammer type: Downhole
Sampler: Sprague & Henwood (S&H)
Logged by: A. Scavullo

| DEPTH (feet) | SAMPLES Sampler Type | SAMPLES Sample | SAMPLES SPT N-Value | LITHOLOGY | MATERIAL DESCRIPTION — Ground Surface Elevation: 349.5 feet[1] | | LABORATORY TEST DATA Type of Strength Test | Confining Pressure Lbs/Sq Ft | Shear Strength Lbs/Sq Ft | Fines % | Natural Moisture Content, % | Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | SANDY SILTY CLAY with GRAVEL (CL-ML)<br>olive-brown, hard, dry, coarse angular gravel | FILL | | | | | | |
| 2 | S&H | ■ | 30/ 5" | CL-ML | LL = 24, PI = 7, see Figure C-1 | | | | | | 5.9 | 127 |
| 4 | | | | | SANDY CLAY (CL)<br>olive-brown, stiff, moist | | | | | | | |
| 6 | S&H | ■ | 10 | | | | | | | 56.5 | 9.7 | 107 |
| 8 | | | | CL | | | | | | | | |
| 9 | S&H | ■ | 12 | | trace fine angular gravel | | | | | | | |
| 12 | | | | | SAND with GRAVEL (SP)<br>olive-brown, dense, moist, fine rounded gravel, trace fines | | | | | | | |
| 14 | S&H | ■ | 34 | SP | Sieve Analysis, see Figure C-5 | | | | | 4.7 | 2.7 | |
| 17 | | | | | CLAY with SAND (CL)<br>olive-brown, stiff, moist | | | | | | | |
| 19 | S&H | ■ | 12 | CL | | | PP | | 1,500 | | | |
| 22 | | | | | GRAVELLY CLAY (CL)<br>olive-brown, stiff, moist, fine gravel | | | | | | | |
| 24 | S&H | ■ | 10 | CL | | | PP | | 1,750 | | | |
| 25 | | | | | grades gravelly | | | | | | | |
| 26 | | | | | GRAVEL with CLAY and SAND (GP-SC)<br>olive-brown with yellow-brown and gray mottling, very dense, moist | | | | | | | |
| 28 | S&H | □ | 30/ 4" | GP-SC | | | | | | | | |
| 30 | | | | | | | | | | | | |

**Treadwell&Rollo**

Project No.: 4490.01
Figure: A-6a

TEST GEOTECH LOG 449001.GPJ TR.GDT 5/25/07

PROJECT: **HANSON RADUM SITE**
Pleasanton, California

# Log of Boring TR-6

PAGE 2 OF 4

| DEPTH (feet) | SAMPLES: Sampler Type | SAMPLES: Sample | SAMPLES: SPT N-Value | LITHOLOGY | MATERIAL DESCRIPTION | LABORATORY TEST DATA: Type of Strength Test | LABORATORY TEST DATA: Confining Pressure Lbs/Sq Ft | LABORATORY TEST DATA: Shear Strength Lbs/Sq Ft | LABORATORY TEST DATA: Fines % | LABORATORY TEST DATA: Natural Moisture Content, % | LABORATORY TEST DATA: Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GRAVEL with CLAY and SAND (GP-SC) (continued) | | | | | | |
| 31 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 33 | | | | | | | | | | | |
| 34 | | | | | | | | | | | |
| 35 | | | | | | | | | | | |
| 36 | | | | | | | | | | | |
| 37 | | | | | | | | | | | |
| 38 | | | | | | | | | | | |
| 39 | S&H | ■ | 27 | | medium dense<br>(sand catcher used to obtain sample)<br>Sieve Analysis, see Figure C-6 | | | | 8.4 | 7.8 | 135 |
| 40 | | | | | | | | | | | |
| 41 | | | | | | | | | | | |
| 42 | | | | | | | | | | | |
| 43 | | | | | | | | | | | |
| 44 | | | | | | | | | | | |
| 45 | | | | GP-SC | | | | | | | |
| 46 | | | | | | | | | | | |
| 47 | | | | | | | | | | | |
| 48 | | | | | | | | | | | |
| 49 | S&H | ■ | 29 | | | | | | | | |
| 50 | | | | | | | | | | | |
| 51 | | | | | | | | | | | |
| 52 | | | | | | | | | | | |
| 53 | | | | | | | | | | | |
| 54 | | | | | | | | | | | |
| 55 | | | | | | | | | | | |
| 56 | | | | | ∇ | | | | | | |
| 57 | | | | | | | | | | | |
| 58 | | | | | (sand catcher used to obtain sample)<br>wet<br>Sieve Analysis, see Figure C-6 | | | | | | |
| 59 | S&H | ■ | 21 | | | | | | 8.0 | 8.8 | 132 |
| 60 | | | | | | | | | | | |

**PROJECT:** **HANSON RADUM SITE**
Pleasanton, California

# Log of Boring TR-6

| | SAMPLES | | | | | LABORATORY TEST DATA | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DEPTH (feet) | Sampler Type | Sample | SPT N-Value | LITHOLOGY | MATERIAL DESCRIPTION | Type of Strength Test | Confining Pressure Lbs/Sq Ft | Shear Strength Lbs/Sq Ft | Fines % | Natural Moisture Content, % | Dry Density Lbs/Cu Ft |
| | | | | | GRAVEL with CLAY and SAND (GP-SC) (continued) | | | | | | |
| 61 | | | | | | | | | | | |
| 62 | | | | | | | | | | | |
| 63 | | | | | | | | | | | |
| 64 | | | | | | | | | | | |
| 65 | | | | | | | | | | | |
| 66 | | | | | | | | | | | |
| 67 | | | | | | | | | | | |
| 68 | | | | | | | | | | | |
| 69 | S&H | ■ | 47 | | dense, increase fine gravel<br>(sand catcher used to obtain sample) | | | | | | |
| 70 | | | | | | | | | | | |
| 71 | | | | | | | | | | | |
| 72 | | | | | | | | | | | |
| 73 | | | | GP-SC | | | | | | | |
| 74 | | | | | | | | | | | |
| 75 | | | | | | | | | | | |
| 76 | | | | | | | | | | | |
| 77 | | | | | | | | | | | |
| 78 | | | | | very dense<br>(hammer submerged during driving) | | | | | | |
| 79 | S&H | ■ | 24/ 6" | | | | | | | | |
| 80 | | | | | | | | | | | |
| 81 | | | | | | | | | | | |
| 82 | | | | | | | | | | | |
| 83 | | | | | | | | | | | |
| 84 | | | | | | | | | | | |
| 85 | | | | | | | | | | | |
| 86 | | | | | | | | | | | |
| 87 | | | | | SAND with CLAY and GRAVEL (SP-SC)<br>gray-brown, very dense, wet | | | | | | |
| 88 | | | | SP-SC | | | | | | | |
| 89 | S&H | ■ | 30/ 6" | | Sieve Analysis, see Figure C-6 | | | | 11.4 | 11.3 | 128 |
| 90 | | | | | | | | | | | |

PROJECT: **HANSON RADUM SITE**
Pleasanton, California

# Log of Boring TR-6

PAGE 4 OF 4

| DEPTH (feet) | SAMPLES: Sampler Type | SAMPLES: Sample | SAMPLES: SPT N-Value | LITHOLOGY | MATERIAL DESCRIPTION | LABORATORY TEST DATA: Type of Strength Test | LABORATORY TEST DATA: Confining Pressure Lbs/Sq Ft | LABORATORY TEST DATA: Shear Strength Lbs/Sq Ft | LABORATORY TEST DATA: Fines % | LABORATORY TEST DATA: Natural Moisture Content, % | LABORATORY TEST DATA: Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SAND with CLAY and GRAVEL (SP-SC) | | | | | | |
| 91 | | | | | | | | | | | |
| 92 | | | | | | | | | | | |
| 93 | | | | | | | | | | | |
| 94 | | | | SP-SC | | | | | | | |
| 95 | | | | | | | | | | | |
| 96 | | | | | | | | | | | |
| 97 | | | | | | | | | | | |
| 98 | | | | | | | | | | | |
| | S&H | ■ | 30/6" | | rounded gravel present | | | | | | |
| 99 | | | | | | | | | | | |
| 100 | | | | | | | | | | | |
| 101 | | | | | | | | | | | |
| 102 | | | | | | | | | | | |
| 103 | | | | | | | | | | | |
| 104 | | | | | | | | | | | |
| 105 | | | | | | | | | | | |
| 106 | | | | | | | | | | | |
| 107 | | | | | | | | | | | |
| 108 | | | | | | | | | | | |
| 109 | | | | | | | | | | | |
| 110 | | | | | | | | | | | |
| 111 | | | | | | | | | | | |
| 112 | | | | | | | | | | | |
| 113 | | | | | | | | | | | |
| 114 | | | | | | | | | | | |
| 115 | | | | | | | | | | | |
| 116 | | | | | | | | | | | |
| 117 | | | | | | | | | | | |
| 118 | | | | | | | | | | | |
| 119 | | | | | | | | | | | |
| 120 | | | | | | | | | | | |

Boring terminated at a depth of 99 feet bgs.
Boring backfilled with cement grout.
Groundwater was encountered at 56 feet bgs.
PP = Pocket Penetrometer.

[1] Elevation based on City of Livermore datum.

**Treadwell&Rollo**

Project No.: 4490.01

Figure: A-6d

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-7

PAGE 1 OF 4

Boring location: See Site Plan, Figure 2
Date started: 10/3/06
Date finished: 10/3/06
Drilling method: Hollow Stem
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Downhole
Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT)
Logged by: A. Scavullo

Ground Surface Elevation: 365.4 feet[1]

| DEPTH (feet) | SAMPLES Sampler Type | SAMPLES Sample | SAMPLES Blows/ 6" | SAMPLES SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA Type of Strength Test | TEST DATA Confining Pressure Lbs/Sq Ft | TEST DATA Shear Strength Lbs/Sq Ft | TEST DATA Fines % | TEST DATA Natural Moisture Content, % | TEST DATA Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  | CL | GRAVELLY CLAY (CL)<br>brown, very stiff, moist |  |  |  |  |  |  |
| 1 |  |  |  |  |  | CLAYEY SAND with GRAVEL (SC) |  |  |  |  |  |  |
| 2 | S&H | ▨ |  | 20 |  | yellow-brown, medium dense, moist, trace gravel |  |  |  | 35.5 | 6.0 |  |
| 3 |  |  |  |  |  | LL = 47, PI = 28, see Figure C-2 |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |  |  |  |  |  |  |
| 6 | S&H | ▨ |  | 26 | SC | brown |  |  |  |  |  |  |
| 7 |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 |  |  |  |  |  |  | PP |  | 3,000 |  |  |  |
| 9 | S&H | ▨ |  | 11 |  | very stiff | TxUU | 1,000 | 2,800 |  | 18.6 | 109 |
| 10 |  |  |  |  |  |  |  |  |  |  |  |  |
| 11 |  |  |  |  |  | SANDY CLAY with GRAVEL (CL)<br>brown with gray mottling, stiff, moist |  |  |  |  |  |  |
| 12 |  |  |  |  |  |  |  |  |  |  |  |  |
| 13 |  |  |  |  | CL |  |  |  |  |  |  |  |
| 14 | S&H | ▨ |  | 9 |  |  |  |  |  |  |  |  |
| 15 |  |  |  |  |  | FILL |  |  |  |  |  |  |
| 16 |  |  |  |  |  | SANDY CLAY (CL)<br>brown and yellow-brown, stiff, moist |  |  |  |  |  |  |
| 17 |  |  |  |  |  |  |  |  |  |  |  |  |
| 18 |  |  |  |  |  |  |  |  |  |  |  |  |
| 19 | S&H | ▨ |  | 10 |  |  |  |  |  |  |  |  |
| 20 |  |  |  |  |  |  |  |  |  |  |  |  |
| 21 |  |  |  |  |  |  |  |  |  |  |  |  |
| 22 |  |  |  |  |  |  |  |  |  |  |  |  |
| 23 |  |  |  |  | CL |  |  |  |  |  |  |  |
| 24 | S&H | ▨ |  | 32 |  | olive-brown with dark brown mottling, hard |  |  |  |  |  |  |
| 25 |  |  |  |  |  |  |  |  |  |  |  |  |
| 26 |  |  |  |  |  |  |  |  |  |  |  |  |
| 27 |  |  |  |  |  |  |  |  |  |  |  |  |
| 28 |  |  |  |  |  |  |  |  |  |  |  |  |
| 29 | S&H | ▨ |  | 19 |  | very stiff, trace gravel |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  |  |  |  |  |  |  |

**Treadwell&Rollo**

Project No.: 4490.02
Figure: A-7a

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-7

| | SAMPLES | | | | | | | TEST DATA | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEPTH (feet) | Sampler Type | Sample | Blows/ 6" | SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION | | Type of Strength Test | Confining Pressure Lbs/Sq Ft | Shear Strength Lbs/Sq Ft | Fines % | Natural Moisture Content, % | Dry Density Lbs/Cu Ft |
| | | | | | | SANDY CLAY (CL) (continued) | | | | | | | |
| 31 | | | | | | | | | | | | | |
| 32 | | | | | | | | | | | | | |
| 33 | | | | | | | | | | | | | |
| 34 | | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | | |
| 36 | | | | | | | | | | | | | |
| 37 | | | | | | | | | | | | | |
| 38 | | | | | CL | hard, increased gravel content | | | | | | | |
| 39 | S&H | ■ | | 30/<br>5" | | | | | | | | | |
| 40 | | | | | | | | | | | | | |
| 41 | | | | | | | | | | | | | |
| 42 | | | | | | | | | | | | | |
| 43 | | | | | | | | | | | | | |
| 44 | | | | | | | | | | | | | |
| 45 | | | | | | | **FILL** | | | | | | |
| 46 | | | | | | | | | | | | | |
| 47 | | | | | | SANDY CLAY with GRAVEL (CL)<br>olive-brown, hard, moist | | | | | | | |
| 48 | | | | | | | | | | | | | |
| 49 | S&H | ■ | | 33 | | | | | | | | | |
| 50 | | | | | | | | | | | | | |
| 51 | | | | | CL | | | | | | | | |
| 52 | | | | | | | | | | | | | |
| 53 | | | | | | | | | | | | | |
| 54 | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | |
| 56 | | | | | | SANDY CLAY (CL)<br>brown, very stiff, moist, silt present | | | | | | | |
| 57 | | | | | | | | | | | | | |
| 58 | | | | | CL | | | | | | | | |
| 59 | S&H | ■ | | 19 | | | | | | | | | |
| 60 | | | | | | | | | | | | | |

**Treadwell&Rollo**

Project No.: 4490.02

Figure: A-7b

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-7

PAGE 3 OF 4

| DEPTH (feet) | SAMPLES Sampler Type | Sample | Blows/ 6" | SPT N-Value$^1$ | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA Type of Strength Test | Confining Pressure Lbs/Sq Ft | Shear Strength Lbs/Sq Ft | Fines % | Natural Moisture Content, % | Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SANDY CLAY (CL) (continued) | | | | | | |
| 61 | | | | | | | | | | | | |
| 62 | | | | | | | | | | | | |
| 63 | | | | | | | | | | | | |
| 64 | | | | | | | | | | | | |
| 65 | | | | | | | | | | | | |
| 66 | | | | | | | | | | | | |
| 67 | | | | | | | | | | | | |
| 68 | | | | | | | | | | | | |
| 69 | S&H | ▨ | | 13 | | stiff<br>increase in sand | | | | | | |
| 70 | | | | | | | | | | | | |
| 71 | | | | | | | | | | | | |
| 72 | | | | | CL | | | | | | | |
| 73 | | | | | | | | | | | | |
| 74 | | | | | | | | | | | | |
| 75 | | | | | | FILL | | | | | | |
| 76 | | | | | | | | | | | | |
| 77 | | | | | | | | | | | | |
| 78 | | | | | | | | | | | | |
| 79 | S&H | ▨ | | 19 | | very stiff<br>brown with olive-gray mottling, fine gravel present | | | | | | |
| 80 | | | | | | | | | | | | |
| 81 | | | | | | | | | | | | |
| 82 | | | | | | | | | | | | |
| 83 | | | | | | | | | | | | |
| 84 | | | | | | | | | | | | |
| 85 | | | | | | CLAY with SAND and SILT (CL)<br>olive with dark brown and yellow-brown mottling, very stiff, wet | | | | | | |
| 86 | | | | | | | | | | | | |
| 87 | | | | | CL | ∇ | | | | | | |
| 88 | | | | | | | | | | | | |
| 89 | S&H | ▨ | | 17 | | | | | | | | |
| 90 | | | | | | | | | | | | |

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Project No.: 4490.02

Figure: A-7c

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-7

PAGE 4 OF 4

| DEPTH (feet) | SAMPLES: Sampler Type | Sample | Blows/ 6" | SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA: Type of Strength Test | Confining Pressure Lbs/Sq Ft | Shear Strength Lbs/Sq Ft | Fines % | Natural Moisture Content, % | Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | CLAY with SAND and SILT (CL) (continued) | | | | | | |
| 91 | | | | | | | | | | | | |
| 92 | | | | | CL | FILL | | | | | | |
| 93 | | | | | | | | | | | | |
| 94 | | | | | | CLAYEY GRAVEL with SAND (GC)<br>brown, dense, wet | | | | | | |
| 95 | | | | | | | | | | | | |
| 96 | | | | | | | | | | | | |
| 97 | | | | | GC | | | | | | | |
| 98 | | | | | | | | | | | | |
| 99 | SPT | ◩ | | 31 | | | | | | | | |
| 100 | | | | | | | | | | | | |
| 101 | | | | | | | | | | | | |
| 102 | | | | | | | | | | | | |
| 103 | | | | | | | | | | | | |
| 104 | | | | | | | | | | | | |
| 105 | | | | | | | | | | | | |
| 106 | | | | | | | | | | | | |
| 107 | | | | | | | | | | | | |
| 108 | | | | | | | | | | | | |
| 109 | | | | | | | | | | | | |
| 110 | | | | | | | | | | | | |
| 111 | | | | | | | | | | | | |
| 112 | | | | | | | | | | | | |
| 113 | | | | | | | | | | | | |
| 114 | | | | | | | | | | | | |
| 115 | | | | | | | | | | | | |
| 116 | | | | | | | | | | | | |
| 117 | | | | | | | | | | | | |
| 118 | | | | | | | | | | | | |
| 119 | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | |

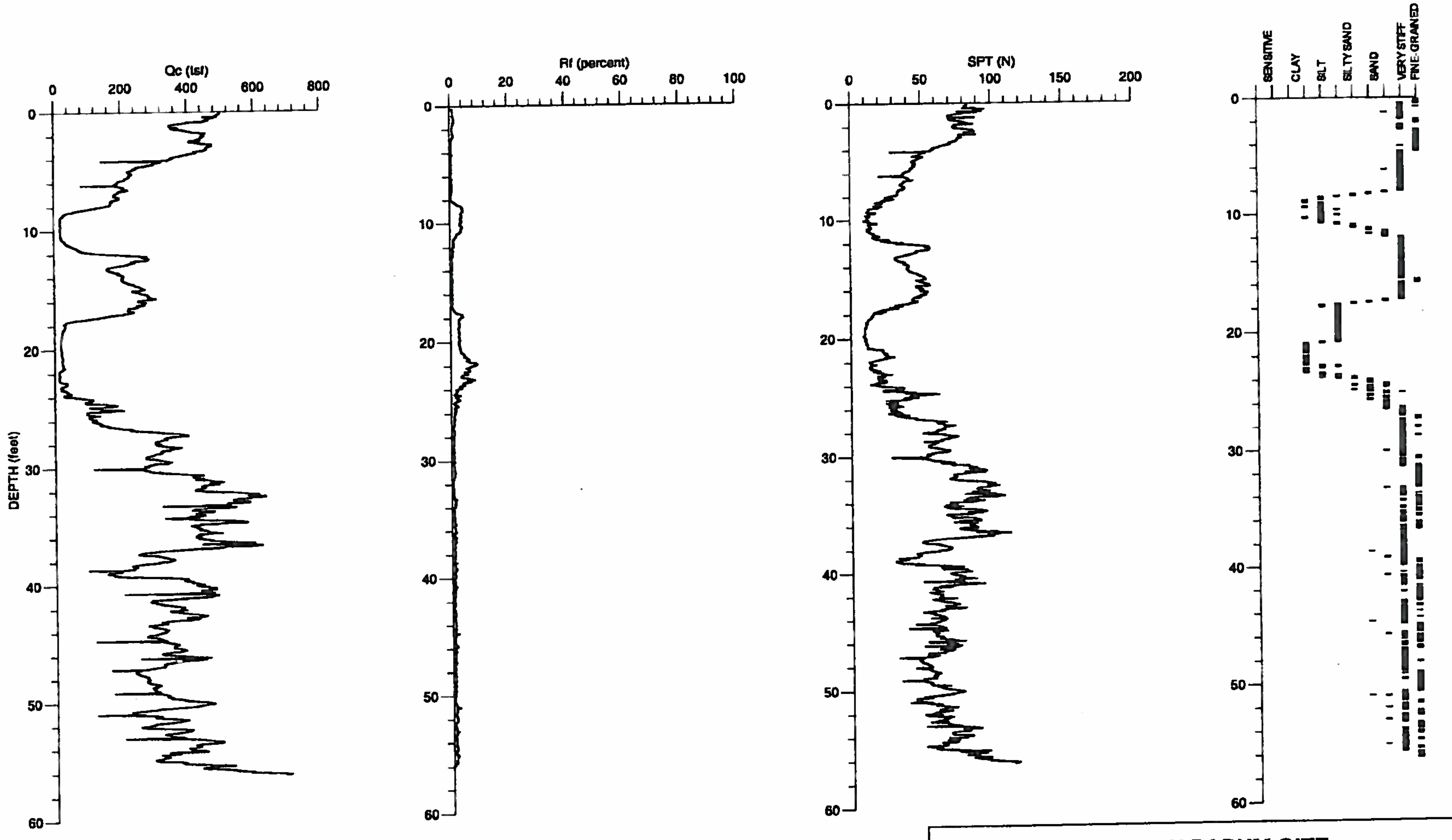
Boring terminated at a depth of 100 feet bgs.
Boring backfilled with cement grout.
Groundwater encountered at 87 feet bgs.
PP = Pocket Penetrometer.
TxUU = Unconsolidated, Undrained Triaxial Test.

[1] Elevation based on City of Livermore datum.

Treadwell&Rollo

Project No.: 4490.02

Figure: A-7d



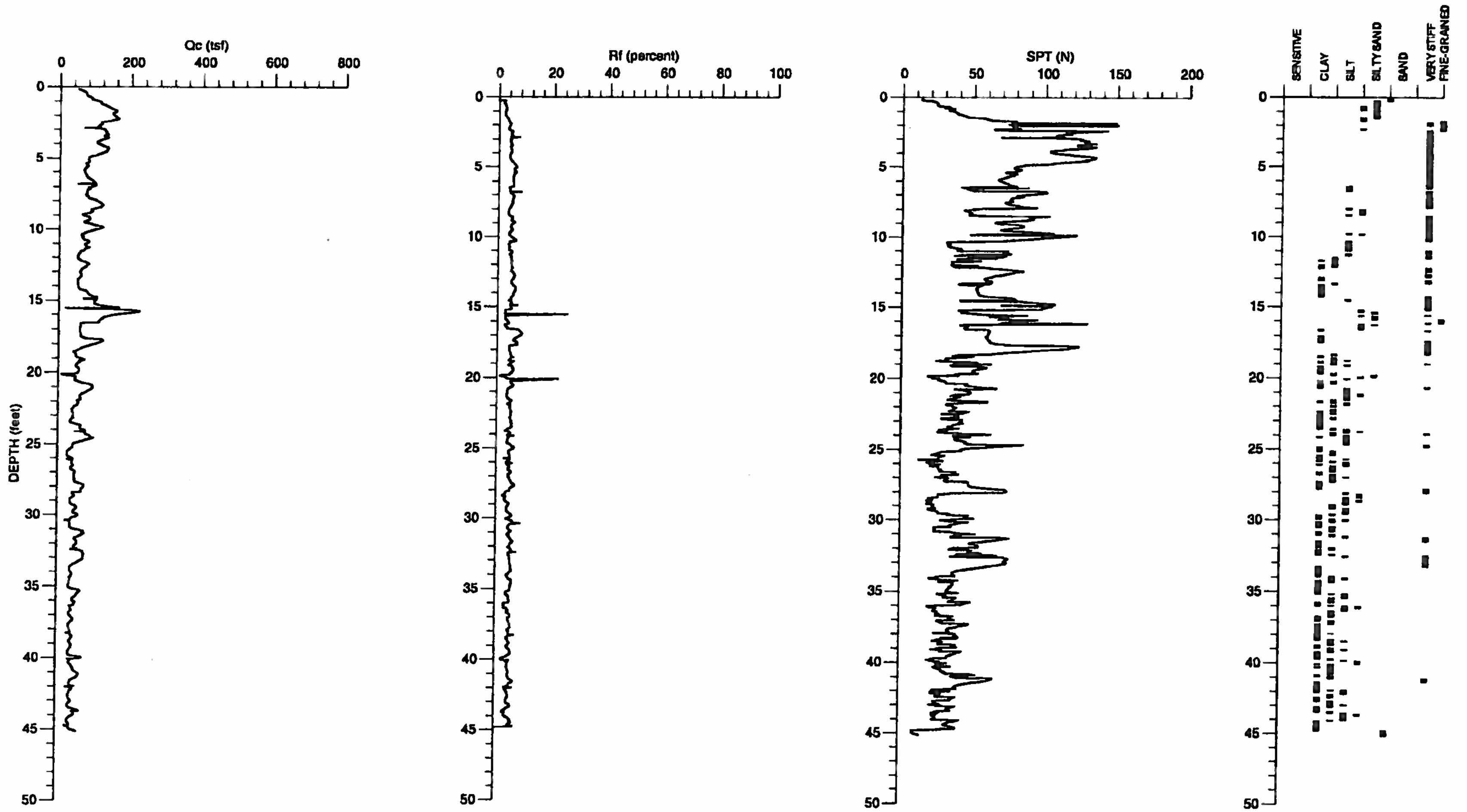
Terminated at 56.2 feet.
Groundwater level not measured.
Date performed: 10/12/06.
Ground surface elevation: 349.0 feet, City of Livermore.

**HANSON RADUM SITE**
Pleasanton, California

## CONE PENETRATION TEST RESULTS
## CPT-6

Date 05/24/07 | Project No. 4490.01 | Figure B-6

**Treadwell&Rollo**



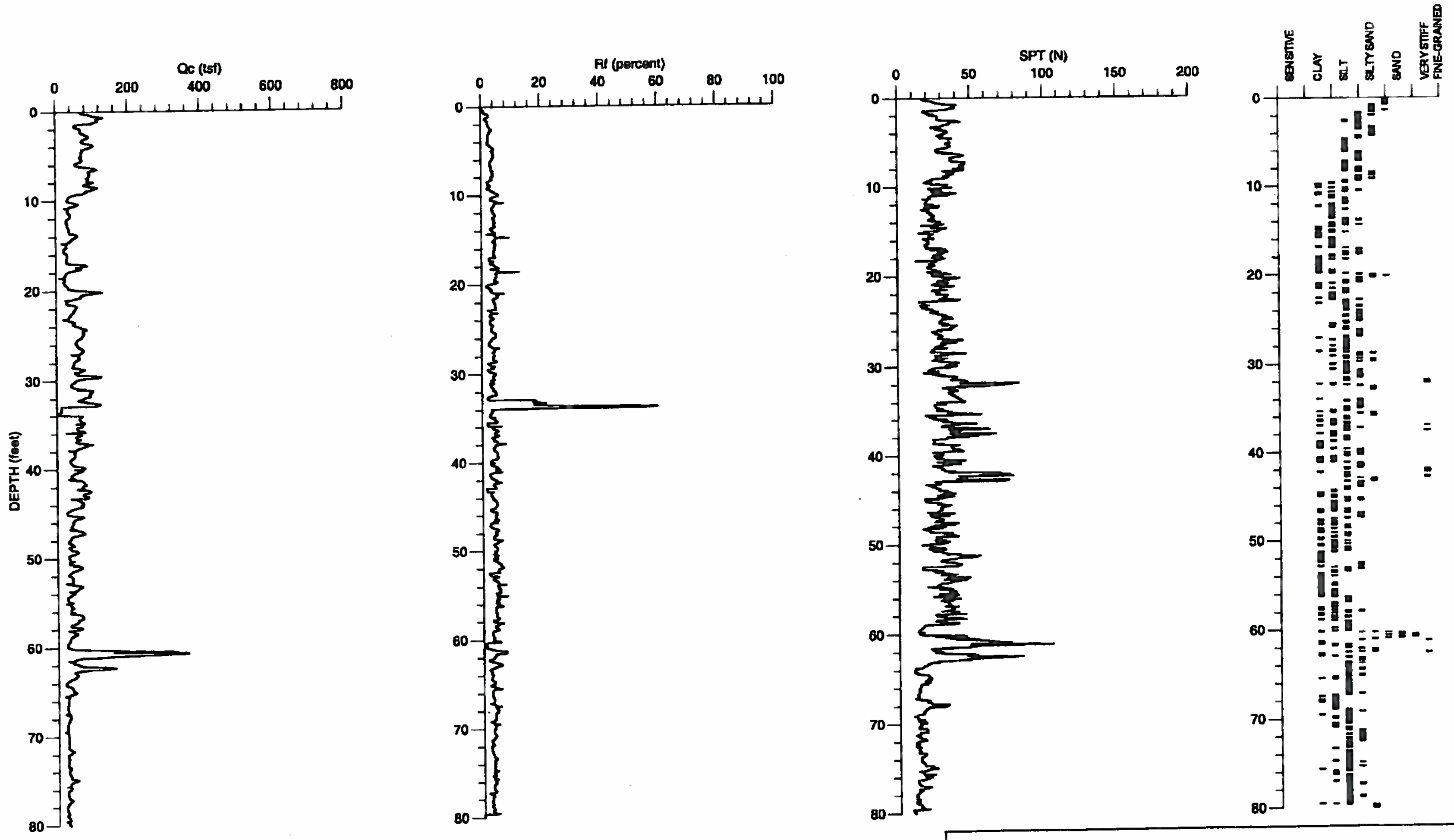
Terminated at 45.2 feet.
Groundwater level not measured.
Date performed: 10/13/06.
Ground surface elevation: 377.3 feet, City of Livermore.

**HANSON RADUM SITE**
Pleasanton, California

## CONE PENETRATION TEST RESULTS
## CPT-7

| | | |
|---|---|---|
| Date 05/24/07 | Project No. 4490.01 | Figure B-7 |

**Treadwell&Rollo**



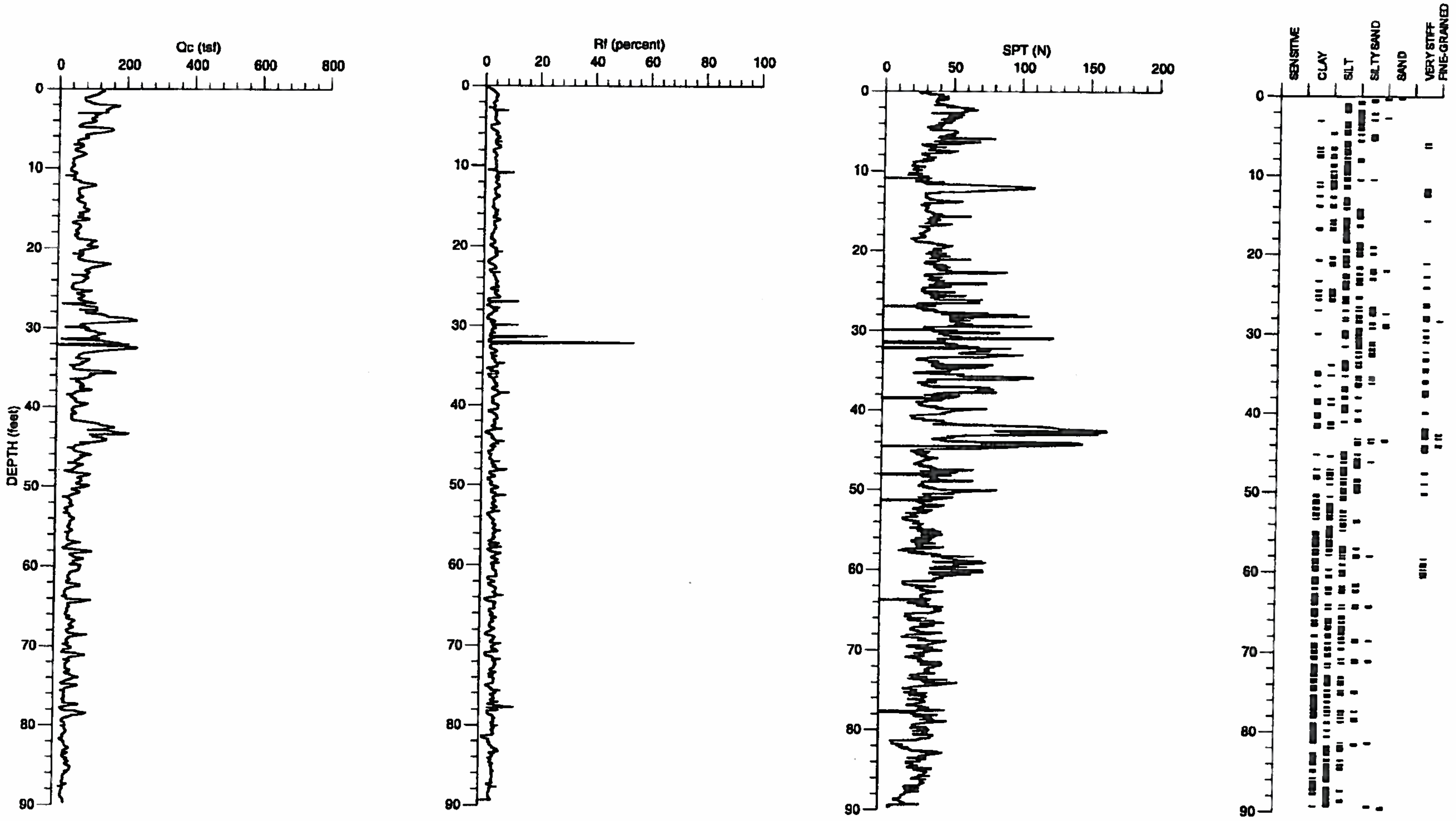
Terminated at 80 feet.
Groundwater level not measured.
Date performed: 10/12/06.
Ground surface elevation: 363.7 feet, City of Livermore.

**HANSON RADUM SITE**
Pleasanton, California

## CONE PENETRATION TEST RESULTS
## CPT-8

Date 05/24/07 | Project No. 4490.01 | Figure B-8

Treadwell&Rollo



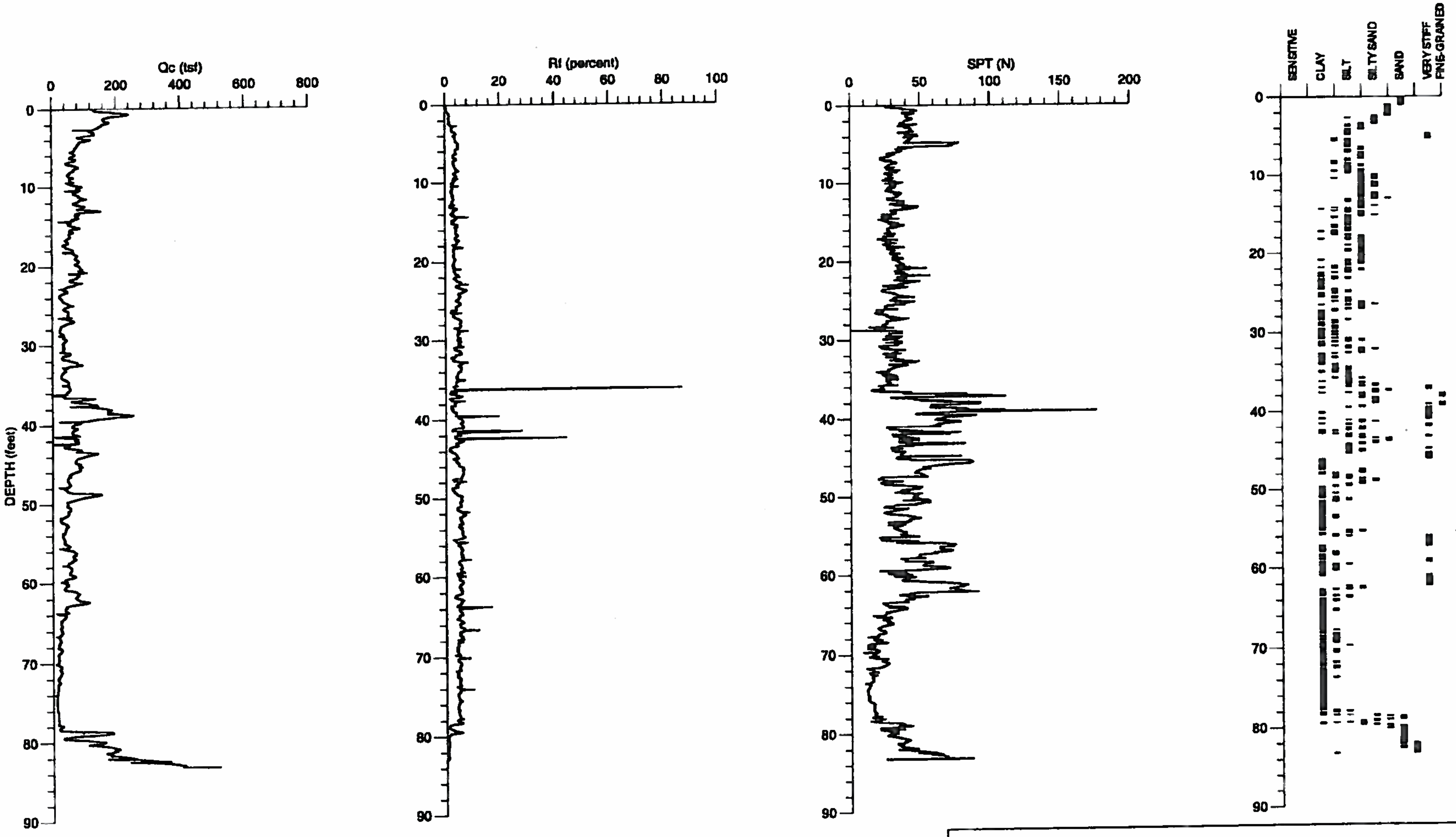
Terminated at 89.7 feet.
Groundwater level not measured.
Date performed: 10/12/06.
Ground surface elevation: 360.5 feet, City of Livermore.

**HANSON RADUM SITE**
Pleasanton, California

## CONE PENETRATION TEST RESULTS
## CPT-9

| | | |
|---|---|---|
| Date 05/24/07 | Project No. 4490.01 | Figure B-9 |

**Treadwell&Rollo**



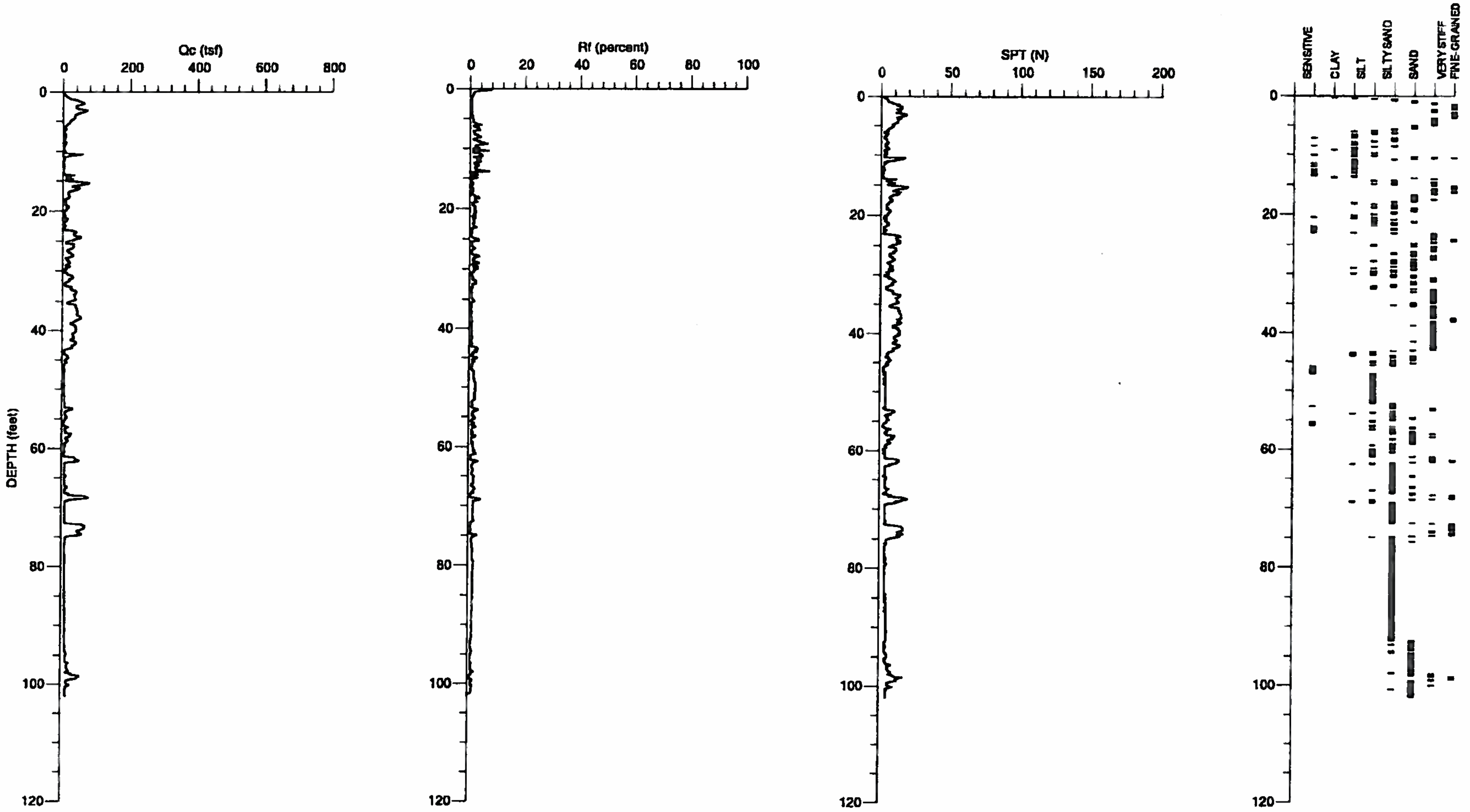
Terminated at 83.2 feet.
Groundwater level not measured.
Date performed: 10/13/06.
Ground surface elevation: 349.5 feet, City of Livermore.

**HANSON RADUM SITE**
Pleasanton, California

## CONE PENETRATION TEST RESULTS
## CPT-10

| Date 05/24/07 | Project No. 4490.01 | Figure B-10 |
|---|---|---|

**Treadwell&Rollo**



Terminated at 102 feet.
Groundwater level not measured.
Date performed: 10/02/06.
Ground surface elevation: 360.0 feet, City of Livermore.

**HANSON RADUM SITE**
Pleasanton, California

## CONE PENETRATION TEST RESULTS
## CPT-11

| Date 05/24/07 | Project No. 4490.01 | Figure B-11 |
|---|---|---|

**Treadwell&Rollo**

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-19

PAGE 1 OF 4

Boring location: See Site Plan, Figure 2

Logged by: K. Lease

.

Date started: 11/7/08 Date finished: 11/7/08

Drilling method: Hollow Stem Auger

Hammer weight/drop: 140 lbs./30 inches Hammer type: Wireline Downhole

Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Shelby Tube (ST)

Ground Surface Elevation: 348.2 feet[2]

| DEPTH (feet) | SAMPLES Sampler Type | Sample | Blows/ 6" | SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA Type of Strength Test | Confining Pressure Lbs/Sq Ft | Shear Strength Lbs/Sq Ft | Fines % | Natural Moisture Content, % | Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SILTY SAND (SM)<br>olive-brown, very loose, moist | | | | | | |
| 1 | | | | | | | | | | | | |
| 2 | | | | | SM | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | SPT | ▨ | 3<br>0<br>1 | 1 | | | | | | | | |
| 5 | | | | | | SANDY CLAY (CL)<br>olive, very soft, moist | | | | | | |
| 6 | | | | | CL | | | | | | | |
| 7 | | | | | | | | | | | | |
| 8 | | | | | | SAND with SILT (SP-SM)<br>olive, very loose, moist, very fine-grained sand | | | | | | |
| 9 | S&H | ▨ | 3<br>2<br>3 | 3 | | | | | | | 12.7 | 90 |
| 10 | | | | | SP-SM | | | | | | | |
| 11 | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13 | | | | | | CLAY (CL)<br>olive, very soft, moist, with silt<br>Liquid Limit = 31, Plasticity Index = 9 | | | | | | |
| 14 | S&H | ▨ | 1<br>0<br>1 | 1 | | | | | | | 45.7 | 78 |
| 15 | | | | | | FILL | | | | | | |
| 16 | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | |
| 19 | S&H | ▨ | 0<br>0<br>0 | 0 | | | | | | | 61.1 | 68 |
| 20 | | | | | CL | | | | | | | |
| 21 | | | | | | | | | | | | |
| 22 | | | | | | ∇ (11/7/08, 8:25) | | | | | | |
| 23 | | | | | | gray, stiff, wet | | | | | | |
| 24 | ST | ▨ | 0 psi | | | | PP<br>TV<br>LVS | --| 2,000<br>400<br>442 | | 31.4 | 88 |
| 25 | | | | | | | | | | | | |
| 26 | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | |
| 28 | | | | | SP-SM | SAND with SILT (SP-SM)<br>olive-brown, very loose, wet | | | | | | |
| 29 | SPT | ▨ | 1<br>1<br>1 | 2 | CL | SANDY CLAY (CL) | | | | 93.4 | | |
| 30 | | | | | | | | | | | | |

PLEASANTON BORING 449002_BORINGS_REV.GPJ TR.GDT 3/17/09

**Treadwell&Rollo**

Project No.: 4490.02

Figure: A-19a

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-19

| DEPTH (feet) | SAMPLES: Sampler Type | SAMPLES: Sample | SAMPLES: Blows/ 6" | SAMPLES: SPT N-Value¹ | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA: Type of Strength Test | TEST DATA: Confining Pressure Lbs/Sq Ft | TEST DATA: Shear Strength Lbs/Sq Ft | TEST DATA: Fines % | TEST DATA: Natural Moisture Content, % | TEST DATA: Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31<br>32 | | | | | CL | SANDY CLAY (CL) (continued)<br>olive-brown, very soft, wet, with silt | | | | | | |
| 33<br>34<br>35<br>36 | S&H | ■ | 1<br>2<br>3 | 3 | CH | CLAY (CH)<br>olive, soft, wet<br>(material experienced a reduction in volume, free water observed on top of sample) | TV | | 300 | | 30.3 | 90 |
| 37<br>38<br>39<br>40<br>41 | S&H | ■ | 3<br>5<br>7 | 7 | ML | SANDY SILT (ML)<br>yellow-brown, medium stiff, wet<br>(material experienced a reduction in volume, free water observed on top of sample) | | | | 93.7 | 30.4 | 93 |
| 42<br>43<br>44<br>45<br>46<br>47 | S&H | ⊡ | 2<br>3<br>3 | 4 | SM | SILTY SAND (SM)<br>yellow-brown, very loose to loose, wet<br>(sample recovered using SPT sampler) | | | | | | |
| 48<br>49<br>50<br>51 | SPT | ◪ | 2<br>2<br>4 | 6 | CH | CLAY (CH)<br>olive-brown mottled yellow-brown, medium stiff, wet | | | | | | |
| 52<br>53<br>54<br>55<br>56<br>57 | ST | ◨ | 0 psi | | CH | yellow-brown<br>Consolidation Test, see Figure C-50 | LVS<br>TV | -- | 417<br>600 | | 60.8 | 65 |
| 58<br>59<br>60 | S&H | ■ | 3<br>3<br>3 | 4 | ML | SILT (ML)<br>olive, soft to medium stiff, wet<br>Non-plastic | TV | | 200 | | 42.3<br>41.7 | 77<br>77 |

FILL

PLEASANTON BORING 449002_BORINGS_REV.GPJ TR.GDT 3/17/09

**Treadwell&Rollo**

Project No.: 4490.02

Figure: A-19b

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-19

PAGE 3 OF 4

| DEPTH (feet) | SAMPLES<br>Sampler Type | <br>Sample | <br>Blows/ 6" | <br>SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA<br>Type of Strength Test | <br>Confining Pressure Lbs/Sq Ft | <br>Shear Strength Lbs/Sq Ft | <br>Fines % | <br>Natural Moisture Content, % | <br>Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SILT (ML) (continued) | | | | | | |
| 61 | | | | | ML | | | | | | | |
| 62 | | | | | | SILT with SAND (ML)<br>olive, soft to medium stiff, wet | | | | | | |
| 63 | | | | | | | | | | | | |
| 64 | S&H | ■ | 3<br>3<br>3 | 4 | | (material experienced a reduction in volume, free water observed on top of sample) | | | | | 30.1 | 94 |
| 65 | | | | | | | | | | | | |
| 66 | | | | | | | | | | | | |
| 67 | | | | | | | | | | | | |
| 68 | | | | | ML | soft, very fine-grained sand | | | | | | |
| 69 | S&H | ⊡ | 1<br>1<br>3 | 2 | | (recovered sample using S&H sampler with sand catcher) | | | | 85.4 | | |
| 70 | | | | | | | | | | | | |
| 71 | | | | | | | | | | | | |
| 72 | | | | | | | | | | | | |
| 73 | | | | | | CLAY (CL)<br>yellow-brown, medium stiff to stiff, wet, with silt | | | | | | |
| 74 | S&H | ■ | 3<br>5<br>9 | 8 | | | PP | | 1,000 | | 58.4 | 66 |
| 75 | | | | | | FILL | | | | | | |
| 76 | | | | | | | | | | | | |
| 77 | | | | | | | | | | | | |
| 78 | | | | | | | | | | | | |
| 79 | S&H | ■ | 2<br>3<br>5 | 5 | | medium stiff | TV | | 500 | | 48.6 | 72 |
| 80 | | | | | | | | | | | | |
| 81 | | | | | | | | | | | | |
| 82 | | | | | CL | | | | | | | |
| 83 | | | | | | soft | LVS | -- | 662 | | 56.0 | 66 |
| 84 | ST | ◨ | 0 psi | | | | TV | | 400 | | | |
| 85 | | | | | | | | | | | 49.8 | 75 |
| 86 | | | | | | | | | | | | |
| 87 | | | | | | | | | | | | |
| 88 | | | | | | | | | | | | |
| 89 | S&H | ■ | 3<br>3<br>5 | 5 | | medium stiff, with trace subangular gravel | PP | | 1,000 | | | |
| 90 | | | | | | | | | | | | |

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Project No.: 4490.02

Figure: A-19c

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-19

PAGE 4 OF 4

| DEPTH (feet) | SAMPLES | | | | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sampler Type | Sample | Blows/ 6" | SPT N-Value[1] | | | Type of Strength Test | Confining Pressure Lbs/Sq Ft | Shear Strength Lbs/Sq Ft | Fines % | Natural Moisture Content, % | Dry Density Lbs/Cu Ft |
| | | | | | | CLAY (CL) (continued)<br>FILL | | | | | | |
| 91 | | ▨ | 10 | | | | | | | | 35.2 | 84 |
| 92 | S&H | | 15<br>21 | 22 | CL | CLAY (CL)<br>olive-brown, very stiff, wet, trace sand and gravel | PP | | 2,000 | | 18.3 | 114 |
| 93 | | | | | | | | | | | | |
| 94 | | | | | | | | | | | | |
| 95 | | | | | | | | | | | | |
| 96 | | | | | | | | | | | | |
| 97 | | | | | | | | | | | | |
| 98 | | | | | | | | | | | | |
| 99 | | | | | | | | | | | | |
| 100 | | | | | | | | | | | | |
| 101 | | | | | | | | | | | | |
| 102 | | | | | | | | | | | | |
| 103 | | | | | | | | | | | | |
| 104 | | | | | | | | | | | | |
| 105 | | | | | | | | | | | | |
| 106 | | | | | | | | | | | | |
| 107 | | | | | | | | | | | | |
| 108 | | | | | | | | | | | | |
| 109 | | | | | | | | | | | | |
| 110 | | | | | | | | | | | | |
| 111 | | | | | | | | | | | | |
| 112 | | | | | | | | | | | | |
| 113 | | | | | | | | | | | | |
| 114 | | | | | | | | | | | | |
| 115 | | | | | | | | | | | | |
| 116 | | | | | | | | | | | | |
| 117 | | | | | | | | | | | | |
| 118 | | | | | | | | | | | | |
| 119 | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | |

Boring terminated at a depth of 92.5 feet.
Boring backfilled with cement grout.
Groundwater level at 22 feet below ground surface during drilling.
TV = Torvane.
PP = Pocket Penetrometer. LVS = Laboratory Vane Shear.

[1] S&H and SPT blow counts for the last two increments were converted to SPT N-Values using a factor of 0.6 and 1.0, respectively to account for sampler type.
[2] Elevation based on Mean Sea Level (NGVD 1929).

**Treadwell&Rollo**

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Figure: A-19d

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-20

PAGE 1 OF 4

Boring location: See Site Plan, Figure 2

Date started: 11/11/08

Date finished: 11/11/08

Drilling method: Hollow Stem Auger

Hammer weight/drop: 140 lbs./30 inches

Hammer type: Wireline Downhole

Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Shelby Tube (ST)

Logged by: K. Lease

Ground Surface Elevation: 355.8 feet[2]

| DEPTH (feet) | SAMPLES: Sampler Type | Sample | Blows/ 6" | SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA: Type of Strength Test | Confining Pressure Lbs/Sq Ft | Shear Strength Lbs/Sq Ft | Fines % | Natural Moisture Content, % | Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0–12 | | | | | GP | GRAVEL with CLAY and SAND (GP)<br>brown, dense, moist, with concrete and asphalt, cobbles up to 1-1/2 inches in diameter | | | | | | |
| 8 | S&H | | 10/0" | | | sample attempted; hard material, asphalt concrete 8:33 drilling through concrete rubble at 8.5 feet below ground surface to 9.5 feet at 8:41 added some water | | | | | | |
| 12–22 | | | | | ML | SANDY SILT (ML)<br>gray mottled yellow-brown and orange, very loose, moist, very fine-grained and with a variable silt content | | | | | | |
| 13 | S&H | | 1<br>1<br>2 | 2 | | | PP | | 2,500 | 82.6 | 23.1 | 83 |
| 19 | S&H | | 2<br>2<br>3 | 3 | | free water present in sample | | | | | 26.7 | 99 |
| 22–28 | | | | | CL | SILTY CLAY (CL)<br>olive-gray, soft, wet, with black (oxidized) organics, with interbedded silty sand lenses | | | | | | |
| 24 | S&H | | 2<br>2<br>2 | 2 | | | LVS<br>TV | -- | 318<br>200 | | 38.4 | 84 |
| 28–30 | | | | | ML | SILT (ML)<br>olive-gray, soft, wet, with isolated thin clay seams and trace sand | | | | | | |
| 29 | ST | ● | 0<br>psi | | | | | | | | | |

FILL (0–30 feet)

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Project No.: 4490.02

Figure: A-20a

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-20

| DEPTH (feet) | SAMPLES: Sampler Type | SAMPLES: Sample | SAMPLES: Blows/ 6" | SAMPLES: SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA: Type of Strength Test | TEST DATA: Confining Pressure Lbs/Sq Ft | TEST DATA: Shear Strength Lbs/Sq Ft | TEST DATA: Fines % | TEST DATA: Natural Moisture Content, % | TEST DATA: Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | ST |  |  |  |  |  |  |  |  |  |  |  |
| 31 | S&H |  | 2<br>2<br>2 | 2 |  | SILT (ML) (continued)<br>yellow-brown to olive-brown<br>clay content is 18.5 percent<br>∇ Particle Size Analysis, see Figure C-14<br>(11/11/08, 9:35) | TV |  | 200 | 98.5 | 28.5 | 95 |
| 32 |  |  |  |  |  |  |  |  |  |  |  |  |
| 33 |  |  |  |  |  |  |  |  |  |  |  |  |
| 34 | S&H |  | 3<br>3<br>5 | 5 |  |  |  |  |  |  | 27.9 | 94 |
| 35 |  |  |  |  |  |  |  |  |  |  |  |  |
| 36 |  |  |  |  | ML |  |  |  |  |  |  |  |
| 37 |  |  |  |  |  |  |  |  |  |  |  |  |
| 38 |  |  |  |  |  | grades yellow-brown |  |  |  |  |  |  |
| 39 |  |  |  |  |  |  |  |  |  |  |  |  |
| 40 | ST |  | 50 psi |  |  | grades dark gray with thin sand lenses | TV<br>PP |  | 400<br>1,250 | 97.5 | 45.0 | 77 |
| 41 |  |  |  |  |  |  |  |  |  |  |  |  |
| 42 |  |  |  |  |  |  |  |  |  |  |  |  |
| 43 |  |  |  |  |  | CLAYEY SILT (ML)<br>gray to yellow-brown, soft, wet, with mixed sand lenses, with 36.7 percent clay<br>Particle Size Analysis, see Figure C-15 |  |  |  |  |  |  |
| 44 | S&H |  | 2<br>2<br>3 | 3 | ML |  | TV |  | 200 to 300 | 99.6 | 39.0 | 89 |
| 45 |  |  |  |  |  | FILL |  |  |  |  |  |  |
| 46 |  |  |  |  |  |  |  |  |  |  |  |  |
| 47 |  |  |  |  |  | SILT (ML)<br>yellow-brown, soft, wet |  |  |  |  |  |  |
| 48 |  |  |  |  |  |  |  |  |  |  |  |  |
| 49 | ST |  | 0 psi |  |  | Non-plastic<br>Consolidation Test, see Figure C-51 | TV |  | 300 |  | 37.0 | 85 |
| 50 |  |  |  |  | ML |  |  |  |  |  |  |  |
| 51 |  |  |  |  |  |  |  |  |  |  |  |  |
| 52 |  |  |  |  |  |  |  |  |  |  |  |  |
| 53 |  |  |  |  |  | CLAY (CL)<br>yellow-brown, soft, wet |  |  |  |  |  |  |
| 54 | S&H |  | 2<br>3<br>4 | 4 |  |  | TV |  | 400 |  |  |  |
| 55 |  |  |  |  |  |  | LVS | -- | 284 |  | 32.7 | 86 |
| 56 |  |  |  |  | CL |  |  |  |  |  |  |  |
| 57 |  |  |  |  |  |  |  |  |  |  |  |  |
| 58 |  |  |  |  |  | grading gray |  |  |  |  |  |  |
| 59 | S&H |  | 3<br>3<br>3 | 4 |  |  | TV |  | 400 |  | 49.7 | 73 |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |

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Project No.: 4490.02

Figure: A-20b

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-20

| DEPTH (feet) | SAMPLES: Sampler Type | SAMPLES: Sample | SAMPLES: Blows/ 6" | SAMPLES: SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION | | TEST DATA: Type of Strength Test | TEST DATA: Confining Pressure Lbs/Sq Ft | TEST DATA: Shear Strength Lbs/Sq Ft | TEST DATA: Fines % | TEST DATA: Natural Moisture Content, % | TEST DATA: Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 61 | | | | | CL | CLAY (CL) (continued) | | | | | | | |
| 62 | | | | | | SANDY SILT (ML)<br>yellow-brown, soft, wet, fine-grained sand | | | | | | | |
| 63 | | | | | | | | | | | | | |
| 64 | S&H | ■ | 3<br>3<br>5 | 5 | ML | | | | | | 70 | 31.0 | 94 |
| 65 | | | | | | | | | | | | | |
| 66 | | | | | | | | | | | | | |
| 67 | | | | | | | | | | | | | |
| 68 | | | | | | SILT with SAND (ML)<br>olive-brown, soft, wet, variable sand content | | | | | | | |
| 69 | SPT | ◪ | 2<br>2<br>2 | 4 | ML | | | | | | | | |
| 70 | | | | | | | | | | | | | |
| 71 | | | | | | | | | | | | | |
| 72 | | | | | | SILTY CLAY (CL)<br>yellow-brown, soft, wet, with trace sand | | | | | | | |
| 73 | | | | | | | | | | | | | |
| 74 | ST | ▥ | 0 psi | | | | | TV<br>LVS | -- | 400<br>478 | | 48.2 | 74 |
| 75 | | | | | | | FILL | | | | | | |
| 76 | | | | | | | | | | | | | |
| 77 | | | | | | | | | | | | | |
| 78 | | | | | CL | | | | | | | | |
| 79 | S&H | ■ | 2<br>3<br>7 | 6 | | | | TV | | 400 | | 42.8 | 81 |
| 80 | | | | | | | | | | | | | |
| 81 | | | | | | | | | | | | | |
| 82 | | | | | | | | | | | | | |
| 83 | | | | | | Highly variable of CLAY (CH), SILT (ML), and SILTY SAND (SM)<br>olive-brown, soft, medium dense<br>wet, sand is very fine to medium-grained | | | | | | | |
| 84 | S&H | ■ | 3<br>6<br>18 | 14 | | | | | | | | | |
| 85 | SPT | ◪ | 3<br>4<br>9 | 13 | | | | | | | | | |
| 86 | | | | | CH/<br>ML/<br>SM | (water flowing into boring; groundwater estimated at 83 feet below ground surface) | | TV | | 300 | | | |
| 87 | | | | | | | | | | | | | |
| 88 | | | | | | | | | | | | | |
| 89 | SPT | ◪ | 4<br>6<br>10 | 16 | | | | | | | | | |
| 90 | | | | | | | | | | | | | |

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Project No.: 4490.02
Figure: A-20c

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-20

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| DEPTH (feet) | SAMPLES: Sampler Type | SAMPLES: Sample | SAMPLES: Blows/ 6" | SAMPLES: SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA: Type of Strength Test | TEST DATA: Confining Pressure Lbs/Sq Ft | TEST DATA: Shear Strength Lbs/Sq Ft | TEST DATA: Fines % | TEST DATA: Natural Moisture Content, % | TEST DATA: Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 91 | | | | | | Highly variable of CLAY (CH) SILT and SILTY SAND (SM) (continued) | | | | | | |
| 92 | | | | | | | | | | | | |
| 93 | | | | | | | | | | | | |
| 94 | S&H | ▨ | 5<br>6<br>8 | 8 | CH/<br>ML/<br>SM | | | | | | 25.4 | 101 |
| 95 | | | | | | | | | | | | |
| 96 | | | | | | | | | | | | |
| 97 | | | | | | | | | | | | |
| 98 | | | | | | SILTY SAND (SM)<br>olive-brown, loose, wet | | | | | | |
| 99 | S&H | ▨ | 5<br>6<br>11 | 10 | SM | | | | | | 28.1 | 99 |
| 100 | | | | | | | | | | | | |
| 101 | | | | | | | | | | | | |
| 102 | | | | | | | | | | | | |
| 103 | | | | | | SANDY SILT (ML)<br>olive-brown, medium stiff, wet | | | | | | |
| 104 | S&H | ▨ | 5<br>6<br>7 | 8 | ML | FILL | TV<br>PP | | 400<br>1,000 | | 27.7 | 93 |
| 105 | | | | | | | | | | | | |
| 106 | | | | | | | | | | | | |
| 107 | | | | | | | | | | | | |
| 108 | | | | | | CLAY (CL)<br>yellow-brown, soft to medium stiff, wet | LVS | -- | 602 | | | |
| 109 | ST | ▨ | 0<br>to<br>75<br>psi | | CL | | TV<br>PP<br>LVS | <br><br>-- | 700<br>1,250<br>1,221 | | 53.2 | 71 |
| 110 | | | | | | | | | | | | |
| 111 | | | | | | CLAY (CL)<br>brown, stiff to hard, wet | | | | | | |
| 112 | | | | | | | | | | | | |
| 113 | | | | | | | | | | | | |
| 114 | S&H | ▨ | 5<br>12<br>47 | 35 | CL | hard, with trace gravel | TV<br>PP | | 1,200<br>1,000 | | 49.1 | 74 |
| 115 | | | | | | | | | | | | |
| 116 | | | | | | | | | | | | |
| 117 | | | | | | | | | | | | |
| 118 | | | | | | GRAVEL with CLAY (GP-GC)<br>yellow-brown, very dense, wet, with sand | | | | | | |
| 119 | SPT | ◩ | 22<br>28<br>30 | 58 | GP-<br>GC | (approx. 3 ft. of water in hole at end of drilling) | | | | 11.9 | | |
| 120 | | | | | | | | | | | | |

Boring terminated at a depth of 120 feet.
Boring backfilled with cement grout.
Groundwater level encountered at 83 feet then interim groundwater level stabilized at 32 feet below ground surface.
TV = Torvane.
~~PP = Pocket Penetrometer. LVS = Laboratory Vane Shear.~~

[1] S&H and SPT blow counts for the last two increments were converted to SPT N-Values using a factor of 0.6 and 1.0, respectively to account for sampler type.

[2] Elevation based on Mean Sea Level (NGVD 1929).

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Figure: A-20d

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-21

PAGE 1 OF 4

Boring location: See Site Plan, Figure 2
Date started: 11/14/08
Date finished: 11/14/08
Drilling method: Hollow Stem Auger
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Wireline Downhole
Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Shelby Tube (ST)
Logged by: K. Lease

Ground Surface Elevation: 364.5 feet[2]

| DEPTH (feet) | SAMPLES: Sampler Type | Sample | Blows/ 6" | SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA: Type of Strength Test | Confining Pressure Lbs/Sq Ft | Shear Strength Lbs/Sq Ft | Fines % | Natural Moisture Content, % | Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | GP | GRAVEL (GP)<br>gray and white, with trace clay and sand<br>FILL | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | CLAY (CL)<br>yellow-brown, hard, moist, with trace very fine-grained sand | | | | | | |
| 4 | S&H | | 50/4" | 30/<br>4" | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 9 | S&H | | 10<br>15<br>14 | 17 | CL | very stiff, with trace subangular gravel 1/2 inch in diameter, with silt | PP | | 4,500 | | 9.5 | 109 |
| 10 | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | |
| 14 | S&H | | 5<br>6<br>8 | 8 | | dark yellow-brown, medium stiff to stiff, no gravel | | | | | 14.0 | 95 |
| 15 | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | |
| 17 | | | | | | SILTY SAND with GRAVEL (SM)<br>brown, medium dense, moist, gravel is gray and white, 1/4 inch to 1-1/2 inch in diameter, and angular to rounded | | | | | | |
| 18 | | | | | | | | | | | | |
| 19 | S&H | | 11<br>18<br>25 | 26 | GP | | | | | | | |
| 20 | | | | | | | | | | | | |
| 21 | | | | | | GRAVEL with SILT and SAND (GP-GM)<br>yellow-brown, dense, moist | | | | | | |
| 22 | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | |
| 24 | SPT | | 21<br>23<br>21 | 44 | | | | | | 8.1 | | |
| 25 | | | | | GP-<br>GM | | | | | | | |
| 26 | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | |
| 29 | SPT | | 13<br>36<br>24 | 36 | | gray-brown, trace clay | | | | 10.2 | | |
| 30 | | | | | | | | | | | | |

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-21

PAGE 2 OF 4

| DEPTH (feet) | SAMPLES: Sampler Type | SAMPLES: Sample | SAMPLES: Blows/ 6" | SAMPLES: SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA: Type of Strength Test | TEST DATA: Confining Pressure Lbs/Sq Ft | TEST DATA: Shear Strength Lbs/Sq Ft | TEST DATA: Fines % | TEST DATA: Natural Moisture Content, % | TEST DATA: Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31 | | | | | | GRAVEL with SILT and SAND (GP-GM) (continued) | | | | | | |
| 32 | | | | | SM | SILTY SAND with GRAVEL (SM)<br>gray-brown, very dense, moist, with some gravel greater than 1-1/2 inch in diameter | | | | | | |
| 34 | SPT | ◪ | 13<br>22<br>25 | 47 | | | | | | | | |
| 39 | SPT | ◪ | 12<br>22<br>27 | 49 | | | | | | | | |
| 42 | | | | | GP-GC | GRAVEL with CLAY and SAND (GP-GC)<br>yellow-brown clay and gray gravel, dense to very dense, moist, gravel is coarse and greater than 1-1/2 inch in diameter | | | | | | |
| 44 | SPT | ◪ | 18<br>22<br>28 | 50 | | | | | | | | |
| 48 | | | | | GC | CLAYEY GRAVEL with SAND (GC)<br>yellow-brown, dense, moist | | | | | | |
| 49 | SPT | ◪ | 24<br>22<br>20 | 42 | | | | | | | | |
| 53 | | | | | SP-SC | SAND with CLAY and GRAVEL (SP-SC)<br>light yellow-brown, dense, moist, very fine to coarse-grained sand | | | | | | |
| 54 | S&H | ■ | 30<br>35<br>29 | 38 | | | | | | | | |
| 58 | | | | | | yellow-brown, very dense | | | | | | |
| 59 | SPT | ◪ | 21<br>39<br>39 | 78 | | | | | | | | |
| 60 | | | | | | | | | | | | |

**Treadwell&Rollo**

Project No.: 4490.02

Figure: A-21b

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-21

| DEPTH (feet) | SAMPLES: Sampler Type | SAMPLES: Sample | SAMPLES: Blows/ 6" | SAMPLES: SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA: Type of Strength Test | TEST DATA: Confining Pressure Lbs/Sq Ft | TEST DATA: Shear Strength Lbs/Sq Ft | TEST DATA: Fines % | TEST DATA: Natural Moisture Content, % | TEST DATA: Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | CLAYEY SAND with GRAVEL (SC) (continued) | | | | | | |
| 61 | | | | | | | | | | | | |
| 62 | | | | | | | | | | | | |
| 63 | | | | | | | | | | | | |
| 64 | S&H | ■ | 21<br>28<br>36 | 38 | | dense, with angular gravel | | | | 9.6 | 9.3<br>9.3 | 133<br>135 |
| 65 | | | | | | | | | | | | |
| 66 | | | | | | ▽ (11/14/08, 10:30 am) | | | | | | |
| 67 | | | | | | | | | | | | |
| 68 | | | | | | | | | | | | |
| 69 | SPT | ◪ | 23<br>38<br>26 | 64 | | very dense, wet, with gravel 1 inch in diameter | | | | | | |
| 70 | | | | | | | | | | | | |
| 71 | | | | | SP-SC | | | | | | | |
| 72 | | | | | | | | | | | | |
| 73 | | | | | | | | | | | | |
| 74 | SPT | ◪ | 22<br>28<br>36 | 64 | | | | | | | | |
| 75 | | | | | | | | | | | | |
| 76 | | | | | | | | | | | | |
| 77 | | | | | | | | | | | | |
| 78 | | | | | | | | | | | | |
| 79 | SPT | ◪ | 27<br>50/5" | 50/ 5" | | | | | | | | |
| 80 | | | | | | | | | | | | |
| 81 | | | | | | | | | | | | |
| 82 | | | | | | SAND (SP)<br>olive-brown, very dense, wet, with trace gravel, fine- to coarse-grained sand | | | | | | |
| 83 | | | | | | | | | | | | |
| 84 | SPT | ◪ | 12<br>27<br>50 | 77 | | | | | | | | |
| 85 | | | | | SP | | | | | | | |
| 86 | | | | | | | | | | | | |
| 87 | | | | | | | | | | | | |
| 88 | | | | | | SAND with CLAY (SP-SC)<br>olive, very dense, wet, fine- to coarse-grained sand | | | | | | |
| 89 | SPT | ◪ | 22<br>38<br>36 | 74 | SP-SC | | | | | | | |
| 90 | | | | | | | | | | | | |

PROJECT: **PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

# Log of Boring TR-21

| DEPTH (feet) | SAMPLES: Sampler Type | SAMPLES: Sample | SAMPLES: Blows/ 6" | SAMPLES: SPT N-Value[1] | LITHOLOGY | MATERIAL DESCRIPTION | TEST DATA: Type of Strength Test | TEST DATA: Confining Pressure Lbs/Sq Ft | TEST DATA: Shear Strength Lbs/Sq Ft | TEST DATA: Fines % | TEST DATA: Natural Moisture Content, % | TEST DATA: Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SAND with CLAY (SP-SC) (continued) | | | | | | |
| 91 | | | | | | | | | | | | |
| 92 | | | | | SP-SC | | | | | | | |
| 93 | | | 13 | | | | | | | | | |
| 94 | SPT | ◩ | 21<br>21 | 42 | | CLAY (CL)<br>yellow-brown, hard, wet, trace gravel | | | | | | |
| 95 | | | | | | | | | | | | |
| 96 | | | | | | | | | | | | |
| 97 | | | | | CL | | | | | | | |
| 98 | | | | | | | | | | | | |
| 99 | SPT | ◩ | 6<br>12<br>20 | 32 | | with silt | | | | | 19.3 | |
| 100 | | | | | | | | | | | | |
| 101 | | | | | | | | | | | | |
| 102 | | | | | | | | | | | | |
| 103 | | | | | | | | | | | | |
| 104 | | | | | | | | | | | | |
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| 107 | | | | | | | | | | | | |
| 108 | | | | | | | | | | | | |
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| 111 | | | | | | | | | | | | |
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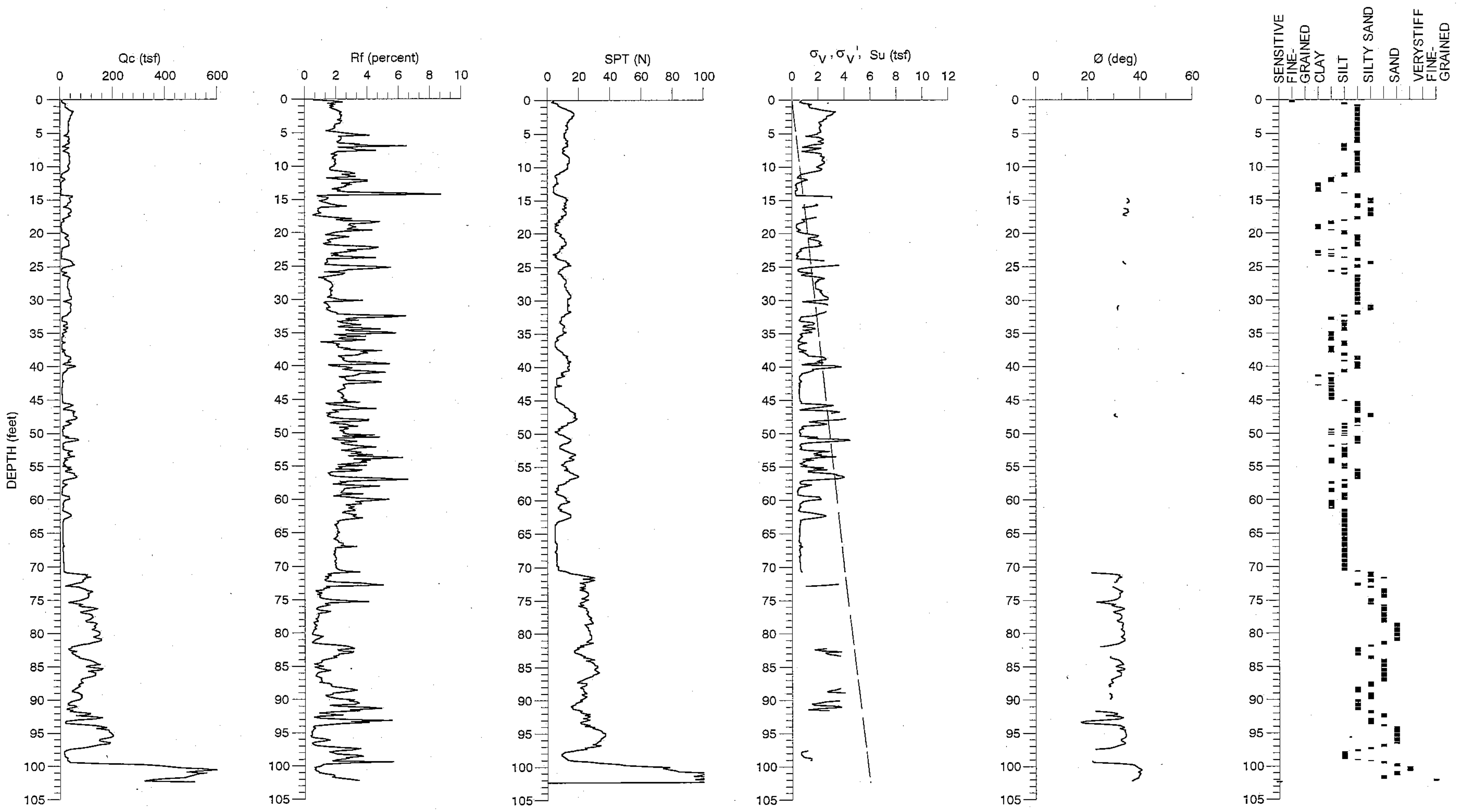
| 113 | | | | | | | | | | | | |
| 114 | | | | | | | | | | | | |
| 115 | | | | | | | | | | | | |
| 116 | | | | | | | | | | | | |
| 117 | | | | | | | | | | | | |
| 118 | | | | | | | | | | | | |
| 119 | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | |

Boring terminated at a depth of 100 feet.
Boring backfilled with cement grout.
Groundwater level at 66.5 feet below ground surface during drilling.
TV = Torvane.
PP = Pocket Penetrometer. LVS = Laboratory Vane Shear.

[1] S&H and SPT blow counts for the last two increments were converted to SPT N-Values using a factor of 0.6 and 1.0, respectively to account for sampler type.
[2] Elevation based on Mean Sea Level (NGVD 1929).

**Treadwell&Rollo**

Project No.: 4490.02
Figure: A-21d



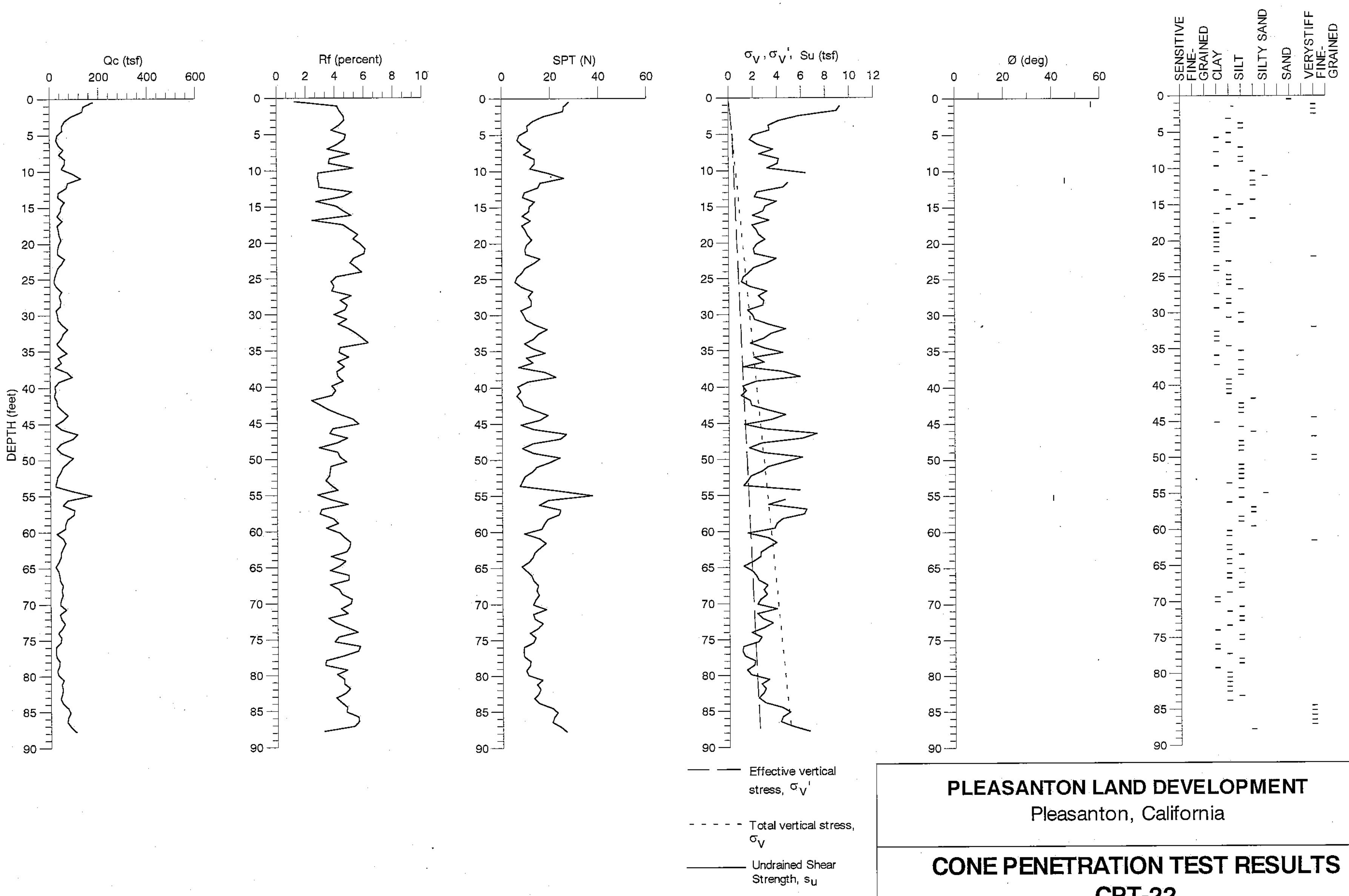
Terminated at 102.4 feet.
Groundwater not measured.
Date performed: 11/20/08.
Approximate Ground Surface Elevation: 351.0 feet, datum: NGVD 1929.

**PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

## CONE PENETRATION TEST RESULTS
## CPT-21

| | | |
|---|---|---|
| Date 03/16/09 | Project No. 4490.02 | Figure B-21 |

**Treadwell&Rollo**



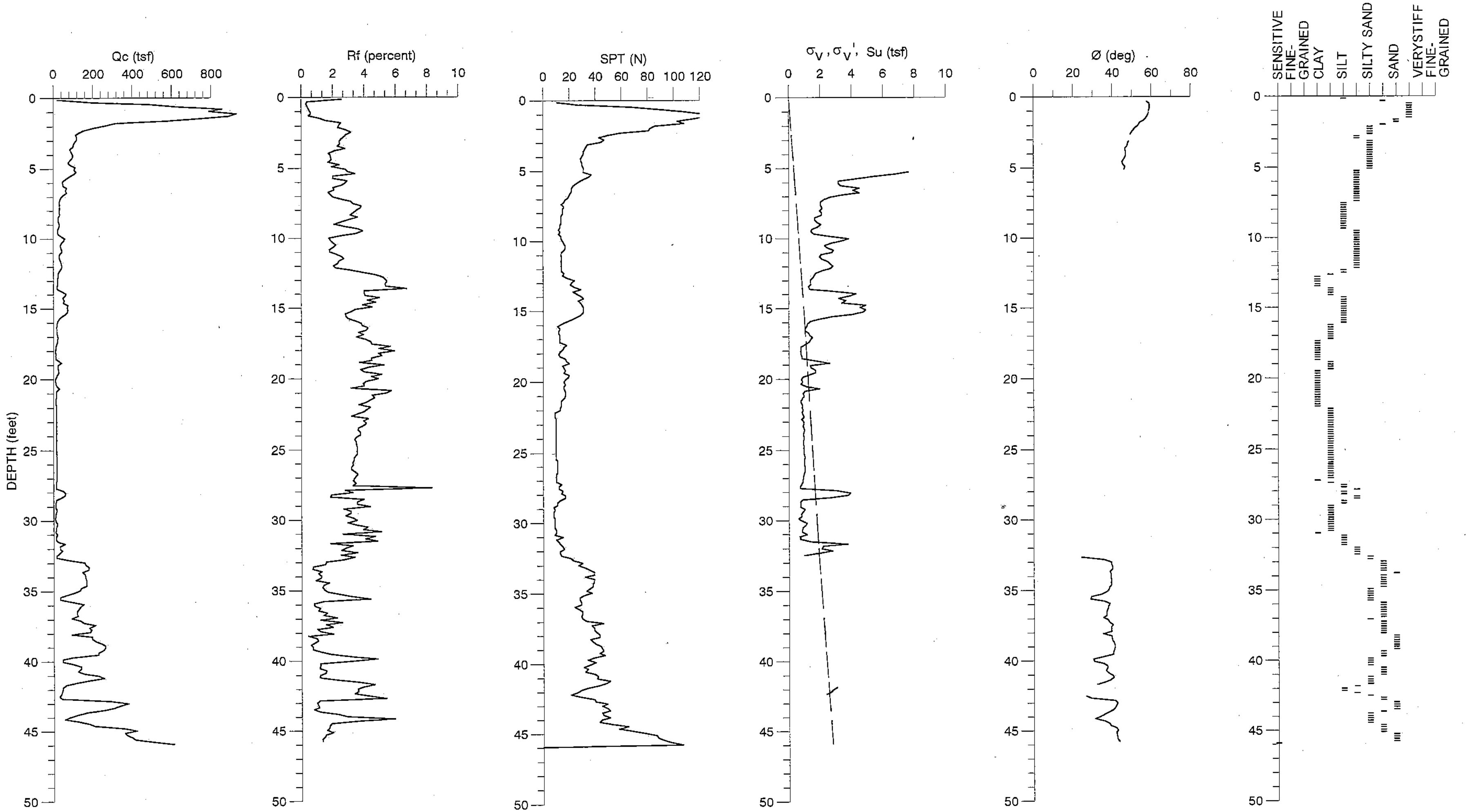
Terminated at 87.8 feet.
Assumed groundwater depth: 5.0 feet.
Date performed: 11/5/08.
Approximate Ground Surface Elevation: 358.5 feet, datum: NGVD 1929.

**PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

**CONE PENETRATION TEST RESULTS**
**CPT-22**

| | | |
|---|---|---|
| Date 03/16/09 | Project No. 4490.02 | Figure B-22 |

**Treadwell&Rollo**



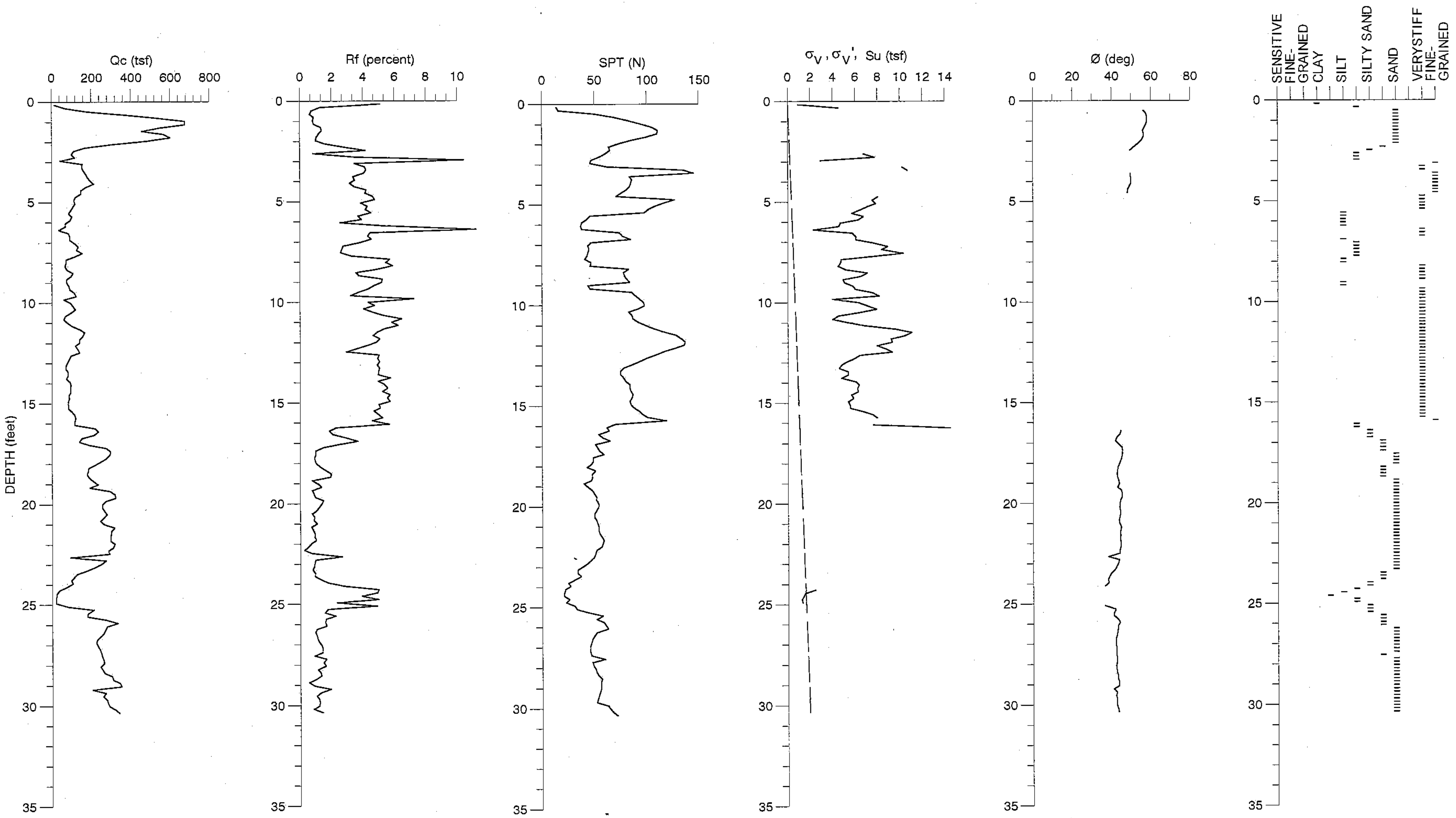
Terminated at 45.9 feet.
Groundwater not measured.
Date performed: 11/5/08.
Approximate Ground Surface Elevation: 363.5 feet, datum: NGVD 1929.

**PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

## CONE PENETRATION TEST RESULTS
## CPT-32

Date 03/16/09 | Project No. 4490.02 | Figure B-32

**Treadwell&Rollo**



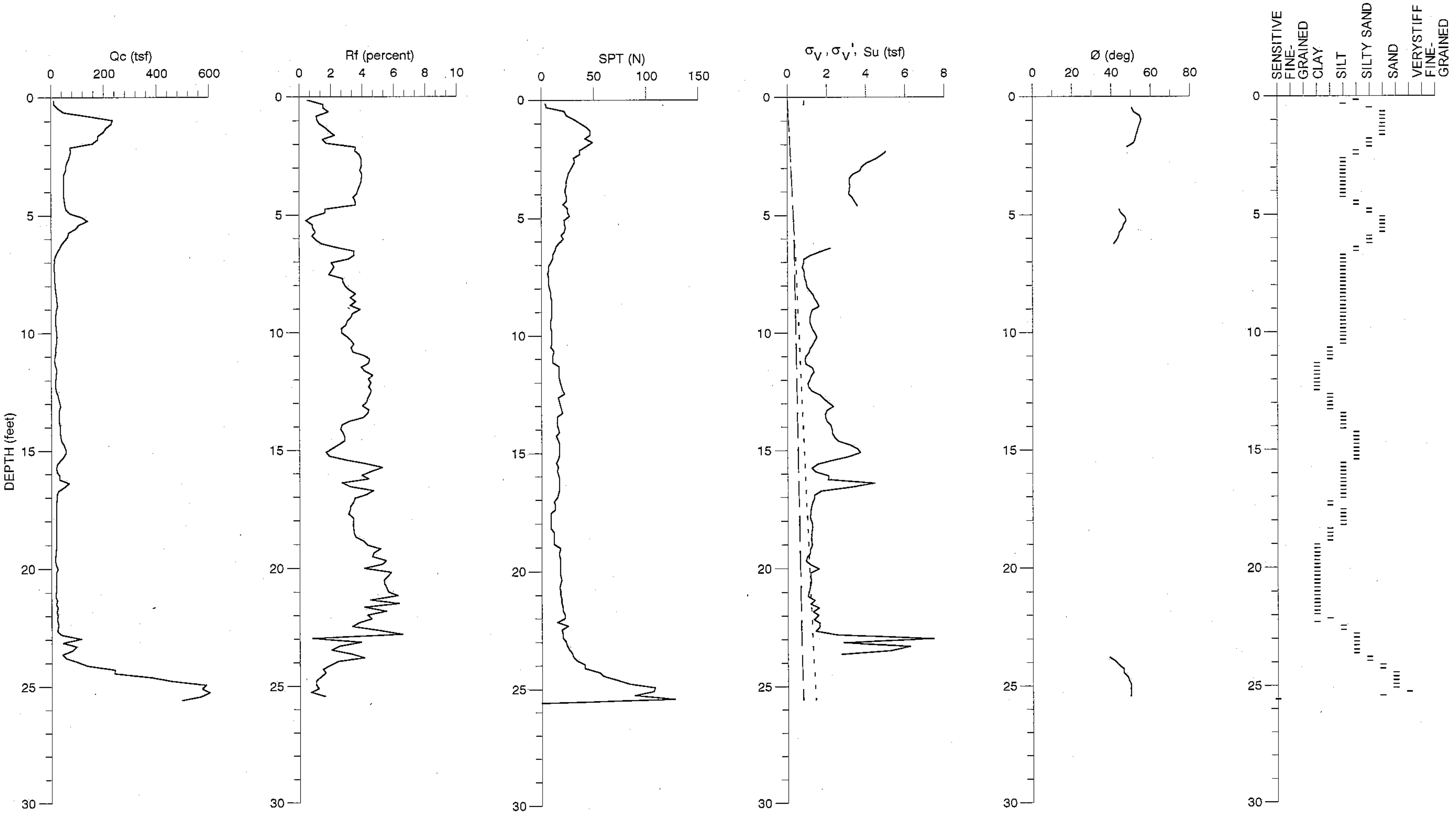
Terminated at 30.4 feet.
Groundwater not measured.
Date performed: 11/5/08.
Approximate Ground Surface Elevation: 368.4 feet, datum: NGVD 1929.

**PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

**CONE PENETRATION TEST RESULTS**
**CPT-33**

| | | |
|---|---|---|
| Date 03/16/09 | Project No. 4490.02 | Figure B-33 |

**Treadwell&Rollo**



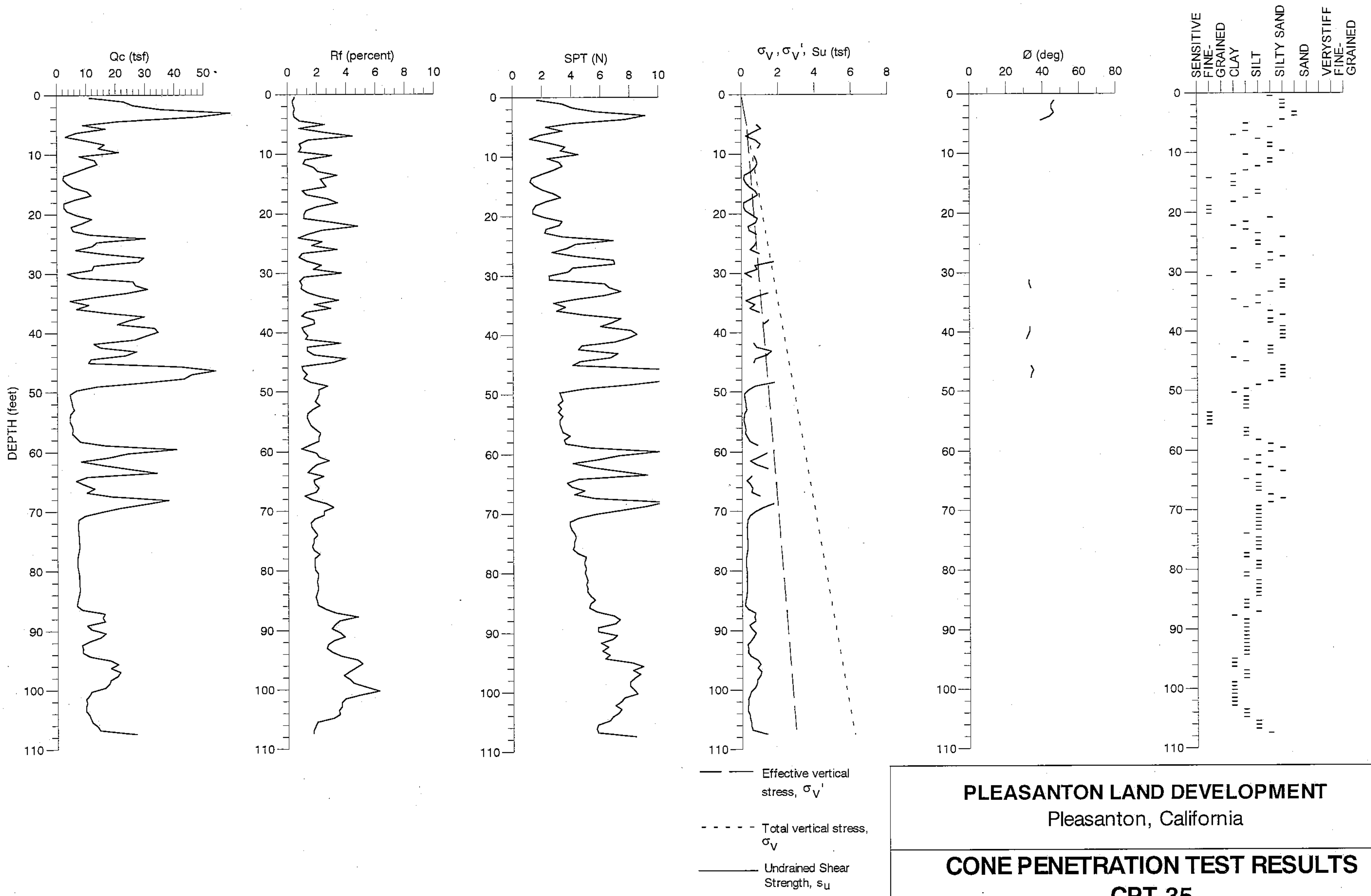
Terminated at 25.6 feet.
Assumed groundwater depth: 5.0 feet.
Date performed: 11/5/08.
Approximate Ground Surface Elevation: 353.7 feet, datum: NGVD 1929.

**PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

## CONE PENETRATION TEST RESULTS
## CPT-34

| | | |
|---|---|---|
| Date 03/16/09 | Project No. 4490.02 | Figure B-34 |

**Treadwell&Rollo**



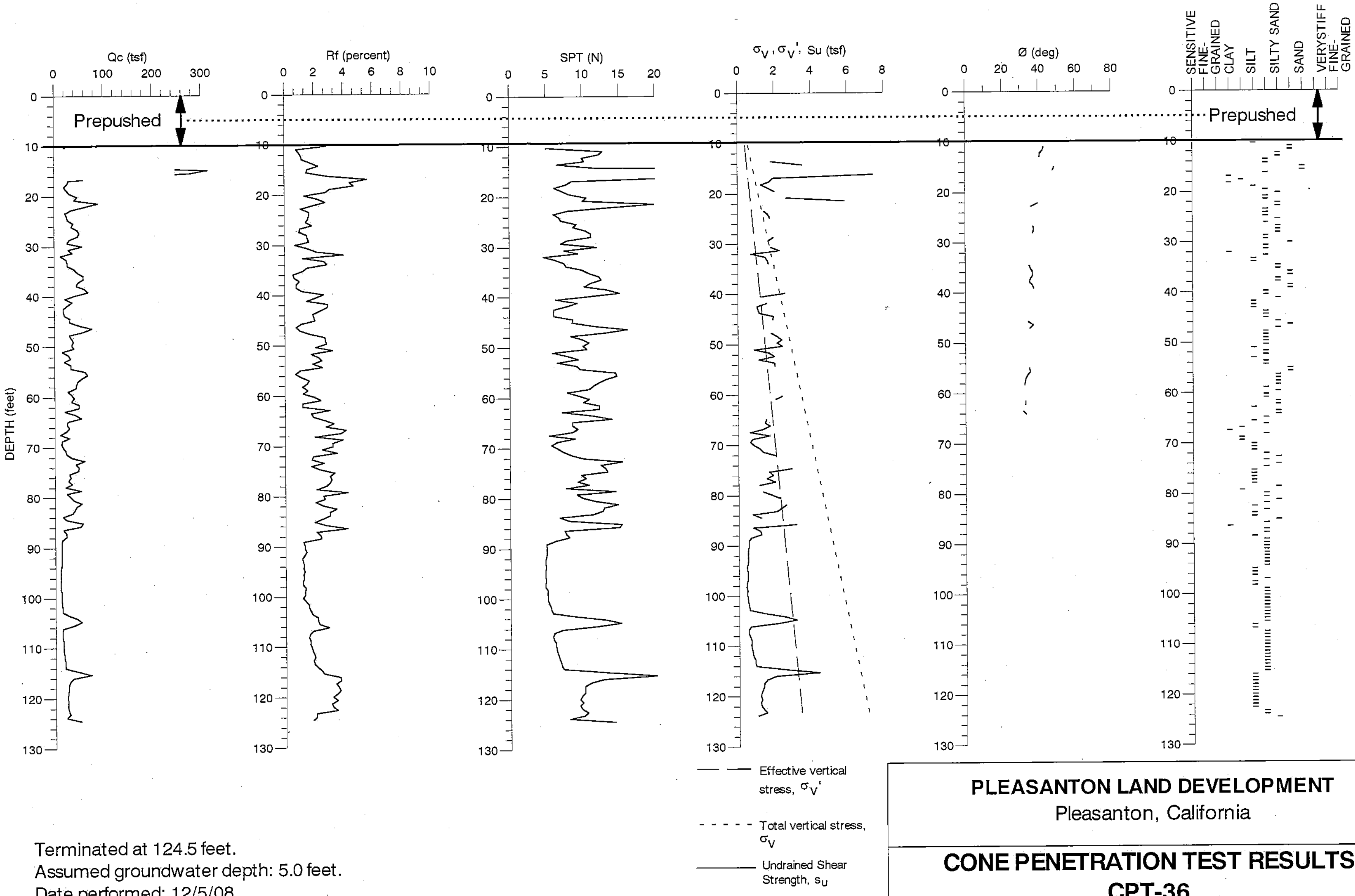
Terminated at 107.5 feet.
Assumed groundwater depth: 5.0 feet.
Date performed: 12/5/08.
Approximate Ground Surface Elevation: 348.2 feet, datum: NGVD 1929.

**PLEASANTON LAND DEVELOPMENT**
Pleasanton, California

## CONE PENETRATION TEST RESULTS
## CPT-35

| Date 03/10/09 | Project No. 4490.02 | Figure B-35 |
|---|---|---|

**Treadwell&Rollo**



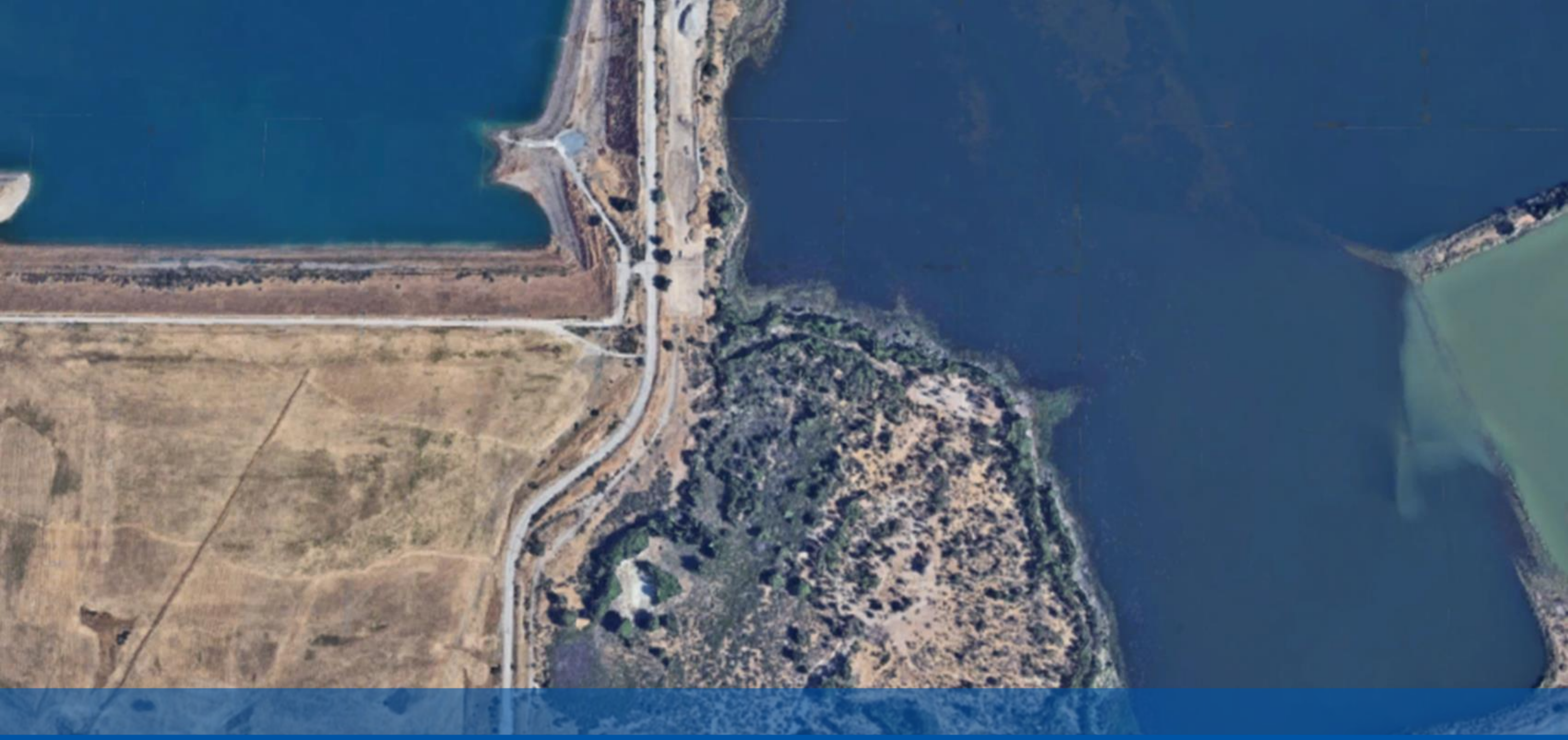
Terminated at 124.5 feet.
Assumed groundwater depth: 5.0 feet.
Date performed: 12/5/08.
Approximate Ground Surface Elevation: 358.2 feet, datum: NGVD 1929.
Dense gravelly material encountered at the ground surface;
CPT was prepushed with a "dummy probe" to a depth of 10 feet.

## PLEASANTON LAND DEVELOPMENT
Pleasanton, California

## CONE PENETRATION TEST RESULTS
## CPT-36

| Date 03/16/09 | Project No. 4490.02 | Figure B-36 |
|---|---|---|

**Treadwell&Rollo**



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