November 9, 2023

San Ramon Valley Fire Protection District
1500 Bollinger Canyon Road
San Ramon, California 94583

Attention: Mr. Chris Parsons | Battalion Chief - Training

Subject: ***Limited Geotechnical Engineering Study***
***Live-Fire Training Facility***
*6100 Camino Tassajara, Pleasanton, California 94588*
*Atlas Proposal No.* ***91-66653-PW***

Dear Mr. Parsons:

Per your authorization, **Atlas Technical Consultants (Atlas)**, has prepared this limited geotechnical engineering study for the proposed new Live-Fire Training Facility project at the Fire District Training Site located at 6100 Camino Tassajara in unincorporated Contra Costa County near Tassajara, California (Pleasanton Address). This report is based on our firm's and staff experience in the specific area, our experience with similar projects with similar subsurface conditions, and the information provided by you. Our work was performed in accordance with our authorized proposal to you for the work dated August 18, 2023.

## Site and Project Description

The site for the new Live-Fire Training Facility is located within the Fire District Training Site at the subject address, as shown on Plate 1, *Site Vicinity Map.* Specifically, the site for the training facility is located at the southwest corner of the property, west of the existing building onsite and south of a water tank, all of which are located on the west side of Camino Tassajara south of Johnston Road in unincorporated Contra Costa County, as shown on Plate 2, *Site Plan*.

Based on the provided information, we understand the project will involve construction of a new three-story training building composed of connected, pre-manufactured and modified, steel Conex boxes with additional exterior balcony and stairway structures, to be located at the existing Live-Fire Training Facility. We further understand that the proposed building would be supported on an approximately 44-foot by 65-foot reinforced concrete pad which would essentially act as a structural mat foundation. The project area is relatively flat, with an approximate average surface elevation of +634 (NAVD 88 Datum), based on elevations shown on the Google Earth Pro application.

According to the provided proprietary plans by Drager dated November 16, 2022, the central container building would be supported by a total of 12 columns with loads ranging from 0.6 to 12.9 kips each, and the exterior balconies would be supported by a total of 10 columns bearing 0.6 kip loads each, all bearing on the structural mat slab.

## Geologic Setting and Seismicity

The subject site is located within the central part of the geologically complex northern Coast Ranges characterized by northwest-trending mountains and intervening valleys shaped by crustal deformation from collision along the Pacific and North American Plate boundary over the past 180 million years. The shallow basin confining the San Francisco Bay waters on the western margin of the Coast Ranges, located approximately 18 miles southwest of the site, is a structural depression (i.e., pull-apart) formed over the past 700,000 years to accommodate right-lateral strike-slip crustal extension between the San Andreas and Hayward-Rodgers Creek Faults both southwest of the site.

Locally, the site is situated within foothills to the south of Mt. Diablo and north of the Livermore Valley, within a narrow, south trending valley formed by Tassajara Creek, which drains into the Livermore Valley. The site is mapped by Dibblee & Minch (2006) as being underlain by Holocene-epoch alluvial surficial sediments (map symbol Qa), consisting of fine-grained alluvium with horizontal stratification, as shown on Plate 3, *Areal Geologic Map*. The site is underlain at depth by late-Miocene to Pliocene-epoch Orinda Formation bedrock generally consisting of interbedded pebble conglomerate, sandstone and claystone, as exposed in the foothills bordering both sides of the valley.

Based on its record of historical earthquakes and its position astride the North American-Pacific plate boundary, the San Francisco Bay region is considered to be one of the more seismically active regions of the world. This seismic activity appears to be largely controlled by displacement between the Pacific and North American crustal plates, separated by the San Andreas Fault zone located approximately 32.5 miles southwest of the site. This plate displacement produced regional strain that is concentrated along the San Andreas Fault and major associated faults. Major active faults include the aforementioned San Andreas Fault; the Calaveras Fault, located approximately 5.5 miles southwest of the site, and the Hayward Fault, located approximately 14 miles southwest of the site. Other nearby active faults include the Greenville-Marsh Creek Fault, located approximately 4.4 miles northeast of the site, and the Concord Fault, the southern end of which is located approximately 14 miles northwest of the site. The site location relative to these and other active and potentially active faults in the greater San Francisco Bay Area region is shown on Plate 4, *Regional Fault Map*.

## Field Exploration

In order to characterize the subsurface conditions in the area of the project footprint, a field exploration program was conducted, which consisted of the drilling of two borings at the locations shown in Plate 2, *Site Plan*, on October 4, 2023, under the responsible charge of a California-registered Geotechnical Engineer. The borings, designated as Borings B-1 and B-2, were drilled to a maximum depth of about 28.5 feet using a B-24 drill rig equipped with a 4-inch diameter, solid-stem auger. Our field engineer visually classified the materials encountered in the boring based on the Unified Soil Classification System as the boring was advanced. Relatively undisturbed soil samples were recovered at selected intervals using a 3-inch outside diameter, Modified California split spoon sampler containing 6-inch long brass liners, and disturbed samples recovered using a 2-inch outside diameter Standard Penetration Test (SPT) sampler. The samplers were driven by means of a 140-pound automatic trip hammer with an approximate 30-inch fall. Resistance to penetration was recorded as the number of hammer blows required to drive the sampler the final foot of an 18-inch drive.

For reporting purposes, all the blow counts recorded using Modified California (MC) split spoon samplers in the field were subsequently converted to equivalent SPT blow counts using appropriate modification factors suggested by Burmister (1948); i.e., multiplied by a factor of 0.65 assuming a liner sample with an inner diameter of 2.5 inches. Therefore, the boring log provided in this report shows equivalent SPT blow counts for the MC sampler in lieu of blow counts recorded in the field. After completion, the boring was backfilled with cement grout. The boring logs, with descriptions of the various materials encountered in the boring and a key to the boring symbols, is attached. The ground surface elevation indicated on the soil boring log was estimated based on Google Earth Pro.

## Laboratory Testing

Laboratory tests were performed on select samples to determine some of the physical and engineering properties of the subsurface soils. The results of the laboratory testing are either attached or found in the boring logs. We performed the following laboratory soil tests for this study:

Moisture Content (ASTM D2216) – In-situ moisture tests were conducted to measure the in-place moisture content of the subsurface materials at the tested sample locations and depths. These properties provide information for evaluating the physical characteristics of the subsurface soil. Test results are shown on the boring logs.

Atterberg Limits (ASTM D4318 and CT204) – Atterberg Limits tests were performed on select samples of cohesive soils encountered at the site. Liquid Limit, Plastic Limit, and Plasticity Index are useful in the classification and characterization of the engineering properties of soil and help to evaluate the expansive characteristics of the soil and determine the USCS soil classification. The test result is attached and presented on the applicable figure and boring log.

Particle Size Analysis (Wet and Dry Sieves) (ASTM D6913 & D1140) – Sieve Analysis or fines content (minus No. 200 sieve) measurements were conducted on select samples to determine the soil particle size distribution. This information is useful for characterizing the soil type according to USCS. The test results are presented on the applicable figure and boring log.

## Subsurface Conditions and Groundwater

During our subsurface exploration program, we investigated the subsurface soils and evaluated soil conditions to a maximum depth of about 28.5 feet as performed for this study. Where explored, the subsurface subgrade soils in our borings consisted of native soils generally consisting of soft to very stiff, lean CLAY with highly variable sand content to the maximum depth explored. The clayey subsurface soils were found to be generally stiff in consistency to a depth of about 10 to 15 feet, underlain by zones of soft to medium stiff clays to the maximum depth of exploration.

Atterberg Limits tests were performed on two samples of the surficial soils encountered in Boring B-1 (at 2.0 foot-depth) and B-2 (at 4.5 foot-depth) resulted in measured Liquid Limits (LL) of 42 and 40, and corresponding Plasticity Indices (PI) of 25 and 25, respectively. Based on these results, the near-surface soils are expected to have a moderate expansion (shrink/swell) potential. Additional details of materials encountered in the exploratory borings, including laboratory test results, are included in the attached boring logs.

Groundwater was encountered in both of our soil borings at a depth of about 14 feet beneath the surface. Groundwater levels can vary in response to time of year, variations in seasonal rainfall, tidal influence, well pumping, irrigation, and alterations to site drainage. Additionally, discontinuous zones of perched water may exist at varying locations and depths beneath the ground surface in an alluvial deposition environment such as at the project site. As a result, groundwater conditions during or after construction may be different than those observed during the field investigation.

## Conclusions and Recommendations

Based on our review of the project details and the results of our field and laboratory investigations, it is our opinion that the site is suitable from a geotechnical perspective for the proposed improvement provided the recommendations of this report are incorporated into the design and implemented during construction. The predominant geotechnical and geological issues that need to be addressed at this site are summarized below.

- Seismic Ground Shaking – The site is located within a seismically active region, and subject to potentially major ground shaking during the life of the structure. As a minimum, the building design should consider the effects of seismic activity in accordance with the latest edition of the California Building Code (CBC).
- Underlying Weak Compressible Soils – Some of the clay soils below a depth of about 10 feet to the maximum depth of exploration were found to be soft to medium stiff in consistency and as a result are relatively weak, and particularly below the groundwater table, are susceptible to consolidation settlement under new structure or fill loads. Such settlements, depending on structure type and design, may potentially be excessive and potentially damaging to structures. The potential for excessive settlements may be controlled by reducing foundation bearing pressures by methods such as increasing the size of footings or spreading out structure loads by using a structural mat foundation. In our opinion, based on the proposed structure design for this project, the underlying supporting slab may be designed as a structural mat foundation to help distribute the discrete column loads across the slab foundation, and due to the relatively low column loads, the reduced average bearing pressures on the slab should result in total settlements tolerable for the type of relatively flexible metal structure proposed for this project.
- Expansive Soils – The near-surface clay soils were found to have a moderate expansion potential, and as such, may be susceptible to seasonal vertical movements (i.e., shrink and swell) in response to changes in moisture content. As such, measures to help mitigate the potential effects of expansive soils are recommended for the design of foundations, including deepening embedment of foundations such as spread footings and structural mats, and placement of a non-expansive fill layer below structural mats and concrete flatwork. Appropriate recommendations for mitigating the effects of surficial expansive soils are presented herein.

Recommendations regarding seismic design parameters, foundations, and earthwork are presented below.

## RECOMMENDATIONS

### Seismic Coefficients

If applicable, the proposed project should be designed to resist the seismic forces generated by earthquake shaking in accordance with the provisions of the 2022 California Building Code (CBC) and local design practice. Based on the subsurface conditions encountered in the borings, our evaluation of the geology of the site, and interpreting the subsurface average conditions of the uppermost 100 feet below the ground surface, we judge Site Class D – *Stiff Soil*, is appropriate for characterizing potential earthquake ground shaking conditions and seismic design considerations for the site, per ASCE/SEI 7-16 (Chapter 20). The geographic coordinates of the site improvements used for analysis were 37.7809 degrees north latitude and 121.8638 degrees west longitude.

Based on ASCE 7-16, Section 11.4.8, a ground motion hazard analysis is required for structures on Site Class “D” with $S_1$ greater than or equal to 0.2 (unless Exceptions are taken). Since the project site is mapped as $S_1$ equal to 0.694, a site-specific ground motion analysis in accordance with CBC 2022 and ASCE 7-16, Section 21.2.1.2, is ordinarily required for the site. However, the following seismic design parameters are provided assuming that Exception No. 2 would be utilized by the designing structural engineer in accordance with ASCE 7-16, Section 11.4.8.

The following values were obtained using the ASCE 7 Hazard Tool seismic hazard mapping website based on the ASCE/SEI 7-16 Standard, as required by the 2022 CBC. However, if the Structural Engineer desires a site-specific ground motion analysis to be performed, we should be contacted to provide such additional services.

**Table 1: Seismic Coefficients Based on 2022 CBC (per ASCE 7-16)**

| Item | Value | 2022 CBC Source[R1] | ASCE 7-16 Table/Plate[R2] |
|---|---|---|---|
| Site Class | D | Table 1613A.3.2 | Table 20.3-1 |
| **Mapped Spectral Response Accelerations**<br>Short Period, $S_S$<br>1-second Period, $S_1$ | 2.082 g<br>0.694 g | | Plate 22-1<br>Plate 22-2 |
| Site Coefficient, $F_a$ | 1.0 | Table 1613A.3.3(1) | Table 11.4-1 |
| Site Coefficient, $F_V$ | 1.7 | Table 1613A.3.3(2) | Table 11.4-2 |
| MCE ($S_{MS}$) | 2.082 g | Equation 16A-37 | Equation 11.4-1 |
| MCE ($S_{M1}$) | 1.180 g | Equation 16A-38 | Equation 11.4-2 |
| **Design Spectral Response Acceleration**<br>Short Period, $S_{DS}$<br>1-second Period, $S_{D1}$ | 1.388 g<br>0.787 g | Equation 16A-39<br>Equation 16A-40 | Equation 11.4-3<br>Equation 11.4-4 |
| Peak Ground Acceleration ($PGA_M$) | 0.947 g | - | Equation 11.8-1 |

R1 California Building Standards Commission (CBSC), "California Building Code," 2022 Edition.
R2 U.S. Seismic "Design Maps" Web Application, https://seismicmaps.org.
R3 $F_V$ value shall be used only for calculation of $T_S$.

ASCE 7-16 § 11.6-1 and 11.6-2 indicate that the Seismic Design Category for all Occupancy Categories is "D".

## Site Grading

### General Grading, Fill Material Requirements and Site Drainage

Site grading is generally anticipated to consist of minor cuts and fills required to establish new site grades as required for the new structural pad, and placement of a non-expansive fill layer for the foundation subgrade per the recommendations presented herein. Imported soil should consist of select (non-expansive) soil having a Plasticity Index of 15 or less, an R-Value greater than 30, and contain sufficient fines so the soil can bind together. Imported materials should be free of environmental contaminants, organic materials and debris, and should not contain rocks or lumps greater than 3 inches in maximum size. Import fill materials should be approved by the Geotechnical Engineer prior to use on site.

Engineered fill materials should be properly moisture conditioned to the minimum moisture contents as indicated in the *Project Compaction Recommendations* and placed in uniform loose lifts not to exceed 8 inches in loose thickness. Smaller lifts may be necessary to achieve the minimum required compaction using lighter weight compaction equipment. It should be noted that the use of on-site soils for fill will require moisture conditioning (drying or wetting). Moisture conditioning may be difficult to achieve during cold, wet periods of the year, or during extreme temperatures and after precipitation events.

Site Preparation

Site grading should be performed in accordance with these recommendations. Prior to commencement of grading activities, areas to receive fill or concrete should be cleared of the existing pavement section, loose soils, debris, and other deleterious materials. Debris resulting from site stripping operations should be removed from the site, unless otherwise permitted by the Geotechnical Engineer.

Excavations resulting from the removal of deleterious materials (for example, old concrete foundations) should be cleaned down to firm soil, the base of the over-excavation moisture conditioned and compacted, and the over-excavation then backfilled using engineered fill in accordance with the grading sections of this report. The Geotechnical Engineer's representative should verify the adequacy of site clearing operations during construction, prior to placement of engineered fill.

Building Pad Grading

To help provide uniform support to the mat foundation slab as well as to reduce potential expansive soil issues, the foundation pad should be underlain by a minimum 6-inch thick non-expansive, aggregate base (baserock) engineered fill layer. This layer should extend a minimum distance of 3 feet beyond the slab perimeter. After clearing and grubbing operations, if required, the pad should be excavated if required for construction of the engineered fill layer. The existing exposed soil in the foundation pad area prior to placement of the baserock layer should be scarified to a depth of 12 inches; moisture conditioned to 3 to 5 percent above optimum moisture content and compacted in accordance with the recommendations presented in the *Project Compaction Recommendations* section of this report. The overlying non-expansive baserock layer should be placed as soon as practical after subgrade grading to protect the subgrade soil from drying. Alternatively, the subgrade should be kept moist by watering until the baserock fill is placed.

Unstable subgrades in smaller, isolated areas can be stabilized by over excavating to a minimum of 18 inches in depth below finished subgrade elevation where competent, stable soils are not encountered. The bottom of the excavation should then be completely covered with a ground stabilization geotextile fabric such as Mirafi 500X, RS380i or equivalent, and typically backfilled with Class 2 aggregate base. Alternatively, with the approval of the Geotechnical Engineer, such areas can be stabilized by over-excavating at least 1 foot, placing Tensar TriAx TX-140 or equivalent geogrid on the soil, and then placing 12 inches of Class 2 baserock on the geogrid. The upper 6 inches of the baserock in either case should be compacted to at least 90 percent relative compaction.

Project Compaction Recommendations

The following table provides recommended compaction requirements for this project. Specific moisture conditioning and relative compaction recommendations will be discussed individually within applicable sections of this report.

**Table 2: Project Compaction Recommendations**

| Description | Min. Percent Relative Compaction | Recommended Minimum Percent Above Optimum Moisture Content |
|---|---|---|
| Engineered Fill (where required) | 90 | 2 |
| Building Pad, Class 2 Baserock (Non-Expansive Fill) | 90 | 2 |
| Building Pad, Subgrade Soil | 90 | 3 |

## Foundations

### Structural Mat Foundation

The proposed training structure can be supported by a structural mat foundation bearing on properly prepared subgrade as described in the *Building Pad Grading* section of this report. Accordingly, the proposed concrete pad shown in the submitted Drager plans should be designed to act as a reinforced concrete structural mat. In addition, to provide relatively even support, the mat foundation should be underlain by a minimum 18-inch thick engineered fill layer, which per our recommendations, would consist of the 6-inch thick baserock layer and the 12-inch thick scarified and recompacted onsite soil layer and/or import engineered fill, depending on the specified design elevation.

Due to the potential for significant site settlement below the structure, bearing pressures would need to be limited. The mat foundation should be designed for the following allowable average bearing pressures, which are based on limiting consolidation settlement, and not based on ultimate bearing pressure due to subgrade failure.

**Table 3: Allowable Average Bearing Pressures for Structural Mat Foundation**

| Load Condition | Allowable Net Bearing Pressure (psf) |
|---|---|
| Dead Load | 300 |
| Dead plus Live Loads | 450 |
| Total Loads (including wind or seismic) | 600 |

If needed for design, an Effective Plasticity Index of 25 may be used. Additionally, the outer perimeter of the slab should also be designed to cantilever a minimum of 3 feet and interior free span a minimum of 8 feet.

Post-construction static settlements of the structural slab under the anticipated loads and designed in accordance with the recommendations presented above are estimated to be on the order of 1 to 2 inches, primarily occurring gradually over one to two years following construction, with maximum differential settlement estimated to be on the order of one-half the total settlement.

Resistance to lateral loads can be provided by friction between the mat foundation bottom and the supporting subgrade. An allowable coefficient of friction of 0.40 between the base of the slab and the underlying baserock layer is recommended.

## Plan Review

We recommend that Atlas be provided the opportunity to review the final project plans prior to construction. The purpose of this review is to assess the general compliance of the plans with the recommendations provided in this report and confirm the incorporation of these recommendations into the project plans and specifications.

## Observation and Testing During Construction

We recommend that Atlas be retained to provide observation and testing services during site preparation, mass grading, foundation excavation, as well as to observe final site drainage. This is to observe compliance with the design concepts, specifications and recommendations, and to allow for possible changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

## LIMITATIONS AND UNIFORMITY OF CONDITIONS

The recommendations of this report are based upon the soil and conditions encountered in the exploratory soil borings. If variations or undesirable conditions are encountered during construction, we should be contacted so that supplemental recommendations may be provided.

This report is issued with the understanding that it is the responsibility of the owner or his representatives to see that the information and recommendations contained herein are called to the attention of the other members of the design team and incorporated into the plans and specifications, and that the necessary steps are taken to see that the recommendations are implemented during construction.

Recommendations are presented in this report which specifically request that Atlas be provided the opportunity to review the project plans prior to construction and that we be retained to provide observation and testing services during construction. The validity of the recommendations of this report assumes that Atlas will be retained to provide these services.

This report was prepared upon your request for our services, and in accordance with currently accepted, local and current geotechnical engineering practice. No warranty based on the contents of this report is intended, and none shall be inferred from the statements or opinions expressed herein.

Should you or members of the design team have questions or need additional information, please contact Mr. Corey Dare at corey.dare@oneatlas.com. We greatly appreciate the opportunity to be of service to you.

Respectfully submitted,

**ATLAS TECHNICAL CONSULTANTS LLC**

Nick Anastasio, PE
Project Engineer

Corey T. Dare, PE, GE
Principal Geotechnical Engineer

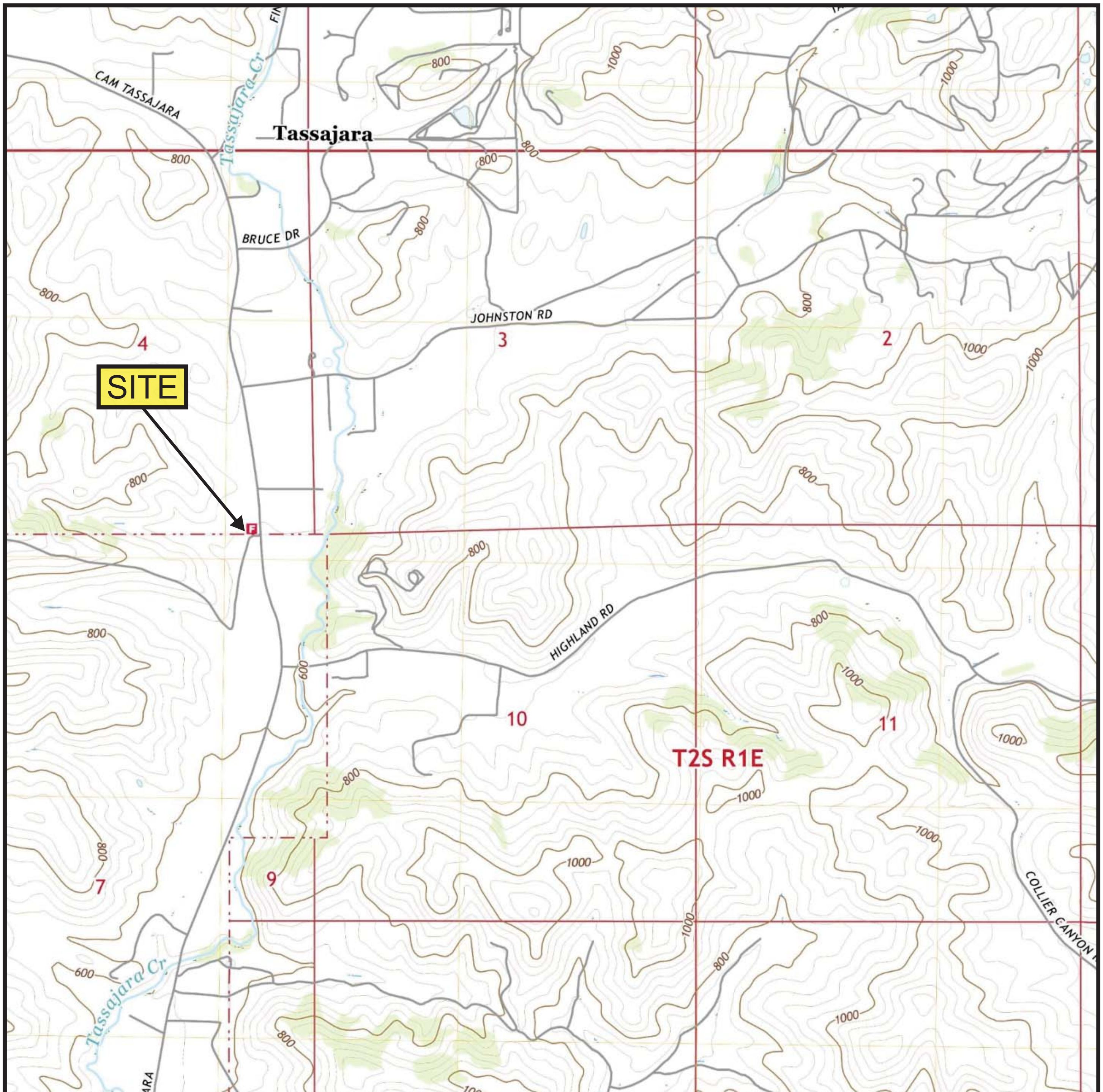
REGISTERED PROFESSIONAL ENGINEER
COREY T. DARE
No. 2013
Exp. 06-30-2024
GEOTECHNICAL
STATE OF CALIFORNIA

Attachments:
- Plate 1 – Vicinity Map
- Plate 2 – Site Plan
- Plate 3 – Areal Geologic Map
- Plate 4 – Regional Fault Map
- Key to Exploratory Boring Logs
- Log of Borings B-1 and B-2
- Laboratory Test Results (Atterberg Limits Test Report + Grain Size Distribution Report)

Distribution: PDF to Addressee; CParsons@srvfire.ca.gov

NAA/CTD:pmf

# EXHIBIT C




N

2000 ft.

Scale

Contour interval = 40’

U.S.G.S. (2021)

| ATLAS | Job No.: 91-66653-PW<br>Approved: NAA<br>Date: 11.3.2023 | **VICINITY MAP**<br>Live-Fire Training Facility<br>6100 Camino Tassajara<br>Unincorporated Country Costa County, California | **Plate**<br>1 |
|---|---|---|---|

# EXHIBIT C


**EXPLANATION**

B1 ⊕ - Approximate Boring Location

- Proposed Improvement Location

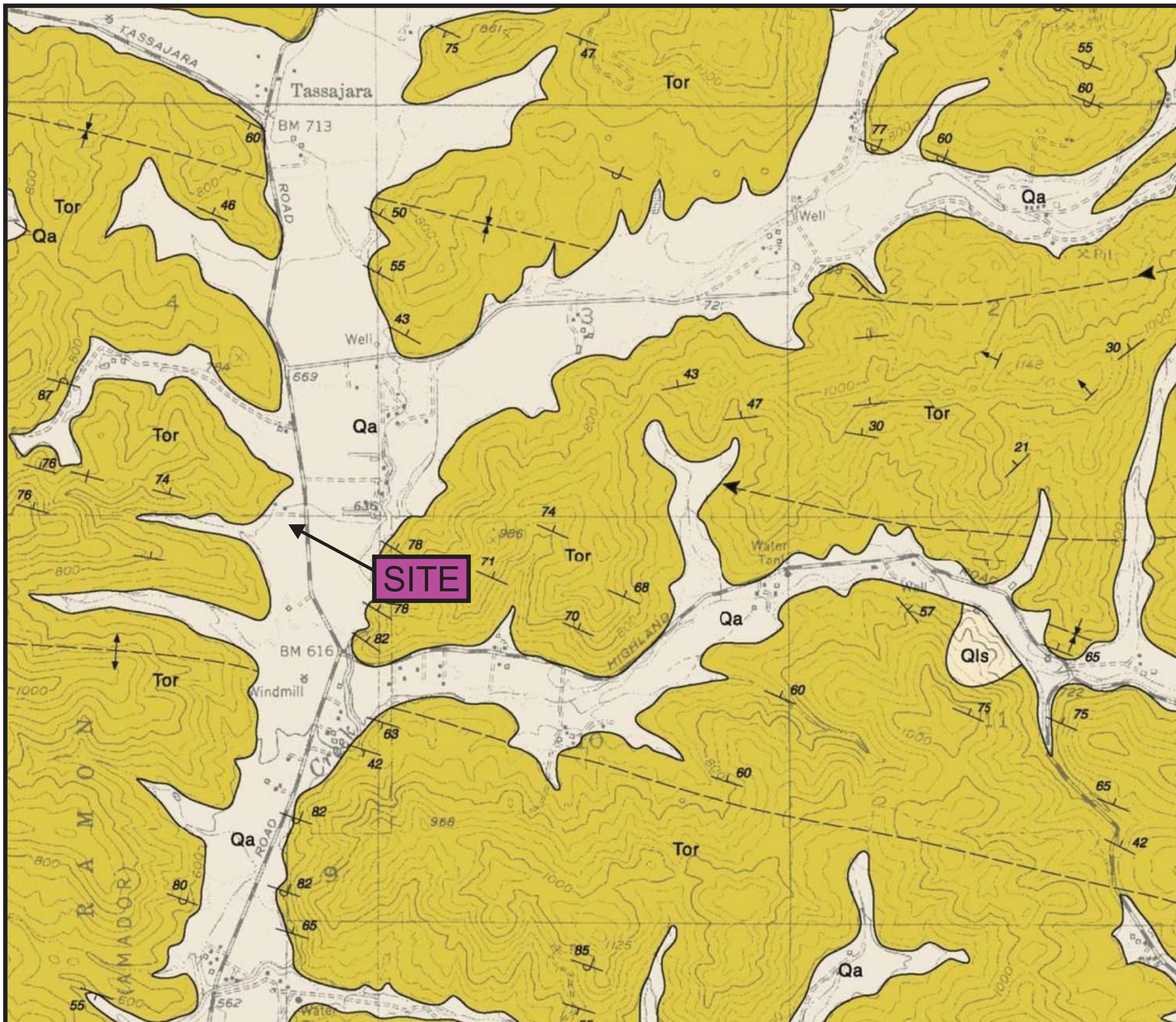
N

60 ft.
Scale

Google Earth Data (2023)

| ATLAS | Job No.: 91-66653-PW<br>Approved: NAA<br>Date: 11.3.2023 | **Site Plan**<br>Live-Fire Training Facility<br>6100 Camino Tassajara<br>Unincorporated Country Costa County, California | **Plate**<br>2 |
|---|---|---|---|

**EXHIBIT C**




## EXPLANATION

### Units

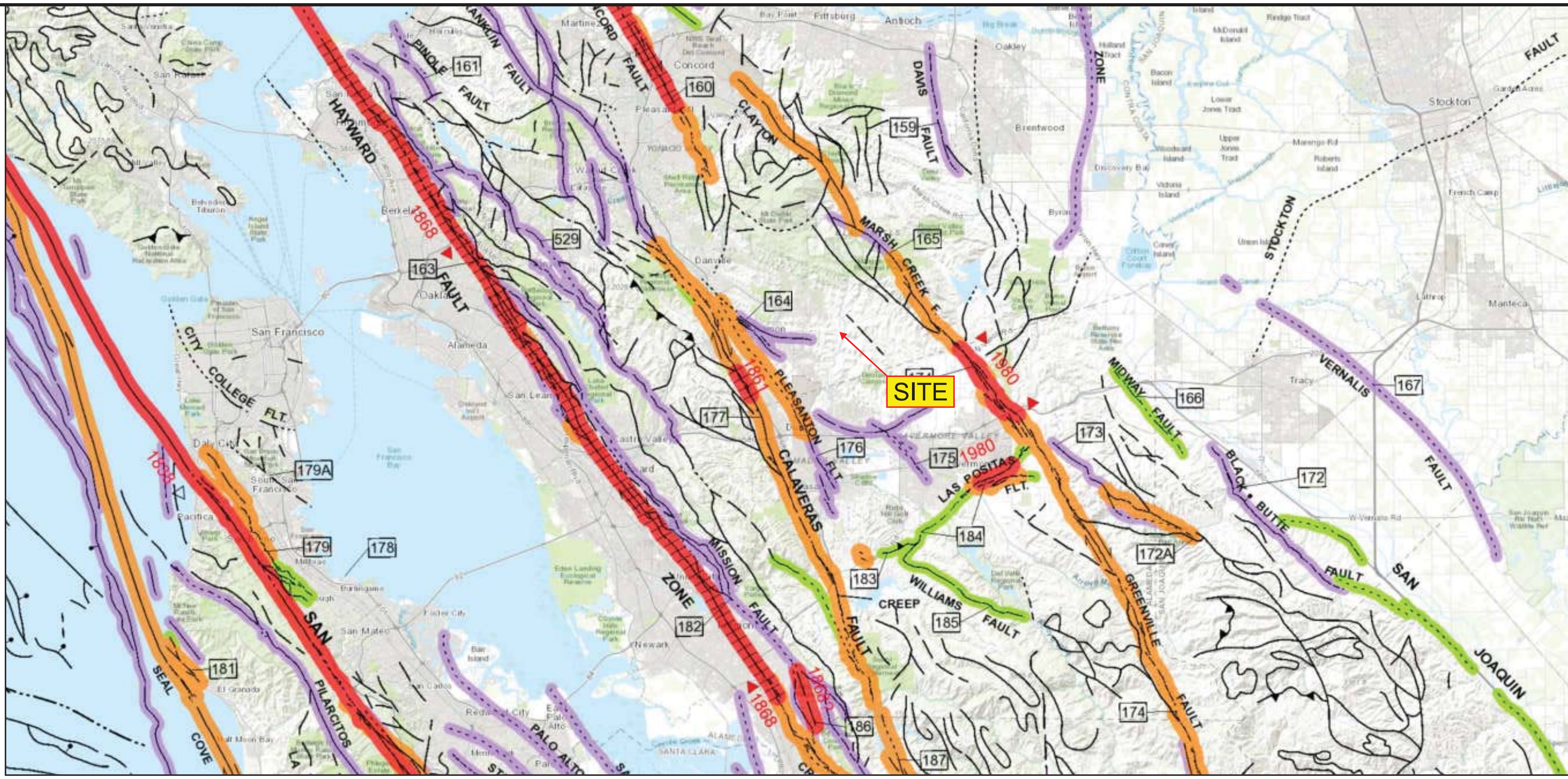
**Qa** Alluvial Surficial Sediments (Holocene)
**Qls** Landslide Rubble (Holocene)
**Tor** Orinda Formation (Pliocene)

N

2000 ft.
Scale
Contour interval = 40 meters
Dibblee & Minch (2006)

| | | | |
|---|---|---|---|
| ATLAS | **Job No.:** 91-66653-PW<br>**Approved:** NAA<br>**Date:** 11.3.2023 | **AREAL GEOLOGIC MAP**<br>Live-Fire Training Facility<br>6100 Camino Tassajara<br>Unincorporated Country Costa County, California | **Plate**<br>3 |

# EXHIBIT C




EXPLANATION

Fault Areas
- Class B
- historic
- late Quaternary
- latest Quaternary
- middle and late Quaternary

National Database
- Historic (< 150 years), well constrained location
- Historic (< 150 years), moderately constrained location
- Historic (< 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
- Late Quaternary (< 130,000 years), well constrained location
- Late Quaternary (< 130,000 years), moderately contrained 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

N

6 miles
Scale

National Geographics, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, MRCAN, BEBCO, NOAA, increment P Corp.

| ATLAS | Job No.: 91-66653-PW<br>Approved: NAA<br>Date: 11.3.2023 | **REGIONAL FAULT MAP**<br>Live-Fire Training Facility<br>6100 Camino Tassajara<br>Unincorporated Country Costa County, California | **Plate**<br>4 |
|---|---|---|---|

# EXHIBIT C

## UNIFIED SOIL CLASSIFICATION (ASTM D-2487)

| Material Types | Criteria for Assigning Soil Group Names | | | Group Symbol | Soil Group Names | Legend |
|---|---|---|---|---|---|---|
| Coarse Grained Soils >50% Retained on No. 200 Sieve | Gravels >50% of Coarse Fraction Retained on No. 4 Sieve | Clean Gravels <5% Fines | Cu≥4 and 1≤Cc≤3 | GW | Well-Graded Gravel | |
| | | | Cu<4 and/or [Cc<1 or Cc>3] | GP | Poorly-Graded Gravel | |
| | | Gravels with Fines >12% Fines | Fines Classify as ML or MH | GM | Silty Gravel | |
| | | | Fines Classify as CL or CH | GC | Clayey Gravel | |
| | Sands ≥50% of Coarse Fraction Passes on No. 4 Sieve | Clean Sands <5% Fines | Cu≥6 and 1≤Cc≤3 | SW | Well-Graded Sand | |
| | | | Cu<6 and/or [Cc<1 or Cc>3] | SP | Poorly-Graded Sand | |
| | | Sands and Fines >12% Fines | Fines Classify as ML or MH | SM | Silty Sand | |
| | | | Fines Classify as CL or CH | SC | Clayey Sand | |
| Fine Grained Soils ≥50% Passes No. 200 Sieve | Silts and Clays Liquid Limits<50 | Inorganic | PI>7 and Plots≥"A" Line | CL | Lean Clay | |
| | | | PI>4 and Plots<"A" Line | ML | Silt | |
| | | Organic | LL (Oven Dried)/LL(not Dried <0.75) | OL | Organic Silt | |
| | Silts and Clays Liquid Limits≥50 | Inorganic | PI Plots≥"A" Line | CH | Fat Clay | |
| | | | PI Plots<"A" Line | MH | Elastic Silt | |
| | | Organic | LL (Oven Dried)/LL(Not Dried <0.75) | OH | Organic Clay | |
| Highly Organic Soils | | Primarily Organic Matter, Dark in Color and Organic Odor | | PT | Peat | |

### PENETRATION RESISTANCE (RECORDED AS BLOWS/0.5 FEET)

| SAND AND GRAVEL | | SILT AND CLAY | | |
|---|---|---|---|---|
| RELATIVE DENSITY | N-VALUE (BLOWS/FOOT)* | CONSISTENCY | N-VALUE (BLOWS/FOOT)* | COMPRESSIVE STRENGTH |
| Very Loose | 0 - 3 | Very Soft | 0 - 1 | 0 - 0.25 |
| Loose | 4 - 10 | Soft | 2 - 4 | 0.25 - 0.50 |
| Medium Dense | 11 - 29 | Medium Stiff | 5 - 7 | 0.50 - 1.0 |
| Dense | 30 - 49 | Stiff | 8 - 14 | 1.0 - 2.0 |
| Very Dense | 50+ | Very Stiff | 15 - 29 | 2.0 - 4.0 |
| | | Hard | 30+ | Over 4.0 |

### SOIL MOISTURE

| DESCRIPTOR | DESCRIPTION |
|---|---|
| Dry | Dry of Standard Proctor Optimum |
| Damp | Sand Dry |
| Moist | Near Standard Proctor Optimum |
| Wet | Wet of Standard Proctor Optimum |
| Saturated | Free Water in Sample |

### PARTICLES SIZES

| COMPONENTS | | SIZE OR SIEVE NUMBER |
|---|---|---|
| Boulders | | Over 12 Inches |
| Cobbles | | 3 to 12 inches |
| Gravels | -Coarse | 3/4 to 3 Inches |
| | -Fine | Number 4 to 3/4 Inch |
| Sand | -Coarse | Number 10 to Number 4 |
| | -Medium | Number 40 to Number 10 |
| | -Fine | Number 200 to Number 40 |
| Fines (Silt and Clay) | | Below Number 200 |

Grab Bulk Sample

Standard Penetration Test

2.5 Inch Modified California

Shelby Tube

No Recovery

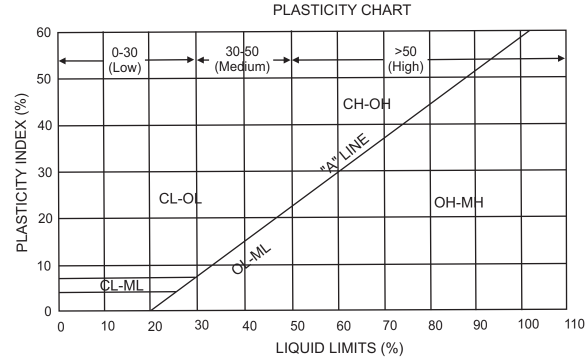
Initial Water Level Reading

Final Water Level Reading

**Blow Count**
The number of blows of the sampling hammer required to drive the sampler through each of three 6-inch increments. Less than three increments may be reported if more than 50 blows are counted for any increment. The notation 50/5" indicates 50 blows recorded for 5 inches of penetration.

**N-Value**
Number of blows 140 LB hammer falling 30 inches to drive a 2 inch outside diameter (1-3/8 inch I.D) split barrel sampler the last 12 inches of an 18 inch drive (ASTM-1586 Standard Penetration Test)

PLASTICITY CHART




CU -Consolidated Undrained triaxial test completed. Refer to laboratory results
DS - Results of Direct Shear test in terms of total cohesion (C, KSF) or effective cohesion and friction angles (C', KSF and degrees)
LL - Liquid Limit
PI - Plasticity Index
PP - Pocket Penetrometer test
TV - Torvane Shear Test results in terms of undrained shear strength (KSF)
UC - Unconfined Compression test results in terms of undrained shear strength (KSF)
#200 - Percent passing number 200 sieve
Cu - Coefficient of Uniformity
Cc - Coefficient of Concavity

**General Notes**

1. The boring locations were determined by pacing, sighting and/or measuring from site features. Locations are approximate. Elevations of borings (if included) were determined by interpolation between plan contours or from another source that will be identified in the report or on the project site plan. The location and elevation of borings should be considered accurate only to the degree implied by the method used.

2. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.

3. Water level readings in the drill holes were recorded at time and under conditions stated on the boring logs. This data has been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, tides, temperature and other factors at the time measurements were made.

4. The boring logs and attached data should only be used in accordance with the report.

ATLAS

# KEY TO EXPLORATORY BORING LOGS

# EXHIBIT C

## BORING NUMBER B-1



**CLIENT** San Ramon Valley Fire Protection District
**PROJECT NAME** Live-Fire Training Facility
**PROJECT NUMBER** 91-66653
**PROJECT LOCATION** 6100 Camino Tassajara,Pleasanton,California 94588
**DATE STARTED** 10/4/23 **COMPLETED** 10/4/23
**GROUND ELEVATION** 633 ft **HOLE SIZE** 4"
**DRILLING CONTRACTOR** California GeoTech
**GROUND WATER LEVELS:**
**DRILLING METHOD** Solid Flight B-24
▽ **AT TIME OF DRILLING** 18.50 ft / Elev 614.50 ft
**LOGGED BY** BB **CHECKED BY** NAA
▼ **AT END OF DRILLING** 14.00 ft / Elev 619.00 ft
**NOTES** Elevations Based on Google Earth
**AFTER DRILLING** ---

| DEPTH (ft) | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | Penetration Rate (sec./ft.) | SPT BLOW COUNTS (N VALUE) | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | MOISTURE CONTENT (%) | ATTERBERG LIMITS: LIQUID LIMIT | ATTERBERG LIMITS: PLASTIC LIMIT | ATTERBERG LIMITS: PLASTICITY INDEX | FINES CONTENT (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | **AC 4"** : | | | | | | | | | | |
| | **AB 8"** : | | | | | | | | | | |
| | (CL) **LEAN CLAY w/ SAND** : Stiff, black, moist. | MC 1-1 | | 5-6-7 (13) | 2.2 | 96 | 22 | 42 | 17 | 25 | 77 |
| 5 | Color becomes brown. | MC 1-2 | | 3-5-6 (11) | 2.7 | 103 | 20 | | | | |
| | | MC 1-3 | | 2-3-5 (8) | 2.4 | 101 | 20 | | | | |
| 10 | Sand content increases, becomes **SANDY CLAY**. | MC 1-4 | | 3-3-5 (8) | 1.6 | 96 | 24 | | | | 57 |
| 15 | ▼ Sand content decreases, becomes **LEAN CLAY w/ SAND**, wet. | MC 1-5 | | 3-5-5 (10) | 1.5 | | | | | | |
| 20 | ▽ Sand content increases, becomes **SANDY CLAY**, medium stiff, saturated. | SPT 1-6 | | 2-3-2 (5) | | | | | | | |
| | Fines content increases. | SPT 1-7 | | 2-2-3 (5) | | | | | | | |
| 25 | | SPT 1-8 | | 3-3-3 (6) | | | | | | | |
| | (CL) **LEAN CLAY** : Medium stiff, brown, saturated, w/ trace sand. | SPT 1-9 | | 4-3-4 (7) | 0.20 | | | | | | |

Becomes grey, wet, w/ no discernible sand content.
Bottom of borehole at 28.5 feet.

# EXHIBIT C

## BORING NUMBER B-2



ATLAS

**CLIENT** San Ramon Valley Fire Protection District
**PROJECT NAME** Live-Fire Training Facility
**PROJECT NUMBER** 91-66653
**PROJECT LOCATION** 6100 Camino Tassajara,Pleasanton,California 94588
**DATE STARTED** 10/4/23 **COMPLETED** 10/4/23
**GROUND ELEVATION** 633 ft **HOLE SIZE** 4"
**DRILLING CONTRACTOR** California GeoTech
**GROUND WATER LEVELS:**
**DRILLING METHOD** Solid Flight B-24
▽ **AT TIME OF DRILLING** 18.00 ft / Elev 615.00 ft
**LOGGED BY** BB **CHECKED BY** NAA
▼ **AT END OF DRILLING** 14.00 ft / Elev 619.00 ft
**NOTES** Elevations Based on Google Earth
**AFTER DRILLING** ---

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | Penetration Rate (sec./ft.) | SPT BLOW COUNTS (N VALUE) | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | MOISTURE CONTENT (%) | ATTERBERG LIMITS: LIQUID LIMIT | PLASTIC LIMIT | PLASTICITY INDEX | FINES CONTENT (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | **Gravel 4"** : | | | | | | | | | | |
| | | (CL) **LEAN CLAY w/ SAND** : Stiff, black, dry. | MC 2-1 | | 6-7-7 (14) | 4.5 | 101 | 15 | | | | |
| 5 | | Sand content increases, becomes **SANDY LEAN CLAY**, very stiff, brown. | MC 2-2 | | 6-8-7 (15) | 4.5 | 109 | 15 | 40 | 15 | 25 | 57 |
| | | Sand content decreases, becomes **LEAN CLAY w/ SAND**, stiff, moist, mottled yellow, brown and grey. | MC 2-3 | | 3-3-5 (8) | 2.5 | | | | | | |
| 10 | | Sand content increases, becomes **SANDY LEAN CLAY**, very moist. | MC 2-4 | | 3-3-5 (8) | 2.2 | 100 | 18 | | | | |
| | | Sand content decreases, becomes **LEAN CLAY w/ TRACE SAND**, medium stiff, moist, mottled brown, yellow and black. | MC 2-5 | | 3-3-3 (6) | 0.60 | | | | | | |
| 15 | ▼ | Sand content increases, becomes **LEAN CLAY w/ SAND**, stiff, wet, brown and grey. | MC 2-6 | | 3-4-5 (9) | 0.70 | | 30 | | | | 77 |
| | | Sand content increases, becomes **SANDY LEAN CLAY**, soft, brown, saturated | SPT 2-7 | | 2-2-2 (4) | | | 24 | | | | |
| 20 | ▽ | Becomes medium stiff. | SPT 2-8 | | 3-2-3 (5) | 0.10 | | | | | | |
| 25 | | Becomes soft. | SPT 2-9 | | 2-1-2 (3) | | | | | | | |

Bottom of borehole at 25.0 feet.

EXHIBIT C

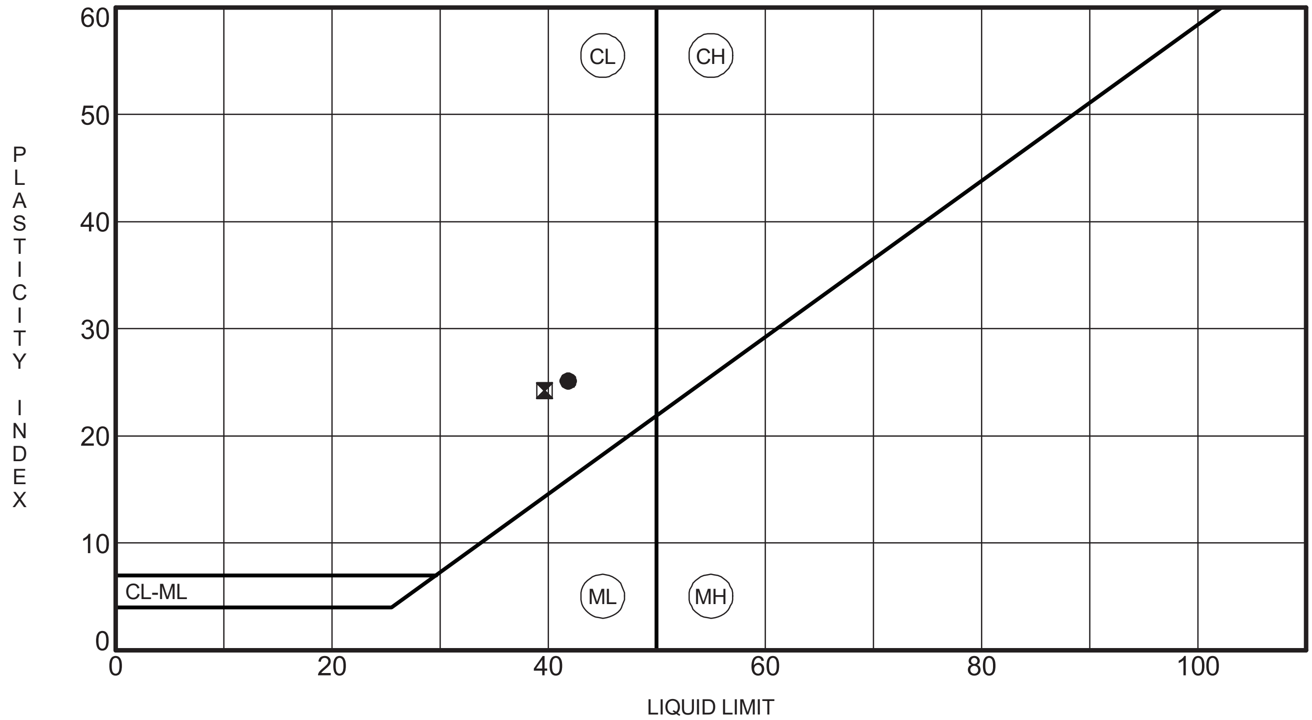
# ATTERBERG LIMITS RESULTS

**CLIENT** San Ramon Valley Fire Protection District

**PROJECT NAME** Live-Fire Training Facility

**PROJECT NUMBER** 91-66653

**PROJECT LOCATION** 6100 Camino Tassajara,Pleasanton,California 94588




| | Specimen Identification | | LL | PL | PI | Fines | Classification |
|---|---|---|---|---|---|---|---|
| ● | **B-1** | **2.0** | **42** | **17** | **25** | **77** | **LEAN CLAY with SAND(CL)** |
| ⊠ | **B-2** | **4.5** | **40** | **15** | **25** | **57** | **SANDY LEAN CLAY(CL)** |

# EXHIBIT C

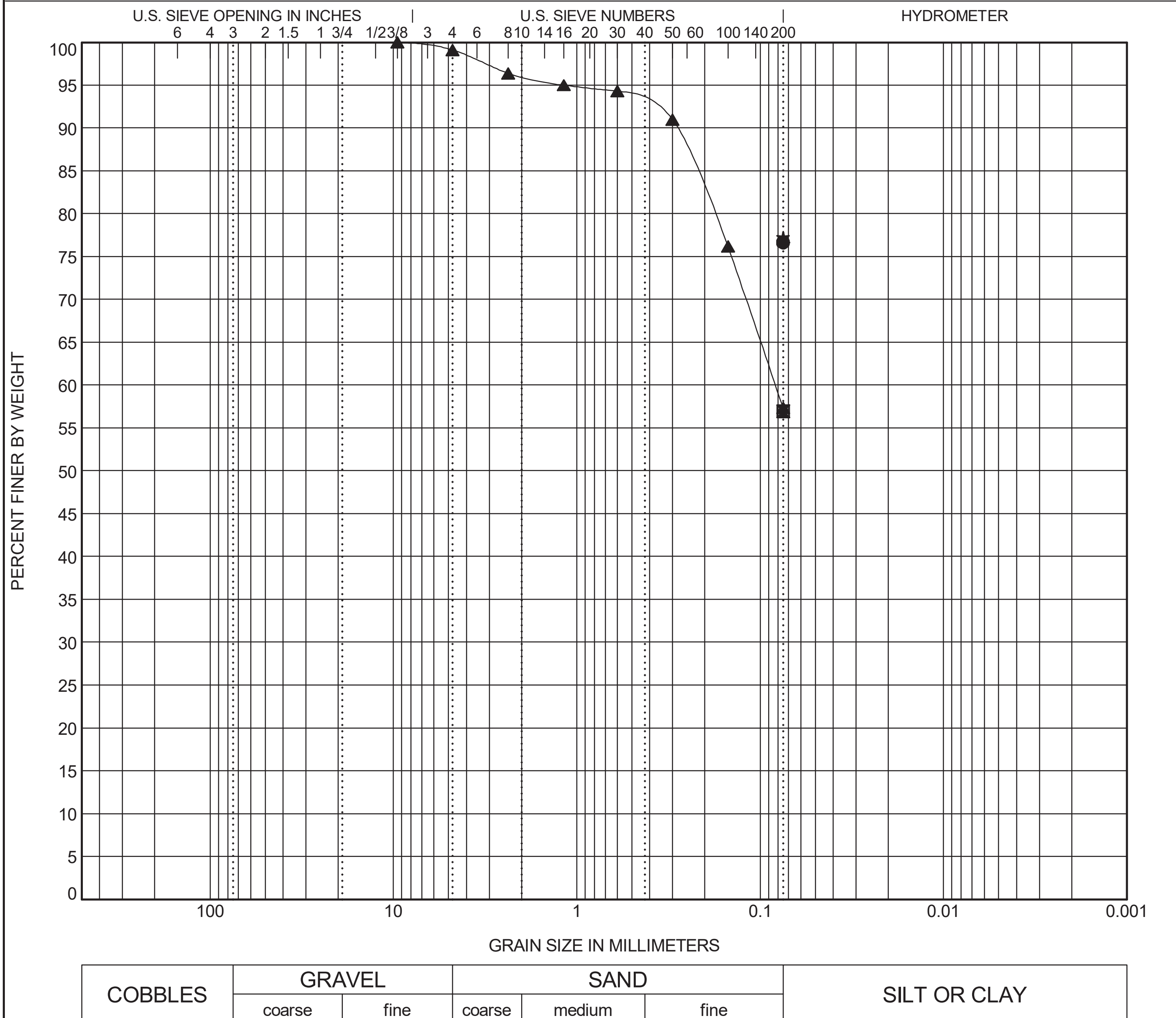
## GRAIN SIZE DISTRIBUTION

**CLIENT** San Ramon Valley Fire Protection District

**PROJECT NAME** Live-Fire Training Facility

**PROJECT NUMBER** 91-66653

**PROJECT LOCATION** 6100 Camino Tassajara,Pleasanton,California 94588




| Specimen Identification | | | Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | **B-1** | **2.0** | **LEAN CLAY with SAND(CL)** | **42** | **17** | **25** | | |
| ⊠ | **B-1** | **9.5** | **SANDY LEAN CLAY(CL)** | | | | | |
| ▲ | **B-2** | **4.5** | **SANDY LEAN CLAY(CL)** | **40** | **15** | **25** | | |
| ★ | **B-2** | **14.5** | **LEAN CLAY with SAND(CL)** | | | | | |
| | | | | | | | | |

| Specimen Identification | | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | **B-1** | **2.0** | **0.075** | | | | | | **76.6** | |
| ⊠ | **B-1** | **9.5** | **0.075** | | | | | | **57.0** | |
| ▲ | **B-2** | **4.5** | **9.5** | **0.083** | | | **0.9** | **41.8** | **57.3** | |
| ★ | **B-2** | **14.5** | **0.075** | | | | | | **77.3** | |
| | | | | | | | | | | |