Kimball High School Two-Story Classroom Building

Geotechnical Engineering and Geologic Hazard Report

Tracy, San Joaquin County, California

December 18, 2025 | Terracon Project No. NA255078

Prepared for:

Tracy Unified School District
1875 W Lowell Avenue
Tracy, CA 95376

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December 18, 2025

Tracy Unified School District
1875 W Lowell Avenue
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Attn: Eloy Vento
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Re: Geotechnical Engineering and Geologic Hazard Report
Kimball High School Two-Story Classroom Building
3200 Jaguar Run
Tracy, San Joaquin County, California
Terracon Project No. NA255078

Dear Mr. Vento:

We have completed the scope of Geotechnical Engineering and Geologic Hazard services for the referenced project in general accordance with Terracon Proposal No. PNA255078 dated September 5, 2025. This report presents the findings of the subsurface exploration and provides a geologic hazard evaluation of the site and presents geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon

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Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the terracon logo will bring you back to this page. For more interactive features, please view your project online at **client.terracon.com**.

Refer to each individual Attachment for a listing of contents.

Report Summary

Topic [1]	Overview Statement [2]
Project Description	The project includes a two-story modular classroom building with surrounding flatwork and landscaping.
Geotechnical Characterization	Subsurface soil encountered in our soil borings and Cone Penetration Test sounding (CPT) generally consisted of interbedded layers of medium stiff to very stiff lean clay and loose to medium dense sand with various amounts of clay and gravel to the maximum depth explored of 51½ feet below the existing ground surface (bgs) in our borings, and 85½ feet bgs in our CPT. Groundwater measured in our CPT and boring B1 at a depth of approximately 24½ feet bgs at the time the CPT and borings were advanced. Regionally, a nearby groundwater monitoring well recorded a historically high groundwater level of approximately 19 feet based on data obtained from the California Department of Water Resources water data library.
Earthwork	Preliminary grading plans were not available for review at the time this report was prepared. We have assumed site grades will generally remain the same as existing at the time this report was prepared. Cuts and fills on the order of 2 feet or less are anticipated to be required to develop final grades. Near surface on-site soils are expansive and <u>may not</u> be reused as structural fill unless chemically stabilized with high calcium quicklime. Grading should be conducted in accordance with the Earthwork section of this report.
Shallow Foundations	Shallow foundations are recommended for building support. Allowable bearing pressure = 2,000 psf Expected settlements: < 1-inch total, < ½-inch differential
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a pdf, the topics in the table can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering and Geologic Hazard services performed for the proposed two-story classroom building to be located at 3200 Jaguar Run in Tracy, San Joaquin County, California. The purpose of these services was to evaluate the risk of geologic hazards impacting the site and provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Seismic site classification per the 2022 California Building Code (CBC)
- Site preparation and earthwork
- Foundation design and construction
- Floor slab design and construction
- Liquefaction potential
- Corrosivity results

The geotechnical engineering Scope of Services for this project included the advancement of test borings, laboratory testing, engineering analysis, and preparation of this report.

Drawings showing the site and boring locations are shown on the **Site Location** and **Exploration Plan**, respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs and/or as separate graphs in the **Exploration and Laboratory Results** section.

Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	An email request for proposal was provided by Melissa Szpik of StudioW Architects on April 30, 2025. The request included a conceptual design of the planned development, dated March 3, 2025.
Project Description	The project includes a two-story modular classroom building with surrounding flatwork and landscaping.

Item	Description
Proposed Structure	The structure associated with the project includes an approximately 7,000 square foot two-story classroom building.
Building Construction	We anticipate construction will consist of steel framing with fiber cement or cement plaster siding.
Finished Floor Elevation	We have assumed the planned finished floor elevation of the proposed building is not more than 2 feet below/above existing grade.
Maximum Loads	Anticipated structural loads were not provided. In the absence of information provided by the design team, we used the following loads in estimating settlement based on our experience with similar projects. ▪ Columns: 80 kips ▪ Walls: 4 kips per linear foot (klf) ▪ Slabs: 150 pounds per square foot (psf)
Grading	We have assumed less than 2 feet of cut or fill will be required to develop final grades, excluding remedial grading requirements.
Building Code	2022 CBC

Terracon should be notified if any of this information is inconsistent with the planned construction, especially the grading limits, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at 3200 Jaguar Run in Tracy, San Joaquin County, California. Assessor Parcel Number (APN): 240-04-004 Latitude/Longitude (approximate): 37.7321°N, 121.4729°W See **Site Location**
Existing Improvements	The site is an existing high school with classrooms and other supporting buildings.

Item	Description
Current Ground Cover	The current ground cover consists of a manicured lawn.
Existing Topography	The property is relatively flat based on a review of Google Earth and observations made during our field exploration.

Geotechnical Characterization

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting, and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in **Exploration and Laboratory Results** and the GeoModel can be found in the **Figures** attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	**Lean Clay**	Medium stiff to very stiff lean clay with varying amounts of sand
2	**Clayey Sand**	Medium dense clayey sand
3	**Poorly Graded Sand**	Loose to medium dense poorly graded sand with varying amounts of clay and gravel

Practical refusal was encountered in the CPT at about 85½ feet bgs. Refusal is defined as the depth below the ground surface at which a CPT can longer be advanced. Refusal is subjective and is based on the type of probing equipment used and the effort exerted by the CPT operator.

Additional borings, auger probes, test pits, or geophysical testing could be performed to obtain more specific subgrade information.

Groundwater Conditions

The boreholes were observed while drilling and after completion for the presence and level of groundwater. Pore pressure dissipation tests were also performed in the CPT to help determine groundwater levels. The water levels observed in the boreholes and CPTs

can be found on the boring/CPT logs in **Exploration and Laboratory Results** section of this report and are summarized in the following table.

Boring/CPT Number	Approximate Depth to Groundwater while Drilling[1] (feet)	Approximate Depth to Groundwater immediately after Drilling[1] (feet)
B1	30	24.6
CPT-01	24.4	-

1. Below ground surface.

Since the borings were backfilled relatively soon after completion, the water levels summarized in the table for the borings are not stable groundwater levels. Due to the low permeability of soils encountered in the borings, a relatively long period may be necessary for a groundwater level to develop and stabilize in a borehole. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels in materials of this type. Long-term groundwater monitoring was outside the scope of services for this project. Terracon is experienced in installing groundwater monitoring wells/piezometers to provide more groundwater data prior to construction if required.

Groundwater conditions may be different at the time of construction. Nearby wells recorded by the California Department of Water Resources were researched for area groundwater levels. State Well No. 02S04E25J001M [1], located approximately ½ mile southwest of the site, indicated a groundwater depth of 19.2 feet bgs in October 1964. The elevations of the monitoring well and the project site are approximately the same. Therefore, we have interpreted the historical high groundwater depth of 19.2 feet bgs to be used for design at the project site.

Groundwater conditions may change because of seasonal variations in rainfall, runoff, and other conditions not apparent at the time the borings and CPTs were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring/CPT logs. The

[1] **https://wdl.water.ca.gov/WaterDataLibrary/GroundwaterBrowseData.aspx?LocalWellNumber=&StationId=3003&StateWellNumber=02S04E25J001M&SelectedCounties=&SiteCode=377277N1214775W001&SelectedGWBasins=**

possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

Geologic Setting

The site lies within the Great Valley geomorphic province of California. The Great Valley is an approximately 50-mile wide and 400-mile-long trough located between the topographic highlands of the Sierra Nevada to the east and the Coast Ranges to the west[1]. The Great Valley was formed during the Jurassic Era (~150 million years ago) shortly after initial uplift of the Sierra batholith and has accumulated sediment continuously since then. The basin broadly has accumulated sediments consisting of (1) alluvium and basin fill deposited throughout the Cenozoic Era and (2) shallow marine deposits of the Great Valley Sequence which have since lithified; both of which overlie deep basaltic basement rock[2]. The province is drained primarily by two rivers; the Sacramento River on the north side of the basin and the San Joaquin River on the south side, both of which eventually flow into the delta and the San Francisco Bay.

According to the U.S. Geological Survey, the site is located within the Tracy 7.5-minute quadrangle. The mapping by the U.S. Geological Survey (USGS)[3] indicates that subsurface conditions at the site consist of Holocene fan and terrace deposits (map unit Qhf), dating to the Holocene Epoch (11,700 years ago to present). The Holocene fan deposits broadly consists of alluvial fan sediments carried by mountain streams. Terrace deposits tend to consist of gravels, sands and silts, while downfan deposition tends to be finer grained. The subsurface conditions encountered in our investigation were generally consistent with the mapped geology.

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[1] California Geological Survey, 2002, *California Geomorphic Provinces, Note 36*.

[2] Wentworth, C.M., Fisher, G.R., Levine, P., and Jachens, R.C., 2012, *The surface of crystalline basement, Great Valley and Sierra Nevada, California*, U.S. Geological Survey, Open-File Report 95-96, Version 1.11.

[3] Sowers, J.M., Noller, J.S. and Lettis, W.R., 1993, *Preliminary maps showing Quaternary geology of the Tracy and Midway 7.5-minute quadrangles, California*, U.S. Geological Survey, Open-File Report OF-93-225, Scale 1:24,000.

Geologic Hazards

Faulting and Seismicity

The tectonics of central California area are dominated by the interaction of the North American and Pacific tectonic plates, which are sliding past each other in transform motion. The San Andreas fault zone represents the major surface expression of the tectonic boundary and accommodates a significant portion of the slip between the Pacific and North American plates. Some of the slip is accommodated by other northwest-trending strike-slip faults that are related to the San Andreas system, such as the Concord-Green Valley fault and Hayward fault. The Great Valley thrust fault system marks a boundary between the Coast Ranges and Great Valley geomorphic provinces of California. To the east, the Foothills fault system marks the boundary between the Great Valley and Sierra Nevada geomorphic provinces. A **Regional Fault** Map **Map** is attached in the **Figures** section of this report.

The Stockton Fault is a basin structure associated with the Stockton Arch, an ancient antiform at the north end of the San Joaquin structural basin.[1] This fault is buried beneath the alluvium and sediments of the valley and is considered inactive for planning purposes.

Fault Rupture Potential: The site is not located within an Alquist-Priolo Earthquake Fault Zone (APZ) designated by the State of California for active faults.[2] The closest APZ boundary, associated with the Greenville fault, is located approximately 21 miles (35 km) southwest of the site. Known faults or fault-related features are not located within the site; therefore, the potential for fault rupture within the site is considered low.

The following table summarizes mapped faults within a 100 km radius of the site.

Fault	Distance (km)	Direction	Magnitude[1]	Type
West Tracy	0.2	SW	7.17	Reverse
Midway	6.9	SW	7.13	Strike-Slip
Las Positas	18.7	SW	6.5	Strike-Slip
Great Valley 6 – Midland	20.2	NW	7.15	Reverse

[1] Bartow, J., 1991, *Cenozoic evolution of the San Joaquin Valley, California*, U.S. Geological Survey, Professional Paper 1501.

[2] California Geological Survey (CGS), *"California Earthquakes Hazards Zone Application (EQ Zapp)"*, 2024 **https://maps.conservation.ca.gov/cgs/informationwarehouse/eqzapp/**

Mount Diablo Thrust	31.0	SW	6.72	Thrust
Great Valley 7– Orestimba	34.1	SE	6.9	Reverse
Greenville	34.5	SSW	6.9	Strike-slip
Calaveras	39.3	SW	6.86	Strike-slip
Hayward	47.4	SW	7.58	Strike-slip
Great Valley 5 -Pittsburg – Kirby Hills	47.6	SW	6.6	Reverse
Concord	54.6	NW	6.45	Strike-slip
Ortigalita	56.5	SE	6.8	Strike-Slip
Great Valley 8 – Quinto	62.8	SE	6.59	Reverse
San Andreas	76.1	SW	8.04	Strike-slip
Foothill Fault System	84.1	NE	6.5[2]	--

[1] Magnitude per BSSC (2014) scenario events (https://earthquake.usgs.gov/scenarios/catalog/bssc2014)

[2] Estimated based on length.

Historical Seismicity:

The following table summarizes significant seismic events in the site region.

Date	Distance from Site (km)	Direction	Magnitude
07-15-1866	4.3	SW	6.3
01-27-1980	20.7	NW	5.4
11-26-1858	38.7	SW	6.2
03-05-1864	39.1	SW	6.0
05-19-1889	50.0	NW	6.0
04-10-1881	50.3	SE	6.0
08-06-1979	69.9	S	5.7
10-08-1865	70.0	SW	6.5
06-25-1838	76.5	SW	7.4
04-30-1892	79.2	NW	5.6
04-19-1892	87.2	NW	6.6
08-24-2014	91.2	NW	6.0
04-18-1906	94.2	W	7.9

A search of the USGS earthquake catalog (USGS, 2024a) for earthquakes of magnitude 4.5 or greater within 100 kilometers of the site returned 125 results including 2 events of magnitude 7 or greater, 17 events of magnitude 6 to 7, 47 events of magnitude 5 to

6, and 59 events of magnitude 4 to 5. A **Regional Seismicity** map based on this data is attached in the **Figures** section of this report.

Based on the seismic setting and history of the greater Bay Area and the San Andreas fault zone, and eastern Great Valley regions near the Foothills fault system, a potential exists for strong ground shaking to occur within the lifetime of the proposed project. Seismic shaking hazard can be addressed by application of building code provisions that consider building use and type, geographic location, site geologic conditions, and distance to seismic sources.

Liquefaction

Liquefaction is a mode of ground failure that results from the generation of high pore water pressures during earthquake ground shaking, causing loss of shear strength. Liquefaction is typically a hazard where loose sandy soils or low plasticity fine grained soils exist below groundwater. The CGS has designated certain areas within California as potential liquefaction hazard zones. These are areas considered at risk of liquefaction-related ground failure during a seismic event, based upon mapped surficial deposits and the presence of a relatively shallow water table. The project site has not yet been evaluated by the CGS for liquefaction hazards. Additionally, San Joaquin County has not evaluated or mapped liquefaction hazards within the county in the most recent iteration of the Safety Element. However, due to the relatively young geologic age of the subgrade soils and depth to groundwater, a liquefaction evaluation for this site was performed. Details regarding the liquefaction evaluation are presented in the **Liquefaction Evaluation** section of this report.

Inundation by Tsunamis and Seiches

Tsunamis are long period waves that travel through large bodies of water (generally oceans), usually produced by a submarine earthquake, volcanic eruption, or landslide. Seiches are an oscillation of a body of water in an enclosed or semi-enclosed basin, mainly caused by local changes in atmospheric pressure aided by tidal currents, winds, and occasionally by earthquakes and landslides. Areas that are low lying in elevation and sufficiently near the affected large body of water can quickly be inundated by tsunami or seiche waves. The site is not within a low-lying coastal area and there are no bodies of water in the immediate vicinity of the site; therefore, tsunamis and seiches are not a potential hazard to the site.

Flooding

Dam inundation from reservoirs impounded by dams in the Sierra Nevada east of the site and the coastal range to the west including New Melones dam and New Hogan dam

may pose a threat to the Tracy area (Tracy General Plan 2015 and **https://fmds.water.ca.gov/maps/damim**). These dams are monitored by State and/or Federal agencies for seismic safety.

Based on a review of the Federal Emergency Management Agency (FEMA) National Flood Hazard Layer (NFHL), the project site is in an area with a FEMA Flood Zone X designation, specified as an area of minimal flood hazard.

Landslides, Lateral Spreading, and Debris Flow

The CGS has designated certain areas within California as potential seismically-induced landslide hazard zones. These are areas considered at risk of slope failure and permanent ground displacement during a seismic event based upon previous occurrence of instability, topographic, geologic, and groundwater conditions, and ground shaking potential. The project site has not yet been evaluated by the CGS for seismically-induced landslide hazards.

Lateral spreading and debris flows are specific types of landslide-related earth movement. Lateral spreading generally occurs when a liquefiable layer of soil daylights at the free face of a slope, such as an excavation or a stream channel. During a seismic event and ensuing liquefaction, the lack of lateral confinement of the layer causes overlying strata to flow, typically as block failures, towards the slope face. Debris flows are typically triggered along steeply sloping ground during particularly heavy rainfall events. Rain waters mobilize loose material downslope, which then funnels into existing steep-sided channels and is deposited at great velocity at the base of the slope.

The site resides on a relatively gentle grade which trends down to the northeast. Topographic relief across the site measures less steep than 100H:1V (Horizontal:Vertical). Given that the site and its surroundings are relatively flat; seismically-induced landslides and lateral spreading are not considered a potential hazard. Since the site and surrounding area is relatively flat and there are no steep, narrow channels near the site, debris flows are not considered a potential hazard.

Expansive Soils

Expansive soil-related hazards may be present on sites with high concentrations of certain clay minerals deposited near the surface. Soils bearing montmorillonite clay minerals in particular may be subject to dramatic shrinking and swelling depending on changes to the soil moisture content. Shrinking and swelling of clay soils can manifest at the surface over time as distress to hardscape surfaces and shallow foundations. The shrink and swell of soil is largely based upon seasonality, but can also be influenced by drainage patterns, ground cover, and other factors.

The near-surface soil at the site consists predominantly of surficial lean clay and sandy lean clays extending to our maximum exploratory depth of approximately 85 feet bgs. Atterberg Limits testing performed on the near-surface soil resulted in a liquid limit (LL) of 46 and a plasticity index (PI) of 28. This result indicates that the material has moderate plasticity. An Expansion Index test was also performed on the near surface soils in Boring B2. The Expansion Index testing of the soil yielded a result of 107. The Atterberg limits and Expansion Index testing performed on the near surface soil indicate that it has high expansion potential. Based on the laboratory test results, we anticipate the onsite surficial soil will have high potential for expansion.

Due to the high potential for expansion of the surficial soils, we recommend mitigation during construction of the project, presented in **Expansive Soils**. The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration and Laboratory Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Subsidence Potential

Subsidence due to fluid withdrawal (groundwater, oil, gas) or peat oxidation is not documented in the site area (USGS, 2024b, 2018 and City of Modesto, 2019). The potential for subsidence to affect the proposed project is low.

While subsidence is potentially damaging to aerially extensive structures, such as irrigation ditches or large water lines, damage to the proposed structures (having relatively small footprint areas) is not anticipated due to the distributed nature of subsidence phenomenon. Organic-rich soils with significant collapse potential were not encountered during our exploration and are not anticipated to be present in the general area of the site. Therefore, the potential for local or regional subsidence effects at the site is considered low.

Erosion Potential

The subject site is covered with pavements, landscape turf, and other vegetation. Erosion by wind and water is not considered to be a hazard at the site.

Volcanic Hazards

Volcanic hazards in California include the Clear Lake volcanic field, Lassen volcano center, and Long Valley volcanic region located approximately 108 miles northwest, 189

miles north and 143 miles east of the site, respectively. These sources are described as "high to very high" threat sources and are monitored by U.S. Geological Survey[1]

The probability of a small to medium size volcanic eruption in California over the next 30 years is estimated to be about 16 percent, which is similar to the estimated likelihood of a moderate magnitude earthquake on the San Andreas fault[2] over an approximately similar time frame. Based on our review of available literature from the USGS, the site is not located within an area designated as a volcanic hazard zone.

Radon

Radon is an odorless and invisible naturally occurring carcinogenic gas produced by the decay of uranium and radium. It is the second leading cause of lung cancer in the United States. In accordance with Sections 307 and 309 of the Indoor Radon Abatement Act of 1988 (IRAA), the EPA identified areas within the United States with the potential for elevated indoor radon levels. An assessment of geologic radon potential in California[3] indicates that San Joaquin County has low radon potential. The EPA Map of Radon Zones in California assigns each county to one of three zone designations based on radon potential. The site location (San Joaquin County) is mapped as Zone 3, indicating that it has a low potential for radon and average indoor radon levels may be less than 2 pCi/L.

Naturally Occurring Asbestos (NOA)

Asbestos minerals naturally form during metamorphosis of ultramafic igneous rock formations. Asbestos minerals in rock are grouped as either serpentine (chrysotile) or amphibole (amosite, crocidolite, tremolite, anthophyllite, and actinolite) minerals. The most common asbestos mineral in California is chrysotile, found within serpentinite rock.

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[1] California Volcano Observatory, *Map of moderate, high, and very high threat volcanos in CA*, **https://www.usgs.gov/media/images/map-moderate-high-and-very-high-threat-volcanoes-ca**

[2] Mangan, M., Ball, J., Wood, N., Jones, J.L., Peters, J., Abdollahian, N., Dinitz, L., Blankenheim, S., Fenton, J., and Pridmore, C. (2019); *California's exposure to volcanic hazards (ver. 1.1, December 2019)*; U.S. Geological Survey (USGS); Scientific Investigations Report 2018-5159; hazard zones in figure 8.

[3] Schumann, R. Randall (1993); *Geologic Radon Potential of EPA Region 9, Arizona, California, Hawaii, and Nevada*; U.S. Geological Survey (USGS); Open-File Report 93-292-I; pp. 70-93.

Chrysotile occurs as very narrow tubular fibers that are often hollow. Based on a review of available literature[1], the site does not lie within a mapped area containing NOA.

Oil and Gas Exploration

According to available mapping by the California Division of Oil, Gas and Geothermal Resources, the subject property is not located within, or near, any gas or oil production area. Plugged and abandoned dry wells are mapped approximately 0.75 miles southeast and southwest from the site (CalGEM, 2025). We do not consider oil- or gas-related hazards to be potential hazards at the site. An **Oil and Gas Map** is attached in the **Figures** section of this report.

Seismic Considerations

The San Joaquin Valley of California is a moderate seismicity region, being bracketed by the Foothills and San Andreas fault systems. The type and magnitude of seismic hazards affecting the site are dependent on the distance to causative faults, the intensity, and the magnitude of the seismic event. The following table indicates the distance of the fault zones and the associated maximum considered earthquake produced by nearby seismic events, as calculated using the USGS Earthquake Hazard Toolbox[2]. Segments of the West Tracy Fault, which is located approximately 1½ kilometers from the site, are considered to have the most significant effect at the site from a design standpoint.

Fault Name	Approximate Contribution (%)	Approximate Distance to Site (kilometers)	Maximum Considered Earthquake (MCE) Magnitude
Grid Source Seismicity	42.04	N/A	5.89
West Tracy	24.22	1.59	7.18
Midway	11.36	7.77	7.13

[1] Ronald K. Churchill and Robert L. Hill, *A General Location Guide for Ultramafic Rocks in California – Areas More Likely to Contain Naturally Occurring Asbestos*, CGS Open-File Report 2000-19.

[2] U.S. Geological Survey, *USGS Earthquake Hazard Toolbox: Disaggregation*, July 2025 **https://earthquake.usgs.gov/nshmp/hazard/disagg**

Fault Name	Approximate Contribution (%)	Approximate Distance to Site (kilometers)	Maximum Considered Earthquake (MCE) Magnitude
Greenville	5.38	17.49	7.23

Based on the ASCE 7-16 Standard, the site-modified peak ground acceleration (PGA_M) for evaluation of seismic soil effects and design for the subject site is 0.575g. Based on the USGS 2023 interactive disaggregations, the PGA at the subject site for a 2% probability of exceedance in 50 years (return period of 2475 years) is expected to be about 0.694g.

The seismic site class was determined according to ASCE 7-16, Chapter 20 by evaluation of seismic shear wave velocity measurements in CPT-1 that indicated a weighted shear wave velocity average within the upper 100 feet of the site subsurface as Vs = 1,162 feet/second. This velocity is within the range of Site Class D defined in ASCE 7-16, Chapter 20.

The 2022 CBC Seismic Design Parameters have been generated using the ASCE Hazard Tool. This web-based software application calculates seismic design parameters in accordance with ASCE 7-16, and 2022 CBC.

The 2022 CBC requires that a site-specific ground motion study be performed in accordance with Section 11.4.8 of ASCE 7-16 for Site Class D sites with a mapped S_1 value greater than or equal 0.2.

However, an exception to this requirement is included in Supplement 3 to ASCE 7-16 that states: "A ground motion hazard analysis is not required where the value of the parameter S_{M1} determined by Eq. (11.4-2) is increased by 50% for all applications of S_{M1} in this standard. The resulting value of the parameter S_{D1} determined by Eq. (11.4-4) shall be used for all applications of S_{D1} in the Standard."

Based on this exception, the spectral response accelerations presented in the following table were calculated using the site coefficients (F_a and F_v) from Tables 1613A.2.3(1) and 1613A.2.3(2) presented in Section 1613 of the 2022 CBC.

Description	Value
2022 CBC Site Class[1]	D[2]
Risk Category	III
Site Latitude[3]	37.7321°N

Description	Value
Site Longitude[3]	121.4729°W
S_S, Spectral Acceleration for a Short Period[4]	1.250
S_1, Spectral Acceleration for a 1-Second Period[4]	0.432
Fa, Site Coefficient	1.0
Fv, Site Coefficient (1-Second Period)	1.868
S_{DS}, Spectral Acceleration for a Short Period	0.833
S_{D1}, Spectral Acceleration for a 1-Second Period	0.807[5]

1. Seismic site class in general accordance with the 2022 CBC, which refers to ASCE 7-16. The site class is required to determine the Seismic Design Category for a structure.
2. Site classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7-16 and the 2022 CBC. Subsurface explorations at this site were extended to a maximum depth of approximately 85½ feet bgs. The site properties below the maximum exploration depth to 100 feet bgs were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper exploration or geophysical testing may be performed to confirm the conditions below the current maximum depth of exploration.
3. Provided coordinates represent a point located at the general center of the site.
4. These values were obtained using online seismic design maps and tools provided by ASCE (**https://ascehazardtool.org/**).
5. The value of S_{D1} has been increased by 50% for structural design in accordance with Item 1 Exception in ASCE 7-16 Supplement 3, Section 11.4.8.

Typically, a site-specific ground motion study may reduce construction costs. We recommend consulting with a structural engineer to evaluate the need for such a study and its potential impact on construction costs. Terracon should be contacted if a site-specific ground motion study is desired.

Liquefaction Evaluation

We performed a liquefaction hazard evaluation in general compliance with the CGS Special Publication 117A (2008) and the Southern California Earthquake Center (SCEC) "Recommended Procedures for Implementation of DMG Special Publication 117 Guidelines for Analyzing and Mitigating Liquefaction Hazards in California," 1999 report.

As recommended in these publications, we performed a screening analysis to determine if there is a potential for liquefaction to occur at the site. We evaluated the soils encountered in our borings advanced to a maximum depth of 51½ feet bgs and CPT advanced to a depth of approximately 85½ feet bgs. We evaluated these soils based on geologic age, soil classification, historically high groundwater elevation, water content, Atterberg limits, and CPT data.

As part of the screening analysis, we reviewed the shear wave velocities measured during advancement of our CPT. The shear wave velocities measured in the upper 50 feet of the CPT generally varied from 898 feet per second (ft/s) to 1,523 ft/s. Based on research by Andrus et al. (2009), it has been accepted that soils with shear wave velocities greater than 720 ft/s are generally not susceptible to liquefaction. Based on this criterion, the soils encountered in CPT-01 would not be susceptible to liquefaction.

Given that the soil in CPT-01 is not susceptible to liquefaction based on shear wave velocity, the potential for liquefaction to occur at the site is low.

Liquefaction can manifest as sand or mud boils, or as bearing capacity failure of the ground surface. As the potential for liquefaction to occur at the site is low, and the near surface material is composed of cohesive lean clay, the potential for liquefaction-induced ground surface disruption is low.

During a seismic event, there is the potential for seismic densification of coarse-grained soil above the groundwater table. Due to the shear wave velocities of the soil above the groundwater table being greater than 720 ft/s, the potential for seismic densification at the site is low.

Corrosivity

The following table lists the results of laboratory soluble sulfate, soluble chloride, electrical resistivity, and pH testing. The values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

Corrosivity Test Results Summary

Boring	Sample Depth (feet)	Soil Description	Soluble Sulfate (%)	Soluble Chloride (%)	Electrical Resistivity (Ω-cm)	pH
B1	5	Lean Clay	0.0642	0.0001	540	7.6

Results of soluble sulfate testing can be classified in accordance with ACI 318 – Building Code Requirements for Structural Concrete. Numerous sources are available to characterize corrosion potential to buried metals using the parameters presented in the previous table. ANSI/AWWA is commonly used for ductile iron, while threshold values for evaluating the effect on steel can be specific to the buried feature (e.g., piling, culverts, welded wire reinforcement, etc.) or agency for which the work is performed. Imported fill materials may have significantly different properties than the site materials noted in the table and should be evaluated if expected to be in contact with metals used for construction. Consultation with a NACE certified corrosion professional is recommended for buried metals on the site.

Mapping by the NRCS includes qualitative severity of corrosion to concrete and steel. This source rates the near-surface materials as "Low" for corrosion to concrete and "High" for corrosion of steel.

Geotechnical Overview

The subject site has geotechnical considerations that will affect the construction and performance of the proposed improvements that are discussed in this report. The primary geotechnical considerations that have been identified at the subject site that may affect development are the following:

- Soft/Unstable subgrade
- Expansive soils

Soft/Unstable Subgrade

Medium stiff clay was noted near the surface in our soil borings. These soils may become unstable when disturbed. During periods of dry weather, these soils may be stable upon initial exposure, however, these soils could become relatively soft and unstable under construction traffic. Furthermore, depending upon site conditions during construction, over-excavation, or stabilization of the subgrade and/or base of overexcavations may be needed to achieve a suitable working surface. Accordingly, we recommend that the owner budget for the possibility that overexcavation and/or stabilization may be

required, and contractors be prepared to handle potentially unstable and/or soft conditions. Stabilization may consist of aerating/drying the soil, a composite section of aggregate base and geogrid, or chemical stabilization using high calcium quick lime or Portland cement.

Expansive Soils

Expansive soils are present on this site. Atterberg Limits tests indicate a liquid limit of 46 and a plasticity index of 28. An Expansion Index of soils test was also performed on the near surface soils in boring B2. The Expansion Index testing yielded a result of 107, indicating high expansion potential. This report provides recommendations to help mitigate the effects of soil shrinkage and expansion. However, even if these procedures are followed, some movement and (at least minor) cracking in the structure should be anticipated. The severity of cracking and other damage such as uneven floor slabs will probably increase if modification of the site results in excessive wetting or drying of the expansive soils. Eliminating the risk of movement and distress may not be feasible, but it may be possible to further reduce the risk of movement if significantly more expensive measures are used during construction. Some of these options are discussed in this report such as complete replacement of expansive soils.

The near surface, medium plasticity lean clay could become unstable with typical earthwork and construction traffic, especially after precipitation events. Effective drainage should be installed early in the construction sequence and maintained after construction to avoid potential issues. If possible, site grading should be performed during the warmer and drier times of the year. If grading is performed during the winter months, an increased risk for possible undercutting and replacement of unstable subgrade will persist. Additional site preparation recommendations, including subgrade improvement and fill placement, are provided in the **Earthwork** section.

The soils which form the bearing stratum for shallow foundations are plastic and exhibit potential for shrink-swell movements with changes in moisture. Maintaining above optimum moisture conditions in the bearing soils and a minimum dead load pressure on footings should reduce the anticipated swell movements to tolerable levels. The **Shallow Foundations** section addresses support of the building directly bearing on granular structural fill. We do not expect significant dead load on the floor slabs and recommend either overexcavation of near-surface clays to reduce the heave potential or use of suspended slabs to accommodate potential ground heave. The **Floor Slabs** section addresses slab-on-grade support of the building using overexcavation techniques.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in **Exploration and Laboratory Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Earthwork

We anticipate grading will consist of cuts and fills on the order of 2 feet or less and that site grades will remain near the existing elevation. Specific site grading information was unavailable at the time this report was prepared. If elevation and site grading differ from our stated assumptions, Terracon should be contacted to determine if additional earthwork recommendations are warranted, particularly with regard to potential ground settlement.

Earthwork is anticipated to include demolition, clearing and grubbing, excavations, and structural fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations and floor slabs.

Demolition

The proposed building will be constructed within the footprint of an existing building which will need to be demolished, along with exterior sidewalks, pavements, and utilities. We recommend existing foundations, slabs, and utilities be removed from within the proposed building footprint and at least 5 feet beyond the outer edge of foundations. This should include removal of any loose backfill found adjacent to existing foundations. If pipes are abandoned in-place, they should be filled completely with lean cement grout, or other suitable material, to avoid collapse in the future. All materials derived from the demolition of existing structures and pavements should be removed from the site and not be allowed for use as on-site fill, unless processed in accordance with the fill requirements included in this report.

For areas outside the proposed building footprints and foundation bearing zones, existing foundations, floor slabs, and utilities should be removed where they conflict with proposed utilities, retaining walls, and pavements. In such cases, existing foundations, floor slabs, and utilities should be removed to a depth of at least 2 feet below the affected utility or design subgrade elevation.

Site Preparation

Prior to placing fill, existing vegetation, topsoil, and root mats should be removed. Complete stripping of the topsoil should be performed in the proposed building and parking/driveway areas. Stripping should extend laterally a minimum of 5 feet beyond the limits of proposed improvements.

Mature trees are located within or near the footprint of some of the proposed buildings, which will require removal at the onset of construction. Tree root systems can remove

substantial moisture from surrounding soils. Where trees are removed, the full root ball, including roots ¼-inch in diameter and larger and all associated dry and desiccated soils should be removed. The soil materials which contain less than 3 percent organics can be reused as structural fill provided the material is moisture conditioned and properly compacted.

Underground facilities (such as utilities) were observed during the exploration and site reconnaissance and such features are anticipated to be encountered during construction. If unexpected fills or underground facilities are encountered, such features should be removed, and the excavation thoroughly cleaned prior to backfill placement and/or construction.

Subgrade Preparation

After clearing, any required cuts and overexcavation should be made.

We recommend that the soil within the footprint of the proposed structures be removed to a minimum depth of 2 feet below the bottom of footings, or 4 feet bgs, whichever is deeper. Structural fill placed beneath the entire footprint of the foundations should extend horizontally a minimum distance of 5 feet beyond the outside edge of footings. The near-surface materials anticipated to be developed as excavation spoils are not considered suitable for use as structural fill.

Subgrade soils beneath proposed floor slabs and exterior hardscape should be removed to a depth of 18 inches beneath proposed slab or hardscape section, or existing grade, whichever is greater and either replaced with granular structural fill or chemically stabilized native soil.

Excavated material may be stockpiled for use as fill provided it is cleaned of organic material, debris, and any other deleterious material and meets the criteria for general or structural fill specified in the ***Fill Material Types*** section of this report.

Once cuts and overexcavation operations are complete, all exposed areas which will receive fill, once properly cleared and benched where necessary, should be scarified, moisture conditioned as necessary, and compacted per the compaction requirements in this report. The depth of scarification of subgrade soils and moisture conditioning of the subgrade is highly dependent upon the time of year of construction and the site conditions that exist immediately prior to construction. If construction occurs during the winter or spring, when the subgrade soils are typically already in a moist condition, scarification and compaction may only be 8 inches. If construction occurs during the summer or fall when the subgrade soils have been allowed to dry out deeper, the depth of scarification and moisture conditioning may be as much as 18 inches or more. A representative from Terracon should be present during earthwork to observe the

exposed subgrade and confirm the depth of scarification and moisture conditioning required.

Following scarification, moisture conditioning, and compaction of the subgrade soils, the resulting subgrade should be proofrolled with an adequately loaded vehicle such as a fully-loaded tandem-axle dump truck. The proofrolling should be performed under the observation of the Geotechnical Engineer or their representative. Areas excessively deflecting under the proofroll should be delineated and subsequently addressed by the Geotechnical Engineer. Such areas should either be removed or modified by stabilizing as noted in the ***Soil Stabilization*** section of this report. Excessively wet or dry material should either be removed, or moisture conditioned and recompacted.

Once proof rolling has been performed, compacted structural fill soils should then be placed to the proposed design grade and the moisture content and compaction of subgrade soils should be maintained until foundation, floor slab, or flatwork construction.

Based upon the subsurface conditions determined from the geotechnical exploration, subgrade soils exposed during construction are anticipated to be relatively workable; however, the workability of the subgrade may be affected by precipitation, repetitive construction traffic or other factors. If unworkable conditions develop, workability may be improved by scarifying and drying.

Excavation

We anticipate that excavations for the proposed construction can be accomplished with conventional earthmoving equipment. The bottom of excavations should be thoroughly cleaned of loose soils and disturbed materials prior to backfill placement and/or construction.

Individual contractors are responsible for designing and constructing stable, temporary excavations. Excavations should be sloped or shored in the interest of safety following local, state, and federal regulations, including current OSHA excavation and trench safety standards.

Soil Stabilization

Methods of subgrade stabilization, as described in this section, could include scarification, moisture conditioning and recompaction, removal of unstable materials and replacement with granular fill (with or without geosynthetics), and chemical stabilization. The appropriate method of improvement, if required, would be dependent on factors such as schedule, weather, the size of area to be stabilized, and the nature of the instability. More detailed recommendations can be provided during construction as the

need for subgrade stabilization occurs. Performing site grading operations during warm seasons and dry periods would help reduce the amount of subgrade stabilization required.

If the exposed subgrade is unstable during proofrolling operations, it could be stabilized using one of the following methods:

- **Scarification and Recompaction** - It may be feasible to scarify, dry, and recompact the exposed soils. The success of this procedure would depend primarily upon favorable weather and sufficient time to dry the soil. Stable subgrades likely would not be achievable if the thickness of the unstable soil is greater than about 1 foot, if the unstable soil is at or near groundwater levels, or if construction is performed during a period of wet or cool weather when drying is difficult.
- **Aggregate Base** - The use of Caltrans Class II aggregate base is a common procedure to improve subgrade stability. Typical undercut depths would be expected to range from about 6 to 18 inches below finished subgrade elevation. The use of high modulus geosynthetics (i.e., engineering fabric or geogrid) could also be considered after underground work such as utility construction is completed. Prior to placing the fabric or geogrid, we recommend that all below grade construction, such as utility line installation, be completed to avoid damaging the fabric or geogrid. Equipment should not be operated above the fabric or geogrid until one full lift of aggregate base is placed above it. The maximum particle size of granular material placed over geotextile fabric or geogrid should meet the manufacturer's specifications.
- **Chemical Stabilization** - Improvement of subgrades with Portland cement or quicklime could be considered for improving unstable soils. Chemical stabilization should be performed by a pre-qualified contractor who has experience with successfully stabilizing subgrades in the project area on similar sized projects with similar soil conditions. The hazards of chemicals blowing across the site or onto adjacent property should also be considered. Additional testing would be needed to develop specific recommendations to improve subgrade stability by blending chemicals with the site soil. Additional testing could include, but not be limited to, determining the most suitable stabilizing agent, the optimum amounts required, and the presence of sulfates in the soil. <u>If this method is chosen to stabilize subgrade soils the actual amount of high calcium quicklime or Portland cement to be used should be determined by Terracon and by laboratory testing **at least three weeks prior** to the start of grading operations</u>.

Further evaluation of the need and recommendations for subgrade stabilization can be provided during construction as the geotechnical conditions are exposed.

Fill Material Types

Fill required to achieve design grades should be classified as structural fill and general fill. Structural fill is material used below, or within 5 feet of structures. General fill is material used to achieve grade outside of these areas.

Reuse of On-Site Soil: Excavated on-site soil is not suitable for reuse as Structural Fill and should not be placed beneath settlement sensitive structures and within foundation bearing zones. Material property requirements for on-site soil for use as general fill and structural fill are noted in the following table:

Property	Structural Fill	General Fill
Composition	Free of deleterious material	Free of deleterious material
Maximum particle size	3 inches	6 inches (or 2/3 of the lift thickness)
Fines content	Less than 40% passing No. 200 sieve	Not limited
Plasticity	Maximum liquid limit of 30 Maximum plasticity index of 10 Expansion Index less than 20	Not limited
GeoModel Layer Expected to be Suitable[1]	2, 3	1, 2, 3

1. Based on subsurface exploration. Actual material suitability should be determined in the field at time of construction.

Imported Fill Materials: Imported fill materials should meet the following material property requirements. Regardless of its source, compacted fill should consist of approved materials that are free of organic matter and debris. For all import material, the contractor shall submit current verified reports from a recognized analytical laboratory indicating that the import has a "not applicable" (Class S0) potential for sulfate attack based upon current ACI criteria and is "mildly corrosive" to ferrous metal and copper. The reports shall be accompanied by a written statement from the contractor that the laboratory test results are representative of all import material that will be brought to the project.

Soil Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
Low Plasticity	CL, SC	Liquid Limit less than 30 Plasticity index less than 10 Expansion index less than 20 Less than 70% passing No. 200 sieve
Granular[2]	GW, GM, SW, SM	Less than 40% passing No. 200 sieve

1. Structural and general fill should consist of approved materials free of organic matter and debris and should contain no material larger than 3 inches and 6 inches in greatest dimension, respectively. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation at least two weeks prior to use on this site. Additional geotechnical consultation should be provided prior to use of uniformly graded gravel on the site.
2. Caltrans Class II aggregate base may be used for this material. Recycled aggregate base should not be used without prior approval by the Geotechnical Engineer.

Fill Placement and Compaction Requirements

Compacted native soil and structural and general fill should meet the following compaction requirements.

Item	Structural Fill	General Fill
Maximum Lift Thickness	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used	Same as structural fill
Minimum Compaction Requirements [1,2]	95% of max. for structural fill below foundations and slabs, within 1 foot of finished pavement subgrade, for aggregate base and chemically treated soil, and for fills deeper than 5 feet 90% of max. for all other locations	90% of max.
Water Content Range [1]	Low plasticity cohesive: +1% to +3% above optimum Granular: -2% to +2% of optimum	As required to achieve min. compaction requirements

Item	Structural Fill	General Fill

1. Maximum density and optimum water content as determined by the Modified Proctor test (ASTM D 1557).
2. If the granular material is a coarse sand or gravel, or of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 70% relative density (ASTM D 4253 and D 4254). Materials not amenable to density testing should be placed and compacted to a stable condition observed full time by the Geotechnical Engineer or representative.

Utility Trench Backfill

Any soft or unsuitable materials encountered at the bottom of utility trench excavations should be removed and replaced with structural fill or bedding material in accordance with public works specifications for the utility to be supported. This recommendation is particularly applicable to utility work requiring grade control and/or in areas where subsequent grade raising could cause settlement in the subgrade supporting the utility. Trench excavation should not be conducted below a downward 1:1 projection from existing foundations without engineering review of shoring requirements and geotechnical observation during construction.

On-site materials are considered suitable for backfill of utility and pipe trenches from 1 foot above the top of the pipe to the final ground surface, provided the material is free of organic matter and deleterious substances. Where trenches are placed beneath slabs or footings, the backfill should satisfy the gradation and Atterberg limit requirements for structural fill discussed in this report.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Flooding or jetting for placement and compaction of backfill is not recommended.

All trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. If utility trenches are backfilled with relatively clean granular material, they should be capped with at least 18 inches of cementitious flowable fill or cohesive fill in non-pavement areas to reduce the infiltration and conveyance of surface water through the trench backfill. Attempts should also be made to limit the amount of fines migration into the clean granular material. Fines migration into clean granular fill may result in unanticipated localized settlements over a period of time. To help limit the amount of fines migration, Terracon recommends the use of a geotextile fabric that is designed to prevent fines migration in areas of contact between clean granular material and fine-grained soils. Terracon also recommends that clean granular fill be tracked or tamped in place, where possible, to

limit the amount of future densification which may cause localized settlements over time.

For low permeability subgrades, utility trenches are a common source of water infiltration and migration. Utility trenches penetrating beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches, which could migrate below the building. The trench should provide an effective trench plug that extends at least 5 feet from the face of the building exterior. The plug material should consist of cementitious flowable fill or low permeability clay. The trench plug material should be placed to surround the utility line. If used, the clay trench plug material should be placed and compacted to comply with the water content and compaction recommendations for structural fill stated previously in this report.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that are tied to tight lines that discharge into a storm drain system.

Exposed ground should be sloped and maintained at a minimum 5 percent away from the building for at least 10 feet beyond the perimeter of the building. If a minimum 5 percent slope cannot be achieved due to site grades, a minimum 2 percent slope could be used provided pavement or hardscape surrounds and extends to the building, or a subdrain could be installed around the perimeter of the foundations that carries water away from the building. Locally, flatter grades may be necessary to transition to ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Any planters and/or bio-swales located within 10 feet of the building should be self-contained or lined with an impermeable membrane to prevent water from accessing subgrade soils below the building. Sprinkler mains and spray heads should be located a minimum of 5 feet away from the foundation lines.

No vegetation over 6 feet in height shall be planted within 20 feet of the building perimeter unless a root barrier is provided between the structure and tree to limit roots

within 10 feet of the building. Roots can draw additional moisture from the soil and cause excessive volume changes in the soil resulting in building movement.

Implementation of adequate drainage for this project can affect the surrounding developments. Consequently, in addition to designing and constructing drainage for this project, the effects of site drainage should be taken into consideration for the planned structures on this property, the undeveloped portions of this property, and surrounding sites. Extra care should be taken to ensure irrigation and drainage from adjacent areas do not drain onto the project site or saturate the construction area.

Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs and exterior hardscape. Construction traffic over the completed subgrades should be avoided to the extent practical. The site should also be graded to prevent ponding surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to construction.

We recommend that the earthwork portion of this project be completed during extended periods of dry weather if possible. If earthwork is completed during the wet season (typically November through April) it may be necessary to take extra precautionary measures to protect subgrade soils. Wet season earthwork operations may require additional mitigation measures beyond that which would be expected during the drier summer and fall months. This could include ground stabilization utilizing chemical treatment of the subgrade, diversion of surface runoff around exposed soils, and draining of ponded water on the site. Once subgrades are established, it may be necessary to protect the exposed subgrade soils from construction traffic.

<u>As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations.</u> Stockpiles of soil, construction materials, and construction equipment should not be placed near trenches or excavations. ***The Contractor is responsible for maintaining the stability of adjacent structures during construction.***

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming

responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Excavations or other activities resulting in ground disturbance have the potential to affect adjoining properties and structures. Our scope of services does not include the review of available final grading information or considering potential temporary grading performed by the contractor for potential effects such as ground movement beyond the project limits. A preconstruction/precondition survey should be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities adjacent or near property lines should be monitored or instrumented for potential ground movements that could negatively affect adjoining property and/or structures.

Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer (or others under their direction). Observation should include documentation of adequate removal of surficial materials (vegetation, topsoil, debris, and pavements), evaluation and remediation of existing fill materials, as well as proofrolling and mitigation of unsuitable areas delineated by the proofroll.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,000 square feet of compacted fill in the building areas. Where not specified by local ordinance, one density and water content test should be performed for every 50 linear feet of compacted utility trench backfill and a minimum of one test performed for every 12 vertical inches of compacted backfill. The frequency of the testing may be adjusted during construction under the direction of the geotechnical engineer.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer. If unanticipated conditions are observed, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer’s evaluation of subsurface conditions, including assessing variations and associated design changes.

Shallow Foundations

The proposed building may be supported by spread footings. If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing Pressure [1, 2]	2,000 psf
Required Bearing Stratum [3]	2 feet of compacted granular structural fill
Minimum Foundation Dimensions	Per CBC 1809A.7
Maximum Foundation Dimensions	Columns: 8 feet Continuous: 4 feet
Passive Resistance[4, 8] (equivalent fluid pressures)	300 pcf
Sliding Resistance [5, 8]	0.35 allowable coefficient of friction - granular material
Minimum Embedment below Finished Subgrade [6]	24 inches
Estimated Total Settlement from Structural Loads [2]	Less than about 1 inch
Estimated Differential Settlement [2, 7]	About ½ of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. This bearing pressure can be increased by 1/3 for transient loads unless those loads have been factored to account for transient conditions. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
2. Values provided are for maximum loads noted in **Project Description**. Additional geotechnical consultation will be necessary if higher loads are anticipated.
3. Unsuitable or soft soils should be overexcavated and replaced per the recommendations presented in **Earthwork**.
4. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face. Assumes no hydrostatic pressure.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Frictional resistance for granular materials is dependent on the bearing

Item	Description

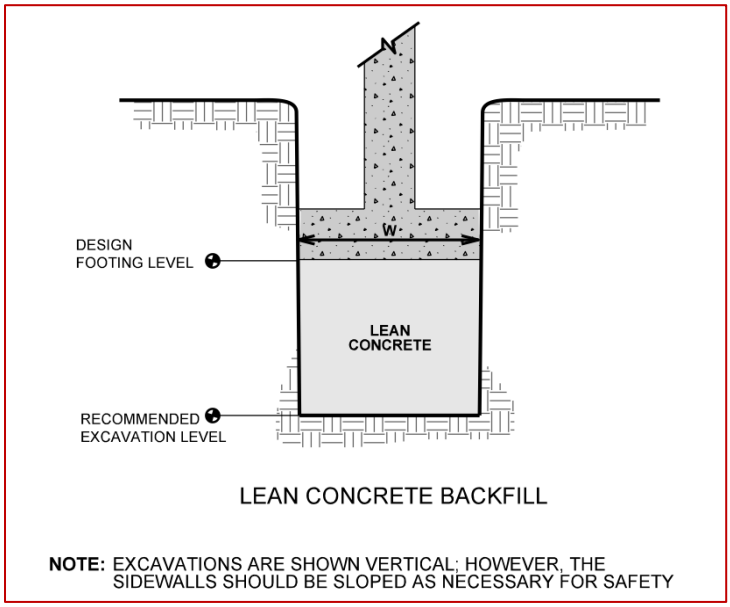
pressure which may vary due to load combinations. For fine-grained materials, lateral resistance using cohesion should not exceed ½ the dead load.

6. Embedment necessary to minimize the effects of seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior subgrade within 5 horizontal feet of the structure.
7. Differential settlements are noted for equivalent-loaded foundations and bearing elevation as measured over a span of 50 feet.
8. Passive Resistance and Sliding Resistance may be combined to resist sliding provided the Passive Resistance is reduced by 50 percent.

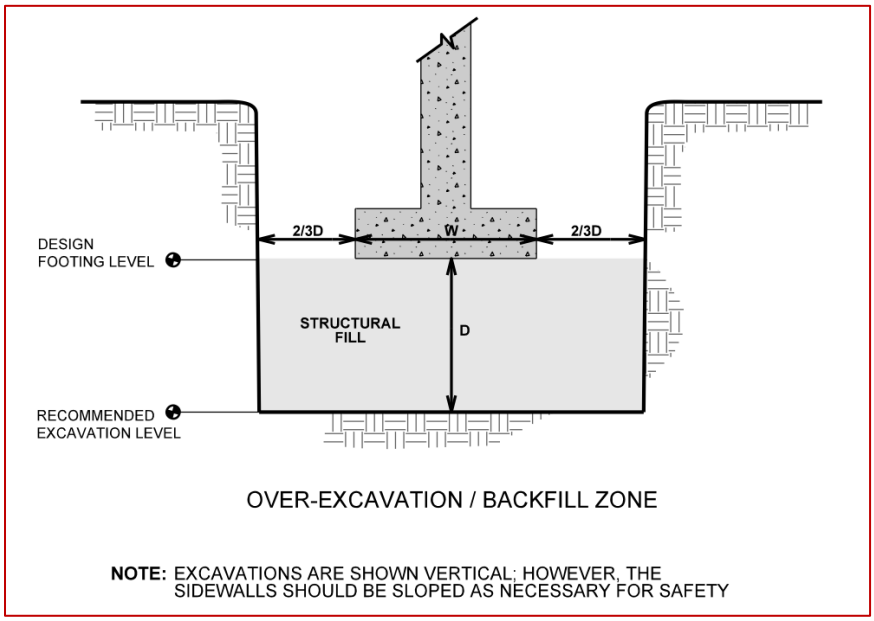
Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the observation of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

If unsuitable bearing soils are observed at the base of the planned footing excavation, the unsuitable soils should be removed and replaced with compacted granular structural fill or lean concrete backfill placed in the excavations. The lean concrete replacement zone is illustrated on the following sketch.



Overexcavation for structural fill placement below footings should be conducted as shown in the following sketch. The overexcavation should be backfilled up to the footing base elevation, with structural fill placed, as recommended in the **Earthwork** section.



To ensure foundations have adequate support, special care should be taken when footings are located adjacent to trenches. The bottom of such footings should be at least 1 foot below an imaginary plane with an inclination of 1.5 horizontal to 1.0 vertical extending upward from the nearest edge of the adjacent trench.

Floor Slabs

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the floor slab support course beneath the floor slab.

The subgrade soils are comprised of lean clays exhibiting the potential to shrink/swell with variations in water content. Construction of the floor slab, combined with the removal of trees, and revising site drainage creates the potential for gradual increased water contents within the clays. Increases in water content will cause the clays to swell and damage the floor slab. To reduce the potential effects of the lean clays on the building floor slabs, at least the upper 18 inches of subgrade soils below the floor slab should consist of granular structural fill or be chemically treated with high calcium quicklime.

Chemical treatment involves treating the subgrade soils with a certain percentage of high calcium quicklime, usually 3.5 to 5.5 percent based on the dry unit weight of the

soil, for a depth of 18 inches. For estimating purposes, we recommend using 4.5 percent lime, and a soil unit weight of 110 pounds per cubic foot. For an 18-inch treatment depth, this results in an estimated minimum spread rate of 7.4 pounds per square foot lime. The actual amount of lime to be used should be determined by Terracon and by laboratory testing **at least three weeks prior** to the start of grading operations. Chemical treatment is performed after rough grading is completed. This procedure reduces the swell potential of the surface soils and creates a stable working platform on which construction can proceed. All chemical treatment operations should be observed by a representative of the project Geotechnical Engineer.

Due to the potential for significant moisture fluctuations of subgrade material beneath floor slabs supported at-grade, the Geotechnical Engineer should evaluate the material within 12 inches of the bottom of the structural granular fill or chemically treated zone immediately prior to placement of additional fill or floor slabs. In chemically treated areas, this can be accomplished by having the grading contractor excavate several test pits within the proposed construction areas prior to the start of grading operations to determine the moisture condition of the subgrade soils. A representative of the Geotechnical Engineer should be present during the excavation of these test pits and samples of the subgrade soils should be obtained for moisture content testing. Soils below the specified water contents within this zone should be moisture conditioned or replaced with structural fill as stated in our **Earthwork** section.

Floor Slab Design Parameters

Item	Description
Floor Slab Support[1]	Use 4 inches of ¾ inch free draining crushed rock[3] overlying 18 inches of granular structural fill or chemically treated native soil. Subgrade compacted to the recommendations in **Earthwork**
Estimated Modulus of Subgrade Reaction [2]	125 pounds per square inch per inch (psi/in) for point loads

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.
3. Free-draining granular material should have less than 5% fines (material passing the No. 200 sieve). Other design considerations such as cold

Item	Description
	temperatures and condensation development could warrant more extensive design provisions.

It is common to reduce the k-value to account for dimensional effects of large, loaded areas. For such features, the value of K_c in the following formula is the corrected or design modulus value in units of psi/in, k is the value provided in the previous table, and b is the mat width (short dimension) or tributary loaded area measured in units of feet. Soft or unstable subgrade will be remediated by scarifying and re-compacting or by over-excavation and replacement. For clay subgrades, this can be estimated as:

$$K_c = k(\frac{1}{b})$$

Terracon can provide refined estimates of K_c if provided more detailed information regarding the loads and application area to conduct settlement analysis.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, when the project includes humidity-controlled areas, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut contraction joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations, refer to the ACI Design Manual. Joints or cracks should be sealed with a waterproof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing, or other means.

Floor Slab Construction Considerations

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning

of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

Exterior Hardscape

In order to help protect the exterior hardscape against the swell pressure of the surficial moderately plastic clays, we recommend the subgrade soil below hardscapes either be over-excavated to a minimum depth of 18 inches and replaced with compacted granular structural fill per the recommendations provided in this report or be chemically treated to a depth of 18 inches.

Exterior hardscape, exterior architectural features, and utilities may experience some movement due to the volume change of the subgrade soils. To reduce the potential for damage caused by movement, we recommend:

- Slabs should be underlain by a minimum of 18 inches of compacted granular structural fill or chemically treated material as indicated. However, at the contractor's discretion, gravel may be placed between the slab and granular structural fill or chemically treated material to assist with constructability.
- Minimizing moisture increases in the subgrade soils and backfill;
- Controlling moisture-density during placement of fill;
- Using designs which allow vertical movement between the exterior features and adjoining structural elements;
- Placing effective control joints on relatively close centers.
- Ensuring clay subgrade soils are in a moist condition prior to slab construction.
- Reinforcing exterior slabs and flatwork with a minimum No. 4 bars at 12 inches on center.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the

absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials, or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly affect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing. This report should not be used after 3 years without written authorization from Terracon.

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Figures

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GeoModel
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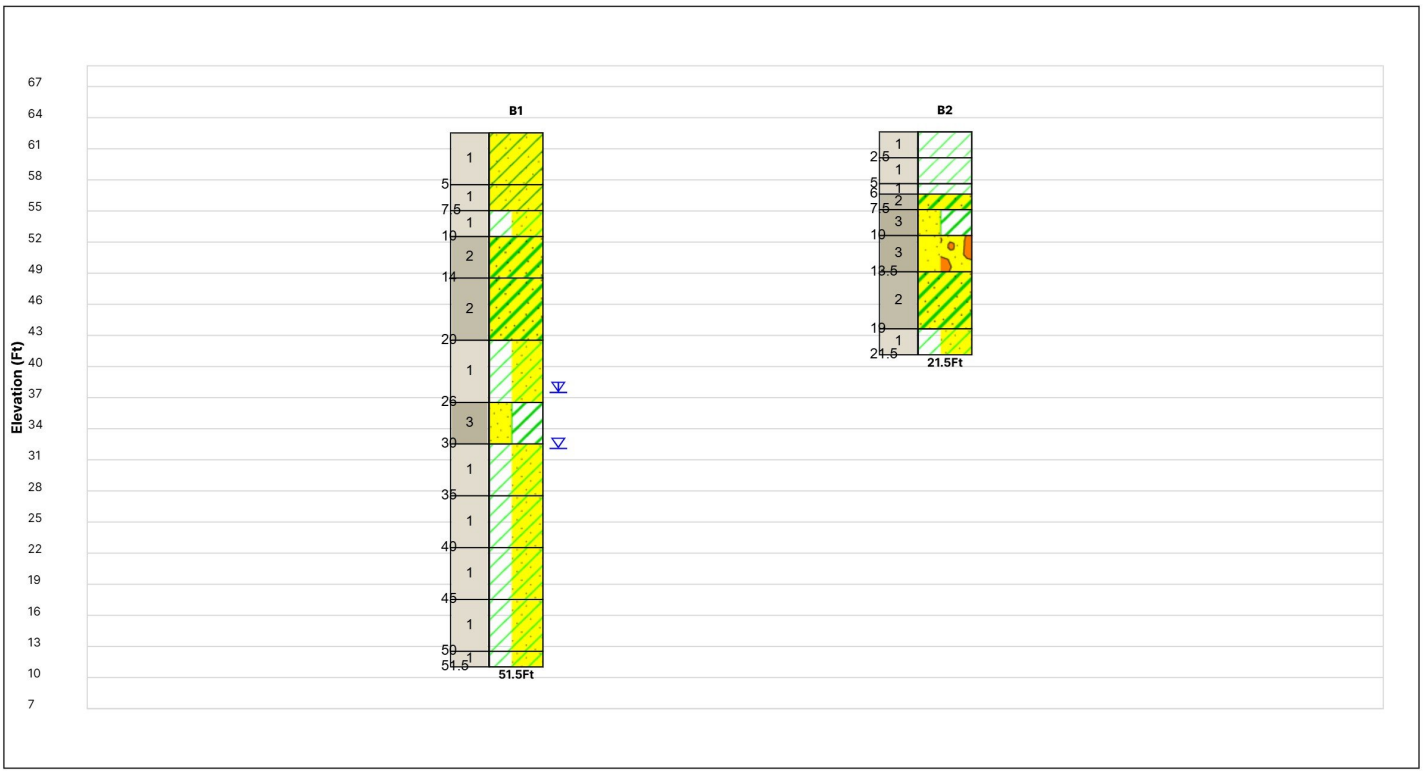
Subsurface Profile Cross Section B-B’
Subsurface Profile Cross Section C-C’
Geologic Map
Regional Faults
Regional Seismicity
Oil and Gas Map

Kimball High School Two-Story Classroom Building

3200 Jaguar Run, Tracy, CA, 95377,USA

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions

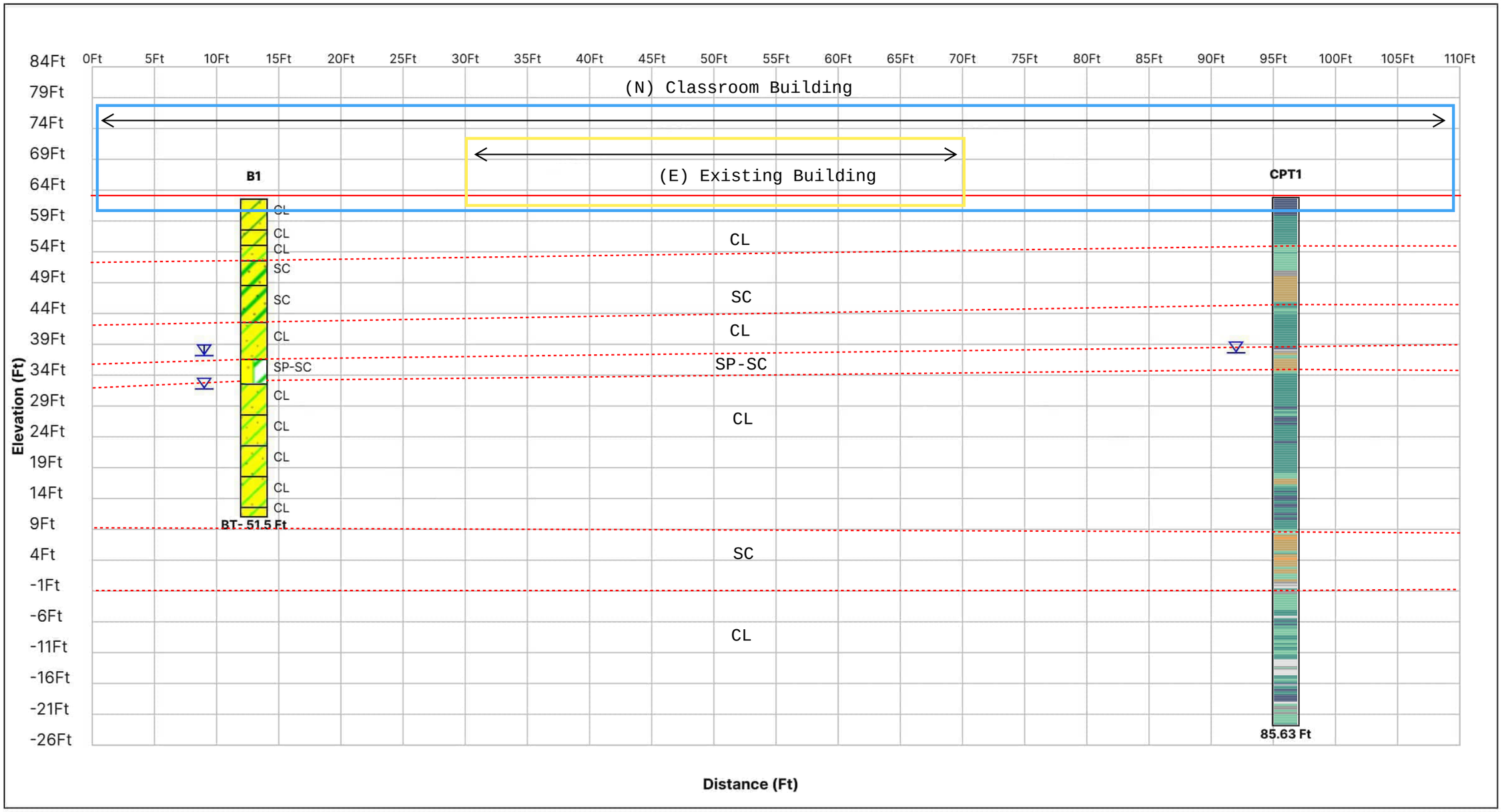
#	Layer Name	General Description
1	Lean Clay	Medium stiff to very stiff lean clay with varying amounts of sand
2	Clayey Sand	Medium dense clayey sand
3	Poorly Graded Sand	Loose to medium dense poorly graded sand with varying amounts of clay and gravel

Kimball High School Two-Story Classroom Building
Terracon Project No.: NA255078
3200 Jaguar Run, Tracy, CA, 95377, USA

Subsurface Profile

" Subsurface Profile A-A' "

A ◄ ► A'



Notes	Water Level Observations	Explanation	Material Legend
See Exploration Plan for orientation of soil profile. See General Notes in Supporting Information for symbols and soil classifications. Soils profile provided for illustration purposes only. Soils between borings may differ AR - Auger Refusal BT - Boring Termination	Water Level Reading at time of drilling. Water Level Reading after drilling.	B-1 — Borehole Number Moisture Content — %w LL PL — Liquid and Plastic Limits Sampling (See General Notes) Borehole Lithology AR BT — Borehole Termination Type	Sandy Lean Clay; Lean Clay with Sand; Clayey Sand; Poorly Graded Sand with Clay

SBT legend

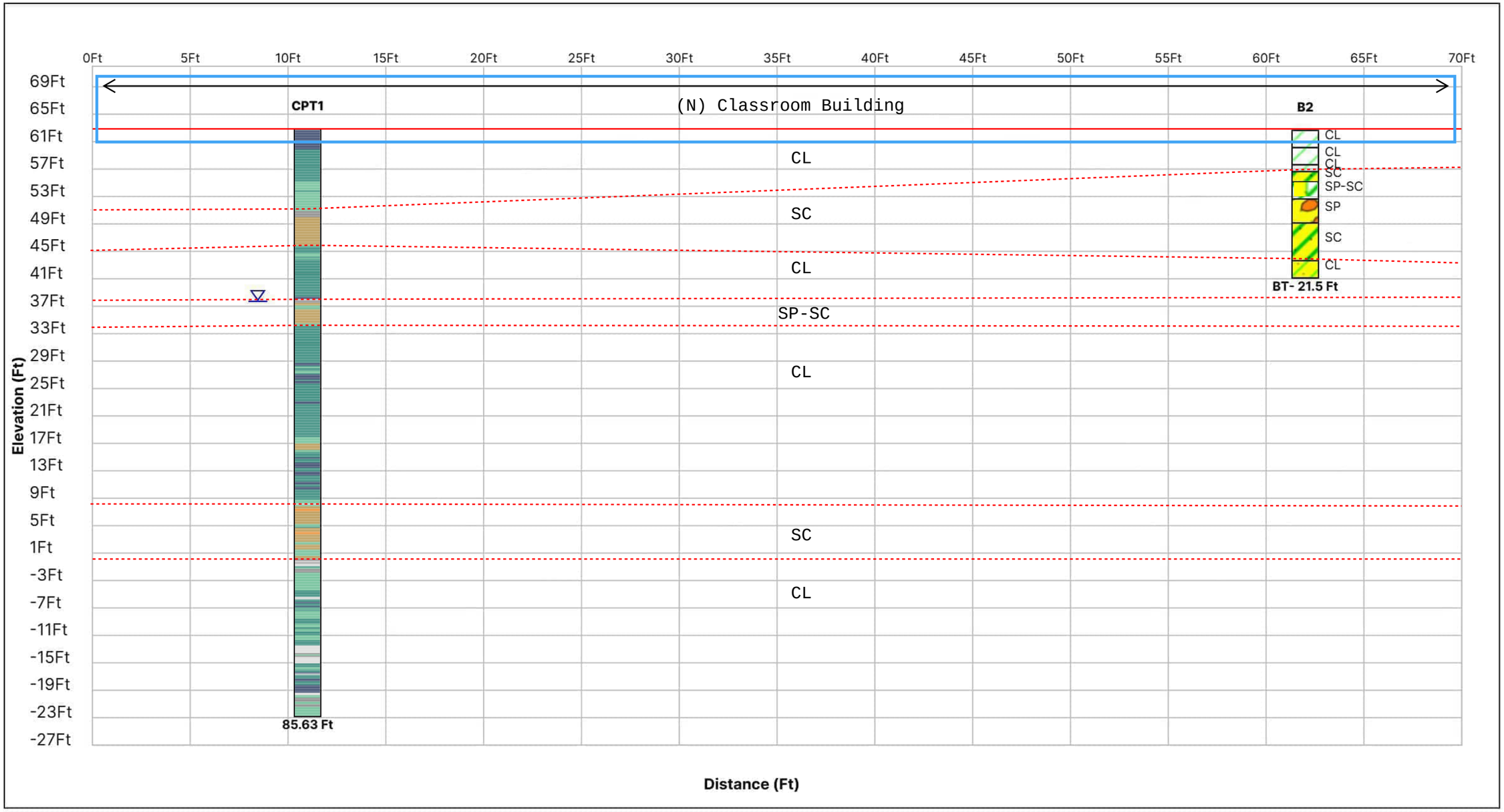
1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

Kimball High School Two-Story Classroom Building
Terracon Project No.: NA255078
3200 Jaguar Run, Tracy, CA, 95377, USA

Subsurface Profile

" Subsurface Profile B-B' "

B ◄ ► B'



Notes	Water Level Observations	Explanation
See Exploration Plan for orientation of soil profile. See General Notes in Supporting Information for symbols and soil classifications. Soils profile provided for illustration purposes only. Soils between borings may differ AR - Auger Refusal BT - Boring Termination	Water Level Reading at time of drilling. Water Level Reading after drilling.	B-1 — Borehole Number Moisture Content — %w LL PL — Liquid and Plastic Limits Borehole Lithology Sampling (See General Notes) AR BT — Borehole Termination Type

Material Legend

- Lean Clay
- Poorly Graded Sand with Gravel
- Poorly Graded Sand with Clay
- Clayey Sand
- Lean Clay with Sand

SBT legend

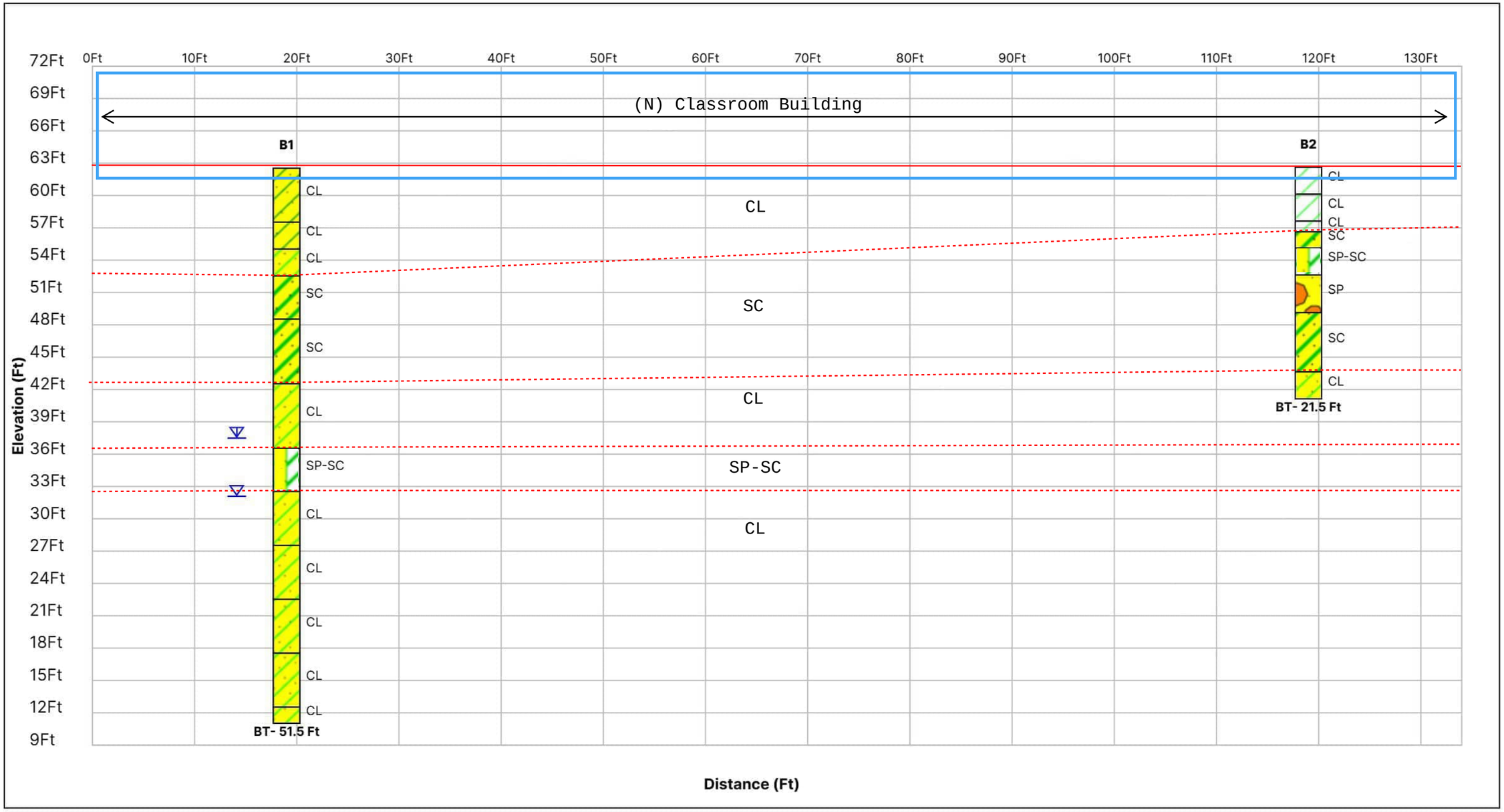
1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

Kimball High School Two-Story Classroom Building
Terracon Project No.: NA255078
3200 Jaguar Run, Tracy, CA, 95377, USA

Subsurface Profile

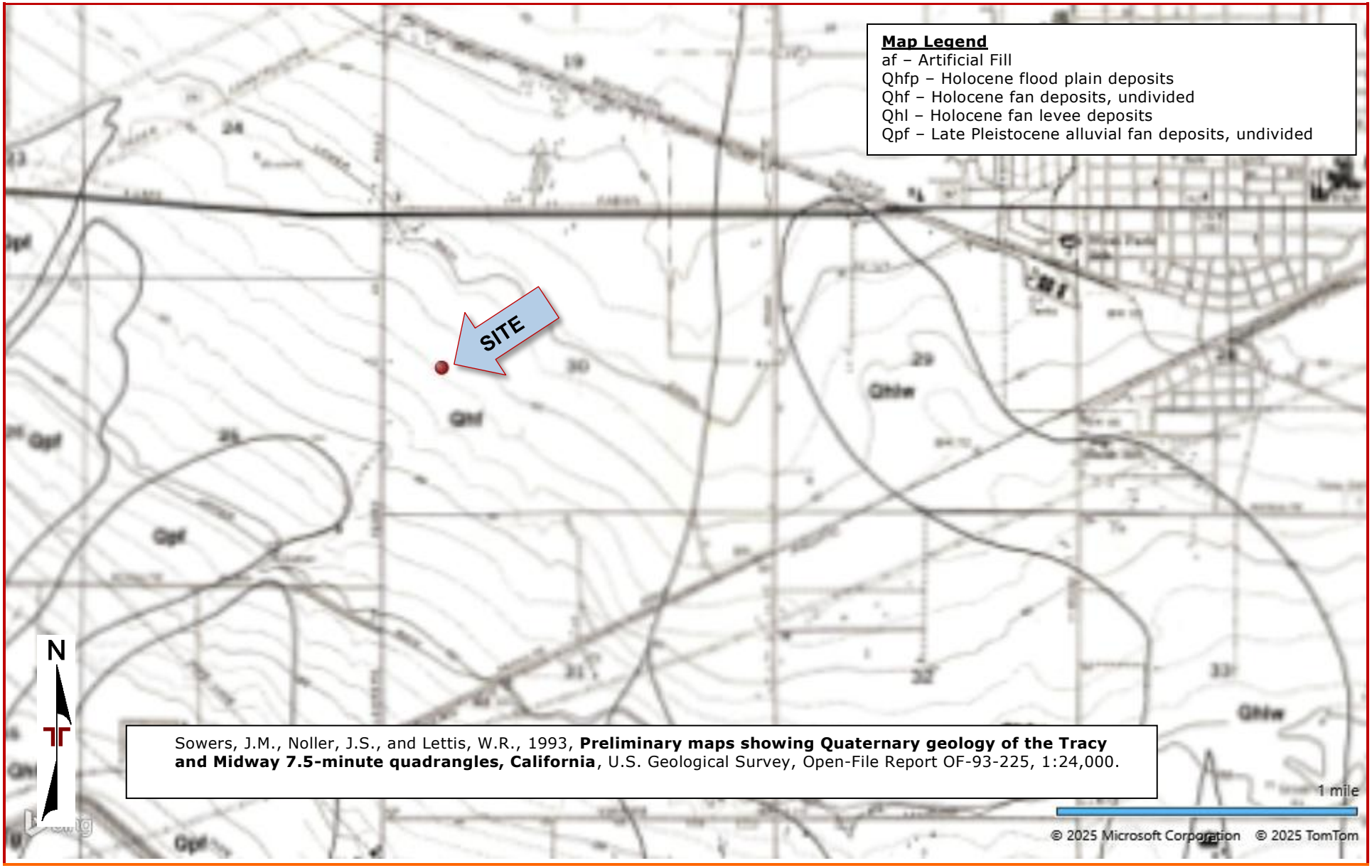
" Subsurface Profile C-C' "

C ◄ ► C'



Notes	Water Level Observations	Explanation	Material Legend
See Exploration Plan for orientation of soil profile. See General Notes in Supporting Information for symbols and soil classifications. Soils profile provided for illustration purposes only. Soils between borings may differ AR - Auger Refusal BT - Boring Termination	Water Level Reading at time of drilling. Water Level Reading after drilling.	B-1 — Borehole Number Moisture Content — %w LL PL — Liquid and Plastic Limits Sampling (See General Notes) Borehole Lithology AR BT — Borehole Termination Type	Sandy Lean Clay Lean Clay with Sand Clayey Sand Poorly Graded Sand with Clay Lean Clay Poorly Graded Sand with Gravel

Regional Geologic Map



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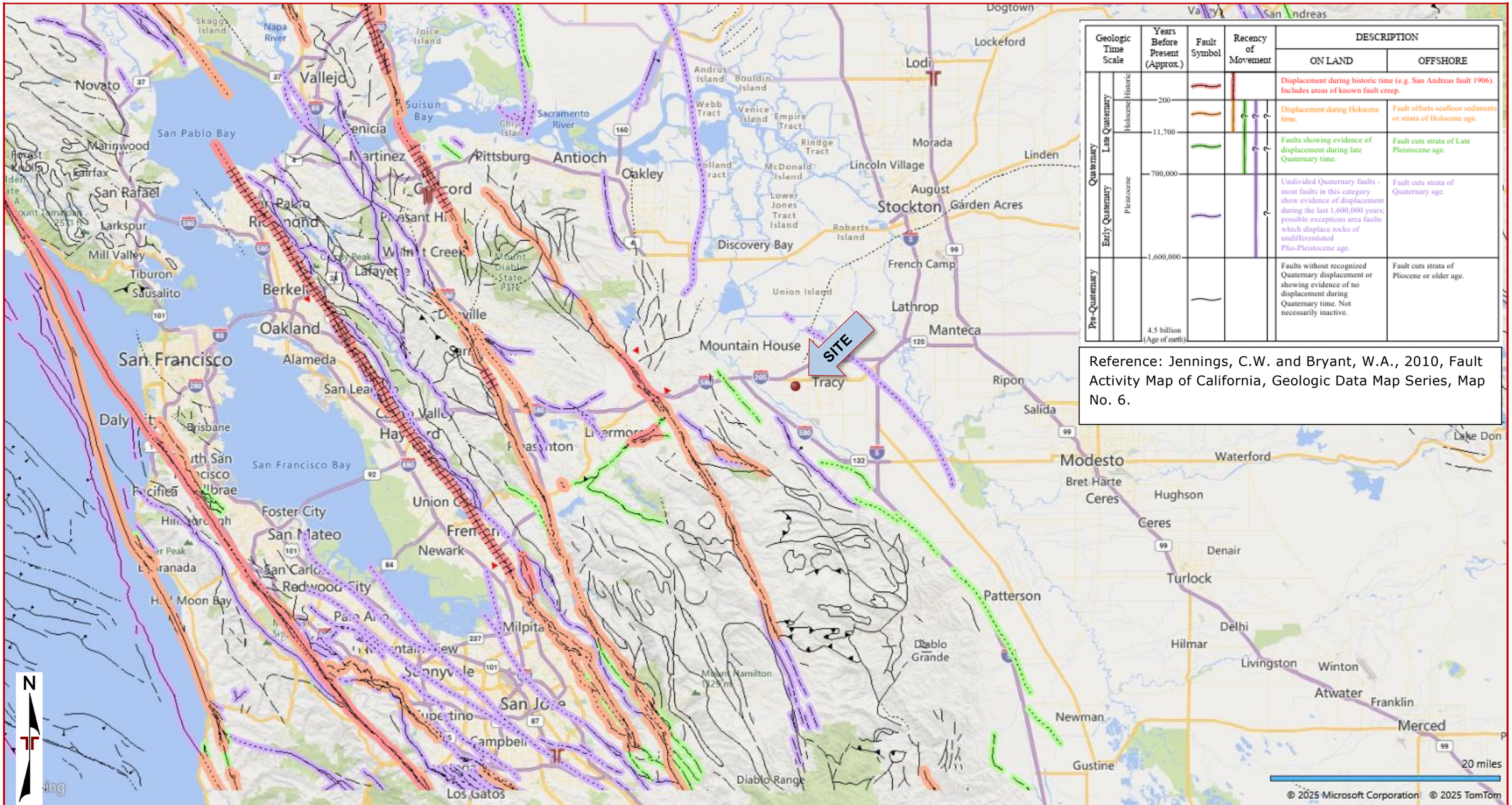
Regional Fault Map



Geologic Time Scale			Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION: ON LAND	DESCRIPTION: OFFSHORE
Quaternary	Late Quaternary	Historic				Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
		Holocene	200			Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.
		Pleistocene	11,700			Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Late Pleistocene age.
	Early Quaternary		700,000			Undivided Quaternary faults - most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions area faults which displace rocks of undifferentiated Plio-Pleistocene age.	Fault cuts strata of Quaternary age.
Pre-Quaternary			1,600,000			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.	Fault cuts strata of Pliocene or older age.
			4.5 billion (Age of earth)				

Reference: Jennings, C.W. and Bryant, W.A., 2010, Fault Activity Map of California, Geologic Data Map Series, Map No. 6.

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Regional Seismicity Map

Oil and Gas Map

Source: https://maps.conservation.ca.gov/doggr/wellfinder/

Attachments

Exploration and Testing Procedures

Field Exploration

Number of Borings/CPTs	Approximate Boring/CPT Depth (feet)	Location
1	21½ and 51½	Proposed Building Area
1 CPT	85½	Proposed Building Area

Boring Layout and Elevations: Terracon personnel provided the boring/CPT layout using handheld GPS equipment (estimated horizontal accuracy of about ±10 feet) and referencing existing site features. Approximate ground surface elevations were estimated using Google Earth. If elevations and a more precise boring and CPT layout are desired, we recommend the exploration locations be surveyed.

Subsurface Exploration Procedures: We advanced the borings with a truck-mounted rotary drill rig using continuous flight hollow stem augers. Four samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. A 3-inch O.D. split-barrel sampling spoon with 2.5-inch I.D. tube lined sampler was also used for sampling. Tube-lined, split-barrel sampling procedures are similar to standard split spoon sampling procedure; however, blow counts are typically recorded for 6-inch intervals for a total of 18 inches of penetration. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with cement grout after their completion.

We also observed the boreholes while drilling and at the completion of drilling for the presence of groundwater. The groundwater levels are shown on the attached boring and CPT logs.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials observed during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's

interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

For the cone penetrometer testing, the CPT rig hydraulically pushed an instrumented cone through the soil while nearly continuous readings were recorded to a portable computer. The cone was equipped with electronic load cells to measure tip resistance and sleeve resistance and a pressure transducer to measure the generated ambient pore pressure. The face of the cone has an apex angle of 60° and an area of 15 cm^2. Digital Data representing the tip resistance, friction resistance, pore water pressure, and probe inclination angle were recorded about every 2 centimeters while advancing through the ground at a rate between 1½ and 2½ centimeters per second. These measurements were correlated to various soil properties used for geotechnical design. In addition, seismic shear-wave velocities were measured every 1.5 to 3 meters (5 to 10 feet) of probe advancement in CPT-01. No soil samples were gathered through this subsurface investigation technique. CPT testing was conducted in general accordance with ASTM D5778 "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils."

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Dry Unit Weight
- Unconfined Compression
- Atterberg Limits
- No. 200 Wash
- Expansion Index of Soils
- Corrosivity

The laboratory testing program often included examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Site Location and Exploration Plans

Contents:

Site Location Plan
Exploration Plan

Note: All attachments are one page unless otherwise noted.

Site Location Plan

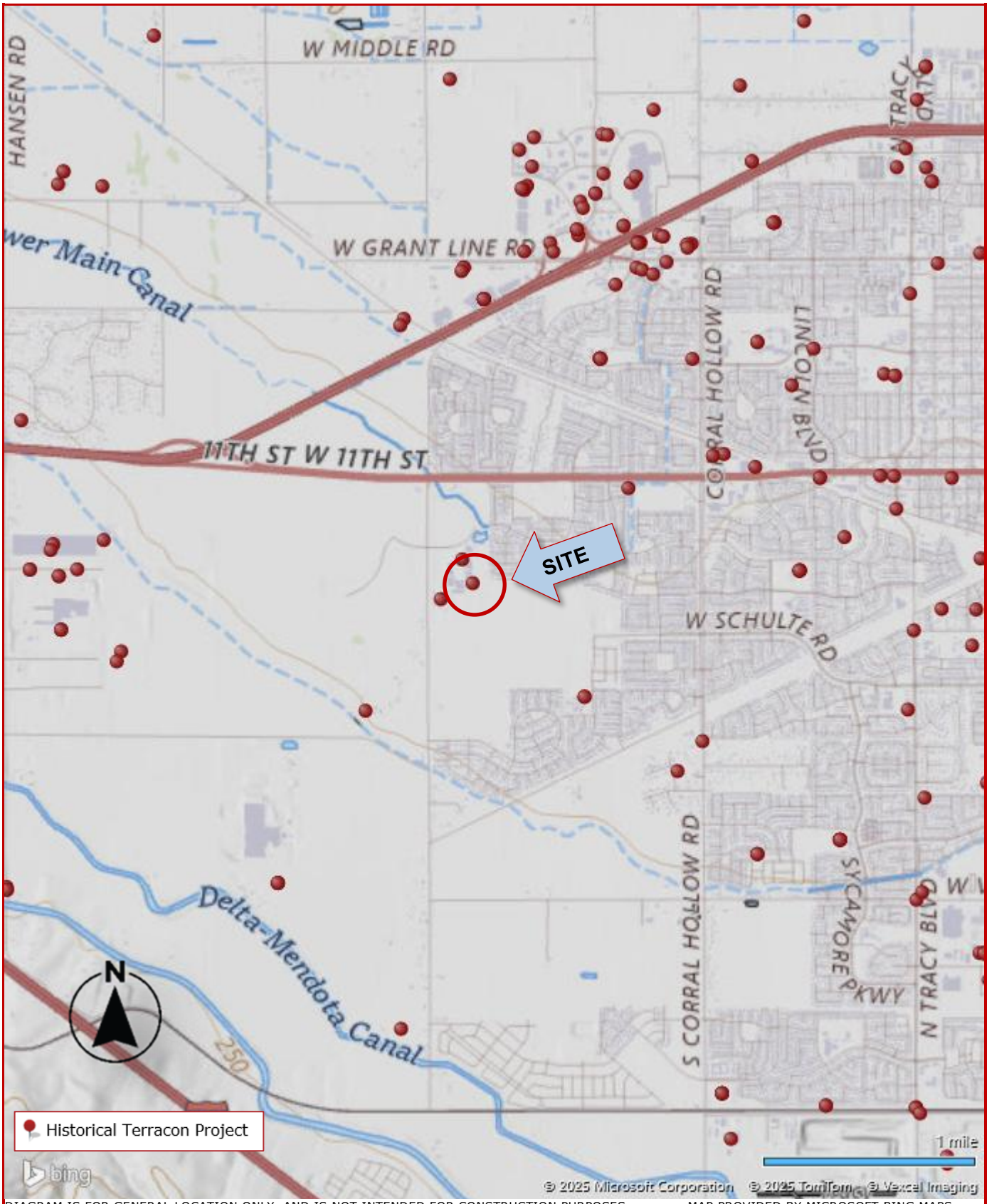


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

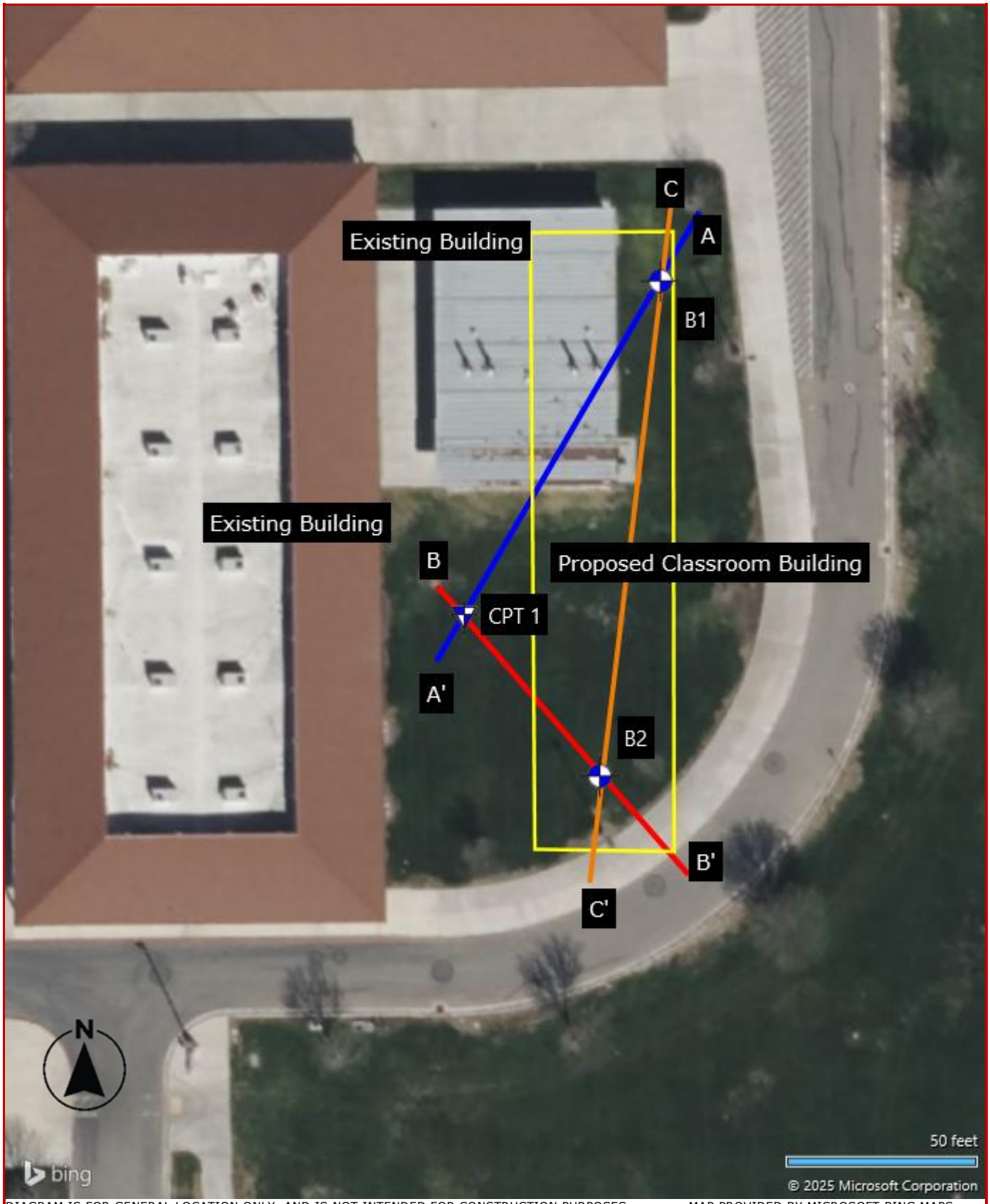


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Boring Logs (B1 and B2)
CPT Logs (CPT-01)
Shear Wave Velocity
Atterberg Limits (2 pages)
Unconfined Compressive Strength
Corrosivity

Note: All attachments are one page unless otherwise noted.

Kimball High School Two-Story Classroom Building
3200 Jaguar Run, Tracy, CA, 95377,USA
Terracon Project No. NA255078

Latitude: 37.7322° Longitude: -121.4729°

BORING LOG NO. B1

Terracon
902 Industrial Way
Lodi, CA 95240-3106

Surface Elevation:
62.53(Ft) +/-

Model Layer	Lithology Depth (Ft.)	Material Description	Depth (Ft.)	Elevation (Ft.)	Sample Type	Field Test Results	Hand Penetrometer (tsf)	Water Content (%)	Percent Fines	Atterberg Limits LL	PL	PI
1		**SANDY LEAN CLAY (CL)**, dark brown, medium stiff										
						1-3-3	2.25	24.1				
						2-3-3		23.6	76.7	46	18	28
	5.0	brown	5	57.5		1-2-3		18.0				
	7.5	**LEAN CLAY WITH SAND (CL)**, fine grained sand, light brown, medium stiff		55.0		2-3-4		20.6				
2	10.0	**CLAYEY SAND (SC)**, fine grained sand, brown, medium dense	10	52.5		6-11-11		11.2	43.9			
	14.0	brown to dark brown		48.5								
			15			10-11-9		19.5	17.1			
1	20.0	**LEAN CLAY WITH SAND (CL)**, fine grained sand, light brown, very stiff	20	42.5		6-9-12		23.2				
			25									
	26.0			36.5		6-7-14		11.1				
3		**POORLY GRADED SAND WITH CLAY (SP-SC)**, fine to medium grained sand, brown, medium dense										

DRAFT

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes
Elevation Reference: Elevation estimated using Google Earth

Water Level Observations
30 Ft. While Drilling
24.6 Ft. After Drilling

Advancement Method
0-51.5 Ft. 6" Hollow Stem Auger

Abandonment Method
Boring backfilled with cement grout upon completion.

Drill Rig
1057/CME-75

Hammer Type
Automatic

Driller
Terracon

Logged By
I. King

Boring Started
11/04/2025

Boring Completed
11/04/2025

Kimball High School Two-Story Classroom Building
3200 Jaguar Run, Tracy, CA, 95377,USA
Terracon Project No. NA255078

Latitude: 37.7322° Longitude: -121.4729°

BORING LOG NO. B1

Terracon
902 Industrial Way
Lodi, CA 95240-3106

Surface Elevation:
62.53(Ft) +/-

Model Layer	Graphic Log	Lithology Depth (Ft.)	Material Description	Depth (Ft.)	Elevation (Ft.)	Sample Type	Water Level Observations	Field Test Results	Hand Penetrometer (tsf)	Water Content (%)	Percent Fines	Atterberg Limits LL	PL	PI
3			**POORLY GRADED SAND WITH CLAY (SP-SC)**, fine to medium grained sand, brown, medium dense (continued)											
		30.0	**LEAN CLAY WITH SAND (CL)**, light brown, stiff	30	32.5			4-6-9		22.5				
1		35.0	medium stiff	35	27.5			2-2-4		27.6	93.5	36	21	15
		40.0	brown to yellowish brown, very stiff	40	22.5			7-11-11		22.5				
		45.0	light yellowish brown, stiff	45	17.5			3-5-6		26.0				
		50.0	very stiff	50	12.5			6-10-14		28.8				
			Boring Terminated at 51.5 Ft											

DRAFT

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes
Elevation Reference: Elevation estimated using Google Earth

Water Level Observations
30 Ft. While Drilling
24.6 Ft. After Drilling

Advancement Method
0-51.5 Ft. 6" Hollow Stem Auger

Abandonment Method
Boring backfilled with cement grout upon completion.

Drill Rig
1057/CME-75

Hammer Type
Automatic

Driller
Terracon

Logged By
I. King

Boring Started
11/04/2025

Boring Completed
11/04/2025

Kimball High School Two-Story Classroom Building
3200 Jaguar Run, Tracy, CA, 95377,USA
Terracon Project No. NA255078

Latitude: 37.7319° Longitude: -121.4729°

BORING LOG NO. B2

Terracon
902 Industrial Way
Lodi, CA 95240-3106

Surface Elevation:
62.63(Ft) +/-

Model Layer	Graphic Log	Lithology Depth (Ft.)	Material Description	Depth (Ft.)	Elevation (Ft.)	Sample Type	Field Test Results	Hand Penetrometer (tsf)	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf.)	Percent Fines
1			**LEAN CLAY (CL)**, brown, stiff										
							2-5-8	1.0			25.3	98.2	
		2.5	dark brown, expansion index of soils of 107		60.1								
							5-7-5		1.13	3.5	30.4	93.6	
		5.0	very stiff	5	57.6								
		6.0			56.6		8-14-15				11.5	116.1	
2			**CLAYEY SAND (SC)**, fine to medium grained sand, brown, medium dense										
		7.5			55.1								
3			**POORLY GRADED SAND WITH CLAY (SP-SC)**, fine to medium grained sand, brown, loose				3-7-9				16.9	100.1	5.1
		10.0		10	52.6								
			POORLY GRADED SAND WITH GRAVEL (SP), fine to coarse grained sand, fine grained gravel, brown, medium dense, gravel up to 3/4 inch				9-17-13				6.5	108.5	
		13.5			49.1								
2			**CLAYEY SAND (SC)**, fine to medium grained sand, brown, medium dense	15			4-11-14				13.0	94.6	
		19.0			43.6								
1			**LEAN CLAY WITH SAND (CL)**, fine grained sand, gray to brown, very stiff	20			6-14-18	4.5			23.4	103.9	
			Boring Terminated at 21.5 Ft										

DRAFT

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes
Elevation Reference: Elevation estimated using Google Earth

Water Level Observations
Groundwater not encountered

Advancement Method
0-21.5 Ft. 6" Hollow Stem Auger

Abandonment Method
Boring backfilled with cement grout upon completion.

Drill Rig
1057/CME-75

Driller
Terracon

Logged By
I. King

Boring Started
11/04/2025

Boring Completed
11/04/2025

CPT: CPT-01

Total depth: 85.63 ft, Date: 11/18/2025

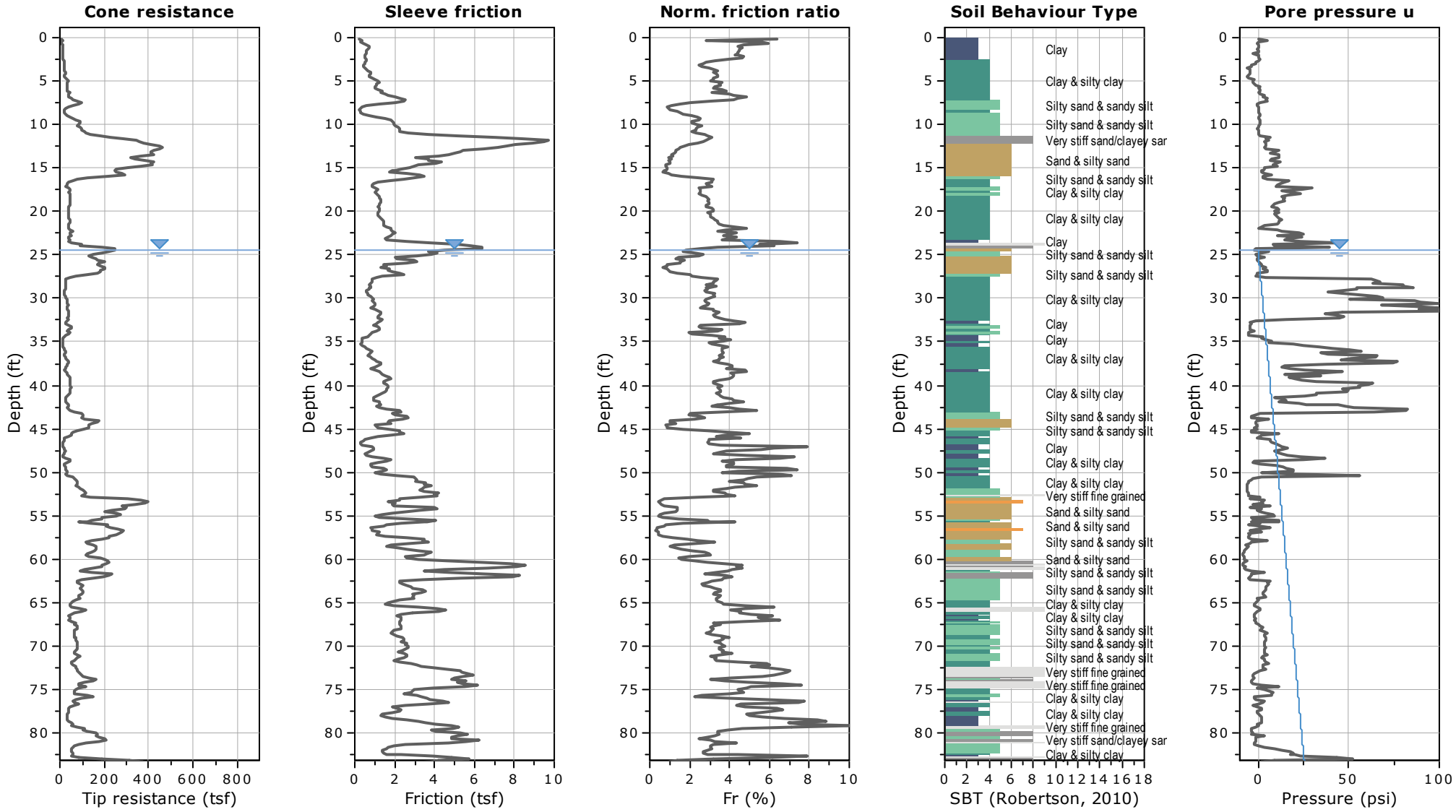
Est. GWL: 24.40 ft

Cone Type: 15cm²

Cone Operator: JM-IY

Project: Kimball High School Two-Story Classroom Building

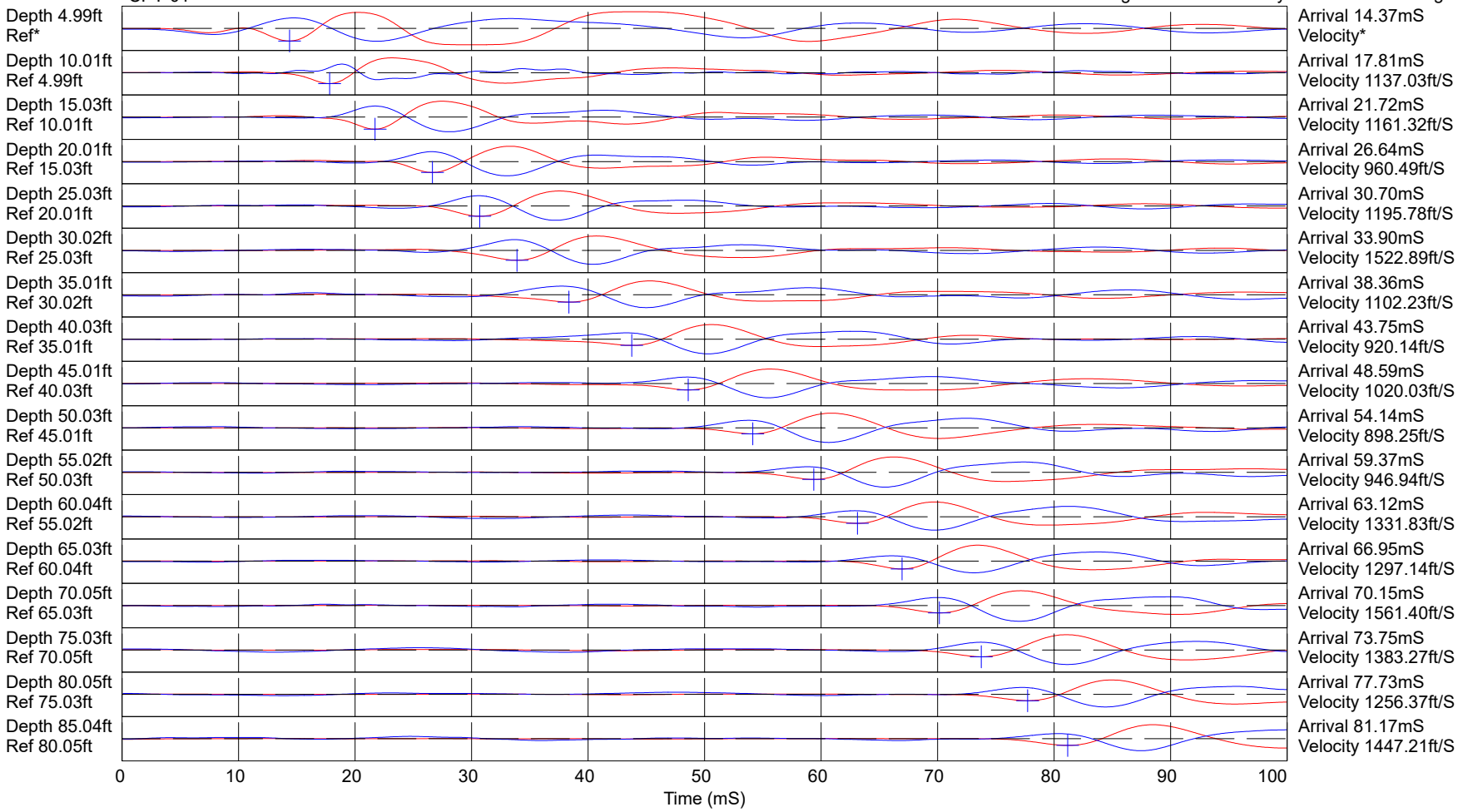
Location: Tracy, CA



Shear Wave Velocity

CPT-01

Kimball High School Two-Story Classroom Building



Hammer to Rod String Distance (ft): 5.83
* = Not Determined

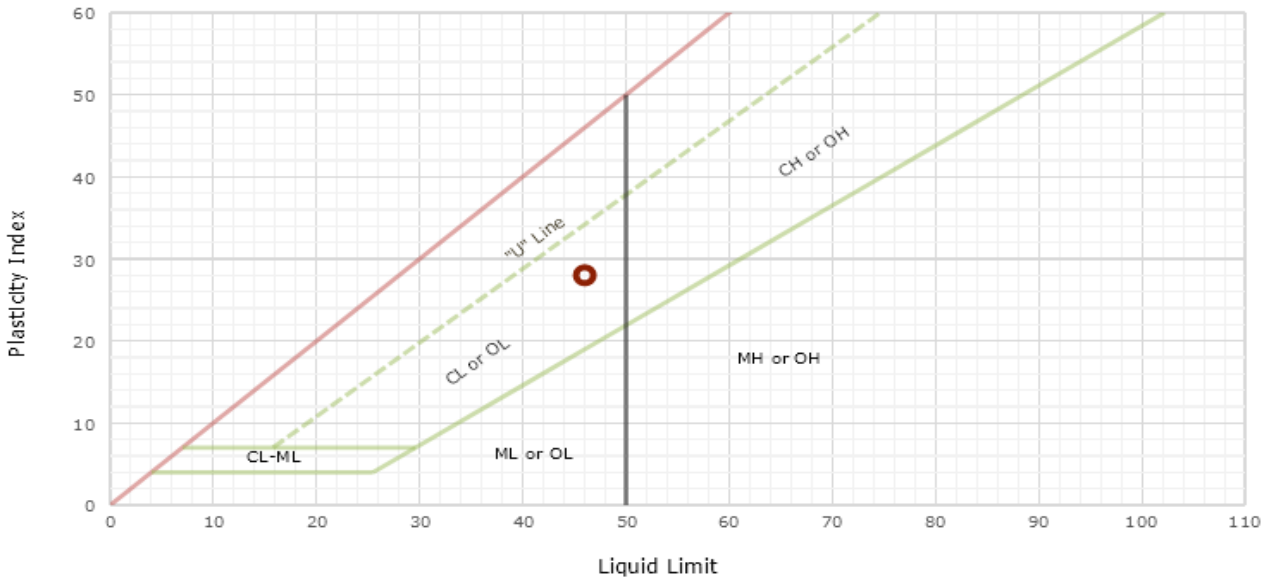
COMMENT:

Kimball High School Two-Story Classroom Building
3200 Jaguar Run | Tracy, CA 95377
Terracon Project No. NA255078

Terracon
902 Industrial Way
Lodi, CA 95240-3106

Liquid Limit, Plastic Limit and Plasticity Index of Soils

ASTM D4318



Boring ID	Depth (Ft)	LL	PL	PI	Fines (%)	Description	USCS
B1	2.5-4	46	18	28	77	Lean Clay	CL

Remarks	

Kimball High School Two-Story Classroom Building
3200 Jaguar Run | Tracy, CA 95377
Terracon Project No. NA255078

Terracon
902 Industrial Way
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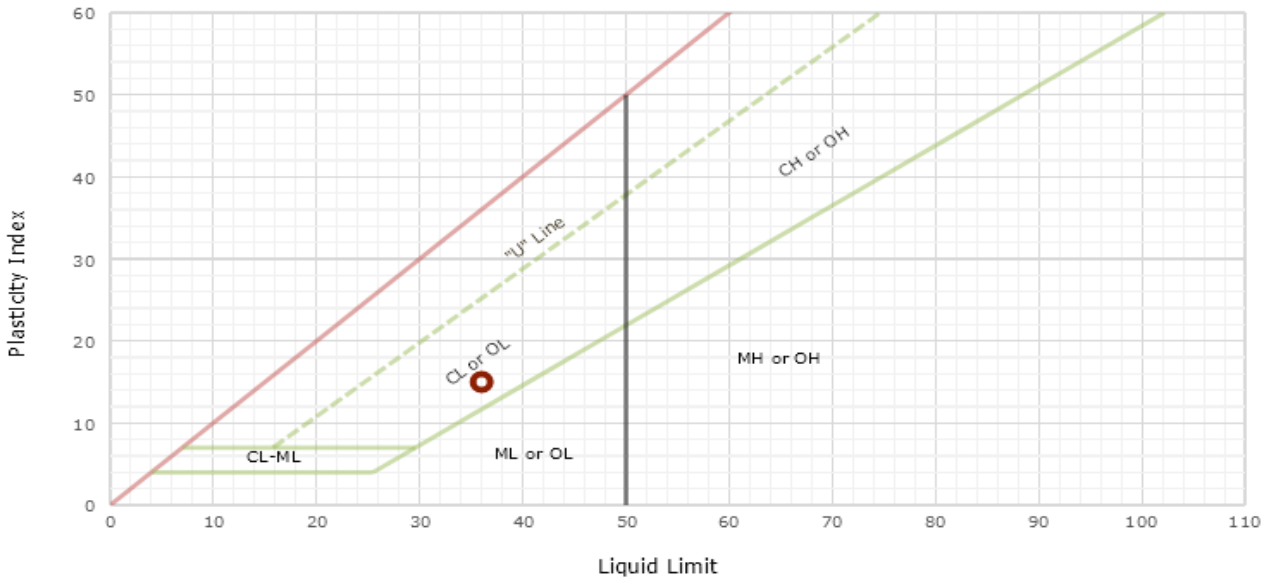
Liquid Limit, Plastic Limit and Plasticity Index of Soils

ASTM D4318



Boring ID	Depth (Ft)	LL	PL	PI	Fines (%)	Description	USCS
B1	35-36.5	36	21	15	94	Lean Clay	CL

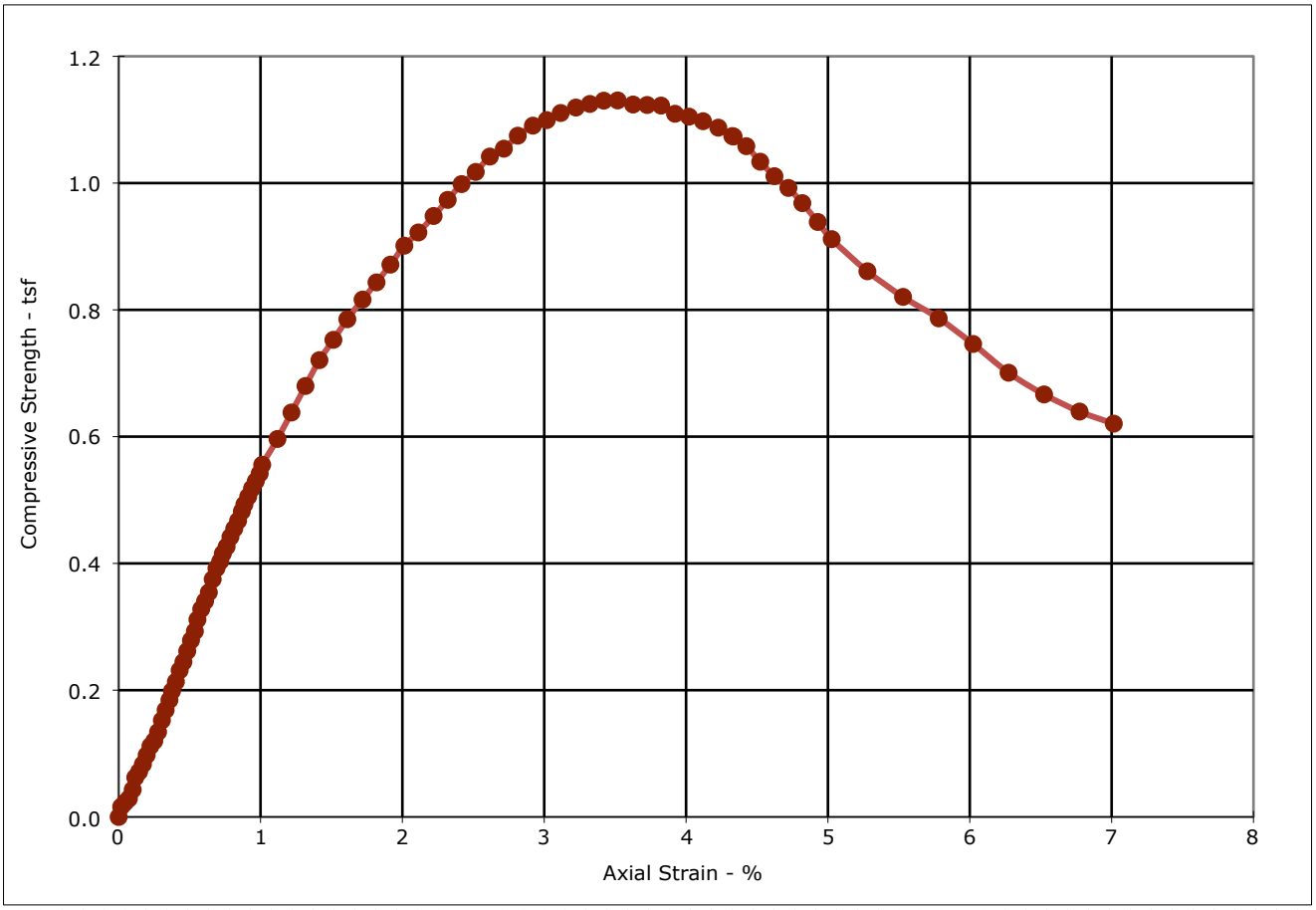
Remarks	

Kimball High School Two-Story Classroom Building
3200 Jaguar Run | Tracy, CA 95377
Terracon Project No. NA255078

Terracon
902 Industrial Way
Lodi, CA 95240-3106

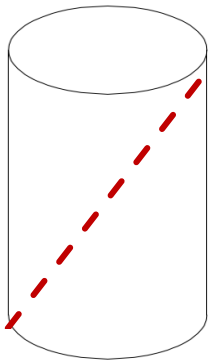
Unconfined Compressive Strength of Cohesive Soil

ASTM D2166



Boring ID	Depth (Ft)	Sample Type	LL	PL	PI	USCS	Fines (%)	Description
B2	2.5 - 4	Intact				CL		Lean Clay

Specimen Failure Mode



Specimen Test Data

Water Content (%):	30.4
Dry Density (pcf):	93.6
Diameter (in.):	2.38
Height (in.):	4.84
Height / Diameter Ratio:	2.03
Calculated Saturation (%):	102.7
Calculated Void Ratio:	0.80
Assumed Specific Gravity:	2.7
Failure Strain (%):	3.5
Unconfined Compressive Strength (tsf):	1.13
Undrained Shear Strength (tsf):	0.57
Strain Rate (%/min):	1.0
Remarks:	.

Terracon
902 Industrial Way
Lodi, CA 95240-3106

Soil Corrosivity Profile

Summary Report

Boring ID	B1
Sample Depth, (ft)	5
Sample Description	Lean Clay

Test Method	Test Designation	Test Result
Electrical Resistivity (Ω·cm)	ASTM G57	540
Oxidation Reduction Potential (RmV)	ASTM G200	129
Acidity (pH)	AASHTO T289	7.6
Chloride Ion Content (mg/kg)	AWWA -4500-CL-B	1
Soluble Sulfate Content (mg/kg)	ASTM D516	642
Total Dissolved Salts (mg/kg)	AWWA 2520 B	1315
Sulfides (mg/kg)	AWWA 4500-S2- D	0

Instrument Identifications			
Oxidation Reduction Potential		**Acidity (pH)**	
Probe ID	Oakton Testr 50	Meter ID	Oakton pH Testr 30
Meter ID	Oakton Testr 50	Thermometric Type	Digital
Thermometric Type	Digital		

Supporting Information

Contents:

General Notes
Unified Soil Classification System

Note: All attachments are one page unless otherwise noted.

General Notes

Sampling		
Auger Cuttings	Modified California Ring Sampler	Rock Core
Dynamic Cone Penetrometer	Modified Dames & Moore Ring Sampler	Dual Sampler SPT
Grab Sample	GeoProbe Macro Core or Large Bore	No Recovery
Ring Sampler	Shelby Tube	Standard Penetration Test
Split Spoon	Texas Cone Penetrometer	Vane Shear

Water Level

- Water Initially Encountered
- Water Level After a Specified Period of Time
- Water Level After a Specified Period of Time
- Cave In Encountered

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

Field Tests

N	Standard Penetration Test Resistance (Blows/Ft.)
(HP)	Hand Penetrometer
(T)	Torvane
(DCP)	Dynamic Cone Penetrometer
UC	Unconfined Compressive Strength
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

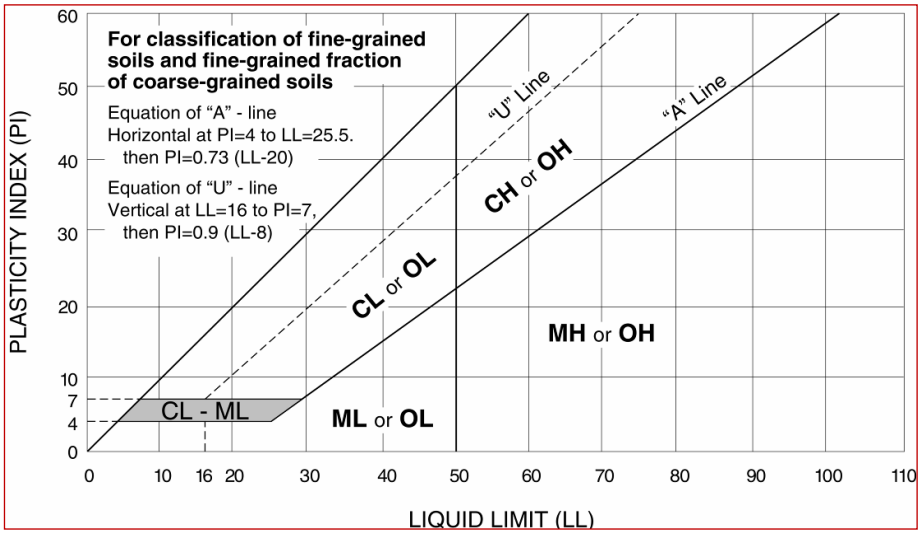
Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance			Consistency of Fine-Grained Soils (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Relative Density	**Standard Penetration or N-Value (Blows/Ft.)**	**Ring Sampler (Blows/Ft.)**	**Consistency**	**Unconfined Compressive Strength Qu (tsf)**	**Standard Penetration or N-Value (Blows/Ft.)**	**Ring Sampler (Blows/Ft.)**
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium Stiff	0.50 to 1.00	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18
Very Dense	> 50	> 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42
			Hard	> 4.00	> 30	> 42

Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.