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July 10, 2023
Project No. 23-2444

Mr. Bruce Dorfman
Education Housing Partners, Inc.
39 Forrest Street, Suite 201
Mill Valley, CA 94941

Subject: Preliminary Geotechnical Study
Proposed Alum Rock Unified School District Faculty Housing
2050 Kammerer Avenue and 2930 Gay Avenue
San Jose, California

Dear Mr. Dorfman:

This letter presents the results of the preliminary geotechnical study performed by Rockridge Geotechnical, Inc. in support of the preliminary evaluation of two properties for a potential residential development. The addresses of the properties under consideration are 2050 Kammerer Avenue and 2930 Gay Avenue in San Jose, California. The approximate locations of the properties are shown on Figure 1, Site Location Map. Based on our discussions with the development team, we understand the Alum Rock Unified School District (ARUSD) is considering building about 50 units of faculty housing at one of the properties. Conceptual development plans consist of two-story apartment buildings.

SCOPE OF SERVICES

Our preliminary geotechnical study was performed in accordance with our proposal dated June 15, 2023. The objectives of our study were to review available geologic, groundwater, and seismic hazard maps, historic aerial photos, and boring logs in the vicinity of both sites to evaluate subsurface conditions at the sites. Subsurface investigations were not performed for this study.

Based on our findings, we developed preliminary conclusions and recommendations for the following:

- anticipated subsurface conditions beneath the sites
- regional seismicity and seismic hazards, including the presence of liquefaction, landslide, or fault rupture hazard zones
- conceptual foundation types for the proposed structures
- anticipated Site Class designations for seismic design

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GEOLOGIC SETTING AND GENERAL SUBSURFACE CONDITIONS

The sites lie along the southern margin of San Francisco Bay near the central portion of the Santa Clara Valley, which is part of the Coast Ranges geomorphic province. The province is characterized by northwest-southeast trending valleys and ridges. These are controlled by folds and faults that resulted from the collision of the Farallon and North American plates and subsequent shearing along the San Andreas fault system. Movements along this plate boundary in the Northern California region occur along right-lateral strike-slip faults of the San Andreas Fault system.

Predominantly Franciscan Complex rocks of Jurassic and Cretaceous age (160 to 100 million years old) flank the large depression that makes up the San Francisco Bay. The Santa Clara Valley is bound by the San Andreas fault on the west, the Santa Cruz mountains on the south, Diablo Range mountains and the Hayward and Calaveras fault systems on the east, and San Francisco Bay on the north. Santa Clara Valley is a broad, irregularly shaped valley of low relief composed of alluvial fan deposits of Quaternary age (2.6 million years old to recent in age) that have accumulated from erosion of the surrounding hills.

A regional geologic map of the site vicinities is presented on Figure 2. Published geologic mapping (Witter et al., 2006) indicates the sites are mapped within or immediately adjacent to the following geologic units:

2050 Kammerer Avenue

Qhff – Holocene (11,000 years ago to present) alluvial fan deposit, fine facies
Qhl -- Holocene alluvial fan levee deposit
ac – Artificial stream channel

2930 Gay Avenue

Qpf – Latest Pleistocene (129,000 to 11,000 years ago) alluvial fan deposit

The Kammerer site is located adjacent to Thompson Creek, which appears to have been channelized with an alignment similar to that of its pre-development watercourse.

Available results subsurface explorations in the general site vicinities within the same geology units are presented in Appendix A. These explorations include publicly available boring logs provided by the California Geologic Survey (CGS) and cone penetration tests (CPTs) performed by the United States Geological Survey (USGS). The approximate location of these investigations in relation to the sites are presented on Figure 2.

Based on the geologic information, our experience in the region, and a review of subsurface explorations (typically within 1/4 to 1/2 mile of the sites), we anticipate the sites are underlain by interbedded layers of clay, silt, sand, and gravel, which is typical of alluvial fan deposits. Near-surface soils in the Santa Clara Valley frequently consist of highly expansive clays.

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Groundwater

We reviewed regional groundwater maps prepared by the California Geologic Survey (CGS), as well as groundwater well measurements available from the State of California.[1] A summary of the groundwater conditions is presented in Table 1.

Table 1
Summary of Groundwater Conditions

Site	Regional Historic High Groundwater Level (feet, depth)	Measured Ground Water Level (feet, depth)	Measurement Info
2050 Kammerer	~10	~5-20	No measurements in immediate site vicinity, reported values are from variety of readings within about a 1/2-mile radius
2930 Gay	>40 feet	-	-

The depth to groundwater is expected to fluctuate seasonally, depending on rainfall amounts.

REGIONAL SEISMICITY

The major active faults in the area are the Hayward, Calaveras, and San Andreas faults. These and other faults in the region are shown on Figure 3. The distance and characteristic magnitudes of the sites to these faults are shown in Table 2.

Table 2
Regional Faults and Seismicity

Fault Name	Characteristic Moment Magnitude†	Approximate Distance from Each Site (km)	
		2050 Kammerer	2930 Gay
Silver Creek	(not assigned)	2.0	3.9
Total Hayward + Rodgers Creek (RC+HN+HS+HE)	7.58	5.1	3.8
Total Calaveras (CS+CC+CS+CE)	7.43	7.6	6.0
Monte Vista - Shannon	7.14	15	17
Total North San Andreas (SAO+SAN+SAP+SAS)	8.04	24	25

†per BSSC scenario catalog (Luco et al. 2015)

[1] https://geotracker.waterboards.ca.gov/

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The U.S. Geological Survey's 2014 Working Group on California Earthquake Probabilities has compiled the earthquake fault research for the San Francisco Bay area to estimate the probability of fault segment rupture. They have determined that the overall probability of a moment magnitude 6.7 or greater earthquake occurring in the San Francisco Region during the 30-year period from 2014-2044, is 72 percent.

SEISMIC HAZARDS

Because the project sites are in a seismically active region, we evaluated the potential for earthquake-induced geologic hazards including ground shaking, ground surface rupture, and liquefaction.[2] The discussion in the following paragraphs is preliminary and seismic hazards should be re-evaluated based on site-specific geotechnical investigations.

Mapped Seismic Hazard Zones

We evaluated whether the sites are located within mapped geotechnical hazard zones. Specifically, we reviewed:

> *Earthquake Zones of Required Investigations* for *San Jose West Quadrangle* and *San Jose East Quadrangle*, prepared by CGS
>
> *USGS Liquefaction Probability for M7.8 San Andreas Fault earthquake scenario, Santa Clara County, Open File Report 2008-1270* prepared by USGS

Portions of these maps are presented on the attached Figures 4 and 5. The zone designations from these sources are summarized for the various sites in Table 3.

Table 3
Mapped Seismic Zone Summary

Site	Fault Hazard (A-P) zone?	Landslide Hazard Zone?	Liquefaction Hazard Zone? (per CGS)	Probability of Shallow Liquefaction (Surface Manifestations)* (per USGS)
2050 Kammerer	No	No	Yes	0-5%
2930 Gay	No	No	No	"Low" (probability not assigned)

*does not consider liquefaction of deeper soil layers

2 Liquefaction is a phenomenon where loose, saturated, cohesionless soil experiences temporary reduction in strength during cyclic loading such as that produced by earthquakes.

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Ground Shaking

The seismicity of the sites is governed by the activity of the Hayward, San Andreas, and Calaveras faults, although ground shaking from future earthquakes on other faults will also be felt at the site. The intensity of earthquake ground motion at the sites will depend upon the characteristics of the generating fault, distance to the earthquake epicenter, and magnitude and duration of the earthquake. We judge that strong to very strong ground shaking could occur at the sites during a large earthquake on one of the nearby faults.

Ground Surface Rupture

Historically, ground surface displacements closely follow the trace of geologically young faults. The site is not within an Earthquake Fault Zone, as defined by the Alquist-Priolo Earthquake Fault Zoning Act, and no known active or potentially active faults exist on the sites. We therefore conclude the risk of fault offset at the sites from a known active fault is very low. In a seismically active area, the remote possibility exists for future faulting in areas where no faults previously existed; however, we conclude the risk of surface faulting and consequent secondary ground failure from previously unknown faults is also very low.

Liquefaction and Associated Hazards

Liquefaction is a phenomenon in which saturated soil temporarily loses strength from the build-up of excess pore water pressure, especially during earthquake-induced cyclic loading. Soil susceptible to liquefaction includes loose to medium dense sand and gravel, low-plasticity silt, and some low-plasticity clay deposits. Flow failure, lateral spreading, differential settlement, loss of bearing strength, ground fissures, and sand boils are evidence of excess pore pressure generation and liquefaction.

Based on the geologic conditions and available subsurface information, we preliminarily conclude the liquefaction potential of the 2050 Kammerer site is low to moderate. Potentially liquefiable layers were encountered between depths of 5 and 9 feet at location 37287-B10. No significant layers of potentially liquefiable soil were encountered in CPT SCC-195 and SCC-196, which are considered a more reliable investigation method for evaluating liquefaction susceptibility. Due to the proximity of Thompson Creek, portions of the site may be partially underlain by geologically young sand deposits from a pre-development creek alignment. If present, this material is likely to be susceptible to liquefaction.

Due to the groundwater depth, geologic age, and available CPT results, we preliminarily conclude the liquefaction potential of the 2930 Gay Avenue site is low.

PRELIMINARY CONCLUSIONS AND CONSIDERATIONS

Based on the results of our study, we anticipate the primary geotechnical concerns for developing the sites as planned is providing adequate foundation support for the proposed buildings. This and other geotechnical issues as they pertain to the proposed developments are briefly discussed in the remainder of this section.

Foundations and Settlement

The building types currently under consideration consist of relatively light, wood-framed structures. We considered conventional spread footings as a foundation alternative for the wood-framed apartment buildings under consideration; however, considering the lack of large, concentrated loads associated with this building construction type, and the multiple angle points and jogs typically used in the building layout, conventional footings are generally not an efficient foundation system from a constructability standpoint. We believe a more economical and better-performing foundation alternative would be stiffened concrete mat foundations or post-tensioned concrete slabs-on-grade (P-T slabs).

If shallow liquefiable material is present at the 2050 Kammerer Avenue site where a mat or P-T slab is used, the potential for liquefaction induced settlements or bearing failure will need to be carefully evaluated. Where settlements are excessive, ground improvement will need to be performed. Ground improvement is briefly discussed in the next section.

The required thickness of the foundation systems is difficult to estimate, as it depends on site-specific soil conditions, building loads, and tolerable deformations specified by the architect and structural engineer. For preliminary estimation purposes, an assumed thickness of 12 inches (PT-slab) or 16 inches (stiffened concrete mat) could be used.

Ground Improvement

Ground improvement serves to stiffen the soil matrix where the ground improvement elements are installed, as well as transferring the foundation loads to deeper, more competent material, thus reducing settlements and providing increased bearing capacity beneath footings or a mat. Depending on the depth, consistency, and soil type of the problematic layers, there are various types of ground improvement which may be used.

For relatively shallow layers, the material may be overexcavated and replaced with well-compacted engineered fill. If over-excavation is not feasible, we anticipate the most economical and appropriate ground improvement systems consists of compacted gravel columns.

Based on our experience on similar projects across Santa Clara Valley and the available subsurface information, potential ground improvement columns would likely be confined to the upper 15 feet of the soil profile, though deeper or alternative ground improvement systems may be needed.

Expansive Soils

Based on our experience in the Santa Clara Valley, we anticipate the near-surface soil may consist of expansive clay. Expansive near-surface soil is subject to volume changes during fluctuations in moisture content. These volume changes can cause movement and cracking of foundations, pavements, slabs, and below-grade walls. Therefore, foundations, pavements, slabs, and below-grade walls should be designed and constructed to resist the effects of the expansive soil.

In general, the effects of expansive soil can be mitigated by moisture-conditioning the expansive soil, providing select, non-expansive fill or lime-treated soil below interior and exterior slabs and behind retaining walls, and either supporting foundations below the zone of severe moisture change or by providing a stiff foundation system that can limit deformation of the superstructure as the underlying soil shrinks and swells. For sites underlain by highly expansive soil, thickening of the mat or P-T slab edge may be warranted to limit seasonal moisture changes in the soil underlying the foundation.

To prevent the soil subgrade beneath the mat or P-T slab from drying during construction and to reduce the long-term effects of expansive subgrade soil, a layer of non-expansive fill (typically between 9 and 18 inches thick, depending on how expansive the soil is) should be placed on the prepared subgrade. The non-expansive fill may consist of either imported select fill material or onsite soil treated in place with lime.

Seismic Site Classification

Based on the geologic conditions, we preliminarily conclude that Site Class D (2050 Kammerer Avenue) and Site Class C (2930 Gay Avenue) can be considered.

FINAL GEOTECHNICAL INVESTIGATION

The preliminary recommendations made in this report are based on regional subsurface information and are provided for preliminary planning purposes. A site-specific geotechnical study should be performed for each of the sites to provide design-level conclusions and recommendations regarding the geotechnical aspects of the projects.

We trust this letter provides the information you need. If you have any questions, please call.

Sincerely,
ROCKRIDGE GEOTECHNICAL, INC.

REGISTERED PROFESSIONAL ENGINEER
CLAYTON J. PROTO
C 84071
CIVIL
STATE OF CALIFORNIA

Clayton J. Proto, P.E.
Senior Engineer

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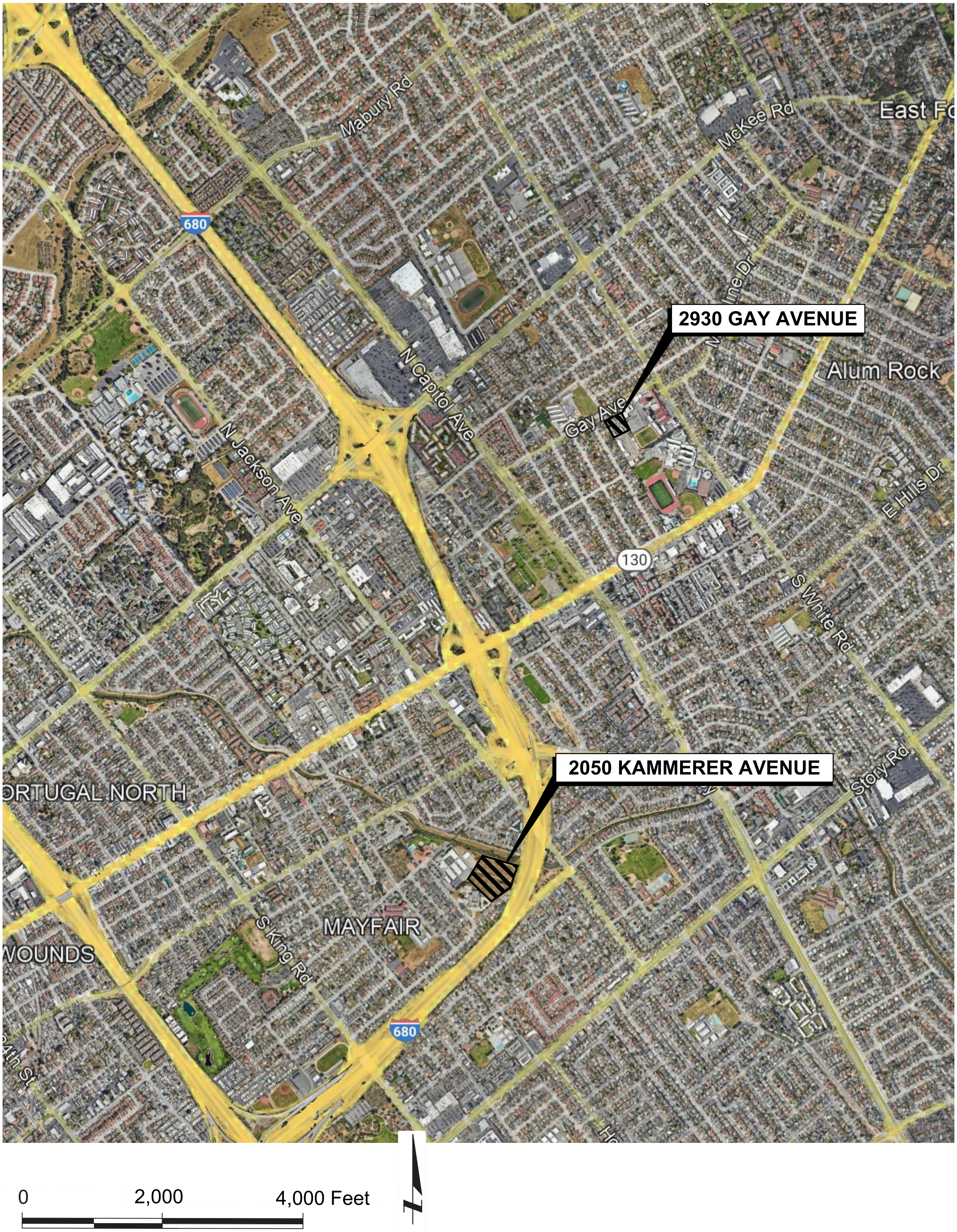
Attachments:

Figure 1 – Site Location Map
Figure 2 – Regional Geologic Map
Figure 3 – Regional Fault Map
Figure 4 – Seismic Hazard Zones Map
Figure 5 – USGS Liquefaction Hazard Map
Appendix A – Available Subsurface Exploration Logs



ARUSD FACULTY HOUSING
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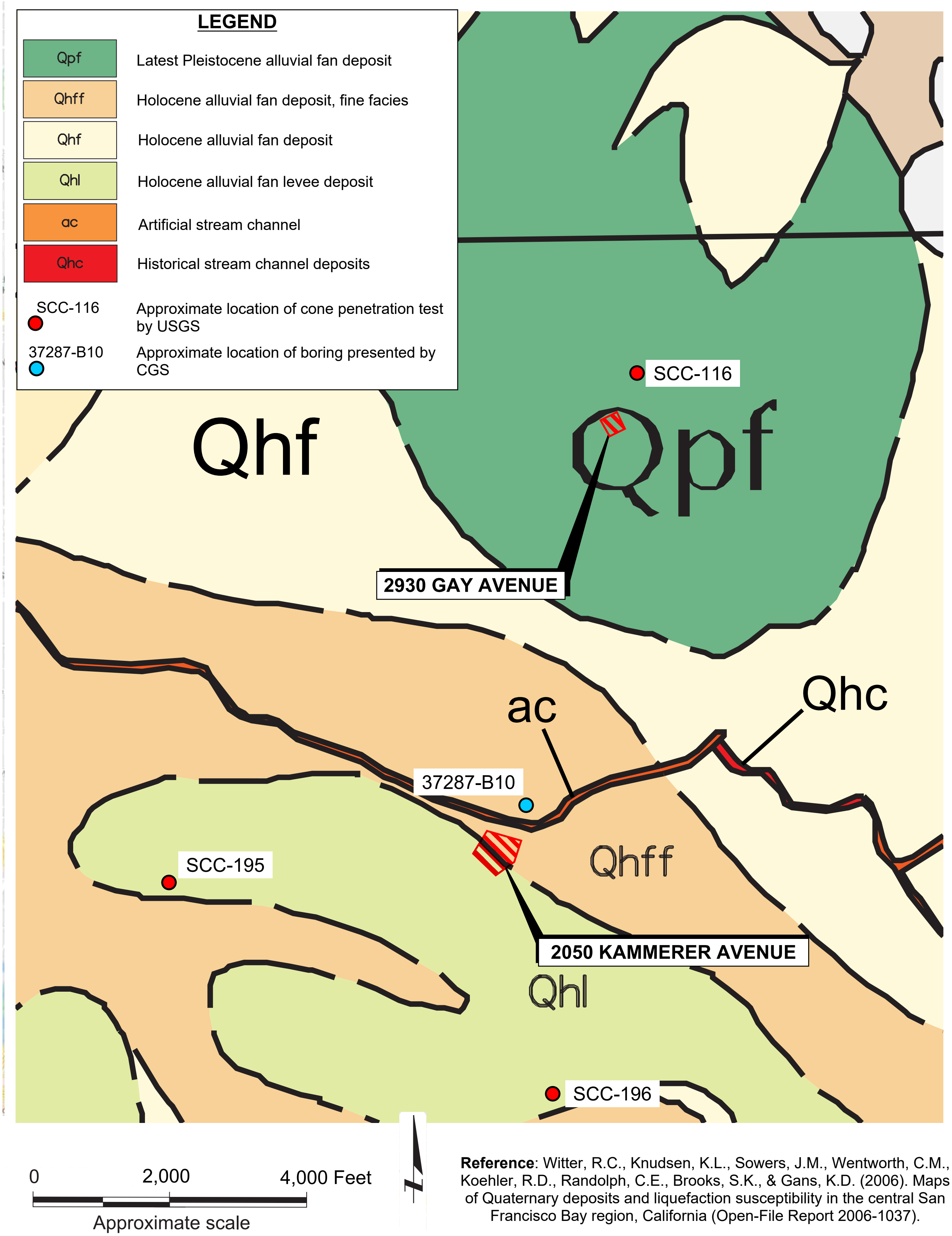
SITE LOCATION MAP

Date 7/7/23	Project No. 23-2444	Figure 1



Reference: Witter, R.C., Knudsen, K.L., Sowers, J.M., Wentworth, C.M., Koehler, R.D., Randolph, C.E., Brooks, S.K., & Gans, K.D. (2006). Maps of Quaternary deposits and liquefaction susceptibility in the central San Francisco Bay region, California (Open-File Report 2006-1037).

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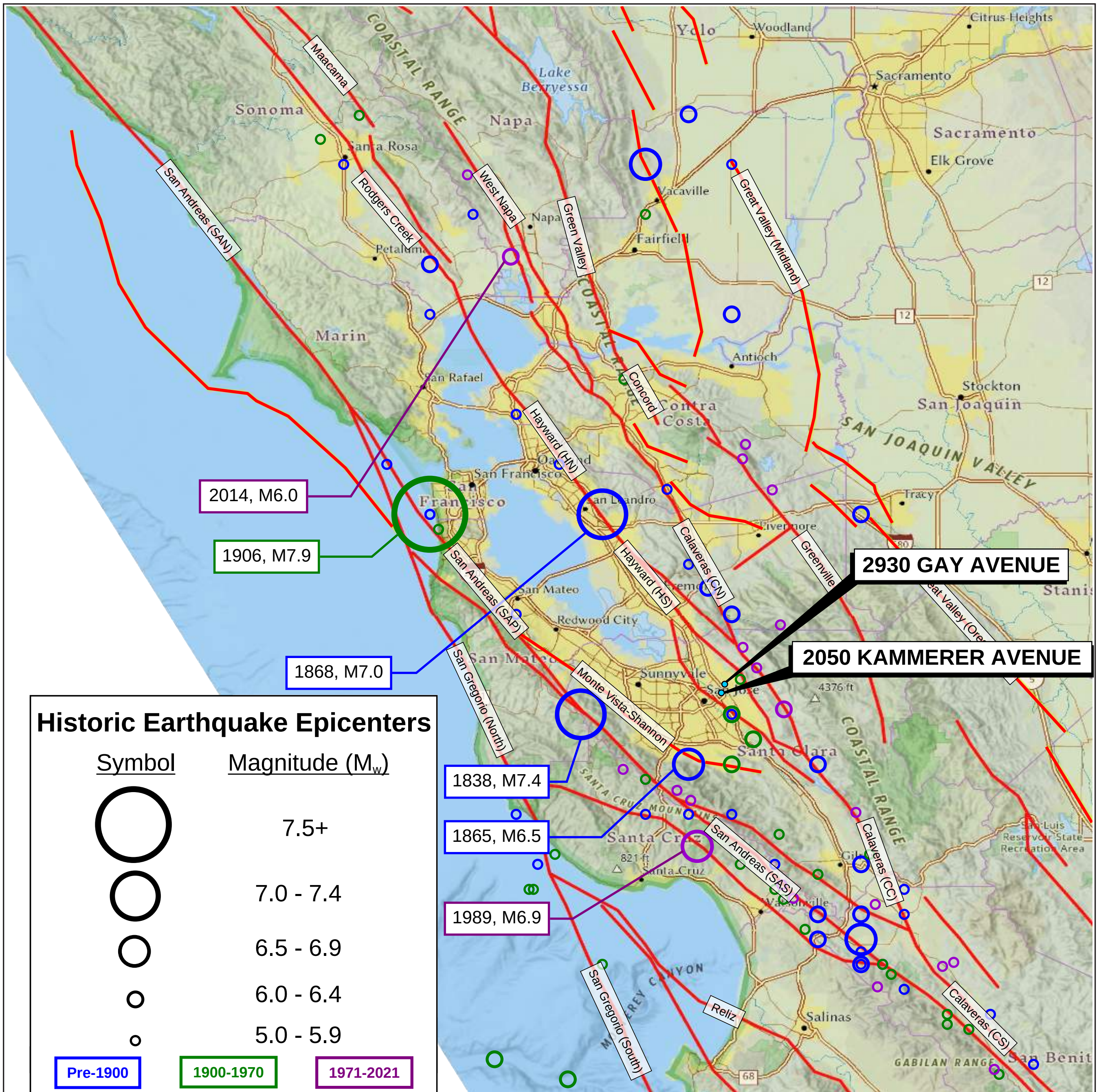
GEOLOGIC MAP

Date 7/7/23 | Project No. 23-2444 | Figure 2



EXPLANATION

Faults (National Seismic Hazard Model)

0 10 20 Miles

0 16 32 Kilometers

Approximate scale

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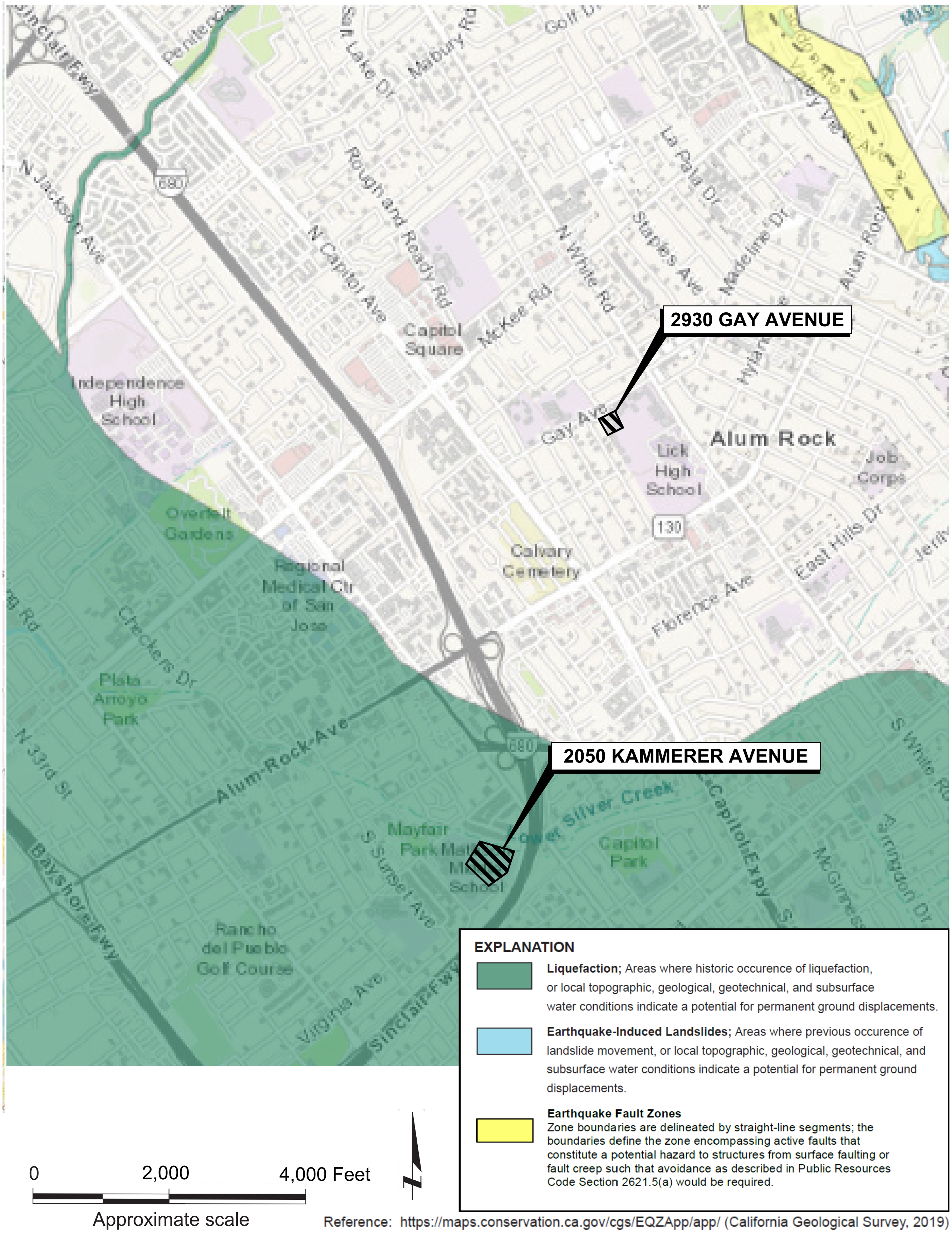
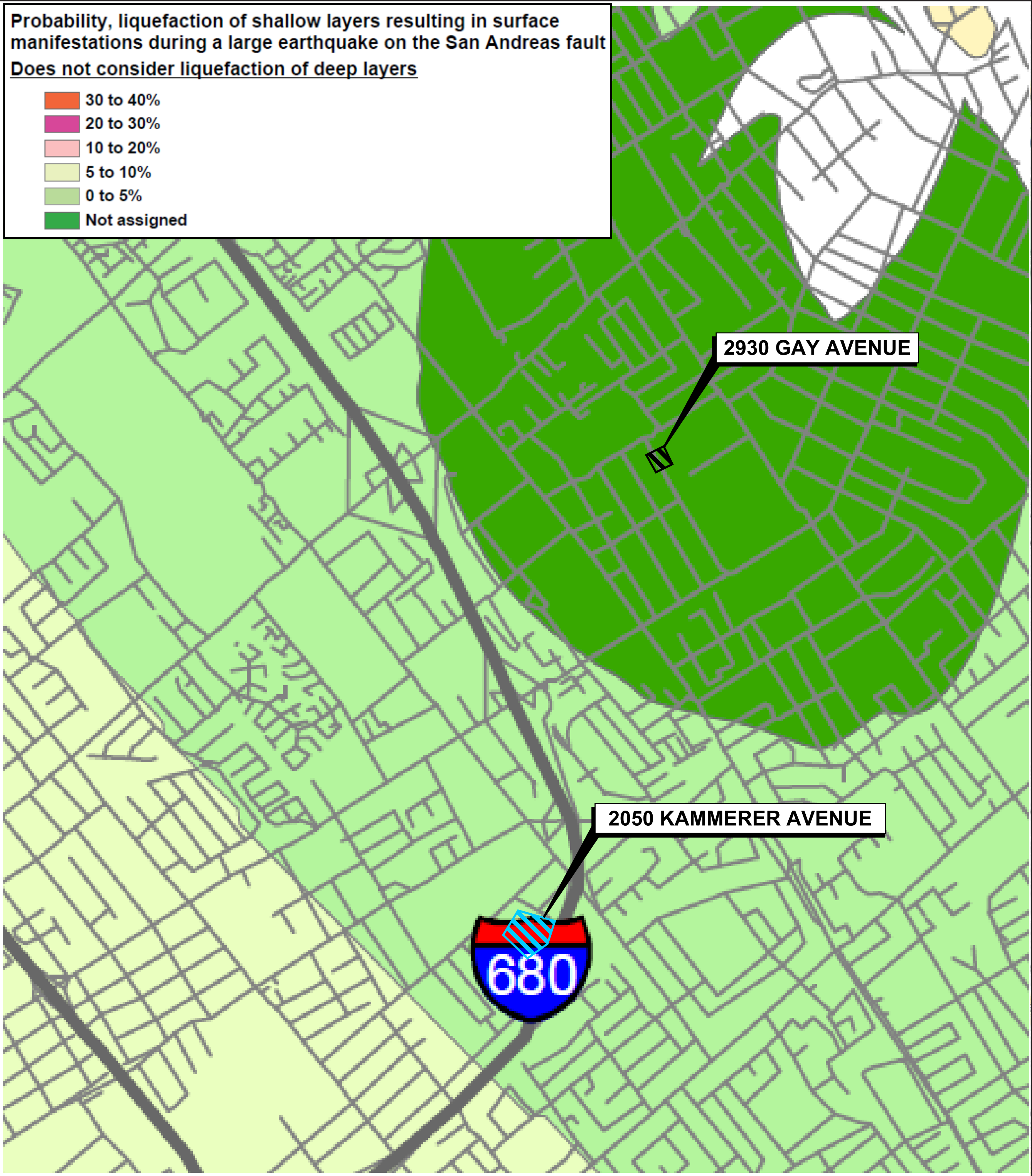
REGIONAL FAULT AND HISTORIC SEISMICITY MAP

Date 7/7/23	Project No. 23-2444	Figure 3

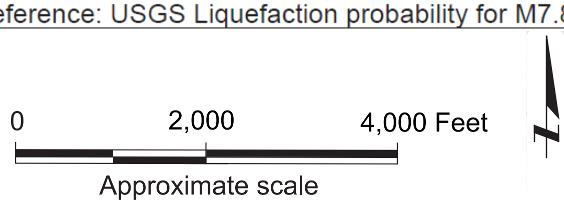


Reference: https://maps.conservation.ca.gov/cgs/EQZApp/app/ (California Geological Survey, 2019)

ARUSD FACULTY HOUSING San Jose, California	SEISMIC HAZARDS ZONE MAP		
ROCKRIDGE GEOTECHNICAL	Date 7/7/23	Project No. 23-2444	Figure 4



Reference: USGS Liquefaction probability for M7.8 San Andreas Fault earthquake scenario, Santa Clara County,



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USGS SHALLOW LIQUEFACTION PROBABILITY MAP

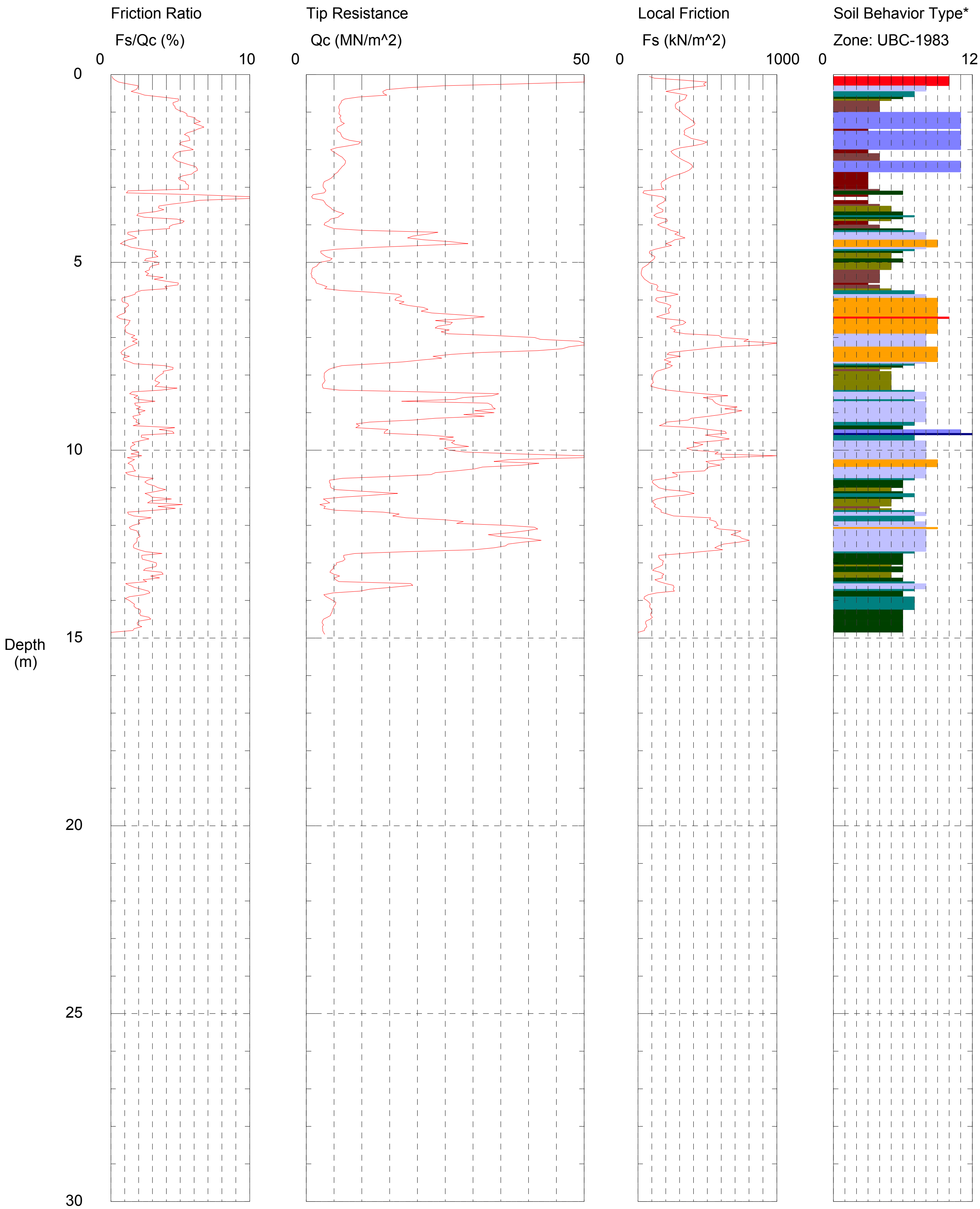
Date 7/7/23	Project No. 23-2444	Figure 5

APPENDIX A
Available Subsurface Exploration Logs

US Geological Survey

Operator: Tom Noce
Sounding: SCC116
Cone Used: 660

CPT Date/Time: 07-31-00 08:40
Location: 178 N. White Rd.
Job Number: Qpf new geology 06: S60



Maximum Depth = 14.90 meters

Depth Increment = 0.050 meters

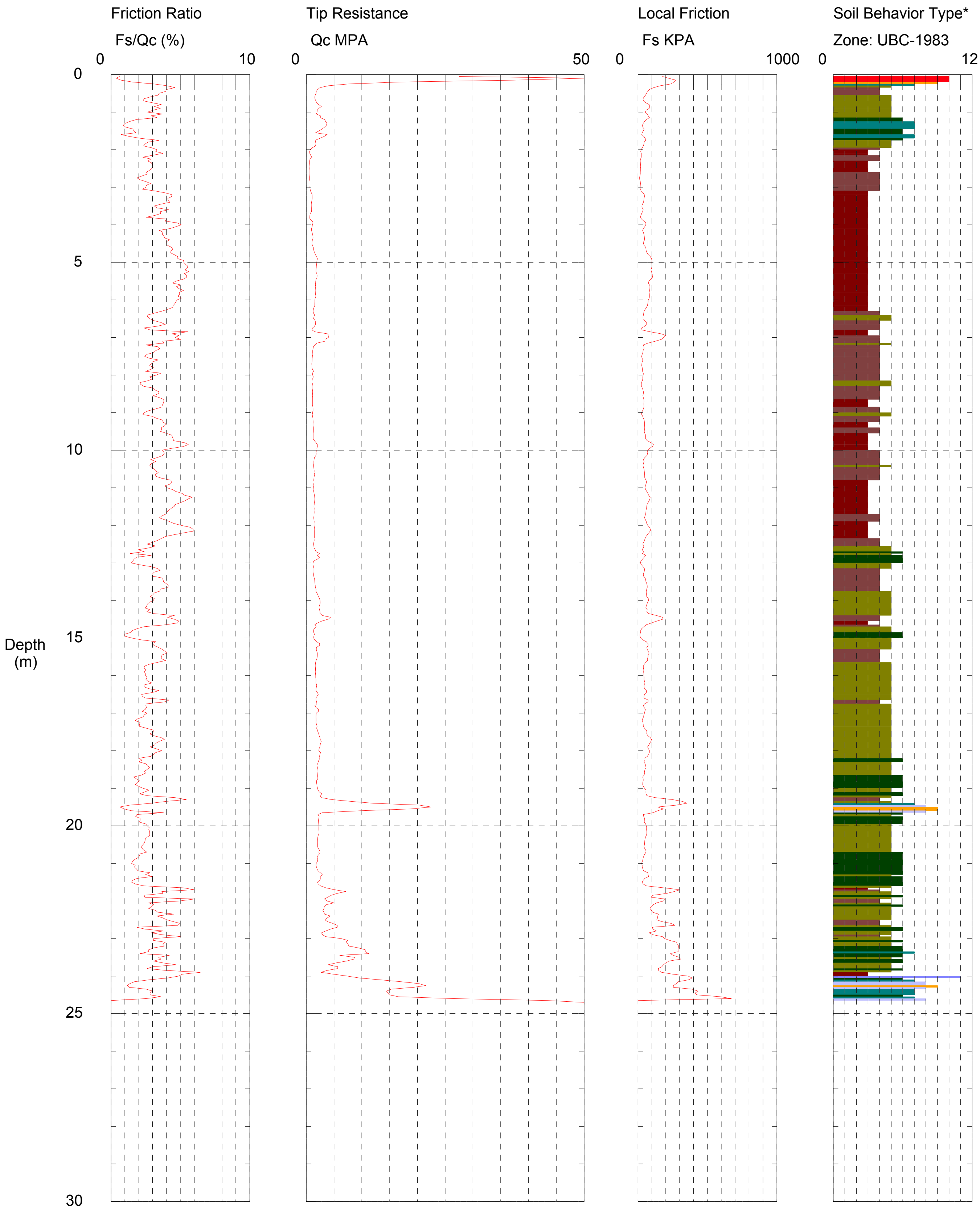
- 1 sensitive fine grained
- 2 organic material
- 3 clay
- 4 silty clay to clay
- 5 clayey silt to silty clay
- 6 sandy silt to clayey silt
- 7 silty sand to sandy silt
- 8 sand to silty sand
- 9 sand
- 10 gravelly sand to sand
- 11 very stiff fine grained (*)
- 12 sand to clayey sand (*)

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

USGS

Operator: Tom Noce
Sounding: SCC195
Cone Used: DDG0766

CPT Date/Time: 8/23/2006 8:48:50 AM
Location: 34th and San Fernando
Job Number: Qhl



Maximum Depth = 24.70 meters

Depth Increment = 0.050 meters

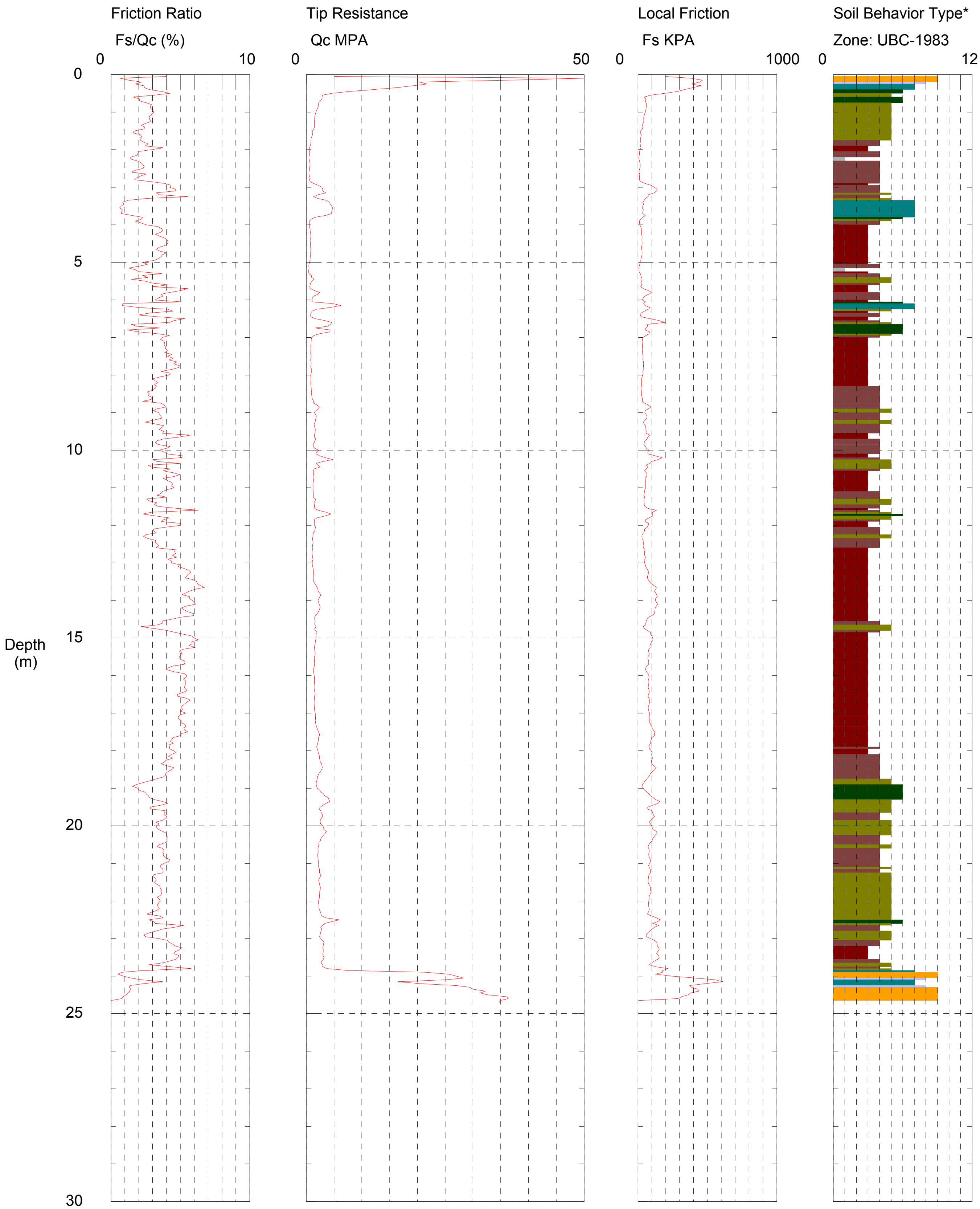
1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

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

USGS

Operator: Tom Noce
Sounding: SCC196
Cone Used: DDG0766

CPT Date/Time: 8/23/2006 10:07:45 AM
Location: Decatur
Job Number: Qhl



Maximum Depth = 24.70 meters

Depth Increment = 0.050 meters

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

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

Boring 37287-B10
Drilling Method: Rotary Wash
Hole Diameter: 2.5 inches
Date: 2/23/1966
Hammer weight: 140 pounds
Hammer drop: 30 inches

LITHOLOGY

Top of Layer Depth (feet)	Bottom of Layer Depth (feet)	USGS Soil Type	Description
0	2.5	CL-ML	soft dk gray silty clay
2.5	9	ML	sl compact brn sandy silt
9	17	CL-ML	stiff brn silty clay
17	30.5	CL	stiff gtay Fe stained clay
30.5	35	SM	dense brn weathered silty sand & small gvl
35	37	CL-ML	stiff gray Fe stained silty clay
37	41.5	SM	v. dense brn F-M weathered silty sand & small gvl w/ interbedded sand lenses
41.5	48.5	SM	sl compact brn sandy silt to silty fine sand
48.5	52.5	GVL-SD	dense brn sand & gravel
52.5	54.5	ML-CL	stiff brn clayey silt
54.5	57.5	ML	dense brn snady silt w/ gvl stringers
57.5	59.5	ML-CL	stiff brn clayey silt
59.5	60.5	GVL-SD	compact brn sand & gvl
60.5	76	CL	stiff gray Fe stained clay

PENETRATION RESISTANCE

Top of Sample Depth (feet)	Top of Sample Depth (feet)	Sampler	N
10	11.5	SPT	11
20	21.5	SPT	16
30	31.5	SPT	45
35	36.5	SPT	12
40	41.5	SPT	76
45	46.5	SPT	16
50	51.5	SPT	62
55	56.5	SPT	44
65	66.5	SPT	15