PRELIMINARY GEOLOGIC HAZARD REPORT
SONOMA DEVELOPMENTAL CENTER
15000 ARNOLD DRIVE
ELDRIDGE, CALIFORNIA

JOB NO. 7692.01

PREPARED FOR:

JAMES STICKLEY
WRT
C/O: POONAM NARKAR
PNARKAR@WRTDESIGN.COM

PREPARED BY:

PJC & ASSOCIATES, INC.
600 MARTIN AVENUE, SUITE 210
ROHNERT PARK, CA 94928
(707) 584-4804

CERTIFIED ENGINEERING GEOLOGIST
STEPHEN M. SCHURKE
NO. 2647
EXP. 5-31-19
★ STATE OF CALIFORNIA ★

STEPHEN M. SCHURKE
CERTIFIED ENGINEERING GEOLOGIST
CEG 2647, CALIFORNIA

CERTIFIED ENGINEERING GEOLOGIST
PATRICK J. CONWAY
NO. 2452
EXP. 10-31-17
★ STATE OF CALIFORNIA ★

PATRICK J. CONWAY
CERTIFIED ENGINEERING GEOLOGIST
CEG 2452, CALIFORNIA

OCTOBER 5, 2017

PJC & Associates, Inc.
Consulting Engineers & Geologists

October 5, 2017

Job No. 7692.01

James Stickley
WRT
c/o: Poonam Narkar
PNarkar@wrtdesign.com
John Leys P.E.
jleys@sherwoodengineers.com

Subject: Preliminary Geologic Hazard Report
Sonoma Developmental Center
15000 Arnold Drive
Eldridge, California

Dear James:

PJC and Associates, Inc. (PJC) is pleased to submit the results of our preliminary geologic hazard report of the Sonoma Developmental Center located at 15000 Arnold Drive in Eldridge, California. The approximate location of the project site is shown on the Site Location Map, Plate 1. Our services were completed in accordance with our proposal for geological services, latest revision dated December 21, 2016, and your authorization to proceed with the work dated April 14, 2017. The following report provides our preliminary overview of geologic hazards at the Sonoma Developmental Center.

We appreciate the opportunity to be of service. If you have any questions regarding this report, please contact us.

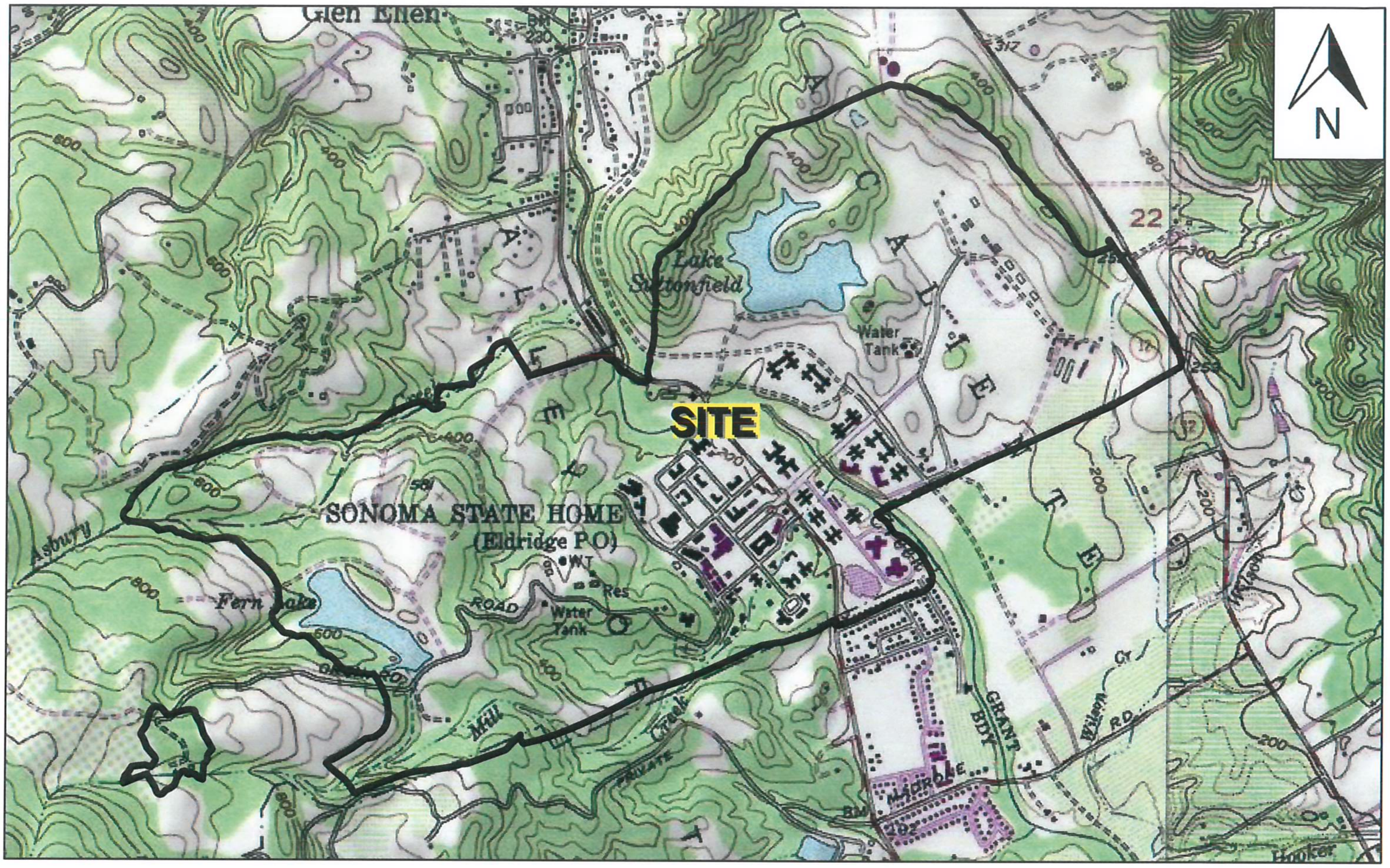
Sincerely,

PJC & ASSOCIATES, INC.

PJC:sms

Main Office • 600 Martin Ave, Ste 210, Rohnert Park, CA 94928 • 707-584-4804 • Fax 707-584-4811
Sonoma Branch • PO Box 469, Sonoma, CA 95476 • 707-935-3747 • Fax 707-935-3587

TABLE OF CONTENTS



SCALE 1:24,000

REFERENCE: USGS GLEN ELLEN, CALIFORNIA 7.5 MINUTE QUADRANGLE, DATED 1978.

PJC & Associates, Inc. Consulting Engineers & Geologists	SITE LOCATION MAP SONOMA DEVELOPMENTAL CENTER 15000 ARNOLD DRIVE ELDRIDGE, CALIFORNIA	PLATE 1
	Proj. No: 7692.01 Date: 9/17 App'd by: PJC	

PRELIMINARY GEOLOGIC HAZARD REPORT
SONOMA DEVELOPMENTAL CENTER
15000 ARNOLD DRIVE
ELDRIDGE, CALIFORNIA

1. PROJECT DESCRIPTION

The scope of our work on the project consisted of evaluating potential geologic hazards at the Sonoma Developmental Center in Eldridge California. The approximately 1,670 acre project site spans from the slopes east of Jack London State Park, across the Valley of the Moon to Highway 12. The facility consists of a total of 103 buildings of varying sizes and levels. It is our understanding that several of the structures are classified as historical buildings. The facility is bisected by Sonoma Creek, a blue-line drainage course. The following report provides our preliminary overview of geologic hazards at the Sonoma Developmental Center.

2. SCOPE OF SERVICES

The purpose of this study was to perform a preliminary geologic hazard study of the project site. Specifically, the scope of our services included the following items:

a. Review of published geologic literature, aerial photographs, and previous studies completed by others in the vicinity of the project site.

b. Surficial reconnaissance conducted of the project site to observe topography, geomorphology, and drainage features. The site reconnaissance was performed by our certified engineering geologist.

c. Discussion of site geology and evaluation of potential geologic and seismic hazards.

d. Evaluation of the stability of the Sonoma Creek banks and impact to nearby structures.

e. Limited reconnaissance of the conditions of existing buildings and retaining walls at the facility from a geotechnical engineering standpoint.

f. Limited discussion of conditions of existing buildings with on-site maintenance personnel.

g. Recommendations for additional site studies such as subsurface exploration, geotechnical investigations, floor level surveys, etc.

h. Preparation of this report, presenting our findings and conclusions.

3. SITE CONDITIONS

The project site is located approximately one and a half miles south-southeast of the town of Glen Ellen. The project site spans across approximately 1,670 acres of land. The upper western margin of the project site is located on the eastern flank of Sonoma Mountain and is bordered to the west by Jack London State Park. The southeastern margin of the project site is bordered by Highway 12. The northeastern boundary of the project site is bordered by Sonoma Valley Regional Park. Private property generally borders the remaining boundaries of the project site. Arnold Drive bisects the center of the project site. It is our understanding the majority of the structures west of Arnold Drive were constructed around and prior to the 1930's. Many of the structures east of Arnold Drive were constructed during and after the 1950's. As of today, the facility consists of a total of 103 buildings of varying sizes and levels. It is our understanding that several of the structures are classified as historical buildings and many consist of unreinforced masonry construction. The western margin of the project site is accessed via a paved roadway (Orchard Road), which ascends and switchbacks up to Fern Lake and Camp Via. During our site reconnaissance, we observed a failing masonry retaining wall at the lower portion of Orchard Road. The eastern margin of the project site is partially occupied by an old dairy, barns, and pasture land.

Site drainage is provided by sheet flow and surface infiltration. Although not observed during our site reconnaissance, it is our understanding the facility's water service is sourced from developed springs in the upper western margin of the project site. Mill Creek and Asbury Creek provide drainage at the upper western margin of the project site. It is our understanding the developed springs are located within the Mill Creek drainage course. Two moderate size reservoirs exist at the project site, Fern Lake and Lake Suttonfield. We observed metal water storage tanks on a level bench north of Orchard Road. We also observed water tanks near Lake Suttonfield. The facility is bisected by Sonoma Creek, a blue-line drainage course. Sonoma Creek discharges into San Pablo Bay, over ten miles south of the project site. A seasonal drainage course, and tributary to Wilson Creek exists at the southeastern corner of the project site.

4. REGIONAL GEOLOGIC SETTING

The site is located in the Coast Ranges Geomorphic Province of California. This province is characterized by northwest trending topographic and geologic features, and includes many separate ranges, coalescing mountain masses and several major structural valleys. The province is bounded on the east by the Great Valley and on the west by the Pacific Ocean. It extends north into Oregon and south to the Transverse Ranges in Ventura County.

The structure of the northern Coast Ranges region is extremely complex due to continuous tectonic deformation imposed over a long period of time. The initial tectonic episode in the northern Coast Ranges was a result of plate convergence which is believed to have begun during late Jurassic time. This process involved eastward thrusting of oceanic crust beneath the continental crust (Klamath Mountains and Sierra Nevada) and the scraping off of materials that were accreted to the continent (northern Coast Ranges). East-dipping thrust and reverse faults were believed to be the dominant controlling structures.

Right lateral, strike slip deformation was superimposed on the earlier structures beginning in mid-Cenozoic time, and has progressed northward to the vicinity of Cape Mendocino in Southern Humboldt County. Thus, the principal structures south of Cape Mendocino are northwest-trending, nearly vertical faults of the San Andreas system.

5. LOCAL GEOLGOY

a. General. The Sonoma Developmental Center's local geology varies from historic and relatively young alluvial soils deposited in the channel and terraces along Sonoma Creek and in the Valley of the Moon, to the clastic terrestrial sediments of the Glen Ellen Formation and extrusive volcanic lava flows and ash tuff of the Sonoma Volcanics Group. Furthermore, a large-scale Pleistocene landslide has been mapped at the upper western margin of the project site. A regional geologic map prepared by the California Geologic Survey (CGS) is presented on Plate 2a. Explanations of the mapped units is presented on Plate 2b. A geologic cross-section of the project site is presented on Plate 3. The following subsections provide additional explanations of the mapped geologic units.

b. Artificial Fill (af). Two man-made embankments exist at the southern perimeter of Lake Suttonfield. In addition, two man-made embankments exist at the northern and southern perimeters of Fern Lake. The embankments consist of compacted artificial fill and were constructed during development of Lake Suttonfield and Fern Lake. We also observed artificial fill along some the roadways, driveways, parking areas, and building pads at the project site.

c. Recent Stream Deposits along Sonoma Creek (Qhc). Late Holocene to modern (less than 150 years old) stream channel sediments exist within the Sonoma Creek channel. These deposits consist of loose alluvial sand, gravel, and silt. During our site reconnaissance we observed recent stream deposits within the active channel of Sonoma Creek. These deposits are actively reshaped annually during and following the wet season.

d. Latest Holocene Point Bar and Overbank Steam Deposits (Qhty). Stream terraces are deposited as point bar and overbank deposits within and along Sonoma Creek. These deposits consist of loose alluvial sand, gravel, and silt and are actively reshaped during and following significant Sonoma Creek flood stages.

e. Landslides (Qls). The CGS geologic map indicates a total of six landslides partially or entirely within the boundaries of the project site. The mapped landslide includes both debris flow and block slump type landslides. Furthermore, we observed a few unmapped landslides which are not indicated on the CGS regional geologic map, including a landslide along Orchard Road and a failure along the Sonoma Creek bank. A notable landslide on the CGS geologic map is a massive landslide complex west and above Fern Lake. The majority of the massive landslide complex is within Jack London State Park, however the toe of the landslide extends to the shoreline of Fern Lake. Arrows on the geologic map indicate the direction of the landslide movement. A discussion of slope stability is provided in Section 7, Subsection t of this report.

f. Latest Alluvium (Qa). Latest Pleistocene to Holocene alluvium deposited within Valley of the Moon. These deposits consist of heterogeneous and discontinuous layers of sand, gravel, silt, and clay.

g. Stream Terrace Deposits (Qt). Latest Pleistocene to Holocene stream terrace deposits consisting of sand, gravel, silt, and minor clay. The relatively flat, undissected stream terraces are located in the nearly level terrain above Sonoma Creek.

h. Older Alluvium (Qoa). Early to late Pleistocene alluvial deposits. The older alluvium consists of sand, gravel, silt, and minor clay which was deposited in alluvial fans, stream terraces, basins, and channels. Topography is gently rolling with little or no original alluvial surfaces preserved. These deposits are generally moderately to deeply dissected.

i. Glen Ellen Formation (QTge). The Glen Ellen Formation consists of gravel, sand, reworked tuff and clay which was deposited during the Pliocene and Pleistocene epochs in a fluvial type environment. In general, sediments within the Glen Ellen Formation are derived from the older Sonoma Volcanic Group, Great Valley Sequence and Franciscan Complex bedrock formations. In the project area, sediments are primarily or possibly entirely derived from the Sonoma Volcanics Group. The Glen Ellen Formation mainly consists of sand, gravel, cobbles, mudstone and reworked tuff units. Obsidian pebbles are often found in the Glen Ellen Formation. The Glen Ellen Formation tuff units are often reworked ash material from older tuff bedrock.

j. Tertiary Sand, Gravel, tuff, and Diatomite (Ts). Tertiary sand, gravel, tuff, and diatomite. Generally rich in both Franciscan Complex and Sonoma Volcanic Group detritus. Although, in the project area, sediments are primarily or possibly entirely derived from the Sonoma Volcanics Group. The CGS map indicates age dates of tuff in this unit around 4.8 million years old.

k. Sonoma Volcanic Group (Tsv, Tsvt, Tsvm, & Tsvb). According to the CGS map, several members of the Sonoma Volcanics Group exist at the project site. The Sonoma Volcanics Group is generally characterized to consist of extrusive volcanic lava flows and layers of ash tuff. The volcanic bedrock was emplaced during the Pliocene and Miocene epochs, approximately three to eight and one-half million years ago. Resistant basalt and andesite boulders are scattered throughout the surface of the slopes at the western and eastern margins of the project site. Shortly after deposition, compressive forces uplifted and folded the bedrock units. The volcanic bedrock can be highly fractured and weathered to depths of 40 to 60 feet below the ground surface.

6. FAULTING

Geologic structures in the region are primarily controlled by northwest trending faults. The property is not located within the State of California Earthquake Fault Studies Zone. The location of the nearest active fault zone in relation to the project site is presented on Plate 4. According to the State of California, no known active faults extend through the project site. However, according to the CGS geologic map (Plates 2a & 3) and the CGS fault activity map (Plate 5), two well-located Quaternary faults bisect the project site. A Quaternary fault exhibits surface rupture features during the Quaternary geologic period (the past approximately 2.6 million years). Furthermore, the CGS map indicates three concealed fault liniments at the eastern margin project site. Whether or not the Quaternary faults and concealed fault lineaments are active or pose a hazard to man is generally unknown. Although the State of California has not classified these particular faults as active seismic sources during the Holocene geologic epoch (the past approximately 11,000 years). According to the computer fault modeling software program *EQFAULT*, the three closest known active faults to the site are the Rodgers Creek, the West Napa, and the Maacama (South) faults. The Rodgers Creek fault is located approximately 4.5 miles to the southwest, the West Napa fault is located approximately 9.1 miles to the east-northeast, and the the Maacama (South) fault is located approximately 18.4 miles north of the project site. The San Andreas fault, a notable fault, is located 24.1 miles southwest of the site. The expected shaking hazards from nearby faults are presented on Plates 6a, 6b, & 6c. An associated soil type and shaking hazard map is presented on Plate 7. Table 1 outlines the nearest known active faults, their associated maximum magnitudes and the estimated peak ground accelerations due to earthquakes which are expected to occur on those faults.

TABLE 1
CLOSEST KNOWN ACTIVE FAULTS &
SITE DETERMINISTIC PARAMETERS

Fault Name	Distance from Site (Miles)	Maximum Earthquakes (Moment Magnitude)	Estimated Peak Ground Accelerations (g's)
Rodgers Creek	4.5	7.0	0.418
West Napa	9.1	6.5	0.211
Maacama (South)	18.4	6.9	0.157

Reference-Blake, T.F, "EQFAULT" Ver 3.00, software program.

7. GEOLOGIC AND SEISMIC CONSIDERATIONS

The following discussion reflects the possible earthquake effects and various geologic hazards which could result in damage to the project site.

a. Fault Rupture. Rupture of the ground surface is expected to occur along known active fault traces. No evidence of existing active faults or previous ground displacement on the site due to fault movement is indicated in the geologic literature or field exploration. Therefore, the likelihood of ground rupture at the site due to faulting is considered to be low. However, two well located Quaternary faults and three concealed faults have been mapped at the project stie. Whether or not the Quaternary faults and concealed fault lineaments are active or pose a hazard to man is generally unknown. Although the State of California has not classified these particular fault features as active fault sources during the Holocene geologic epoch (the past approximately 11,000 years).

b. Ground Shaking. The site has been subjected in the past to ground shaking by earthquakes on the active fault systems that traverse the region. It is believed that earthquakes with significant ground shaking will occur in the region within the next several decades. Therefore, it must be assumed that the site will be subjected to strong ground shaking during the design life of the project. Shaking severity is indicated to be strong to very strong (MMI 7-8) due to potential activity from the Rodgers Creek fault, Maacamas fault, and to a lesser degree, the West Napa and San Andrea faults. Maps displaying projected shaking severity from nearby faults are presented on Plates 6a, 6b, and 6c. An associated soil type and shaking hazard map is presented on Plate 7. The unreinforced masonry structures could be prone to catastrophic failure during or following seismic shaking. A structural engineer should provide seismic retrofit recommendations and design criteria for the existing buildings. Furthermore, the aging infrastructure elements, such as pipe lines, roads, etc. could be prone to damage during seismic events. We recommend the infrastructure elements be evaluated by a civil engineer.

c. Liquefaction. Liquefaction is a phenomenon in which loose and saturated, fine to medium grained sandy soils experience temporary shear strength loss during and immediately following seismic ground shaking. The shear strength loss could cause ground settlement and/or ground failure. The degree of potential liquefaction potential at the site is dependent on several factors including the intensity and duration of ground shaking, soil density and grain size, depth of the groundwater table and thickness of underlying unconsolidated sediments.

According to the Association of Bay Area Governments (ABAG), liquefaction potential at the project site varies from very high along Sonoma Creek to low in the rolling and hillside terrain. A liquefaction susceptibility map is presented on Plate 8. The terraces along Sonoma Creek are considered to have high liquefaction potential, and the flanking Valley of the Moon is considered to have moderate liquefaction potential. Existing buildings at the project site generally span across moderate to high liquefaction zones and could be affected by liquefaction during or following a severe seismic event. We recommend that liquefaction potential should be evaluated with a detailed subsurface exploration, soil laboratory testing, and analysis.

d. Differential Compaction and Densification. Soil densification is a phenomenon where earthquake induced ground shaking causes soil particles to compress, thus causing ground settlement. Non-cemented, cohesionless soils, such as loose sands or gravels above the groundwater level, are susceptible to this type of settlement. We recommend that densification potential should be evaluated during a detailed subsurface exploration, soil laboratory testing, and analysis.

e. Lateral Spreading and Lurching. Lateral spreading is normally induced by vibration of near-horizontal alluvial soil layers adjacent to an exposed face. Lurching is an action, which produces cracks or fissures parallel to streams or banks when the earthquake motion is at right angles to them. The banks along Sonoma Creek could be prone to lateral spreading and lurching. Furthermore, cuts abutting failing retaining walls or basement walls could be prone to lateral spreading and lurching. Further detailed studies should be performed to define lateral spreading and lurching concerns at the project site.

f. Dam Failure. Two moderate size reservoirs impounded with man-made embankments exist at the project site. We recommend the embankments should be inspected and routinely monitored. We also observe concrete spillways at both of the reservoirs. The spillways should be inspected and repaired as needed.

g. Seiche Waves. A seiche wave is a standing wave that can oscillate in an enclosed body of water such as a lake, bay or gulf. Although a remote possibility, it should be considered as a potential geologic hazard in Lake Suttonfield and Fern Lake.

h. Tsunamis. The project site is located over 20 miles east of the Pacific Ocean. San Pablo Bay is located over 10 miles to the south. Therefore, the threat of tsunami inundation is nonexistent.

i. Spring Water. It is our understanding the water supply for the facility is sourced from springs at the upper western margin of the property. It is possible the spring discharge rate, quality, and quantity could change over time due to factors such as seismic events, aquifer drawdown, landslides, etc. We recommend a geologist, hydrogeologist, and civil engineer evaluate the spring water supply and associated pipelines.

j. Subsidence. We are unaware of large amounts of groundwater being withdrawn for subsidence to be a serious geologic concern. Furthermore, the hillsides at the project site are generally underlain by the Glen Ellen Formation and Sonoma Volcanic Group bedrock which typically do not contain large amounts of organic matter (peat or soft coal) that could cause subsidence through oxidation. Although a remote possibility, it is possible the young alluvial soils in the Valley of the Moon and along Sonoma Creek could be prone to subsidence if large amounts of groundwater are withdrawn from the underlying aquifer.

k. Flooding. According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map panel 06097C 0910E, effective December 1, 2008, the channel along Sonoma Creek and adjoining level terraces are located in Zone AE. A FEMA flood hazard map is presented on Plate 9. The FEMA designated Zone AE is considered a high risk flood area. Base flood elevations are provided on the FEMA map for Zone AE. Aside from the aforementioned Zone AE mapped area, the remaining majority of the project site is located in Zone X. According to FEMA, Zone X indicates that the site is located outside the 1% annual chance floodplain or areas of 1% annual chance sheet flow flooding where average depths are less than one foot. No base flood elevations or depths are shown within this zone. According to FEMA, Zone X is considered a moderate to low risk area. We recommend that the potential of flooding and site drainage should be further evaluated by a hydrogeologist or civil engineer.

l. Water Intrusion. It is our understanding some of the buildings at the facility have experienced water intrusion into basement areas. It is also possible water intrusion occurs in crawl space areas. It is unknown if the water intrusion is a result of high groundwater conditions, perched water tables, poor surface and near surface drainage features, or a combination of conditions. We recommend water intrusion should be further evaluated at the project site.

m. Volcanic Hazards. The nearest potentially active volcanic area is in the vicinity of Clear Lake in Lake County. Lava flows could not conceivably reach the project site from Clear Lake. Additionally, the predominately westerly prevailing winds from the coast would probably prevent any large amounts of ash from reaching the project site during or after a major eruption in Lake County or elsewhere.

n. Waste Disposal. We are uninformed of the current waste disposal system at the project site. We recommend waste disposal should be evaluated by a civil engineer or a waste management engineer.

o. Corrosive Soils. It is unknown if corrosive soils are present at the project site. This should be verified by subsurface investigation and laboratory testing.

p. Asbestos. Our investigation and review of published geologic literature indicate that the project site is not underlain by soils or bedrock which could contain naturally occurring asbestos such as serpentinite bedrock. However, we anticipate asbestos fibers are likely present in the building materials within the existing structures. We recommend the building materials be evaluated by an asbestos abatement company.

q. Expansive Soils and Bedrock. Based on our experience with nearby projects, potentially expansive soils and bedrock do exist in the nearby hillsides and valleys. Based on our site observations at the project site, it is possible potentially expansive soils and bedrock exist at the project site. However, this should be confirmed by a subsurface exploration and laboratory testing. If expansive soils are present, they can be mitigated with geotechnical engineering strategies.

r. Uncompacted fill and unsupported cuts. We observed overly steep and tall fill slopes and unsupported near vertical to vertical cut slopes at the project site. We generally recommend cut and fill slopes should not exceed inclinations of two horizontal to one vertical (2H:1V). Steeper slopes should be retained with walls. A geotechnical engineer and civil engineer should furthermore evaluate cut and fill slopes at the project site.

s. Erosion. Erosion is possible along the banks of Sonoma Creek, Mill Creek, and Asbury Creek. Furthermore, the slopes at the project site could be potentially unstable and erodable in manufactured (cut and fill) slopes unless proper grading procedures are implemented. We recommend that care should be exercised in protecting finished slope surfaces from the effects of erosion by appropriate drainage control and landscaping. Effective slope face protection from erosion damage can be achieved by placing a jute mat or equivalent erosion control parameters on the slope face and landscaping slope faces in accordance with the recommendations of a landscape architect.

t. Landslides and Slope Stability. Landslides consist of deposits varying from intact slabs of bedrock, to unconsolidated rock, soil, and colluvium that are displaced down-slope by gravitational processes. Topography at the project site varies from level terrain along Valley of the Moon to steep hillsides, and near vertical creek banks. According to a regional slope stability map provided in Special Report 120, the vast majority of hillsides at the project site are considered to be relatively unstable soil and rock units, on slopes greater than 15 percent (Categories C). Areas mapped in this slope stability category generally contain numerous landslides. A slope stability map is present on Plate 10. The Valley of the Moon is considered relatively stable due to low slope inclinations. However, although a remote possibility, it is of concern that debris flows triggered from landslides in the slopes above could potentially extend down and into the valley. A landslide distribution and earth flow map is presented on Plate 11. The creek banks at the project site are also prone to block slides and bank failures. Slopes exceeding 15 percent could also be prone to soil creep.

The CGS geologic map indicates a total of six landslides partially or entirely within the boundaries of the project site. Furthermore, we observed several landslides at the project site which are not indicated on the CGS regional geologic map, including a landslide along Orchard Road, and a 2001 bank failure along the Sonoma Creek. Furthermore, it is our understanding a landslide in 2001 damaged a water supply line from the spring at the upper western margin of the project site. We also observed a small landslide above the concrete spillway at Lake Suttonfield. We observed hummocky terrain features in the sloping grasslands below Fern Lake. The hummocky terrain is indicative of global landsliding. We recommend the existing landslides and unstable slopes should be mapped in detail. Following mapping, the landslides should be evaluated by a subsurface exploration, laboratory testing, and analysis.

A notable mapped landslide is a massive complex west and above

Fern Lake. The majority of the massive landslide complex is within Jack London State Park, although the toe of the landslide extends down to the western shoreline of Fern Lake. Furthermore, another massive older landslide complex has been mapped beyond the northern border of the project site. The mapped large-scale landslide within the project site boundaries appears to be a relatively old feature which was likely triggered during a climatic wet period of the Pleistocene epoch which coincided with a significant seismic event. Based on our site reconnaissance there are no obvious indications that the global mapped landslide is actively moving. However, a detailed study of the mapped global massive landslide complex is beyond the scope of this project. Large-scale global landslides can be triggered during severe seismic events which coincide with extreme wet periods. Based on the results of our investigation, we judge that the project site is located in an area which is considered to have a higher than normal risk for displacement and deformation resulting from earthquake-induced landsliding. We recommend a more in-depth subsurface exploration, laboratory testing, and analysis. Detailed geologic mapping and geotechnical evaluations should be performed to determine the locations and activity of landslides at the project site.

8. CONCLUSIONS

Our evaluation has determined several geologic hazards do exist at the project site. As the project proceeds, we recommend that detailed geologic assessments and geotechnical investigations be performed to develop recommendations and design criteria. The additional geologic and geotechnical studies should include detailed mapping and reconnaissance, subsurface exploration, laboratory testing, and engineering analysis. Qualitative and quantitative slope stability analyses should also be performed to evaluate slope stability and landsliding at the project site. This information should be analyzed to provide specific geologic and geotechnical conclusions and recommendations regarding grading and earthwork, roadway and driveway recommendations, retaining wall design criteria, foundation design criteria, slab-on-grade floor recommendations, geotechnical engineering drainage recommendations and cut and fill grading guidelines, seismic design criteria, etc. We also recommend that a civil engineer should assess the roadways, driveways, alignment grades, embankments, and site drainage conditions, and to provide recommendations. We also recommend floor level surveys be performed inside the existing buildings to determine if settlement, heave, or distress has occurred. A structural engineer should provide seismic retrofit recommendations and design criteria for the existing buildings. We recommend a hydrogeologist evaluate the spring water supply. The dams and spillways should also be inspected and monitored.

9. LIMITATIONS

The data, information, interpretations and recommendations contained in this report were presented for WRT and the Sonoma Developmental Center. The conclusions and professional opinions presented herein were developed by PJC in accordance with generally accepted geological principles and practices. No warranty, either expressed or implied, is intended.

This report has not been prepared for use by parties other than the designers of the project. It may not contain sufficient information for the purposes of other parties or other uses. If any changes are made in the project as described in this report, the conclusions and recommendations contained herein should not be considered valid, unless the changes are reviewed by PJC and the conclusions and recommendations are modified or approved in writing.

It has been a pleasure working with you on this project. Please call if you have any questions regarding this report or if we can be of further assistance.

Sincerely,

PJC & ASSOCIATES, INC.

APPENDIX
REFERENCES

1. Geologic Map of the Santa Rosa Quadrangle, Scale: 1:250,000, compiled by D.L Wagner and E.J. Bortugno, 1982.

2. Geology for Planning in Sonoma County, Special Report 120, California Division of Mines and Geology, 1980.

3. USGS Glen Ellen, California Quadrangle 7.5-Minute Topographic Map, dated 1978.

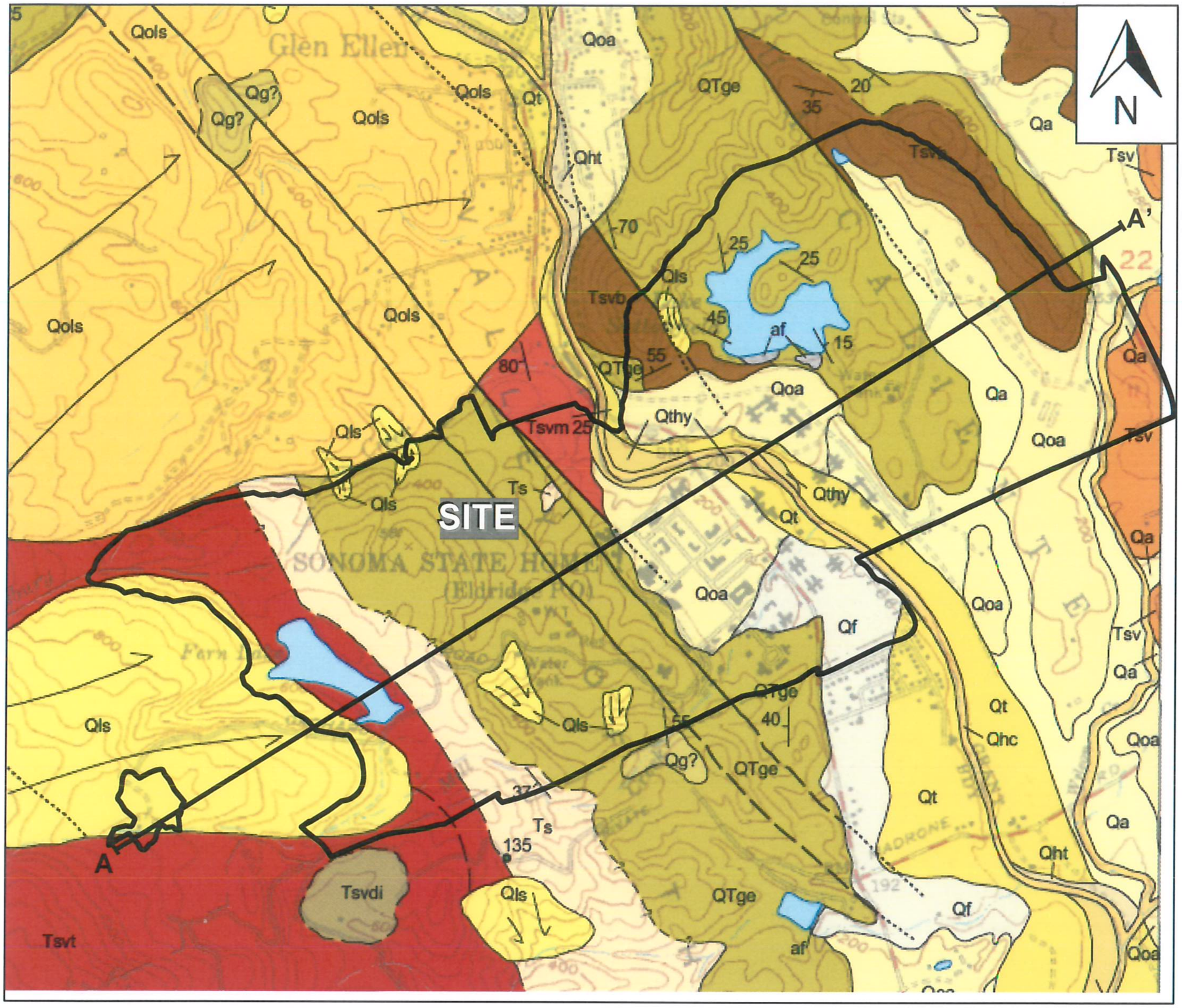
4. Geologic Map of the Glen Ellen Quadrangle, 7.5 Minute, compiled by David L. Wagner, Carolyn E. Randolph-Loar, Robert C. Witter and Michael E. Huffman, California Geological Survey, 2003.

5. “Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada”, California Department of Conservation Division of Mines and Geology, Dated February 1998.

6. “EQFAULT” Ver 3.00, software program.

7. Association of Bay Area Governments (ABAG), interactive geologic hazards map, dated March 1, 2013.

8. Flood Insurance Rate Map, Federal Emergency Management Agency, County of Sonoma & Unincorporated Areas, Panel 910 of 1,150, County Panel Number 06097C 0910 E, Effective December 1, 2008.



SCALE 1:24,000

REFERENCE: GEOLOGIC MAP OF THE GLEN ELLEN 7.5 MINUTE QUADRANGLE, CALIFORNIA GEOLOGIC SURVEY DATED 2003.

A — A' GEOLOGIC CROSS SECTION LINE, *SEE PLATE 3

*SEE PLATE 2B FOR EXPLANATION OF GEOLOGIC UNITS

PJC & Associates, Inc.
Consulting Engineers & Geologists

REGIONAL GEOLOGIC MAP
SONOMA DEVELOPMENTAL CENTER
15000 ARNOLD DRIVE
ELDRIDGE, CALIFORNIA

PLATE
2a

Proj. No: 7692.01 | Date: 9/17 | App'd by: PJC

af Artificial fill.

Qhc Late Holocene to modern (<150 years) stream channel deposits in active, natural stream channels. Consists of loose alluvial sand, gravel, and silt.

Qhty Latest Holocene stream terrace deposits. Stream terraces are deposited as point bar and overbank deposits by Sonoma Creek.

Qls Landslides. Includes debris flow and block slump landslides. Arrows show the direction of movement.

Qa Latest Pleistocene to Holocene alluvium in small valleys. Sand, gravel, silt and clay.

Qt Latest Pleistocene to Holocene stream terrace deposits. Sand, gravel, silt and minor clay. Relatively flat, undissected stream terraces where absolute age is uncertain.

Qf Latest Pleistocene (<30,000 years) to Holocene alluvial fan deposits. Sand, gravel, silt, and clay mapped on gently sloping, fan-shaped, relatively undissected alluvial surfaces. Qfc - Fan of Carriger Creek consisting of cobble gravel rich in well-rounded volcanic clasts.

Qoa Early to late Pleistocene alluvial deposits, undivided. Alluvial fan, stream terrace, basin, and channel deposits. Topography is gently rolling with little or no original alluvial surfaces preserved; moderately to deeply dissected.

QTge Glen Ellen Formation. Gravel, sand, reworked tuff and clay of unknown age. Sediments derived mostly from the Sonoma Volcanics. Obsidian pebbles are characteristic of this unit.

Ts (Tsdi) Sand and gravel, tuff and diatomite. Rich in both Franciscan and Sonoma Volcanic detritus. Contains tuff dated at 4.8 +/- 0.03 Ma (J. Allen, Written communication).

Tsv (Tsvb, Tsvm, Tsvt, Tsvr) Sonoma Volcanics- Mafic lava flows, breccias, agglomerate tuff, tuff breccia with interbedded tuffaceous sediments; also includes dacitic to rhyolitic lava flows, debris flows, tuff, and tuffaceous sediment. The age range for the Sonoma Volcanics on this quadrangle is 8.65 to 3.80 Ma (Fox and others, 1985). There is a diatomite-rich sequence within the Sonoma Volcanics (Tsvdi). The Sonoma Volcanics are divided into the following subunits:

Tsvb- Basalt flows. The basalt flows near Carriger Creek yielded an Ar/Ar date of 4.1 Ma (Robert Fleck, Personal communication, 2004).

Tsvm- Mafic flows and breccias. Andesite and basaltic andesite.

Tsvt- Silicic tuff and interbedded tuffaceous sediments. Interbedded sand and gravel is similar to the Petaluma Formation.

Tsvr- Rhyolitic to dacitic flows, breccias, and sediments. Pink, white, gray, brown flow banded rhyolite in flows, debris flows and breccia. Interbeds of sand, gravel, and tuff. Dacite near Carriger Creek is dated at 5.79 +/- 0.3 Ma; Robert Fleck (Personal communication, 2004).

——— — — - - - - ...? Contact between map units - Solid where accurately located, dashed where approximately located; short dash where inferred; dotted where concealed; queried where uncertain.

27 ——— — — - - - - ...? Fault - Solid where accurately located, dashed where approximately located; short dash where inferred; dotted where concealed; queried where uncertain. U = upthrown block, D = downthrown block. Arrow and number indicate direction and angle

25 Strike and dip of sedimentary beds:

Landslide - Arrows indicate principal direction of movement. Queried where questionable. A megalandslide occurs in the west part of the quadrangle. It displays a well-developed headwall scarp but its full extent is difficult to ascertain. Because it is a large block landslide, geologic units can be mapped within it. This slide is shown by a stipple pattern. Its full extent may be considerably greater than shown on this map.

PJC & Associates, Inc. Consulting Engineers & Geologists	REGIONAL GEOLOGIC MAP- GEOLOGY LEGEND SONOMA DEVELOPMENTAL CENTER 15000 ARNOLD DRIVE ELDRIDGE, CALIFORNIA	PLATE **2b**
	Proj. No: 7692.01 Date: 9/17 App'd by: PJC	

VERTICAL SCALE: 1"=200'

HORIZONTAL SCALE: 1"=2,000'

10X EXAGGERATION

*SEE PLATE 2B FOR EXPLANATION OF GEOLOGIC UNITS

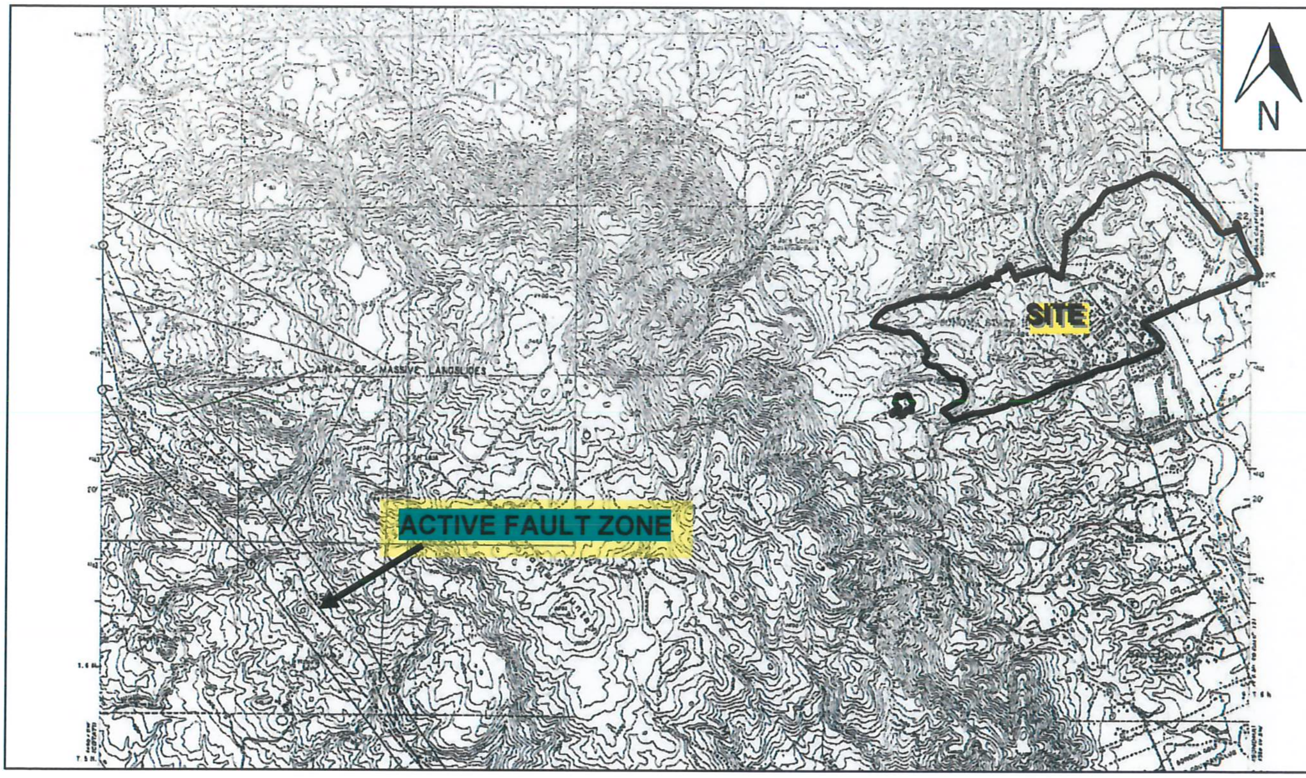
SECTION INTERPRETED FROM GEOLOGIC MAP OF THE GLEN ELLEN 7.5 MINUTE QUADRANGLE, CALIFORNIA GEOLOGIC SURVEY, DATED 2003.

PJC & Associates, Inc.
Consulting Engineers & Geologists

GEOLOGIC CROSS SECTION A-A'
SONOMA DEVELOPMENTAL CENTER
15000 ARNOLD DRIVE
ELDRIDGE, CALIFORNIA

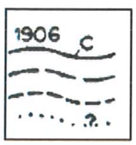
PLATE
3

Proj. No: 7692.01 Date: 9/17 App'd by: PJC



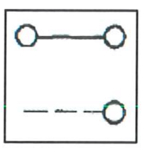
SCALE 1" = 6000 FT

MAP EXPLANATION



POTENTIALLY ACTIVE FAULTS:

Faults considered to have been active during Holocene time and to have a relatively high potential for surface rupture, solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed, query (?) indicates additional uncertainty. Evidence of historic offset indicated b year of earthquake-associated event or C for displacement caused by creep or possible creep.



SPECIAL STUDIES ZONE BOUNDARIES:

These are delineated as straight line segments that connect encircled turning points so as to define special studies zone segments.

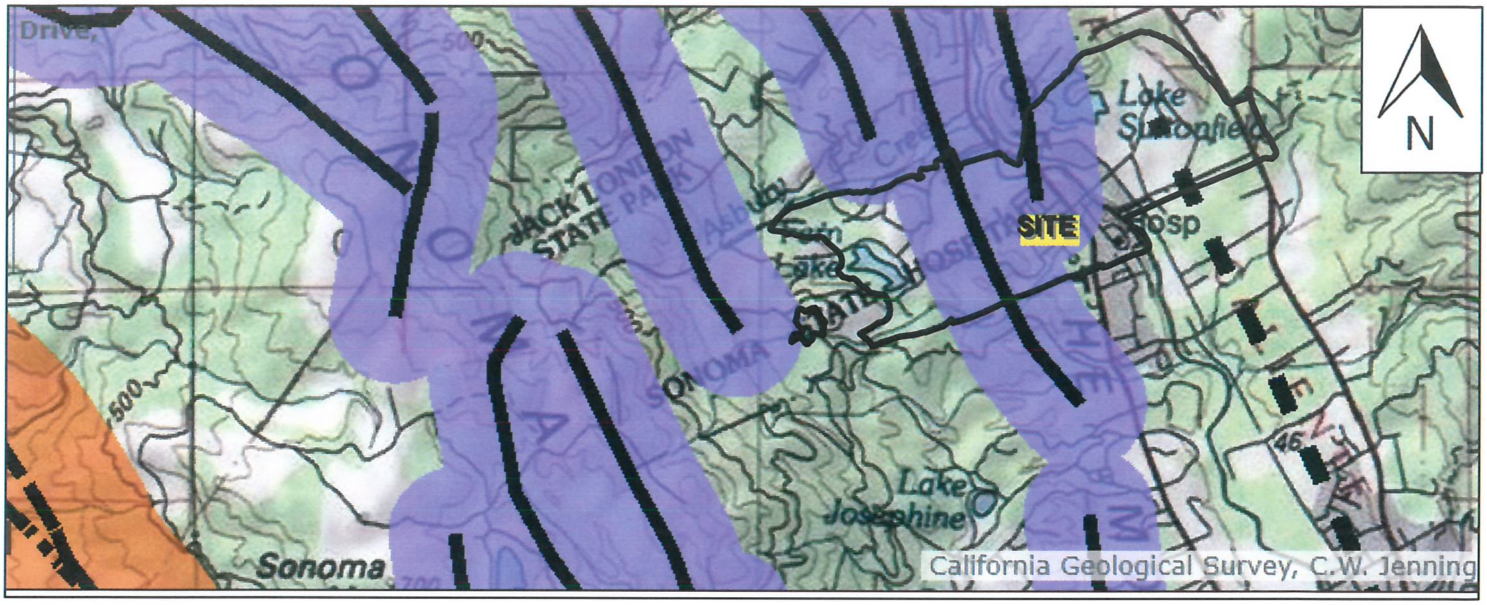
REFERENCE: CALIFORNIA DEPARTMENT OF CONSERVATION "STATE OF CALIFORNIA SPECIAL STUDIES ZONE, GLEN ELLEN QUADANGLE," DATED JULY 1, 1983.

PJC & Associates, Inc.
Consulting Engineers & Geologists

ALQUIST PRIOLO LOCATION MAP
SONOMA DEVELOPMENTAL CENTER
15000 ARNOLD DRIVE
ELDRIDGE, CALIFORNIA

PLATE 4

Proj. No: 7692.01 Date: 9/17 App'd by: PJC



SCALE 1" = .9 MILES

EXPLANATION

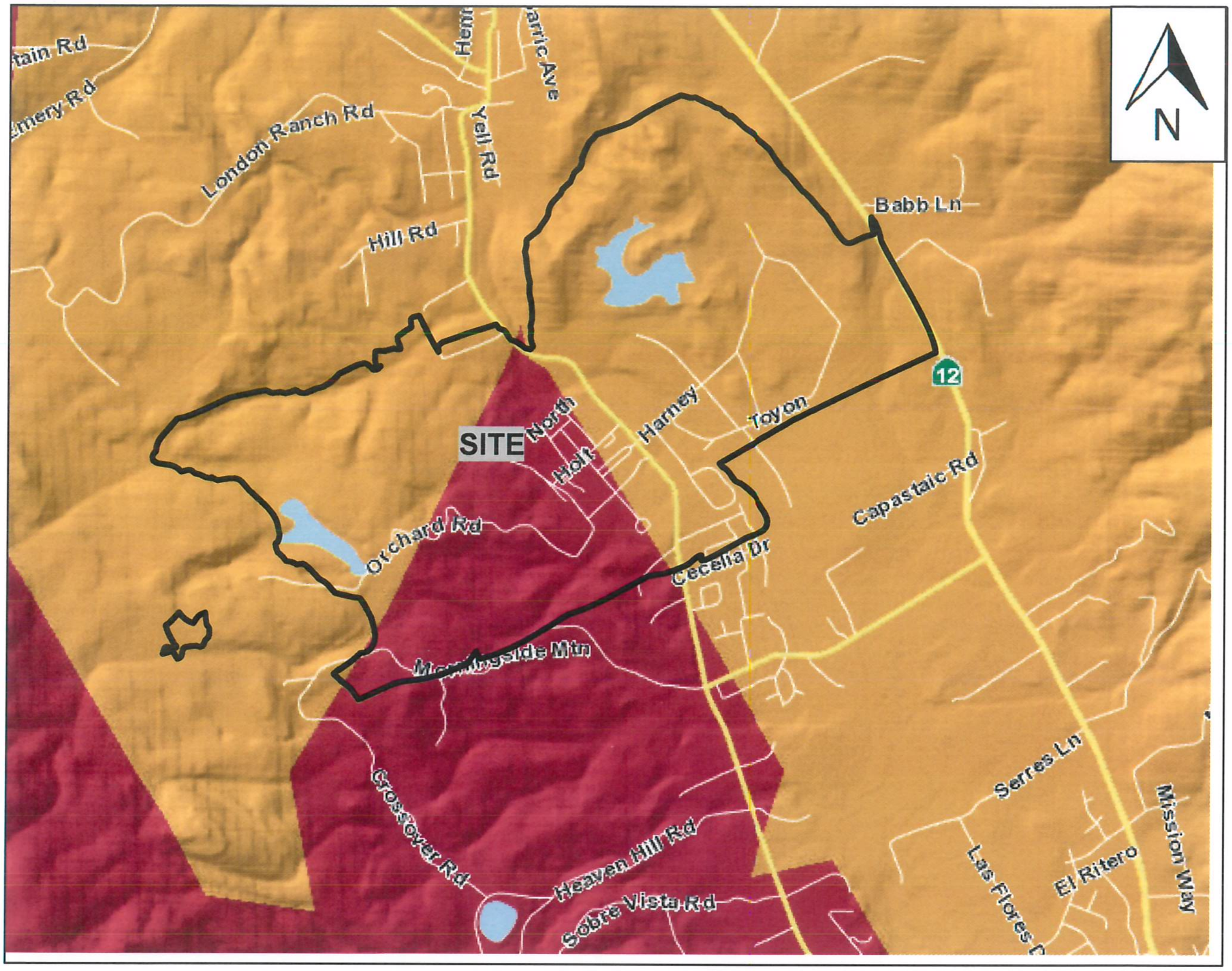
Holocene fault displacement (during past 11,700 years) without historic record.

Quaternary fault (age undifferentiated).

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement.

REFERENCE: CALIFORNIA GEOLOGICAL SURVEY, DATED 2013.

PJC & Associates, Inc. Consulting Engineers & Geologists	FAULT ACTIVITY MAP SONOMA DEVELOPMENTAL CENTER 15000 ARNOLD DRIVE ELDRIDGE, CALIFORNIA	PLATE 5
	Proj. No: 7692.01 Date: 9/17 App'd by: PJC	



SHAKE SEVERITY MAP- **RODGERS CREEK FAULT** SCALE 1" = .5 MILES

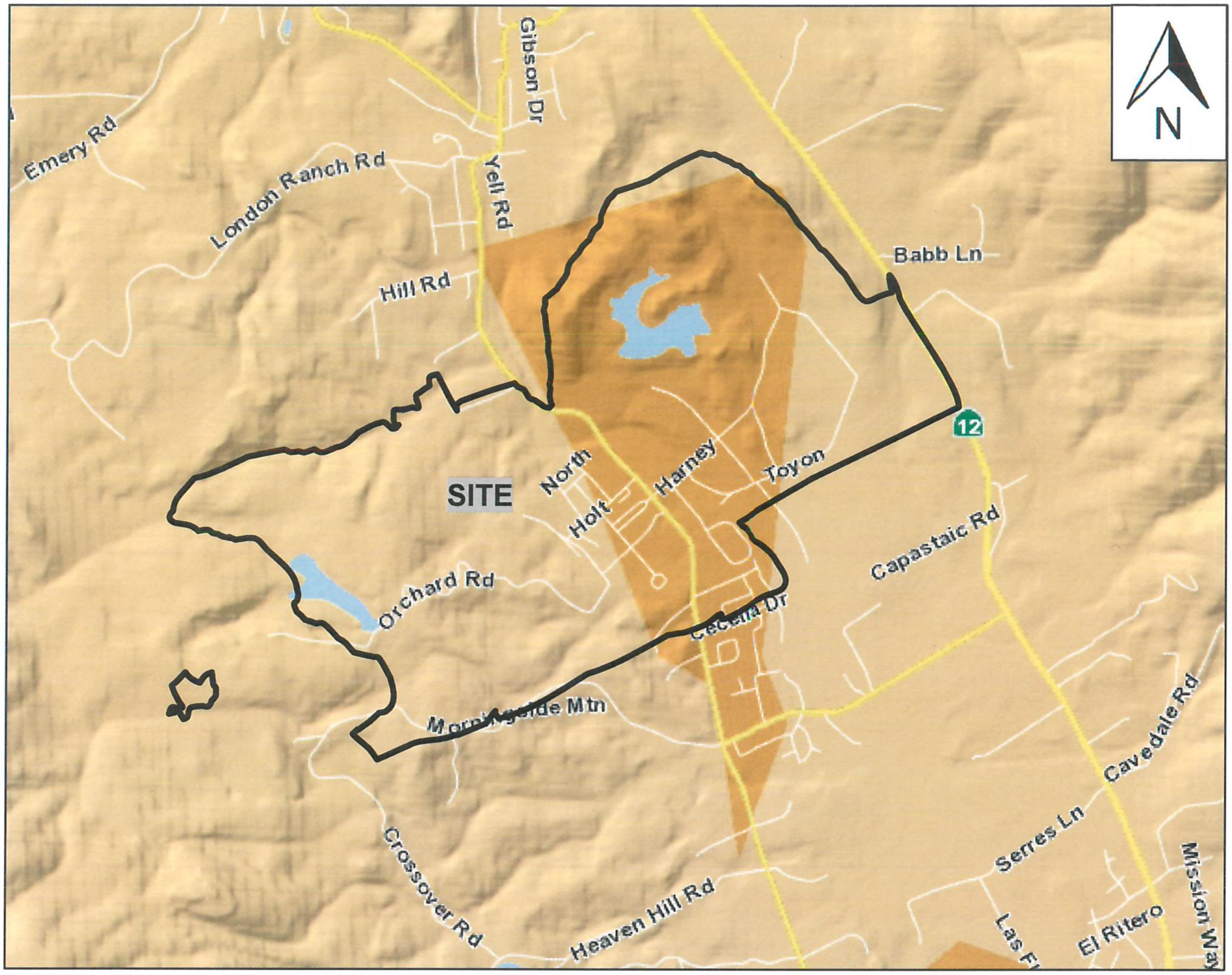
EXPLANATION

Shaking Severity

- Light - MMI 5
- Moderate - MMI 6
- Strong - MMI 7
- Very Strong - MMI 8
- Violent - MMI 9
- Very Violent - MMI 10

REFERENCE: ASSOCIATION OF BAY AREA GOVERNMENTS, SHAKE SUSCEPTIBILITY MAP, DATED JUNE 2009.

PJC & Associates, Inc. Consulting Engineers & Geologists	SHAKE SEVERITY MAP- RODGERS CREEK FAULT SONOMA DEVELOPMENTAL CENTER 15000 ARNOLD DRIVE ELDRIDGE, CALIFORNIA	PLATE 6a
	Proj. No: 7692.01 Date: 9/17 App'd by: PJC	



SHAKE SEVERITY MAP- **WEST NAPA FAULT** SCALE 1" = .5 MILES

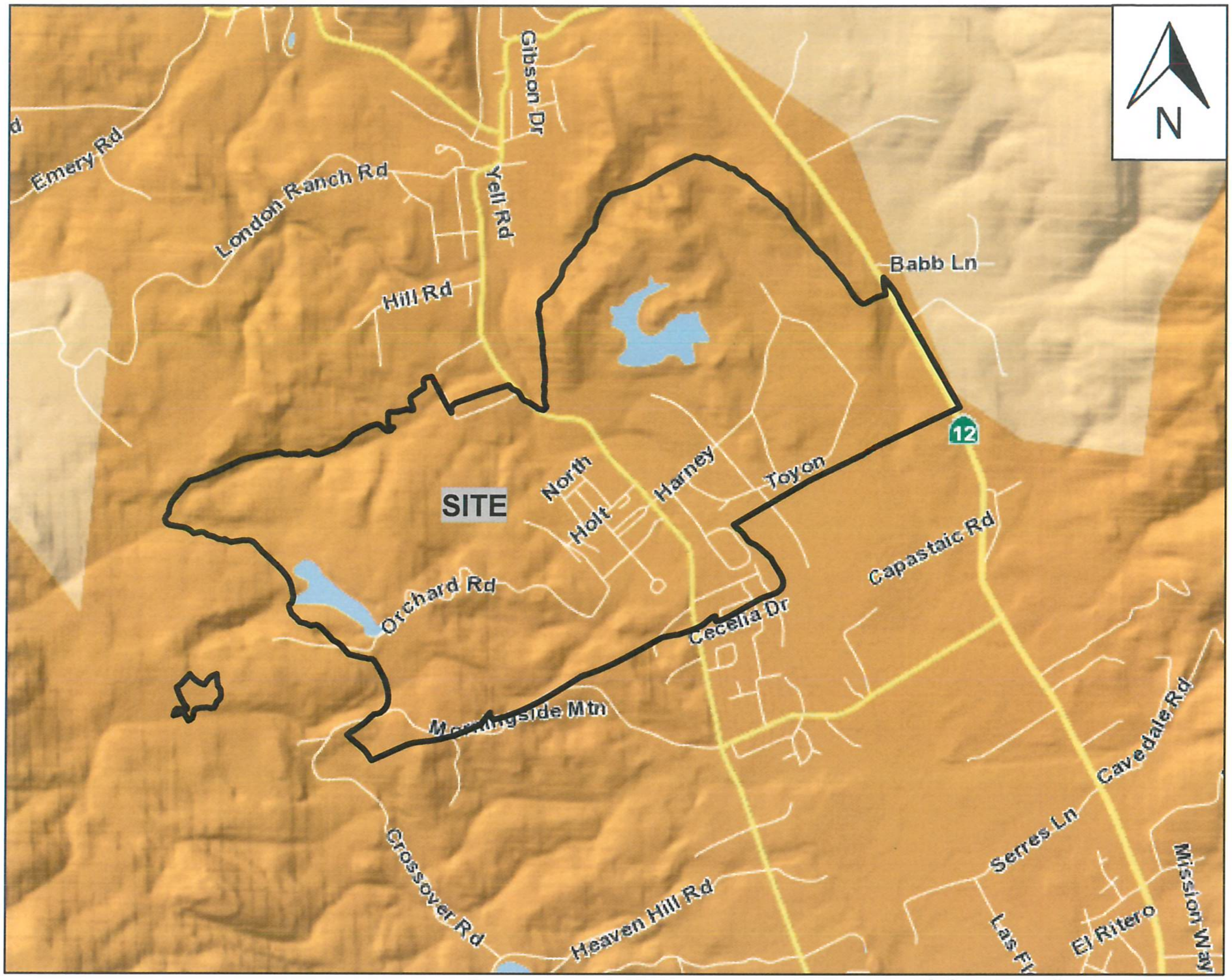
EXPLANATION

Shaking Severity

- Light - MMI 5
- Moderate - MMI 6
- Strong - MMI 7
- Very Strong - MMI 8
- Violent - MMI 9
- Very Violent - MMI 10

REFERENCE: ASSOCIATION OF BAY AREA GOVERNMENTS, SHAKE SUSCEPTIBILITY MAP, DATED JUNE 2009.

PJC & Associates, Inc. Consulting Engineers & Geologists	SHAKE SEVERITY MAP- WEST NAPA FAULT SONOMA DEVELOPMENTAL CENTER 15000 ARNOLD DRIVE ELDRIDGE, CALIFORNIA	PLATE **6b**
	Proj. No: 7692.01 Date: 9/17 App'd by: PJC	



SHAKE SEVERITY MAP- **SAN ANDREAS FAULT** SCALE 1" = .5 MILES

EXPLANATION

Shaking Severity

- Light - MMI 5
- Moderate - MMI 6
- Strong - MMI 7
- Very Strong - MMI 8
- Violent - MMI 9
- Very Violent - MMI 10

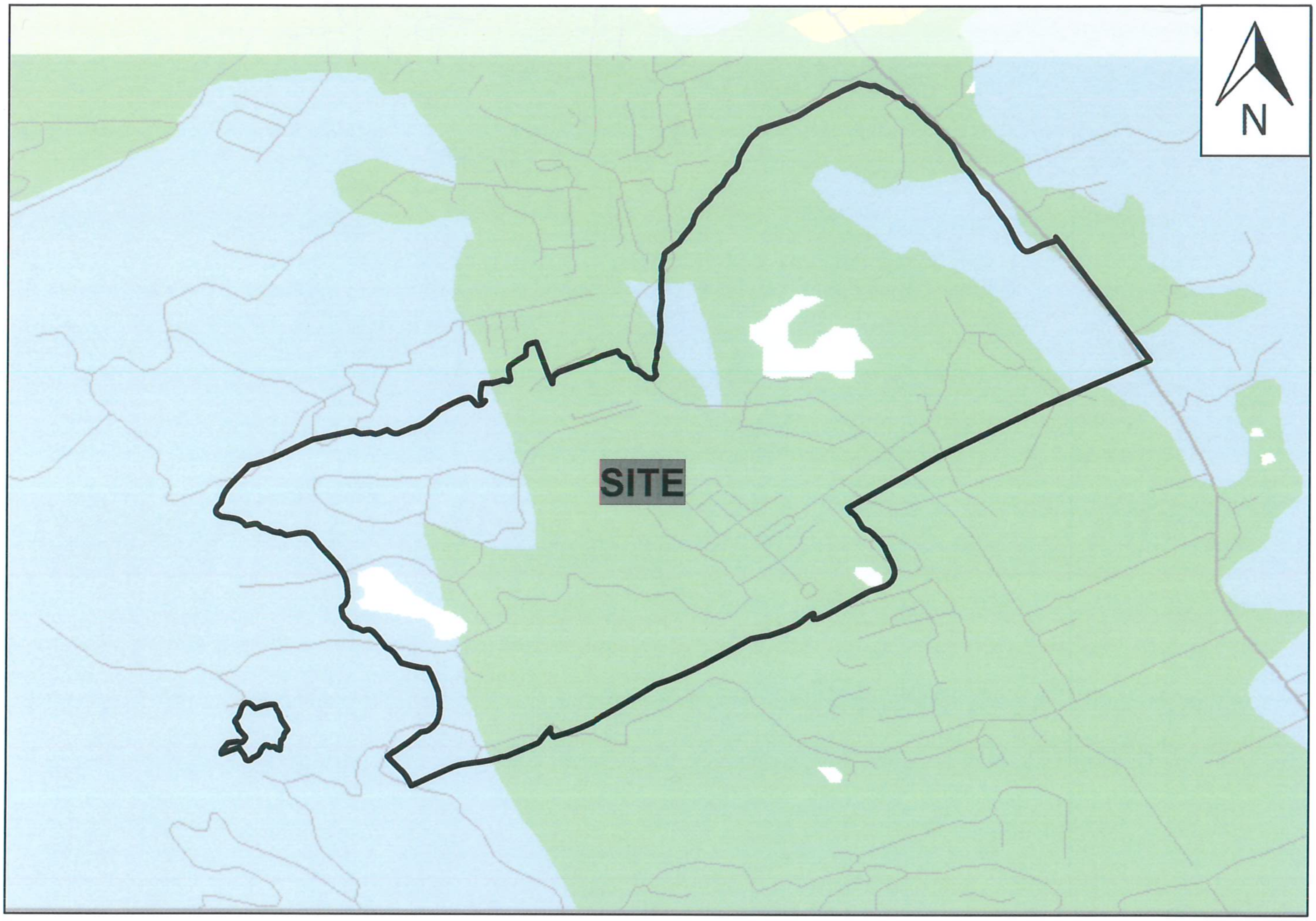
REFERENCE: ASSOCIATION OF BAY AREA GOVERNMENTS, SHAKE SUSCEPTIBILITY MAP, DATED JUNE 2009.

PJC & Associates, Inc.
Consulting Engineers & Geologists

SHAKE SEVERITY MAP- SAN ANDREAS FAULT
SONOMA DEVELOPMENTAL CENTER
15000 ARNOLD DRIVE
ELDRIDGE, CALIFORNIA

PLATE
6c

Proj. No: 7692.01 Date: 9/17 App'd by: PJC



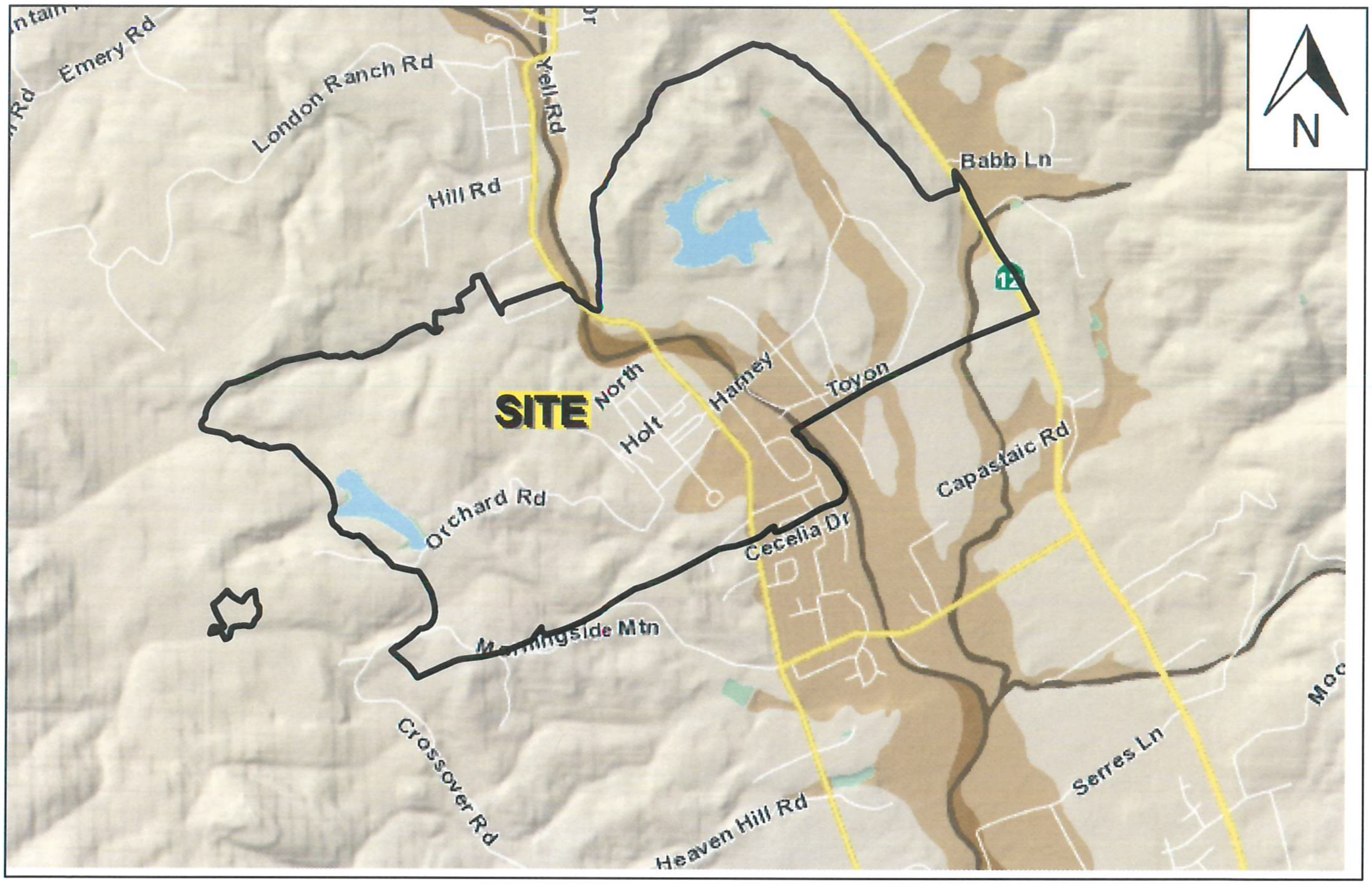
NO SCALE

EXPLANATION

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

REFERENCE: USGS- SOIL TYPE AND SHAKING HAZARD IN THE SAN FRANCISCO BAY AREA, NO DATE INDICATED (ONLINE VERSION).

PJC & Associates, Inc. Consulting Engineers & Geologists	SOIL TYPE AND SHAKING HAZARD MAP SONOMA DEVELOPMENTAL CENTER 15000 ARNOLD DRIVE ELDRIDGE, CALIFORNIA	PLATE 7
	Proj. No: 7692.01 Date: 9/17 App'd by: PJC	



SCALE 1" = .5 MILES

EXPLANATION

VERY HIGH LIQUEFACTION SUSCEPTIBILITY

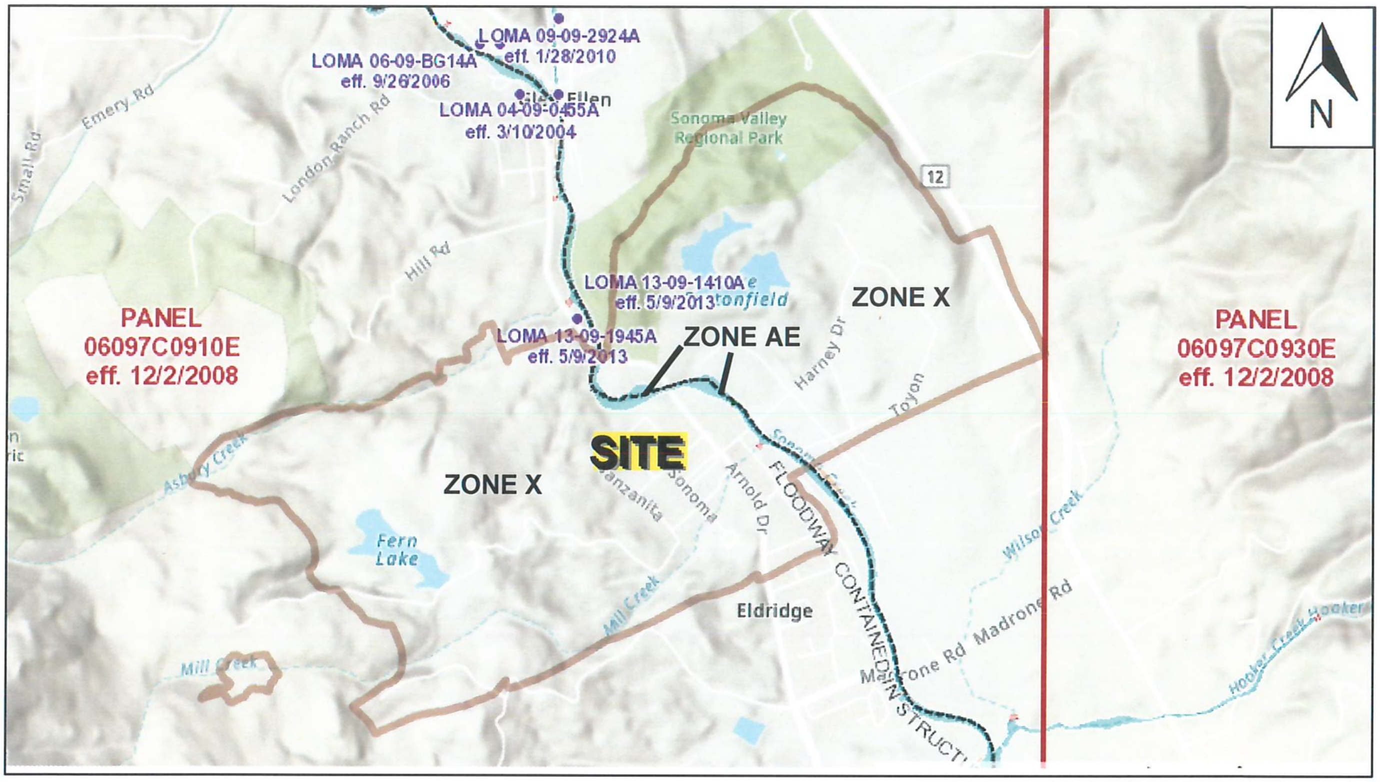
HIGH LIQUEFACTION SUSCEPTIBILITY

MODERATE LIQUEFACTION SUSCEPTIBILITY

LOW LIQUEFACTION SUSCEPTIBILITY

REFERENCE: ASSOCIATION OF BAY AREA GOVERNMENTS, INTERACTIVE LIQUEFACTION SUSCEPTIBILITY MAP, DATED JUNE 2009.

PJC & Associates, Inc. Consulting Engineers & Geologists	LIQUEFACTION SUSCEPTIBILITY MAP SONOMA DEVELOPMENTAL CENTER 15000 ARNOLD DRIVE ELDRIDGE, CALIFORNIA	PLATE **8**
	Proj. No: 7692.01 Date: 9/17 App'd by: PJC	



SCALE 1" = .4 MILES

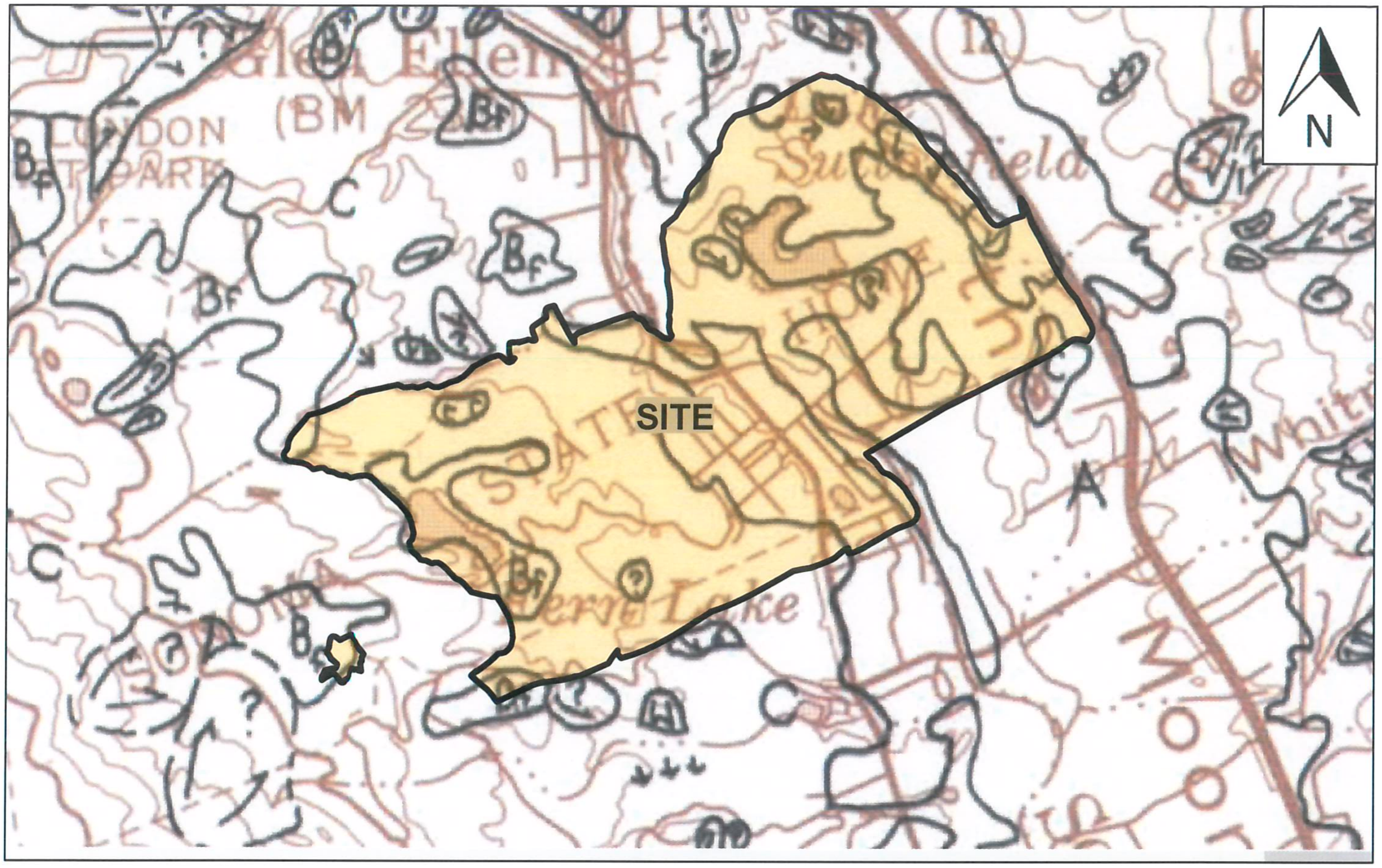
EXPLANATION

ZONE AE - HIGH RISK FLOOD ZONE – BASE FLOOD ELEVATIONS ESTABLISHED

ZONE X - AREA OF MINIMAL FLOOD RISK

REFERENCE: FLOOD INSURANCE RATE MAP, FEDERAL EMERGENCY MANAGEMENT AGENCY, COUNTY OF SONOMA & UNINCORPORATED AREAS, PANEL 910 OF 1,150, COUNTY PANEL NUMBER 06097CE, EFFECTIVE DECEMBER 1, 2008

PJC & Associates, Inc. Consulting Engineers & Geologists	FEMA FLOOD HAZARD MAP SONOMA DEVELOPMENTAL CENTER 15000 ARNOLD DRIVE ELDRIDGE, CALIFORNIA	PLATE 9
	Proj. No: 7692.01 Date: 9/17 App'd by: PJC	



SCALE: 2.5” = 1 MILE

EXPLANATION

Landslides; arrows show general direction of movement (areas of lowest relative slope stability), question marks indicate possible landslides.

Relative Slope Stability Categories:

C   Areas of relatively unstable rock and soil units on slopes greater than 15%, containing abundant landslides.

B   Areas of relatively stable rock and soil units, on slopes greater than 15%, containing few landslides.

A   Areas of greatest relative stability due to low slope inclinations, dominantly less than 15%.

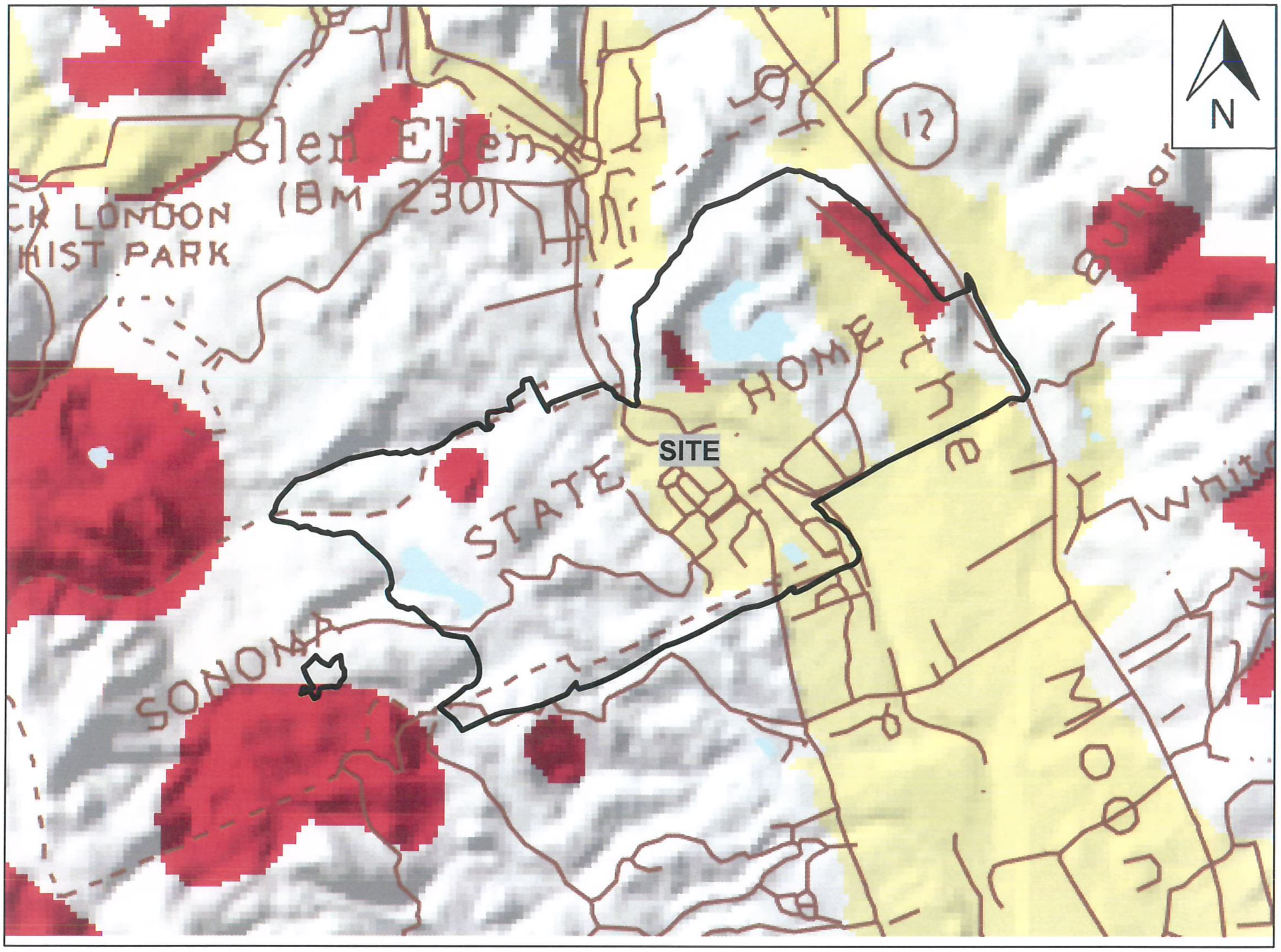
REFERENCE: LANDSLIDES AND RELATIVE SLOPE STABILITY, SONOMA COUNTY, PREPARED BY THE CALIFORNIA DIVISION OF MINES AND GEOLOGY, COMPILED BY CHARLES F. ARMSTRONG, DATED 1980.

PJC & Associates, Inc.
Consulting Engineers & Geologists

LANDSLIDE & SLOPE STABILITY MAP
SONOMA DEVELOPMENTAL CENTER
15000 ARNOLD DRIVE
ELDRIDGE, CALIFORNIA

PLATE 10

Proj. No: 7692.01   Date: 9/17   App'd by: PJC



APPOXIMATE SCALE 2" = 1 MILE

EXPLANATION

- Mostly Landslide - consists of mapped landslides, intervening areas typically narrower than 1500 feet, and narrow borders around landslides; defined by drawing envelopes around groups of mapped landslides.
- Many Landslides - consists of mapped landslides and more extensive intervening areas than in 'Mostly Landslide'; defined by excluding areas free of mapped landslides; outer boundaries are quadrangle and County limits to the areas in which this unit was defined.
- Few Landslides - contains few, if any, large mapped landslides, but locally contains scattered small landslides and questionably identified larger landslides; defined in most of the region by excluding groups of mapped landslides but defined directly in areas containing the 'Many Landslides' unit by drawing envelopes around areas free of mapped landslides.
- Flat Land - areas of gentle slope at low elevation that have little or no potential for the formation of slumps, translational slides, or earth flows except along stream banks and terrace margins; defined by the distribution of surficial deposits (Wentworth, 1997).

REFERENCE: USGS- SUMMARY DISTRIBUTION OF SLIDES AND EARTH FLOWS IN SONOMA COUNTY CALIFORNIA. DATED 1997.

PJC & Associates, Inc. Consulting Engineers & Geologists	LANDSLIDE AND EARTH FLOW MAP SONOMA DEVELOPMENTAL CENTER 15000 ARNOLD DRIVE ELDRIDGE, CALIFORNIA	PLATE 11
Proj. No: 7692.01	Date: 9/17	App'd by: PJC