Geologic Impact Analysis

Santa Rosa Fire Station 5
1400 Fountaingrove Parkway

Santa Rosa, California

Ross Drulis Cusenbery Architecture, Inc.

18294 Sonoma Highway | Sonoma, California 95476

December 14, 2020 | Project No. 403891001

Ninyo & Moore

Geotechnical & Environmental Sciences Consultants

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1 INTRODUCTION

In accordance with your authorization, we have performed a Geologic and Geotechnical Impact Analysis for the proposed Permanent Fire Station 5 Rebuild project located at 1400 Fountaingrove Parkway, at the southeast corner of intersection of Fountaingrove Parkway and Stagecoach Road in Santa Rosa, California (Figures 1 and 2). The purpose of this study was to evaluate the geologic and soil conditions at the project site based on available information, and to assess potential project impacts related to geology and soil.

Our scope of services for this study consisted of a geologic site reconnaissance; procurement and review of geotechnical and geologic reports for the site vicinity on file with the City of Santa Rosa and other public sources; and a review of regional geologic maps, seismic hazard reports, seismic hazard maps, project plans, topographic data, soil surveys, and aerial imagery. The findings from this study will be incorporated into an Environmental Impact Report (EIR) for the project.

2 PROJECT DESCRIPTION

The proposed fire station project consists of an approximately 9,000- to 11,000-square-foot, one- or two-story essential structure with three drive through apparatus bays along with paved driveways, an above-ground fuel storage tank and an emergency generator pad (RDC, 2020). Conceptual plans for the project indicate that development of the site will require cut and fill grading and may require construction of retaining walls and excavation along the adjoining slopes (Figure 3).

3 PHYSICAL SETTING

The subject property is located in a hillside neighborhood and encompasses approximately 2 acres of undeveloped land (Figures 1 and 2). Access to the site is provided by a gravel paved road that is located about 100 feet south of the intersection of Fountaingrove Parkway and Stagecoach Road. Parts of the site were impacted by the 2017 Tubbs Fire that burned several trees on the site that have since been cut down and removed. Vegetation at the site includes patches of light grasses and weeds and scattered shrubs and trees that were not impacted by the fire.

The project site has an irregular shape and includes a rectangular-shaped area at its western end adjacent to Fountaingrove Parkway and a narrow strip, or panhandle, that runs parallel to Stagecoach Road (Figures 2 and 3). The proposed fire station will be located in the rectangular area at the west end of the site, which includes a large pad area that has a surface gradient of about 10% and drains to the northeast into a small creek.

Topographic features at the site include the large pad area, ascending slopes along the eastern, southwestern, and southern site boundaries, and a small creek channel that runs along the base of the eastern slope (Figure 3). The top of the eastern slope lies at an elevation of about 530 feet above mean sea level (MSL) and descends to an elevation of about 470 feet above MSL with an overall height of about 60 feet. The overall horizontal to vertical ratios of the slope vary from about 3:1 to 4:1 (H:V), with localized lower portions of the slope at about 2:1 (H:V). A smaller slope with a height of about 16 feet is located in the southwest corner of the project site along Fountaingrove Parkway. The creek channel that runs along the eastern side of the pad area flows to the northeast into a storm water inlet structure on the south side of Stagecoach Road. The creek channel currently conveys surface drainage from the pad area and adjoining hillsides along with drainage off of Fountaingrove Parkway via a 36-inch diameter CMP culvert that flows into the head of the channel, which is located south of the site. Within the site boundaries, the creek consists of a one- to two-foot deep, unlined, open channel that exposes surficial soil overlying bedrock. The current conceptual plans include the creek channel within a drainage easement that connects to the existing inlet structure at Stagecoach Road (RDC, 2020).

4 PREVIOUS GEOTECHNICAL REPORTS

Previous geotechnical reports for the subject property were not made available for our review and we did not find any reports during our search for background materials. A geotechnical report prepared by PJC & Associates in 2009 for the Terrazzo project located at the 1500 block of Fountaingrove Parkway was obtained by our firm and reviewed. The Terrazzo project is located about a ¼ mile north of the subject site on the west side of Fountaingrove Parkway. The proposed multi-unit residential development was never constructed. The site is located on a small knoll that rises to an elevation of about 615 feet above mean sea level. The knoll is underlain by volcanic bedrock and has side slopes with slope ratios of about 1.5H:1V (horizontal to vertical). The geotechnical investigation included the excavation and logging of ten test pits that encountered colluvial and residual soils overlying basalt. The consultant concluded that development of the site was feasible from a geotechnical viewpoint provided that their recommendations were incorporated into the design plans and implemented during construction. The main geologic and geotechnical issues addressed in the report included the potential for strong ground motion, slope stability in areas underlain by surficial soils, expansive soils, and hard bedrock conditions.

5 GEOLOGIC SETTING

The project study area is located north of San Francisco Bay in the Coast Ranges geomorphic province of California. The Coast Ranges are comprised of several mountain ranges and structural valleys formed by tectonic processes commonly found around the Circum-Pacific belt (Ring of Fire). Basement rocks have been sheared, faulted, metamorphosed, and uplifted, and are separated by thick blankets of Cretaceous and Cenozoic sediments that fill structural valleys and line continental margins. The San Francisco Bay Area has several ranges that trend northwesterly, parallel to major strike-slip faults such as the Rodgers Creek-Healdsburg, Bennett Valley, and Maacama (Figure 4). Major tectonic activity associated with these and other faults within this regional tectonic framework consists primarily of right-lateral, strike-slip movement.

5.1 Soil

A regional soil survey from the Natural Resources Conservation Service (NRCS, 2020) indicates that the soil units in the study area include the Goulding cobbly clay loam and Spreckels loam. Goulding cobbly clay loam covers most of the site and generally consists of well drained cobbly clay loam and very gravelly clay loam that formed in residuum weathered from metavolcanics. Spreckels loam is located at the eastern end of the panhandle next to Stagecoach Road and generally consists of well drained loam, clay, and cemented soil that formed in residuum weathered from metavolcanics. During our site reconnaissance we observed about 12 to 24 inches of sandy clay soil overlying bedrock in some areas.

5.2 Site Geology

Regional geologic mapping by McLaughlin et al. (2008) indicates that the site is underlain by late Tertiary age volcanic rocks of the Sonoma Volcanics, which includes several distinct units of various volcanic rock types including rhyolite, dacite, tuff, andesite, and basalt. According to the map, the site is underlain by late Miocene age deposits of andesite and basalt. During our site reconnaissance we observed bedrock composed of basalt and andesite at the surface and in the creek channel. A regional geologic map is presented as Figure 5.

Geologic structures, such as faults and folds, within the project boundaries include a northwesterly trending fault that transects the southwest corner of the site (Figure 5). This fault is one of several in the local area that trend roughly parallel to the active trace of the Rodgers Creek fault, which is located about ½ mile southwest of the site. Recent studies of the Rodgers Creek fault by Hecker and Randolph Loar (2018), include this fault as part of a broad zone of deformation along the Rodgers Creek fault. They describe the fault strand that transects the southwest corner of the site as being “potentially Holocene” and part of the long-term displacement zone that has been created along the fault over geologic time.

5.3 Groundwater

Groundwater was not encountered during the geotechnical exploration for the Terrazzo project approximately ¼ mile north of the project at the 1500 block of Fountaingrove Parkway (PJC & Associates, 2009). The exploration for the Terrazzo project consisted of ten test pits excavated to depths of up to 10½ feet below the ground surface.

Monitoring wells associated with the remediation of impacted groundwater at the former Hewlett Packard Fountaingrove Site at 1412 Fountaingrove Parkway indicate that the groundwater level is about 20 feet below the ground surface at the monitored location, which is about 2,000 feet south-southwest of site (Stantec, 2019).

The depth to groundwater is subject to spatial variations in topography and hydrogeologic conditions. Furthermore, groundwater levels may fluctuate over time in response to seasonal variations in precipitation, termination or initiation of nearby groundwater pumping/dewatering, changes in irrigation, leaking pipes, and other potential factors.

6 GEOLOGIC AND SEISMIC HAZARDS

This study considered a number of geologic and seismic hazards relevant to the proposed development. These hazards are discussed in the following subsections.

6.1 Historic Seismicity

The site is located in a seismically active region. Figure 4 presents the location of the site relative to the epicenters of historic earthquakes with magnitudes of 5.5 or more from 1800 to 2000. Earthquakes of historical significance to the site are summarized in Table 1 including earthquakes within 10 kilometers (km) of the site exceeding a magnitude of 5.5, earthquakes exceeding magnitude 6 within 50 km of the site, and earthquakes exceeding magnitude 7 within 100 kilometers (km) of the site since 1900. Two earthquakes exceeding magnitude 5.5 have occurred within 10 km of the site since 1900. These two earthquakes, of magnitude 5.6 and 5.7, occurred on October 1, 1969 along the Rodgers Creek fault, in the eastern part of Santa Rosa, causing wide spread damage to many of the older structures in Santa Rosa (Cloud et al., 1970; USGS, 2019). The epicenters of these earthquakes were located about 2.6 km and 3.8 km south of the project site. The magnitude 5.6 earthquake occurred with the City of Santa Rosa and is shown on Figure 6.

Records of historic ground effects related to seismic activity (e.g. liquefaction, sand boils, lateral spreading, ground cracking) compiled by Knudsen et al. (2000), indicate that no ground effects related to historic seismic activity have been reported for the site.

Table 1 – Significant Historic Earthquakes

Date	Place	Location	Magnitude	Epicentral Distance
1969-10-01	Santa Rosa	38.467ºN,122.692ºW	5.6	2.6 km
1969-10-01	Santa Rosa	38.455ºN,122.692ºW	5.7	3.8 km
2014-08-24	South Napa	38.215ºN,122.312ºW	6.0	46.1 km
1906-04-18	San Francisco	37.750°N, 122.550°W	7.9	82.9 km

Reference: https://earthquake.usgs.gov/earthquakes/search

6.2 Ground Surface Fault Rupture

In response to hazards associated with earthquake-related ground rupture, the State of California enacted the Alquist-Priolo Earthquake Fault Zoning Act (AP Act) in 1972, which regulates development of structures for human occupancy in areas within active fault zones. The AP Act requires that the State Geologist delineate zones along active faults where evaluation of the potential for ground rupture is required. As defined by the California Geological Survey (CGS, 2018), active faults are faults that have caused surface displacement within Holocene time, or within approximately the last 11,700 years.

The site is not located within an Alquist-Priolo Earthquake Fault Zone established by the State Geologist (CDMG, 1983; CGS, 2018), or fault rupture hazard zones established by the City of Santa Rosa (2009) and the County of Sonoma (2017). These zones delineate regions of potential ground surface rupture adjacent to active faults. The regional fault map presented as Figure 4 indicates that several faults are located near the site (Jennings and Bryant, 2010). The closest active fault to the site is the Rodgers Creek fault, which is within approximately ½ mile of the site to the southwest.

The Rodgers Creek fault is a northwesterly trending strike-slip fault that is one of several active faults in the northern Bay Area that accommodates movement along the boundary between the North American and Pacific tectonic plates. Regional geologic mapping by McLaughlin et al. (2008) depicts a northwesterly trending fault transecting the southwest corner of the site. Studies by Hecker and Randolph Loar (2018) indicate that this fault is part of a broad zone of deformation associated with the Rodgers Creek fault; however, this particular fault strand is not considered active and poses a low potential for fault rupture.

6.3 Seismic Ground Motion

The 2014 Working Group on California Earthquake Probabilities (Field et al., 2015) predicted that the probability of a magnitude 6.7 or greater earthquake occurring in the greater Bay Area before 2043 is 72 percent. The United States Geological Survey (USGS), through the California Integrated Seismic Network (CISN), developed a series of maps depicting the projected distribution of likely shaking intensity for various earthquake scenarios based on the Third Uniform California Earthquake Rupture Forecast (Field et al., 2015). The scenarios predicting high levels of shaking intensity from this assessment are summarized in Table 2**Error! Reference source not found.** with earthquake magnitude considered, fault location, and fault distance to the site in kilometers. The results of this assessment indicate that the site could experience a severe degree of seismic ground shaking. Based on regional mapping, the site is near a region where a violent degree of seismic ground shaking is predicted for a future earthquake on the Rodgers Creek fault (Figure 6).

Table 2 – Estimated Future Ground Shaking from Nearby Faults

Fault (Segment)	Fault to Site Distance (km)	Moment Magnitude	Shaking Severity
Rodgers Creek	0.9	7.1	VIII (severe)
Maacama	5.5	7.4	VII (very strong)
San Andreas (All Northern)	34.5	7.8	VIII (very strong)
Berryessa	36.4	7.1	VI (strong)
West Napa	19.8	6.7	VI (strong)

Reference: https://abag.ca.gov/our-work/resilience/data-research/hazard-viewer

6.4 Liquefaction

The strong vibratory motions generated by earthquakes can trigger a rapid loss of shear strength in saturated, loose, granular soil through liquefaction. Soils that are susceptible to liquefaction are typically of late Quaternary age and found in alluvial, fluvial and estuarine environments with shallow groundwater conditions. Liquefaction is generally not a concern at depths of more than 50 feet below ground surface. Liquefaction can result in a loss of foundation bearing capacity or lateral spreading of sloping or unconfined ground. Liquefaction can also generate sand boils leading to settlement at the ground surface.

The subject site is underlain by shallow bedrock that is mantled with a thin layer of soil in some areas. Regional studies of liquefaction susceptibility (Witter et al., 2006) indicate that the liquefaction potential at the site location is very low (Figure 7). The shallow bedrock conditions observed during our site reconnaissance further indicates that the potential for liquefaction and related hazards such as lateral spreading, sand boils, or a reduction in foundation bearing capacity due to liquefaction, is very low.

6.5 Dynamic Settlement

The strong vibratory motion associated with earthquakes can also dynamically compact loose granular soil leading to settlement and ground subsidence. Dynamic settlement may occur in both dry and saturated sand and silt. The study area is within the area considered to have a very low susceptibility to liquefaction (Figure 7) and shallow bedrock conditions are anticipated based on the findings from our site reconnaissance for this study. As such, the potential for dynamic settlement following an earthquake is likely to be very low. The potential for dynamic settlement and the need for mitigation can be further evaluated by site-specific subsurface evaluation of the various areas proposed for development.

6.6 Expansive Soils

Some clay minerals undergo volume changes upon wetting or drying. Unsaturated soils containing those minerals will shrink/swell with the removal/addition of water. The heaving pressures associated with this expansion and shrink/swell movement can damage structures and flatwork. Expansive soils may be present within the study area. The potential for shrink/swell movement due to expansive soils and the need for mitigation can be further evaluated by site-specific evaluation of the various areas proposed for development.

6.7 Consolidation Settlement

Compression or consolidation of loose or soft soil due to overburden fill, large structures, or local dewatering can result in ground subsidence. Based on the proposed project, mitigation of ground subsidence due to compression or consolidation settlement may be needed if loose or soft soil is present and fill is placed to raise grades a few feet or more. The potential for ground subsidence due to consolidation or compression and the need for mitigation can be further evaluated by site-specific subsurface evaluation of the various areas proposed for development.

6.8 Collapsible Soils

Loose, dry, low-density soil can “collapse” or compact with the addition of water under foundation loads or the weight of overlying soil. Ground settlement occurs when the collapsible soil is first saturated or is saturated to depths greater than those achieved by typical rain events. Undocumented fills, young alluvial fans, debris flow sediments, and deposits of wind-blown soil may include collapsible soils, particularly in arid or semi-arid environments. Regional geologic mapping indicates that the site is underlain by shallow bedrock; however, loose undocumented fills may be present based on past land use practices. As such, collapsible soils may be present within the study area. The potential for ground settlement due to collapsible soils and the need for mitigation can be further evaluated by site-specific evaluation of the various areas proposed for development.

6.9 Flood Hazards and Dam Failure Inundation

Our review of the flood hazard map covering the property (FEMA, 2008) indicates that the site is not located in a flood hazard zone (Figure 8). Flooding does not need to be considered during design phases of the proposed development.

Flooding can also occur when dams of nearby reservoirs fail and inundate the surrounding downstream areas. Our review of the dam failure inundation map prepared by County of Sonoma (2017) indicates that the site is not in a dam failure inundation zone (Figure 9). Therefore, flooding due to dam failure does not need to be considered during the design phase of the proposed development.

6.10 Landsliding and Slope Stability

Regional mapping of landslides and earth flows in Sonoma County by the USGS (Wentworth et al., 1997) is presented on the Association of Bay Area Governments interactive hazard viewer map web site and is included as Figure 10. The regional mapping indicates that the site is located in an area where few landslides are present or likely to occur. The California Geological Survey (Wills et al., 2011) has also prepared regional maps depicting the susceptibility of hillside areas to deep-seated landslides. This map indicates that the slope along the eastern and southern boundaries of the site has a high susceptibility to deep-seated landslides.

During our site reconnaissance we observed evidence of possible shallow landslide deposits on the slope that borders the eastern and southern portions of the site. This slope has an overall height of about 60 feet with slope ratios varying from about 2:1 (H:V) to 4:1 (H:V). This slope is considered to be grossly stable, but surficially unstable. The stability of the slope should be addressed during future geotechnical evaluations of the site.

6.11 Regional and Local Ground Subsidence

Ground subsidence or settlement of the ground surface can occur over large areas as a result of groundwater pumping, oil or gas extraction, or decomposition of organic soil. The study area is not within or near mapped areas of recorded ground subsidence from these sources (USGS, 2018). Accordingly, the potential for ground subsidence in the study area due to groundwater pumping, oil/gas extraction, or decomposition of organic soil is low.

Underground voids resulting from historic mining activities or the dissolution of soluble rocks in karst terrane can cause ground subsidence by collapse of these voids or by sinkholes where overlying soil is transported into the void through erosion. The geology in the study area is not consistent with karst terrane and a database maintained by the California Department of Conservation (2016) contains no records of historic mining activities in the study area. Accordingly, the potential for ground subsidence in the study area due to sinkholes or collapsing ground related to historic mining activities or karst terrane is very low.

6.12 Bedrock Excavatability

The site is underlain by shallow bedrock, which could be difficult to excavate during site development. The design-level geotechnical evaluation should include an evaluation of the excavatability of the underlying bedrock for consideration during the development of the project grading plan and design of foundations.

7 IMPACT ANALYSIS

The following sections present our analysis of potential impacts related to geology and soils that may result from the proposed project. The impacts considered are consistent with the California Environmental Quality Act (CEQA) guidelines for geology and soil. The analysis indicates where mitigation is needed to reduce the significance of the potential impact to a less than significant consideration. The Santa Rosa Transportation and Public Works department, through Assistant City Manager Jason Nutt, will be responsible for reviewing and approving all mitigation measures.

7.1 Ground Surface Rupture

Known active faults are not mapped in the study area and the site is not located within a fault-rupture hazard zone established by the California Geological Survey, the City of Santa Rosa or the County of Sonoma. The potential for ground surface fault rupture that could expose people or structures to potential adverse effects is considered less than significant.

7.2 Strong Ground Shaking

The study area is in a seismically active region with a potential for a strong ground shaking at the site following an earthquake on a nearby fault. The impact of strong ground shaking can be mitigated by designing and constructing the improvements in accordance with the California Building Code to resist the anticipated strong ground shaking by adding the appropriate connections and lateral-force-resisting elements. The potential for strong ground shaking to expose people or structures to substantial adverse effects is therefore considered to be less than significant with mitigation incorporation.

7.3 Seismic-Related Ground Failure

The study area is located within an area with a very low susceptibility to liquefaction based on regional mapping (Figure 7). Based on the shallow bedrock conditions at the site, the potential for liquefaction to expose people or structures to substantial adverse effects as a result of this project is considered less than significant.

The potential for earthquake-induced landslides has not been evaluated by the California Geological Survey for this area; however, the eastern and southern sides of the site are bounded by an ascending slope with a height of up to approximately 60 feet and the site could potentially experience a severe level of earthquake-related ground motion. As such, seismic-related ground failure due to earthquake-induced landslides could potentially expose people or structures to substantial adverse effects as a result of this project. The impact of earthquake-induced landslides can be mitigated by remedial measures such as setting the proposed structures back from the toe of the slope, regrading or buttressing the slope, or the construction of retaining structures. Accordingly, seismic-related ground failure may be considered a less than significant impact with mitigation incorporation.

7.4 Landslides

The study area and surrounding areas are in hilly terrain, and the eastern and southern sides of the site are bounded by an ascending slope with a height of up to approximately 60 feet. Evidence of surficial instability was observed on the slope along the eastern and southern boundaries during the reconnaissance for this study. Based on these observations, landslides could potentially expose people or structures to substantial adverse effects as a result of this project. However, remedial measures such as setting structures back from the toe of the slope, regrading or buttressing the slope, or the construction of retaining structures can reduce the impact to a less than significant level. Therefore, landslides may be considered a less than significant impact with mitigation incorporation.

7.5 Soil Erosion

The proposed project will disturb existing ground during site preparation, and expose soil during grading. As such, the proposed project could potentially result in substantial soil erosion including the loss of topsoil by erosion. Impacts related to erosion and loss of topsoil are typically mitigated by compliance with the Best Management Practices stipulated in the grading permits issued the local building official. These practices generally consist of utilizing sedimentation control measures such as silt fences, straw wattles, or sediment traps during construction, and the installation of appropriate soil stabilization measures including erosion control blankets, slope drains with outlet protection, and the establishment of vegetative cover. Erosion and loss of topsoil may therefore be considered a less than significant impact with mitigation incorporation.

7.6 Unstable Soil

Although the potential for liquefaction, lateral spreading, sand boils, and dynamic settlement is considered very low; and the potential for ground subsidence due to groundwater pumping, oil/gas extraction, decomposition of organic soil, or collapse/filling of underground voids from past mining activities or karstic terrain is also low; portions of the site might be underlain by loose/soft soil or undocumented fill due to past land use practices. The loose/soft soil or undocumented fill could be unstable due to the potential to settle under applied loads or due to the potential to collapse on wetting. The project may also potentially reduce the stability of the slopes bordering the eastern and southern portions of the site if project grading removes material from the bottom portion of the slope. The potential for settlement or collapse of unstable soil can be mitigated, if found to be a concern during a future design-level geotechnical evaluation for the project, by remedial grading to remove and replace the unstable soil or by appropriate foundation type selection and design. The potential impact to the stability of adjacent slopes can be mitigated by considering the stability of the adjacent slopes in the development of the project grading plans and by the appropriate design and construction of retaining structures for temporary and long-term conditions. Accordingly, unstable soil, or the development of an unstable condition as a result of the proposed project, may be considered a less than significant impact with mitigation incorporation.

7.7 Expansive Soil

Expansive soils may be present within the project study area and create a risk for property damage where project improvements are constructed on or adjacent to expansive soils. The impact of expansive soil can be mitigated by removing the expansive soil, chemically treating the soil to reduce the expansion characteristic, or by designing structures to accommodate the heaving pressures and shrink/swell movement associated with expansive soils. The potential for property damage due to expansive soil may therefore be considered a less than significant impact with mitigation incorporation.

7.8 Wastewater Disposal

Given the location of the project, we expect that sewers will be used for disposal of wastewater. Therefore, the ability of site soil to support the use of septic tanks and leach fields or other alternative wastewater disposal systems will have no impact relative to the project.

8 LIMITATIONS

The limited geologic hazards assessment and geologic impact analysis presented in this report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions and opinions presented in this report. Our findings are based on a review of the referenced geologic literature. Geologic variations may exist on the site, and conditions not described in this report may be encountered.

The purpose of this study was to evaluate geologic hazard conditions within the study area using readily available data and to provide a geologic impact analysis which can be utilized in the preparation of environmental documents for the project. A more detailed geotechnical and geologic evaluation, including site reconnaissance, subsurface exploration, and laboratory testing, should be performed prior to design and construction of the proposed project.

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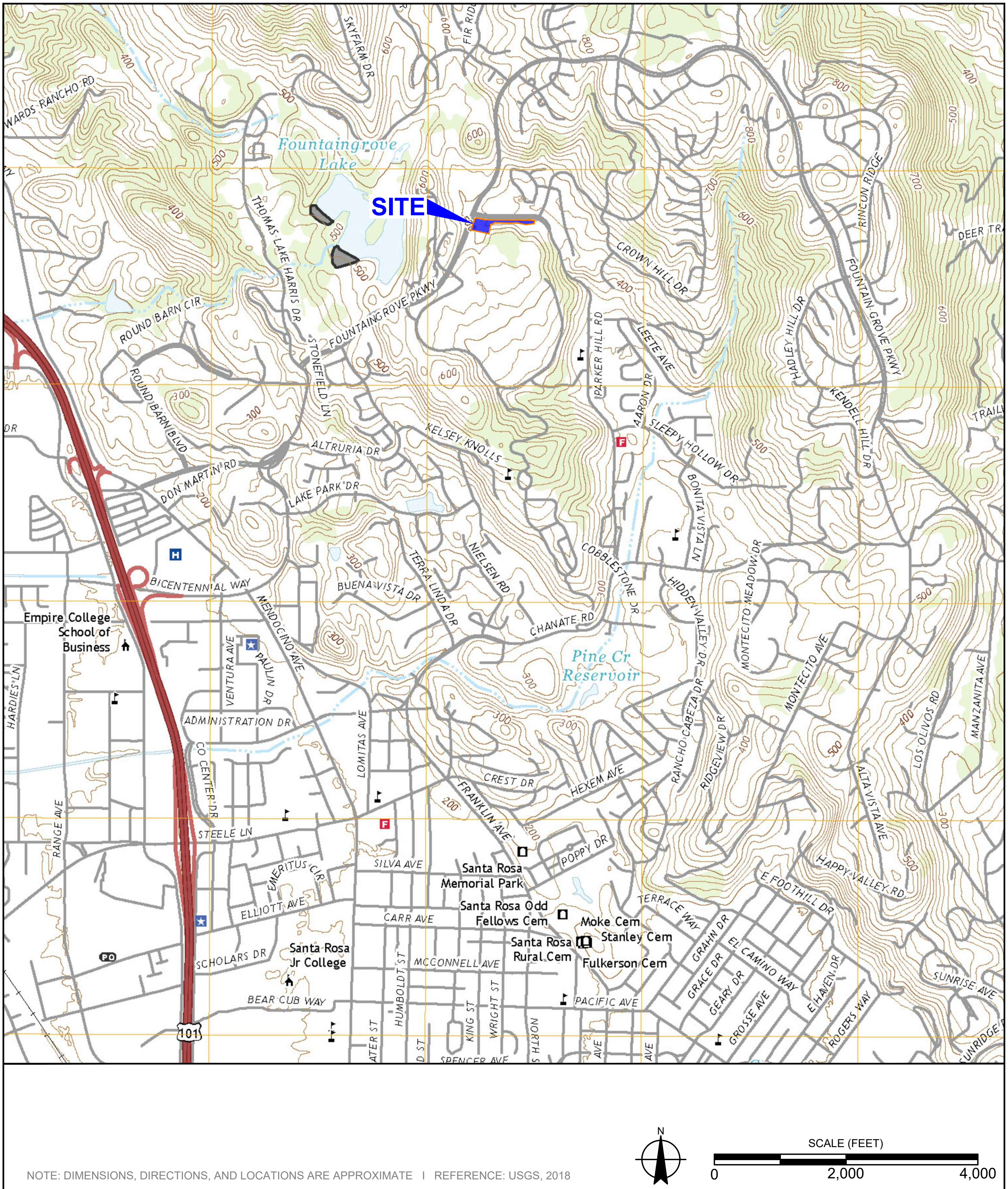
FIGURES



NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE I REFERENCE: USGS, 2018

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FIGURE 1

SITE LOCATION

SANTA ROSA FIRE STATION 5
1400 FOUNTAINGROVE PARKWAY
SANTA ROSA, CALIFORNIA
403891001 I 12/20

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LEGEND

SITE BOUNDARY

NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE | REFERENCE: GOOGLE EARTH, 2020

N

SCALE (FEET)

0 100 200

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FIGURE 2

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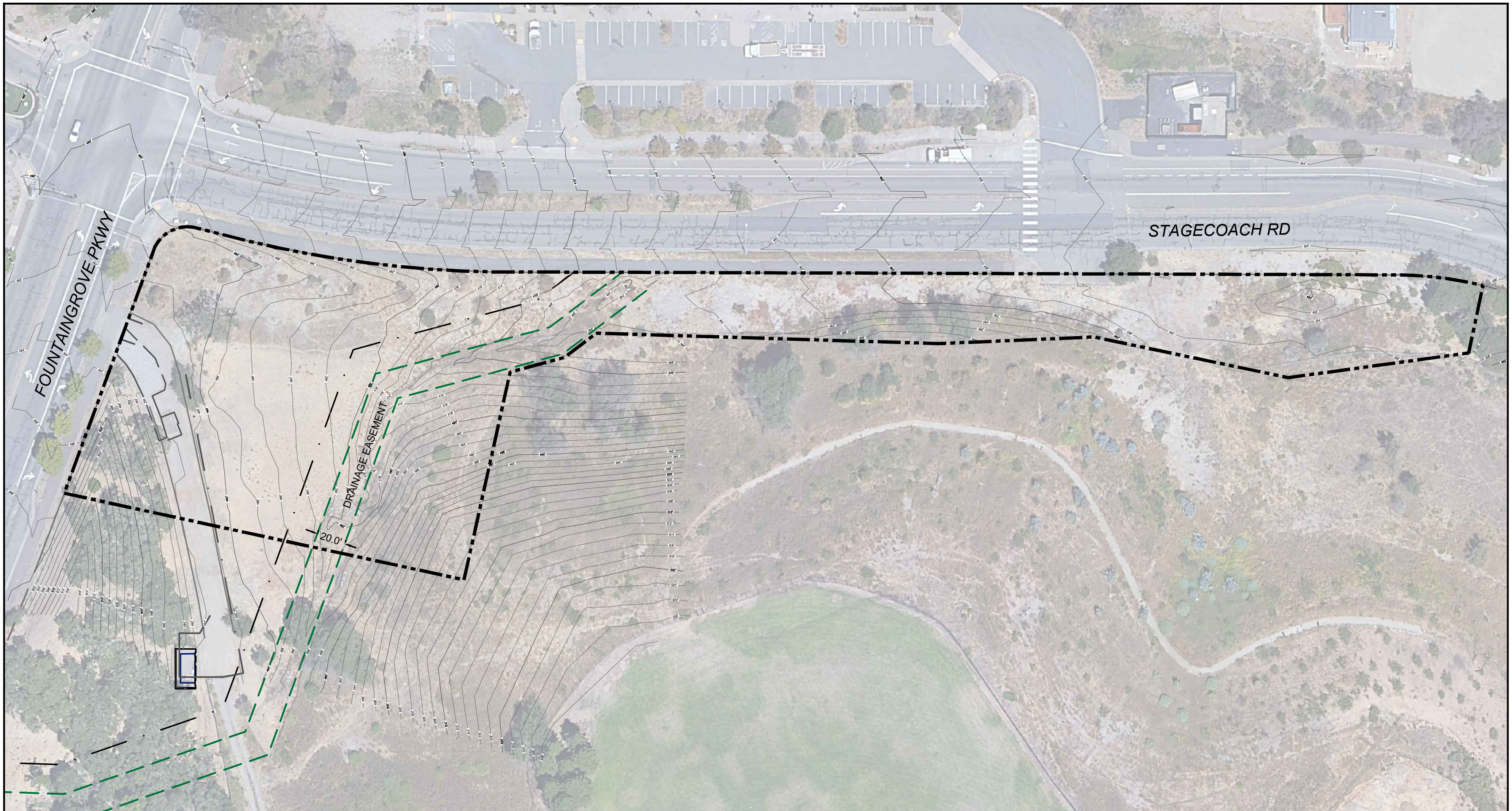
AERIAL PHOTOGRAPH

SANTA ROSA FIRE STATION 5
1400 FOUNTAINGROVE PARKWAY
SANTA ROSA, CALIFORNIA
403891001 | 12/20



LEGEND

SITE BOUNDARY

NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE I REFERENCES: RossDrulisCusenbery, 2020; GOOGLE EARTH, 2020

N

SCALE (FEET)

0 100 200

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FIGURE 3

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SITE PLAN

SANTA ROSA FIRE STATION 5
1400 FOUNTAINGROVE PARKWAY
SANTA ROSA, CALIFORNIA
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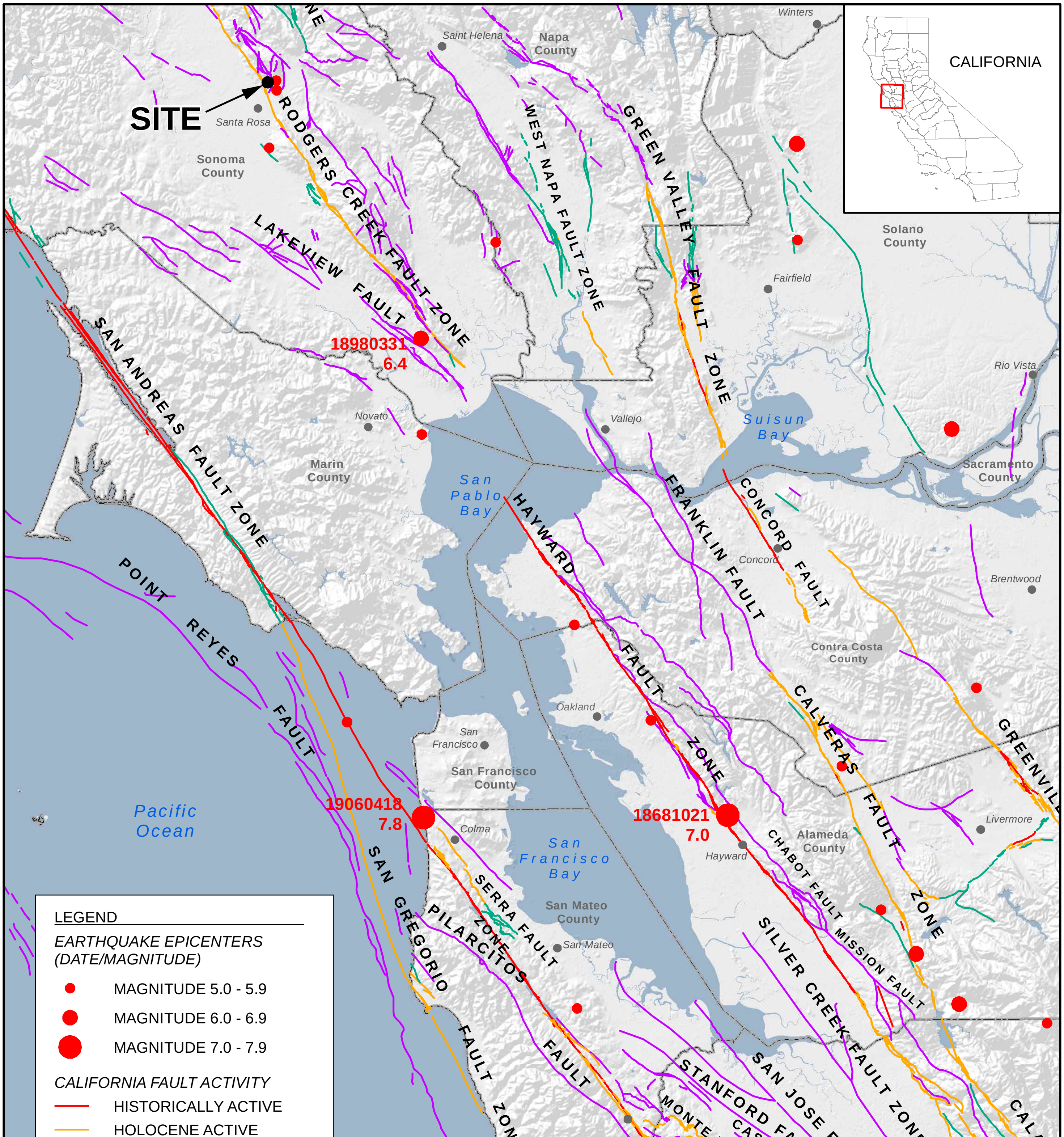

LEGEND

EARTHQUAKE EPICENTERS (DATE/MAGNITUDE)

- MAGNITUDE 5.0 - 5.9
- MAGNITUDE 6.0 - 6.9
- MAGNITUDE 7.0 - 7.9

CALIFORNIA FAULT ACTIVITY

- HISTORICALLY ACTIVE
- HOLOCENE ACTIVE
- LATE QUATERNARY
- QUATERNARY
- STATE/COUNTY BOUNDARY

NOTE: DIRECTIONS, DIMENSIONS, AND LOCATIONS ARE APPROXIMATE

SOURCES: CALIFORNIA GEOLOGICAL SURVEY, 2010, FAULT ACTIVITY MAP OF CALIFORNIA; CALIFORNIA GEOLOGICAL SURVEY, 2000, MAP SHEET MS 49

N

SCALE (MILES)

0 10 20

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FIGURE 4

FAULT LOCATIONS AND EARTHQUAKE EPICENTERS

SANTA ROSA FIRE STATION 5
1400 FOUNTAINGROVE PARKWAY, SANTA ROSA, CALIFORNIA

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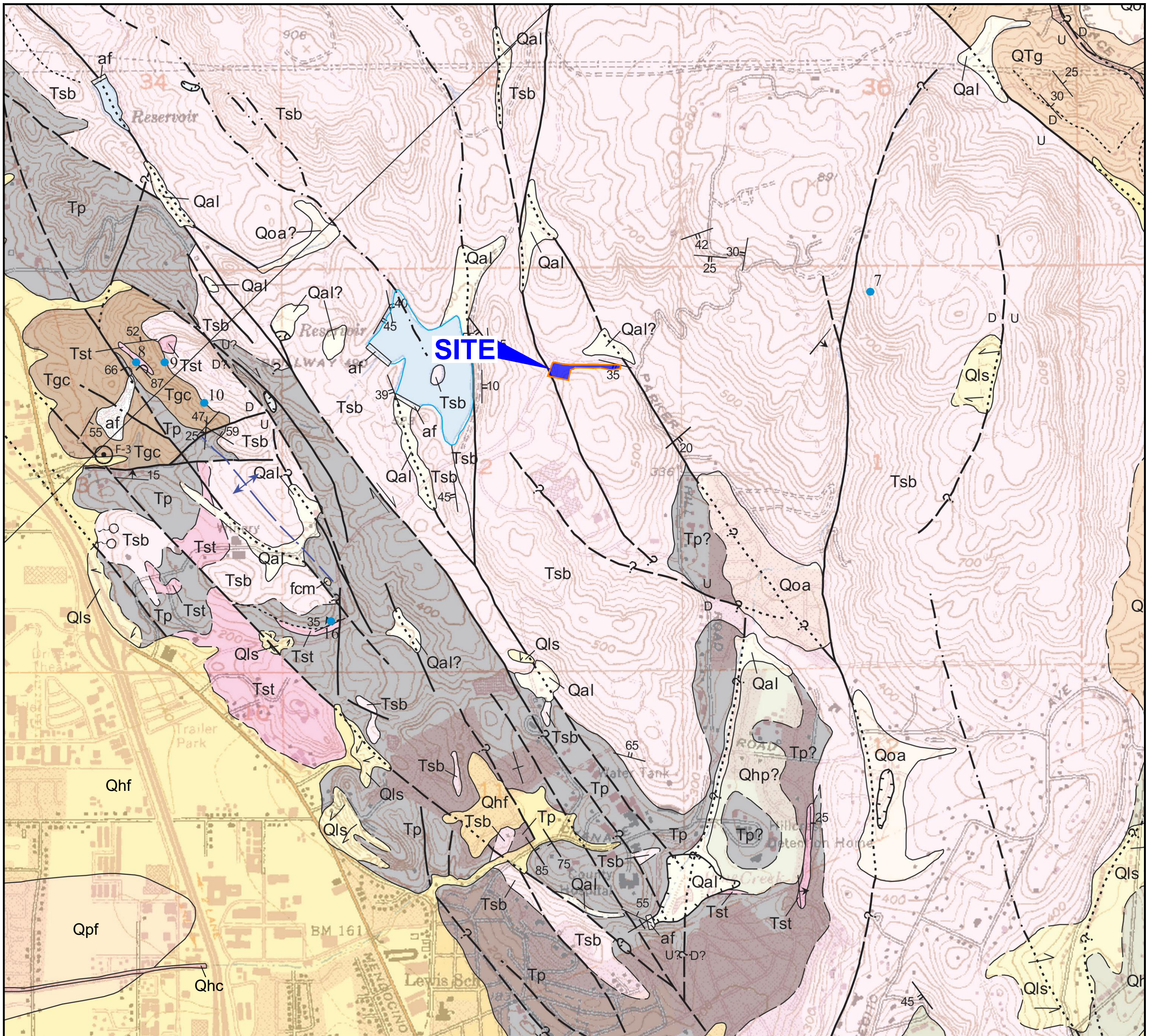

LEGEND

af	ARTIFICIAL FILL (HOLOCENE)	**Qhp**	ALLUVIAL DEPOSITS, UNDIVIDED (HOLOCENE & PLEISTOCENE)
Qhc	CHANNELS (HOLOCENE)	**Qhpf**	ALLUVIAL FAN & TERRACE DEPOSITS (HOLOCENE & PLEISTOCENE)
Qhf	ALLUVIAL FAN DEPOSITS (HOLOCENE)	**Qls**	LANDSLIDE DEPOSITS (HOLOCENE & PLEISTOCENE)
Qal	ALLUVIAL DEPOSITS (HOLOCENE/ PLEISTOCENE)	**Qoa**	OLDER ALLUVIUM, UNDIVIDED (PLEISTOCENE)
QTg	FLUVIAL & LACUSTRINE DEPOSITS (PLEISTOCENE & PLIOCENE)	**Tsb**	ANDESITE, BASALTIC ANDESITE, & BASALT (PLIOCENE & MIOCENE)
Tgc	CLOVERLEAF RANCH GRAVEL (PLIOCENE)		THRUST FAULT
Tp	PETALUMA FORMATION (PLIOCENE & MIOCENE)		FAULT
Tst	RHYOLITIC TO DACITIC & MINOR ANDESITIC TUFF (PLIOCENE & MIOCENE)		GEOLOGIC CONTACT
			STRIKE AND DIP OF BEDDING

N

SCALE (FEET)

0 2,000 4,000

NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE
REFERENCE: USGS: McLAUGHLIN ET AL; 2008

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FIGURE 5

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REGIONAL GEOLOGY

SANTA ROSA FIRE STATION 5
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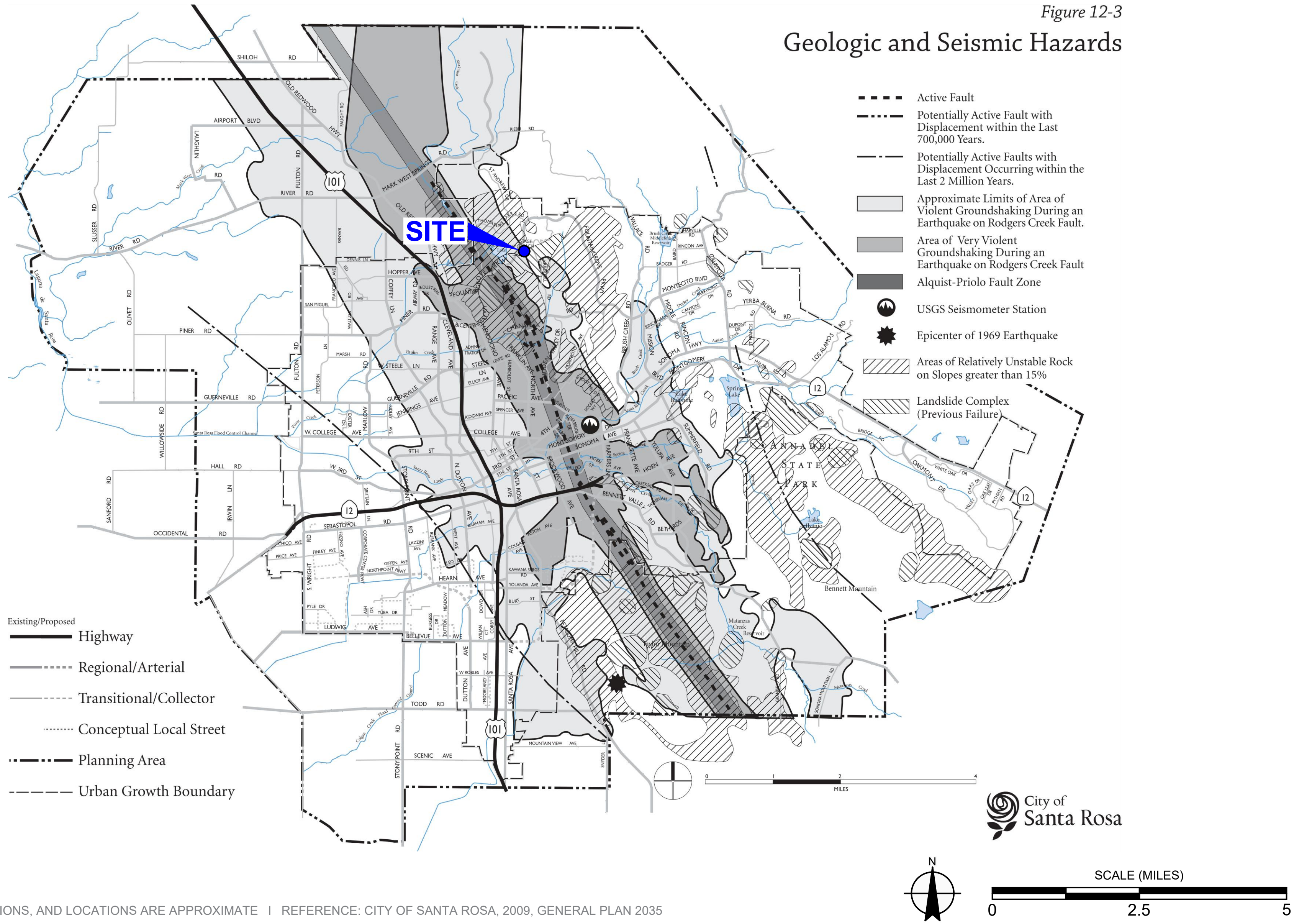

NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE I REFERENCE: CITY OF SANTA ROSA, 2009, GENERAL PLAN 2035

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FIGURE 6

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CITY OF SANTA ROSA GEOLOGIC AND SEISMIC HAZARDS

SANTA ROSA FIRE STATION 5
1400 FOUNTAINGROVE PARKWAY
SANTA ROSA, CALIFORNIA
403891001 I 12/20

LEGEND

EARTHQUAKE LIQUEFACTION SUSCEPTIBILITY:

VERY HIGH | HIGH | MODERATE | LOW | VERY LOW

N

SCALE (FEET)

0 | 4,000 | 8,000

NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE | REFERENCES: SONOMA COUNTY, 2017; ESRI, 2020

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FIGURE 7

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LIQUEFACTION SUSCEPTIBILITY

SANTA ROSA FIRE STATION 5
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SANTA ROSA, CALIFORNIA
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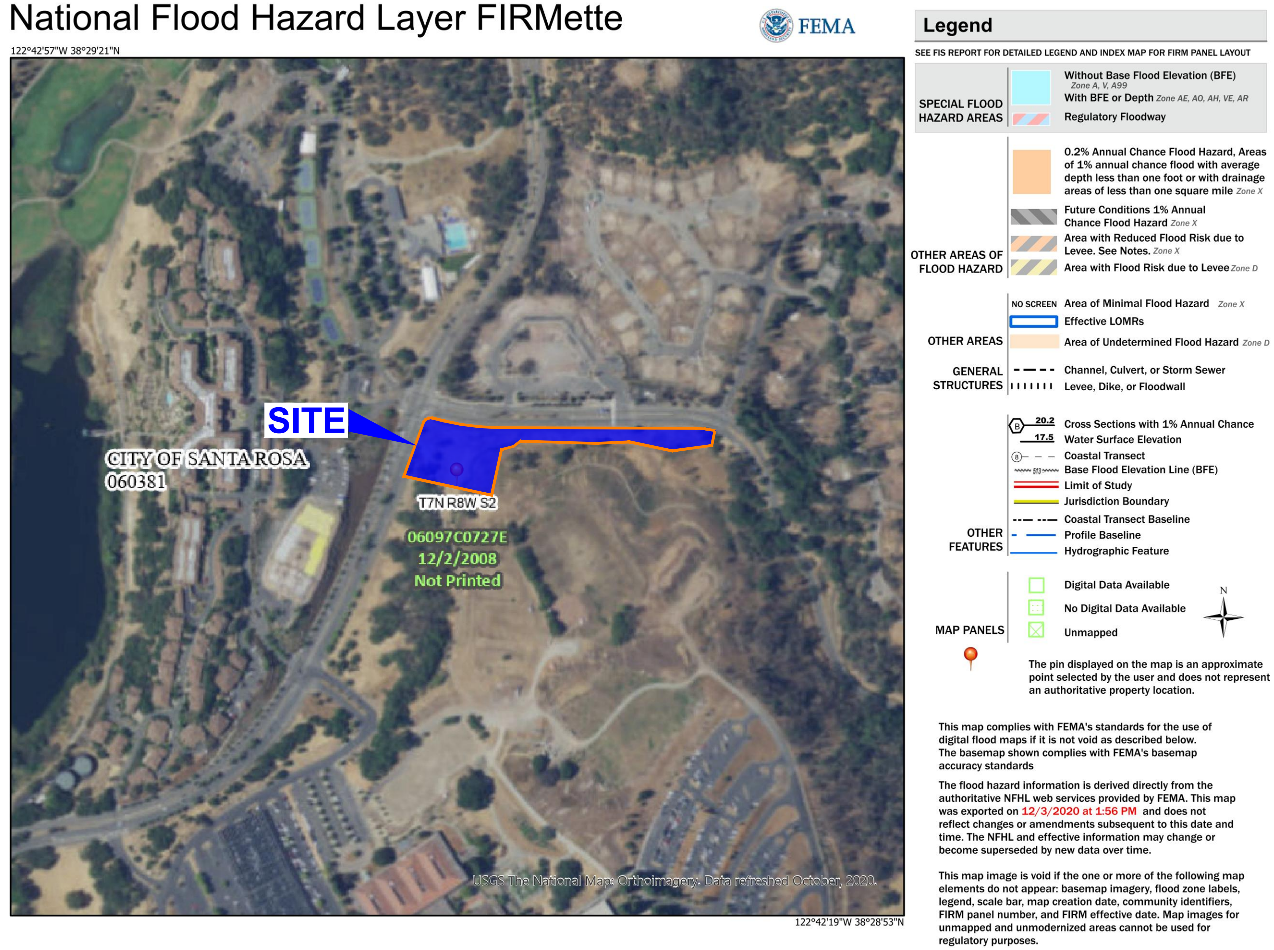
National Flood Hazard Layer FIRMette



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NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE I REFERENCE: FEMA, 2008

FIGURE 8

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FEMA FLOOD MAP

SANTA ROSA FIRE STATION 5
1400 FOUNTAINGROVE PARKWAY
SANTA ROSA, CALIFORNIA
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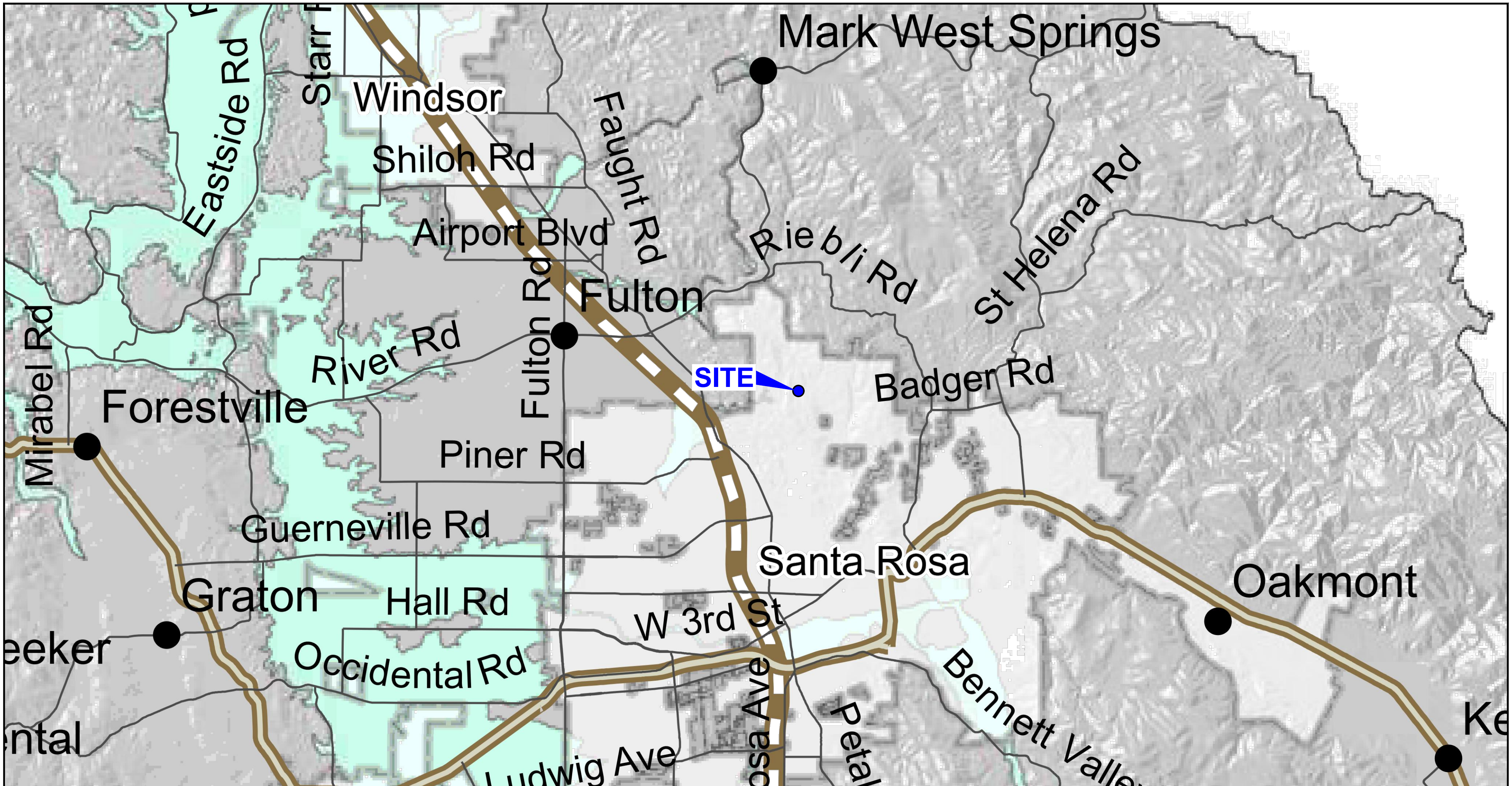

LEGEND

EXTENT OF WATER INUNDATION CAUSED BY DAM FAILURE

NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE | REFERENCE: COUNTY OF SONOMA, 2011

N

SCALE (MILES)

0 2 4

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FIGURE 9

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DAM FAILURE INUNDATION

SANTA ROSA FIRE STATION 5
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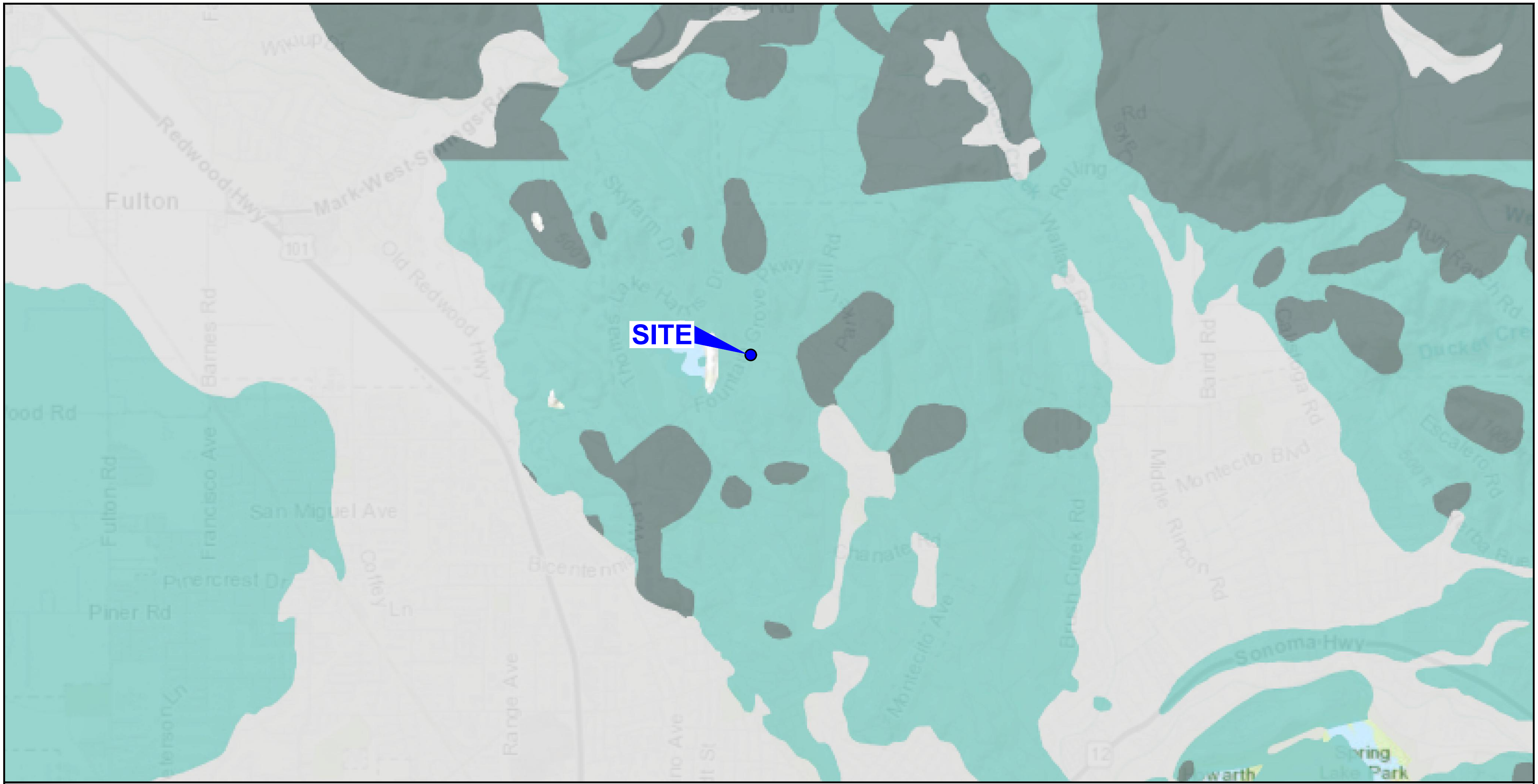

LEGEND

LANDSLIDE HAZARD (RAINFALL INDUCED):

MOST LANDSLIDES

FEW LANDSLIDES

FLAT LAND

NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE | REFERENCES: SONOMA COUNTY, 2017; ESRI, 2020

N

SCALE (FEET)

0 4,000 8,000

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FIGURE 10

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LANDSLIDE HAZARD

SANTA ROSA FIRE STATION 5
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SANTA ROSA, CALIFORNIA
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2020 Challenger Drive, Suite 103 | Alameda, California 94501 | p. 510.343.3000

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