4.7 GEOLOGY AND SOILS

This chapter of the Draft Environmental Impact Report (EIR) describes the potential impacts to geology and soils associated with the adoption and implementation of the proposed project. This chapter describes the regulatory framework and existing conditions, identifies criteria used to determine impact significance, provides an analysis of the potential impacts to geology and soils, and identifies proposed General Plan 2050 goals, policies, and actions that would minimize any potentially significant impacts.

4.7.1 ENVIRONMENTAL SETTING

4.7.1.1 REGULATORY FRAMEWORK

Federal Regulations

Paleontological Resources Preservation Act

The federal Paleontological Resources Preservation Act of 2002 limits the collection of vertebrate fossils and other rare and scientifically significant fossils to qualified researchers who have obtained a permit from the appropriate state or federal agency. Additionally, it specifies that these researchers must agree to donate any materials recovered to recognized public institutions, where they will remain accessible to the public and to other researchers. This act incorporates key findings of a report, *Fossils on Federal Land and Indian Lands*, issued by the Secretary of Interior in 2000, which establishes that most vertebrate fossils and some invertebrate and plant fossils are considered rare resources.[1]

State Regulations

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface fault rupture to structures used for human occupancy.[2] The main purpose of this act is to prevent the construction of buildings used for human occupancy on top of active faults. This act only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards, such as earthquake-induced liquefaction or landslides.[3] This act requires the State Geologist to establish regulatory zones (known as Earthquake Fault Zones or Alquist-Priolo Zones) around surface traces of active faults, and to issue appropriate maps.[4] The maps, which are developed using existing United States Geological Survey's

[1] U.S. Department of the Interior, May 2000, *Fossils on Federal & Indian Lands, Report of the Secretary of the Interior*. https://www.blm.gov/sites/blm.gov/files/programs_paleontology_quick%20links_Assessment%20of%20Fossil%20Management%20on%20Federal%20%26%20Indian%20Lands%2C%20May%202000.pdf, accessed January 31, 2022.

[2] California Geological Survey, Alquist-Priolo Earthquake Fault Zoning Act, https://www.conservation.ca.gov/cgs/alquist-priolo, accessed January 31, 2022.

[3] California Geological Survey, Alquist-Priolo Earthquake Fault Zoning Act, https://www.conservation.ca.gov/cgs/alquist-priolo, accessed January 31, 2022.

[4] California Geological Survey, Alquist-Priolo Earthquake Fault Zoning Act, https://www.conservation.ca.gov/cgs/alquist-priolo, accessed January 31, 2022.

(USGS) 7.5-minute quadrangle map bases, are then distributed to all affected cities, counties, and state agencies for their use in planning and controlling new or renewed construction. Generally, construction within 50 feet of an active fault zone is prohibited.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act, which was passed in 1990, addresses seismic hazards such as liquefaction and seismically induced landslides.[5] Under this act, seismic hazard zones are mapped by the State Geologist to assist local governments in land use planning. Section 2691(c) of this act states that "it is necessary to identify and map seismic hazard zones in order for cities and counties to adequately prepare the safety element of their general plans and to encourage land use management policies and regulations to reduce and mitigate those hazards to protect public health and safety." Section 2697(a) of the act states that "cities and counties shall require, prior to the approval of a project located in a seismic hazard zone, a geotechnical report defining and delineating any seismic hazard."

California Building Code

The State of California provides a minimum standard for building design through Title 24 of the California Code of Regulations. The California Building Code (CBC) is in Part 2 of Title 24. The CBC is updated every three years. It is generally adopted on a jurisdiction-by-jurisdiction basis, subject to further modification based on local conditions. Through the CBC, the State provides a minimum standard to protect property and public safety by regulating the design and construction of excavations, foundations, building frames, retaining walls, and other building elements to mitigate the effects of seismic shaking and adverse soil conditions. They also regulate grading activities, including drainage and erosion control.

California Environmental Quality Act

Paleontological resources are afforded protection under the California Environmental Quality Act (CEQA). The Society of Vertebrate Paleontology has set significance criteria for paleontological resources.[6] Most practicing professional vertebrate paleontologists adhere closely to the Society of Vertebrate Paleontology's assessment, mitigation, and monitoring requirements as specifically provided in its standard guidelines. Most State regulatory agencies with paleontological laws, ordinances, regulations, and standards accept and use the professional standards set forth by the Society of Vertebrate Paleontology.

[5] California Geological Survey, Alquist-Priolo Earthquake Fault Zoning Act, https://www.conservation.ca.gov/cgs/alquist-priolo, accessed January 31, 2022.

[6] Society of Vertebrate Paleontology, 2010, *Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources,* Impact Mitigation Guidelines Revision Committee.

California Public Resources Code Section 5097

California Public Resources Code Section 5097.5 prohibits the destruction or removal of any paleontological site or feature from public lands without the permission of the jurisdictional agency.

California Penal Code Section 622.5

The California Penal Code Section 622.5 details the penalties for damage or removal of paleontological resources from private or public lands.

Regional Regulations

Sonoma County Emergency Operations Plan

The Sonoma County Emergency Operations Plan (EOP) is the foundation for disaster response and recovery operations for Sonoma County and outlines how the County complies with and implements the requirements of the California Emergency Services Act to protect the lives and property within Sonoma County. The Sonoma County EOP establishes the emergency organization, specifies policies and general procedures, and provides for coordination of the responsibilities of the County departments in all phases of an emergency or disaster. The Sonoma County EOP provides an overview of the Emergency Operations Center and outlines the various modes of activation of the EOP. Most provisions related to geology, soils, and seismic events are in the Hazard Analysis Summary of the EOP.

Local Regulations

Santa Rosa City Code

The Santa Rosa City Code (SRCC) includes various directives pertaining to geology and soils. The SRCC is organized by title, chapter, and section, and in some cases, articles. Most provisions related to geology, soils, and seismic events are in Title 14, *Potable and Recycled Water*; Title 15, *Sewers*; Title 17, *Environmental Protection;* Title 18, *Buildings and Construction;* Title 19, *Subdivisions;* and Title 20, *Zoning*, as follows:

- **Chapter 14-30, *Water Efficient Landscape*.** Section 14-30.055, *Grading Design Plan*, sets forth the requirements for the submittal of grading plans that demonstrate that the project has been designed to minimize soil erosion. This plan must be submitted along with the landscape design plan and the irrigation design plan.
- **Chapter 15-08, *Pretreatment*.** Section 15-08.210, *Hauled Wastewater*, requires that septic tanks can only be introduced by the Director of Facilities, and that the waste shall not violate any requirements established by the City. This section also states that haulers/generators of industrial wastewater need to obtain wastewater discharge permits.
- **Chapter 15-16, *Sewer Connections*.** Section 15-16.021, *Discovery and Repair of Illegal Connections*, adopts certain rules and regulations against property owners making connections that direct surface water runoff or groundwater to a sewer service lateral which in turn is connected to a public sanitary sewer.

- **Chapter 17-08, *Seismic Safety*.** Section 17-08.020, *Earthquake Fault Zones*, sets forth the requirements for a State Geologist to delineate active and recently active earthquake fault zones that are a potential hazard. Any projects within the delineated earthquake fault zone require specialized approval authority from the decision-making body. Section 17-08.060, *Building Permits for Projects within Earthquake Fault Zones*, states that the decision-making body shall evaluate the suitability of a project and can attach conditions to the project if necessary. The decision-making body also can deny permits if it is found that the site is unsuitable for the proposed project.
- **Chapter 17-12, *Storm Water*.** Section 17-12.100, *Purpose and Intent of Article*, states that the purpose and intent of this chapter is to protect and enhance the water quality of watercourses and water bodies from erosion and other sources of contamination. Sections in this chapter require applicants to comply with National Pollution Discharge Elimination System Permit to control and monitor erosion and loss of soil.
- **Chapter 18-16, *California Building Code*.** Section 18-16.010, *Citation of California Building Code,* adopts the CBC in its entirety, subject to the amendments, additions, and deletions set forth in this chapter. The purpose of the CBC is to prescribe regulations governing the erection, construction, enlargement, alteration, repair, moving, removal, demolition, conversion, occupancy, equipment, use, height, area, and maintenance of all buildings and structures within the city. By regulating the design and construction of excavations, foundations, building frames, retaining walls, and other structures, the City's Building Code provides protections during the design, permitting, and construction of structures intended for human occupancy.
- **Chapter 19-64, *Grading and Erosion Control*.** Section 19-64.010, *Requirements,* outlines the Grading and Erosion Control standards new subdivisions must adhere to prevent sedimentation or damage to on-site and off-site property.
- **Chapter 20-32, *Hillside Development Standards*.** This chapter includes the regulations required to preserve the City's natural waterways and hillsides, amongst other areas, conserves open spaces and natural features, design standards to ensure the hillside development will be sensitive to existing terrain. Section 20-32.050, S*ite Planning and Development Standards*, specifically requires that development on hillsides be located on the most geologically stable portion of the site. Section 20-32.060, *Hillside Development Permit,* requires a review process for the City to consider the appropriateness of proposed development on hillside parcels to ensure that a proposed project minimizes its environmental impact, including the preparation of geotechnical reports that identify and mitigate impacts.

Hazard Mitigation Plan

On December 7, 2021, the Santa Rosa City Council adopted the Sonoma County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), which also provides an update to the City's Local Hazard Mitigation Plan (LHMP).[7] The MJHMP consists of two volumes. Volume 1 includes all federally required elements of a disaster mitigation plan as they apply to the entirety of Sonoma County. Volume 2 consists of chapters, or

[7] City of Santa Rosa, 2021, Local Hazard Mitigation Plan, https://www.srcity.org/540/Local-Hazard-Mitigation-Plan, accessed March 9, 2023.

annexes, for each local agency and special district participating in the MJHMP. The LHMP identifies the natural hazards faced by the city, assesses vulnerabilities to these hazards, and identifies mitigation strategies that can be taken to reduce or alleviate the loss of life, personal injury, and property damage that otherwise might result from these natural hazards. Mitigation actions are suggested and carried out by various City departments. The City of Santa Rosa Annex serves as a five-year update to the LHMP and is in Volume 2, Chapter 3. It includes a section on earthquake hazards and mitigating actions for Santa Rosa. Mitigation actions for earthquakes include the following:[8]

- Continue to update the City's emergency planning documents every five years to ensure consistency with state and federal law, local conditions, and best practices and the most recent science.
- Replace or retrofit water-retention structures determined to be structurally deficient, including levees, dams, reservoirs, and tanks. Continue to analyze and identify needs for future upgrades. Evaluate, reinforce, and/or enhance wastewater treatment facility structures with seismic risk.
- Create inventory and develop funding mechanisms to assist building owners to retrofit unreinforced masonry, soft-story, and/or non-ductile concrete structures.
- Require the retrofit of seismically vulnerable structures consistent with City Code. This program should include community education and outreach.
- Conduct seismic evaluations on City-owned leased buildings that contain critical facilities/operations to determine the need for upgrades/retrofitting.
- Conduct Microgrid feasibility study.
- Secure redundant power supply for City-owned and leased facilities and infrastructure that lack adequate back-up power.
- Relocate/Update Emergency Operations Center (EOC)[9] to City-owned facility that can accommodate use and renovation to permanent warm/hot EOC with appropriate equipment for communication and situational awareness.
- Actively participate in the annual maintenance protocols outlined in Volume I of the MJHMP
- Support the County-wide initiatives identified in Volume I of the MJHMP.
- Integrate the LMHP into other plans, ordinances and programs that dictate land use decisions within the community including the General Plan, Specific Plans, and the City Code.
- Develop a plan for expediting the repair and functional restoration of water and wastewater systems through stockpiling of shoring materials, temporary pumps, surface pipelines, portable hydrants, and other supplies, such as those available through the Water/Wastewater Agency Response Network. Communicate that plan to local governments and critical facility operators.
- Explore the feasibility of resilience hubs within the City of Santa Rosa.

---

[8] Sonoma County, 2021, Sonoma *County Hazard Mitigation Plan Update, Volume 2: Chapter 3: City of Santa Rosa*, https://permitsonoma.org/Microsites/Permit%20Sonoma/Documents/Planning/Long%20Range%20Plans/Hazard%20Mitigation%20Plan/Adopted-Sonoma-County-MJHMP-Volume-2-December-2021.pdf, accessed October 21, 2022.

[9] Warm/hot refers to the level of Emergency Operations Center staffing.

4.7.1.2 EXISTING CONDITIONS

Geology

Santa Rosa is on the eastern side of the Santa Rosa Plain, a northwest-trending intermountain valley of the California Coast Ranges. The valley is bounded on the west by the Mendocino Ridge and on the east by the Sonoma and Mayacamas Mountains. The city's geology varies from consolidated sedimentary and volcanic rock in the highland areas to the east, to deep, uncompressed sediments of sand, silt, clay, and gravel underneath the flat valley floor. Recent geophysical studies indicate that depositional basins underlying the Santa Rosa Plain in the vicinity of Santa Rosa may extend for more than a mile beneath the surface and may be the source of increased levels of ground shaking at the surface during earthquakes.

The Santa Rosa Plain is also bounded and transected by major faults, including the active northwest-striking, right-lateral Rodgers Creek-Healdsburg fault zone running along the east side of the plain. The west and southwest side of the plain is bounded by a system of poorly defined faults generalized as the Sebastopol fault.

Soils

Most soils within Santa Rosa are clayey alluvial soils, riverwash, and some silty and gravelly soils and loams.[10] The most prominent soil type in the city is the Zamora silty claim loam found on 0 to 2 percent slopes, although many other soil units are also mapped in the area, including Arbuckle, Clear Lake, Guenoc, Haire Clays, Spreckles, Wright, and Yolo soil series units.[11] Zamora soils are moderately permeable and exhibit slow runoff and slight susceptibility to erosion hazards.[12]

Regional Seismicity

The Earth's crust includes tectonic plates that locally collide with or slide past one another along plate boundaries. California is particularly susceptible to such plate movements, notably the largely horizontal or "strike-slip" movements of the Pacific Plate as it impinges on the North American Plate. In general, earthquakes occur when the accumulated stress along a plate boundary or fault is suddenly released, resulting in seismic slippage. This slippage can vary widely in magnitude, ranging in scale from a few millimeters or centimeters to tens of feet.

Santa Rosa and communities across the San Francisco Bay region reside within the active boundary between the Pacific and North American tectonic plates, where the Pacific plate slowly and continually slides northwest past the North American plate. Several major and active faults are part of this complex plate boundary, most notably the San Andreas, Hayward, Rodgers Creek, Calaveras, Maacama, San Gregorio, Concord, Green Valley, and Greenville Faults, all of which are capable of producing ground shaking in Santa Rosa.

[10] Santa Rosa General Plan EIR, p. 4.M-2.
[11] Santa Rosa General Plan EIR, p. 4.M-2.
[12] Santa Rosa General Plan EIR, p. 4.M-2.

The performance of human-made structures during a major seismic event varies widely due to a number of factors, including:

- Location, with respect to active fault traces or areas prone to liquefaction or seismically-induced landslides.
- Type of building construction (i.e., wood frame, unreinforced masonry, non-ductile concrete frame).
- Proximity, magnitude, depth, and intensity of the seismic event itself as well as many other factors.

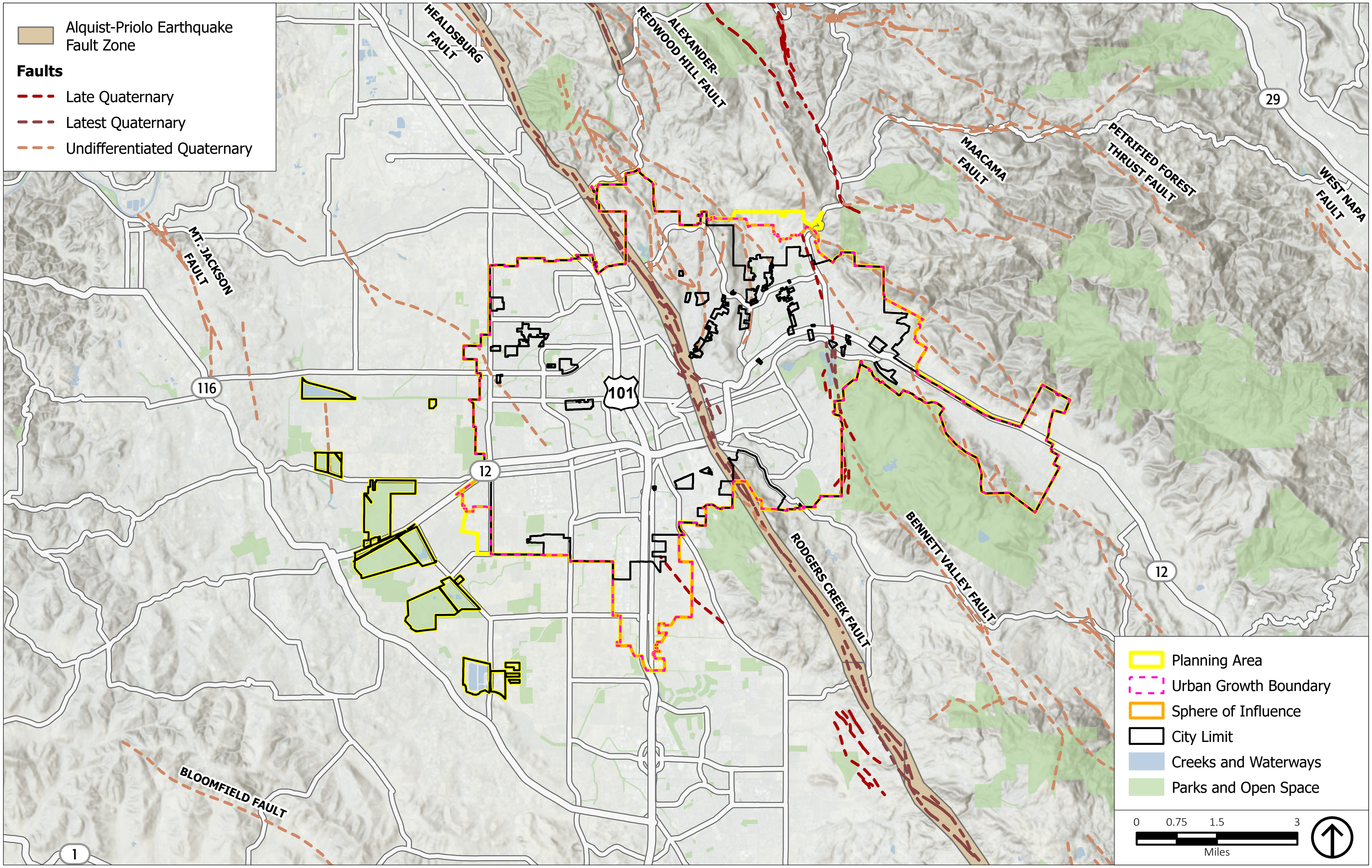
In general, evidence from past earthquakes shows that wood-frame structures tend to perform well during a seismic event, especially when their foundations are properly designed and anchored. Conversely, older, unreinforced masonry structures and nonductile reinforced concrete buildings (especially those built in the 1960s and early 1970s) do not perform as well if they have not undergone appropriate seismic retrofitting. Applicable building code requirements, such as those found in the CBC, include seismic requirements that are designed to ensure the satisfactory performance of building materials under prescribed seismic conditions.

The Richter Scale is used to describe the magnitude of an earthquake. Each one-point increase in magnitude (M) represents a 10-fold increase in earthquake wave size and a 30-fold increase in energy release (strength). For example, an M8 earthquake produces 10 times the ground motion amplitude of an M7 earthquake, 100 times that of an M6 quake, and 1,000 times the motion of a M5 earthquake. However, the M8 earthquake is 27,000 times stronger than an M5 quake. Typically, earthquakes of M5 or greater are considered strong earthquakes capable of producing damage.

Seismic activity in the nearby Coast Ranges is generally associated with active faults of the San Andreas system, which includes major active faults. Over the width of the San Francisco Bay region, approximately 1.5 inches per year of relative horizontal movement occurs between the North American and Pacific Plates. This movement is partially accommodated by earthquakes and creep along several active faults. Locations of these active faults relative to Santa Rosa are shown on Figure 4.7-1, *Regional Faults*.

The San Andreas Fault, approximately 20 miles to the west of Santa Rosa, is the fastest-slipping fault along the plate boundary and the source of two magnitude 7.8 to 7.9 earthquakes in history, including the 1906 San Francisco earthquake, which destroyed much of downtown Santa Rosa, toppled City Hall, and killed at least 85 people; the city's population was approximately 7,000 at the time.

The Rodgers Creek Fault runs through the central part of Santa Rosa and was the source of two moderate earthquakes—of magnitudes 5.6 and 5.7, respectively—that struck below the north end of the city within a period of two hours on the night of October 1, 1969. Fortunately, no one died in the earthquakes, but many old commercial buildings downtown; homes in several residential neighborhoods; and a few modern, engineered buildings were all damaged. Although none collapsed, at least 74 buildings in the central business district sustained damage and about a third of those were beyond repair. The shaking toppled brick chimneys and broke windows over a wide area; locally, the earthquake ruptured water mains and buckled sidewalks and curbs. Total damage, including building contents, exceeded $7 million ($50.6 million in 2020 dollars).



Source: USGS, 2019; City of Santa Rosa, 2020; ESRI, 2022; PlaceWorks, 2024.

Figure 4.7-1
Regional Faults

Table 4.7-1, *Distances and Directions to Active Faults*, provides a summary of the key faults that could produce significant earthquakes (exceeding M5) that could impact Santa Rosa. The table also includes the maximum associated magnitudes of earthquakes along each fault. Due to the proximity of active fault lines, Santa Rosa is historically susceptible to earthquake-related hazards, which include ground shaking and liquefaction.

TABLE 4.7-1 DISTANCES AND DIRECTIONS TO ACTIVE FAULTS

Fault	Approx. Distance and Direction from Site	Fault Length (miles)	Maximum Magnitude	Slip Rate (mm/yr)
Rodgers Creek	Within City	39	7.0	9.0
Bennett Valley	0.75 miles southeast	24	Unspecified	Unspecified
Alexander-Redwood Hill	0.75 miles north	12	Unspecified	Unspecified
Maacama	3 miles northeast	113	7.5	9.0
Healdsburg	3 miles northwest	19	7.5	1.0
Tolay	4.5 miles southwest	21	Unspecified	1.0
Bloomfield	7.5 miles southwest	11	Unspecified	Unspecified

Note: Distances are approximate; mm/yr = millimeters per year
Sources: Cao, T., W. A. Bryant, B. Rowshandel, D. Branum, and C. J. Wills, June 2003, *The Revised 2002 California Probabilistic Seismic Hazard Maps*, https://www.conservation.ca.gov/cgs/Documents/PSHA/2002%20California%20Hazard%20Maps.pdf, accessed August 28, 2023; United States Geological Surve, 2023, U.S. Quaternary Faults website, https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=5a6038b3a1684561a9b0aadf88412fcf, accessed August 28, 2023.

Landslides

Landslides are gravity-driven movements of earth materials that can include rock, soil, unconsolidated sediment, or combinations of such materials. The rate of landslide movement can vary; some move rapidly, as in a soil or rock avalanche, while other landslides creep or move slowly for long periods of time. The susceptibility of a given area to landslides depends on many variables, although the general characteristics that influence landslide hazards are widely acknowledged. Some important factors are:

- **Slope Material.** Loose, unconsolidated soils and soft, weak rocks are more hazardous than are firm, consolidated soils or hard bedrock.
- **Slope Steepness.** Most landslides occur on moderate to steep slopes.
- **Structure and Physical Properties of Materials.** This includes the orientation of layering and zones of weakness relative to slope direction.
- **Water Content.** Increased water content increases landslide hazard by decreasing friction and adding weight to the materials on a slope.
- **Vegetation Coverage.** Abundant vegetation with deep roots promotes slope stability.
- **Proximity to Areas of Erosion or Human-Made Cuts.** Undercutting slopes can greatly increase landslide potential.
- **Earthquake Ground Motions.** Strong seismic ground motions can trigger landslides in marginally stable slopes or loosen slope materials and also increase the risk of future landslides.

Santa Rosa has experienced landslides in the past ranging from small, localized events to events that caused injury and substantial damage. On December 31, 2005, a mudslide on Montgomery Drive collided with houses and automobiles as it extended into the middle of the road. Two houses were damaged and a third was destroyed. The home that sustained the heaviest damage also involved a person that was trapped alone for an hour and sustained minor injuries before being rescued by Santa Rosa Fire Department. An additional fire department engine was sent to the end of Sullivan Court to evaluate the home above the slide, secure utilities, and evacuate residents at risk.

Decreased vegetation from wildfires can combine with excessive ground moisture from heavy rains to cause landslides. These conditions occurred in 1997 to activate the Hidden Acres landslide in the Bennett Valley area (outside of the Santa Rosa city limit). Landslides were also a major concern following the 2017 wildfires, with preventative actions taken to cover and protect exposed slopes in fire-damaged hillside areas of the city.

Landslide-prone areas in the EIR Study Area are depicted in Figure 4.7-2, *Landslide Map*, and broken down into three categories: “Mostly landslides” cover areas with the largest and most concentrated landslides; “few landslides” indicates smaller, more scattered landslides; and “flat land” is unlikely to have a landslide. Portions of the northern and southern reaches of the city have experienced few to many landslides. The landslide hazard for both earthquake- and moisture-induced landslides is increased with steep slopes close to the Rodgers Creek Fault Zone.

Outside of these larger areas, localized landslides are possible along small slopes elsewhere in the city, including the sides of the Santa Rosa Creek and the Santa Rosa Flood Control Channel. Landslides in these areas are unlikely to cause substantial injuries or destruction but may result in limited damage.

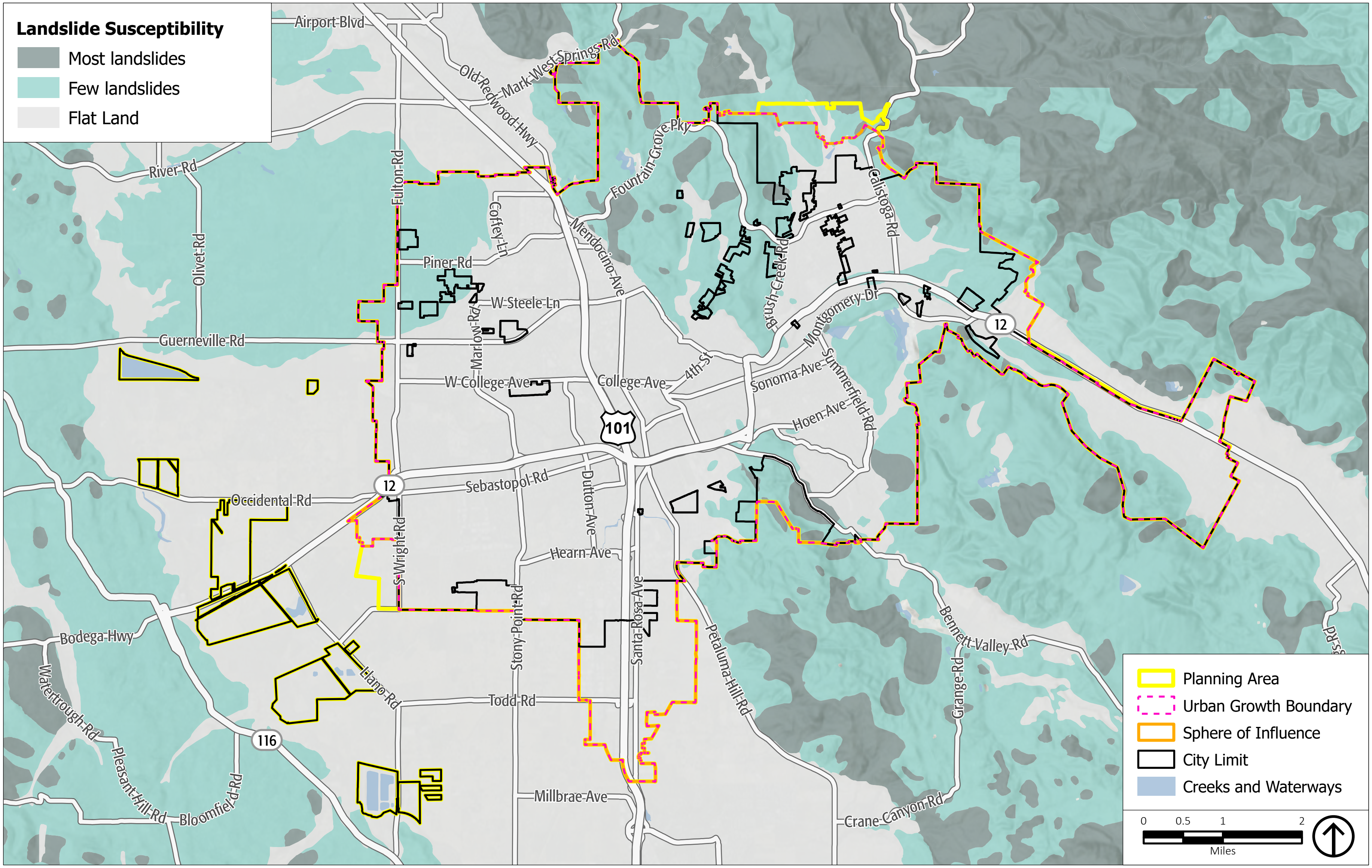
Liquefaction and Related Ground Failure

Liquefaction refers to loose, saturated sand or gravel deposits that lose their load-supporting capability when subjected to intense shaking. Liquefaction potential varies based on three main contributing factors: (1) cohesionless, granular soils having relatively low densities (usually of Holocene age); (2) shallow groundwater (generally less than 50 feet); and (3) moderate to high seismic ground shaking. Cohesionless and granular soils are sand or gravel, typically with little or no clay content. Soil liquefaction generally occurs in submerged granular soils and nonplastic silts during or after strong ground shaking.

The Seismic Hazards Mapping Act (1990) directed the State Geologist to delineate regulatory “zones of required investigation” to reduce the threat to public health and safety and to minimize the loss of life and property posed by earthquake-triggered ground failures. Zones of required investigation, referred to as Seismic Hazard Zones in the California Code of Regulations, Article 10, Section 3722, are areas shown on Seismic Hazard Zone Maps where site investigations are required to determine the need for mitigation of potential liquefaction and/or earthquake-induced landslide ground displacements.

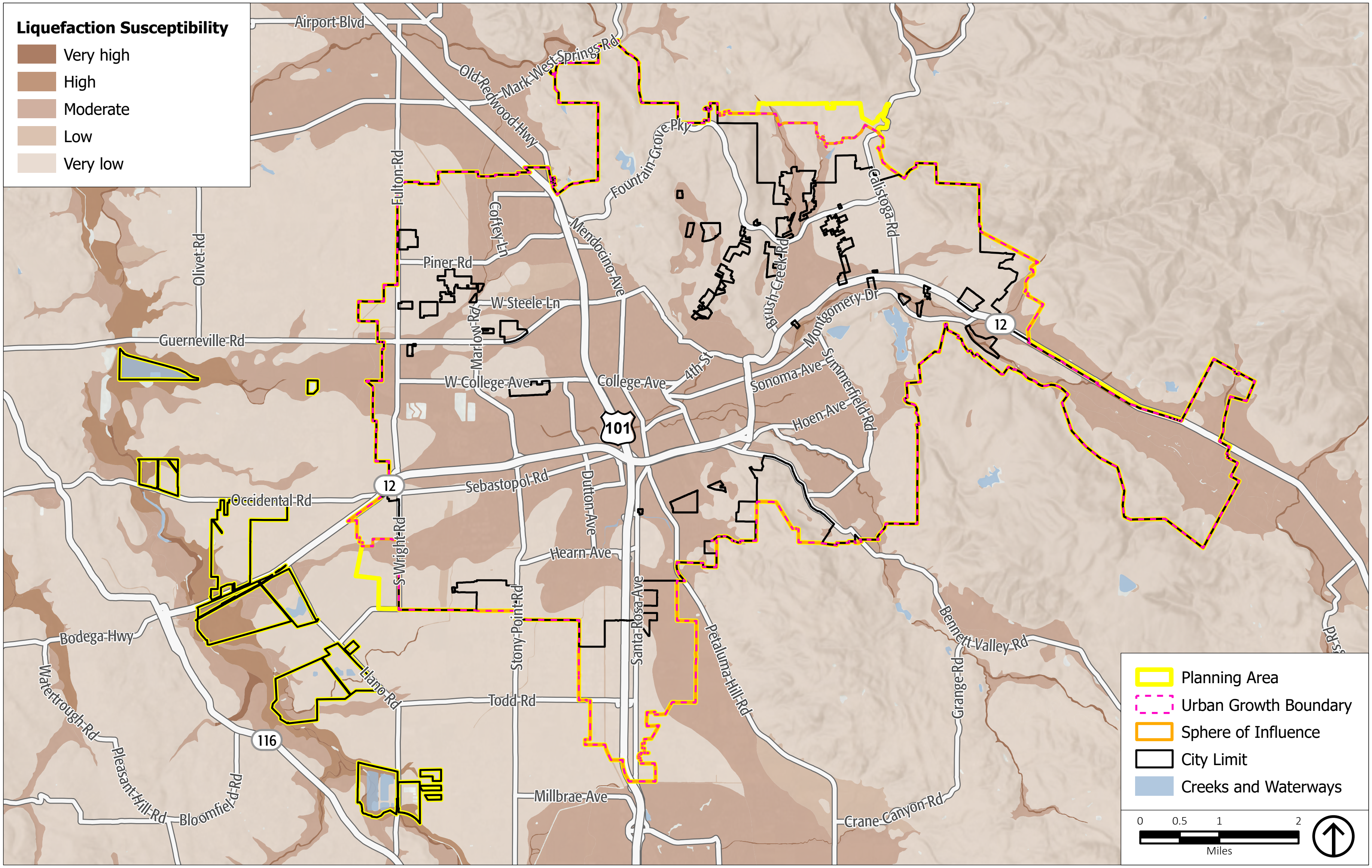
Lateral spreading involves lateral ground movements caused by seismic shaking. These lateral ground movements are often associated with a weakening or failure of an embankment or soil mass overlying a layer of liquefied sands or weak soils. Shallow groundwater; liquefiable, cohesionless soils; and the presence of a free face, such as a stream bank, are all contributing factors in determining the likelihood of lateral spreading. Figure 4.7-3, *Liquefaction Susceptibility*, shows the liquefaction susceptibility of the EIR Study Area.

GEOLOGY AND SOILS



Source: USGS, 1997; City of Santa Rosa, 2020; ESRI, 2022; PlaceWorks, 2024.

Figure 4.7-2
Landslide Map



Source: USGS, 2006; City of Santa Rosa, 2020; ESRI, 2022; PlaceWorks, 2024.

Figure 4.7-3
Liquefaction Susceptibility

Erosion

Erosion occurs when the upper layers of soil are displaced by erosive agents such as water, ice, snow, air, plants, animals, or anthropogenic forces. Sandy soils on moderate slopes, or clayey soils on steep slopes are susceptible to erosion when exposed to these forces. Erosion can become more frequent when established vegetation is disturbed or removed due to grading, wildfires, or other factors. Within the valley areas of the EIR Study Area, water flow in streams is generally sluggish, and erosion is nearly imperceptible. With a greater slope gradient, erosion can cause the soil underneath buildings and structures to become compromised or fail, which is typically limited to localized areas. Based on a review of the Web Soil Survey, the soils within the EIR Study Area have a low to moderate risk from erosion.[13] The risk of erosion is greatly increased during grading and construction activities when soils are loosened and bare of vegetation. Erosion-control measures prevent downstream sedimentation and surface water degradation.

Subsidence

Subsidence is the gradual sinking of the ground as a result of loss of subsurface materials, with little or no horizontal motion. It is often accompanied by large-scale ground cracking, and in some cases, the cracking has movement across it, making it into incipient faulting. Ground cracking from subsidence in the future would be expected to occur along the boundaries of groundwater basins, such as a contact between alluvium and bedrock, or over prominent geologic structures, i.e., faults.

Subsidence of the ground surface has been reported in alluvial basins where significant amounts of groundwater (often in an overdraft condition) or petroleum are withdrawn over long periods. The primary cause of non-tectonic subsidence has been the alluvial compaction by closing of porosity due to removal of large quantities of groundwater or petroleum and a significant lowering of the groundwater levels. Shifts in the water table or loss of groundwater are major causes.

Subsidence may occur over a small or large area depending on the amount of subsurface movement. Subsidence can also be caused by excavation work, hydrocompaction, or oxidation of organic soils. On rare occasions, subsidence may occur due to earthquake-induced ground movement.

Expansive/Shrink-Swell Soils

Expansive soils can change dramatically in volume depending on moisture content. When wet, these soils can expand; when dry, they can contract or shrink. Sources of moisture that can trigger this shrink-swell phenomenon can include seasonal rainfall, landscape irrigation, utility leakage, and/or perched groundwater. Expansive soil can exhibit wide cracks in the dry season, and changes in soil volume have the potential to damage concrete slabs, foundations, and pavement. Special building/structure design or soil treatment are often needed in areas with expansive soils.

[13] United States Department of Agriculture, 2023, Web Soil Survey, https://websoilsurvey.sc.egov.usda.gov/app/WebSoilSurvey.aspx, accessed August 29, 2023.

Expansive soils are typically very fine-grained with a high to very high percentage of clay, typically montmorillonite, smectite, or bentonite clay. Linear extensibility soil tests are often used to identify expansive soils, where soil sample volume/length changes in response to reduced moisture content.[14] A linear extensibility of 3 percent or greater connotes moderate to high shrink-swell potential. This soil behavior has the potential to cause damage to buildings, roads, and other structures.

Most soils within Santa Rosa are clayey alluvial soils, riverwash, and some silty and gravelly soils and loams.[15] The soils most prone to expansion in the EIR Study Area include Raynor clay, Clear Lake clay, Diablo clay, Wright loam, and Yorkville clay loam.[16]

Paleontological Resources

Paleontological resources are the fossilized remains of organisms from prehistoric environments found in geologic strata. These are valued for the information they yield about the history of the Earth and its past ecological settings. There are two types of resources: vertebrate and invertebrate. These resources are found in geologic strata conducive to their preservation, typically sedimentary formations. Paleontological sites are areas that show evidence of prehumen activity. Often, they are simply small outcrops visible on the surface or sites encountered during grading. While the sites are important indications, it is the geologic formations that are the most important, since they may contain important fossils. Potentially sensitive areas for the presence of paleontological resources are based on the underlying geologic formations. The EIR Study Area is an area filled with fertile sediments as a result of terrestrial deposits from millions of years ago. Based on this and the alluvium of the EIR Study Area, it is likely that paleontological resources would be found within the EIR Study Area. The Pliocene Sonoma Volcanics are the only unit besides recent artificial fill that do not have a potential for paleontological resources within the EIR Study Area.

Unique Geologic Features

Unique geologic features are those that are unique to the field of geology. Each rock unit tells a story of the natural processes operating at the time it was formed. The rocks and geologic formations exposed at the earth's surface or revealed by drilling and excavation are our only record of that geologic history. What makes a geologic unit or feature unique can vary considerably. For example, a geologic feature may be considered unique if it is the best example of its kind and has distinctive characteristics of a geologic principle that is exclusive locally or regionally, is a key piece of geologic information important to geologic history, contains a mineral that is not known to occur elsewhere in the area, or is used as a teaching tool. Unique geological features are not common in Santa Rosa or the EIR Study Area. The geologic processes are generally the same as those in other parts of the state, country, and even the world. The previously described geology and soils in the EIR Study Area are common throughout the city and region and are not considered unique.

---

[14] US Army Corps of Engineers, 1983, Field Manual TM 5-818-7, https://www.discountpdh.com/wp-content/themes/discountpdh/pdf-course/foundation-in-expansive-soils.pdf, accessed July 7, 2023.

[15] Santa Rosa General Plan EIR, p. 4.M-2.

[16] United States Department of Agriculture, 2023, Web Soil Survey, https://websoilsurvey.sc.egov.usda.gov/app/WebSoilSurvey.aspx, accessed August 29, 2023.

4.7.2 STANDARDS OF SIGNIFICANCE

Implementation of the proposed project would result in significant geology and soils impacts if it would:

1. Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury or death involving: (i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault; (ii) Strong seismic ground shaking; (iii) Seismic-related ground failure, including liquefaction; (iv) Landslides, mudslides, or other similar hazards.
2. Result in substantial soil erosion or the loss of topsoil.
3. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.
4. Be located on expansive soil, as defined by Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property.
5. Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.
6. Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.
7. In combination with past, present, and reasonably foreseeable projects, result in a cumulative impact with respect to geology and soils.

4.7.3 IMPACT DISCUSSION

As described in Chapter 4.0, *Environmental Analysis*, of this Draft EIR, some proposed General Plan 2050 policies and actions are required as means to mitigate environmental impacts under CEQA. These policies and actions are fully enforceable at the discretion of the decision-maker through permit conditions, agreements, or other legally binding instruments. These mitigating policies and actions use the imperative "shall," include performance criteria, and are marked with an asterisk (*). Note that all actions are required to be implemented by the City and therefore the imperative "shall," if not explicitly stated, is implied.

GEO-1	**Implementation of the proposed project could directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury or death involving: (i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault; (ii) Strong seismic ground shaking; (iii) Seismic-related ground failure, including liquefaction; (iv) Landslides, mudslides, or other similar hazards.**

The location and underlying geology in the EIR Study Area make it likely to experience seismic hazards, including strong seismic ground shaking and secondary hazards. As described in Section 4.7.1.1, *Regulatory Setting*, the State and City have established regulations to protect the residents of Santa Rosa from seismic hazards. The following discussions address the potential impacts from implementation of the proposed project with respect to earthquake faults, strong seismic ground shaking, seismic related ground shaking, and landslides.

Earthquake Faults

As stated in Section 4.7.1.2, *Existing Conditions,* there are active faults that are very nearby and within the EIR Study Area. Due to this, there is the possibility that surface fault rupture could occur along the active trace or within the associated Alquist Priolo Earthquake Fault Zone of the Rodgers Creek fault. SRCC Chapter 17-08 requires the State Geologist to delineate active and recently active earthquake fault zones and that an evaluation of the suitability of a project can attach conditions to the project if necessary. Pursuant to SRCC Chapter 17-08, the decision-making body also can deny permits if it is found that the site is unsuitable for the proposed project. Compliance with SRCC regulations would reduce impacts related to fault rupture.

Strong Seismic Ground Shaking

Ground shaking is responsible for most of the damage from earthquakes and can damage or destroy buildings, structures, pipelines, and infrastructure. The intensity of shaking depends on the type of fault, distance to the epicenter, magnitude of the earthquake, and subsurface geology. Rodgers Creek Fault, Maacama Fault, and Healdsburg Fault are the most likely faults and potentially capable of producing the most intense ground accelerations within the EIR Study Area. Secondary effects of earthquakes are nontectonic processes such as liquefaction, lateral spreading, seismically induced landslides, and ground lurching, which can lead to ground deformation. Ground deformation, including fissures, settlement, displacement, and loss of bearing strength, are the leading causes of damage to structures during a moderate to large earthquake.

In northern California, there is no method to completely avoid earthquake hazards. However, appropriate measures to minimize the effects of earthquakes are included in the CBC, with specific provisions for seismic design. The design of structures in accordance with the CBC would minimize the effects of ground shaking to the greatest degree feasible, except for during a catastrophic seismic event. The City has adopted the CBC in SRCC Chapter 18-16. Additionally, potential future development projects under the proposed project would be required to comply with SRCC Chapter 17-08, which would reduce impacts related to ground shaking.

Seismic-Related Ground Failure

Secondary effects of earthquakes are nontectonic processes such as ground deformation, including fissures, settlement, displacement, and loss of bearing strength, and are the leading causes of damage to structures during a moderate to large earthquake. Secondary effects could lead to ground deformation, including liquefaction, lateral spreading, seismically induced landslides, and ground lurching.

Based on the potential for strong ground shaking, combined with a groundwater depth of under 50 feet in much of the EIR Study Area,[17] much of the city is within an area with high liquefaction susceptibility. All potential future structures constructed in the EIR Study Area would be designed in accordance with current seismic design standards as found in the CBC, which the City has adopted in SRCC Chapter 18-16. Design measures would be implemented according to the most recent CBC, which would reduce the impact of liquefaction and seismic settlement, including, but not limited to, ground improvement techniques such as in-situ densification, load transfer to underlying nonliquefiable bearing layers, and over-excavation and recompaction with engineered fill method. These design measures would reduce the potential exposure of people and structures to the hazard from liquefaction and seismic settlement.

Landslides

Marginally stable slopes (including existing landslides) may be subject to landslides caused by earthquakes. The landslide hazard depends on many factors, including existing slope stability, shaking potential, and presence of existing landslides. Landslides, debris flows, or any movement of earth or rock are most common in areas of high topographic relief, such as steep canyon walls or steep hillsides. Landslide-prone areas in the EIR Study Area are depicted in Figure 4.7-2. The landslide hazard for both earthquake- and moisture-induced landslides are increased with steep slopes close to the Rodgers Creek Fault Zone. In addition, localized landslides are possible along small slopes elsewhere in the city, including the sides of the Santa Rosa Creek and the Santa Rosa Flood Control Channel. While these landslide-prone areas exist within Santa Rosa, the potential future development under the proposed project is expected to occur in existing urban areas and would be concentrated on a limited number of vacant parcels and in the form of infill/intensification on sites either already developed and/or underutilized, and/or in close proximity to existing residential and residential-serving development where the topography is generally flat. New development or redevelopment in any of the portions of the EIR Study Area deemed to be within landslide-susceptible areas would be required to comply with grading, erosion, and sediment control regulations in the CBC (SRCC Chapter 18-16) and the provisions in SRCC Chapters 14.30 and 19-64.

[17] Santa Rosa Plain Groundwater Sustainability Agency, 2023, Basin Conditions, https://santarosaplaingroundwater.org/conditions/, accessed August 29, 2023.

Summary

In addition, Chapter 5, *Safety, Climate Resilience, Noise, and Public Services and Facilities,* of the proposed General Plan 2050 contains goals, policies, and actions that require local planning and development decisions to consider geological and soil impacts. The following General Plan goal, policy, and actions would serve to minimize potential adverse impacts from earthquakes:

- **Goal 5-1:** Minimize community exposure to seismic and geologic hazards.
  - ***Policy 5-1.1:** New development, redevelopment, and major remodels shall avoid or adequately mitigate seismic and geologic hazards.
    - ***Action 5-1.1:** Prior to new development approval, ensure geologic studies and analyses are deemed acceptable by a California Certified Engineering Geologist and/or Geotechnical Engineer for applicable hazard conditions.
    - ***Action 5-1.2:** Restrict development in areas where adverse impacts associated with known natural or human-caused geologic hazards cannot be effectively mitigated, as determined by a California Certified Engineering Geologist and/or Geotechnical Engineer.
    - **Action 5-1.3:** Avoid or adequately mitigate any development of critical facilities—hospitals, fire stations, emergency management headquarters, broadcast services, sewage treatment plants, and places of large congregations—in high-risk geologic hazard zones (e.g., Rodgers Creek Fault zone, liquefiable soils, areas of slope instability.
    - **Action 5-1.4:** Establish and periodically update an inventory of seismically vulnerable structures that includes unreinforced masonry construction, soft-story construction, and nonductile concrete construction.
    - **Action 5-1.5:** Require retrofitting and abatement of structural hazards to levels of risk acceptable to the Building Official.
    - **Action 5-1.6:** Prioritize retrofitting and abatement of City-owned buildings in areas determined to experience strong ground shaking during an earthquake.
    - **Action 5-1.7:** Provide owners of potentially vulnerable structures, such as unreinforced masonry, soft-story construction, and/or nonductile concrete, with information needed to retrofit to meet the latest State seismic safety requirements.
    - **Action 5-1.8:** Retrofit and harden water storage facilities, wastewater conveyance, electricity transmission lines, roadways, water detention facilities, levees, and other utilities near the Rodgers Creek Fault.

Because potential future development under the proposed General Plan 2050 has the potential to be constructed where there is the potential for geological hazards, impacts are considered potentially *significant*.

Impact GEO-1: Impacts from potential future development under the proposed General Plan 2050 where there are known geological hazards could occur over the buildout horizon of the proposed project.

> Significance with Mitigation: Less than significant. Implementation of the proposed General Plan 2050 goals, policies, and actions, as well as compliance with State, regional, and local regulations pertaining to structural safety regarding fault rupture, ground shaking, liquefaction, and landslides, would ensure that potential future development under the proposed project would not directly or indirectly cause or worsen the likelihood of or substantial adverse effects from seismic hazards related to earthquakes, including the risk of loss, injury, or death. Specifically, proposed General Plan 2050 *Policy 5-1.1 requires that potential future development avoid or mitigate seismic hazards; *Action 5-1.1 requires potential future development to prepare geologic studies are prepared by qualified engineers; and *Action 5-1.2 requires that potential future development be restricted in areas where adverse impacts associated with known natural or human-caused geologic hazards cannot be effectively mitigated, as determined by a qualified engineer. This includes prohibiting development that would be subject to geological hazard due to its location and/or design and that cannot be mitigated to safe levels. Compliance with the Santa Rosa City Code (SRCC) regulations and proposed General Plan 2050 goals, policies, and actions would mitigate impacts by permitting development only in areas where potential danger to the health, safety, and welfare of the community can be adequately mitigated. Because potential future development under the proposed project would be required to comply with both the California Building Code and the SRCC as well as proposed General Plan 2050 goals, policies, and actions, implementation of the proposed project would not cause or worsen seismic ground shaking; therefore, impacts would be *less than significant.*

GEO-2 Implementation of the proposed project would not result in substantial soil erosion or the loss of topsoil.

Soils are particularly prone to erosion during the grading phase of development, especially during heavy rains. Substantial soil erosion or the loss of topsoil during construction of future development could undermine structures or minor slopes, which would be a concern during implementation of the proposed project.

The CBC provides regulations for construction to provide proper grading, drainage, and erosion and sediment control. In addition, SRCC Chapter 17-12 protects and enhances the water quality of watercourses and water bodies from erosion and other sources of contamination. Erosion-control measures can include seeding slopes, installation of temporary dikes and swales, placement of straw bales and filter fences, outlet protection, grass-lined swales, and installation of sediment retention structures, as appropriate for specific sites. In addition, SRCC Section 14-30.055 and Section 19-64.010 sets forth the requirements for the submittal of grading plans that demonstrate that potential future development has been designed to minimize soil erosion.

As described in further detail in Chapter 4.10, *Hydrology and Water Quality*, of this Draft EIR, to minimize potential impacts related to erosion, future development pursuant to the proposed project would require compliance with the Construction General Permit (CGP) Water Quality Order WQ 2022-0057-DWQ, which includes the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP). A

SWPPP requires an erosion-control plan with the incorporation of best management practices to control erosion during construction. Typical construction best management practices include silt fences, fiber rolls, catch basin inlet protection, water trucks, street sweeping, and stabilization of truck entrance/exits. While this regulation is primarily aimed at water quality, it is another mechanism routinely applied by the City that would help to minimize the risk of erosion.

In addition, Chapter 5, *Safety, Climate Resilience, Noise, and Public Services and Facilities,* of the proposed General Plan 2050 contains goals, policies, and actions that require local planning and development decisions to consider potential geological and soil impacts. The following goal, policy, and actions would serve to minimize potential adverse impacts from soil erosion:

- Goal 5-1: Minimize community exposure to seismic and geologic hazards.
  - Policy 5-1.5: Promote erosion-control strategies that reduce hazards to structures, properties, and drainages.
    - Action 5-1.9: Identify enhanced erosion-control measures for properties that exhibit high erosion potential, are in areas of steep slopes, or have experienced past erosion problems.
    - Action 5-1.10: Ensure each update to the Community Wildfire Protection Plan identifies slope stability and wildfire hazard areas and mitigation strategies to reduce post-wildfire erosion.

Implementation of the proposed General Plan 2050 goal, policy, and actions identified above, as well as adherence to existing regulatory requirements that include, but are not limited to, the CBC and the SRCC grading and drainage requirements for new developments, would ensure that impacts associated with substantial erosion and loss of topsoil from potential future development would be *less than significant*.

Significance without Mitigation: Less than significant.

GEO-3	**Implementation of the proposed project could be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.**

Unstable geologic units are known to be present within the EIR Study Area. The following sections discuss the hazards associated with landslides, lateral spreading, subsidence, liquefaction, or collapse.

Landslides

As stated under impact discussion GEO-1, the EIR Study Area includes landslide-prone areas; however, the majority of the potential future development under the proposed project is expected to occur in existing urban areas and would be concentrated on a limited number of vacant parcels and in the form of infill/intensification on sites either already developed and/or underutilized, and/or in close proximity to existing residential and residential-serving development where the topography is generally flat. The areas of high landslide susceptibility are not located in the highly urbanized portions within the EIR Study Area where potential future development is anticipated to occur; therefore, implementation of General Plan

2050 would not be intentionally located on a geologic unit or on soil that is unstable. However, there is the potential that future development could occur near areas of potential landslides. As described under impact discussion GEO-1, new development or redevelopment in any of the portions of the EIR Study Area deemed to be within landslide-susceptible areas would be required to comply with grading, erosion, and sediment control regulations in the CBC (SRCC Chapter 18-16), SRCC Chapter 14.30 and 19-64, SRCC Chapters 17-08 and 20-32, and proposed General Plan 2050 *Policy 5-1.1, *Action 5-1.1, and *Action 5-1.2, which would mitigate impacts from the potential of landslides.

Subsidence

Subsidence has not been observed within Santa Rosa and groundwater levels have not declined significantly. The probability of subsidence impacts is generally low in Santa Rosa, due to the lack of significant groundwater overdraft conditions within the EIR Study Area. As described in further detail in Chapter 4.10, *Hydrology and Water Quality*, of this Draft EIR, under the Sustainable Groundwater Management Act, in groundwater basins that are designated as medium and high priority, local public agencies and groundwater sustainability agencies must assess conditions in their local groundwater basins and then prepare groundwater sustainability plans. The act encourages sustainable groundwater management practices to reduce the potential for future land subsidence, and ongoing surveying of the ground surface by the California Department of Water Resources and the USGS provides a way to verify that efforts in preventing subsidence are effective. The Santa Rosa Plain Groundwater Sustainability Agency's groundwater programs continue to prevent long-term groundwater overdraft conditions and reduce the impact of subsidence.

Liquefaction and Lateral Spreading

As stated under impact discussion GEO-1, based on the potential for strong ground shaking combined with a groundwater depth of under 50 feet in much of the EIR Study Area, much of the EIR Study Area is within an area susceptible to liquefaction. All structures constructed in the EIR Study Area would be designed in accordance with current seismic design standards as found in the CBC. Design measures would be implemented according to the most recent CBC, which would reduce the impact of liquefaction and seismic settlement, including, but not limited to, ground improvement techniques such as in-situ densification, load transfer to underlying nonliquefiable bearing layers, and over-excavation and recompaction with engineered fill method. These design measures would reduce the potential exposure of people and structures to the hazard from liquefaction and seismic settlement such that there would not be a significant impact. Further, the requirements for the preparation of site-specific assessments that include project-specific mitigation pursuant to SRCC Chapter 17-08 and proposed General Plan 2050 *Policy 5-1.1, *Action 5-1.1, and *Action 5-1.2 to reduce the impacts from ground lurching or lateral spreading.

Settlement and Collapse

Settlement and collapse are likely to exist in areas with alluvial soils. Areas of large settlement can damage, or in extreme cases, destroy structures. The presence of compressible soils in the EIR Study Area represents a hazard to structures and people.[18] CBC's design code has been adopted by the City (SRCC Chapter 18-16) and requires that structures be designed to mitigate compressible soils. Methods that could be used to reduce the impact of compressible soils include in-situ densification, transferring the load to underlying non-compressible layers with piles, and over excavation of compressible soil and recompaction with engineered fill.

Summary

Because potential future development under the proposed General Plan 2050 has the potential to be constructed where there are unstable soils or soils that could become unstable over the buildout horizon of the proposed project, impacts are considered potentially *significant*.

Impact GEO-3: Impacts from potential future development under the proposed General Plan 2050 where there are potentially unstable soils could occur over the buildout horizon of the proposed project.

Significance with Mitigation: Less than significant. As determined under impact discussions GEO-1 and GEO-2, potential future development from implementation of the proposed project would be required to comply with the California Building Code, as adopted in Santa Rosa City Code (SRCC) Chapter 18-16, which provides regulations for building design and construction to ensure geologic and soil stability. In addition to protections afforded by State laws, the proposed General Plan 2050 goals, policies, and actions listed under impact discussions GEO-1 and GEO-2 would require local planning and development decisions to consider potential risks of development on unstable soils or geologic units. Specifically, SRCC Chapters 17-08 and 20-32 and proposed General Plan 2050 *Policy 5-1.1, *Action 5-1.1, and *Action 5-1.2 requirements for geotechnical reports that identify and mitigate impacts related to unstable soils.

All potential future development under the proposed project would be required to comply with State, regional, and local regulations, including SRCC provisions and the proposed General Plan 2050 goals, policies, and actions, to ensure that potential future development that results from implementation of the proposed project would not directly or indirectly cause substantial adverse effects. Therefore, impacts would be *less than significant*.

[18] United States Department of Agriculture, 2023, Web Soil Survey, https://websoilsurvey.sc.egov.usda.gov/app/WebSoilSurvey.aspx, accessed August 29, 2023.

GEO-4 Implementation of the proposed project could be located on expansive soil, as defined by Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property.

Based on the presence of alluvial materials in the EIR Study Area, there is some potential for expansive/shrink-swell soils throughout Santa Rosa.[19, 20] Expansive soils are possible wherever clays and elastic silts may be present, including alluvial soils and weathered granitic and fine-grained sedimentary rocks. The presence of expansive soils represents a hazard to structures and people.

As discussed under impact discussion GEO-1, Chapter 5, *Safety, Climate Resilience, Noise, and Public Services and Facilities,* of the proposed General Plan 2050 contains policies and actions that require local planning and development decisions to consider potential geological and soil impacts. Additionally, SRCC Chapters 17-08 requires that an evaluation of the suitability of a project can attach conditions to the project if necessary to mitigate impacts from expansive soils and SRCC Chapter 20-32 requires a review process for the City to consider the appropriateness of proposed development on hillside parcels to ensure that a proposed project minimizes its environmental impact, including the preparation of geotechnical reports that identify and mitigate impacts. As part of the City review process regulations from the CBC shall be followed, including the use of a soils engineer, as outlined in SRCC Chapter 18-16, Appendix J. Specific engineering methods that could be used to reduce the impact of expansive soils include drainage-control devices to limit water infiltration near foundations, over-excavation and recompaction of engineered fill method, or support of the foundation with piles.

Because potential future development under the proposed General Plan 2050 has the potential to be constructed where there are expansive soils in the EIR Study Area, impacts are considered potentially *significant*.

Impact GEO-4: Impacts from potential future development under the proposed General Plan 2050 where there are expansive soils could occur over the buildout horizon of the proposed project.

> Significance with Mitigation: Less than significant. Implementation of the proposed General Plan 2050 goals, policies, and actions would mitigate potential impacts as a result of developing on expansive soils. Specifically, proposed *Policy 5-1.1, *Action 5-1.1, and *Action 5-1.2 include requirements for geotechnical reports that would ensure that new development, redevelopment, and major remodels avoid or adequately mitigate seismic and geologic hazards as part of the City project review process. Additionally, compliance with existing State, regional, and local regulations, would ensure that potential future development under the proposed project would not directly or indirectly cause substantial adverse effects, including the risks to life or property. Therefore, impacts would be *less than significant*.

[19] Wagner, D. L., and E. J. Bortugno, 1982, Geologic Map of the Santa Rosa Quadrangle, scale 1:250,000, https://ngmdb.usgs.gov/Prodesc/proddesc_518.htm , accessed August 29, 2023.

[20] United States Department of Agriculture, 2023, Web Soil Survey, https://websoilsurvey.sc.egov.usda.gov/app/WebSoilSurvey.aspx, accessed August 29, 2023.

GEO-5 Implementation of the proposed project would not utilize septic tanks or alternative wastewater disposal systems where soils would be incapable of adequately supporting such systems, where sewers are not available for the disposal of wastewater.

As discussed in Chapter 4.17, *Utilities and Service Systems*, of this Draft EIR, wastewater from new lots or parcels would be discharged into the existing public sanitary sewer system serviced by the City of Santa Rosa. Therefore, potential future development in the EIR Study Area is not anticipated to result in the use of septic tanks or alternative wastewater disposal systems.

In the event septic tanks or alternative wastewater disposal systems are required, SRCC Chapter 15-16 would allow for the construction of septic tanks or alternative wastewater disposal systems provided that the applicant obtains a City permit and the wastewater disposal system is only employing subsurface soil absorption facilities where such facilities would not endanger or affect the public water supply. In addition, such a wastewater disposal system is subject to inspection by City personnel, who have the authority to deny the permit if conditions are not up to City standards.

Compliance with State, regional, and local regulations for structural safety regarding inadequate soils would ensure that potential future development under the proposed project would not directly or indirectly cause substantial adverse effects. Therefore, potential future development would not result in septic tanks or alternative wastewater disposal systems where soils are not capable of adequately supporting such systems, and the impact would be *less than significant*.

Significance without Mitigation: Less than significant.

GEO-6 Implementation of the proposed project would not directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

As stated in Section 4.7.1.2, *Existing Conditions*, the geology and soils in the EIR Study Area are common throughout the city and region and are not considered unique. However, geological formations underlying the EIR Study Area have the potential to contain unique paleontological resources. Potential future development would be required to comply with the federal Paleontological Resources Preservation Act, which limits the collection of vertebrate fossils and other rare and scientifically significant fossils to qualified researchers who have obtained a permit from the appropriate state or federal agency, and PRC Section 5097, which prohibits the removal of any paleontological site or feature from public lands without the permission of the jurisdictional agency. Ground-disturbing construction activities (e.g., grading and excavation) associated with potential future development in the EIR Study Area could uncover fossilized remains of organisms from prehistoric environments that have not been recorded. The implementation protocols and adherence to the Society of Vertebrate Paleontology standards would ensure the protection of unique paleontological resources during construction of future development. Some protocols include, but are not limited to:

- Excavations within a 50-foot radius of the find shall be temporarily halted or diverted.
- Ground-disturbance work shall cease until a City-approved, qualified paleontologist determines whether the resource requires further study.
- The paleontologist shall document the discovery as needed, in accordance with Society of Vertebrate Paleontology standards as appropriate, evaluate the potential resource, and assess the significance of the finding under the criteria set forth in CEQA Guidelines Section 15064.5.
- The paleontologist shall notify the appropriate agencies to determine procedures that would be followed before construction activities are allowed to resume at the location of the find.
- If is not feasible, the paleontologist shall prepare an excavation plan for mitigating the effect of construction activities on the discovery. The excavation plan shall be submitted to the City of Santa Rosa review and approval prior to implementation.
- All construction activities shall adhere to the recommendations in the excavation plan.

Compliance with federal, state, regional, and local regulations pertaining to paleontological resources, would ensure that potential future development under the proposed project would not directly or indirectly cause substantial adverse effects to paleontological resources. Therefore, the impact would be *less than significant*.

Significance without Mitigation: Less than significant.

GEO-7	**Implementation of the proposed project would not in combination with past, present, and reasonably foreseeable projects, result in a cumulative impact with respect to geology and soils.**

As discussed in Chapter 4.0, *Environmental Analysis*, of this Draft EIR, the cumulative setting includes growth within the EIR Study Area in combination with projected growth in the rest of Sonoma County and the surrounding region. As discussed previously, implementation of the proposed project would not result in significant impacts related to geology and soils. Although the project site includes some potentially significant hazards—strong ground shaking, subsidence, settlement, collapse, seismic-related ground failure, and erosion—anticipated development in the EIR Study Area would be subject to regulations pertaining to seismic safety, including the CBC and SRCC requirements and proposed General Plan 2050 goals, policies, and actions identified under impact discussions GEO-1 through GEO-7. Compliance with these requirements would, to the maximum extent practicable, reduce cumulative, development-related impacts that pertain to seismic shaking, seismic-related ground failure, seismically induced landslides, soil erosion, and unstable soils. Similarly, compliance with relevant SRCC requirements and the requirements of the CBC would minimize the cumulative impacts associated with substantial erosion or loss of topsoil. Though none of the soils in the EIR Study Area are considered to have unique geological resources, unique paleontological resources may occur. Site-specific evaluation in the event that previously unknown resources are discovered during construction activities for new development or redevelopment would be required. Future development would be focused on specific sites or areas, which would be evaluated for site development constraints on a case-by-case basis. Cumulative development in adjacent jurisdictions would be subject to the same federal, state, and local regulations. Since impacts associated with geology and soils are by their nature focused on specific sites or areas, the less-than-significant impacts in the EIR Study Area to avoid impacts related to geology and soils from the proposed project would not contribute to a cumulative increase in hazards in the immediate vicinity of the EIR Study Area or greater Sonoma County. Therefore, cumulative impacts associated with geology and soils would be *less than significant*.

Significance without Mitigation: Less than significant.