3.7 Geology and Soils

This chapter assesses potential environmental impacts from future development under the Proposed Project as related to geology and soils, including those related to geologic and seismic hazards and soil stability. The chapter describes the Planning Area's geologic and seismic setting, as well as relevant federal, State, and local regulations and programs.

No comments on the Notice of Preparation (NOP) and recirculated NOP were received regarding issues pertaining to geology or soils.

Environmental Setting

PHYSICAL SETTING

Geology and Soils

Regional Geology

Fairfield is situated along the eastern margin of the seismically active Coast Ranges geomorphic province of California. The area is characterized by folded and faulted sedimentary and volcanic rocks that forms the hills to the west and north and range in age from Mesozoic to Pliocene, while more recent alluvial and intertidal deposits are found in the southeast (CGS, 2002). Four major formations make up the local geologic units: alluvial deposits that fill the level Suisun and Green valleys; the Sonoma volcanics, which are relatively young (Pliocene age) and comprise the steeper, higher hills north and east of Green Valley; Markley sandstone deposited during the Eocene Epoch, which comprises the north-trending hills west of Interstate 680; and the Great Valley sequence rocks, which are Cretaceous and Jurassic in age and mainly comprise the hills in the north of the Planning Area.

Topography

The Planning Area is primarily flat and mostly lies approximately 16 feet above sea level (Maplogs.com, n.d.). Hilly terrain borders the city to the north and northwest, culminating in the area's two mountain landmarks: Twin Sisters (to the west) and Cement Hill (to the northeast). South of the central city is the Suisun Marsh, the continental United States' largest brackish marsh. The areas north and east of Travis AFB are characterized by grazing, as well as unique "vernal pool" seasonal wetlands. There are also several creeks running through or bordering Fairfield, including Green Valley Creek in Middle Green Valley, American Canyon Creek in Cordelia Villages, Ledgewood Creek bordering Suisun Valley, and Laurel Creek in eastern Fairfield.

Soil Properties

Soil is generally defined as the unconsolidated mixture of mineral grains and organic material that mantles the land surfaces of the earth. The characteristics of soil reflect the five major influences on their development: topography, climate, biological activity, parent (source) material, and time.

The surface soils in the Planning Area have been mapped by the Natural Resources Conservation Service (NRCS) and consist of many soil types, as shown in **Figure 3.7-1**. The Planning Area is primarily underlain by Loam, Clay, Clay Loam, Muck, and Silty Clay. Descriptions of the general characteristics of the primary soils are presented below.

- **Loam soils** comprise 26.74 percent of the Planning Area. Loam soils are composites that contain relatively 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. Loam soils are widely considered to be the best type of soil for plant growth because their composition of sand, silt, and clay provide desirable texture and drainage characteristics (University of Michigan, 2003). Tehama Loam and Henneke Very Rocky Loam are the most common types of loam soils in the Planning Area; Tehama Loam is found in the southern portion of the Planning Area surrounding the Suisun Marsh and Henneke Very Rocky Loam tops large portions of the Rockville Hills. Tehama soils are very deep, well drained soils that are formed in mixed alluvium. They are considered farmland of statewide importance, meaning that they are considered by the state to be important soils for growing crops. Henneke Very Rocky Loam is a shallow, well-drained soil that is found on hills with slopes of 15 to 60 percent, and rock fragments comprise 35 to 60 percent of the soil volume (USDA, 2020).
- **Clay soils,** primarily categorized as Stockton Clay, comprise 13.77 percent of the Planning Area. These soils are characterized as well draining with slow runoff when soil is dry, medium to rapid when soils are moist, and slow permeability.
- **Clay loam soils,** primarily categorized as Dibble Los Osos soils, are a composite soil that contain 27 to 40 percent clay and 20 to 45 percent sand. These soils are located along the slopes of the Vaca Mountains north of I-80 and downtown Fairfield, and are characterized as well drained, slow to rapid runoff, and slow permeability. This soil type covers 13.2 percent of the Planning Area.
- **Silty clay soils,** primarily categorized as Reyes silty clay, cover 7.8 percent of the Planning Area. Reyes soil is very deep and poorly drained soil that formed in alluvium along the margin of bays, and they are found in the Suisun Marsh wetlands in the Planning Area. Reyes silty clay found in the Suisun Bay have a more than 50 percent organic matter composition, and are capable of supporting vegetation.
- **Muck** is an organic soil that is saturated for more than 30 cumulative days of the year, and comprises 7.78 percent of the Planning Area, all of it Joice Muck. Joice Muck is located in the Suisun Marsh wetlands. This type of soil is nutritionally rich and therefore ecologically important; muck is not suitable for building upon as it cannot support heavy loads (USDA, 2020).

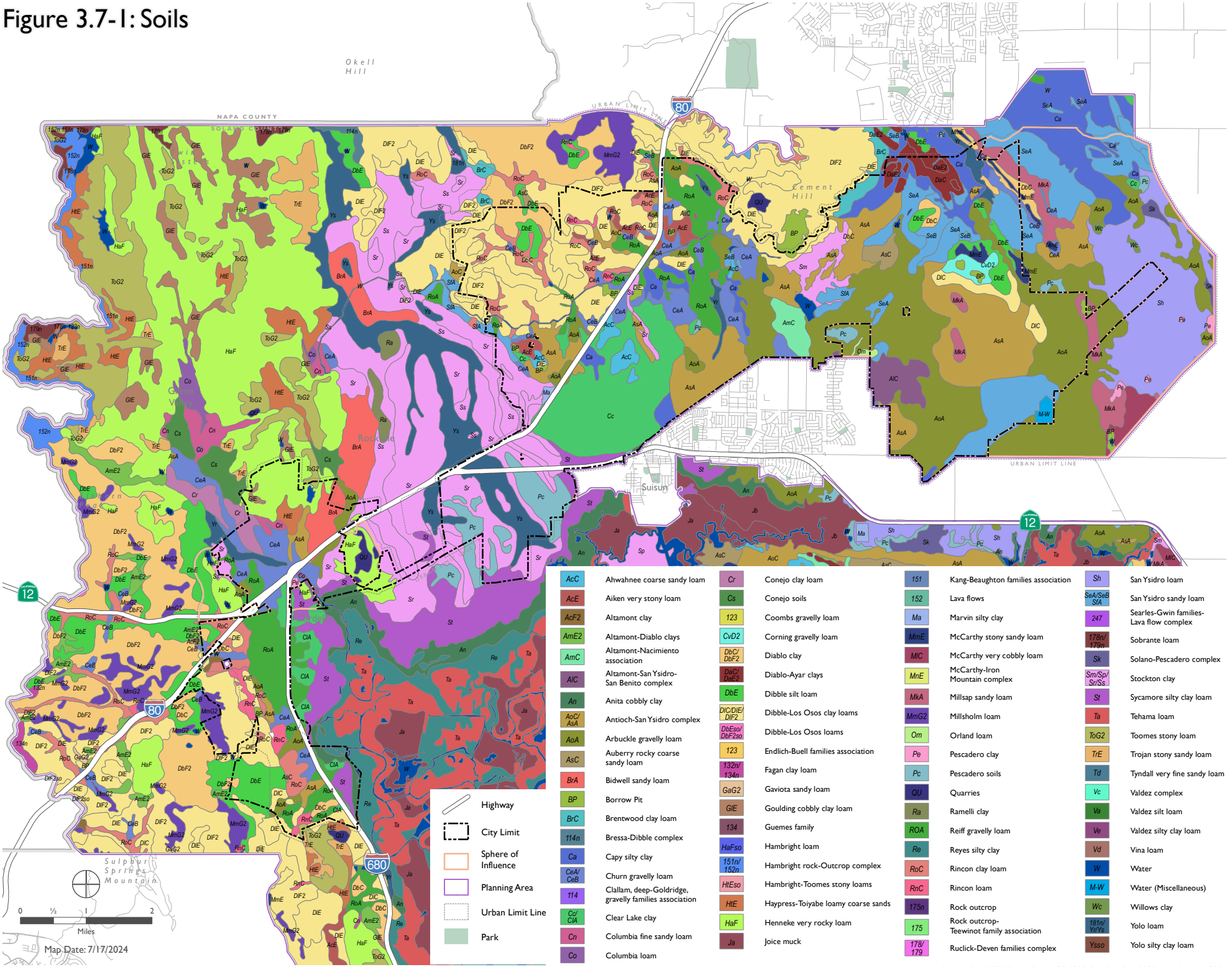
Seismicity

Regional Faults

The term "seismicity" describes the effects of seismic waves that are radiated from an earthquake as it ruptures. The Planning Area is seismically dominated by the presence of the active San Andreas fault system (SAFS). The SAFS is the general boundary between the northward-moving Pacific Plate and the southward-moving North American Plate. Movement of the plates relative to one another results in the accumulation of strain along the faults, which is released during earthquakes. Numerous moderate to strong historic earthquakes have been generated in northern California by the SAFS. This level of active seismicity results in a relatively high seismic risk in the San Francisco Bay Area. In their most recent evaluation, the U.S. Geological Survey's (USGS) Working Group on California Earthquake Probabilities estimated that there is a 72 percent likelihood that a 6.7 or greater magnitude earthquake will occur in the San Francisco Bay Area between 2014 and 2044. The faults with a greater probability of movement, with a magnitude of 6.7 or higher earthquake, are the Hayward fault at 14 percent, the Calaveras fault at 7.4 percent, and the San Andreas fault at 6.4 percent (Field et al., 2015).

The SAFS includes numerous faults found by the California Geological Survey (CGS) in the Bay Area under the Alquist-Priolo Earthquake Fault Zoning Act to be "active" (i.e., to have evidence of fault rupture in the past 11,000 years). Active regional faults include the San Andreas, Hayward, Calaveras, Greenville, Rodgers Creek, and Green Valley faults. In addition to the regional faults, the Cordelia fault poses a potential risk to city residents and property. The Cordelia fault zone crosses the western portion of the Planning Area through Rockville Regional Park and the Cordelia neighborhood. The Vaca-Kirby Hills fault also passes through the eastern portion of the Planning Area but has not experienced displacement within the past 11,700 years. Due to its proximity to regional and local fault systems, the Planning Area is subject to various seismic and geologic hazards, including surface rupture, ground shaking, liquefaction, and landslides.

Figure 3.7-1: Soils



Source: USDA, 2019; Solano County GIS, 2020; City of Fairfield, 2020; Dyett & Bhatia, 2024

Seismic and Geological Hazards

Seismic Shaking

Fairfield is located within a seismically active region and earthquakes have the potential to cause ground shaking of significant magnitude. Ground shaking is a general term referring to all aspects of motion of the Earth's surface resulting from an earthquake and is normally the major cause of damage in seismic events. The extent of ground shaking is controlled by the magnitude and intensity of the earthquake, distance from the rupture, and local geologic conditions. Intensity is a subjective measure of the perceptible effects of seismic energy at a given point and varies with distance from the epicenter and local geologic conditions. The Modified Mercalli Intensity (MMI) Scale is a commonly used scale for measurement of the subjective effects of earthquake intensity. It reports the intensity of shaking on a scale from: (I) not felt ("not felt except by a few under especially favorable circumstances") to (XII) extreme ("damage total"). The moment magnitude scale, abbreviated M_W, is the scale typically used to report the objective size of an earthquake. It measures the total moment release of the earthquake, where *movement* is a product of the force required to move a fault and the distance it moved. Sufficiently intense and sustained seismic ground shaking can result in significant damage to, or catastrophic failure of, buildings or other man-made structures.

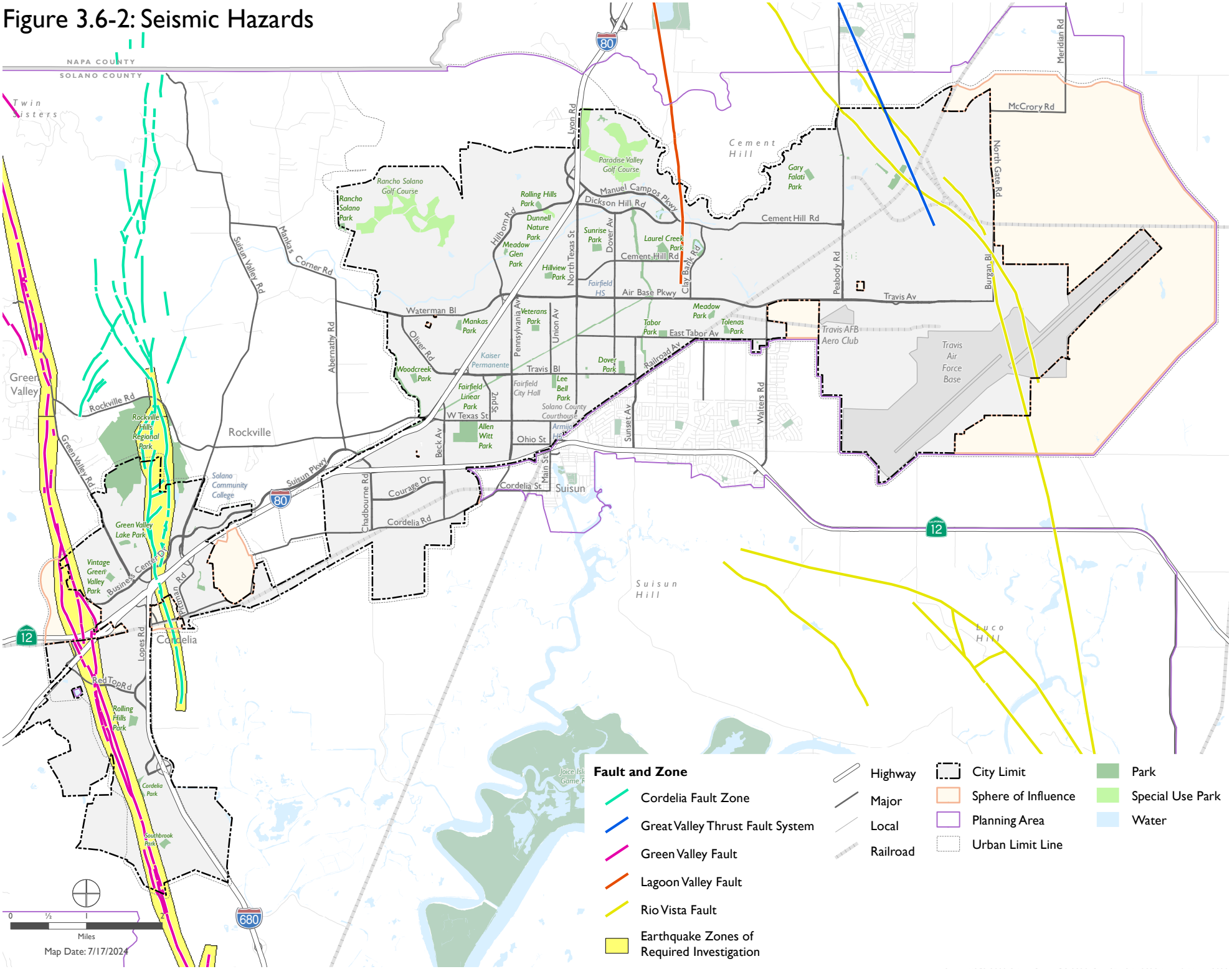
Seismic activity along nearby or more distant fault zones is likely to cause ground shaking within the city limits. If an earthquake were to occur, Fairfield could potentially feel ground shaking at a MMI of up to VII, very strong shaking with moderate damage, though it would most likely be at a lower intensity (USGS, 2017).

Surface Rupture

Surface fault rupture can occur during significant seismic events. The process generally involves the sudden failure and displacement of the Earth's surface along a fault trace or fault zone. The magnitude and geometry of such ground displacement is highly variable. Buildings or other manmade structures that lie atop the fault can experience serious damage or catastrophic failure during a strong earthquake.

If an earthquake would occur along the Green Valley or Cordelia faults, which run through the western portion of the Planning Area and city, fault rupture could occur along that fault line. To prevent the construction of buildings used for human occupancy on the surface trace of active faults, the Alquist-Priolo Earthquake Fault Zoning Act was passed to address the hazards of surface fault rupture. Fairfield has two Alquist-Priolo Fault Zones as shown in **Figure 3.7-2**, one surrounding the Green Valley fault line, and one surrounding the Cordelia fault line.

Figure 3.6-2: Seismic Hazards



Source: USGS, 2018; Solano County GIS, 2020; City of Fairfield, 2020; Dyett & Bhatia, 2020

Liquefaction

Liquefaction occurs when loosely packed sandy or silty materials saturated with water experience ground shaking extreme enough to lose strength and stiffness. Liquefied soils behave like a liquid and are responsible for tremendous damage in an earthquake. For example, it can cause buildings to collapse, pipes to leak, and roads to buckle. Since saturated soils are a necessary condition for liquefaction, soil layers in areas where the groundwater table is near the surface have higher liquefaction potential than those in which the water table is located at greater depths.

As shown in **Figure 3.7-3**, the Planning Area includes areas ranging from low to moderate liquefaction susceptibility. Due to their proximity to the Suisun Marsh, much of the central Fairfield and Cordelia neighborhoods have a moderate liquefaction susceptibility (USGS, 2006).

Lateral Spreading

Lateral spreading refers to a type of landslide that forms on gentle slopes and has rapid fluid-like movement. Factors determining the potential for liquefaction and lateral spreading are soil type, the level and duration of seismic ground motions, the type and consistency of soils, and the depth to groundwater. Locations within the Planning Area that have high liquefaction susceptibility, as shown on **Figure 3.7-3**, have the highest risk of lateral spreading.

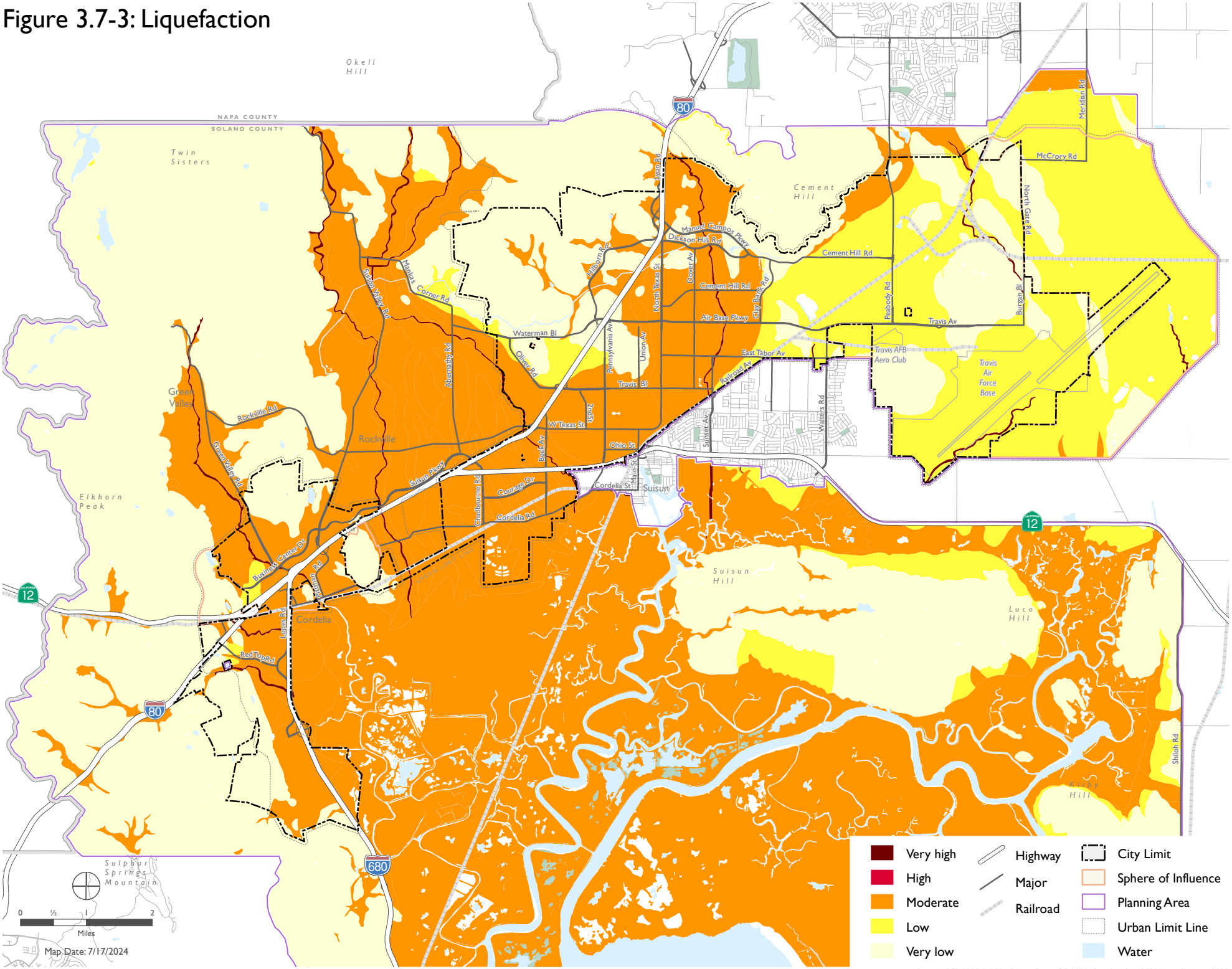
Landslides

Earthquake-induced landslides are a secondary earthquake hazard that occurs from ground shaking. They can destroy roads, buildings, utilities, and other critical facilities necessary to respond and recover from an earthquake. Many communities in the Bay Area have a high likelihood of encountering such risks, especially in areas with steep slopes. While much of the city's populated land area is relatively flat and has little to no identified landslide potential hazards, hilly areas around Planning Area have varying degrees of landslide susceptibility. As shown in **Figure 3.7-4,** the slopes to the east and west of Green Valley are particularly vulnerable to landslides. The hills of the Rancho Solano area have a lower landslide susceptibility.

Soil Erosion

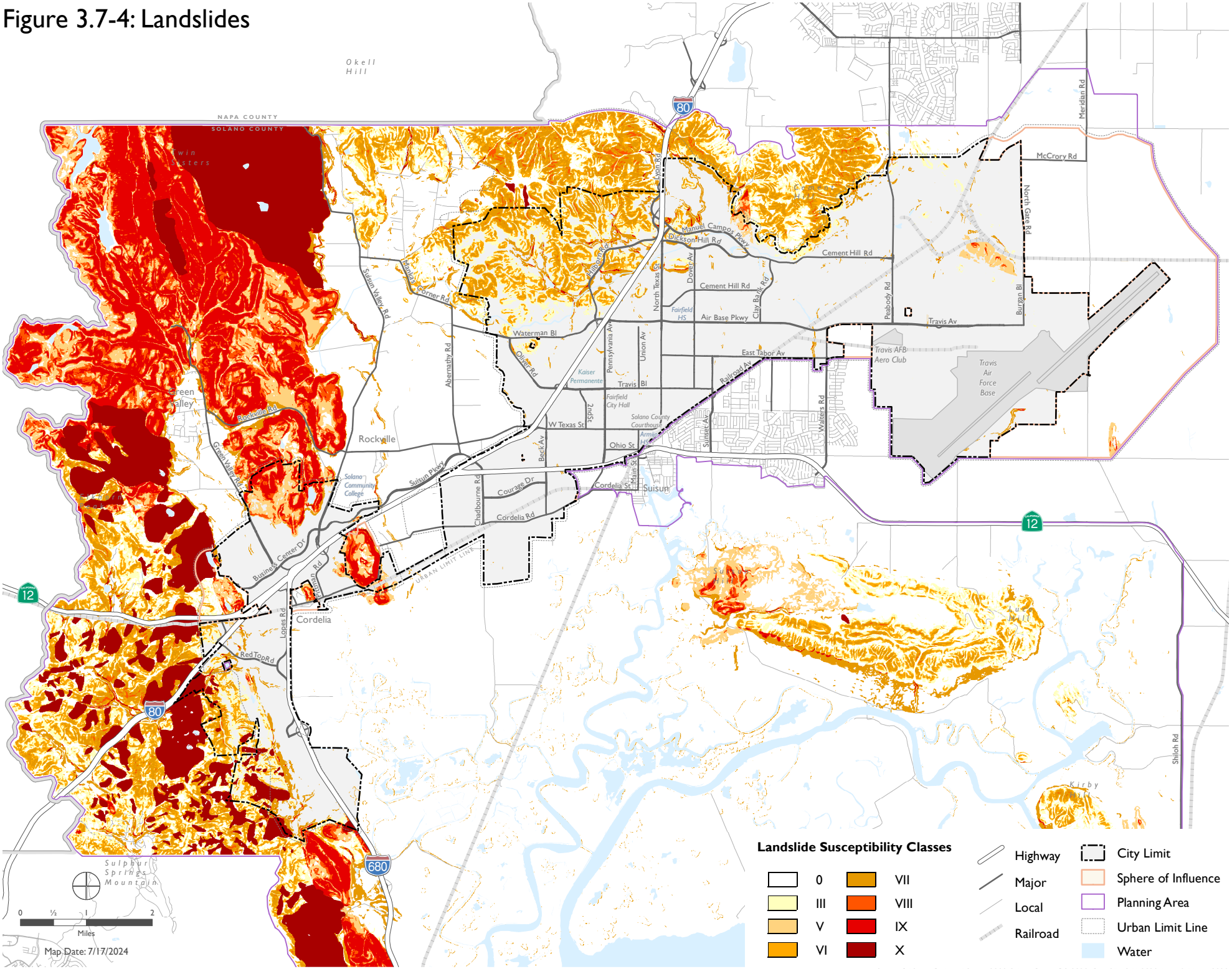
Soil erosion is the process by which soil materials are worn away and transported to another area, either by wind or water. Not accounting for slope and groundcover factors, soils high in clay have low susceptibility to erosion because they are resistant to detachment. Coarse textured soils, such as sandy soils, also have low erosion potential despite their easy detachment, because of low runoff. Medium textured soils, such as the silt loam soils, are moderately susceptible to erosion, while soils with a high silt content are the most susceptible (IWR, 2002).

Figure 3.7-3: Liquefaction



Source: USGS, 2000 & 2006; Solano County GIS, 2020; City of Fairfield, 2020; Dyett & Bhatia, 2020

Figure 3.7-4: Landslides



Source: California Geological Survey, 2011; Solano County GIS, 2020; City of Fairfield, 2020; Dyett & Bhatia, 2020

Most of the Planning Area—92,768 acres, or 64 percent—is underlain by soils that have low erosion susceptibility. Further, since the Planning Area is primarily flat, the risk of soil erosion due to water runoff is relatively low. Stormwater drainage can be a significant cause of soil erosion, if stormwater is not managed well, especially during construction. Excessive soil erosion can eventually damage building foundations and roadways.

Expansive Soils

Expansive soils have shrink-swell capacity, meaning they may swell when wetted and shrink when dried. Expansive soils can be hazardous to built structures, and may cause cracks in building foundations, distortion of structural elements, and warping of doors and windows. The higher the clay content of a soil, the higher its shrink-swell potential. The United States Department of Agriculture National Resource Conservation Service (NRCS) analyzes the shrink-swell potential of each soil type based on its linear extensibility and clay content and categorizes it as "low," "moderate," "high," or "very high." Where the shrink-swell classification is moderate to very high, shrinking and swelling can cause damage to buildings, utilities, roads, and other structures and the gradual cracking, settling, and weakening of older buildings could create potential safety concerns and financial loss.

The soils of the Planning Area range from low to very-high shrink-swell potential. Moderate to high shrink-swell potential soils are classified as expansive soils and construction will require appropriate engineering. Many soils in the Planning Area are classified as "moderate" shrink-swell potential (see **Table 3.7-1**). Areas of high and very-high expansiveness occur in a number of locations, as seen in **Figure 3.7-1.**

Subsidence

Subsidence occurs when a large portion of land is displaced vertically. This typically is due to the withdrawal of groundwater, oil, or natural gas. USGS scientists have mapped areas of subsidence in California since the beginning of the 20th century, most of which was a result of excessive groundwater pumping. These USGS California Water Science Center maps of historical and current recorded subsidence do not identify Fairfield as an area that has experienced subsidence, though substantial areas of land subsidence have occurred due to peat loss in the Sacramento-San Joaquin Delta, about 25 miles southeast of the Planning Area. Furthermore, the USGS California Water Science Center Sustainable Groundwater Modeling identifies the Planning Area as a very low California Department of Water Resources (DWR) basin prioritization ranking, based on sustainability indicators from the State Sustainable Groundwater Management Act (i.e., changes in groundwater levels, changes in groundwater storage, seawater intrusion, subsidence, surface water/groundwater interactions, and water quality).

Table 3.7-1: Soil Types in the Planning Area

		Susceptible to		*Corrosive to*			*% of*
Soil Type	*Slopes (%)*	*Erosion*	*Shrink-Swell*	*Steel*	*Concrete*	*Acres*	*Planning Area*
Ahwahnee coarse sandy loam	9-15					1,121	0.6
Aiken very stony loam	30-50					1,387	0.8
Altamont clay	30-50	VH	H	H	L	402	0.2
Altamont-Diablo clays	9-30	H/VH	H	H	L	833	0.5
Altamont-Nacimiento association	3-15					870	0.5
Altamont-San Ysidro-San Benito complex	2-9, 9-30	H/VH	H	H	L	628	0.4
Anita cobbly clay	-					1,642	0.9
Antioch-San Ysidro complex	30-50					5,082	2.9
Arbuckle gravelly loam	0-2					7,637	4.3
Auberry rocky coarse sandy loam	5-15					1,529	0.9
Bidwell sandy loam	0-2					1,001	0.6
Borrow Pit	-					428	0.2
Brentwood clay loam	2-9	H	M	H	L	294	0.2
Bressa-Dibble complex	30-50	H/VH	L	M	L	65	0.0
Capy silty clay	0					2,116	1.2
Churn gravelly loam	0-3, 3-8					2,111	1.2
Clallam, deep-Goldridge, gravelly families association	30-90					3	0.0
Clear Lake clay	0-4	H	VH	H	M	2,268	1.3
Columbia fine sandy loam	0-3	VL	L	H	L	345	0.2
Columbia loam	0-3					210	0.1
Conejo clay loam	-	L	M	M	L	300	0.2
Conejo soils	-	L	M	H	L	437	0.2
Coombs gravelly loam	2-5, 0-12	L	L	M, H	M	1	0.0
Corning gravelly loam	0-12	VH	L	H	M	128	0.1
Diablo clay	2-9, 30-50	VH				5,284	2.3

Table 3.7-1: Soil Types in the Planning Area

		Susceptible to		*Corrosive to*			
Soil Type	*Slopes (%)*	*Erosion*	*Shrink-Swell*	*Steel*	*Concrete*	*Acres*	*% of Planning Area*
Diablo-Ayar clays	2-9, 9-30	VH	M, H	H	L	1,233	0.7
Dibble silt loam	8-38	VH				2,379	1.3
Dibble-Los Osos clay loams	2-9, 9-30, 30-50	VH	M, H	M, H	L	11,916	6.7
Dibble-Los Osos loams	9-30, 30-50	VH	M	M, H	L	16	0.0
Endlich-Buell families association	15-70					0	0.0
Fagan clay loam	15-30, 30-50	H, VH	M	H	L	69	0.0
Gaviota sandy loam	30-75	VH	M	L	L	481	0.3
Goulding cobbly clay loam	15-30					1,114	0.6
Guemes family	30-90					3	0.0
Hambright loam	15-40	H	L	L	L	1	0.0
Hambright rock-Outcrop complex	2-30, 30-75	M/VH	L	M	L	451	0.3
Hambright-Toomes stony loams	9-30	H	L	L	L	2	0.0
Haypress-Toiyabe loamy coarse sands	2-30					1,159	0.7
Henneke very rocky loam	15-60					8,458	4.8
Joice muck (clay)	0-2	N	M	H	H	137	0.1
Joice muck	-	N	L	H	H	13,863	7.8
Kang-Beaughton families association	9-90					1	0.0
Lava flows	-					11	0.0
Marvin silty clay	0-1					58	0.0
McCarthy stony sandy loam	30-50					1,134	0.6
McCarthy very cobbly loam	3-16					377	0.2
McCarthy-Iron Mountain complex	30-50					110	0.1
Millsap sandy loam	0-2	VH	M	M	M	815	0.5
Millsholm loam	2-9, 15-65	H, VH	L	M, L	L	1,539	0.9

Table 3.7-1: Soil Types in the Planning Area

		Susceptible to		*Corrosive to*			
Soil Type	*Slopes (%)*	*Erosion*	*Shrink-Swell*	*Steel*	*Concrete*	*Acres*	*% of Planning Area*
Orland loam	0-2					41	0.0
Pescadero clay	0	VH	H	H	M	67	0.0
Pescadero soils	-					1,315	0.7
Quarries	-					158	0.1
Ramelli clay	-					174	0.1
Reiff gravelly loam	0-3					2,104	1.2
Reyes silty clay	-	N	H	H	H	11,717	6.6
Rincon clay loam	2-9	H	H	H	L	1,624	0.9
Rincon loam	2-9	N	M	M	L	274	0.2
Rock outcrop	-	VH	L	n/a	n/a	3	0.0
Rock outcrop-Teewinot family association	50-90					0	0.0
Ruclick-Deven families complex	0-9, 15-30					4	0.0
San Ysidro loam	0-5					2,720	1.5
San Ysidro sandy loam	0-2, 2-5	VH	M	H	M	2,871	1.6
Searles-Gwin families-Lava flow complex	1-10					2	0.0
Sobrante loam	5-30, 30-50					226	0.1
Solano-Pescadero complex	-	VH	M	M	M	213	0.1
Stockton clay	-					12,602	7.1
Sycamore silty clay loam	0	M	M	H	H	2,118	1.2
Tehama loam	0-2					14,366	8.1
Toomes stony loam	30-75	H	L	L	L	2,958	1.7
Trojan stony sandy loam	2-30					676	0.4
Tyndall very fine sandy loam	-					1,819	1.0
Valdez complex	-					56	0.0
Valdez silt loam	0-2	L	L	M	M	265	0.2
Valdez silty clay loam	-	M	M	H	H	6,931	3.9
Vina loam	0-3					8	0.0
Willows clay	0	H	VH	H	L	28	0.0
Yolo loam	0-10	L	L	L	L	2,630	1.2
Yolo silty clay loam	0-2	L	M	M	L	0	0.0

Table 3.7-1: Soil Types in the Planning Area

Soil Type	Slopes (%)	Susceptible to Erosion	Susceptible to Shrink-Swell	Corrosive to Steel	Corrosive to Concrete	Acres	% of Planning Area
Total Soils						**149,419**	**83.9**
Water						*28,677*	*16.1*
GRAND TOTAL						**178,096**	**100.0**

Notes:

N = Negligible VL = Very Low L = Low M = Moderate H = High VH = Very High

1. Totals may not add up due to rounding, and acreage/percentage shown as 0 are non-zero values that have been rounded to 0.

Source: Web Soil Survey, USDA Natural Resource Conservation Service, 2021; Dyett & Bhatia, 2021

Paleontological Resources

Paleontological resources are the fossil remains or traces of past life forms, including both vertebrate and invertebrate species, as well as plants. The Planning Area is located in the Sacramento Valley, which forms part of the northern portion of the Great Valley Geomorphic Province of California. The province, a sedimentary basin, is bounded by the Coastal Ranges to the west and the foothills of the Sierra Nevada to the east. The Sacramento Valley is mainly composed of alluvial sediments. The Planning Area is underlain with Quaternary-age alluvium, consisting of an unstratified mix of sand, silt, clay, and gravel. According to a records search of the University of California Museum of Paleontology Specimen Search, no paleontological resources have been found within Fairfield. Multiple resources have been discovered throughout Solano County and in neighboring cities, including Vacaville just to the north of Fairfield, with similar geological features as the Planning Area. Therefore, there is a possibility for paleontological resources to be discovered in the Planning Area (UC Museum of Paleontology, 2020).

REGULATORY SETTING

Federal Regulations

Earthquake Hazards Reduction Act

The Earthquake Hazards Reduction Act was enacted in 1977 to "reduce the risks to life and property from future earthquakes in the United States through the establishment and maintenance of an effective earthquake hazards and reduction program." To accomplish this, the Act established the National Earthquake Hazards Reduction Program (NEHRP). This program was last amended in 2004 by NEHRP.

NEHRP's mission includes improved understanding, characterization, and prediction of hazards and vulnerabilities; improvement of building codes and land use practices; risk reduction through post-earthquake investigations and education; development and improvement of design and construction techniques; improvement of mitigation capacity; and accelerated application of research results. The NEHRP designates the National Institute of Standards and Technology

(NIST) as the lead agency of the program. As lead agency, it develops, evaluates, and tests earthquake resistant design and construction practices for implementation in the building codes and engineering practice. Under NEHRP, the Federal Emergency Management Agency (FEMA) is responsible for developing earthquake risk reduction tools and promoting their implementation, as well as supporting the development of disaster-resistant building codes and standards. USGS monitors seismic activity, provides earthquake hazard assessments, and conducts and supports targeted research on earthquake causes and effects. Programs under NEHRP help inform and guide planning and building code requirements such as emergency evacuation responsibilities and seismic code standards.

U.S. Geological Survey Landslide Hazard Program

The USGS created the Landslide Hazard Program in the mid-1970s; the primary objective of the program is to reduce long-term losses from landslide hazards by improving our understanding of the causes of ground failure and suggesting mitigation strategies. The federal government takes the lead role in funding and conducting this research, whereas the reduction of losses due to geologic hazards is primarily a state and local responsibility. In Solano County, plans and programs designed for the protection of life and property are coordinated by the Solano County Office of Emergency Services.

Disaster Mitigation Act of 2000

The Disaster Mitigation Act of 2000 (DMA2K) (Public Law 106-390) amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 to establish a Pre-Disaster Mitigation (PDM) program and new requirements for the federal post-disaster Hazard Mitigation Grant Program (HMGP). DMA2K encourages and rewards local and state pre-disaster planning. It promotes sustainability and seeks to integrate state and local planning with an overall goal of strengthening statewide hazard mitigation. This enhanced planning approach enables local, tribal, and state governments to identify specific strategies for reducing probable impacts of natural hazards such as floods, fire, and earthquakes. In order to be eligible for hazard mitigation funding after November 1, 2004, local governments are required to develop a Hazard Mitigation Plan that incorporates specific program elements of the DMA2K law. Fairfield participated in the multi-jurisdictional Solano County Multi-Hazard Mitigation Plan, as described under Local Regulations, below.

State Regulations

California Multi-Hazard Mitigation Plan

The State of California Multi-Hazard Mitigation Plan, also known as the State Hazard Mitigation Plan (SHMP), was approved by FEMA in 2023. The SHMP outlines present and planned activities to address natural hazards. The adoption of the SHMP qualifies the State of California for federal funds in the event of a disaster. The State is required under the Disaster Mitigation Act of 2000, described above, to review and update its SHMP and resubmit for FEMA approval at least once every 5 years to ensure the continued eligibility for federal funding. The SHMP provides goals and

strategies which address minimization of risks associated with natural hazards and response to disaster situations. The SHMP notes that the primary sources of losses in the state of California are fire and flooding; and while earthquakes occur less frequently, they account for the greatest combined losses.

California Building Standards Code

The California Building Code (CBC) is Part 2 of Title 24 of the California Code of Regulations. The CBC incorporates the International Building Code, a model building code adopted across the United States. The CBC is updated every three years, and the current 2022 version took effect January 1, 2023. With the exception of certain additions, deletions, and amendments, the City adopted the CBC by reference pursuant to Chapter 5 of the Municipal Code. Through the CBC, the State provides a minimum standard for building design and construction. Of particular relevance, Chapter 16 of the CBC contains specific requirements for structural (building) design, including seismic loads. Chapter 18 of the CBC includes requirements for soil testing, excavation and grading, and foundation design.

California Alquist–Priolo Earthquake Fault Zoning Act

The Alquist–Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures used for human occupancy. The main purpose of the law is to prevent the construction of buildings used for human occupancy on top of active faults. The law only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards, such as groundshaking or landslides.

The law requires the State Geologist to establish regulatory zones (known as Earthquake Fault Zones or Alquist–Priolo Zones) around the surface traces of active faults, and to issue appropriate maps. The maps 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. As discussed in the Physical Setting section, Alquist-Priolo zones are found in the Cordelia area of Fairfield, around the Cordelia and Green Valley faults.

Seismic Hazards Mapping Act, California Public Resources Code Sections 2690–2699.6

The Seismic Hazards Mapping Act was developed to protect the public from the effects of strong ground shaking, liquefaction, landslides, or other ground failure, and from other hazards caused by earthquakes. This act requires the State Geologist to delineate various seismic hazard zones and requires cities, counties, and other local permitting agencies to regulate certain development projects within these zones. Before a development permit is granted for a site within a Seismic Hazard Zone, a geotechnical investigation of the site must be conducted, and appropriate mitigation measures incorporated into the project design. Geotechnical investigations conducted within Seismic Hazard Zones must incorporate standards specified by the CGS Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards. The south of Fairfield is in a zone of required investigation (State of California, 1972).

California Department of Transportation (Caltrans)

Jurisdiction of the California Department of Transportation (Caltrans) includes State and interstate routes within California. Any work within the right-of-way of a federal or State transportation corridor is subject to Caltrans regulations governing allowable actions and modifications to the right-of-way. Caltrans standards incorporate the CBC, and contain numerous rules and regulations to protect the public from seismic hazards such as surface fault rupture and ground shaking. In addition, Caltrans standards require that projects be constructed to minimize potential hazards associated with cut and fill operations, grading, slope instability, and expansive or corrosive soils, as described in the Caltrans Highway Design Manual (HDM).

Caltrans and local project sponsors, as part of the project development and delivery process, are obligated to conduct paleontological studies in response to federal, state, and local laws, regulations, and ordinances. For example, Section 305 of the Federal Aid Highway Act of 1956 (20 USC 78, 78a) gives authority to use federal funds to salvage archaeological and paleontological sites affected by highway projects.

National Pollution Discharge Elimination System Permits

In California, the State Water Resources Control Board (SWRCB) and its Regional Water Quality Control Board (RWQCB) administer the National Pollution Discharge Elimination System (NPDES) program. The NPDES permit system was established as part of the Federal Clean Water Act to regulate both point source discharges and non-point source discharges to surface water of the United States, including the discharge of soils eroded from construction sites.

The NPDES program consists of characterizing receiving water quality, identifying harmful constituents (including siltation), targeting potential sources of pollutants (including excavation and grading operations), and implementing a comprehensive stormwater management program. Construction and industrial activities typically are regulated under statewide general permits that are issued by the SWRCB. Additionally, the SWRCB issues Water Discharge Requirements that also serve as NPDES permits under the authority delegated to the RWQCBs, under the Clean Water Act. See Section 3.9: Hydrology and Water Quality, for more information about the NPDES.

California Public Resources Code

Sections 5097–5097.6 of the California Public Resources Code outline the requirements for cultural resource analysis prior to the commencement of any construction project on state lands. The state agency proposing the project may conduct the cultural resource analysis or they may contract with the State Department of Parks and Recreation. In addition, this section stipulates that the unauthorized disturbance or removal of archaeological, historical, or paleontological resources located on public lands is a misdemeanor. It prohibits the knowing destruction of objects of antiquity without a permit (expressed permission) on public lands and provides for criminal sanctions. As used in this section, "public lands" means lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof.

Local Regulations

Solano County Local Multi-Hazard Mitigation Plan

Fairfield participated in the preparation of the 2022 Solano County Multi-Hazard Mitigation Plan (MHMP), an effort undertaken by the County to mitigate the effects of natural hazards and plan for resiliency for all residents of the county. The Solano County MHMP identifies wildfire, severe weather and storms as highly likely occurrences in the county (between 10 and 100 percent probability in the next year); and flooding, earthquakes/seismic shaking, and dam failure as an occasional occurrence (between one and ten percent probability in the next year). Fairfield's Annex profiles the City of Fairfield's hazards, vulnerabilities, and mitigation actions to address these vulnerabilities.

Solano County Code

Chapter 6.3-03 of the Solano County Code adopts the 2022 CBC in its entirety, subject to the definitions, clarifications, and amendments set forth in the chapter. As discussed above, the CBC regulates seismic design, the excavation of foundations and retaining walls, analysis of slope instability, requirements for drainage and grading, and other aspects of building design and construction that relate to geology, soils, and seismicity. Amendments to the CBC in the County Code are made regarding roofing requirements, exemptions from building permits, and standard plans.

Chapter 6.4 of the Solano County Code, Sewage Standards, establishes a comprehensive, uniform set of standards for the review and approval of on-site sewage disposal systems for individual lots and subdivisions in Solano County (which includes some areas within the Sphere of Influence). The standards contained in this Chapter apply to the siting, design and construction of on-site sewage treatment, storage and disposal systems, or their components. The Chapter requires a connection to a public sewer system for all proposed lots, new development, additions, or remodels that propose to generate wastewater, and for existing structures requiring repairs to the septic system if sewer is available, and no permit for installation, repair, replacement or expansion of a septic system shall be issued if sewer is available. The Code requires that site evaluation and permits shall require a determination of the soil conditions in the area proposed for on-site sewage disposal systems and replacement areas.

Chapter 12.2 includes regulations regarding flood damage prevention, and defines provisions aimed at reducing flood and erosion damage and hazards. The purpose of this chapter is to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas. This chapter includes standards of construction and additional regulations for floodways and coastal high hazard areas.

Chapter 31, Grading, Drainage, and Erosion Control, provides the means for controlling soil erosion, sedimentation, increased rates of water runoff and related environmental damage by establishing minimum standards and providing regulations for the construction and maintenance of fills, excavations, cuts and clearing of vegetation, revegetation of cleared areas, drainage control, and the protection of exposed soil surfaces in order to protect downstream waterways and wetlands

and to promote the safety, public health, convenience and general welfare of the community. All grading plans and permits shall comply with applicable NPDES provisions. The ordinance requires all construction site owners and contractors to implement stormwater best management practices (BMPs), which prevent pollutants generated during construction from leaving the construction site and entering the County's stormwater system during wet or dry weather.

City of Fairfield Municipal Code

Chapter 5, Article 1 of the City of Fairfield Municipal Code adopts the 2022 CBC in its entirety, subject to the definitions, clarifications, and amendments set forth in the chapter. As discussed above, the CBC regulates seismic design, the excavation of foundations and retaining walls, analysis of slope instability, requirements for drainage and grading, and other aspects of building design and construction that relate to geology, soils, and seismicity. Amendments to the CBC in the Municipal Code pertaining to geology and soils require that demolition prevents silt and dust from entering the storm drain system.

Section 5.3.6 provides requirements to reduce earthquake hazards for unreinforced masonry buildings (URMs) through the City's Seismic Hazards Identification Program. The building inspection department shall inspect buildings to create a list of buildings that by nature or extent of their structural deficiencies or deficiencies in anchoring could collapse or partially collapse. An appropriate solution, which could be used to strengthen the structure to alleviate any collapse or partial collapse threat, shall be specified.

Chapter 6B, Public Improvement Reimbursements, requires that construction of sanitary sewers, water and storm drainage facilities and street improvements take place at such time as there are occupied lands to be served that when such facilities are constructed, such shall be so sized and located as to be or become an integral part of the planned sewer, water, storm drainage and street systems of the city. That such construction and such sizing and location shall not be delayed until all lands ultimately to be served by such facilities are occupied.

Chapter 8A, Article 1 includes regulations regarding flood damage prevention, and defines provisions aimed at reducing flood and erosion damage and hazards. The purpose of this chapter is to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas. This chapter includes establishment of a floodplain development permit, standards of construction, and requires that the flood carrying capacity of the altered or relocated portion of said watercourse is maintained.

Chapter 15, Sewers, governs the installation of replacement or supplementary sewer mains in certain areas of the city where it has been determined that changing or increased land usage has rendered, or will render, existing sewer mains inadequate or obsolete.

Chapter 22B, Stormwater Management and Discharge Control, provides provisions to protect and enhance the water quality of watercourses, water bodies, and wetlands in a manner pursuant to and consistent with the Clean Water Act and the Porter-Cologne Act. This chapter shall be construed to assure consistency with the requirements of the Federal Clean Water Act, applicable implementing regulations, and NPDES Permit No. CAS612008. The ordinance requires all

construction site owners and contractors to implement stormwater management practices (BMPs), which prevent pollutants generated during construction from leaving the construction site and entering the city's storm water system during wet or dry weather.

Fairfield Public Works Department General Development Conditions

The Public Works Department applies General Development Conditions to individual development proposals, developed within the guidance of the California Government Code. Many of the conditions directly and proactively address environmental issues relevant to this CEQA EIR analysis. Related requirements include preparation of an erosion and sedimentation control plan as part of the grading plan submittal, subject to review and approval by the City Engineer.

Impact Analysis

SIGNIFICANCE CRITERIA

For the purposes of this EIR, a significant impact would occur if the Proposed Project would:

Criterion 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 or based on other substantial evidence of a known fault (refer to Division of Mines and Geology Special Publication 42),**
- **ii. Strong seismic ground shaking,**
- **iii. Seismically related ground failure, including liquefaction, or**
- **iv. Landslides;**

Criterion 2: **Result in substantial soil erosion or the loss of topsoil;**

Criterion 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;**

Criterion 4: **Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property;**

Criterion 5: **Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water; or**

Criterion 6: **Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.**

METHODOLOGY AND ASSUMPTIONS

Geology, Soils, and Seismicity

This evaluation of geologic, soils, and seismic hazard conditions was completed using published geologic, soils, and seismic maps and studies from USGS and CGS. In order to reduce or mitigate potential hazards from earthquakes or other local geologic hazards, implementation of the Proposed Project would be governed by existing regulations at the federal, state, and local levels, including City and County municipal codes. These regulations require that a proposed project design reduce potential adverse soils, geological, and seismicity effects to the extent feasible. Compliance with these regulations is required, not optional. These provisions ensure that development will continue to be completed in compliance with local and State regulations.

Paleontological Resources

An evaluation of impacts on paleontological resources was completed using published geologic maps from CGS (Wagner & Bortugno, 1982) and database query at the University of California Museum of Paleontology (University of California Museum of Paleontology, 2021), following procedures outlined in the Standard Guidelines provided by the Impact Mitigation Guidelines Revisions Committee of the Society of Vertebrate Paleontology (2010).

The Standard Guidelines include procedures for the investigation, collection, preservation, and cataloguing of fossil-bearing sites, including the designation of paleontological sensitivity. The Standard Guidelines are widely accepted among paleontologists and are followed by most investigators. The Standard Guidelines identify the two key phases of paleontological resource protection as (1) assessment and (2) implementation. Assessment involves identifying the potential for a project site or area to contain significant nonrenewable paleontological resources that could be damaged or destroyed by project excavation or construction. Implementation involves formulating and applying measures to reduce such adverse effects.

For the assessment phase, the Standard Guidelines prescribe the following steps (SVP, 2010):

- Identify the geologic units that would be affected by the project, based on the project's depth of excavation—either at ground surface or below ground surface, defined as at least 5 feet below ground surface.
- Evaluate the potential of the identified geologic units to contain significant fossils (paleontological sensitivity).
- Identify impacts on paleontologically sensitive geologic units as a result of near-term and longer-term construction and operation that involve ground disturbance.
- Evaluate impact significance.

The paleontological sensitivity of the geologic units identified in the study area is classified according to four categories. SVP defines the level of potential as one of four sensitivity categories for sedimentary rocks: High, Undetermined, Low, and No Potential.

- **High Potential.** Assigned to geologic units from which vertebrate or significant invertebrate, plant, or trace fossils have been recovered; and sedimentary rock units suitable for the preservation of fossils ("middle Holocene and older, fine-grained fluvial sandstones…fine-grained marine sandstones, etc."). Paleontological potential consists of the potential for yielding abundant fossils, a few significant fossils, or "recovered evidence for new and significant taxonomic, phylogenetic, paleoecologic, taphonomic, biochronologic, or stratigraphic data."
- **Undetermined Potential.** Assigned to geologic units "for which little information is available concerning their paleontological content, geologic age, and depositional environment." In cases where no subsurface data already exist, paleontological potential can sometimes be assessed by subsurface site investigations.
- **Low Potential.** Field surveys or paleontological research may allow determination that a geologic unit has low potential for yielding significant fossils (e.g., basalt flows). Mitigation is generally not required to protect fossils.

  No Potential. Some geologic units have no potential to contain significant paleontological resources, such as high-grade metamorphic rocks (such as gneisses and schists) and plutonic igneous rocks (such as granites and diorites). Mitigation is not required.

Geologic units at the project site were identified through California Geological Survey regional maps (Wagner & Bortugno, 1982). Determination of the presence of paleontological resources in the units was based on the fossil record as documented by the University of California Museum of Paleontology (2020). For the implementation phase, the Standard Guidelines states that evaluation must identify impacts on significant paleontological resources and formulate and implement measures to mitigate potential impacts relative to the paleontological sensitivity of the geologic units that would be disturbed (SVP, 2010).

For the purposes of this analysis, an impact on paleontological resources was considered significant and to require mitigation if it would result in any of the following (SVP, 2010):

- Damage to or destruction of vertebrate paleontological resources.
- Damage to or destruction of any paleontological resource that:
  - Provides important information about evolutionary trends, including the development of biological communities;
  - Demonstrates unusual circumstances in the history of life;
  - Represents a rare taxon or a rare or unique occurrence;
  - Is in short supply and in danger of being destroyed or depleted;
  - Has a special and particular quality, such as being the oldest of its type or the best available example of its type; or
  - Provides information used to correlate strata for which it may be difficult to obtain other types of age dates.

RELEVANT POLICIES

The Proposed Project contains the following goals and policies relevant to geology, soils, and seismicity.

Land Use and Urban Design Element

LU-6.5 **Environmental Constraints in Site Design.** Ensure that development is reflective of the area's environmental constraints—including localized presence of geologic faults, slopes/unstable soils, flood hazards—as well as natural resources. Consider incorporating geologic faults/Alquist Priolo Zones as part of the open space or trails system.

LU-21.5 **Cordelia Neighborhood School Site.** Coordinate with the Fairfield Suisun Unified School District on additional school facilities planning needs and land acquisitions. At least 10 usable acres of the new neighborhood is designated for an additional school (see Minimum Standards and Standards for School Site Selection in Title 5 of the California Code of Regulations); should this site not be needed; a low medium density shall apply.

Open Space, Conservation, and Recreation Element

OSCR-4.7 **Erosion Control.** Manage erosion in the Planning Area, particularly in watershed areas, through on-site erosion control.

Sustainability Element

SUS-10.2 **Stormwater Management.** Require stormwater management techniques that minimize surface water runoff in public and private developments. Utilize low impact development techniques such as bioswales and other best management practices to manage stormwater.

Health and Safety Element

HS-1: Protect people and property from earthquakes and other geologic hazards.

HS-1.1 **Seismic Hazard Zones.** Require new development to be sited and designed to minimize risks from seismic events. Buildings for hu-man occupancy shall avoid surface traces of active faults and com-ply with the latest seismic and geologic safety structural standards, consistent with the Alquist-Priolo Earthquake Fault Zone Act and other relevant State laws.

HS-1.2 **Building Standards.** Continue to maintain and enforce appropriate building standards, such as the California Building Code, to ensure new development is designed to meet current safety standards associated with seismic activity.

HS-1.3 **Geologic Studies.** Require detailed geologic studies prior to issuance of building permits by a Registered Geologist, Certified Engineering Geologist, and/or Geotechnical Engineer for projects within areas of:

i. Potential seismic activity, including earthquake hazard zones shown in **Figure 8-1, 8-2, and 8-3**. Studies prepared shall identify the location of all surface fault traces within 100 feet of any proposed structure and determine their relative activity;
ii. Landslide potential;
iii. Liquefaction;
iv. Soils with high shrink/swell potential, or unstable soils; and
v. Slope grades in excess of 20 percent.

Strict engineering standards and adequate provisions for mitigation of potential hazards to human life or property shall also be included.

HS-1.4 **Erosion Control.** Require an erosion control and rehabilitation plan to be prepared for projects requiring substantial groundbreaking activities to control short-term and long-term erosion and sedimentation in nearby streams and rivers.

HS-1.5 **Rehabilitation and Retrofit.** Identify and catalogue structures that may be subject to serious structural damage in the event of a major earthquake, and provide information to property owners on ways to pay for rehabilitation or retrofit of existing buildings to minimize the potential for damage from an earthquake. Prioritize retrofit of City-owned critical facilities and buildings.

HS-1.6 **Transmission Facilities.** Restrict the crossing of Alquist-Priolo Act Special Studies zones by new public and private transmission facilities, including power, water, sewer, gas, and oil lines, to the extent practical and feasible. Require owners to file an operations plan documenting probable effects of transmission line failure at the fault and various emergency facilities and safety assurance procedures. Should transmission facility crossing be unavoidable, facility design shall include sufficient provisions for valves, switches and other ap-propriate equipment for minimizing adverse impacts to nearby development from fire, disruption of service, spillage, etc. as a result of fault displacement and be equipped with adequate emergency devices to shut off gas flows in the event of pipeline rupture due to fault displacement.

HS-1.7 **Protect Water Infrastructure from Seismic Activity.** Reinforce local direct-fed water systems, tanks, pumps and storage tanks that could potentially be damaged by seismic activity through various protection activities.

HS-1.8 **Seismic Hazard Coordination.** Work with other public agencies to reduce potential damage from earthquakes and other geologic hazards to "lifeline" utility, economic, and transportation systems, including Caltrans; PG&E, FSSD; and other utilities providers.

Public Facilities and Services Element

PFS-8.4 **New Development**. Require that all new development located within City limits connect to the public wastewater collection system, construct all sanitary sewer lines serving such development (including over-sizing of sewers if requested by Fairfield-Suisun Sewer District or the City; the costs of oversizing shall be borne by the beneficiary of the oversizing), and provide adequate funding for the development's use of all wastewater infrastructure and facilities.

PFS-9.3 **Storm Drainage Plan.** Prior to project approval, require new development and redevelopment projects to submit a storm drainage plan that meets the following requirements:

- Adherence to the City of Fairfield Standard Specifications and Details, Engineering Design Standards (Section 4 - Storm Drainage);
- Prevention of on and off-site flooding through "green infrastructure", Low Impact Development techniques and, if applicable, trash capture devices; and
- Demonstration of stormwater runoff volumes that are no greater than the capacity of any portion of the existing downstream system through utilization of detention, retention, or other approved methods of stormwater management.

IMPACTS

Impact 3.7-1 Implementation of the Proposed Project would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault; strong seismic ground shaking; seismically related ground failure, including liquefaction; or landslides. *(Less than Significant)*

Fault Rupture

For the Proposed Project, a significant impact due to fault rupture could occur if new structures were constructed within a designated Alquist-Priolo Earthquake Fault Zone, or within an active or

potentially active known fault. As discussed above, Fairfield has two Alquist-Priolo Fault Zones as shown in **Figure 3.7-2**, one surrounding the Green Valley fault line, and one surrounding the Cordelia fault line. In particular, the Cordelia fault line crosses the western portion of the Planning Area through Rockville Regional Park and the proposed new Cordelia neighborhood. This 380-acre SOI growth area west of Business Center Drive adds a new lower-medium density residential neighborhood in this area, punctuated by open space breaks to reflect topography and geologic constraints. Even so, if an earthquake would occur along the Green Valley or Cordelia faults, which run through the western portion of the Planning Area, fault rupture could occur along that fault line.

However, the Alquist-Priolo Earthquake Fault Zoning Act was passed to address the hazards of surface fault rupture. Generally, construction within 50 feet of an active fault zone is prohibited. In addition, compliance with CBC regulations incorporated in the Fairfield Municipal Code and Solano County Code and implementation of General Plan policies would minimize the risk of loss or damage dure to fault rupture. California Building Code earthquake protection standards apply to all newly constructed structures as well as older pre-code buildings that need to be reinforced in order to lessen the impact of a severe seismic event.

Additionally, Land Use Element Implementing Policy LU-6.5 ensures that development is reflective of the area's environmental constraints—including localized presence of geologic faults. Further, Health and Safety Element Implementing Policy HS-1.1 requires new development to be sited and designed to minimize risks from seismic events. Buildings for human occupancy shall avoid surface traces of active faults and comply with the latest seismic and geologic safety structural standards, consistent with the Alquist-Priolo Earthquake Fault Zone Act and other relevant State laws. Implementing Policy HS-1.2 continues to maintain and enforce appropriate building standards, such as the CBC, to ensure new development is designed to meet current safety standards associated with seismic activity. Implementing Policy HS-1.3 also requires detailed geologic studies prior to issuance of building permits for projects within areas of potential seismic activity. Studies prepared shall identify the location of all surface fault traces within 100 feet of any proposed structure and determine their relative activity. Strict engineering standards and adequate provisions for mitigation of potential hazards to human life or property shall also be included.

Therefore, compliance with existing regulations and continued implementation of General Plan policies would reduce potential impacts from surface fault rupture to the maximum extent practicable. Thus, the Proposed Project would have a less than significant impact with regards to adverse effects from fault rupture.

Ground Shaking

A significant impact due to ground shaking could occur if implementation of the Proposed Project would permit construction in an area that would experience ground shaking, such that substantial damage or harm to buildings or people could result. Generally speaking, fault activity has the potential to result in ground shaking, which can be of varying intensity depending on the magnitude of the event, the epicenter distance, the response of geologic materials, and the design and construction quality of structures. Ground shaking tends to be more severe in softer sediments such as alluvial deposits than in bedrock materials, because in alluvial deposits surface waves can

be amplified causing a longer duration of ground shaking. Areas where bedrock is exposed or located at relatively shallow depth tend to experience surface waves from an earthquake as more of a sharp jolt, compared to other areas (USGS, 2013). The Planning Area's proximity to active local faults places it at risk for strong ground shaking. As discussed above under *Seismic Shaking*, Fairfield could potentially feel ground shaking at a MMI of up to VII, very strong shaking with moderate damage, though it would most likely be at a lower intensity.

As discussed above, the Seismic Hazards Mapping Act regulates structures intended for human habitation in order to minimize damage due to seismic ground shaking. Additionally, development occurring under the Proposed Project would be required to conform to the current seismic design provisions of the 2022 CBC, adopted and incorporated into the Fairfield Municipal Code and Solano County Code. The CBC contains the latest seismic safety requirements to resist ground shaking through modern construction techniques, which are periodically updated to reflect the most recent seismic research. Compliance with existing regulations would reduce potential impacts from ground shaking to the maximum extent practicable. Thus, associated impacts would be less than significant.

Liquefaction

A significant impact due to liquefaction could occur if implementation of the Proposed Project would result in construction in areas of elevated liquefaction risk such that substantial damage or harm to buildings or people could result. As discussed above under *Liquefaction*, and shown in **Figure 3.7-3**, the Planning Area includes areas ranging from low to moderate liquefaction susceptibility. Due to their proximity to the Suisun Marsh, much of the central Fairfield and Cordelia neighborhoods have a moderate liquefaction susceptibility.

Potential impacts from ground failure resulting from liquefaction would be addressed through site-specific geotechnical studies prepared in accordance with CBC requirements as adopted in the Municipal and County Code and standard industry practices. Chapter 18 of the CBC requires the preparation of a preliminary soil report, engineering geologic report, geotechnical report, and supplemental ground-response report. As described in Chapter 18, Seismic Design Category C requires analysis of slope instability, liquefaction, and surface rupture attributable to faulting or lateral spreading. Categories D, E, and F require additional analyses as well as mitigation measures to be considered in structural design. While seismic hazards cannot be eliminated completely, adherence to the State and local regulatory requirements would minimize potential exposure of people and new structures to seismic hazard by requiring incorporation of hazard mitigation measures into project design. In addition, General Plan Implementing Policy HS-1.3 requires detailed geological studies prior to issuance of building permits for projects within areas of liquefaction, along with strict engineering standards and adequate provisions for mitigation. Therefore, impacts due to liquefaction are less than significant.

Landslides

Implementation of the Proposed Project could have a significant impact due to landslides if new development were to be located in areas with high landslide risk such that substantial damage or harm to buildings or people could result. Landslides may occur on slopes of 15 percent or less;

however, the probability is greater on steeper slopes that exhibit old landslide features such as steep slopes or banks, slanted vegetation, and transverse ridges. Landslide-susceptible areas are characterized by steep slopes and downslope creep of surface materials. As discussed above under *Landslides*, the slopes to the east and west of Green Valley are particularly vulnerable to landslides, as shown in **Figure 3.7-4**. The hills of the Rancho Solano area have a lower landslide susceptibility. While most of the Planning Area is in an area of little to no landslide susceptibility, there are some sites identified for development that experience moderate landslide risk.

Development on these sites and in areas with slope stability hazards would be subject to the provisions of the CBC, adopted and incorporated into the Municipal and County Codes, which regulate analysis of slope instability and requirements for drainage and grading. In addition, All New and Redevelopment projects shall comply with all applicable requirements set forth in Section C.3 of the NPDES Permit which includes best management practices (BMPs) to minimize stormwater runoff and erosion. Further, Chapter 22B of the Municipal Code and Chapter 31 of the County Code requires all construction site owners and contractors to implement stormwater management practices (BMPs), which prevent pollutants generated during construction from leaving the construction site and entering the County's stormwater system during wet or dry weather.

Proposed Project policies also seek to reduce slope stability hazards. Land Use Element Implementing Policy LU-6.5 ensures that development is reflective of the area's environmental constraints—including slopes/unstable soils. Implementing Policy OSCR-4.7 requires on-site erosion control. Implementing Policy HS-1.3 requires detailed geological studies prior to issuance of building permits for projects within areas of landslide potential, along with strict engineering standards and adequate provisions for mitigation. Implementing Policy HS-1.4 also requires an erosion control and rehabilitation plan to be prepared for projects requiring substantial groundbreaking activities to control short-term and long-term erosion and sedimentation in nearby streams and rivers.

Compliance with these NPDES, local Municipal and County Code regulations, and General Plan policies would reduce impacts related to landslides. Associated impacts would be less than significant.

Mitigation Measures

None required.

Impact 3.7-2 Implementation of the Proposed Project would not result in substantial soil erosion or the loss of topsoil. *(Less than Significant)*

Topsoil refers to the uppermost layer of soil, which has the highest concentration of organic matter, and where most biological soil activity occurs. Implementation of the Proposed Project could have a significant impact due to soil erosion or loss of topsoil if associated construction and development activities could expose soils to the effects of erosion, which could hinder proper drainage and stormwater management. Erosion control, particularly during grading, is necessary to avoid downstream sedimentation and flooding. Once disturbed, through the removal of vegetation, asphalt, or an entire structure, exposed and stockpiled soils could be affected by wind and water.

As discussed above under *Soil Erosion*, most of the Planning Area Most is underlain by soils have low erosion susceptibility. Further, since the Planning Area is primarily flat, the risk of soil erosion due to water runoff is relatively low.

Any project with soil disturbance of at least 500 square feet or 50 cubic yards would be required to submit an Erosion and Sediment Control Plan (ESCP), which would be subject to review and approval by the City. The ESCP would need to meet City standards of including erosion control best management practices (BMPs) such as avoidance of land-disturbing activities during the wet weather season, protection of existing vegetation, use of slope and slope stabilization BMPs, and containment of construction waste on-site.

Individual projects disturbing more than one acre of ground would be required to obtain coverage under the State Construction General Permit, which requires preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP); the SWPPP also must include BMPs to control contamination of surface flows and potential discharge of pollutants from commencement of construction through project completion. Further, Chapter 22B of the Municipal Code and Chapter 31 of the County Code requires all construction site owners and contractors to implement stormwater management practices (BMPs), which prevent pollutants generated during construction from leaving the construction site and entering the County's stormwater system during wet or dry weather.

Proposed Project policies also seek to reduce erosion and loss of topsoil. Land Use Element Implementing Policy LU-6.5 ensures that development is reflective of the area's environmental constraints—including slopes/unstable soils. Implementing Policy OSCR-4.7 requires on-site erosion control. Implementing Policy HS-1.3 requires detailed geological studies prior to issuance of building permits for projects within areas of unstable soils, along with strict engineering standards and adequate provisions for mitigation. Implementing Policy HS-1.4 also requires an erosion control and rehabilitation plan to be prepared for projects requiring substantial groundbreaking activities to control short-term and long-term erosion and sedimentation in nearby streams and rivers. Implementing Policy PFS-9.3 requires preparation of a storm drainage plan that includes low impact development techniques, which help to minimize erosion from runoff.

Accordingly, compliance with the Construction General Permit, Municipal and County Code requirements, Public Works Department General Development Conditions, and General Plan policies would ensure that the risk of substantial soil erosion or topsoil loss resulting from implementation of the Proposed Project will be less than significant.

Mitigation Measures

None required.

Impact 3.7-3 Implementation of the Proposed Project would not locate structures on expansive soils or on a geologic unit or soil that is unstable, or that would become unstable as a result of new development under the Proposed Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse. (*Less than Significant*)

Liquefaction and landslide hazards associated with implementation of the Proposed Project are examined under Impact 3.7-1, while potential impacts related to expansive soils are discussed below under Impact 3.7-4. Development associated with the implementation of the Proposed Project could be located on a geologic unit or soils that are susceptible to lateral spreading. As discussed above under *Lateral Spreading*, the factors determining the potential for lateral spreading are liquefiable soils and the proximity to an open face or slope. As shown in **Figure 3.7-3**, locations within the Planning Area that have liquefaction susceptibility have the highest risk of lateral spreading. The Planning Area includes areas ranging from low to moderate liquefaction susceptibility. Due to their proximity to the Suisun Marsh, much of the central Fairfield and Cordelia neighborhoods have a moderate liquefaction susceptibility.

Development associated with the implementation of the Proposed Project could be located on soils that pose a low risk of subsidence. As discussed above under *Subsidence*, the withdrawal of groundwater, oil, or natural gas can cause land to displace vertically. However, the USGS California Water Science Center does not identify Fairfield as an area that has experienced subsidence, and none of the projects which could be constructed under the Proposed Project would be allowed to withdraw groundwater, oil, or natural gas in a quantity great enough to result in subsidence (USGS, n.d.). Therefore, subsidence is unlikely to result from construction created under the Proposed Project. The Health and Safety Element Implementing Policy HS-1.3 also requires detailed geological studies prior to issuance of building permits for projects within areas of unstable soils, along with strict engineering standards and adequate provisions for mitigation. Compliance with existing regulations would ensure that impacts would be less than significant.

Mitigation Measures

None required.

Impact 3.7-4 Implementation of the Proposed Project would not be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property. *(Less than Significant)*

A significant impact could occur if new development under the Proposed Project would locate structures in areas on top of expansive soil that would create substantial risk to life or property. As described above, expansive soils, which swell and shrink as they gain and lose moisture and can result in damage to overlying structures. Many soils in the Planning Area are classified as "moderate" shrink-swell potential. Areas of high and very-high expansiveness occur in a number of locations, as seen in **Figure 3.7-1**. The Health and Safety Element Implementing Policy HS-1.3 requires detailed geological studies prior to issuance of building permits for projects within soils

with high shrink/swell potential, along with strict engineering standards and adequate provisions for mitigation. Therefore, compliance with existing regulations would ensure that expansive soil-related impacts would be less than significant.

Mitigation Measures

None required.

Impact 3.7-5 Implementation of the Proposed Project would not 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. *(Less than Significant)*

A significant impact could occur if new development under the Proposed Project would locate structures in areas without connection to the city's sanitary sewer system and on soils incapable of adequately supporting the use of septic tanks. However, proposed Public Facilities and Services Element Implementing Policy PFS-8.4 requires that all new development within city limits connect with the existing public wastewater system. The Municipal Code (Chapter 15.1) also requires the installation or replacement of sewer mains in certain areas of the city where it has been determined that existing sewer mains are inadequate or obsolete. Further, Chapter 6B requires that construction of sanitary sewers take place at such time as there are occupied lands to be served and that when such facilities are constructed, such shall be so sized and located as to be or become an integral part of the planned sewer system of the city. As such, new septic systems would not be permitted for proposed developments within city limits.

Further, Chapter 6.4 of the County Code establishes a comprehensive, uniform set of standards for the review and approval of on-site sewage disposal systems for individual lots and subdivisions in Solano County (which includes some areas within the Proposed Project's Sphere of Influence). The Chapter requires a connection to a public sewer system for all proposed lots, new development, additions, or remodels that propose to generate wastewater, and for existing structures requiring repairs to the septic system if sewer is available, and no permit for installation, repair, replacement or expansion of a septic system shall be issued if sewer is available. The Code requires that site evaluation and permits shall require a determination of the soil conditions in the area proposed for on-site sewage disposal systems and replacement areas. As such, in the event that the use of septic tanks is permitted outside the city limits during development under the Proposed Project, compliance with all requirements outlined in Chapter 6.4 the County Code would be required. As a result, related impacts would be less than significant.

Mitigation Measures

None required.

Impact 3.7-6 Implementation of the Proposed Project would not directly or indirectly destroy a unique paleontological resource or site or unique geologic feature. (*Less than Significant with Mitigation Incorporated*)

The geologic units exposed at and below ground surface in the Planning Area are composed primarily of Quaternary-age alluvium, consisting of an unstratified mix of sand, silt, clay, and gravel. These units are known to have yielded scientifically important fossils in the larger county. Based on Society of Vertebrate Paleontology (SVP) methods described under *Methodology and Assumptions* above, this geologic unit is considered to have high paleontological sensitivity. Because paleontological resources are located below ground surface, ground disturbing activities such as excavating, grading, and resurfacing could affect any paleontological resources present, including destruction of the resource.

A significant impact would occur if implementation of the Proposed Project would directly or indirectly destroy a unique paleontological resource or site or unique geological feature. Construction enabled by the Proposed Project would involve ground-disturbing activities that could extend into paleontologically sensitive geologic units. Therefore, construction enabled by the Proposed Project would disturb a geologic unit with high paleontological sensitivity and accordingly has potential to destroy unique paleontological resources. In addition, any operations or maintenance activities that would involve ground disturbance also has potential to destroy unique paleontological resources. The potential for destruction of unique paleontological resources is considered a significant impact. To further address potential impacts to paleontological resources, any project applicant pursuing construction under the Proposed Project would be required to adhere to Public Resources Code Section 5097.5, which prohibits the willful excavation, removal, destruction, injury, or defacing of any historic or prehistoric ruins, burial grounds, archaeological or vertebrate paleontological site. Any project applicant pursuing construction under the Proposed Project would also be required to implement **Mitigation Measures GEO-1 and GEO-2**, which require training to construction staff regarding paleontological resources and which establish protocols to follow in the event of the discovery of an unidentified paleontological resource, respectively. Through the conformance to Public Resources Code Section 5097.5 and adherence to **Mitigation Measures GEO-1 and GEO-2**, the impact would be less than significant.

Mitigation Measures

MM-GEO-1: **Worker Awareness Training.** Prior to commencing construction, and ongoing throughout ground-disturbing activities (e.g., excavation, utility installation), the applicants proposing development of projects within the Planning Area and/or their designee shall ensure that all project construction workers are trained on the contents of a paleontological resources alert sheet, as provided by the Fairfield Building Safety Division. The paleontological resources alert sheet shall be prominently displayed at the construction site during ground-disturbing activities for reference regarding potential paleontological resources. In addition, the project applicant shall inform the contractor and construction personnel of the immediate stop work procedures and other procedures to be followed if bones or other potential fossils are unearthed at the project site. Should new workers who will be involved in ground-disturbing construction activities begin employment after the

initial training has occurred, the construction supervisor shall ensure that they receive the worker awareness training as described above.

The applicant shall complete a standard form/affidavit confirming the timing of the worker awareness training to the City. The affidavit shall confirm the project's location, the date of training, the location of the informational handout display, and the number of participants. The affidavit shall be transmitted to the City within five business days of conducting the training.

MM GEO-2: **Halt Construction, Maintenance, or Landscaping Activity in Case of Finding Paleontological Resources, Evaluate Find, and Excavate Find.** In the event that previously unidentified paleontological resources are uncovered during site preparation, excavation, or other ground-disturbing activity, applicants proposing development of projects within the Planning Area shall cease all such activity within 25 feet of the discovery or ensure that all such activity within 25 feet of the discovery ceases until the resources have been evaluated by a qualified professional and specific measures can be implemented to protect these resources in accordance with Public Resources Code Section 5097.5. If the qualified paleontologist determines the find is potentially significant, the project applicant shall ensure a qualified paleontologist shall excavate the find in compliance with state law, document the find, and arrange for curation at a depository, keeping project delays to a minimum. If the qualified paleontologist determines the find is not significant, then the project will continue without delay.

Significance after mitigation: Less than significant