

This section describes the regional geology, site geology, faults and seismicity, seismic hazards, and non-seismic hazard conditions in the regional and the Plan Area. The purpose of this section is to disclose and analyze the potential impacts related to geology and soils associated with development of the proposed Specific Plan. Information in this section is based in part on the following documents, reports, and studies:

- *2000 Fresno County General Plan Background Report* (County of Fresno, 2000);
- *Fresno General Plan* (City of Fresno, 2014);
- *Draft Master Environmental Impact Report General Plan and Development Code Update, City of Fresno, Fresno County, California* (City of Fresno, 2014);
- *Fresno General Plan Public Review Draft Program Environmental Impact Report* (City of Fresno, 2020);
- *Fresno Municipal Code* (City of Fresno, 2007);
- *Geologic Hazards Investigation, Fresno General Plan Update* (Krazen and Associates, 2012);
- *Fresno County Multi-Hazard Mitigation Plan* (County of Fresno, 2018);
- *Cultural and Paleontological Resource Assessment for the Fresno West Area Specific Plan Project* (Cogstone, October 2019 – included in **Appendix D**; and
- *Web Soil Survey* (NRCS, 2019).

One comment was received during the public review period for the Notice of Preparation regarding this topic from Cathy Caples (August 2019). The portion of this comment letter which relates to this topic is addressed within this section. Full comments received are included in **Appendix A**.

3.6.1 ENVIRONMENTAL SETTING

REGIONAL GEOLOGY

The Plan Area is in the Great Valley Geomorphic Province, which is about 400 miles long and 50 miles wide between the Coast Ranges and Sierra Nevada. The Plan Area is in the San Joaquin Valley, the southerly of two large valleys comprising the province; the Sacramento Valley is the northerly valley. The San Joaquin Valley is surrounded by the Sierra Nevada to the east, the Coast Ranges to the west, the Tehachapi Mountains to the south, and the Sacramento Valley to the north.¹ The Fresno Metropolitan area is set on gently southwest-sloping alluvial fans and plains formed by the San Joaquin and Kings rivers.²

¹ California Geological Survey (CGS). 2002, December. Note 36: California Geomorphic Provinces. Available at: http://www.conservation.ca.gov/cgs/information/publications/cgs_notes/Pages/index.aspx.

² City of Fresno, 2014. Master Environmental Impact Report General Plan and Development Code Update City of Fresno, Fresno County, California, Section 5.6, Geology and Soils, July 22. <https://www.fresno.gov/darm/wp-content/uploads/sites/10/2016/11/Sec-05-06-Geo-Fresno-MEIR.pdf>, accessed September 3, 2019.

Great Valley Geomorphic Province

The Great Valley is an alluvial plain drained by the Sacramento and San Joaquin rivers, which join and enter San Francisco Bay. The eastern border is the west-sloping Sierran bedrock surface, which continues westward beneath alluvium and older sediments. The western border is underlain by east-dipping Cretaceous and Cenozoic strata that form a deeply buried synclinal trough, lying beneath the Great Valley along its western side.

SITE GEOLOGY

Soil Survey

A Web Soil Survey was completed for the Plan Area using the Natural Resources Conservation Service (NRCS) Web Soil Survey program. The NRCS Soils Map is provided in Figure 3.6-1. Table 3.6-1 identifies the type and range of soils found in the Plan Area.

TABLE 3.6-1: PLAN AREA SOILS

NAME	ACRES IN PLAN AREA	PERCENT OF PLAN AREA
Exeter loam	215.7	3.1%
Exeter sandy loam	1,227.6	17.5%
Exeter sandy loam, shallow	150.2	2.1%
Hanford gravelly sandy loam	15.0	0.2%
Hanford sandy loam, benches	17.3	0.2%
Hesperia fine sandy loam, moderately deep	1.7	0.0%
Pollasky fine sandy loam, 2-9% slopes	2.6	0.0%
Pollasky sandy loam, 9-15% slopes	5.3	0.1%
San Joaquin loam, 0-3% slopes	213.4	3.0%
San Joaquin loam, shallow, 0-3% slopes	757.6	10.8%
San Joaquin sandy loam, 0-3% slopes, MLRA 17	1,523.4	21.7%
San Joaquin sandy loam, shallow, 0-3% slopes	2,872.8	41.0%
Water	12.1	0.2%

SOURCE: NRCS WEB SOIL SURVEY, 2019.

Hanford sandy loam. This soil is located on approximately 32.3 acres on the northern corner of the Plan Area (see Figure 3.6-1). Hanford soils consists of very deep, well drained soils that formed in moderately coarse textured alluvium dominantly from granite. Hanford soils are on stream bottoms, floodplains and alluvial fans at elevations of 150 to 3,500 feet. Slopes range from 0 to 15 percent. The climate is dry subhumid mesothermal with hot, dry summers and cool, moist winters.

Exeter Loam. This soil is located throughout the plan area, particularly on the eastern half, covering approximately 1,593.5 acres of the Plan area (see Figure 3.6-1). The Exeter series consists of moderately deep to a duripan, moderately well drained soils that formed in alluvium mainly from granitic sources. Exeter soils are on alluvial fans and stream terraces and have slopes of 0 to 9 percent. This soil is used for irrigated cropland growing oranges, olives and deciduous orchards,

vineyards and row crops. It is also used for dairy and cattle production and building site development. Vegetation in uncultivated areas is mainly annual grasses and forbs. Moderately well drained; very slow to medium runoff; moderately slow permeability above the duripan. Permeability of the duripan is very slow.

Hesperia Sandy Loam. This soil is located on approximately 1.7 acres on the northern corner of the Plan Area (see Figure 3.6-1). The Hesperia series consists of very deep, well drained soils that formed in alluvium derived primarily from granite and related rocks. Hesperia soils are on alluvial fans, valley plains and stream terraces and have slopes of 0 to 9 percent. Used for desert range, and for production of irrigated orchards, row crops, field crops, grain, hay, pasture and grapes. Native vegetation consists of creosotebush in the high desert and sparse annuals in the valley. Well drained; negligible to low runoff, moderately rapid permeability.

Pollasky Sandy Loam. This soil is located on approximately 7.9 acres on the northern portion of the Plan Area (see Figure 3.6-1). The Pollasky series consists of moderately deep, well drained, moderately coarse textured Regosols formed in the residuum from softly to moderately consolidated arkosic sediments. They occur on undulating to steep dissected terraces under annual grasses and forbs. They have brown, slightly acid sandy loam A horizons and pale brown to yellowish brown, slightly acid to neutral, sandy loam C horizons abruptly overlying consolidated granitic sediments. Pollasky soils occur at elevations below 500 feet to semiarid mesothermal climate having a mean annual precipitation ranging from about 9 to 16 inches with hot, dry summers and cool, moist winters. The Pollasky series is mapped along the eastern edge of the San Joaquin Valley of California where it is moderately extensive. Used as annual range and dry farmed small grain, usually barley, with limited sprinkler irrigated pasture.

San Joaquin Loam. This soil is located throughout the entirety of the plan area on approximately 5,367.2 acres (see Figure 3.6-1). The San Joaquin series consists of moderately deep to a duripan, well and moderately well drained soils that formed in alluvium derived from mixed but dominantly granitic rock sources. They are on undulating low terraces with slopes of 0 to 9 percent. Well and moderately well drained; medium to very high runoff; very slow permeability. Some areas are subject to rare or occasional flooding. Typically used as cropland and livestock grazing; crops are small grains, irrigated pasture and rice; vineyards, fruit and nut crops.

FAULTS AND SEISMICITY

Faults and Fault Systems

A fault is a fracture in the crust of the earth along which rocks on one side have moved relative to those on the other side. A fault trace is the line on the earth's surface defining the fault. Displacement of the earth's crust along faults releases energy in the form of earthquakes and in some cases in fault creep. Most faults are the result of repeated displacements over a long period of time.

Surface rupture occurs when movement on a fault deep within the earth breaks through to the surface. Surface ruptures have been known to extend up to 50 miles with displacements of an inch

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to 20 feet. Fault rupture almost always follows preexisting faults, which are zones of weakness. Rupture may occur suddenly during an earthquake or slowly in the form of fault creep. Sudden displacements are more damaging to structures because they are accompanied by shaking.

The State of California designates faults as active, potentially active, and inactive depending on how recent the movement that can be substantiated for a fault. Table 3.6-2 presents the California fault activity rating system.

TABLE 3.6-2: FAULT ACTIVITY RATING

<i>FAULT ACTIVITY RATING</i>	<i>GEOLOGIC PERIOD OF LAST RUPTURE</i>	<i>TIME INTERVAL</i>
Active (A)	Holocene	Within last 11,700 Years
Potentially Active (PA)	Quaternary	Age Undifferentiated
Inactive (I)	Pre-Quaternary	Greater than 1.6 Million Years

SOURCE: CALIFORNIA DEPARTMENT OF CONSERVATION, FAULT ACTIVITY MAP OF CALIFORNIA.

No active faults are mapped within the City of Fresno.³ Active faults are those showing evidence of surface displacement within the last 11,000 years.⁴ The nearest faults to the Plan Area include the Nunez fault, located approximately 50 miles to the southwest, and the San Joaquin fault, located approximately 50 miles to the west of the Plan Area (see Figure 3.6-2). The San Andreas fault zone is located approximately 60 miles to the southwest of the Plan Area (see Figure 3.6-2).

Alquist-Priolo Special Study Zone

A fault rupture occurs when the surface of the earth breaks as a result of an earthquake, although this does not happen with all earthquakes. These ruptures generally occur in a weak area of an existing fault. Ruptures can be sudden (i.e. earthquake) or slow (i.e. fault creep). The Alquist-Priolo Fault Zoning Act requires active earthquake fault zones to be mapped and it provides special development considerations within these zones. The Plan Area does not have surface expression of active faults and fault rupture is not anticipated.

The nearest Alquist-Priolo Earthquake Fault Zone to the Plan Area is along the Nunez Fault about 50 miles to the southwest (see Figure 3.6-2).

Seismicity

The amount of energy available to a fault is determined by considering the slip-rate of the fault, its area (fault length multiplied by down-dip width), maximum magnitude, and the rigidity of the displaced rocks. These factors are combined to calculate the moment (energy) release on a fault. The total seismic energy release for a fault source is sometimes partitioned between two different recurrence models, the characteristic and truncated Gutenberg-Richter (G-R) magnitude-frequency distributions. These models incorporate our knowledge of the range of magnitudes and relative frequency of different magnitudes for a particular fault. The partition of moment and the weights for multiple models are given in the following summary.

³ U.S. Geologic Survey, 2019.

⁴ California Geological Survey, 2019. Alquist-Priolo Earthquake Fault Zoning Act, <https://www.conservation.ca.gov/cgs/alquist-priolo>, accessed September 3, 2019.

Earthquakes are generally expressed in terms of intensity and magnitude. Intensity is based on the observed effects of ground shaking on people, buildings, and natural features. By comparison, magnitude is based on the amplitude of the earthquake waves recorded on instruments, which have a common calibration. The Richter scale, a logarithmic scale ranging from 0.1 to 9.0, with 9.0 being the strongest, measures the magnitude of an earthquake relative to ground shaking. Table 3.6-3 provides a description and a comparison of intensity and magnitude.

The California Building Standards Code (CBSC) places all of California in the zone of greatest earthquake severity because recent studies indicate high potential for severe ground shaking.

TABLE 3.6-3: RICHTER MAGNITUDE SCALE FOR EARTHQUAKES

<i>RICHTER MAGNITUDE</i>	<i>EFFECTS OF INTENSITY</i>
0.1 – 0.9	Earthquake shaking not felt
1.0 – 2.9	Shaking felt by those at rest.
3.0 – 3.9	Felt by most people indoors, some can estimate duration of shaking.
4.0 – 4.5	Felt by most people indoors. Hanging objects rattle, wooden walls and frames creak.
4.6 – 4.9	Felt by everyone indoors, the duration of shaking can be estimated by most people. Standing autos rock. Crockery clashes, dishes rattle and glasses clink. Doors open, close and swing.
5.0 – 5.5	Felt by all who estimate duration of shaking. Sleepers awaken, liquids spill, objects are displaced, and weak materials crack.
5.6 – 6.4	People frightened and walls unsteady. Pictures and books thrown, dishes and glass are broken. Weak chimneys break. Plaster, loose bricks and parapets fall.
6.5 – 6.9	Difficult to stand. Waves on ponds, cohesionless soils slump. Stucco and masonry walls fall. Chimneys, stacks, towers, and elevated tanks twist and fall.
7.0 – 7.4	General fright as people are thrown down, hard to drive. Trees broken, damage to foundations and frames. Reservoirs damaged, underground pipes broken.
7.5 – 7.9	General panic. Ground cracks, masonry and frame buildings destroyed. Bridges destroyed, railroads bent slightly. Dams, dikes and embankments damaged.
8.0 – 8.4	Large landslides, water thrown, general destruction of buildings. Pipelines destroyed, railroads bent.
8.5 +	Total nearby damage, rock masses displaced. Lines of sight/level distorted. Objects thrown into air.

SOURCE: UNITED STATES GEOLOGICAL SURVEY.

SEISMIC HAZARDS

Seismic Ground Shaking

The Fresno region has historically been subject to low to moderate ground shaking. Two of the historic earthquakes that caused ground shaking in the region, the Owens Valley Earthquake of 1872 and the Coalinga Earthquake of 1983, each generated ground shaking of intensity VII in the region. Seismic ground shaking in the Plan Area is expected over the lifetime of the Specific Plan implementation.

Liquefaction

Liquefaction typically requires a significant sudden decrease of shearing resistance in cohesionless soils and a sudden increase in water pressure, which is typically associated with an earthquake of high magnitude. The potential for liquefaction is highest when groundwater levels are high, and loose, fine, sandy soils occur at depths of less than 50 feet. Liquefaction potential in the City of Fresno is considered low to moderate.⁵ No liquefaction has been observed in Fresno from any historic earthquake.⁶ Additionally, liquefaction zones have not been identified in Fresno County by the State.⁷

Seismic Ground Settlement

Ground shaking can cause unconsolidated sediments to settle. Due to the nature of the soils underlying the City, and the history of low to moderate ground shaking, seismic settlement is not considered a significant hazard in the region.⁸

Lateral Spreading

Lateral spreading typically results when ground shaking moves soil toward an area where the soil integrity is weak or unsupported, and it typically occurs on the surface of a slope, although it does not occur strictly on steep slopes. Oftentimes, lateral spreading is directly associated with areas of liquefaction. Lateral spreading is not considered a substantial hazard in the region for the same reasons given for seismic ground settlement.

Landslides

Landslides include rockfalls, deep slope failure, and shallow slope failure. Factors such as the geological conditions, drainage, slope, vegetation, and others directly affect the potential for landslides. One of the most common causes of landslides is construction activity that is associated with road building (i.e. cut and fill). The potential for landslides is considered remote in the Plan Area, as the site has a relatively flat slope. Additionally, landslide zones have not been identified in Fresno County by the State.⁹

⁵ Krazen and Associates, Inc. June 15, 2012. Geologic Hazards Investigation, Fresno General Plan Update.

⁶ County of Fresno. 2018. Fresno County Multi-Hazard Mitigation Plan. Available at: <https://www.co.fresno.ca.us/home/showdocument?id=24743>

⁷ California Department of Conservation. CGS Information Warehouse: Regulatory Maps. Accessed May 27, 2002. Available at: <https://maps.conservation.ca.gov/cgs/informationwarehouse/regulatorymaps/>

⁸ Krazen and Associates, Inc. 2012. Geologic Hazards Investigation, Fresno General Plan Update. Accessed on September 3, 2019.

⁹ California Department of Conservation. CGS Information Warehouse: Regulatory Maps. Accessed May 27, 2002. Available at: <https://maps.conservation.ca.gov/cgs/informationwarehouse/regulatorymaps/>

NON-SEISMIC HAZARDS

Expansive Soils

Expansive soils can undergo significant volume change with changes in moisture content. They shrink and harden when dried and expand and soften when wet. Soils underlying the Fresno region consist partly of clays that are considered slightly to moderately expansive.¹⁰ The Plan Area is not mapped as having moderate to high expansion potential (County of Fresno, 2018).

Erosion

Erosion naturally occurs on the surface of the earth as surface materials (i.e. rock, soil, debris, etc.) are loosened, dissolved, or worn away, and transported from one place to another by gravity. Two common types of soil erosion include wind erosion and water erosion. The steepness of a slope is an important factor that affects soil erosion. Erosion potential in soils is influenced primarily by loose soil texture and steep slopes. Loose soils can be eroded by water or wind forces, whereas soils with high clay content are generally susceptible only to water erosion. The potential for erosion generally increases as a result of human activity, primarily through the development of facilities and impervious surfaces and the removal of vegetative cover.

The Fresno County Multi-Hazard Mitigation Plan identifies two types of areas with moderate to high erosion potential: 1) certain soil types in the Sierra Nevada and foothills (both Sierra Nevada and Coast Ranges) on slopes generally over 30 percent, and 2) certain soil types in the western San Joaquin Valley and the Coast Ranges, both in western Fresno County. The Plan Area is not mapped in an area of moderate to high erosion potential (County of Fresno, 2018).

Subsidence

Land subsidence is the gradual settling or sinking of an area with little or no horizontal motion due to changes taking place underground. It is a natural process, although it can also occur (and is greatly accelerated) as a result of human activities. Common causes of land subsidence from human activity include: pumping water, oil, and gas from underground reservoirs; dissolution of limestone aquifers (sinkholes); collapse of underground mines; drainage of organic soils; and initial wetting of dry soils. The Fresno region is not known to be subject to subsidence hazards. Areas of subsidence in Fresno County mapped in the Multi-Hazard Mitigation Plan are in western Fresno County over 20 miles west and southwest from the Plan Area (County of Fresno, 2018).

MINERAL RESOURCE CLASSIFICATION

Pursuant to Surface Mining and Reclamation Act (SMARA), the California State Mining and Geology Board oversees the mineral resource zone (MRZ) classification system. The MRZ system characterizes both the location and known/presumed economic value of underlying mineral resources. The mineral resource classification system uses four main MRZs based on the degree of available geologic information, the likelihood of significant mineral resource occurrence, and the

¹⁰ Krazen and Associates, Inc. 2012. Geologic Hazards Investigation, Fresno General Plan Update. Accessed on September 3, 2019.

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known or inferred quantity of significant mineral resources. The four classifications are described in Table 3.6-4.

TABLE 3.6-4: MINERAL RESOURCE CLASSIFICATION SYSTEM

CLASSIFICATION	DESCRIPTION
MRZ-1	Areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence.
MRZ-2	Areas where adequate information indicates that significant mineral deposits are present, or where it is judged that a high likelihood exists for their presence.
MRZ-3	Areas containing mineral deposits, the significance of which cannot be evaluated.
MRZ-4	Areas where available information is inadequate for assignment to any other MRZ classification.

SOURCE: CALIFORNIA DEPARTMENT OF CONSERVATION DIVISION OF MINES AND GEOLOGY, 2002.

MINERAL RESOURCES

Mineral resources include commercially viable oil and gas deposits, and nonfuel mineral resources deposits. Nonfuel mineral resources include metals such as gold, silver, iron, and copper; industrial metals such as boron compounds, rare-earth elements, clays, limestone, gypsum, salt, and dimension stone; and construction aggregate, including sand, gravel, and crushed stone. California is the largest producer of sand and gravel in the nation.

According to Fresno County's existing General Plan Background Report, Fresno County has been a leading producer of minerals because of the abundance and wide variety of mineral resources that are present in the county. Extracted resources include aggregate products (sand and gravel), fossil fuels (oil and coal), metals (chromite, copper, gold, mercury, and tungsten), and other minerals used in construction or industrial applications (asbestos, high-grade clay, diatomite, granite, gypsum, and limestone). Aggregate and petroleum have been historically considered the county's most significant extractive mineral resources.

The principal area for mineral resources in the City is located in and immediately adjacent to the San Joaquin River Corridor. However, the Plan Area is located outside of the immediate vicinity of the San Joaquin River corridor.

The City of Fresno permits mining only within the Mining (M) Overlay District (Citywide Development Code). The Plan Area does not include any land within the M Overlay District. MRZ-2 zones are those areas documented to have regionally significant mineral resources; the Plan Area is not within a MRZ-2 zone. The boundaries of the Plan Area are classified as MRZ-3, which are defined as potential, but unproven mineral resource reserves (State of California, Division of Mines and Geology, Open File Report 99-02).

LOCATION OF PERMITTED AGGREGATE MINES

The California Office of Mine Reclamation periodically publishes a list of qualified permitted aggregate mines regulated under SMARA that is generally referred to as the AB 3098 List. The Public Contract Code precludes mining operations that are not on the AB 3098 List from selling sand, gravel, aggregates or other mined materials to State or local agencies. As of February 27,

2020, there are no aggregate mines on the AB 3098 list within the Plan Area. The closest mine is located approximately 0.5 miles west of the Plan Area (the Glamis Pit-Reclaimed Mine; Mine ID # 91-13-0094).

3.6.2 REGULATORY SETTING

The following is an overview of the State and local regulations that are applicable to the proposed Specific Plan.

STATE

The State of California has established a variety of regulations and requirements related to seismic safety and structural integrity, including the California Building Code, the Alquist-Priolo Earthquake Fault Zoning Act and the Seismic Hazards Mapping Act.

California Building Standards Code

The California Building Standards Code (CBSC) is included in Title 24 of the California Code of Regulations (CCR) and includes the California Building Code (CBC). Under State law, all building standards must be centralized in Title 24 or they are not enforceable.

The CBSC is a compilation of three types of building criteria from three different origins:

- Building standards that have been adopted by State agencies without change from building standards contained in national model codes;
- Building standards that have been adopted and adapted from the national model code standards to meet California conditions; and
- Building standards, authorized by the California legislature, that constitute extensive additions not covered by the model codes that have been adopted to address particular California concerns.

Through the CBSC, the State provides a minimum standard for building design and construction. The CBSC contains specific requirements for seismic safety, excavation, foundations, retaining walls, and site demolition. It also regulates grading activities, including drainage and erosion control.

The potential for seismic ground shaking is expected in California. As a result of the foreseeable seismicity in California, the State requires special design considerations for all structural improvements in accordance with the seismic design provisions in the CBSC. These seismic design provisions require enhanced structural integrity based on several risk parameters.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act of 1972 sets forth the policies and criteria of the State Mining and Geology Board, which governs the exercise of governments' responsibilities to prohibit the location of developments and structures for human occupancy across the trace of active faults. The policies and criteria are limited to potential hazards resulting from surface

faulting or fault creep within Earthquake Fault Zones, as delineated on maps officially issued by the State Geologist. Working definitions include:

- Fault – a fracture or zone of closely associated fractures along which rocks on one side have been displaced with respect to those on the other side;
- Fault Zone – a zone of related faults, which commonly are braided and sub parallel, but may be branching and divergent. A fault zone has a significant width (with respect to the scale at which the fault is being considered, portrayed, or investigated), ranging from a few feet to several miles;
- Sufficiently Active Fault – a fault that has evidence of Holocene surface displacement along one or more of its segments or branches (last 11,000 years); and
- Well-Defined Fault – a fault whose trace is clearly detectable by a trained geologist as a physical feature at or just below the ground surface. The geologist should be able to locate the fault in the field with sufficient precision and confidence to indicate that the required site-specific investigations would meet with some success.

“Sufficiently Active” and “Well Defined” are the two criteria used by the State to determine if a fault should be zoned under the Alquist-Priolo Act.

The California legislature passed the Alquist-Priolo Special Studies Zone Act in 1972 to address seismic hazards associated with faults and to establish criteria for developments for areas with identified seismic hazard zones. The California Geologic Survey (CGS) evaluates faults with available geologic and seismologic data and determines if a fault should be zoned as active, potentially active, or inactive. If CGS determines a fault to be active, then it is typically incorporated into a Special Studies Zone in accordance with the Alquist-Priolo Earthquake Hazard Act. Alquist-Priolo Special Study Zones are usually one-quarter mile or less in width and require site-specific evaluation of fault location and require a structure setback if the fault is found traversing a Project site.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act, passed in 1990, addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically-induced landslides. Under the Act, seismic hazard zones are to be mapped by the State Geologist to assist local governments in land use planning. The program and actions mandated by the Seismic Hazards Mapping Act closely resemble those of the Alquist-Priolo Earthquake Fault Zoning Act (which addresses only surface fault-rupture hazards) and are outlined below:

The State Geologist is required to delineate the various “seismic hazard zones.”

- Cities and Counties, or other local permitting authority, must regulate certain development “projects” within the zones. They must withhold the development permits for a site within a zone until the geologic and soil conditions of the site are investigated and appropriate mitigation measures, if any, are incorporated into development plans.
- The State Mining and Geology Board provides additional regulations, policies, and criteria, to guide cities and counties in their implementation of the law. The Board also provides

guidelines for preparation of the Seismic Hazard Zone Maps and for evaluating and mitigating seismic hazards.

- Sellers (and their agents) of real property within a mapped hazard zone must disclose that the property lies within such a zone at the time of sale.

National Pollutant Discharge Elimination System (NPDES)

National Pollutant Discharge Elimination System (NPDES) permits are required for discharges of pollutants to navigable waters of the United States, which includes any discharge to surface waters, including lakes, rivers, streams, bays, the ocean, dry stream beds, wetlands, and storm sewers that are tributary to any surface water body. NPDES permits are issued under the Federal Clean Water Act, Title IV, Permits and Licenses, Section 402 (33 USC 466 et seq.)

The Regional Water Quality Control Board (RWQCB) issues these permits in lieu of direct issuance by the Environmental Protection Agency, subject to review and approval by the Environmental Protection Agency Regional Administrator. The terms of these NPDES permits implement pertinent provisions of the Federal Clean Water Act and the Act's implementing regulations, including pre-treatment, sludge management, effluent limitations for specific industries, and anti-degradation. In general, the discharge of pollutants is to be eliminated or reduced as much as practicable so as to achieve the Clean Water Act's goal of "fishable and swimmable" navigable (surface) waters. Technically, all NPDES permits issued by the RWQCB are also Waste Discharge Requirements issued under the authority of the California Water Code.

These NPDES permits regulate discharges from publicly owned treatment works, industrial discharges, stormwater runoff, dewatering operations, and groundwater cleanup discharges. NPDES permits are issued for five years or less, and are therefore to be updated regularly. The rapid and dramatic population and urban growth in the Central Valley Region has caused a significant increase in NPDES permit applications for new waste discharges. To expedite the permit issuance process, the RWQCB has adopted several general NPDES permits, each of which regulates numerous discharges of similar types of wastes. The SWRCB issues general permits for stormwater runoff from construction sites statewide. Stormwater discharges from industrial and construction activities in the Central Valley Region can be covered under these general permits, which are administered jointly by the SWRCB and RWQCB.

In accordance with the NPDES General Construction Permit requirements, a Storm Water Pollution Prevention Plan (SWPPP) is required for projects that disturb at least one acre of soil. The SWPPP must be submitted to the RWQCB.

Mandated by Congress under the Clean Water Act, the NPDES Stormwater Program is a comprehensive two-phased national program for addressing the non-agricultural sources of stormwater discharges which adversely affect the quality of our nation's waters. The program uses the National Pollutant Discharge Elimination System (NPDES) permitting mechanism to require the implementation of controls designed to prevent harmful pollutants, including soil erosion, from being washed by stormwater runoff into local water bodies. The construction activities that would

occur as part of Specific Plan implementation would be governed by the General Permit 2009-0009-DWQ (amended by 2010-0014-DWQ & 2012-0006-DWQ), which states:

“...Particular attention must be paid to large, mass graded sites where the potential for soil exposure to the erosive effects of rainfall and wind is great and where there is potential for significant sediment discharge from the site to surface waters. Until permanent vegetation is established, soil cover is the most cost-effective and expeditious method to protect soil particles from detachment and transport by rainfall. Temporary soil stabilization can be the single most important factor in reducing erosion at construction sites. The discharger is required to consider measures such as: covering disturbed areas with mulch, temporary seeding, soil stabilizers, binders, fiber rolls or blankets, temporary vegetation, and permanent seeding. These erosion control measures are only examples of what should be considered and should not preclude new or innovative approaches currently available or being developed. Erosion control BMPs should be the primary means of preventing storm water contamination, and sediment control techniques should be used to capture any soil that becomes eroded...”

General Permit 2009-0009-DWQ (amended by 2010-0014-DWQ & 2012-0006-DWQ) further states that:

“Sediment control BMPs should be the secondary means of preventing storm water contamination. When erosion control techniques are ineffective, sediment control techniques should be used to capture any soil that becomes eroded. The discharger is required to consider perimeter control measures such as: installing silt fences or placing straw wattles below slopes. These sediment control measures are only examples of what should be considered and should not preclude new or innovative approaches currently available or being developed...Inappropriate management of run-on and runoff can result in excessive physical impacts to receiving waters from sediment and increased flows. The discharger is required to manage all run-on and runoff from a project site. Examples include: installing berms and other temporary run-on and runoff diversions...All measures must be periodically inspected, maintained and repaired to ensure that receiving water quality is protected. Frequent inspections coupled with thorough documentation and timely repair is necessary to ensure that all measures are functioning as intended...”

State Laws Pertaining to Paleontological Resources

Section 5097.5 of the California Public Resources Code prohibits “knowing and willful” excavation, removal, destruction, injury, and defacement of any “vertebrate paleontological site, including fossilized footprints,” on public lands, except where the agency with jurisdiction has granted express permission. “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.”

Section 30244 of the California Public Resources Code requires reasonable mitigation for impacts on paleontological resources that occur as a result of development on public lands.

The California Administrative Code relating to the State Division of Beaches and Parks affords protection to geologic features and “paleontological materials” but grant the director of the State park system authority to issue permits for specific activities that may result in damage to such resources, if the activities are in the interest of the State park system and for State park purposes (California Administrative Code, Title 14, Section 4307–4309).

LOCAL

Fresno General Plan

The Fresno General Plan establishes the following objectives and policies directly related to geology and soils.

NOISE AND SAFETY ELEMENT

Objective NS-2: Minimize risks of property damage and personal injury posed by geologic and seismic risks.

Policy NS-2-a: Seismic Protection. Ensure seismic protection is incorporated into new and existing construction, consistent with the Fresno Municipal Code.

Policy NS-2-b: Soil Analysis Requirement. Identify areas with potential geologic and/or soils hazards, and require development in these areas to conduct a soil analysis and mitigation plan by a registered civil engineer (or engineering geologist specializing in soil geology) prior to allowing on-site drainage or disposal for wastewater, stormwater runoff, or swimming pool/spa water.

PUBLIC UTILITIES AND SERVICES ELEMENT

Objective PU-5: Preserve groundwater quality and ensure that the health and safety of the entire Fresno community is not impaired by use of private, on-site disposal systems.

Policy PU-5-a: Mandatory Septic Conversion. Continue to evaluate and pursue where determined appropriate the mandatory abatement of existing private wastewater disposal (septic) systems and mandatory connection to the public sewage collection and disposal system.

Policy PU-5-b: Non-Regional Treatment. Discourage, and when determined appropriate, oppose the use of private wastewater (septic) disposal systems, community wastewater disposal systems, or other nonregional sewage treatment and disposal systems within or adjacent to the Metropolitan Area if these types of wastewater treatment facilities would cause discharges that could result in groundwater degradation.

Fresno Municipal Code

The City of Fresno has incorporated and adopted the 2016 CBC with the City's amendments as Municipal Code Section 11-102, referred to as the Fresno Building Code.

A preliminary soils report is required under Municipal Code Section 12-1022 for every subdivision for which a final map is required. Grading and erosion control requirements are set forth in Section 12-1023.

3.6.3 IMPACTS AND MITIGATION MEASURES

THRESHOLDS OF SIGNIFICANCE

Consistent with Appendix G of the CEQA Guidelines, the Specific Plan will have a significant impact on geology, soils, and seismicity if it will:

- Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:
 - 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;
 - Strong seismic ground shaking;
 - Seismic-related ground failure, including liquefaction; and/or
 - Landslides;
- Result in substantial soil erosion or the loss of topsoil;
- 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;
- 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; and/or
- Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

There would be **no impact** associated with the use of septic tanks or alternative wastewater disposal systems, since septic tanks or alternative wastewater systems would not be implemented within the Plan Area as part of Specific Plan implementation. Therefore, this issue will not be addressed further.

Additionally, consistent with Appendix G of the CEQA Guidelines, the proposed project will have a significant impact on mineral resources if it would:

- Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State; and/or
- Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan.

IMPACTS AND MITIGATION

Impact 3.6-1: Specific Plan implementation would not directly or indirectly cause potential substantial adverse effects involving strong seismic ground shaking or seismic related ground failure. (Less than Significant)

The Plan Area is not within an Alquist-Priolo Special Study Zone. There are no known faults (active, potentially active, or inactive) that traverse the city. Faults with known or estimated activity during the Holocene are generally located in the San Francisco Bay Area to the west, or in the Lake Tahoe area to the east. However, the CBSC places all of California in the zone of greatest earthquake severity because recent studies indicate high potential for severe ground shaking.

There is the potential for groundshaking caused by seismic activity anywhere in California, including the Plan Area. In order to minimize potential damage to the buildings and site improvements, all construction in California is required to be designed in accordance with the latest seismic design standards of the CBC. Design in accordance with these standards would reduce any potential impact to a *less than significant* level. Refer to Impact 3.6-3 for a discussion of impacts related to landslides, lateral spreading, subsidence, and liquefaction.

Impact 3.6-2: Specific Plan construction and implementation has the potential to result in substantial soil erosion or the loss of topsoil. (Less than Significant with Mitigation)

Although the Plan Area is not mapped in an area of moderate to high erosion potential, soil erosion and the loss of topsoil is one of the most common sources of polluted stormwater runoff during construction activities. When left uncontrolled, storm water runoff can erode soil and cause sedimentation in waterways, which collectively result in the destruction of fish, wildlife, and aquatic life habitats; a loss in aesthetic value; and threats to public health due to contaminated food, drinking water supplies, and recreational waterways.

As noted above in the Regulatory Setting, the future construction activities that would occur as part of Specific Plan implementation would be governed by the General Permit 2009-0009-DWQ (amended by 2010-0014-DWQ & 2012-0006-DWQ). Construction activities associated with implementation of the Specific plan, would be required to comply with all requirements set forth in the NPDES permit for construction activities, including preparation of a SWPPP containing Best Management Practices (BMPs) to reduce erosion and sediments to meet water quality standards. Such BMPs may include: temporary erosion control measures such as silt fences, staked straw bales/wattles, silt/sediment basins and traps, check dams, geofabric, sandbag dikes, and temporary revegetation or other ground cover. The BMPs and overall SWPPP is reviewed by the Regional Water Quality Control Board as part of the permitting process. The SWPPP, once approved, is kept on site and implemented during construction activities and must be made available upon request to representatives of the RWQCB and/or the lead agency.

Nevertheless, in accordance with the NPDES Stormwater Program, Mitigation Measure 3.6-1 requires an approved SWPPP designed to control erosion and the loss of topsoil to the extent practicable using BMPs that the RWQCB has deemed effective in controlling erosion, sedimentation, runoff during construction activities. The RWQCB has stated that these erosion control measures are only examples of what should be considered and should not preclude new or innovative approaches currently available or being developed. The specific controls are subject to the review and approval by the RWQCB and are existing regulatory requirements. Additionally, as discussed in Section 3.3, Air Quality, construction activities would be subject to the San Joaquin Valley Air Pollution Control District rules and regulations pertaining to dust control. Specifically, Under Rule 8021, a Dust Control Plan is required for any residential project that will include 10 or more acres of disturbed surface area, a nonresidential project with 5 or more acres of disturbed surface area, or a project that relocates 2,500 cubic yards per day of bulk materials for at least three days. The Dust Control Plan is required to be submitted to SJVAPCD prior to the start of any construction activity. The Dust Control Plan must also describe fugitive dust control measure to be implemented before, during, and after any dust-generating activity. For sites smaller than those listed above, the project is still required to notify SJVAPCD a minimum of 48 hours prior to commencing earthmoving activities.

Implementation of Mitigation Measures 3.6-1, and compliance with the Dust Control Plan required by SJVAPCD Rule 8021, would ensure that construction during Specific Plan implementation would have a ***less than significant*** impact relative to this topic.

MITIGATION MEASURE(S)

Mitigation Measure 3.6-1: Prior to clearing, grading, and disturbances to the ground such as stockpiling, or excavation for each phase of the Project, the Project proponent shall submit a Notice of Intent (NOI) and Storm Water Pollution Prevention Plan (SWPPP) to the RWQCB to obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit Order 2009-0009-DWQ amended by 2010-0014-DWQ & 2012-0006-DWQ). The SWPPP shall be designed with Best Management Practices (BMPs) that the RWQCB has deemed as effective at reducing erosion, controlling sediment, and managing runoff. These include: covering disturbed areas with mulch, temporary seeding, soil stabilizers, binders, fiber rolls or blankets, temporary vegetation, and permanent seeding. Sediment control BMPs, installing silt fences or placing straw wattles below slopes, installing berms and other temporary run-on and runoff diversions. These BMPs are only examples of what should be considered and should not preclude new or innovative approaches currently available or being developed. Final selection of BMPs will be subject to approval by City of Fresno and the RWQCB. The SWPPP will be kept on site during construction activity and will be made available upon request to representatives of the RWQCB.

Impact 3.6-3: Specific Plan implementation has the potential to be located on a geologic unit or soil that is unstable, or that would become unstable as a result of Specific Plan implementation, and potentially result in landslide, lateral spreading, subsidence, liquefaction or collapse. (Less than Significant with Mitigation)

LIQUEFACTION

As stated above, the Plan Area is not located within an area mapped by the State as having the potential for liquefaction. Liquefaction potential in the City of Fresno is considered low to moderate and liquefaction has not been observed in Fresno from any historic earthquake. Additionally, liquefaction zones have not been identified in Fresno County by the State.¹¹ Nevertheless, Mitigation Measure 3.6-2 is included below. This measure requires that future project proponents in the Plan Area complete and submit a final geotechnical evaluation of the soils at a design-level, as required by the requirements of the California Building Code Title 24, Part 2, Chapter 18, Section 1803.1.1.2.

LATERAL SPREADING

Lateral spreading is not considered a substantial hazard in the region. However, since the potential for liquefaction is low to moderate within the Plan Area, the potential for lateral spreading is also present. As such, Mitigation Measure 3.6-2 is included below. This measure requires that future project proponents in the Plan Area complete and submit a final geotechnical evaluation of the soils at a design-level, as required by the requirements of the California Building Code Title 24, Part 2, Chapter 18, Section 1803.1.1.2.

LANDSLIDES

As noted previously, landslide zones have not been identified in Fresno County by the State.¹² The Plan Area is essentially flat; therefore, the potential for a landslide within the Plan Area is virtually non-existent.

SUBSIDENCE

Areas of subsidence in Fresno County mapped in the Multi-Hazard Mitigation Plan are in western Fresno County over 20 miles west and southwest from the Plan Area.¹³ The Fresno region is not known to be subject to subsidence hazards. Areas of subsidence in Fresno County mapped in the

¹¹ California Department of Conservation. CGS Information Warehouse: Regulatory Maps. Accessed May 27, 2002. Available at: <https://maps.conservation.ca.gov/cgs/informationwarehouse/regulatorymaps/>

¹² California Department of Conservation. CGS Information Warehouse: Regulatory Maps. Accessed May 27, 2002. Available at: <https://maps.conservation.ca.gov/cgs/informationwarehouse/regulatorymaps/>

¹³ County of Fresno. 2018. Fresno County Multi-Hazard Mitigation Plan. Available at: <https://www.co.fresno.ca.us/home/showdocument?id=24743>

3.6 GEOLOGY, SOILS AND SEISMICITY

Multi-Hazard Mitigation Plan are in western Fresno County over 20 miles west and southwest from the Plan Area (County of Fresno, 2018).

CONCLUSION

The Plan Area does not have a significant risk of becoming unstable as a result landslide, subsidence, or soil collapse. There is a potential for liquefaction, liquefaction induced settlement, and lateral spreading. However, through the implementation of Mitigation Measure 3.6-2, implementation of the Specific Plan would have a ***less than significant*** impact relative to this topic.

MITIGATION MEASURE(S)

Mitigation Measure 3.6-2: *Prior to earthmoving activities associated with future development activities within the Plan Area , a certified geotechnical engineer, or equivalent, shall be retained to perform a final geotechnical evaluation of the soils at a design-level as required by the requirements of the California Building Code Title 24, Part 2, Chapter 18, Section 1803.1.1.2 related to expansive soils and other soil conditions. The evaluation shall be prepared in accordance with the standards and requirements outlined in California Building Code, Title 24, Part 2, Chapter 16, Chapter 17, and Chapter 18, which addresses structural design, tests and inspections, and soils and foundation standards. The final geotechnical evaluation shall include design recommendations to ensure that soil conditions do not pose a threat to the health and safety of people or structures, including threats from liquefaction or lateral spreading. The grading and improvement plans, as well as the storm drainage and building plans shall be designed in accordance with the recommendations provided in the final geotechnical evaluation.*

Impact 3.6-4: The Specific Plan would not be located on expansive soil creating substantial risks to life or property. (Less than Significant)

Soils underlying the Fresno region consist partly of clays that are considered slightly to moderately expansive.¹⁴ The Plan Area is not mapped as having moderate to high expansion potential.¹⁵

The California Building Code Title 24, Part 2, Chapter 18, Section 1803.1.1.2 requires specific geotechnical evaluation when a preliminary geotechnical evaluation determines that expansive or other special soil conditions are present, which, if not corrected, would lead to structural defects. Mitigation Measure 3.6-2, presented above, provides the requirement for a final geotechnical evaluation in accordance with the standards and requirements outlined in the California Building Code, Title 24, Part 2, Chapter 16, Chapter 17, and Chapter 18, which addresses structural design, tests and inspections, and soils and foundation standards. The final geotechnical evaluation would include design recommendations to ensure that soil conditions do not pose a threat to the health and safety of people or structures. The grading and improvement plans, as well as the storm

¹⁴ Krazen and Associates, Inc. 2012. Geologic Hazards Investigation, Fresno General Plan Update. Accessed on September 3, 2019.

¹⁵ County of Fresno. 2018. Fresno County Multi-Hazard Mitigation Plan. Available at: <https://www.co.fresno.ca.us/home/showdocument?id=24743>

drainage and building plans, are required to be designed in accordance with the recommendations provided in the final geotechnical evaluation. With the implementation of Mitigation Measure 3.6-2 (requiring a final Geotechnical Evaluation and implementation of site recommendations), implementation of the Specific Plan would have a ***less than significant*** impact relative to this topic.

MITIGATION MEASURE(S)

*Implement **Mitigation Measure 3.6-2.***

Impact 3.6-5: Project implementation has the potential to directly or indirectly destroy a unique paleontological resource. (Less than Significant with Mitigation)

Although no paleontological resources have been recorded within the Plan Area, unknown resources may be present. It is possible that undiscovered paleontological resources could be encountered during ground-disturbing activities.

Damage to or destruction of a paleontological resource would be considered a potentially significant impact under local, State, or federal criteria. Implementation of Mitigation Measure 3.6-3 would ensure steps would be taken to reduce impacts to paleontological resources in the event that they are discovered during construction. This mitigation measure would reduce this impact to a ***less than significant*** level.

MITIGATION MEASURE(S)

Mitigation Measure 3.6-3: If any paleontological resources are found during grading and construction activities, all work shall be halted immediately within a 200-foot radius of the discovery until a qualified paleontologist has evaluated the find.

Work shall not continue at the discovery site until the paleontologist evaluates the find and makes a determination regarding the significance of the resource and identifies recommendations for conservation of the resource, including preserving in place or relocating within the Plan Area, if feasible, or collecting the resource to the extent feasible and documenting the find with the University of California Museum of Paleontology.

Impact 3.6-6: Specific Plan implementation would not have the potential to result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State, or in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan. (Less than Significant)

The City of Fresno permits mining only within the Mining (M) Overlay District (Citywide Development Code). Moreover, the boundaries of the Plan Area are classified as MRZ-3, which are defined as potential, but unproven mineral resource reserves (State of California, Division of Mines

and Geology, Open File Report 99-02). MRZ-2 zones are those areas documented to have regionally significant mineral resources.


As of February 27, 2020, there are no aggregate mines on the AB 3098 list within the Plan Area. The closest mine is located approximately 0.5 miles west of the Plan Area (the Glamis Pit-Reclaimed Mine; Mine ID # 91-13-0094). Therefore, implementation of the proposed Project would have a ***less than significant*** impact relative to this environmental topic.


**CITY OF FRESNO
SPECIFIC PLAN OF THE WEST AREA**

Figure 3.6-1. Soil Types

NRCS SOIL CLASSIFICATION	ACRES WITHIN THE SPECIFIC PLAN OF THE WEST AREA
Delhi loamy sand	10.1
Delhi loamy sand, 0-3% slopes, MLRA 17	0.6
Delhi loamy sand, 3-9% slopes	9.5
Exeter loam	1,616.2
Exeter loam	232.8
Exeter sandy loam	1,232.9
Exeter sandy loam, shallow	150.5
Hanford loam	43.3
Hanford fine sandy loam, silty substratum	5.2
Hanford gravelly sandy loam	17.9
Hanford sandy loam, benches	20.1
Hesperia loam	4.8
Hesperia fine sandy loam, deep	4.8
Pits	9.7
Pits	9.7
Pollasky loam	8.5
Pollasky fine sandy loam, 2-9% slopes	2.6
Pollasky sandy loam, 9-15% slopes	5.9
San Joaquin loam	5,372.7
San Joaquin loam, 0-3% slopes	213.3
San Joaquin loam, shallow, 0-3% slopes	757.3
San Joaquin sandy loam, 0-3% slopes	1,522.3
San Joaquin sandy loam, shallow, 0-3% slopes	2,879.8
Water	12.1
Water	12.1


BOUNDARIES

 Specific Plan of the West Area


 Fresno City Limits

 Fresno Sphere of Influence

MAP UNIT GROUP

 Delhi loamy sand

 Exeter loam

 Hanford loam

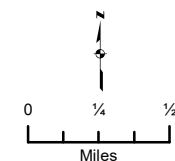
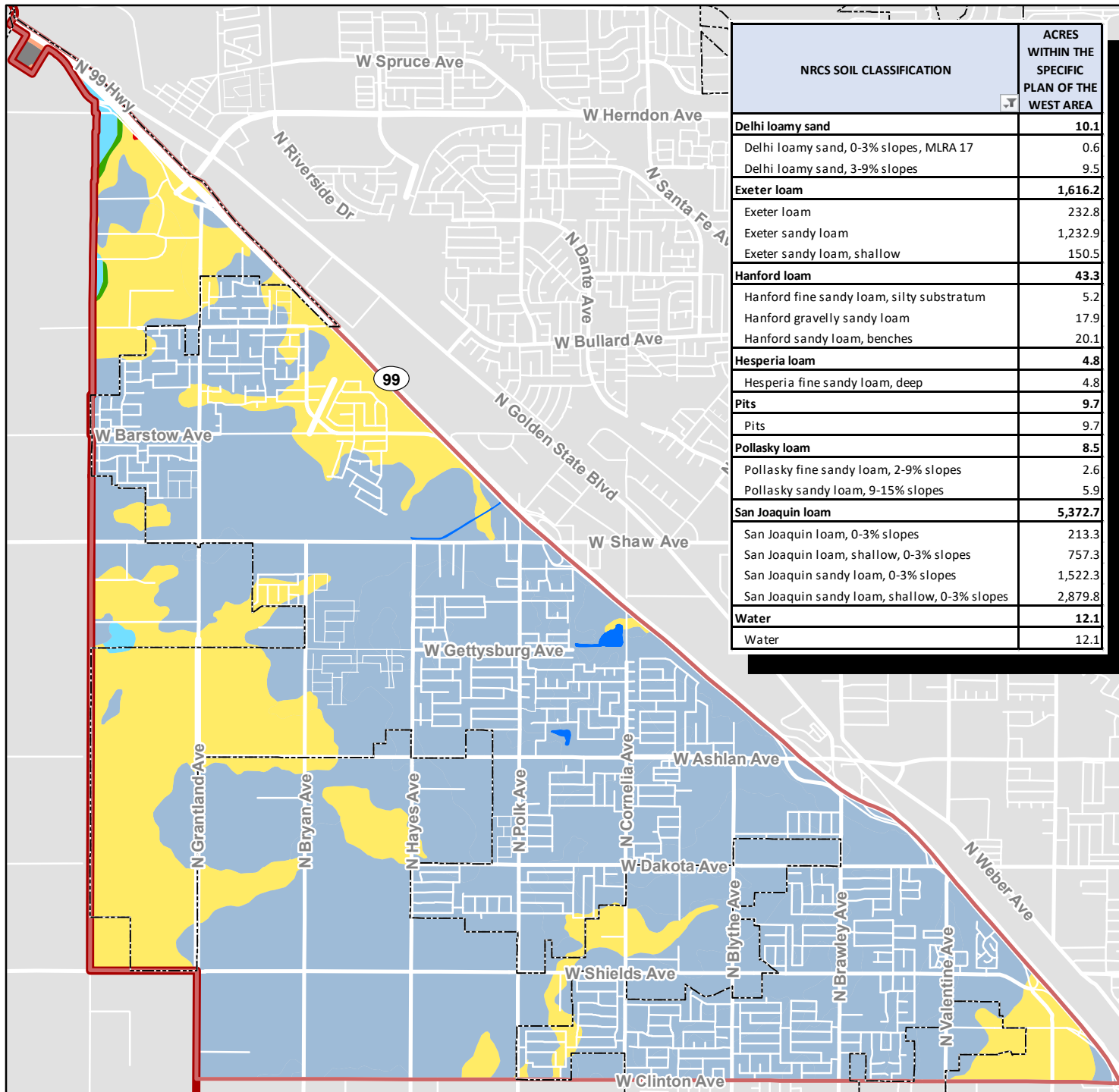
 Hesperia loam

 Pits

 Pollasky loam

 San Joaquin loam

 Water

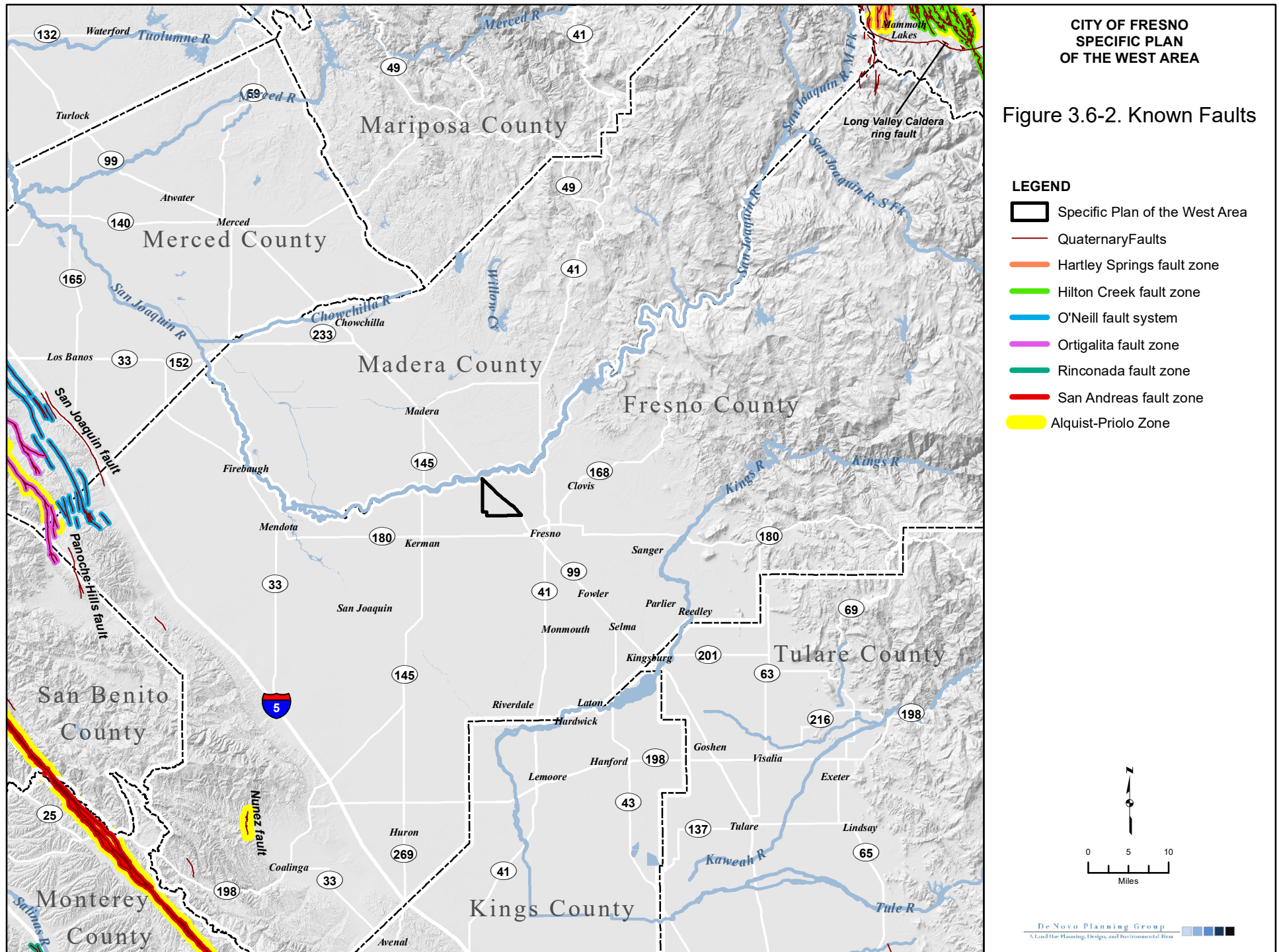


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A Land Use Planning, Design, and Environmental Firm

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**CITY OF FRESNO
SPECIFIC PLAN
OF THE WEST AREA**

Figure 3.6-2. Known Faults



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