4.6 GEOLOGY, SOILS, AND SEISMICITY

This chapter provides an overview of the existing geologic conditions in the Parkway Plan Area and discusses the associated regulatory framework. It also evaluates the potential for implementation of the proposed Project to result in significant environmental impacts, direct and indirect, related to geology, soils, and seismicity.

4.6.1 ENVIRONMENTAL SETTING

4.6.1.1 REGULATORY FRAMEWORK

State Regulations

The most relevant State laws that regulate geology and soils in the Parkway Plan Area are the Alquist-Priolo Earthquake Fault Zoning Act, the Seismic Hazards Mapping Act, the Surface Mining and Reclamation Act, and the California Building Code, each of which is described below.

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.[1] The main purpose of the Act is to prevent the construction of buildings used for human occupancy on top of the traces of active faults, namely, faults that have ruptured during the last 11,000 years (i.e., roughly equivalent to the Holocene Epoch). Although the Act addresses the hazards associated with surface fault rupture, it does not address other earthquake-related hazards, such as seismically induced ground shaking or landslides.[2]

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 publish appropriate maps that depict these zones.[3] The maps are then distributed to all affected cities, counties, and State agencies for their use in planning and controlling new or renewed construction. In general, construction within 50 feet of an active fault zone is prohibited.

[1] Originally titled the Alquist-Priolo Special Studies Zones Act until renamed in 1993, Public Resources Code Division 2, Chapter 7.5, Section 2621.

[2] California Geological Survey, Alquist-Priolo Earthquake Fault Zones, http://www.conservation.ca.gov/cgs/rghm/ap/Pages/main.aspx, accessed April 24, 2017.

[3] Earthquake Fault Zones are regulatory zones around active faults. The zones vary in width, but average about ¼-mile-wide. http://www.conservation.ca.gov/cgs/rghm/ap/Pages/main.aspx, accessed April 24, 2017.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act, passed in 1990, addresses earthquake hazards other than surface fault rupture, including liquefaction and seismically induced landslides.[4] Under this Act, seismic hazard zones are mapped by the State Geologist to assist local governments in land use planning. The Act states that "it is necessary to identify and map seismic hazard zones in order for cities and counties to adequately prepare the safety element of their general plans and to encourage land use management policies and regulations to reduce and mitigate those hazards to protect public health and safety."[5] Section 2697(a) of the Act states that "cities and counties shall require, prior to the approval of a project located in a seismic hazard zone, a geotechnical report defining and delineating any seismic hazard."[6]

Surface Mining and Reclamation Act

The California Surface Mining and Reclamation Act (SMARA) of 1975, was enacted in response to land use conflicts between urban development and mineral production. SMARA requires the State Geologist to classify land according to the presence or absence of important mineral deposits, including sand and gravel.[7] Local governments must consider this information before land with important mineral deposits is committed to land uses incompatible with mining.

SMARA provides for the evaluation of an area's mineral resources using a system of Mineral Resource Zone (MRZ) classifications that reflect the known or interpreted presence of a particular mineral resource. The Plan Area flanks the San Joaquin River, in an area known for commercially-viable alluvial sand, silt, and gravel deposits.

California Building Code

The California Building Standards Code, also known as Title 24 of the California Code of Regulations, reflects various building criteria that have been derived from different sources.[8] One of these sources is the International Building Code (IBC), a model building code adopted across the United States that has been modified to suit conditions in the state of California, thereby creating what is known as the California Building Code (CBC), or Part 2 of CCR Title 24.

The CBC is updated every three years, and the current 2010 CBC took effect on January 1, 2011. The 2013 CBC is scheduled to go into effect in January 2014. Both Fresno County and Madera County have adopted the CBC by reference in their respective ordinance codes.[9,10] Through the CBC, the State provides a minimum standard for

[4] California Geological Survey (CGS), Alquist-Priolo Earthquake Fault Zones, http://www.conservation.ca.gov/cgs/rghm/ap, accessed April 24, 2017.

[5] California Public Resources Code, Division 2, Chapter 7.8, Section 2691(c).

[6] California Public Resources Code, Division 2, Chapter 7.8, Section 2697(a).

[7] California Geological Survey (CGS), SMARA Mineral Land Classification, http://www.conservation.ca.gov/cgs/minerals/mlc/Pages/Index.aspx, accessed April 24, 2017.

[8] California Building Standards Commission, http://www.bsc.ca.gov/codes.aspx, accessed April 24, 2017.

[9] Fresno County Ordinance Code, Building Code, Section 15.08.010, http://library.municode.com/index.aspx?clientId=14972, accessed April 24, 2017.

[10] Madera County Code, Title 14, Chapter 14, https://www.municode.com/library/ca/madera_county/codes/code_of_ordinances?nodeId=TIT14BUCO, accessed April 24, 2017.

building design and construction. The CBC contains specific requirements for seismic safety, excavation, foundations, retaining walls, and site demolition. It also regulates grading activities, including drainage and erosion control.[11]

Parkway Master Plan Policies

The Conservancy will implement its mission and the Parkway Master Plan in a manner consistent with its adopted Parkway Master Plan goals, objectives, policies, design guidelines, and best management practices (BMPs) to the extent practicable.

Local Regulations and Policies

The Conservancy is the lead agency responsible for preparing, approving, and implementing the proposed Parkway Master Plan. The Conservancy may assist other government agencies and nonprofit organizations in implementing elements of the proposed Plan. The Conservancy's authorities and jurisdiction are described in Chapter 3. Local land use policies relevant to Parkway development and implementation are discussed in this section.

Madera County General Plan

The following Madera County General Plan goals and policies provide guidelines for seismic and geological hazard protection (Table 4.6-1).[12]

Madera County Ordinance Code

In contrast to the Fresno County grading and excavation ordinances discussed further below, Madera County's Code contains few provisions for grading and excavation that extend beyond those contained in the CBC. The Madera County Ordinance Code does, however, include requirements for mineral resource extraction (i.e., aggregate mining) and reclamation.[13] Chapter 19.01 of the code incorporates the provisions of SMARA by reference, and also sets forth other requirements that relate to matters such as: vested mineral resource rights; reclamation standards; financial assurances on the part of mine owners; interim management plans in the event a mine is idled; annual reporting requirements; inspections; and mineral resource protection.

[11] California Building Standards Commission, 2011. 2010 California Building Standards Administrative Code California Code of Regulations, Title 24, Part 1.

[12] Madera County General Plan Policy Document, adopted October 14, 1995, http://www.madera-county.com/index.php/forms-and-documents/category/46-general-plan-document-materials, accessed April 24, 2017.

[13] Madera County Code, Title 19, Chapter 19.01, https://www.municode.com/library/ca/madera_county/codes/code_of_ordinances?nodeId=TIT19SUMIREMILA, accessed April 24, 2017.

TABLE 4.6-1 MADERA COUNTY GENERAL PLAN GOALS AND POLICIES RELATED TO GEOLOGY, SOILS, AND SEISMICITY

Policy/Goal Number	Policy/Goal
Health and Safety Element - Seismic and Geological Hazards	
Goal 6.A	*To minimize the loss of life, injury, and property damage due to seismic and geological hazards.*
Policy 6.A.l	The County shall require the preparation of a soils engineering and geologic-seismic analysis prior to permitting development in areas prone to geological or seismic hazards (i.e., ground-shaking, landslides, liquefaction, critically expansive soils).
Policy 6.A.2	In landslide hazard areas, the County shall prohibit avoidable alteration of land in a manner that could increase the hazard, including concentration of water through drainage, irrigation, or septic systems; removal of vegetative cover; and steepening of slopes and undermining the bases of slopes. Areas of known landslides should be designated for open space uses.
Policy 6.A.3	The County shall limit development in areas of steep or unstable slopes to minimize hazards from landslides. Development will be prohibited in areas with slopes of 30 percent or more unless it can be demonstrated by a registered engineer or registered engineering geologist that such development will not present a public safety hazard.
Policy 6.A.4	The County shall continue to support scientific geologic investigations that refine, enlarge, and improve the body of knowledge on active fault zones, unstable areas, severe ground-shaking, and other hazardous conditions in Madera County.

Fresno County General Plan

The following existing Fresno County General Plan policies and standards provide guidelines for protecting against seismic and geological hazards (Table 4.6-2).[14]

Fresno County Ordinance Code

In addition to the adoption of the CBC by reference, the Fresno County Ordinance Code also contains rules and regulations that govern grading and excavation operations.[15] These standards apply to specifications for engineered fill and requirements for prior completion of a soil investigation report; geotechnical test methods for soil density and moisture-density measurements; criteria for building and grading permit issuance in areas where geological and/or flood hazards are present; grading permit application materials, including plans and specifications, as well as supporting data, including a soils engineering report and engineering geology report; requirements for drainage and terracing during grading; and oversight and inspection responsibilities for grading projects in general.

[14] Fresno County General Plan Policy Document, 2013. 2000 General Plan Review, Revised Public Review Draft, January, http://www2.co.fresno.ca.us/0110a/Questys_Agenda/MG201174/AS201197/AS201199/AI201247/DO201407/5.PDF, accessed April 24, 2017.

[15] Fresno County Ordinance Codes, Title 15, Chapter 15.28, https://www.municode.com/library/ca/fresno_county/codes/code_of_ordinances?nodeId=TIT15BUCO_CH15.28GREX, accessed April 24, 2017.

TABLE 4.6-2 FRESNO COUNTY GENERAL PLAN GOALS AND POLICIES RELATED TO GEOLOGY, SOILS, AND SEISMICITY

Policy/Goal Number	Policy/Goal
Health and Safety Element	
Goal HS-D	*To minimize the loss of life, injury, and property damage due to seismic and geologic hazards*
Policy HS-D.3	The County shall require that a soils engineering and geologic-seismic analysis be prepared by a California-registered engineer or engineering geologist prior to permitting development, including public infrastructure projects, in areas prone to geologic or seismic hazards (i.e., fault rupture, ground-shaking, lateral spreading, lurch-cracking, fault creep, liquefaction, subsidence, settlement, landslides, mudslides, unstable slopes, or avalanche).
Policy HS-D.4	The County shall require all proposed structures, additions to structures, utilities, or public facilities situated within areas subject to geologic-seismic hazards as identified in the soils engineering and geologic-seismic analysis to be sited, designed, and constructed in accordance with applicable provisions of the Uniform Building Code (Title 24 of the California Code of Regulations) and other relevant professional standards to minimize or prevent damage or loss and to minimize the risk to public safety.
Policy HS-D.7	The County shall ensure compliance with State seismic and building standards in the evaluation, design, and sighting of critical facilities, including police and fire stations, school facilities, hospitals, hazardous material manufacture and storage facilities, bridges, large public assembly halls, and other structures subject to special seismic safety design requirements.
Policy HS-D.8	The County shall require a soils report by a California-registered engineer or engineering geologist for any proposed development, including public infrastructure projects, that requires a County permit and is located in an area containing soils with high “expansive” or “shrink-swell” properties. Development in such areas shall be prohibited unless suitable design and construction measures are incorporated to reduce the potential risks associated with these conditions.
Policy HS-D.9	The County shall seek to minimize soil erosion by maintaining compatible land uses, suitable building designs, and appropriate construction techniques. Contour grading, where feasible, and revegetation shall be required to mitigate the appearance of engineered slopes and to control erosion.
Policy HS-D.10	The County shall require the preparation of drainage plans for development or public infrastructure projects in hillside areas to direct runoff and drainage away from unstable slopes.
Policy HS-D.11	The County shall not approve a County permit for new development, including public infrastructure projects, where slopes are over thirty (30) percent unless it can be demonstrated by a California-registered civil engineer or engineering geologist that hazards to public safety will be reduced to acceptable levels.
Policy HS-D.14	Whenever zoning is employed to restrict the use of land subject to severe geologic hazards (e.g., landslides), the County shall designate parcels so restricted for open space uses.

City of Fresno General Plan

The following existing City of Fresno General Plan 2025 objectives and policies provide guidelines for seismic and geological hazard protection (Table 4.6-3).[16]

[16] 2025 City of Fresno General Plan, 2002, http://cdm16255.contentdm.oclc.org/cdm/ref/collection/p266301ccp2/id/623, accessed April 24, 2017.

TABLE 4.6-3 CITY OF FRESNO GENERAL PLAN OBJECTIVES AND POLICIES RELATED TO GEOLOGY, SOILS, AND SEISMICITY

Policy/Goal Number	Policy/Goal
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.
Policy NS-2-d	Bluff Preservation Overlay Zone. Per the requirements of the Bluff Preservation Overlay Zone District and Policy POSS-7-f (Chapter 5, Parks and Open Space), the following standards shall be applicable for property located within the Bluff Preservation zone: • Require proposed development within 300 feet of the toe of the San Joaquin River bluffs to undertake an engineering soils investigation and evaluation report that demonstrates that the site is sufficiently stable to support the proposed development, or provide mitigations to provide sufficient stability; and • Establish a minimum setback of 30 feet from the San Joaquin River bluff edge for all buildings, structures, decks, pools and spas (which may be above or below grade), fencing, lighting, steps, etc. - An applicant may request to reduce the minimum setback to 20 feet from the bluff edge if it can be demonstrated, to the satisfaction of the City's Building Official and the Planning Director, that the proposed building, structure, deck, pool and/or spas (which may be above or below grade), fencing, steps, etc., will meet the objectives of the Bluff Preservation Overlay Ordinance. In no case shall the setback be reduced to less than 20 feet.
Parks, Open Space, and Schools	
Policy-7-f	River Bluffs. Preserve the river bluffs as a unique geological feature in the San Joaquin Valley by maintaining and enforcing the requirements of the "BP" Bluff Preservation Overlay Zone District, maintaining the bluff area setback for buildings, structures, decks, pools and spas (which may be above or below grade), fencing, and steps, and maintaining designated vista points.

City of Fresno Municipal Code

Much like the ordinance codes for Fresno and Madera Counties discussed above, the City of Fresno Municipal Code also incorporates the CBC by reference.[17] The City enacted certain amendments to the CBC, including

[17] City of Fresno, California Municipal Code, Chapter 11, Article 1, Section 11.101, https://www.municode.com/library/ca/fresno_county/codes/code_of_ordinances?nodeId=FRCOORCO, accessed April 24, 2017.

designation of the City of Fresno Development and Resource Management Department as the appropriate code enforcement agency.

4.6.1.2 EXISTING SETTING

This section presents a discussion of the existing geological, soil, and seismic conditions in the Plan Area.

Site Soils and Bedrock Geology

The Parkway Plan Area consists of an approximately 22-mile reach, extending from Friant Dam on the east to State Route 99 on the west. The Parkway Plan Area traverses several U.S. Geological Survey (USGS) topographic map quadrangles, including (listed from east to west) the Friant, Lanes Bridge, Fresno North, and Herndon 7.5-minute sheets (all dated 2012).

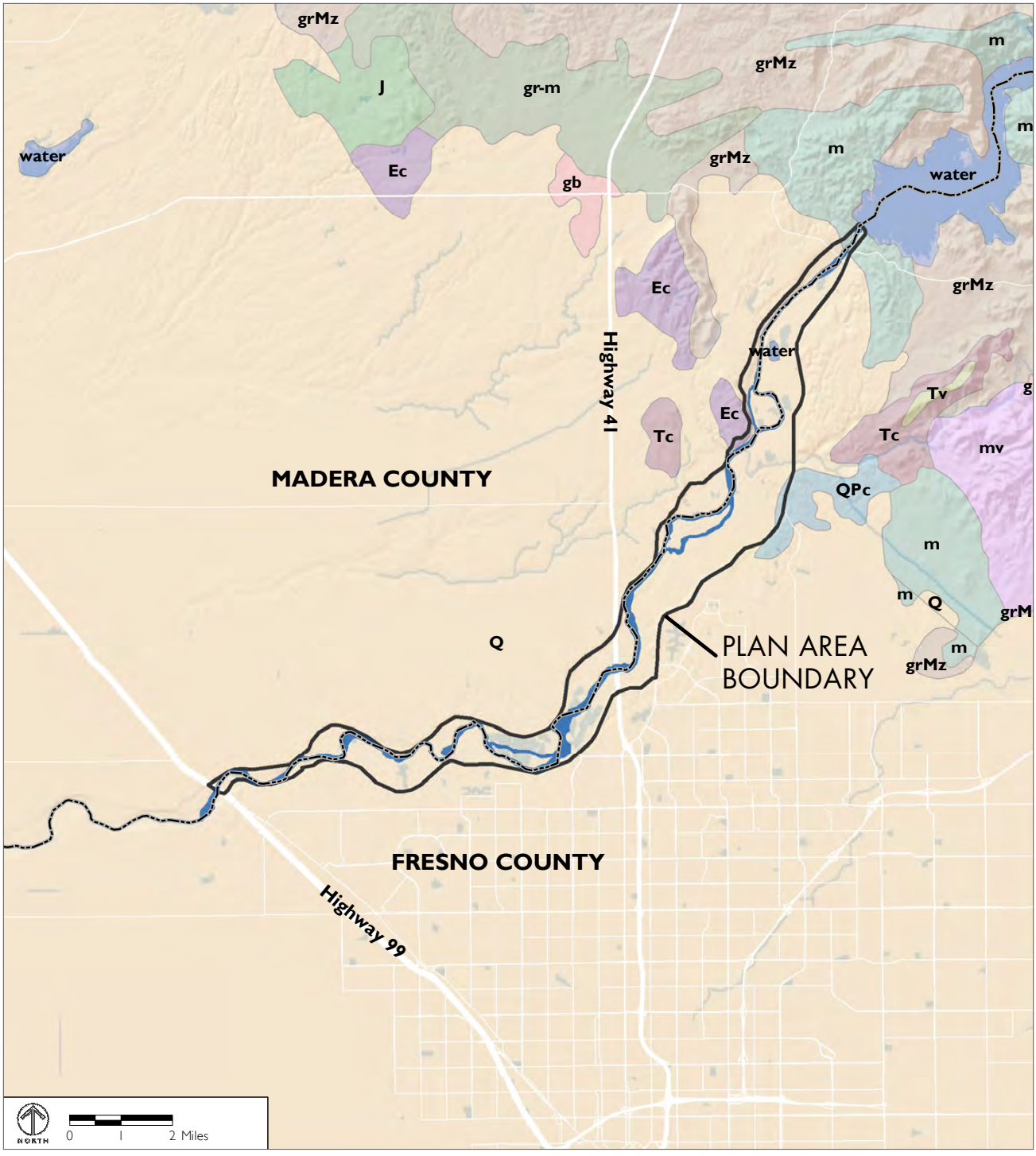
The topography flanking the Parkway Plan Area varies somewhat, with generally flat prevailing slopes in the west, to somewhat hillier terrain in the east near Friant Dam and Millerton Lake. The single most significant topographic feature is the San Joaquin River—the river and its associated floodplain uniquely define the Parkway Plan Area. Within the Parkway Plan Area, the floodplain varies from 0.10 mile to nearly one mile in width. It is bounded by erosional escarpments or "bluffs" that typically range from 100 to 150 feet in height. With the exception of man-made gravel mining pits, the topography in the floodplain itself is subdued, showing relic fluvial landforms/deposits such as point bars, oxbows, meander scars, and cut banks. The average stream gradient of the San Joaquin River across the Parkway Plan Area is approximately 0.77 feet/1,000-foot, and the general direction of flow is to the southwest.

The Parkway Plan Area is geologically situated on the east flank of the Central Valley, a topographic and sedimentary basin that dominates the geomorphologic setting of central California, averaging 50 miles in width and extending nearly 400 miles from the northern part of the Sacramento Valley to the southern part of the San Joaquin Valley.[18] The Plan Area is located in the San Joaquin Valley, which constitutes the southern part of the Central Valley of California. Geologically, the San Joaquin Valley is an asymmetric sedimentary basin that is filled with upper Mesozoic and Cenozoic marine and continental sediments up to 6 miles thick. Most of the sedimentation in this basin occurred in the Cenozoic Era starting roughly 65 million years ago. The basin's depositional history has been controlled primarily by tectonic activity, but it has also been influenced by sea-level changes and climate.[19] Figure 4.6-1 shows the geologic features in the Plan Area and vicinity.

The bedrock geology east of the San Joaquin Valley is dominated by Mesozoic igneous rocks that comprise the Sierra Nevada Mountains. The Sierra Nevada, in turn, are locally flanked by a belt of Mesozoic and Paleozoic marine and non-marine sedimentary and metavolcanic rocks. The sediments that underlie the Plan Area reflect this provenance; they represent clastic debris that has been shed from the west flank of the Sierras, then deposited in

[18] CA Geologic Survey, Geologic Map of California, Fresno Sheet, 1965, scale 1:250,000, compiled by Robert Matthews and John Burnett.

[19] US Geological Survey (USGS), 1991. The Cenozoic Evolution of the San Joaquin Valley, California, USGS Professional Paper: 1501, Bartow, J. Alan.



Source: U.S. Geological Survey, California Geological Servey, 2000; Esri, 2013; TPC|DC&E, 2013.

- Ec, Eocene
- J, Triassic to Late Jurassic
- Q, Pliocene to Holocene
- QPc, Miocene to Pleistocene
- Tc, Paleocene to Pliocene
- Tv, Tertiary (3-4 Ma)
- gb, Triassic to Cretaceous
- gr-m, Early Proterozoic to Late Cretaceous
- grMz, Permian to Tertiary; most Mesozoic
- m, Early Proterozoic to Cretaceous
- mv, Ordovician(?) to Permian(?)
- water, Holocene

Figure 4.6-1
Geologic Map - Parkway Plan Area and Vicinity

the valley as alluvial fans or aprons. Rivers incised into this alluvium, such as the San Joaquin River, contribute their own sediment load and also rework older alluvial deposits. Relatively few bedrock outcrops have been mapped in the Plan Area or in its immediate vicinity. Outcroppings of Eocene and Undifferentiated Tertiary non-marine sedimentary bedrock were mapped by the California Geological Survey in the area directly northwest of Ledger Island in the east part of the Plan Area. This bedrock reportedly includes tuffaceous sands and gravel and well-indurated sandstone and conglomerate of the Eocene Ione Formation.[20]

Over the years, the soils in the vicinity of the Parkway Plan Area have been mapped by various government agencies and researchers. In the early 1900s, the U.S. Department of Agriculture (USDA) Bureau of Soils (now the Natural Resource Conservation Service) mapped the soils in and around the City of Fresno. That mapping effort classified the floodplain soils in the Plan Area as "riverwash" (i.e., recent deposits of sand and gravel) and Hanford-series sandy loam, sand, and gravelly sand.[21] Data recently retrieved from the USDA's online Web Soil Service is largely consistent with these early mapping results, insofar as Hanford-series sandy and gravelly loams, Greenfield-series sandy loams, riverwash, and a more recently defined Grangeville-series sandy loam appear to dominate the floodplain portions of the Parkway Plan Area.[22]

The prevailing physical and engineering soil properties in the Parkway Plan Area were broadly researched using the USDA's online Web Soil Service. One such property is of particular importance in this evaluation. Linear extensibility serves as an indicator of soil shrink-swell potential, wherein alternating wetting and drying can result in significant changes in soil volume. These soil volume changes can cause heaving and cracking in foundations and/or flatwork that are built on these soils. The reported linear extensibility values for prevailing soil types in the Plan Area were typically less than 3 percent, suggesting low shrink-swell potential. Other soil properties relevant to proposed development of the Plan Area include measurements of soil erodibility, or susceptibility of a soil to sheet and rill erosion by water. The reported erosion factors for prevalent Parkway Plan Area soil types generally varied from 0.20 to 0.32, values suggesting a moderate susceptibility to erosion.

Regional Faulting, Seismicity, and Related Seismic Hazards

The State of California Geological Survey has not identified or mapped any Alquist-Priolo Earthquake Fault Zones in the Parkway Plan Area or in its immediate vicinity, and no "active" faults are known to be present. Accordingly, the seismic risk due to primary ground rupture in the Parkway Plan Area appears to be low. Although no active faults are known to pass directly through the Parkway Plan Area, an earthquake of moderate to high magnitude generated along earthquake faults in the Coast Range to the west, such as the San Andreas Fault, could cause significant ground shaking in the Parkway Plan Area. The degree of shaking would depend on the magnitude of the event, the duration of the event, the distance to the zone of rupture (i.e., hypocenter), and local geologic conditions.

[20] US Geological Survey (USGS), 2007. Type Region of the Ione Formation (Eocene), Central California: Stratigraphy, Paleogeography, and Relation to Auriferous Gravels, Scott Creely and Eric R. Force, Open File Report 2006-1378.

[21] US Department of Agriculture, Bureau of Soils, 1914. Soil Survey of the Fresno Area, California, by A.T. Strahorn, J.W. Nelson, L.C. Holmes, and E.C. Eckmann.

[22] US Department of Agriculture, Natural Resource Conservation Service, Web Soil Survey, http://websoilsurvey.sc.egov.usda.gov/app/WebSoilSurvey.aspx, accessed April 24, 2017.

The only State-designated Alquist-Priolo Earthquake Fault Zones in Fresno or Madera counties are located in the far western part of Fresno County, roughly 50 to 55 miles southwest of the Plan Area. One such fault zone lies astride the Nunez Fault, located close to the town of Coalinga, California. Recent seismicity has been associated with this fault, notably, a 1983 M6.5 earthquake that resulted in more than $10 million of property damage.[23] Although this earthquake was felt over a more than 200,000-square-kilometer area, significant damage to buildings was primarily limited to older, non-reinforced masonry structures located in Coalinga itself. A Modified Mercalli Intensity (MMI) of VII was assigned to this event based on the observed damage. Published shaking maps suggest that the impacts to buildings and property near Fresno, California was comparatively minor (i.e., MMI rating of V).

Landslides

As previously discussed, the topography within the Parkway Plan Area and the immediately surrounding areas is comparatively flat, sloping gently to the southwest. Locally steeper topography is evident along the bluffs that flank the San Joaquin River floodplain, where the relief is often in the range of 100 to 150 feet. Occasional sloughing or small-scale earth slides would be expected in such an environment, given the slope and unconsolidated sediments exposed in the bluffs themselves. Nevertheless, the California Geological Survey's Seismic Hazard Mapping Program has not identified/mapped any seismically-induced landslide hazard zones in the Plan Area.

Liquefaction

Liquefaction can occur in water-saturated, cohesionless sediments during major seismic events. During such events, the liquefied sediment suddenly loses strength and may fail, causing damage to overlying buildings, bridges, and other man-made structures. The California Geological Survey's Seismic Hazard Mapping Program has not identified/mapped any seismically-induced liquefaction hazard zones in the Parkway Plan Area. Although major seismic events are not anticipated in the Parkway Plan Area, it should be noted that the actual risk from liquefaction may necessarily vary from location-to-location within the Plan Area; appropriate mitigation measures may also vary and are best formulated through site-specific geotechnical studies.

Unstable Geologic Units

Geologic units and soils in the Parkway Plan Area could present risks where they are considered unstable, that is, prone to subsidence or differential settlement. Much like liquefaction, soil stability often depends on a variety of site-specific factors, such as soil texture, moisture content, mineralogical composition, cohesiveness, and organic content. Although certain alluvial floodplain depositional environments such as overbank deposits and oxbows can contain significant uncompacted organic material, and therefore be more prone to subsidence and/or differential settlement, a preliminary review of the USDA's Web Soil Service online database suggests that typical soil organic content in the Parkway Plan Area generally low, ranging from 0.5 to 6 percent.[24]

[23] US Geological Survey (USGS), 1990. The Coalinga, California Earthquake of May 2, 1983. Michael J. Rymer and William L. Ellsworth, Editors, Professional Paper 1487.

[24] US Department of Agriculture, Natural Resource Conservation Service, Web Soil Survey, http://websoilsurvey.sc.egov.usda.gov/app/WebSoilSurvey.aspx, accessed April 24, 2017.

4.6.2 STANDARDS OF SIGNIFICANCE

The future proposed development under the proposed Parkway Plan would result in a significant impact with regard to geology, soils, and seismicity if it would:

1. Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
    - Surface rupture along a known active fault, including those faults identified on recent Alquist-Priolo Earthquake Fault Zoning Maps issued by the State Geologist, or active faults identified through other means (i.e., site-specific geotechnical studies, etc.)
    - Strong seismic ground shaking.
    - Seismic-related ground failure, including liquefaction.
    - Landslides.
2. Result in substantial soil erosion or the loss of topsoil.
3. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the proposed Project, and potentially result in on- or off-site landsliding, lateral spreading, subsidence, liquefaction, or collapse.
4. Be located on expansive soil, as defined in Table 18-1-b of the Uniform Building Code (1994), creating substantial risks to life or property.
5. Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

4.6.3 IMPACT DISCUSSION

This section analyzes the potential project-specific and cumulative impacts on geology, soils, and seismicity that could occur as a result of the implementation of the proposed Project. This discussion is organized by each of the potential impacts identified in the Standards of Significance.

GEO-1	The proposed Plan would not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving surface rupture along a known active fault; strong seismic ground shaking; seismic-related ground failure, including liquefaction; and landslides.

Future development under the proposed Plan would have a significant environmental impact if it would expose people or structures to potentially substantial adverse effects including the risk of loss, injury, or death involving surface rupture along a known active fault; strong seismic ground shaking; seismic-related ground failure, including liquefaction; and landslides. As previously discussed, no Alquist-Priolo Earthquake Fault Zones have been established by the California Geological Survey (CGS) within the Parkway Plan Area, nor have any seismically-

induced landslide or liquefaction hazard zones been mapped by the CGS in that area. Thus, the risks from surface fault rupture or earthquake-induced landslides or liquefaction associated with the implementation of the proposed Plan are considered low.

State regulations and policies require the conduct of detailed, site-specific geotechnical evaluations prior to the approval of a project located in such a zone. These regulations and policies further require the incorporation of the geotechnical report recommendations into any proposed building design and implementation during its construction.

Although, strong seismic ground shaking during a major earthquake generated along faults in the Coast Range, could cause significant ground and pose hazards across the Parkway Plan Area, adherence to applicable building code and building permit requirements would ensure that the impacts associated with such ground shaking are minimized to the maximum extent practicable.

Compliance with existing State regulations listed above would ensure that the impacts associated with surface rupture along a known active fault; strong seismic ground shaking; seismic-related ground failure, including liquefaction; and landslides are minimized to the maximum extent practicable. Consequently, the overall associated impacts of implementation of the proposed Project would be *less than significant*.

Applicable Laws, Regulations, and Permits, Relevant Local Land Use Policies:

- California Building Code

Significance Without Mitigation: Less than significant.

GEO-2	Future development under the proposed Plan would not result in substantial soil erosion or the loss of topsoil.

Substantial soil erosion or loss of topsoil during implementation of future projects of the proposed Plan could undermine structures and slopes. This could be a concern in certain parts of the Plan Area, and could be further exacerbated where steep slopes and/or highly erodible soils are anticipated. However, compliance with existing regulatory requirements, such as implementation of erosion control measures as specified by the CBC, would reduce impacts from erosion and the loss of topsoil. Adherence to existing regulatory requirements would ensure that impacts associated with substantial erosion and loss of topsoil during implementation of the proposed Project would be less than significant.

Compliance with applicable State regulations pertaining to grading and erosion control would ensure that impacts involving substantial soil erosion or loss of topsoil during implementation of the proposed Project would be *less than significant*.

Applicable Laws, Regulations, and Permits, Relevant Local Land Use Policies:

- California Building Code

Significance Without Mitigation: Less than significant.

GEO-3	Future development under the proposed Plan would not 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.

Although unstable soils or geologic units that may be susceptible to liquefaction, lateral spreading, differential settlement, and/or subsidence are not known to occur within the Parkway Plan Area, this susceptibility is subject to natural variation and site-to-site differences. Given this natural variation, the susceptibility of a particular Parkway Plan Area location to these hazards is best evaluated through a suitably detailed, site-specific geotechnical evaluation prior to development. The scope of such geotechnical evaluations is generally broad enough that highly compressible soils, such as peat soil, and other soil areas prone to differential settlement or subsidence are identified, and corrective measures, if needed, can be formulated. State regulations further require incorporation of the geotechnical report recommendations into any proposed structure/building design, as well as subsequent implementation during its construction.

Compliance with applicable State regulations pertaining to construction of buildings or structures on potentially unstable geologic units or soils would ensure that the associated impacts would be reduced to a *less-than-significant* level.

Applicable Laws, Regulations, and Permits, Relevant Local Land Use Policies:

- California Building Code

Significance Without Mitigation: Less than significant.

GEO-4	Future development under the proposed Plan would not be located on expansive soil, as defined in Table 18-1-b of the Uniform Building Code (1994), creating substantial risks to life or property.

Although expansive soils are not known to occur within the Parkway Plan Area, their presence and susceptibility to shrink-swell behavior is subject to natural variation and could vary between specific sites. Development of future Parkway facilities would be preceded by a suitably detailed geotechnical evaluation, the scope of which would include tests to determine and quantify the presence and characteristics of expansive soils.

Compliance with the foregoing policies would ensure that the potential future development impacts related to expansive soils would be reduced to a *less-than-significant* level.

Applicable Laws, Regulations, and Permits, Relevant Local Land Use Policies:

- California Building Code

Significance Without Mitigation: Less than significant.

GEO-5	Future development under the proposed Plan 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.

Development within the Parkway Plan Area could require the use of a combination of different types of wastewater disposal systems, including septic systems, self-contained vault toilet restrooms, or connections to existing public sanitary sewer systems.

A municipal public system is serviced by the City of Fresno's Department of Public Utilities Sewer Management Division and their 80 million gallon per day (mgd) Fresno/Clovis Regional Water Reclamation Facility. Wastewater connections to this public system would be limited to those parts of the Parkway Plan Area that lie within the City of Fresno and that could be feasibly served by the municipal system.

In parts of the Parkway Plan Area that lie within unincorporated Fresno and Madera counties not served by public wastewater systems, public low-impact recreational use areas under the proposed Plan would be served by self-contained vault toilet restrooms. Alternatively, in appropriate locations, Parkway development may rely on individual septic systems for wastewater treatment and disposal. For projects under the jurisdictions of the Fresno County Public Works and Planning Department and the Madera County Environmental Health Department Liquid Waste Program, septic systems are required to be regulated, permitted, and must meet the standards and criteria for onsite systems, such as minimum setbacks from surface water bodies and water supply wells. In addition, State requirements include the State Water Resources Control Board's (SWRCB's) most current water quality control policy for the siting, design, operation, and maintenance of onsite wastewater treatment systems (OWTS).

Proposed Parkway Master Plan Policy Water.7 would require that vault toilets and septic systems are only installed in areas where community wastewater treatment is not available and feasible. Additionally, Policy Water.7 requires that design, installation, and operation of vault toilets and septic systems be in accordance with all applicable laws and regulations. The aforementioned regulatory controls required by Fresno and Madera counties and the City of Fresno related to permit requirements include, but are not limited to mandatory soil and site evaluations for all new OWTS. These regulatory controls would ensure that soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems for development within the Parkway Plan Area are avoided. As a result, impacts are considered *less than significant*.

Applicable Laws, Regulations, and Permits, Relevant Local Land Use Policies:

- State Water Resources Control Board Resolution No. 2012-0032

Significance Without Mitigation: Less than significant.

4.6.4 CUMULATIVE IMPACTS

GEO-6	The proposed Plan, in combination with past, present, and reasonably foreseeable projects, would result in less than significant cumulative impacts with respect to geology, soil, and seismicity.

When considering this geographically large Parkway Plan Area, cumulative impacts with respect to geology and soils could result from development under the proposed Plan together with the effects of development unrelated to the Parkway on land in and near the Plan Area. The geographic scope of this analysis includes past, present, and reasonably foreseeable projects in the Parkway Plan Area. The impacts associated with geology, soils, and seismicity are often site-specific. Development of the Parkway, as well as other past, present, and foreseeable projects in the Plan Area would be subject to State and local policies and regulations that govern seismic and geologic hazards.

Examples of these policies and regulations include, but are not limited to: the City of Fresno, Fresno County, and Madera County building and grading permit process, and required adherence to the California Building Code; required performance of geotechnical studies where significant site-specific geologic risks, such as expansive soils or otherwise unstable soils, are known or suspected to be present; and incorporation of geotechnical recommendations into the design and construction of new structures and buildings. Compliance with these requirements for the future projects under the proposed Plan as well as compliance on the part of other past, present, and foreseeable projects in the vicinity would ensure that the cumulative impacts related to geology, soils, and seismicity would be reduced to the maximum extent practicable. For these reasons, the proposed Project would not result in a cumulatively considerable contribution to impacts related to geology, soils, and seismicity.

In combination with past, present, and reasonably foreseeable projects, development of the Parkway Plan would result in a *less-than-significant* cumulative impact with respect to geology, soils, and seismicity.

Applicable Laws, Regulations, and Permits, Relevant Local Land Use Policies:

- California Public Resources Code Division 2, Chapter 7.5, Section 2621 [Alquist-Priolo Earthquake Fault Zoning Act]
- California Public Resources Code, Division 2, Chapter 7.8, Section 2697(a) [CA Seismic Hazards Mapping Act]
- California State Water Resources Control Board Resolution No. 2012-0032, Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems
- California Building Code
- Madera County General Plan
- Fresno County General Plan
- Fresno County Ordinance Codes, Title 15, Section 15.28.020
- City of Fresno General Plan
- City of Fresno, Development and Resource Management Department Grading Plan Check Process

Significance Without Mitigation: Less than significant.