

4.13 SEISMIC AND GEOLOGIC HAZARDS

INTRODUCTION

This section describes the impacts of seismic and geologic hazards on development anticipated under the Draft General Plan. This section focuses on how development could be affected by earthquakes and related seismic hazards, landslides, expansive soils, and erosion. Issues related to subsidence due to groundwater withdrawal are presented in Section 4.8, Water Resources

ENVIRONMENTAL SETTING

Seismic hazards and conditions in Fresno County are described in Chapter 9.2 of the *General Plan Background Report (Background Report)*. Information on expansive soils and erosion potential is included in Chapter 7.2 of the *Background Report*. The relationship between groundwater withdrawal and subsidence is discussed in Chapter 5.4, of the *Background Report*. These chapters are hereby incorporated by reference and summarized below.

Seismic Hazards

There are a number of active and potentially active faults within and adjacent to Fresno County. Faults within Fresno County and major active and potentially active faults in the region are described below. Their locations are shown on Figure 9-2 in the *Background Report*, and a description of their activity is included in Chapter 9, Safety, in the *Background Report*. Two of the active faults, which are located near Coalinga and Panoche in the West Valley, have been designated Alquist-Priolo Earthquake Fault Zones (EFZ). Most of Fresno County, from approximately Interstate 5 (I-5) east, is located in Seismic Zone 3, as defined by the most recent California Uniform Building Code. Areas in the Coast Range and foothills and a small area along the Fresno County-Inyo County boundary are located in Seismic Zone 4 (see Figure 9-4 in the *Background Report*).

Groundshaking is the primary seismic hazard in Fresno County, because of the County's seismic setting and record of historical activity. Most of the already urbanized locations in the East and West Valleys and Sierra Nevada Foothills areas are subject to less intense seismic effects than locations in the Coast Range Foothills and Sierra Nevada Mountain areas.

Liquefaction is a process whereby soil is temporarily transformed to a fluid form during intense and prolonged groundshaking. Areas most prone to liquefaction are those that are water saturated (e.g., where the water table is less than 30 feet below the surface) and consist of relatively uniform sands that are loose to medium density. No specific County-wide assessments to identify liquefaction hazards have been performed. Areas where groundwater is less than 30 feet below the surface occur primarily in the valley. However, soil types in the area are not conducive to liquefaction because they are either too

coarse or too high in clay content. Areas subject to 0.3g acceleration or greater are located in a small section of the Sierra Nevada along the Fresno-Inyo Counties boundary, or along the Coast Range foothills in western Fresno County. However, the depth to groundwater in such areas is greater than in the valley, which would minimize liquefaction potential as well.

Settlement can occur in poorly consolidated soils during groundshaking. During settlement, the soil materials are physically rearranged by the shaking to result in a less stable alignment of the individual minerals. Settlement of sufficient magnitude to cause significant structural damage is normally associated with rapidly deposited alluvial soils, or improperly founded or poorly compacted fill. These areas are known to undergo extensive settling with the addition of irrigation water, but evidence due to groundshaking is not available. The only urban area directly affected by settlement is the city of Coalinga. Fluctuating groundwater levels may have changed the local soil characteristics. Sufficient subsurface data is lacking to conclude that settlement would occur during a large earthquake; however, the data is sufficient to indicate that the potential exists.

Landslides and Avalanches

Certain areas in Fresno County are more prone to landsliding than others (see Figure 9-6 in the *Background Report*). Such areas can be found in the foothill and mountain areas where fractured and steep slopes are present (as in the Sierra Nevada), where less consolidated or weathered soils overlie bedrock (e.g., the Coast Range), or where inadequate ground cover accelerates erosion. Other areas where steep slopes are present, however, are not heavily populated and most are located in federal or State lands, although roadways such as State Route (SR) 168 in eastern Fresno County and SR 198 in western Fresno County could be affected by landslides in the event of an earthquake or heavy rain. For example, during the 1995 storm event in California, a fairly large landslide occurred on Los Gatos Road, which is a significant local access road west of Coalinga. California Division of Mines and Geology (CDMG) geologists determined that catastrophic failure was unlikely, but long-term road maintenance could be compromised due to undercutting of the slope by the creek below the road. There is no risk of large landslides in the valley area of the County due to its relatively flat topography. There is, however, the potential for small slides and slumping along the steep banks or river or creeks in the valley.

Avalanche potential is greatest at the higher elevations of the Sierra Nevada in eastern Fresno County. Recreational facilities in open space and park areas under U.S. Forest Service or other federal or State agency jurisdiction where development is precluded could be subject to avalanche hazard. However, most of these areas are inaccessible during periods of highest avalanche potential.

Other Geologic Hazards

Fresno County is not located in an area susceptible to seiches or tsunamis.

The Mono Lake-Long Valley Area is adjacent to the north and east of northernmost areas of Fresno County and includes such features as Mono Craters and Long Valley calderas and numerous active and potential faults. The Mono Lake-Long Valley Area is considered an active volcanic region of California.

At the northernmost tip of Fresno County, lava flows, steam blasts, or base surges could occur. Northern portions of the Silver Divide (including Duck Lake and Fish Creek) could be subject to tephra (ejected volcanic material) hazards. This particular area of Fresno County is unpopulated, not easily developable, and is situated in the high peaks of the Sierra Nevada; therefore, potential safety hazards would be limited to individuals visiting the area.

Subsidence occurs when a large portion of land is displaced vertically, usually due to the withdrawal of groundwater, oil, or natural gas. Soils that are particularly subject to subsidence include those with high silt or clay content. Subsidence caused by groundwater withdrawal generally presents a more serious problem, since it can affect large areas. Oil and gas withdrawal, on the other hand, tends to affect smaller, localized areas. Some areas of the Central Valley have subsided more than 20 feet during the past 50 years. In some areas along the valley trough and in parts of western Fresno County, groundwater pumping has caused subsidence of the land surface. Subsidence has been a problem in the Westlands Water District and the Pleasant Valley Water District.

Soils

Expansive Soils

Expansive soils are those that greatly increase in volume when they absorb water and shrink when they dry out. Expansion is measured by shrink-swell potential, which is the relative volume change in soil with a gain in moisture. If the shrink-swell potential is rated moderate to high, damage to buildings, roads, and other structures can occur. Soils exhibiting a high to moderately high shrink-swell potential generally occur in a northwest-trending belt approximately parallel to the Friant-Kern Canal foothills in Kings Canyon National Park in the Sierra Nevada, and along Fresno Slough from Madera County to Kings County. The locations of these soil associations that exhibit high to moderately high expansion potential in eastern Fresno County are shown in Figure 7-1 in the *Background Report*. Comprehensive information regarding expansive soils in the western part of Fresno County (west of Fresno Slough) is not provided in the soil survey report published in 1950 for that area (*Soils of Western Fresno County California*). However, recent local investigations conducted under the auspices of the Natural Resource Conservation Service Hanford Office for the Westlands Water District have identified areas of expansive soils that roughly parallel the San Luis Drain west of Tranquility and San Joaquin.

Erosion

Natural forces, both chemical and physical, are continually at work breaking down soils. Erosion poses two hazards: it removes soils, thereby undermining roads and buildings and producing unstable slopes; and it deposits eroded soil in reservoirs, lakes, drainage structures, and on roads as mudslides. In the eastern Fresno County area, soils exhibiting moderately high to high erosion potential are located in the Sierra Nevada and the foothills, as shown on Figures 7-2 and 7-3 in the *Background Report*, and generally coincide with land slope areas that exceed 30 percent. Many of the soils are located within the boundaries of the Sierra National Forest, Sequoia National Forest, or Kings Canyon National Park, which would limit their availability for intensive development. Within the valley, erosion is generally not problematic except for areas containing Rossi soil east of the Fresno Slough from approximately Mendota to Fish Slough near Helm. Severe erosion potential has also been identified along the San

Joaquin River Bluff. Along the main bypass floodway of Fresno Slough, widely spaced gullies in a trellis pattern have eroded the soils where subsiding floodwaters drain back into the deeper main flood channel. In western Fresno County, most soils associated with the Kettleman series appear to be subject to moderate to severe sheet and gully erosion potential. Areas where Kettleman soils are present are located primarily west of I-5 in the Coast Range foothills. As noted in the *Soils of Western Fresno County* report, although the Panoche and Panhill soils are classified as exhibiting no erosion under natural conditions, their physical properties make them particularly susceptible to erosion as a result of human activity. These soils are located extensively throughout the western area and are especially prevalent in areas on recent alluvial fans in the central part of the western area.

REGULATORY SETTING

The following subsection is a brief summary of the regulatory context under which soils and geologic hazards are managed at the federal, State, and local levels.

Seismic and Structural Safety

The State of California provides minimum standards for building design through the California Building Standards Code (California Code of Regulations (CCR), Title 24). The California Uniform Building Code (CUBC) is based on the Uniform Building Code (UBC) used widely throughout the U.S. (generally adopted on a state-by-state or district-by-district basis), and has been modified for California conditions with numerous more detailed and/or more stringent regulations. Where no other building codes apply, Chapter 29 regulates excavation, foundations, and retaining walls; and Chapter 70 regulates grading activities, including drainage and erosion control. The State earthquake protection law (California Health and Safety Code 19100 et seq) requires that buildings be designed to resist stresses produced by lateral forces caused by wind and earthquakes. Specific minimum seismic safety requirements are set forth in Chapter 23 of the UBC. Installation of underground utility lines must comply with industry standards specific to the type of utility (e.g., National Clay Pipe Institute for sewers and American Water Works Association for water lines). These standards contain specifications for installation and design.

State regulations and engineering standards related to geology, soils, and seismicity are reflected in the Fresno County building standards. Construction and design would be required to comply with the latest standards at the time of construction. Both the UBC and County require preparation of a geotechnical study to identify site-specific conditions. The results of such geotechnical studies provide design criteria that ensure structural integrity and public safety of proposed development, particularly during seismic events. Issues addressed include seismic design, slope protection, and ongoing engineering/geotechnical review, as well as site preparation, grading, and foundation design, as stipulated in the UBC and local building regulation. The recommendations of the geologic and soils reports must be incorporated in the design of foundations and buildings. Earthquake-resistant design and materials are required to meet or exceed the current seismic engineering standards of the UBC Seismic Zone 3 or 4 requirements, depending on the location.

Grading and Erosion

The primary concern with erosion relates to increased sedimentation in receiving water from construction site runoff and urban development. Regulations pertaining to the management of erosion/sedimentation as they relate to the protection of water resources are summarized in Section 4.8, Water Resources, of this EIR.

The Fresno County Grading Ordinance (Section 7002, March 1991) stipulates safety and environmental control measures for construction practices. The Ordinance sets forth rules and regulations to control excavation, grading, and earthwork construction, including fills and embankments. The Ordinance also establishes the administrative procedure for issuance of permits, and provides for approval of plans and inspection of grading construction. All grading activities are required to be permitted by the County's Building Official with the exception of various kinds of grading that are indicated in the Ordinance. The Ordinance also sets forth other requirements that must be met before any permit is issued. The County requires erosion control measures and inspections to be made by the Building Official.

PLAN ELEMENTS

Development under the Draft General Plan would increase the number of people in existing incorporated areas, primarily Fresno and Clovis, and their spheres of influence. Development in western Fresno County and other unincorporated areas would be limited. The General Plan would result in residential, commercial, industrial, and public uses being constructed in areas subject to the seismic and geological conditions described above. The Draft General Plan contains the following policies that address seismic and geological conditions.

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| Policy HS-D.1 | 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 groundshaking, avalanche potential, and other hazardous geologic conditions in Fresno County. |
| Policy HS-D.2 | The County shall ensure that the General Plan and/or County Ordinance Code is revised, as necessary, to incorporate geologic hazard areas formally designated by the State Geologist (e.g., Earthquake Fault Zones and Seismic Hazard Zones). Development in such areas, including public infrastructure projects, shall not be allowed until compliance with the investigation and mitigation requirements established by the State Geologist can be demonstrated. |
| 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, groundshaking, lateral spreading, lurchcracking, 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.5 Pursuant to the Alquist-Priolo Earthquake Fault Zoning Act (Public Resources Code, Chapter 7.5), the County shall not permit any structure for human occupancy to be placed within designated Earthquake Fault Zones unless the specific provisions of the Act and Title 14 of the California Code of Regulations have been satisfied.
- Policy HS-D.6 The County shall inventory unreinforced masonry structures, including emergency facilities and other critical facilities constructed prior to 1948, used for human occupancy (excluding single-family residential structures), and evaluate the facilities for seismic safety. If found below acceptable standards, the County shall implement a program to mitigate potential hazards.
- Policy HS-D.7 The County shall ensure compliance with State seismic and building standards in the evaluation, design, and siting 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.12 In known or potential 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, undercutting the bases of slopes, removal of vegetative cover, and steepening of slopes.
- Policy HS-D.13 The County shall not approve a County permit for new development, including public infrastructure projects, in known or potential avalanche hazard areas unless it can be demonstrated by a California-registered engineer or engineering geologist that the structures will be safe under anticipated snow loads and avalanche conditions.

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.
Policy HS-D.15	The County Board of Review or other subsequently-appointed body shall serve as the review body on appeals from seismic and geologic hazard requirements.
Policy LU-B.12	<p>The County shall require a preliminary soils report for discretionary development projects when the project site is subject to moderate or high risk landslide potential and has slopes in excess of fifteen (15) percent.</p> <p>If the preliminary soil report indicates soil conditions could be unstable, a detailed geologic report by a registered geologist and registered civil engineer, or a registered engineering geologist, shall be required indicating the suitability of any proposed or additional development.</p>

IMPACTS AND MITIGATION MEASURES

Method of Analysis

The analysis of potential seismic and geological impacts is based on information compiled and presented in the *Background Report*. This information includes available technical reports and published information, correspondence, and consultation with knowledgeable agency personnel. The analysis is qualitative, and evaluates the extent to which development under the Draft General Plan could be affected by known seismic and geologic hazards. The analysis assumes that growth would continue to occur primarily in areas that are already urbanized.

Seiches, tsunamis, or volcanic events and their associated hazards are not considered to be a safety concern in Fresno County. Avalanche potential is greatest at the higher elevations of the Sierra Nevada in eastern Fresno County. However, most of these areas are inaccessible during periods of highest avalanche potential, and no new development is proposed for those areas. Therefore, these issues are not analyzed in this EIR. For a discussion of subsidence related to groundwater withdrawal, please see Section 4.8, Water Resources.

Standards of Significance

For purposes of this EIR, an impact may be deemed significant if development under the Draft General Plan would:

- expose people or structures to potential substantial risk of loss, injury, or death involving: rupture of a known earthquake fault, strong seismic groundshaking, seismic-related ground failure (e.g., liquefaction);
- expose people or structures to potential substantial risk of loss, injury, or death as a result of landslides, erosion, or other unstable slope conditions;

- expose structures to substantial increased risk of damage as a direct result of subsidence due to groundwater withdrawal; or
- create substantial risks to life or property due to the presence of expansive soils.

Impacts and Mitigation Measures

4.13-1 Development under the Draft General Plan would increase the number of people and structures who could be exposed to seismic hazards.

Based on the historic seismicity of the region, it is probable that portions of Fresno County would be affected by at least one moderate to large earthquake during the 20-year timeframe of the General Plan.

For example, the 1983 Coalinga earthquake was a significant seismic event in western Fresno County. Because of the variety of geologic units and soil types throughout the County, the extent of damage would depend on the specific physical characteristics of the underlying soils, rock types, duration and intensity of shaking, and other factors. Development under the Draft General Plan would increase the number of people who could be exposed to seismic hazards. The increase in population that could be exposed to seismic hazards would be identical with or without the project. Earthquake-induced groundshaking would be the primary hazard. Groundshaking and related secondary effects (e.g., liquefaction, lateral spreading, landslides, or other ground failure) could result in injury, loss of life, or property damage due to damage or failure of structural and non-structural building components. In addition, utility service could be disrupted due to damage or destruction of infrastructure, which could result in unsanitary or unhealthful conditions (e.g., broken water supply or sewer lines), or possible fires or explosions from damaged natural gas lines. Emergency response services could be delayed if roadways are damaged.

Recommended measures to reduce the potential for life safety and property damage would be identified in site-specific geotechnical studies prepared for new development. Prior to the issuance of building permits, project applicants would be required to demonstrate that the proposed development complies with all required regulations and standards pertaining to seismic hazards. The evaluation of potential seismic hazards and incorporation of appropriate design and construction features and effective land use planning is required by State law and is reflected in General Plan Policies HS-D.2, HS-D.4, HS-D.5, HS-D.6, and HS-D.7. These State laws and regulations apply equally to cities within the unincorporated areas of the County.

There are no significant constraints to development related to seismic hazards within the County or incorporated areas that cannot be mitigated through implementation of applicable regulations and codes and standard engineering practices. Implementation of applicable CUBC and local building code and permitting requirements would minimize the potential for adverse effects on people and property due to seismic activity. Although more people would be exposed to seismic hazards, assuming compliance with all applicable regulations, standards, and codes, development under the Draft General Plan would not expose people or property to any new or substantially different risks associated with seismic hazards compared to existing conditions and impacts would be reduced to a ***less-than-significant level***.

Mitigation Measures

4.13-1 *None required.*

4.13-2 Future development near Coalinga and Panoche in western Fresno County could expose people and property to hazards associated with surface rupture or fault creep from active faults designated as Alquist-Priolo Earthquake Fault Zones.

The Nunez and Ortigalita faults in western Fresno County are classified as active faults and have been designated Alquist-Priolo Earthquake Fault Zones. An active fault may pose a risk of surface fault rupture. Surface rupture occurs when movement on a fault deep within the earth breaks through to the surface. Fault rupture almost always follows preexisting faults, and the rupture may occur suddenly during an earthquake or slowly in the form of a fault creep.

Buildings, structures, roadways, and infrastructure located on or adjacent to an active fault could be severely damaged or destroyed by surface rupture or fault creep, resulting in injury, death, or property damage. Sudden displacements are more damaging to structures because they are accompanied by groundshaking. Fault creep offsets and deforms curbs, roadways, and building foundations, which can also increase the risk to human health and property.

The communities that could be affected by fault rupture are not anticipated to experience a substantial amount of growth, with or without the project. Nonetheless, the Alquist-Priolo Earthquake Fault Zoning Act requires that cities and counties require a geologic investigation to demonstrate the proposed development will not be constructed across active faults. Projects include all land divisions and most structures for human occupancy. If an active fault is found, a structure for human occupancy cannot be placed over the trace of the fault and must be set back from the fault (generally 50 feet). Policy HS-D.5, which incorporates the Alquist-Priolo law, combined with other policies that require preparation of site-specific geotechnical studies, continued research, and use of that information to design and construct projects (Policies HS-D.1, HS-D.2, HS-D.3, HS-D.4, and HS-D.7), would ensure that potential hazards associated with fault rupture would be reduced to levels required by State laws and regulations, regardless of whether the development occurs in incorporated or unincorporated areas of the County. Therefore, impacts related to active faults would be ***less than significant***.

Mitigation Measures

4.13-2 *None required.*

4.13-3 Development under the Draft General Plan could expose an increased number of people to hazards associated with unreinforced masonry buildings.

Older buildings constructed before building codes were adopted, and some newer buildings constructed before earthquake-resistant provisions were included in the codes, could be damaged during an earthquake. Unless the buildings are identified and properly reinforced, building occupants, visitors, or workers could be exposed to potential hazards from falling debris or structural failure. Older masonry buildings without seismic reinforcement (unreinforced masonry) are the most susceptible to the type of structural failure that can result in injury or death. Wood-frame buildings one or two stories high (e.g., single-family dwellings) are considered to be the most structurally resistant to earthquake damage.

General Plan Policy HS-D.6 directs the County to identify unreinforced masonry buildings and methods to improve their safety during an earthquake. This would reduce potential impacts to less-than-significant levels within unincorporated areas in the County by ensuring that the structural safety of these structures would be improved so the hazard to building occupants from earthquakes would be reduced. However, such programs may not exist or have not been fully implemented within all incorporated areas where most of the future growth, with or without the project, would occur. Therefore, this impact is considered **significant**.

Mitigation Measures

4.13-3 *No mitigation is required beyond Draft General Plan Policy HS-D.6 for Fresno County. No mitigation measures are available to the County to reduce impacts occurring within the cities' jurisdiction.*

Although General Plan policies would reduce potentially significant impacts related to unreinforced masonry buildings within unincorporated areas of the County, implementation of such programs within the incorporated areas is not within the County's jurisdiction to monitor and enforce. Therefore, the impact remains significant and unavoidable.

4.13-4 Development under the Draft General Plan could increase the number of people in areas subject to landslide hazard.

Mountainous areas in eastern and western Fresno County are potentially susceptible to landslides. Probable future slides can also be anticipated in areas where landsliding has already taken place. Slopes covered with deep soils, or hillsides heavily saturated with groundwater are potential slide areas, as are areas where bedding or jointing of rock materials and hill slope directions are similar. A landslide into a lake has the potential to produce a wave that could affect waterfront development. Slides along river banks and streams could also affect adjacent development, particularly along certain portions of the San Joaquin River where such instability has been observed.

Little or no development would occur in steep, mountainous areas. The greatest potential for development to be affected by landslide hazard would be in the unincorporated foothills. Growth in the foothills, with or without the project, would increase the number of structures that could be placed on materials susceptible to landslide. Some development could occur along the San Joaquin River and local streams, both in incorporated areas and unincorporated areas. Locations along streams and rivers

could be maintained as open space, or buffers and setbacks could be incorporated into site design to protect species and habitat, water quality, and views, and to provide recreational opportunities. This would minimize the amount or density of development that could be exposed to landslide hazard in those areas.

General Plan Policies HS-D.10 through HS-D.12 and LU-B.12 would ensure that hazards related to landslides within the unincorporated areas are properly identified and that potential hazards are minimized through land use planning and building permitting processes. However, similar policies may not exist for all cities under whose jurisdiction most of the future growth, with or without the project, would occur. Therefore, this impact is considered **significant**.

Mitigation Measures

4.13-4 *No mitigation is required beyond Draft General Plan Policies HS-D.10 through HS-D.12 and LU-B.12 for Fresno County. No mitigation measures are available to the County to reduce impacts occurring within the cities' jurisdiction.*

Although General Plan policies would reduce potentially significant impacts related to erosion within unincorporated areas of the County, implementation of such requirements within incorporated areas is not within the County's jurisdiction to monitor and enforce. Therefore, the impact remains significant and unavoidable.

4.13-5 Additional development could occur in areas with expansive soils.

Some areas of the County are underlain by soils that are moderate to highly expansive. Development under the Draft General Plan would result in construction of new buildings and structures on expansive soils. The presence of expansive soils could cause damage to building foundations or floor slabs if volume changes due to moisture variations occur in the subgrade materials. Utility lines, roadways, or other project features that cross adjacent soil unit boundaries where expansive properties differ could be even more susceptible to damage. The potential for expansive soils to result in structural or property damage would increase personal safety risks and risk of property damage. General Plan Policies HS-D.1 and HS-D.8 reflect the County's commitment to minimizing hazards related to construction on expansive soils. In addition to identifying areas of expansive soil potential, development, including infrastructure projects, would be required to conduct site-specific geotechnical studies as part of the application and approval process to identify both the potential hazards resulting from construction on expansive soils, and necessary design and construction features (e.g., use of soil amendments to reduce shrink/swell properties of soil, specialized foundation design, removal of expansive soil at foundation sites, and replacement with non-expansive soil) to minimize or prevent such hazards.

Potential impacts related to expansive soils would occur with or without the project as growth occurs in the County. A site-specific geotechnical study must be prepared as part of the development process, regardless of whether the location is within incorporated or unincorporated areas of the County. Further, all new building construction and design must comply with specific UBC requirements. Therefore, this impact is considered **less than significant**.

Mitigation Measures

4.13-5 *None required.*

4.13-6 Additional development could affect the rate or extent of erosion.

Erosion is frequently accelerated by site preparation activities such as excavation and grading and cuts and fills. Exposed rock or soil surfaces resulting from site preparation (e.g., cuts and fills and vegetation removal) can lead to increased erosion. Erosion potential can also be enhanced by changing the permeability or runoff characteristics of the soil, or by modifying or creating new pathways for drainage. After development, slopes that are not effectively contoured, compacted, or revegetated may be susceptible to erosion. In addition to potential adverse effects on water quality from increased sediment loads carried in runoff, as discussed in more detail in Impact 4.8-5, erosion can result in slope instability during construction and after development is complete. Unless erosion controls are in place, people and structures could be exposed to increased risk of injury or damage as a result of mudslides, landslides, or other downslope movement of soil or rock. Development in the foothills and along river and stream banks would be most susceptible to erosional effects. Such hazards could occur with or without the project as growth and associated development in the County increases.

General Plan Policies HS-D.9, HS-D.10, HS-D.11, and HS-D.14 identify steps that must be taken during the planning and permitting process in unincorporated areas to identify erosion hazards and methods (through design and construction) to reduce the risk to the public and the environment from erosional processes. Although these policies would address development in unincorporated areas in the foothills, similar policies may not exist for all cities under whose jurisdiction most of the future growth, with or without the project, would occur. Therefore, this impact is considered **significant**.

Mitigation Measures

4.13-6 *No mitigation is required beyond Draft General Plan Policies HS-D.9, HS-D.10, HS-D.11 and HS-D.14 for Fresno County. No mitigation measures are available to the County to reduce impacts occurring within the cities' jurisdiction.*

Although General Plan policies would reduce potentially significant impacts related to erosion within unincorporated areas of the County, implementation of such requirements within the incorporated areas is not within the County's jurisdiction to monitor and enforce. Therefore, the impact remains significant and unavoidable.

Cumulative Impacts

For seismic and geologic hazards, the impacts are not considered cumulatively considerable because all of the impacts would be site-specific and would not combine with other similar effects to create a loss or contribute to a cumulative condition.