

4.6 GEOLOGY

This section describes the geologic, soils, and seismic conditions within Tuolumne County and expected impacts associated with implementation of development facilitated by the proposed General Plan Update. Much of the background setting and analysis was based on information provided in the Tuolumne County Multi-Jurisdiction Hazard Mitigation Plan, which was adopted by the Tuolumne County Board of Supervisors on October 19, 2004, and revised on December 4, 2012.

4.6.1 Setting

a. Regional Geology. Tuolumne County is located primarily within the Sierra Nevada geomorphic province, with an extremely small portion (less than 10%) of the western boundary creeping into the Great Valley province. The Sierra is a tilted fault block nearly 400 miles long. Its east face is a high rugged multiple scarp, contrasting with the gentle western slope that disappears under the sediments of the Great Valley to the west. Deep river canyons are cut into the western slope. Their upper courses, especially in massive granites of the higher Sierra, are modified by glacial sculpturing, forming such scenic features as Yosemite Valley. The high crest in the Sierra culminates in Mt. Whitney with an elevation of 14,495 feet above sea level near the eastern scarp. The metamorphic bedrock contains gold-bearing veins in the northwest trending Mother Lode. The northern Sierra boundary is marked where bedrock disappears under the Cenozoic volcanic cover of the Cascade Range (California Geological Survey, 2002).

b. Geomorphology and Topography. The topography of Tuolumne County displays a wide range of landforms ranging from vertical cliffs to gently undulating plains. Combined with often times complex underlying geology that gives rise to a wide range of surficial soil types, native topography can provide a challenging environment for safe development (Tuolumne County Multi-Jurisdiction Hazard Mitigation Plan, 2013).

Faults. Tuolumne County is located to the east of the Foothills fault system. The Foothills fault system is a complex, braided system of individual fault segments that extends for approximately 200 miles from Mariposa in the south to Lake Alamanor in the North. There are two primary fault zones within the Foothills fault system: the Melones fault zone along the east side of the system and the Bear Mountain fault zone on the west. The Melones fault zone is classified as “active” (has demonstrated displacement within the last 100,000 years). The Bear Mountain fault zone is classified as “indeterminable active” (definitive evidence has not been established locally concerning its activity within the last 100,000 years). According to the Sonora General Plan 2020, there are four “capable” faults (i.e., faults with tectonic displacement within the last 35,000 years which could produce a quake) are located within Tuolumne County: Negro Jack Point, Bowie Flat, Rawhide Flat West, and Rawhide Flat East.

Soil Characteristics. Soil is generally defined as the unconsolidated mixture of mineral grains and organic material that mantles the land surfaces of the earth. Soils can develop on unconsolidated sediments and weathered bedrock. The characteristics of soil reflect the five major influences on their development topography, climate, biological activity, parent source material, and time. The soils in Tuolumne County can be generally considered to be shallow. The diverse underlying geology along with agents of weathering such as erosion, soil



chemistry, and cultural activities all play a part in the soil type. Clays exist both as a weathering product and as native sediments. Clays have the potential for expansion and contraction when they go through wet/dry cycles. Foundations based on clay soils have the potential for being affected by the associated changes in soil volumes over time. This phenomenon can be most directly observed by areas of roadway failure that are commonly evidenced by repeated patching over the years (although patching is often due not only to clay soils but also to the presence of inadequate drainage of the subbase beneath the pavement).

c. Seismicity. Geologic hazards in Tuolumne County are primarily associated with potential seismic activity along the Foothills fault zone and associated groundshaking. The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. The law requires the State Geologist to establish regulatory zones around the surface traces of active faults and to issue appropriate maps. The maps are distributed to all affected cities, counties and state agencies for their use in planning and controlling new or renewed construction. That list does not include Tuolumne County due to its location as being relatively distant from any known faults that meet the criteria of the mapping program, according to the Tuolumne County Multi-Jurisdictional Hazard Mitigation Plan. Tuolumne County lies within the portion of the State that has had no record of damaging shaking events since 1800.

Historically, earthquake activity in Tuolumne County is substantially below the California State average. In fact, it has one of the lowest earthquake risks in the State. However, it still remains 735% greater than the overall U.S. average (Tuolumne County Emergency Services Plan, 2012). The potential for ground shaking is discussed in terms of the percent probability of exceeding peak ground acceleration (% g) in the next 50 years. In Tuolumne County, the predicted peak acceleration for the entire developed portion of the County does not exceed 20% of gravity, which puts the County in the lowest potential for the entire State.

A total of 4 historical earthquake events with recorded magnitudes of 3.5 or greater occurred in or near Tuolumne County this past century. These earthquakes did not cause substantial damage due to their occurrence in mountainous and remote areas generally devoid of development or human presence. Tuolumne County’s earthquake history is shown in Table 4.6-1 below:

**Table 4.6-1
 Tuolumne County Earthquake History 1930-2011**

Date	Location	Magnitude	Depth (km)	Latitude	Longitude
June 25, 1933	Eastern Mono County, near Tuolumne/Mono County line	6.1	N/A	38.08	-119.33
August 9, 1983	Southeast Tuolumne County, near Tuolumne/Mariposa County line	4	2	37.9	-119.49
August 10, 1975	Southern Mariposa County	4	N/A	37.37	-119.99
June 10, 1965	Eastern Mono County, near Tuolumne/Mono County line	3.5	N/A	38.2	-119.5

Source – Tuolumne County Emergency Services Plan, June 2012



d. Subsidence and Liquefaction. Subsidence as a result of previous underground mining activity could prove to be consequential in portions of Tuolumne County where significant underground mining activity has occurred. Most of the underground mining happened in the areas of the County that overlie the Mother Lode gold veins, or in “pocket” mine areas of isolated gold ore that are found to the east of the Mother Lode. Fortunately, most of the mined areas have not been substantially developed. So if subsidence occurs then the losses should be minimized to a few structures. However, portions of the City of Sonora are underlain by mine workings, and the threat could be more substantial for Sonora (Hazard Mitigation Plan).

Without a historical record of substantial failures or damage associated with subsidence, an approach to attempt to quantify the hazard has not been identified. Therefore, the annualized losses for sinkhole hazards are considered to be negligible, and the annualized losses for subsidence are unknown. It is known that the potential for subsidence is very limited geographically (Tuolumne County Multi-Jurisdictional Hazard Mitigation Plan, 2013).

Liquefaction is the process by which saturated, unconsolidated soil or sand is converted into a quicksand like suspension during an earthquake. Even well-constructed buildings may “sink” during a major earthquake if foundations are built on areas susceptible to liquefaction (alluvial soils and high water content) (Tuolumne County Emergency Services Plan). Since liquefaction most likely would occur during or following an earthquake and severe earthquake risk is deemed to be low in the county, the risk and danger of liquefaction and subsidence occurring within the County is also considered to be minimal.

e. Landslides. Landslides may be triggered by both natural and human induced changes in the environment resulting in slope instability. Precipitation, topography, and geology affect landslides and debris flows. Human activities, such as mining, road construction, and changes to surface drainage areas, also affect the landslide potential. Landslides often accompany other natural hazard events, such as floods, wildfires, or earthquakes. They can also occur slowly or very suddenly and damage and destroy structures, roads, utilities, and forested areas and cause injuries and death.

In general, the greater the existing slope, the greater the overall threat of landslide. Downslope development on relatively flat land at the base of steep cliffs should occur only after the potential for rockfall is evaluated. The steep cliffs, for example as found along the edge of Table Mountain in Tuolumne County (but not limited to Table Mountain) have the potential for depositing landslide debris over a large area which may exceed, in a horizontal plane measured from the foot of the cliff face, several times the height of the cliff. Surface mapping of rock exposures along with observation of conditions in the local area of a project will assist in the determination of site specific areas subject to rockfall damage (Tuolumne County Multi-Jurisdictional Hazard Mitigation Plan, 2013).

According to Figure II-12 of the Tuolumne County Multi-Jurisdictional Hazard Mitigation Plan, the landslide hazard risk in Tuolumne County is generally low, while moderate in some areas. The diverse geology of western Tuolumne County includes areas underlain by serpentine. This generic rock type is particularly prone to slope failure as evidenced by native slope failures and failure of man-made slopes such as those experienced on the roadways in the vicinity of Don



Pedro Reservoir. Slope failure of the steep slopes on Table Mountain have littered the adjacent slopes with boulders and other debris. In places, the layering of relatively soft volcanic mudflows beneath more dense volcanic rocks has resulted in erosion removing portions of the softer materials with the overlying harder volcanic rock exposed.

The above discussion concerning areas with potential landslide hazard is limited to certain areas near cliff-like structures or on very steep slopes, none of which are often subject to development. There have been reported incidents of landslides and general slope failure in isolated portions of the County, but this is a very uncommon occurrence with no defined history of significant damages. Although the above discussion shows that portions of the privately-owned and potentially developable land of Tuolumne County can include areas where landslides could occur, it is not common to most areas. Overall, the hazard is much less than can be expected to occur in much of the more densely developed portions of the State, where the geologic conditions are much more prone to landslide and general instability.

g. Soil Erosion and Topsoil. Erosion is a natural process where soil is removed by water, wind or gravity from one location to another. The process of removal and deposition changes the topography toward a condition of equilibrium. It is a natural process that when aided by man can result in undesirable consequences. Grading activities remove the natural vegetative cover that protects the soil from erosion agents.

The potential for erosion of soils increases as a function of the steepness of the slope. The areas in excess of 30% slope steepness should be considered as having a high potential for erosion. The vast majority of development in Tuolumne County is not in proximity to cliff-like areas such as Table Mountain, nor has it often occurred on steep slopes in excess of 30%. Erosion problems are generally limited to restricted areas where grading has oversteepened slopes, or deposited fill in areas where it has not stabilized, or where improper grading practices have not included provisions to seed or otherwise protect fresh slopes from eroding. There have also been other examples of burned areas being eroded prior to establishment of vegetation to protect the slopes from degrading. Otherwise, compared to many areas of the State such as the coastal mountains, erosion has proven to be a modest hazard in Tuolumne County.

g. Volcanoes. The volcano hazard of Tuolumne County is presented by the relative proximity to the Long Valley Caldera and Mono-Inyo Craters Volcanic Field. This Long Valley area is located on the east side of the crest of the Sierra Nevada, east of the most extreme southeastern portion of the County.

Tephra, or ash falling from the sky after volcanic events, can cause impacts ranging from inconvenience to equipment failure and large-scale property and agricultural losses, depending on the amount of ash being deposited and the duration of the event. The movement of ash is subject to the normal jet stream effects of air masses moving in general from west to east. This reduces the risk of a significant ash event from affecting Tuolumne County.

h. Regulatory Setting. The County's Safety Element, the Tuolumne County Multi-Jurisdiction Hazard Mitigation Plan (LHMP), the California Building Code (CBC), and the California Residential Code (CRC) include measures to protect lives, health, property and public welfare. The County's Safety Element is intended to relate County land use policies to



local safety planning and contains policies for determining acceptable levels of public risk imposed by these land uses, as well as policies for mitigating the effects of natural or manmade catastrophes. The Element incorporates the LHMP and implements the policy recommendations for the County's area of responsibility as guiding policies in dealing with natural disasters.

On December 4, 2012, the Board of Supervisors adopted the 2013 Tuolumne County Multi-Jurisdictional Hazard Mitigation Plan pursuant to Resolution 74a-12. The Federal Emergency Management Agency (FEMA) approved the LHMP on September 3, 2013. The LHMP recommends specific actions to combat or accommodate the forces of nature and protect the County's residents from hazard losses associated with earthquakes, flooding, landslides and sinkholes, volcanoes, wildfire, extreme weather and hazardous materials.

The CBC is the regulatory environment for design and construction of building codes and standards covering state and federal land use and environmental regulations which are developed specifically for the purpose of regulating the life safety, health, and welfare of the public. The CRC is a parallel set of requirements that applies to detached single-family and multiple-family dwellings (townhouses) not more than three stories above grade plane in height. All other buildings and structures are subject to the CBC.

4.6.2 Impact Analysis

a. Methodology and Significance Thresholds. The General Plan Update would result in potentially significant impacts if development facilitated by the General Plan would result in any of the following conditions, which are based upon the environmental checklist in Appendix G of the CEQA Guidelines:

1. *Expose people or structures to 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 groundshaking*
 - *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 project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse*
4. *Be located on expansive soil, as defined in Table 18-1-A of the California Building Code (1994), creating substantial risks to life or property*
5. *Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of wastewater*

Geology impacts 1-4 of Appendix G of the CEQA Guidelines are analyzed and discussed below. Specific impacts related to soils incapable of adequately supporting septic tanks and alternative waste water disposal systems are discussed in Section 4.17, Less than Significant Environmental Factors. Chapter 13.08 of the Tuolumne County Ordinance Code describes requirements for



septic tanks that would ensure soil conditions would adequately support such facilities. Therefore, impacts with respect to this issue would be less than significant and this issue is therefore not discussed further in this section.

b. Project and Cumulative Impacts.

Impact GEO-1 The General Plan Update would result in development subject to future seismic events that could produce ground shaking, fault rupture, and ground failure within Tuolumne County that could damage structures and/or create adverse health and safety effects. However, with implementation of draft General Plan policies and required building codes, impacts would be Class III, less than significant.

In populated areas, the greatest potential for loss of life and property damage from a powerful earthquake can be a direct result of ground shaking. The degree of damage depends on many interrelated factors, including magnitude, focal depth, distance from fault, duration of shaking, type of surface, ground water depth, topography, and quality of buildings. As a result of the General Plan Update, a mixture of new residential, retail, entertainment, office and commercial uses would be encouraged to be developed near urbanized areas with existing public infrastructure and services. No new development would occur within or near fault lines known to be significantly hazardous. Furthermore, since new structures are required to be designed and built to withstand probable shaking without collapse, the greatest existing danger relating to geological events is the continued use of older structures incapable of withstanding earthquake forces. Wood frame structures of two stories or less constructed prior to 1948 can be considered safe, while buildings constructed prior to 1948 of other materials should be considered suspect. In all cases, unreinforced masonry structures should be considered unsafe.

Damage and injury resulting from geologic hazards can be reduced to acceptable levels through zoning and building permit review procedures and construction standards. New construction conforming to the standards of the California Building Code (CBC) or California Residential Code (CRC) would provide adequate protection from seismic events. Dams, schools, and hospitals are more stringently regulated by state and federal agencies for protection against such hazards. As discussed in Section 4.9, *Hydrology and Water Quality*, the O'Shaughnessy Dam is the only dam in the County which, if breached, might cause flooding of significance to local inhabited areas within the General Plan area.

New development within the County would conform to the CBC as required by law. Although nothing can ensure that structures do not fail under seismic stress, proper engineering, including compliance with the CBC, can minimize the risk to life and property, resulting in a less than significant impact to new development from groundshaking. Furthermore, the General Plan Safety Element would include policies intended to minimize the risks associated with groundshaking, fault rupture, and ground failure by identifying areas subject to these hazards or risks and directing development away from areas identified:

Policy 6.A.1 Reduce exposure to risk in hazardous areas, and enable recreational and agricultural opportunities to be maintained or provided by designating



hazardous areas, such as areas immediate to capable faults, as open space, agricultural, or recreational.

Policy 6.B.1 Apply zoning and other land use controls to regulate, and in some instances prohibit development in known hazardous areas capable of seismic activity.

Policy 6.B.2 Limit the extent of development in seismically hazardous areas in such a way as to be commensurate both with the degree of hazard involved and with the public costs which would be incurred if emergency or remedial actions became necessary.

*Implementation
Program 6.A.a*

Designate areas within 100 feet of capable faults as Open Space (O), Agricultural (AG) or Parks and Recreation (R/P) on the General Plan land use maps, and zone these areas for open space preservation, agriculture or recreation. For lands owned by a public agency, such as the Bureau of Land Management, the designation of Public (P) is also compatible within 100 feet of a capable fault area.

Adherence to CBC, CRC and General Plan policies and programs would ensure that new development under the draft General Plan Update would be able to withstand seismic activity and be sited away from known seismically hazardous areas or active fault lines. With adherence and compliance to the CBC and with implementation of the policies from the General Plan, impacts related to groundshaking, ground failure, and fault rupture would be reduced to a less than significant level.

Mitigation Measures. No additional mitigation measures are required beyond compliance with applicable proposed General Plan policies and provisions of the CBC.

Significance After Mitigation. Impacts would be less than significant with implementation of the CBC requirements and polices contained in the Safety Element.

Impact GEO-2 Future seismic events could result in liquefaction of soils in portions of the County. Development in these areas facilitated by the General Plan Update could be subject to liquefaction and subsidence. However, the risk and danger of liquefaction and subsidence occurring within the County is considered to be minimal. With implementation of proposed General Plan policies, impacts would be Class III, less than significant.

As discussed above, hazard maps for Tuolumne County are not available from the State Geologist due to a low anticipation of earthquake risk in the county. Since liquefaction would most likely occur during or following an earthquake and severe earthquake risk is deemed to be low in the county, the risk and danger of liquefaction occurring within the County is also considered to be minimal. Subsidence potential is also known to be minimal throughout Tuolumne County and most likely to occur in areas where significant underground mining activity has occurred. As a result of the General Plan Update, a mixture of new residential, retail, entertainment, office and commercial uses would be encouraged to be developed near



urbanized areas with existing public infrastructure and services. No new development would occur within or near areas subject to high risk of liquefaction or subsidence. Furthermore, the proposed General Plan Safety Element includes policies intended to minimize the risks associated with liquefaction and subsidence by identifying areas subject to seismic or geologic hazard risk or activity and directing development away from areas identified.

- Policy 6.B.1 Apply zoning and other land use controls to regulate, and in some instances prohibit development in known hazardous areas capable of seismic activity.*
- Policy 6.B.2 Limit the extent of development in seismically hazardous areas in such a way as to be commensurate both with the degree of hazard involved and with the public costs which would be incurred if emergency or remedial actions became necessary.*
- Implementation
Program 6.B.d Establish a program for geologic, seismic, and geotechnical engineering reports required for proposed developments to be reviewed by a technically qualified consultant*

Adherence to General Plan policies would ensure that new developments would be sited away from areas subject to high liquefaction or subsidence risk, and that any liquefaction or subsidence risks would be identified by required geologic, seismic, and geotechnical engineering reports. With adherence to the policies contained in the General Plan’s Safety Element, impacts related to liquefaction and subsidence would be less than significant.

Mitigation Measures. Compliance with applicable policies of the Safety Element would ensure that impacts would be less than significant.

Significance After Mitigation. Impacts would be less than significant with implementation of the policies contained in the Safety Element.

Impact GEO-3 The General Plan Update would result in development subject to landslide hazard and risk. Landslides have the potential to damage and destroy structures, roadways and other improvements as well as to deflect and block drainage channels, causing further damage and erosion. However, with implementation of proposed General Plan policies, impacts would be Class III, less than significant.

Tuolumne County has very “Low” to “Moderate” risk for landslides. Landslide areas are generally located in remote uninhabited sections of southwest Tuolumne County. The areas potentially susceptible to landslides within Tuolumne County are nearly all defined as having “Low” (less than 1.5 percent of area involved) and “Moderate” potential (1.5 to 15 percent of area involved) for landslide incident. As a result of the General Plan Update, a mixture of new residential, retail, entertainment, office and commercial uses would be encouraged to be developed near urbanized areas with existing public infrastructure and services. According to Figure II-12 of the Tuolumne County Multi-Jurisdiction Hazard Mitigation Plan (2013), all of Tuolumne County has a “Low” risk for landslides except for the area east of Columbia, which



has a “Moderate” risk. Development as a result of the General Plan Update would occur within areas of “Low” risk. Therefore, development as a result of the General Plan Update would not generally occur near any area susceptible to landslide risk since development would not generally occur in remote, uninhabited areas.

Slope instability may result in landslides, mudslides, or debris flows that can cause substantial damage and disruption to buildings and infrastructure. Impacts from these types of soil hazards are generally reduced to less than significant levels by the standard development review process. The following policies of the draft General Plan Safety Element would address landslide hazard and risk prior to construction and development:

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| <i>Goal 6.E</i> | <i>Monitor development to see that construction in landslide or unstable slope areas is accomplished safely, and that development does not create unsafe slopes.</i> |
| <i>Policy 6.E.1</i> | <i>Prior to urban development in landslide or unstable slope areas, require engineering studies to be undertaken in order to determine the extent of the slope instability and require appropriate measures to be undertaken to promote safety.</i> |
| <i>Policy 6.E.2</i> | <i>Confirm that the stability of any slope, which can be altered by grading operations and improper drainage conditions, is not adversely affected during grading and construction activities.</i> |

Adherence to General Plan policies would ensure that prior to and during construction of new development under the General Plan Update, potential for creating unsafe or unstable slopes would be sufficiently identified and avoided via required engineering studies, and appropriate measures would be undertaken when necessary. With adherence to the policies contained in the General Plan’s Safety Element, impacts related to landslides would be reduced to a less than significant level.

Mitigation Measures. Compliance with applicable policies of the draft General Plan Update’s Safety Element would ensure that impacts would be less than significant.

Significance After Mitigation. Impacts would be less than significant with implementation of policies contained in the Safety Element.

Impact GEO-4 The General Plan Update would potentially result in development on expansive soils. Expansive soil conditions could result in foundation and building distress problems and cracking of concrete slabs. However, implementation of draft General Plan Safety Element policies and applicable provisions of the Tuolumne County Ordinance Code would reduce impacts relating to soil expansion to a Class III, less than significant, level.

Development under the draft General Plan update has the potential to occur on expansive soils. Expansive soils exhibit clay like characteristics and swell when wetted and shrink when dried. Wetting can occur naturally in a number of ways, (e.g., absorption from the air, rainfall,



groundwater fluctuations, lawn watering and broken water or sewer lines). In hillside areas, as expansive soils expand and contract, gradual downslope creep may occur, eventually causing landsliding. Clay soils also retain water and may act as lubricated slippage planes between other soil/rock strata, also producing landslides, often during earthquakes or by unusually moist conditions. The shrink-swell characteristics of soils can vary widely within short distances, depending on the relative amount and type of clay. Clay soils are present in Tuolumne County according to the Hazard Mitigation Plan, and have the potential for expansion and contraction when they go through wet/dry cycles. Expansive soils are also often prone to erosion. Foundations of structures placed on expansive soils may swell during the wet season and shrink during the succeeding dry season, potentially resulting in foundation damage.

The following Implementation Program under the draft General Plan Update Safety Element would ensure expansive or clay soils would be identified prior to construction of new developments:

Implementation

Program 6.B.d

Establish a program for geologic, seismic, and geotechnical engineering reports required for proposed developments to be reviewed by a technically qualified consultant under contract to the County of Tuolumne. These reports will be required as part of the application review process when a potential hazard exists, and funded by the developers paying for study of their respective projects.

In addition, new development under the General Plan Update may also be subject to a soil engineering report if required by the Community Resources Agency under Section 12.20.160 of the Tuolumne County Ordinance Code:

The soil engineering report required by Section 12.20.140 shall include data regarding the nature, distribution and strength of existing soils, conclusions and recommendations for grading procedures and design criteria for corrective measures, including buttress fills, when necessary, and opinions and recommendations covering adequacy of sites to be developed by the proposed grading. Where applicable in the opinion of the qualified professional, the report shall also include a description of the geology of the site, conclusions and recommendations regarding the effect of geologic conditions on the proposed development, and opinion in the adequacy for the use of the sites to be developed by the proposed grading, as affected by geologic factors. Recommendations included in the report and approved by the Department shall be incorporated in the grading or stockpiling plans or specifications.

For developments subject to the CBC, Section 1808.6 of the CBC requires design features for foundations of buildings and structures in areas subject to expansive soils. For buildings and structures in areas with expansive soils and subject to the CRC, Section R403.1.7.2 also refers to Section 1808.6 of the CBC for foundation design requirements. Furthermore, under Section 66490 of the Subdivision Map Act, a preliminary soils report prepared by a civil engineer registered in California, and based upon adequate test borings, would be required for every subdivision for which a final map is required by such a division. If the preliminary soils report indicates the presence of critically expansive soils or other soil problems that would lead to



structural defects, a soils investigation of each lot in the subdivision would be required (State of California, April 2008).

Typical measures to treat expansive soils involve removal, proper fill selection, and compaction. Expansion would not be a substantial constraint to development of individual sites provided that adequate soil and foundation studies are performed prior to construction and that recommendations in any soil engineering reports made by a qualified professional are followed.

With adherence to Implementation Program 6.B.d contained in the General Plan's Safety Element, Section 12.20.160 in the Tuolumne County Ordinance Code and other State regulations, impacts related to expansive soils would be reduced to a less than significant level.

Mitigation Measures. Compliance with the Tuolumne County Ordinance Code and applicable policies of the Safety Element would ensure that impacts would be less than significant.

Significance After Mitigation. Impacts would be less than significant with implementation of the CBC requirements and policies contained in the Safety Element.

Impact GEO-5 The General Plan Update would result in development that would require grading, which would potentially contribute to unstable slopes and therefore cause soil erosion. However, compliance with applicable policies of the proposed Safety Element and applicable codes of the Tuolumne County Ordinance Code would ensure that impacts would be Class III, less than significant.

As discussed above, the vast majority of development in Tuolumne County is generally not in proximity to cliff-like areas or on steep slopes in excess of 30%. Erosion problems are generally limited to restricted areas where grading has oversteepened slopes, or deposited fill in areas where it has not stabilized, or where improper grading practices have not included provisions to seed or otherwise protect fresh slopes from eroding. Due to areas of particularly steep gradient that occur within Tuolumne County, it is expected that erosion will continue over time to reduce the slopes to lower and lower elevations. However, this normal function is slow and incremental as to be imperceptible. This can change if the erosion functions are accelerated by events, predominantly human activities related to development and grading.

In general, erosion impacts from grading and development are typically on a very small scale and present no quantifiable vulnerability to the community. The overall potential of erosion as a hazard to the County is either negligible or undefined (Tuolumne County Multi-Jurisdiction Hazard Mitigation Plan 2013). The areas delineated on the Tuolumne County General Plan Geotechnical Maps as being in excess of 30% should be considered as having a high potential for erosion. Grading, either by natural agents such as erosion or the activities of man, has the potential for creating unstable slopes. Erosion control can be accomplished on critical slopes being affected by natural agents. Grading, concurrent testing in conformance with the Tuolumne County Ordinance Code, and oversight by the project engineer would ensure that a project would avoid future problems with stability or erosion. Furthermore, the draft General



Plan Safety Element would reduce the potential for erosion and sedimentation from earthmoving and construction activities by enforcing the following policy and program:

Policy 6.F.1 Mandate erosion control measures for all grading operations

Implementation

Program 6.F.A Apply Chapter 12.20 of the Tuolumne County Ordinance Code, the Grading Ordinance, in order to protect soil stability and natural topography and prevent soil erosion and creation of unstable slopes. Areas identified as having erosive soils, either by the Geotechnical Interpretive Maps or by other means, shall receive special consideration related to the erosive potential of grading and earthmoving activities.

Title 12 of the Tuolumne County Ordinance Code includes the following sections to be applied to ensure erosion control:

Section 12.20.150(H) An erosion control plan, showing the type and exact locations of measures to be taken, shall be supplied when determined necessary by the Department.

Section 12.20.350 The faces of cut and fill slopes shall be prepared and maintained to control against erosion. This control may consist of effective planting. The protection of the slopes shall be installed as soon as practicable and prior to calling for final approval. If, in the opinion of the Department, the protection for the slopes is not subject to erosion due to the erosion-resistant character of the materials, such protection may be omitted.

Section 12.20.360 When necessary, check dams, cribbing, rip rap or other devices or methods shall be employed to control erosion and provide safety.

The Regional Water Quality Control Board would require a project-specific Storm Water Pollution Prevention Plan (SWPPP) to be prepared for each project that disturbs an area one acre or larger. The SWPPPs would include project-specific best management practices (BMPs) designed to control drainage and erosion. These BMPs would be required as part of each individual project permit and would mitigate potential impacts on soil erosion as a result of construction or grading.

With adherence to Implementation Program 6.B.d contained in the General Plan's Safety Element and other State and County regulatory programs, impacts related to unstable slopes and erosion would be reduced to a less than significant level.

Mitigation Measures. Compliance with General Plan Safety Element policies, State regulations and the Tuolumne County Ordinance Code would ensure that impacts would be less than significant. Therefore, mitigation is not required.

Significance After Mitigation. Impacts related to soil erosion would be less than significant following compliance with the General Plan Safety Element, State regulations and the Tuolumne County Ordinance Code.

