4.5 GEOLOGY AND SOILS

This section evaluates potential impacts that could result from geologic and soils conditions if the proposed SOI Plan update (proposed project) is implemented. Information in this section comes from GIS mapping analysis as well as existing federal, state, and local regulations. The evaluation includes a discussion of the proposed project compatibility with these required applicable regulations and provides mitigation measures, if needed and as appropriate that would reduce these impacts. The following analysis of the potential environmental impacts related to geology and soils quality is derived primarily from the following sources and agencies:

- California Department of Conservation
- California Geologic Survey (CGS)
- Nevada City Zoning Ordinance
- Nevada County Safety Element

4.5.1 ENVIRONMENTAL SETTING

Regional Setting

Nevada County is within the Sierra Nevada Mountains, a geologic block approximately 400 miles long and 80 miles wide which extends in a north-south band along the eastern portion of California. The terrain of Nevada County is distinctly characterized by two features of the Sierra Nevada Mountains. The western third of the County is comprised of rolling foothills which form a transition between the low-lying Sacramento Valley to the west and the mountains to the east. The eastern two-thirds of the County is comprised of the steep terrain and exposed granite of the Sierra Nevada Mountains itself.

The geologic substructure of the county can be divided into three very broad groups, which are reflected in the surface soils:

- Western Foothills. This area, extending from the Yuba County border to just northeast of the Grass Valley/Nevada City area, is generally comprised of metavolcanic and granitic formations.
- Central Portion. The area extending northeast of the Grass Valley/Nevada City area to the upper mountainous area near Bowman Lake Road is generally comprised of sedimentary, metasedimentary and volcanic formations.
- Eastern Portion. This portion of the County through the high Sierra to the Nevada state line is generally comprised of volcanic and granitic formations.

Geologic Setting

Nevada County is a seismically active region, within the Sierra Nevada Mountains and foothills influenced heavily by uplift and faulting within the Mesozoic Sierra Nevada batholith, one of the largest and most
complex masses of granitic rock in the world. These movements create fractures or faults in the earth’s crust to accommodate compressional strain, and many of the faults, which remain active today, have uplifted and tilted the range to the west, producing a spectacularly rugged eastern escarpment and a gently inclined western slope. The proposed project is located in a geologically complex and diverse area that has the potential for earthquake-induced hazards. Earthquakes are produced in Nevada County and throughout the state from sudden movements along faults, described in detail below, generating ground motion when the accumulated stress within the rocks is released as waves of seismic energy.

**FAULTS AND SEISMIC HISTORY**

A fault is a fracture in the crust of the earth along which land on one side has moved relative to land on the other side. Most faults are the result of repeated displacement over a long period of time. A fault is defined as "a planar or gently curving fracture in the earth’s crust across which there has been relative displacement." When movement occurs along a fault, the energy generated is released as waves, which causes ground shaking. Ground shaking intensity varies with the magnitude of the earthquake, the distance from the epicenter, and the type of rock or sediment through which seismic waves move (City of Grass Valley, 2018). The mountain system rose to its current elevation, primarily by westward tilting along normal faults located along the eastern escarpment (DeCourten, 2018). Generally, the greater the number of faults within an area, the greater the risk of seismic activity.

The geologic structures that dominate the Sierra Nevada are the Foothills fault system on the west, and the active Sierra Nevada Frontal fault zone on the east. The Foothill Fault System is a broad zone of northwest-trending east dipping normal faults formed along the margin of the Great Valley and the Sierra Nevada geologic provinces on the western flank of the Sierra Nevada and southern Cascade mountain ranges. According to the U.S. Geological Service, Nevada County falls within five earthquake ground movement intensity zones. The western half of the County is in the lower intensity zones (8-20 % gravity), the middle portion is in the moderate zone (21-30% gravity) and the eastern edge is in the 31-40% gravity zone. No part of Nevada County is exposed to an earthquake probability of gravity 40% or more. The western half of Nevada County is in the lowest Earthquake Shaking Potential for California. It is likely that the region will be impacted by future seismic activity and with the exception of the far eastern edge of the County, the magnitude of the incident is not likely to be severe. (Nevada County, 2016).

According to the California Department of Conservation fault activity map, there are no faults under Nevada City. The nearest fault is the Grass Valley Fault approximately 3 miles to the west. The Grass Valley Fault is a pre-quaternary fault that has had recognized movement in the last 1,600,000 years. The nearest faults with more recent activity include the Giant Gap Fault approximately 10 miles to the east the Swan Ravine Fault approximately 16 miles to the west, and the Cleveland Fault within the most recent movement approximately 20 miles to the northwest near Oroville.

**Cleveland Hill Fault**

According to the California Department of Conservation (CDOC) Fault Activity Map, the closest historically active fault with surface displacement to the western portion of Nevada County is the Cleveland Hill Fault, which is located approximately 16 miles northwest of the boundary with Yuba County. The Cleveland Hill
Fault was active in 1975 and is associated with ground rupture during the Oroville earthquakes (Holdrege & Kull, 2018).

**The Swain Ravine Fault**

The Swain Ravine Fault is part of the western trend of the Bear Mountains fault zone. This zone includes a number of faults that trend from the southeast to northwest, and includes the Deadman near Auburn, Spenceville, Prairie Creek, and Cleveland Hills fault into the Oroville area. The northern portion of the Swain Ravine fault is identified as having possible late Quaternary activity due to its close association with the Cleveland Hills fault and Oroville earthquake. The late Quaternary portion of the Swain Ravine fault is located approximately 10 miles northwest of the boundary with Yuba County [California Department of Parks and Recreation (CDPR), 2009].

**Giant Gap Fault**

The Giant Gap Fault is within the Melones Fault Zone and has portions that experienced movement within the 700,000 years (Quaternary) as well as sections that are undifferentiated in age and older than 2,000,000 years. The fault is overlain by Miocene-Pliocene volcanics and underlain by pre-Cenozoic bedrock. Displacement can be seen and offsets with as much as a few hundred feet (Sierra College, 2009) are evidenced-based on a down-Pliocene mudflows that cap Giant Gap Ridge (CDMG, 1978).

**GEOLOGIC HAZARDS**

**Strong Ground Shaking**

Seismicity is the geographic and historical distribution of earthquakes, including their frequency, intensity, and distribution. Geologic hazards associated with ground failure that can be induced from seismic events (earthquake shaking) include surface rupture, ground shaking, liquefaction, landslides, subsidence, expansive soils, tsunamis and seiches, and soil erosion. In addition, in the higher elevations of the county, during the winter or times with snow cover, a seismic event could result in an avalanche.

The county is underlain by a number of fault systems, three of which are in proximity to the proposed project area. Western County, in which the project is located, was identified as having low constraints in terms of seismicity, but because of the numerous geologic features within the County, all development within the County is subject to geologic hazards.

**Induced Seismicity**

The majority of earthquakes that occur each year are the result of natural causes; however, some earthquakes can result from human activity and are called induced-seismic events or induced earthquakes. Naturally occurring earthquakes result from the buildup of stresses and pressure caused by the lateral or vertical movement of blocks or plates moving against the other. When the plates move, suddenly the built-up energy is released and an earthquake can occur. Human activities that can result in induced seismic events include injection and withdrawal of fluids such as hydraulic fracturing, impoundment of reservoirs, mining and controlled explosions (including those underground).
4.5 Geology and Soils

**Ground Shaking**

Northern California is a seismically active region, and the City and project area may be subject to seismic shaking generated from a variety of regional sources. The intensity of seismic shaking, or strong ground motion, during an earthquake depends on the distance of a site to the epicenter of the earthquake, the magnitude of the earthquake, and the geologic conditions underlying and surrounding the area. Earthquakes occurring on faults closest to a site would have the potential to generate the largest ground motions. There are a number of faults that could result in an earthquake felt in the proposed project area.

**Fault Rupture**

Surface rupture occurs when movement on a fault breaks through to the surface of the earth. Fault rupture may occur suddenly during an earthquake or slowly in the form of fault creep. Where fault rupture is a sudden deformation, fault creep is a slow and more or less continuous movement on faults due to ongoing deformation that tend not to produce large earthquakes. Fault rupture almost always follows preexisting faults, which are zones of weakness. Surface rupture occurs when movement on a fault deep within the earth breaks through to the surface. The California Geologic Survey (CGS) provides maps of earthquake zones of required investigation that show Alquist-Priolo Earthquake Fault Zones. Neither Nevada City nor any of the Sphere of Influence (SOI) area is underlain by a known fault (CGS, 2020).

**Expansive Soil**

Expansive soils are characterized by their ability to undergo significant volume change (i.e., to shrink and swell) as a result of variations in moisture content. Changes in soil moisture can result from rainfall, landscape irrigation, utility leakage, roof drainage, and/or perched groundwater. Expansive soils are typically very fine-grained and have a high to very high percentage of clay. Expansion and contraction of expansive soils in response to changes in moisture content can lead to differential and cyclical movements that can cause damage and/or distress to structures and equipment.

**Landslides**

Earthquake motions can induce substantial stresses in slopes, causing earthquake-induced landslides or ground cracking when the slope fails. Earthquake-induced landslides can occur in areas with steep slopes that are susceptible to strong ground motion. Slope failures, commonly referred to as landslides, include many phenomena that involve the downslope displacement and movement of material, triggered either by static (i.e., gravity) or dynamic (i.e., earthquake) forces. Exposed rock slopes undergo rockfalls, rockslides, or rock avalanches, while soil slopes experience soil slumps, rapid debris flows, and deep-seated rotational slides. Slope stability can depend on several complex variables, including the geology, structure, topography, slope geometry, and amount of groundwater present, as well as external processes such as climate and human activity.

Landslides are generally grouped into the following categories:

- Falls – falling of soil or rock masses where a sliding surface does not occur;
• Flows – surface material breaks up and moved down and slope and flows as a viscous fluid;
• Creeps – slow downslope movements of an earth mass; and
• Transitional or Rotational Slides – Movements of earth that involve a distinct rupture or zone of weakness separating the earth slide.

The California Department of Conservation maps some of the areas of the state are susceptible to landslide hazards. None of the SOI Plan update areas have been evaluated in this regard (CDOC, 2018). The California Geologic Survey (CGS), has mapped areas that contain smectite clay deposits that can be susceptible to land sliding hazards and published a geologic hazard notice for Nevada County. The notice provides a description of the soil materials and a generalized map of the County showing locations that contain smectite bearing geologic units. While the map is not localized enough to compare to specific locations with the SOI Plan area, because some locations may contain smectite soils, the notice and map have been inserted for reference, below.

Nevada County also has a history of mining including hydraulic mining which used jets of water to break down gold-laden gravel banks and wash the materials through gold separating devices (Central Pacific Railroad, 2004). Any area adjacent to a hydraulically mined area is subject to landslide activity. Uphill instability is increased by removal of the toe of the slope and a landslide can be triggered by seismic activity, heavy rainfall, overloading, grading activities, etc.

**Liquefaction**

Seismic ground shaking of relatively loose, granular soils that are saturated or submerged can cause the soils to liquefy and temporarily behave as a dense fluid. Liquefaction is caused by a sudden temporary increase in pore water pressure due to cyclic loading during earthquakes. Liquefaction most often occurs in areas underlain by young alluvium subject to shallow groundwater conditions and strong, long-duration earthquakes. The effects of liquefaction can include the temporary loss of soil shear strength (and therefore, its bearing capacity), regional or localized settlement, lateral gliding of large blocks on liquefied layers at depth, and the extrusion of large volumes of liquefied sand (as sand volcanoes). The California Department of Conservation maps some of the areas of the state are susceptible to liquefaction. None of the SOI Plan update areas have been evaluated (CDOC, 2020).

**Lateral Spreading**

Lateral Spreading typically occurs as a form of horizontal displacement of relatively flat-lying alluvial material toward an open or “free” face such as an open body of water, channel, or excavation. In soils, this movement is generally due to failure along a weak plane (soil structure) and may often be associated with liquefaction.
GEOLOGICAL HAZARD NOTICE
From the California Geological Survey
CGS GeoHazard Notice 2009-001
Issued: December 23, 2009

SMECTITE CLAY DEPOSITS IN SIERRA NEVADA FOOTHILLS

The California Geological Survey (CGS) recognizes that preliminary information generated in an on-going geologic investigation has provided sufficient data to warrant a Geologic Hazard Notice. This notice is directed to engineering and building departments of counties and cities whose jurisdictions encompass land within the following defined region: from the eastern margin of the Sacramento/San Joaquin Valleys to the eastern extent of historic hydraulic gold mines of the Sierra Nevada, between the Feather and Stanislaus River watersheds.

Hazard Description
Exposed in patchy, often isolated, localities within the defined region is a particular geologic unit composed of varying mixtures of durable sand and an unusual form of expansive smectite clay. Despite geologic field observations, geotechnical site investigations, and laboratory soil testing performed by experienced professionals, the recognition of these deposits and the behavior of the expansive clay component has proven problematic. As a consequence, a significant number of dwellings and other structures located in several foothill community developments have experienced severe foundation cracking and other significant structural damage resulting from unanticipated latent ground swelling. In other locations, landslides and other slope failures are associated with the subject geologic unit. Damage to structures due to expansive clay has been documented in Sacramento and Placer counties, and slope instability in this geologic horizon is known to have occurred in Placer, Nevada, Sierra, and Plumas counties. This geologic unit is also likely to be exposed in Butte, Yuba, El Dorado, Amador, Calaveras and Tuolumne counties (see attached map).

Soil Recognition and Testing Issues
Following are the basic issues related to the recognition, testing, and behavior of the subject geologic unit.

- Geologic mapping has historically portrayed the hazardous clayey materials as part of, or as the "upper" member of the Lone Formation. The Lone Formation is well known for producing non-expansive kaolinite clay for the ceramic industry. The expansive clay deposits stratigraphically lie above the commercial kaolinitic units, but have rarely been differentiated on geologic maps. Geologic investigations to date have demonstrated that the unusual form of these expansive clay deposits has caused geologists to variably assign them to geologic units besides the Lone Formation, including the Valley Springs, Mehrten, Riverbank, and Turlock Lake formations, as well as Quaternary surficial deposits. Such confusion suggests that the geologic map units listed above should be considered suspect and receive careful scrutiny when they appear on geologic maps and soil logs included in geotechnical reports.

- Field identification of the unit and its expansive clay fraction can be difficult. This is because the clay occurs mainly in the form of sand-sized nodules, or clasts that have thin coatings of silica, iron oxide, and other cementing agents (see photos). These physical characteristics often lead geologists,
4.5 Geology and Soils

engineering geologists, and geotechnical engineers to misinterpret the material as being composed largely of durable sand and granular constituents.

- Laboratory testing using conventional ASTM laboratory methods to obtain index engineering properties of the subject soil has been unreliable. ASTM grain size (sieve and hydrometer) tests appear unable to reliably detect the true proportion of potentially expansive clay during the relatively short time it takes to process soil samples in the laboratory. The cementing agents coating the clay inhibit the dispersion and expansive behavior of the clay until the cements are broken down by earthwork or dissolve following surface exposure. The latter process can take years to fully develop. This same phenomenon causes the ASTM Atterberg limits, Plasticity Index (PI), and the Expansive Index (EI) tests to indicate much lower plasticity and expansion potential than what actually occurs in the soil over time.

- Compaction specifications determined in the laboratory using ASTM methods often prove to be invalid. This is because the laboratory generated “optimum moisture” specifications only apply to the initial granular form of the subject clay and not its behavior once a significant amount of smectite is released from the encapsulating cementing agents. Absorption of water by the stabilized clay granules during the laboratory testing can be a small fraction of the soil’s actual latent water absorption capacity. Likewise, when using the material for engineered fill, even careful moisture conditioning and compaction of the subject soil using recommended methods for expansive fill placement leaves enormous latent expansion potential. One local soil engineer found that up to 15% latent expansion potential remained in engineered fill following very careful moisture conditioning, compaction, and placement of fill material derived from the subject clayey soil.

Supplemental Soil Test Methods
It is apparent that conventional ASTM soil tests often fail to provide results that reflect the true engineering properties of the subject smectite clay. Some local consultants have been successful using petrographic techniques, including optical microscope and X-Ray Diffraction (XRD), to identify and characterize the smectite clay content of these problem soils. However, until a set of consistently reliable tests have been identified, permitting agencies should work closely with developers to ensure that contracted geotechnical firms are aware of the form and characteristic behavior of the smectite clay component.

Ongoing Work
An informal group of engineers and geologists from consulting, academic and state government organizations has been working to better understand the distribution and characteristics of this smectite clay unit. Geologic maps that more accurately depict the areal distribution of the problematic clay materials are in progress. Several foundation design strategies have been developed to accommodate the expansion potential of these soils, and if recognized beforehand, landslide-prone areas can be avoided or remediated prior to development.

For more information contact CGS Senior Engineering Geologists Tim McCrink (916) 324-2549 or Ralph Loyd (916) 322-9207. CGS may issue a Revised Notice on smectite clay occurrences as more information becomes available.

The California Geological Survey produces a wide variety of maps and data on the geology, geologic hazards, and other geology-related topics relevant to the State of California. For more information about CGS programs, please visit:

http://www.conservation.ca.gov/cgs
Encapsulated Smectite Clay

Quartz and Feldspar

Typical fine-grained sand of the subject smectite-bearing geologic unit. Sample collected from northeastern Sacramento County. Microscope photo by James L. Wood.

Same fine-grained sand after adding moisture and hand rolling the sample. Photo by James L. Wood.
County map showing sites where swelling and slope failure of soils of smectite-bearing geologic unit have been documented (red dots); the lower Sierra Nevada foothill belt (tan colored) where deposits of the subject geologic unit are most likely to be encountered; and notable historic hydraulic pits (black dots) where the unit is commonly exposed immediately above the main channel gravel deposits of the Ancient Tertiary Rivers of the Sierra Nevada.
**Slumps or Land Subsidence**

Land subsidence can occur in various ways. Land subsidence is the gradual, local settling or shrinking of the earth’s surface with little or no horizontal motion. Subsidence is normally the result of gas, oil, or water extraction; hydro-compaction; and/or peat oxidation and not the result of landslide or ground failure. Subsidence also can occur during an earthquake. Movement that occurs along faults can be horizontal or vertical or have a component of both. As a result, a large area of land can subside drastically during an earthquake. Land subsidence can also be caused during liquefaction.

**Corrosion**

Many factors can affect the corrosion potential of soil. In general, soil resistivity, which is a measure of how easily electrical current flows through soils, is the most influential factor. Chloride and sulfate ion concentrations and pH appear to play secondary roles in affecting corrosion potential. High chloride levels tend to reduce soil resistivity and break down otherwise protective surface deposits, which can result in corrosion of buried metallic improvements or reinforced concrete structures. Sulfate ions in the soil can lower the soil resistivity and can be highly aggressive to Portland cement concrete (PCC) by combining chemically with certain constituents of the concrete, principally tricalcium aluminate.

Acidity is also an important factor of soil corrosivity. The lower the pH, the more acidic the environment, and the higher the soil corrosivity will be with respect to buried metallic structures. As soil pH increases above 7 (the neutral value), the soil is increasingly more alkaline and less corrosive to buried steel structures due to protective surface films which form on steel in high pH environments. A pH between 5 and 8.5 is generally considered relatively passive from a corrosion standpoint.

**Avalanche**

Avalanche hazard areas are generally located on high, mountainous slopes and terrain at elevations above 7,000 feet. The most important factor necessary to release an avalanche is heavy snowfall. A rapidly increasing snow layer is unable to stabilize or bond with the old layer of snow or the ground below it, so that after a certain amount of time the new snow layer will simply slide off as an avalanche.

**Tsunamis and Seiches**

A tsunami is a sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or exploding volcanic islands. These waves can move at a rate exceeding 500 miles per hour. In smaller closed water bodies like inland seas and lakes, a seiche, or a sloshing of the water may occur from earthquakes or underwater landslides (USGS, 2020).

**Subsidence**

Subsidence consists of surface land sinking into below-surface holes or fissures. Subsidence may be caused by a variety of natural conditions, some in combination with human activity. The primary cause of actual and potential subsidence in the Nevada City areas is previous underground withdrawal of material from mining. Less hazardous and generally better controlled is improper burial of organic materials during land
development. Subsidence hazards in Nevada City and surrounding vicinity are principally man-made rather than natural geologic phenomena, and are addressed under Mine-Related Hazards.

**Mine Related Hazards**

Although mining related hazards are not specifically called out by CEQA requiring evaluation for potential impacts, due to the changes to the local geologic setting that mining activities can create, certain geologic conditions particularly in relation to land sliding are applicable. This recognition also considers that a wealth of information about the locations of mine-related hazards is not known making analysis difficult absent site-specific evaluation.

Mine-related hazards include the presence of open holes at ground surface; inadequately covered/shored up shafts and tunnels below ground level; tailings, and other abandoned mining features. Safety and hazard concerns resulting from old mine operations include the risk of falling into open shafts, surface collapse/subsidence into old shafts, and landslides.

Numerous mining operations, both large and mechanized as well as smaller underground hand dug mines are present under the City and surrounding areas. Mining operations created shafts to access minerals and excavated materials or tailings were brought to the surface and dumped. The shafts created underground voids that can collapse, and the tailings of uncompacted unconsolidated mixed soils and rock dumped at the surface created areas with unstable surface soils. While some areas of abandoned mines are known, many are not and due to these unknown factors and without current, comprehensive information, it is difficult to assess the magnitude of the problem or to devise remedial programs (Nevada County, 2016).

### 4.5.2 REGULATORY SETTING

Geologic resources and geotechnical hazards are governed primarily by local jurisdictions. The California Environmental Quality Act (CEQA) is the major environmental statute that guides the design and construction of projects on non-federal lands in California. This statute sets forth a specific process of environmental impact analysis and public review. Relevant and potentially relevant statutes, regulations, and policies are discussed below.

**Earthquake Hazards Reduction Act**

The National Earthquake Hazards Reduction Program (NEHRP) was established by the U.S. Congress when it passed the Earthquake Hazards Reduction Act of 1977, Public Law (P.L.) 95–124. At the time of its creation, Congress’ stated purpose for NEHRP was “to reduce the risks of life and property from future earthquakes in the United States through the establishment

**State**

**California Geologic Survey**

The mission of the CGS is to provide products and services about the State’s geology, seismology and mineral resources, including their hazards, which affect the health, safety and business interests of the
people of California. The programs operated by the California Geological Survey include responsibility for providing technical information, advice and production of maps that reflect landslide hazards, seismic hazards (earthquake faults), geological, mineral resources and hazards, and tsunamis.

**Alquist-Priolo Earthquake Fault Zoning Act**

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to prevent the construction of buildings used for human occupancy on the surface trace of active faults (those having evidence of surface displacement within about the last 11,000 years). It requires the State Geologist to delineate earthquake fault zones around the surface traces of active faults and publish maps showing these zones.

**Seismic Hazards Mapping Act**

The Seismic Hazards Mapping Act was developed to protect the public from the effects of strong ground shaking, liquefaction, landslides, or other ground failure, and from other hazards caused by earthquakes. The Act requires the State Geologist to delineate various seismic hazard zones and requires cities, counties, and other local permitting agencies to regulate certain development projects within these zones. Before a development permit is granted for a site within a seismic hazard zone, a geotechnical investigation of the site must be conducted, and appropriate mitigation measures incorporated into the project design.

**California Building Code**

The State of California provides minimum standards for building design through the CBC. The CBC is based on the International Building Code (IBC), which is used widely throughout the United States (generally adopted on a state-by-state or district-by-district basis) and has been modified for conditions within California. On January 1, 2014, a revised version of the CBC took effect. In accordance with the CBC, generally, a grading permit is required if more than 50 cubic yards of soil are moved during implementation of a proposed project. Chapter 16 of the CBC contains definitions of seismic sources and the procedure used to calculate seismic forces on structures. Chapter 18 of the CBC contains standards and regulations relating to soil stability, design standards for seismic safety, and construction standards for building foundations. Specific regulations in Section 1803 require geotechnical investigations or preliminary soil reports as a condition of building permit approval. Section 1804 provides regulations on the siting of structures and site grading based on the soils and slope stability of a site. Section 1808 establishes regulations for the design and construction of building foundations, with emphasis on stability (i.e., issues pertaining to shifting soils, seismic overturning, and expansive soils) and design loads.

**Disaster Mitigation Act**

The Disaster Mitigation Act of 2000 (DMA 2000), PL-106-390 requires that each State develop a hazard mitigation plan, in order to receive future disaster mitigation funding following a disaster. California completed its most recent State of California Multi-Hazard Mitigation Plan (SHMP) in 2018. The SHMP represents the state’s primary hazard mitigation guidance document, and is composed of comprehensive and valuable input provided by State Hazard Mitigation Team members and stakeholders. The 2018 SHMP continues to build upon the state’s commitment to reduce or eliminate potential risks and impacts of
natural and human-caused disasters to help communities with their mitigation and disaster resiliency efforts. The 2018 plan includes: an updated statewide risk assessment, disaster history, and statistics; recent mitigation progress, success stories, and best practices; updated state hazard mitigation goals, objectives, and strategies; and updated climate mitigation progress and adaptation strategies. FEMA approved California’s 2018 SHMP on September 28, 2018

**Local Hazard Mitigation Plan**

As part of the SHMP, development of local or county Local Hazard Mitigation Plans (LHMPs) are needed that particular county to be eligible for post-disaster mitigation funding. The purpose of these requirements is to encourage state and local government to engage in systematic and nationally uniform planning efforts that will result in locally tailored programs and projects that help minimize loss of life, destruction of property, damage to the environment and the total cost of disasters before they occur. The Nevada County Operational Area Emergency Services Council prepared the Local Hazard Mitigation Plan for Nevada County, for the years 2011 to 2016.

Nevada County specifically includes and adopts the most recent State of California Multi-Hazard Mitigation Plan where the State’s plan relates to issues pertaining to Nevada County. However, in the interest of not duplicating State efforts, Nevada County in its plan refers to the State where the State has identified an issue or provided information that supplements Nevada County’s plan. As part of the LHMP, various geotechnical issues pertinent to Nevada County area discussed. This includes landslides, earthquakes, avalanche, subsidence, and mine related hazards.

The Code of Federal Regulations (CFR) Section 201.6(c)(3) outlines the process for localities in developing their mitigation strategies. Specifically, the Local Hazard Mitigation Plan must “include a mitigation strategy that provides the jurisdiction’s blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.” These strategies should be built on an assessment of hazard risks and vulnerabilities.

**Nevada City General Plan**

The Nevada City General Plan includes the Public Safety element that includes findings related to seismic hazards, and geotechnical hazards, and provides objectives and policies related to design and minimizing hazards. The Public Safety element discussed earthquake hazards both in terms of surface rupture and ground shaking and secondary hazards such as settlement, subsidence, liquefaction, and landslides. The Safety Element notes that there are no potentially active faults near Nevada City and because the city is underlain by igneous and metamorphic bedrock, the risk of secondary effects is low. The Safety Element does not discuss the potential for landslides due to past mining activities. This, however, is discussed in detail in the impacts section below. Immediately below are the Objectives and Policies from the NCGP pertinent to Geology and Soils.

**Objective:**

Ensure a high level of safety from earthquake, landslide, severe erosion, and other geotechnical hazards.
Policies:

- Require detailed soils and geologic studies prior to approval for development in potentially hazardous areas. Require mitigation measures if significant hazards are identified.
- Encourage upgrading of unreinforced masonry buildings to prevent disastrous earthquake damage.
- Consider establishing a slope/density formula to limit development on steep hillsides.
- In cooperation with the county, maintain rural densities in areas not provided with public services.

Nevada City Zoning Ordinance

Title 15 – Buildings and Construction of the City Zoning Ordinance was enacted for the purpose of providing minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, location and maintenance of all buildings and structures, regulated equipment, grading and construction activities that result in a land disturbance on private property within this jurisdiction in conformity with the 2016 edition of the California Building Standards and consistent with and complementary to standards adopted by the County of Nevada.

Chapter 15.04.015, relates specifically to the CBC, and, adopts specific codes and standards which are incorporated into the Municipal Code of the City of Nevada City by reference and have legal affect. In addition, Chapter 15.04.020 – of the Code adopts the County amendments to the 2019 California Building Standards that were adopted by Nevada County Ordinance No. 2424 and incorporates them by reference.

Chapter 17.80.100 discusses grading and erosion control measures in addition to the those in the CBC, and requires that a grading plan be approved by the building department in certain circumstances, the city engineer shall also have authority to approve grading plans. Grading is to be limited to All grading the dry season of the year, between May 1st and October 15th, unless the written permission is given. During the wet season (October 16th and April 30th, or as amended by the city), all grading is required to include temporary or permanent erosion control measures, as necessary to prevent soil erosion from the site. Erosion control shall include any and/or all effective methods generally accepted as normal practice, such as fertilization and seeding, straw mulch, jute netting, earthen berms, straw barricades, plastic sheeting, holding basins and flow dissipators. Lastly, this chapter provides the city has the authority to review all temporary and permanent erosion control measures, and may require additional measures.

4.5.3 STANDARDS OF SIGNIFICANCE

The interface of the natural and manmade environments creates potential safety hazards associated with landslides, earthquakes and associated hazards such as liquefaction, subsidence, and ground rupture, floods, and avalanches (in the higher elevations of the County). Each of these hazards has particular characteristics that affect the future development of the County. Some of these safety hazards can be minimized with emergency planning, while other hazards are reduced by development standards and land use planning.
Thresholds of Significance

According to Appendix G of the CEQA Guidelines, the proposed project would have a significant impact to geology and soils if it would:

- Directly or indirectly cause potential substantial adverse effects, including the risk 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? Refer to Division of Mines and Geology Special Publication 42;
  - Strong seismic ground shaking;
  - Seismic-related ground failure, including liquefaction; or landslides;
- Result in substantial soil erosion or loss of topsoil;
- Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse;
- Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property; or,
- 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 waste water.
- Directly or indirectly destroy a unique paleontological resources or site or unique geologic feature.

4.5.4 PROJECT IMPACTS AND MITIGATION

This EIR evaluates four project alternatives. The following impact evaluation focuses on the LAFCo/City Preferred Consensus Alternative (Consensus Alternative) which has been identified as the Preferred Alternative in accordance with CEQA requirements. Impacts for the other alternatives are discussed in Chapter 6.0 Alternatives. In some instances; however, impacts related to the overall SOI Plan update may be presented when applicable and to help illustrate the environmental effects in the framework of the overall SOI Plan update. The impacts are discussed in terms of direct and indirect impacts. Direct impacts are those that occur immediately upon initiation of a project such as ground disturbance or demolition of existing structure(s). Indirect impacts occur when a project would induce growth into areas such as through the extension of infrastructure and that extension could facilitate new development or result in an annexation that could enable future development.

Impacts Discussion Overview

The Impacts Discussion Overview describes the characteristics of the Consensus Alternative, development potential, assumptions for provision of services, and City and environmental review requirements related to geology and soils and seismic hazards. This discussion is applicable to each impact.
The Consensus Alternative would update the SOI Plan area, and future development projects under City jurisdiction would occur only after being annexed to the City. The majority of the undeveloped areas within the Consensus Alternative area are designated for estate residential, rural residential, or open space with minor areas designated for planned development, employment centers, public uses, or service commercial. The lands that could be annexed are anticipated to be built out over time and development in these areas is anticipated to be consistent with the existing designations and planning documents.

Within the Consensus Alternative boundaries there are four priority annexation areas. In general, these areas are already developed, are in close proximity to, or are already being served by existing water or wastewater lines. These areas are in logical locations for extension of City municipal services and represent a logical progression of City boundaries.

In addition, there are six potential development areas identified by the City that are discussed throughout this document. These sites do not yet have any development approval and the specific project footprints are unknown. Annexation and the anticipated timeline for build out would occur over a period of time and is anticipated to be at similar densities as to what is shown in the project description and in accordance with existing City planning documents.

All future development within the Consensus Alternative area, including the six potential development areas identified by the City, would be subject to City design and review as part of City’s project review process. All projects would be evaluated for consistency with the NCGP, Nevada City Municipal Code, and Nevada City Design Guidelines. The City also has authority to pre-zone all future annexations to Nevada City, and for annexations that include new development, the City would be able to specify conditions to ensure that future projects would incorporate all required elements of the listed development guidance documents related to geology and soils and seismic hazards. The project by project review also would include a City led CEQA analysis and as applicable, would require project-specific mitigation measures or binding conditions of approval to reduce impacts related to these topics.

**Impact GEO-1:** Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mins and Geology Special Publication 42?

According to the California Department of Conservation geologic hazards mapping and the City General Plan there are no known earthquake faults that trace through the City or any portion of the SOI update area. None of the project areas are mapped in Alquist-Priolo Earthquake. As such, none of the Priority Annexation Areas, six potential development areas, or any other within the SOI would be affected by fault rupture. Therefore, this impact is less than significant, and mitigation is not required.
**Mitigation Measures: No Mitigation Measures are Required.**

**ii) Strong seismic ground shaking?**

The Consensus Alternative would not directly implement any development proposals, new construction, new entitlements or improvements, and it would not change any existing land use designations in any of these areas. The Consensus Alternative would not result in any direct impacts associated with strong seismic ground shaking.

Indirect impacts from strong seismic ground shaking to the Consensus Alternative could occur if future areas are annexed to the City and developments occurs that experiences seismic ground shaking. Due to the large areas over which seismic ground shaking can be felt, the four priority annexation areas, six potential development areas, and SOI area overall, will likely experience moderate ground shaking from activity on faults within the County and other faults in the region. Strong seismic ground shaking could result in loss, injury, and death, but these effects can be reduced.

The effects of seismic ground shaking can be reduced if future site grading is performed in accordance with the recommendations of a site-specific geotechnical engineering report and development in accordance with the UBC and CBC. Using standard construction techniques and following the recommendations of a site-specific geotechnical investigations that would be required as part of all future projects, and applicable codes and requirements, structures can be designed and built to withstand the geologic shaking hazards.

Although some structural damage cannot be typically be completely avoided through seismic movements, building codes and local construction requirements help to protect against building collapse and personal injury during seismic events. Future developers within the SOI Plan update area would be required to comply with applicable City regulations, such as the CBC and Nevada County Code as required by Title 15 – Buildings and Construction of the City Zoning Ordinance, and the City of Nevada City General Plan. Conformance with these requirements would ensure a design-level investigation is completed and the findings of all future geotechnical engineering reports are incorporated to future project design. This reduce effects from seismic ground shaking to less than significant.

**Level of Impact After Mitigation:** Less Than Significant Impact.

**iii) Seismic-related ground failure, including liquefaction?**

The Consensus Alternative would not directly implement any development proposals, new construction, new entitlements or improvements, and it would not change any existing land use designations in any of these areas. The Consensus Alternative would not result in any direct impacts associated with strong ground failure, liquefaction, or landslides.
As discussed in \textit{impact ii)}, above, indirect impacts from future annexation and development could occur from seismic ground shaking. Seismic ground shaking can induce secondary effects such as liquefaction. Liquefaction is typically associated structures that overlay granular soils that are saturated or submerged and that can liquefy and temporarily behave as a dense fluid during an earthquake. The effects of liquefaction can include the temporary loss of soil shear strength (and therefore, its bearing capacity), regional or localized settlement, lateral gliding of large blocks on liquefied layers at depth. Liquefaction most often occurs in areas underlain by young alluvium subject to shallow groundwater conditions and strong, long duration earthquakes.

Much the Consensus Alternative area and SOI Update area overall is underlain by igneous and metamorphic rocks that are not typically associated with liquefaction hazards. None the less, there may be isolated areas underlying the four priority annexation areas, six potential development areas, or other areas within the SOI that may be subject to liquefaction. If liquefaction occurs, it could result in damage to overlying structures and harm or death to occupants. To reduce these potentials, MM-GEO-1 would require completion of a site-specific geotechnical evaluation that would account for liquefaction hazards and propose site-specific designs of mitigation that would reduce effects. It is anticipated this would reduce impacts to less than significant and no further mitigation is required.

\textbf{Mitigation Measures:} Implement MM-GEO-1.

\textbf{MM-GEO 1:} Prior to LAFCo approval of an annexation involving new, non-ministerial development and construction of habitable structures in or adjacent to hydraulically mined areas or steep slopes, the City shall require a geotechnical\textbackslash geologic hazard investigation of the site and surrounding area to determine if there is a risk of land subsidence. The geotechnical investigation shall describe the potential for the site to experience subsidence either due to seismic ground shaking or soil saturation leading to liquefaction, lateral spreading, subsidence, or collapse. If the investigation indicates such risk, the applicant shall provide to the satisfaction of the City a design-level geotechnical report and investigation for the subject property. The design level geotechnical investigation shall prescribe, as necessary design and construction features or mitigation that will adequately mitigate the risks of such land subsidence both on the development and surrounding area.

\textbf{Level of Impact After Mitigation:} Less Than Significant Impact with Mitigation Incorporated.

\textbf{iv) Landslides?}

The Consensus Alternative would not directly implement any development proposals, new construction, new entitlements or improvements, and it would not change any existing land use designations in any of these areas. The Consensus Alternative would not result in any direct impacts associated with strong ground failure, liquefaction, or landslides.

Priority Annexation Area #1 contains the existing Caltrans facility and Priority Annexation Area #2 contains the existing County Juvenile Hall. There are no plans to expand or construct additional buildings on these
sites and the areas are on relatively flat ground and not adjacent to any steep slopes. Priority Annexation areas #3 and #4 contain an existing cemetery, rural residential uses and a few undeveloped parcels. Extension of services could encourage development of the undeveloped parcel. These areas have some moderately sloped terrain but substantial development that could result in significant potential to induce or be affected by landslides is not anticipated. However, because the specific nature of the geologic character is unknown, associated land sliding hazards, including slower slump landslides may exist.

The consensus alternative does include six potential development areas some of which are located on moderately sloped areas, and locations that are adjacent to locations with steeper slopes that may be prone to slumping. Future development of some of these may be affected by potential effects from landslides. In addition, due to the use of hydraulic mining within areas of the City and County, slopes adjacent to the six potential development areas, as well as other areas within the SOI area may be subject to landslide hazards from off-site areas.

It should be noted that the potential for landslides to affect a project are not limited to a development being placed on a site that is prone to sliding itself. Placement of a development adjacent to a landslide prone slope also requires consideration prior to initiation of the building process. Of the six potential development areas, Highway 49 Planned Development area and the Gold Flat/Gracie Road are on relatively flat terrain and are no adjacent to any steep slopes. The Hew Property, Providence West, Hurst Ranch, and Manzanita Diggins are located on areas with moderately sloping terrain, and may contain some areas with isolated steeper slopes. In addition, some of these sites are located in areas adjacent to areas with moderate to steep slopes including the Manzanita Diggins site. Manzanita Diggins is located adjacent to the Coyote Street which. According to the LHMP, Coyote Street has experience various cut bank failures resulting in debris entering the roadway. The LHMP notes that landslides have occurred in the past and given the nature of rocks and soils, such as areas with smectite clay as described in the CGS hazard notice inserted above, and certain locations within sloped areas of the County, landslides will likely continue to impact areas when heavy precipitation occurs (Nevada County, 2017).

All areas of future development as part of the annexation process would be subject to the City’s review and regulation when development plans are submitted, and/or application(s) filed. This would include City design and review as part of City’s project review process including CEQA analysis. As part of the CEQA analysis, the potential for impacts to geology and soils would be considered, and depending on the evaluation, mitigation measures would be incorporated as conditions of project approval or as project-specific mitigation. Due to the potential for future projects to be located adjacent to land slide hazards, MM-GEO-1 would be implemented. This measures will require that all subsequent geotechnical evaluations for future project sites also evaluated the potential for adjacent slopes to affect or be affected by the project site. Implementation of MM-GEO-1 would reduce this impact to less than significant.

**Mitigation Measures:** Implement MM-GEO-1.

**Level of Impact After Mitigation:** MM GEO-1 would reduce impacts to less than significant.

b) **Result in substantial soil erosion or the loss of topsoil?**
The Consensus Alternative does not propose any development within the SOI Plan Update area. If approved, the Consensus Alternative would not result in any entitlements for development or change existing land use or zoning designations. In this regard, direct impacts to erosion would not occur, and no mitigation would be required.

Indirectly, the Consensus Alternative has the potential to induce growth and result in grading of currently vegetated areas resulting in an increased potential for erosion. No additional development within Priority Annexation Areas #1, #2, #3, and #4 is proposed, and any new development that could occur after annexation would be limited to a few rural residential lots. The erosive effects from the potential changes to these sites is anticipated to be minimal. In addition, the city would ensure these projects comply with Chapter 17.80.100 which requires grading plans to be approved by the building department and which sets limits on the timing of grading, and requires grading to include temporary or permanent erosion control measures, as necessary to prevent soil erosion from the site. Conformance with these requirements in this regard is anticipated to reduce these impacts to less than significant.

Regarding the six potential development areas and any other future development site, these sites also would be subject to the City’s review and regulation and also would be required to conform to requirements of Chapter 17.80.100 which would be verified when development plans are submitted, and/or application(s) filed. Although the specific footprint and site conditions and specific areas of disturbance are unknown, all future annexation sites greater than one acre would be subject to a Construction General Permit. The Construction General Permit requires implementation of a storm water pollution prevention plan (SWPPP), which would include best management practices designed to reduce potential impacts from water degradation, storm water runoff, and associated erosion. Construction BMPs may include, but are not limited to, stabilization of construction entrances, straw wattles on embankments, and sediment filters on existing inlets. The SWPPP would be required to be kept on-site, updated as needed while construction progresses, and would contain a summary of the structural and non-structural BMPs to be implemented during both construction and post-construction periods. Both structural and non-structural BMPs would assist in reducing impacts from erosion.

Lastly, all future development within the City upon annexation would be subject to City design and review as part of City’s project review process including CEQA analysis. As part of the CEQA analysis, the potential for impacts to erosion would be considered, and as discussed above, proper permitting and water quality protection measures would be incorporated as conditions of project approval or as project specific mitigation. Conformance with City code and participation with both the NPDES General Permit and the Construction General Permit, including the SWPPP and BMPs, would reduce potential impacts from erosion. As a result, impacts associated with erosion in this regard would be less than significant.

**Mitigation Measures:** No Mitigation Measures are Required.

| c) Be located on a geologic unit or soil that is unstable, or what would become unstable as a result of the project, and potentially result in on-site or off-site landslide, lateral spreading, subsidence, liquefactions, or collapse? |
The Consensus Alternative does not propose any development within the SOI Plan Update area. If approved, the Consensus Alternative would not result in any direct impacts to on-site or off-site landslides, lateral spreading, subsidence, liquefaction, or collapse. No mitigation would be required.

Indirect impacts associated with the secondary effects of liquefaction and landslides are discussed in impacts a iv) and a iv), above. Based on the evaluation, impacts would be less than significant.

Related to four priority annexation areas, six potential development areas, land other areas that may be annexed and developed in the future, future indirect impacts associated with lateral spreading, subsidence, and collapse, could occur depending on the nature of the project site and the specific sites susceptibility to these hazards. Much of the SOI Plan update area is underlain by igneous and metamorphic rock which are not typically as susceptible to these hazards as projects underlain by alluvium and thick sedimentary materials. Subsidence and collapse can occur if water from wells is withdrawn faster than the source is replenished. Most wells within the area; however, are from fissures in the underlying rock and not typically susceptible to subsidence and associated collapse of structures. Lateral spreading can occur on the margins of streams and rivers if the banks become unstable and liquefy during ground shaking events. This secondary effect of a ground shaking event also is considered unlikely.

All areas of future development as part of the annexation process would be subject to the City’s review and regulation when development plans are submitted, and/or application(s) filed. This would include City design and review as part of City’s project review process including CEQA analysis. As part of the CEQA analysis, the potential for impacts to lateral spreading, subsidence, and collapse, would be considered, and depending on the evaluation, mitigation measures would be incorporated as conditions of project approval or as project-specific mitigation. In consideration of other potential effects from geotechnical hazards MM-GEO-1 would be adopted as part of the project. MM-GEO-1 would require site-specific geotechnical evaluations be prepared for future projects. As part of these evaluations, geologic conditions including lateral spreading, subsidence, and collapse of the sites would be evaluated and subsequent conditions or mitigation would be included on a project by project basis as needed. Implementation of MM-GEO-1, and conformance with all other requirements would reduce this impact to less than significant.

**Level of Impact After Mitigation:** Implement MM GEO-1.

**Level of Impact After Mitigation:** Less than Significant Impact with Mitigation Incorporated.

\[ d) \quad \text{Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?} \]

The Consensus Alternative does not propose any development within the SOI Plan Update area. If approved, the Consensus Alternative would not result in any direct impacts associated with expansive soils. No mitigation would be required.

The four priority annexation areas, six potential development areas, and other areas that may be annexed and developed in the future may be located in areas or be located with isolated units of expansive soils.
Expansive soils can undergo substantial volume change (i.e., shrink and swell) as a result of variations in moisture content, which can result from rainfall, landscape irrigation, utility leakage, roof drainage, and/or perched groundwater. Expansive soils are typically very fine-grained and have a high to very high percentage of clay. If expansive soils underlay future project sites and they are not properly treated, subsequent expansion and contraction could lead to differential and cyclical movements and cause damage and/or distress to structures and equipment. It is now known if expansive soils underlay potential development areas, and this is considered a potentially significant impact.

All areas of future development as part of the annexation process would be subject to the City’s review and regulation when development plans are submitted, and/or application(s) filed. This would include City design and review as part of City’s project review process including CEQA analysis. As part of the CEQA analysis, the potential for impacts associated with expansive soils would be considered, and depending on the evaluation, mitigation measures would be incorporated as conditions of project approval or as project-specific mitigation. In consideration of other potential effects from geotechnical hazards MM-GEO-1 would be adopted as part of the project. MM-GEO-1 would require site-specific geotechnical evaluations be prepared for future projects. As part of these evaluations the presence of expansive soils would be evaluated, and subsequent conditions or mitigation would be included on a project by project basis as needed. Implementation of MM-GEO-1, and conformance with all other requirements would reduce this impact to less than significant.

**Mitigation Measures:** Implement MM-GEO-1.

**Level of Impact After Mitigation:** Less Than Significant Impact with Mitigation Incorporated.

e) **Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal system where sewers are not available for the disposal of wastewater?**

The Consensus Alternative does not propose any development within the SOI Plan Update area. If approved, the Consensus Alternative would not result in any direct impacts associated with alternative wastewater systems. No mitigation would be required.

Annexation of the four priority annexation areas and six potential development areas are anticipated to connect to the existing sewer system through the expansion of on-site lines or lines in immediate proximity to these areas. Wastewater would be treated at the City of Nevada City Wastewater Treatment Plant and would not require the use of separate alternative wastewater disposal systems. No impacts associated with these connections would occur.

The potential for future annexation areas to be provided wastewater services would be determined as more comprehensive development plans and entitlements are proposed or approved. All future projects or individual developments that propose to utilize an alternative wastewater disposal system would be subject to the Regional Water Quality Control Board (RWQCB) regulations. For example, on June 19, 2012, the State Water Board adopted Resolution No. 2012-0032, the Water Quality Control Policy for Siting,
Design, Operation and Maintenance of Onsite Wastewater Treatment Systems. The purpose of the policy was to allow the continued use of Onsite Wastewater Treatment Systems (OWTS), while protecting water quality and public health. This Policy only authorizes subsurface disposal of domestic strength, and in limited instances high strength, wastewater and establishes minimum requirements for the permitting, monitoring, and operation of OWTS for protecting beneficial uses of waters of the State and preventing or correcting conditions of pollution and nuisance.

All areas of future development as part of the annexation process would be subject to the City’s review and regulation related to use of alternative wastewater treatment. This would include City design and review as part of City’s project review process including CEQA analysis. As part of the CEQA analysis, if an alternative wastewater disposal system is proposed, the potential for associated impacts would be considered, and depending on the evaluation, mitigation measures would be incorporated as conditions of project approval or as project-specific mitigation. Conformance with all applicable regulations and site-specific review would reduce this impact to less than significant.

**Mitigation Measures:** No Mitigation Measures are Required.

**f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?**

The Consensus Alternative does not include any development proposals, new construction, new entitlements or improvements, and it would not change any existing land use designations. Therefore, the Consensus Alternative would not result in any direct impacts to a unique paleontological resource or a unique geological feature.

The four priority annexation areas are largely developed and are not proposed to undergo substantial changes should be the annexed in the future. Priority Annexation areas #1 and #2, consist of an existing Caltrans site and the County Juvenile Hall. These sites are currently developed, and no additional expansion of the sites is proposed. Priority Annexation Areas #3 and #4 contain existing rural residential uses and a cemetery. The majority of the sites are developed with a few lots remaining undeveloped. Future development within the remaining open parcels could contain unknown paleontological resources. While these areas may be undeveloped and contribute to the positive aesthetics of the sites and surroundings, none of these areas; however, are known to contain unique geologic features.

Considering the area over which the other six potential development areas and overall undeveloped area within the SOI, it is likely that some unknown paleontological resources would be present and could be disturbed or located during construction activities. Additionally, due to the nature and steep and rocky terrain of the areas within and surrounding Nevada City, it is possible that future projects may be located in areas with unique geologic features. If in either case, a unique paleontological resource or unique geologic feature is destroyed, a significant impact could result.

Potential impacts to these resources would be reduced through conformance with the requirement of the Nevada City Municipal Code. As part of all future annexations, projects would undergo a site-specific
CEQA evaluation and all projects would be evaluated by the City to determine potential impacts associated with these resources. The potential for associated impacts would be considered, and depending on the evaluation, mitigation measures, such as those requiring paleontological monitoring, a resource recovery plan, and/or worker awareness training would be incorporated as conditions of project approval or as project-specific mitigation. It is anticipated that this review and subsequent requirements would reduce impacts to less than significant.

**Mitigation Measures:** No Mitigation Measures are Required.

### 4.5.5 CONCLUSION

It is anticipated that some future projects, if not properly mitigated, could result in impacts associated with hazards from seismic ground shaking and although unlikely due to the nature of the geologic conditions of the project areas, secondary seismic effects including liquefaction, subsidence, lateral spreading, or collapse. Future annexation areas also are anticipated to have potential, but minimal impacts associated with expansive soils, locations of alternative wastewater disposal systems, and loss of paleontological or unique geologic resources. However, because the exact footprint and design of future projects is not known, it is possible that certain project sites may contain existing resources or be located on sites that may be susceptible to geologic hazards. This is especially true of the potential effects from landslides. Due to the steepness of some slopes and history of hydraulic mining in the City and SOI Plan update areas, this risk is considered potentially significant. Thus, mitigation measures have been proposed to ensure these impacts are reduced to less than significant.

MM-GEO-1 requires that as part of annexation requests for future projects within the SOI, a geotechnical investigation be prepared. The geotechnical evaluation will evaluate project sites for the potential to experience seismic ground shaking and secondary effects including liquefaction, lateral spreading, subsidence, or collapse. In addition, due to the geologic considerations associated with landslides and the history of hydraulic mining, MM-GEO-1 incorporates language specifically related to lands that are adjacent to hydraulically mined areas or areas with steep slopes and requires an evaluation of a site to increase the potential for land subsidence or to be impacted from an adjacent or nearby area that may be susceptible to land sliding hazards. In all cases, the geotechnical investigation shall prescribe, as necessary, design features or additional mitigation that would be incorporated on a project by project basis to any future project.

The geotechnical investigations will be used as part of the site-specific CEQA review that would be required for all future projects. Through the incorporation of these measures and conformance to all UBC, CBC, and other applicable state codes and city codes and development standards, impacts would be reduced to less than significant.

### 4.5.6 CUMULATIVE IMPACTS

The Consensus Alternative area is currently developed with predominantly rural and estate residential uses, separated by open tracts of undeveloped land. Under the Consensus Alternative, while no direct
impacts would occur, there is the potential for the area to experience growth as the future projects are approved.

The cumulative nature of geologic impacts occurs over both a wide area and are site-specific. For example, regionally significant faults, or those that are capable of generating large earthquakes can be felt over wide areas and will affect many existing as well as planned projects that will be but have not yet been constructed. At the same time, geologic hazards, typically secondary effects from ground shaking such as liquefaction, are typically site specified. Effects such as those resulting from landslides, are both site-specific if they occur on a project site, but landslides can also flow to adjacent areas, sometimes at substantial distances and cause damage or harm to these off-site areas. Lastly, cumulative impacts to paleontological resources and unique geologic features are typically site-specific and are mitigated on a case by case basis.

As discussed above, the proposed project could result in potential cumulative impacts, both from changes to the project site and from being located in a seismically active region, to geologic resources. The combination of the proposed project as well as past, present, and reasonably foreseeable projects in the City and SOI Plan Update area would be required to comply with all applicable State, federal, and County and local regulations related building and structural design that would be able to withstand anticipated shaking from a seismic event. Similar to the proposed project, these projects also would be required to perform site-specific geologic investigation and implement and conform to mitigation measures, which would be likely to reduce impacts to less than significant. In addition, implementation of Mitigation Measure GEO-1, above, would reduce project-specific impacts and therefore, the projects contribution to cumulative impacts would be less than significant level.