# 3.11 GEOLOGY, SOILS, LAND CAPABILITY, AND COVERAGE

This section contains an evaluation of the potential impacts on geology, soils, land capability, and coverage associated with the implementation of the US 50/South Shore Community Revitalization Project alternatives. The analysis includes a description of existing conditions and an evaluation of changes to geologic conditions, relevant soil properties, and associated elements of land capability and coverage. Regulations and guidelines established by the Tahoe Regional Planning Agency (TRPA) and local jurisdictions, along with the California Environmental Quality Act (CEQA) statute and guidelines, provide the regulatory background that guides the assessment of potential environmental effects on these resources. This section is also based on information provided in the Preliminary Geotechnical Report prepared for the project by Parikh Consultants in 2011 for Wood Rodgers (Parikh Consultants 2011).

Potential environmental effects related to water quality resulting from soil erosion and other stormwater issues are addressed in Section 3.10, "Water Quality and Stormwater Runoff." Section 3.10 also includes a discussion of excavation in excess of 5 feet as it relates to groundwater interception. Cumulative impacts on geology, soils, land capability and coverage are addressed in Section 3.19, "Cumulative Impacts."

Comments received on the Notice of Preparation/Notice of Intent related to geology, soils, land capability, and coverage include requests for discussion of land coverage increases and transfers. These topics are discussed in the analysis below.

The project site does not contain expansive soils or slopes that could become unstable or generate landslides or avalanche. Additionally, TRPA regulations prohibit mining and the construction of septic tanks or wastewater disposal systems within the Lake Tahoe Basin. These topics are not discussed further in this document.

# 3.11.1 Regulatory Setting

Regulations protecting the soil resources in the study area are enforced by TRPA, the Lahontan Regional Water Quality Control Board (RWQCB) (through water quality regulations), the Nevada Department of Environmental Protection, the City of South Lake Tahoe, and Douglas County in Nevada. Other regulations aid in the establishment of safe structures to ensure minimal, if any, impact on earth resources. The following discussion provides the background for applicable earth resource requirements in the Tahoe Region.

This section also discusses geology, soils, and seismic concerns as they relate to public safety and project design. Earthquakes are prime considerations in the design and retrofit of structures. The Department's Office of Earthquake Engineering is responsible for assessing the seismic hazard for Department projects. Structures are designed using the Department's Seismic Design Criteria (SDC). The SDC provides the minimum seismic requirements for highway bridges designed in California. A bridge's category and classification will determine its seismic performance level and which methods are used for estimating the seismic demands and structural capabilities. For more information, please see the Department's *Division of Engineering Services, Office of Earthquake Engineering, Seismic Design Criteria*.

## FEDERAL

For geologic and topographic features, the key federal law is the Historic Sites Act of 1935, which establishes a national registry of natural landmarks and protects "outstanding examples of major geological features." Topographic and geologic features are also protected under the CEQA.

## National Earthquake Hazards Reduction Act

The National Earthquake Hazards Reduction Act was passed to reduce the risks to life and property resulting from earthquakes. To accomplish this, the act established the National Earthquake Hazards Reduction Program (NEHRP). The mission of NEHRP includes improved understanding, characterization, and prediction of hazards and vulnerabilities; improved building codes and land use practices; risk reduction through post-earthquake investigations and education; development and improvement of design and construction techniques; improved mitigation capacity; and accelerated application of research results. NEHRP designates the Federal Emergency Management Agency (FEMA) as the lead agency of the program and assigns several planning, coordinating, and reporting responsibilities. Other NEHRP agencies include the National Institute of Standards and Technology, National Science Foundation, and the U.S. Geological Survey (USGS).

## National Pollutant Discharge Elimination System

The U.S. Environmental Protection Agency (EPA) regulates water quality in stormwater runoff through implementation of the National Pollutant Discharge Elimination System (NPDES) (55 Code of Federal Regulations [CFR] 47990). NPDES permits are intended to address land uses and activities that could create erosion or sediment transportation and potentially degrade water quality. Compliance with these permits requires implementation of erosion control best management practices (BMPs) and preparation of a Storm Water Pollution Prevention Plan (SWPPP) to minimize erosion and sediment transport adjacent to water bodies. In California, EPA has delegated implementation of the NPDES to the State Water Resources Control Board and its nine regional boards. Refer to Section 3.10, "Water Quality and Stormwater Runoff," for a more detailed discussion.

## TAHOE REGIONAL PLANNING AGENCY

## **Environmental Threshold Carrying Capacities**

TRPA has established threshold carrying capacity standards and indicators for soil conservation. TRPA threshold standards are minimum standards of environmental quality to be achieved in the Tahoe Region. Every 5 years, TRPA evaluates the attainment status of all TRPA threshold standards. The 2015 Threshold Evaluation was completed in December 2016 (TRPA 2016).

TRPA has two soil conservation threshold standard indicator reporting categories:

- ▲ Land Coverage (impervious cover) Threshold Standard to comply with allowable land coverage limitations established in the Land Capability Classification of the Lake Tahoe Basin. This threshold standard indicator reporting category consists of nine different standards for the nine separate land capability districts (LCDs). All soils within the Tahoe Region have been assigned an LCD based on their ability to tolerate disturbance and development while retaining their natural function. LCDs 1a to 3 are considered sensitive to and LCD 7 is considered the most tolerant of development.
- Stream Environment Zone (SEZ) Threshold Standard to restore 25 percent of the SEZ lands that have been identified as disturbed, developed or subdivided to attain a 5 percent increase in the area of naturally functioning SEZ lands. LCD 1b comprises SEZ lands.

The 2015 status of the Tahoe Region's soil conservation threshold standards is considerably better than the target for LCDs 1a and 3 through 6; somewhat better than the target for LCDs 1c and 7; and considerably worse than the target for LCD 1b. The 2015 status of the SEZ restoration threshold is considerably worse than the target.

## Lake Tahoe Regional Plan

Several components of the Lake Tahoe Regional Plan address policies and regulations pertaining to geology, soils, land capability, and coverage: Goals and Policies, Code of Ordinances, and Water Quality Management Plan (TRPA 2012).

### **Goals and Policies**

Goals and policies applicable to geology, soils, land capability, and coverage are included in several elements and subelements of the Goals and Policies document of the Regional Plan. The Natural Hazards Subelement of the Land Use Element addresses risks from natural hazards (e.g., flood, fire, avalanche, and earthquake). Specifically, Goal 1, Policy LU-2 prohibits new construction on, or disturbance of land within the 100-year floodplain and in the area of wave run-up except as necessary to implement the goals and policies of the Plan; and requires all public utilities, transportation facilities, and other necessary public uses located in the 100-year floodplain and area of wave run-up to be constructed or maintained to prevent damage from flooding and to not cause flooding. The Water Quality Subelement of the Land Use Element includes goals to reduce loads of sediment and algal nutrients to Lake Tahoe (Goal WO-3): meet sediment and nutrient objectives for tributary streams, surface runoff, and subsurface runoff (Policy WO-3.1); restore 80 percent of the disturbed lands relative to the 1983 baseline (Policy WQ-3.2); and specifies that the implementation of BMPs shall be required as a condition of approval for all projects (Policy WQ-3.12). The Soils Subelement of the Conservation Element addresses soil erosion and loss of soil productivity through policies pertaining to coverage, including allowable coverage for categories of land uses in specific LCDs (Policies S-1.1 and S-1.2). This subelement also addresses special regulations regarding construction and soil-disturbing activities occurring between October 15 and May 1 (Policy S-1.6) and restoration of disturbed areas in SEZs (Policy S-1.7). The full text of these goals and policies, along with a discussion of the project's consistency with the goals and policies, is included in Appendix E, "Goals and Policies Consistency Analysis."

## **Code of Ordinances**

The TRPA Code of Ordinances implements the Regional Plan Goals and Policies. The following TRPA Code provisions are most relevant to the geology, soils, land capability, and coverage aspects of the US 50/South Shore Community Revitalization Project.

### Chapter 30 - Land Coverage Standards

Since the late 1970s, TRPA has used the land capability classification system known as the Bailey System (Bailey 1974) to guide land use planning, policy formulation related to the impacts of development on soil erosion, and permitting of development. The Bailey System was developed as a threat assessment and planning tool to identify and mitigate adverse impacts on water quality and stream systems that occur from surface runoff and erosion related to development. The Bailey System is the basis of the land coverage standards and limitations set forth in Chapter 30 of the TRPA Code.

Coverage is defined by TRPA as a human-built structure or other impervious surface that prevents normal precipitation from directly reaching the surface of the land underlying the structure, therefore precluding or slowing the natural infiltration of water into the soil (Code Chapter 90). TRPA further defines coverage as impervious surface (hard coverage) or compacted soil (soft coverage). Research has established the connection between impervious surfaces and water quality. Specifically, coverage may affect water quality as it reduces the amount of soil available to infiltrate water and has the potential to result in surface runoff, erosion, and delivery of pollutants to receiving waters.

The Bailey System assigns LCDs based primarily on soil characteristics and slope. The LCDs reflect the amount of development that a given site can support without experiencing soil or water quality degradation. The LCDs range from 1 to 7, with 1 being the most environmentally sensitive and 7 being most suitable for supporting development (Table 3.11-1). Under this system, TRPA allows landowners to cover 1, 5, 20, 25, or 30 percent of their parcel with impervious surfaces, depending on its environmental sensitivity as defined by the Bailey classification system.

For parcels of up to 20 acres, parcel size is used to determine the amount of allowable coverage for a project site. As described in Code Section 30.4.1.C.3.b.i, however, highways, streets, roads, and the easements or rights-of-way allowing potential land coverage for linear public facilities, highways streets, and roads are not included within a project site.

Capability Levels	Tolerance for Use	Slope Percent	Relative Erosion Potential	Runoff Potential	Disturbance Hazards	
7		0-5		Low to moderately low		
6		0-16 Slight		LOW to moderately low	Low hazard	
5	Moot	0-16		Moderately high to high		
4	MOSL	9-30	Madarata	Low to moderately low	Madarata bazard landa	
3		9-30	woderate	Moderately high to high	moderate nazaru lanus	
2		30-50		Low to moderately low		
1a	Least		Llich		High bozord landa	
1b	(Poor Natural Drainage)	30+	підн	Moderately high to high	nigii nazaru ianus	
1c	(Fragile Flora and Fauna)					
Source: Bailey	1974	•	• •		•	

Table 3.11-1	Land Capability Districts for Lake Tahoe Region
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Exemption from Land Coverage Calculations for Non-Motorized Trails

Section 30.4.6.D.3 of the TRPA Code provides an exemption from land coverage calculations for nonmotorized public trails. To qualify for this exemption, the non-motorized trail must be a component of the trail network identified in the Lake Tahoe Region Bike Trail and Pedestrian Plan; open to the public in perpetuity, at no cost; be routed to minimize disturbance of sensitive land and removal of large trees and riparian vegetation; meet industry standard engineering criteria; provide elevated stream crossings; incorporate appropriate BMPs; and minimize disturbance to sensitive wildlife habitat.

### Exceptions to Prohibition in Land Capability District 1b (Stream Environment Zone)

Section 30.5 of the TRPA Code prohibits additional land coverage in low capability LCDs unless the project meets certain exceptions. The following exception applies to the prohibition of land coverage and disturbance in LCD 1b (Stream Environment Zone):

### C. Public Service Facilities

Land coverage and disturbance for public service facilities may be permitted in LCD 1b (Stream Environment Zone) if TRPA finds that:

- 1. The project is necessary for public health, safety, or environmental protection;
- 2. There is no reasonable alternative, including a bridge span or relocation, that avoids or reduces the extent of encroachment in the stream environment zone; and
- 3. The impacts of the land coverage and disturbance are fully mitigated through application of BMPs and restoration in accordance with Section 30.5.3 in the amount of 1.5 times the area of SEZ land covered or disturbed by the project.

Linear Public Facilities (LPFs) are a sub-category of the TRPA-defined Public Service Facilities. The allowable land coverage permitted for an LPF is limited to the minimum amount needed to achieve its public purpose (TRPA Code Section 30.4.2.D). If an LPF requires more land coverage than allowed by Table 4.5-2 [in Section 30.5 of the TRPA Code], the additional coverage may be purchased from a land coverage bank, or transferred from another parcel. In order to qualify for this special consideration, the LPF must be necessary (per TRPA Code Section 50.8.1), minimize the amount of new coverage, and be operated by a public agency, and must demonstrate that there are no feasible alternatives.

#### Chapter 60 - Water Quality

Chapter 60 of the TRPA Code sets forth requirements for installation of BMPs for the protection or restoration of water quality and attainment of minimum discharge standards. Projects shall comply with temporary and permanent BMP programs as a condition of project approval.

#### Chapter 33 - Grading and Construction

Chapter 33 of the TRPA Code describes the various standards and regulations that protect the environment against significant adverse effects from excavation, filling, and clearing, resulting from such conditions as exposed soils, unstable earthworks, or groundwater interference.

### **Tourist Core Area Plan**

The City of South Lake Tahoe, in conjunction with and approval from TRPA, adopted the Tourist Core Area Plan (TCAP) on October 15, 2013, which largely replaced the Stateline/Ski Run Community Plan of 1994. The tourist core stretches approximately 2 miles along US 50 from Fairway Drive to the California/Nevada state line and along Ski Run Boulevard from Lake Tahoe to Pioneer Trail. This area functions as the primary visitor and tourist district in South Lake Tahoe and provides direct access to recreation opportunities such as Heavenly Ski Resort, Edgewood Golf Course, Ski Run Marina, Lakeside Marina, and Van Sickle Bi-State Park.

TCAP goals and policies for soil and geologic resources that are applicable to the project are found in the Natural and Cultural Resources section. Water quality policies include a requirement for installation of BMPs on all projects identified in the MOU between TRPA and the City of South Lake Tahoe (Policy NCR-3.1). Land coverage policies address reduction of onsite land coverage through environmental redevelopment (Policy NCR-4.1); opportunities for coverage reduction (Policy NCR-4.2); landscaping features in all private and public redevelopment projects (Policy NCR-4.3); and transferring hard coverage from SEZs and other sensitive lands to high capability lands (Policy NCR-4.4). The full text of these goals and policies, along with a discussion of the project's consistency with the goals and policies, is included in Appendix E, "Goals and Policies Consistency Analysis."

### **South Shore Area Plan**

Douglas County, in conjunction with and with approval from TRPA, prepared and approved the South Shore Area Plan (SSAP) on November 21, 2013. The SSAP replaced the Stateline Community Plan; Kingsbury Community Plan; a portion of Plan Area Statement 070A (Edgewood), including Special Area #1 (C-070A SA1); and a portion of Plan Area Statement 080 (Kingsbury Drainage), including Special Area #2 (R-080 SA2). The SSAP has been developed to build upon the concepts in the South Shore Vision Plan, as well as be consistent with the goals and policies in the 2012 TRPA Regional Plan. The SSAP includes four separate components that are integrated into Douglas County planning documents: the Douglas County Master Plan, Zoning Map, Development Code, and Design Criteria and Improvement Standards.

## STATE

## California

#### National Pollutant Discharge Elimination System Permits and Stormwater Pollution Prevention Plans

In California, the State Water Resources Control Board (SWRCB) administers the federal NPDES for EPA. In turn, the SWRCB's jurisdiction is administered through nine regional water quality control boards, which provide region-specific water quality standards and control measures to implement the federal Clean Water Act (see discussion in Section 3.10, "Water Quality and Stormwater Runoff"). The Lahontan RWQCB is responsible for regulating surface water and groundwater quality within the Tahoe Basin, including the project site. The Water Quality Control Plan for the Lahontan Region (Lahontan RWQCB 2015) establishes water quality objectives enforced through federal NPDES permits.

Under these federal regulations, an operator must obtain a General Permit through the NPDES Stormwater Program for all construction activities with ground disturbance of 1 acre or more. The General Permit requires the implementation of BMPs to control erosion and reduce sedimentation into surface waters. One element of compliance with the NPDES permit is preparation of a SWPPP that addresses prevention and control of water pollution, including sediment, in runoff during construction. (See Section 3.10, "Water Quality and Stormwater Runoff," for more information about the NPDES permit process and SWPPPs.)

### Lake Tahoe Water Quality Management Plan (208 Plan)

The Lake Tahoe Water Quality Management Plan (also known as the 208 Plan, in reference to the pertinent section of the Clean Water Act) is a framework that sets forth the components of the water quality management system in the Lake Tahoe Region, the desired water quality outcomes for the Tahoe Basin, and the mechanisms adopted by the relevant entities to achieve and maintain those outcomes. The agencies with primary responsibility for regulatory oversight of water quality in the Basin is the Lahontan Regional Water Quality Control Board and the Nevada Division of Environmental Protection; other entities with regulatory responsibility for aspects of water quality are TRPA and the U.S. Army Corps of Engineers. The *Best Management Practices Handbook* (TRPA 2014a) provides technical guidance and assistance to engineers, architects, consultants, builders, homeowners, and other agencies proposing a project in the Tahoe Basin that may affect water quality. It identifies and recommends BMPs for various situations. Elements of the 208 Plan relevant to geology, soils, land capability, and coverage are as follows:

- Best management practices: Use of BMPs is mandatory for all new development; BMPs must be retrofitted for existing development and are required for resource management uses (e.g., timber harvest, livestock grazing).
- ▲ Land coverage restrictions: The land capability system limits the amount of allowable impervious surface coverage, especially on lands with high erosion hazard and in SEZs. Limited exceptions for public projects, coverage transfer, and coverage relocation are provided in Code of Ordinances Chapter 30.
- ▲ Roads and rights-of-way: The Lahontan RWQCB requires controls for potential erosion from new and existing roads, road maintenance activities, and snow and ice control.

### California Tahoe Conservancy

The mission of the California Tahoe Conservancy (Conservancy) is to preserve, protect, restore, enhance, and sustain the unique and significant natural resources and recreational opportunities of the Lake Tahoe Region (7.42 California Government Code, Sections 66905–66908.3). The Conservancy's jurisdiction extends throughout the California side of the Tahoe Region, as defined in California Government Code Section 66905.5. In 1987, the Conservancy authorized staff to develop and implement a land coverage (land bank) program. Through this program, the Conservancy acquires properties eligible for purchase from willing sellers. The development potential on these properties is then retired. All rights and credits acquired by the Conservancy are stored in a land bank. Through a Memorandum of Understanding (MOU) with TRPA, the Conservancy is authorized to receive disbursements of TRPA excess coverage mitigation fees to perform coverage reduction through its land bank (TRPA and Conservancy 1988). The MOU also authorizes the Conservancy to sell coverage rights on the open market and conduct SEZ restoration or mitigation for private or public service projects through the land bank.

The benefits of the Conservancy's land coverage program include acquisition and restoration of developed areas that have become degraded and that contribute, or have the potential to contribute, to water quality problems; protection of undeveloped land before development activities generate the need for mitigation; ongoing management to ensure that resource benefits are sustained; assistance to property owners in complying with regional land coverage policies so they may construct or rehabilitate homes and businesses; and actions to simplify and expedite public and private projects.

In the study area, the Conservancy owns and manages the California portion of the Van Sickle Bi-State Park. In accordance with an MOU with Nevada Division of State Parks, the Conservancy manages the property for its recreational, cultural, and natural resource values, including soil conservation.

#### Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) (Public Resources Code Sections 2621–2630) was passed in 1972 to mitigate the hazard of surface faulting to structures designed for human occupancy. The main purpose of the law is to prevent the construction of buildings used for human occupancy on the surface trace (the intersection of a fault with the ground surface) of active faults. The law addresses only the hazard of surface fault rupture and is not directed toward other earthquake hazards. The Alquist-Priolo Act requires the State Geologist to establish regulatory zones known as Earthquake Fault 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 efforts. Before a project can be permitted in a designated Alquist-Priolo Earthquake Fault Zone, cities and counties must require a geologic investigation to demonstrate that proposed buildings would not be constructed across active faults.

#### Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 (Public Resources Code Sections 2690–2699.6) addresses earthquake hazards from nonsurface fault rupture, including liquefaction and seismically induced landslides. The act established a mapping program for areas that have the potential for liquefaction, landslide, strong ground shaking, or other earthquake and geologic hazards. The act also specifies that the lead agency for a project may withhold development permits until geologic or soils investigations are conducted for specific sites and mitigation measures are incorporated into plans to reduce hazards associated with seismicity and unstable soils.

#### California Building Standards Code

The State of California provides minimum standards for building design through the California Building Standards Code (California Code of Regulations, Title 24). The California Building Code (CBC) applies to building design and construction in the state and is based on the International Building Code used widely throughout the country (generally adopted on a state-by-state or district-by-district basis). In the CBC, the International Building Code has been modified for California conditions with more detailed and/or more stringent regulations.

The state earthquake protection law (California Health and Safety Code Section 19100 et seq.) requires that structures be designed to resist stresses produced by lateral forces caused by wind and earthquakes. Specific minimum seismic safety and structural design requirements are set forth in Chapter 16 of the CBC. The CBC identifies seismic factors that must be considered in structural design.

Chapter 18 of the CBC regulates the excavation of foundations and retaining walls, and Chapter 33 regulates grading activities, including drainage and erosion control and construction on unstable soils, such as expansive soils and areas subject to liquefaction.

### Nevada

### Nevada Division of Environmental Protection

The Nevada Division of Environmental Protection (NDEP), Bureau of Water Quality Planning administers the NPDES program authorized by the federal Clean Water Act within the state of Nevada. All projects disturbing more than 1 acre of land must obtain a NPDES General Permit for stormwater discharge associated with construction activity. As described above, NPDES permits are intended to address land uses and activities that could create erosion or sediment transportation and potentially degrade water quality. Refer to Section 3.10, "Water Quality and Stormwater Runoff," for a more detailed discussion.

#### Nevada Division of State Lands

The Nevada Division of State Lands (NDSL) leads the state's programs to protect Lake Tahoe. NDSL administers the excess coverage mitigation program for the Nevada portion of the Lake Tahoe Region, which is funded by excess coverage mitigation fees disbursed from TRPA. The objective of this program is to improve the water quality of Lake Tahoe through the retirement of land coverage and restoration of disturbed lands. This program acquires land and land coverage. Acquired lands are protected and are not

available for development or disposal. Management goals include clean water, healthy forests, the reduction of excess fire fuels and hazardous forest conditions, good wildlife habitat, and reasonable public access.

## LOCAL

## **Area Plans**

The Tourist Core Area Plan and the South Shore Area Plan are joint planning documents prepared by the local jurisdictions, City of South Lake Tahoe and Douglas County, and TRPA. The goals and policies of these plans are discussed above under "Tahoe Regional Planning Agency."

## City of South Lake Tahoe General Plan

The City of South Lake Tahoe adopted the 2030 General Plan on May 17, 2011. The 2030 General Plan is the City's policy document containing elements that guide land use, transportation, public facilities and services, recreation, natural resources, and other decisions in compliance with the TRPA Regional Plan. The Health and Safety Element of the General Plan contains goals and policies applicable to the build alternatives, including a requirement buildings and structures in the City are constructed to withstand seismically-induced ground shaking and related geologic hazards (Policy HS-3.1). The full text of these goals and policies, along with a discussion of the project's consistency with the goals and policies, is included in Appendix E, "Goals and Policies Consistency Analysis."

## South Lake Tahoe City Code

The South Lake Tahoe City Code requires the submission of engineered plans for all large projects (Section 7.20.280). The required components of engineered plans are described in Section 7.20.290 and include a detailed erosion and sediment control plan showing the specific locations, construction details, and supporting calculations for temporary and permanent structural BMPs and facilities; a revegetation plan describing temporary and permanent erosion control plantings, groundcovers, and irrigation facilities; a drainage study; and a geotechnical investigation report providing recommendations addressing the proposed work. Geotechnical investigations are required when the proposed grading exceeds 10 feet in depth at any point, when highly expansive soils are present, and in areas of known or suspected geological hazards. All projects must meet the minimum standards provided in the City of South Lake Tahoe Public Improvement and Engineering Standards.

## **Douglas County Master Plan**

The 15-year update of the Douglas County Master Plan was adopted on March 1, 2012. This updated included the adoption of the SSAP, which incorporated the relevant updates from the 2012 TRPA Regional Plan into the Douglas County Code and Douglas County Master Plan. The Douglas County Master Plan contains several elements that detail goals, policies, and actions for future development within Douglas County, Nevada. The Environmental Resources and Conservation Element of the Master Plan describes the concerns related to the natural environment in Douglas County has established goals to protect these resources as well as to protect public health and safety. The County has established goals to minimize danger and damage to county residents from geologic hazards (ERC Goal 1) and to protect future residents from safety hazards (ERC Goal 2). The full text of these goals, along with a discussion of the project's consistency with them, is included in Appendix E, "Goals and Policies Consistency Analysis."

## **Douglas County Building and Development Ordinances**

Douglas County Consolidated Development Code Title 20, Chapter 20.690, "Property Development Standards," contains provisions related to grading activities in hillside areas with slopes of 15 percent or greater and having a minimum vertical rise of at least 30 feet. Chapter 20.690, Section K(4) requires that a slope analysis and a grading plan, prepared by a Nevada registered professional engineer, be submitted to the Community Development Department for review and approval. The grading plan must include data on proposed slopes, drainage patterns, storm water detention, and cross-section exhibits showing preliminary cut-and-fill areas. An applicant must also submit an erosion control and re-vegetation plan prepared by a

Nevada licensed landscape architect, registered forester, or civil engineer. Chapter 20.690, Section K(6) sets forth Douglas County grading standards that apply in hillside areas.

# 3.11.2 Affected Environment

## **GEOLOGY AND TOPOGRAPHY**

## **Regional Geology**

The study area is located in the Sierra Nevada geomorphic province. The Sierra Nevada mountain range is a tilted fault block with a gentle western slope and a steep, rugged eastern escarpment. It runs through eastern California and a small portion of western Nevada, from the Mojave Desert in the south to the Cascade Range and Modoc Plateau on the north, for more than 400 miles and averages 50 to 80 miles wide. The Sierra Nevada geomorphic province is primarily composed of massive granitic bedrock, remnants of metavolcanic and metasedimentary rocks (volcanic and sedimentary rocks subsequently subjected to substantial heat and pressure), and more recent volcanic and sedimentary rocks. It is bounded on the west by sedimentary rocks of the Great Valley geomorphic province and on the north by volcanic sheets extending south from the Cascade Range (California Department of Conservation, California Geological Survey [CGS] 2002).

The Lake Tahoe Basin is located in the northern Sierra Nevada, between the Sierra crest to the west and the Carson Range to the east, and is one of the most prominent mountain ranges in California. Faulting and volcanism created the Lake Tahoe Basin over 2 million years ago, and as a result, the Basin contains granitic, metamorphic, and volcanic rock (Saucedo 2005). The bedrock in the Tahoe Basin is predominantly Cretaceous granodiorite of the Sierra Nevada batholith. Cretaceous rock formed during the later period of the Mesozoic Era, characterized by the development of flowering plants and ending with the sudden extinction of the dinosaurs and many other forms of life. Pre-Cretaceous metamorphic rocks are found in localized areas.

Over the past 1.5 million years, the Lake Tahoe Region has been altered by glacial activity, and most of the landforms surrounding the Lake are a result of glaciation. During glacial activities, valley glaciers dammed the Truckee River Canyon, raising the water level of Lake Tahoe. Lacustrine sediments (those formed at the bottom of lakes) were deposited in the bays and canyons around the Lake as a result of rising water levels. The faulting, folding, and (in some cases) overturning of rock formations that has taken place during various periods of geologic activity, in combination with erosion, deposition, and subsequent cementation of rock materials that occurred during relatively quiet periods, have left a complex arrangement of geologic rock types and structures in the area. The extraordinary clarity of Lake Tahoe is related to the prevalence of resistant granitic bedrock in the Lake Tahoe Basin and the unusually small drainage basin relative to the size of Lake Tahoe.

A review of the Geologic Map of the Lake Tahoe Basin (Saucedo 2005) indicates that there is a strong geologic split between the east and west sides of the project site. The eastern side of the project site is located on Cretaceous-era (145–65 million years ago) granodiorite rock, specifically the East Peak (Keg) and Bryan Meadows (Kbmg) granodiorite. Near the resort-casinos the geology shifts to Pleistocene-era (1.8 million–10,000 years ago) Lacustrine terrace deposits (Qlt), which continue westward until reaching more recent beach deposits along the shore of Lake Tahoe.

## **Site Topography**

Slope of the land is an important consideration in development planning. Slopes, in conjunction with soil types, geological and seismic hazards, and scenic vistas, are potential limitations to development. Typically, challenges associated with development on slight slopes are minimal. Development on steep slopes, hillsides, and ridgelines has greater potential for erosion problems, has lower rates of revegetation, can degrade the aesthetic value of the natural environment, and can represent hazards to the land itself.

The project site is located on the South Lake Tahoe 7.5-minute USGS quadrangle map. The project site is located on gently sloping terrain between the foot of East Peak and the shore of Lake Tahoe. Elevations range from 6,400 feet in the areas around Van Sickle Bi-State Park to 6,240 feet west of the tourist core.

### Seismicity

An earthquake is classified by the amount of energy released, which traditionally has been quantified using the Richter scale. Recently, seismologists have begun using a moment magnitude (M) scale because it provides a more accurate measurement of the size of large earthquakes. For earthquakes of less than M 7.0, the moment and Richter magnitude scales are nearly identical. For earthquakes greater than M 7.0, readings on the moment magnitude scale are slightly higher than the corresponding Richter magnitude.

The intensity of seismic shaking, or strong ground motion, during an earthquake is dependent on the distance and direction from the epicenter of the earthquake, the magnitude of the earthquake, and the geologic conditions of the surrounding area. Ground shaking may result in damage to or collapse of buildings and other structures. Most earthquakes occur along faults, which are fractures or geological areas of weakness, with rocks on one side being displaced with respect to those on the other side. Most faults are the result of repeated displacement that may have taken place suddenly and/or by slow creep (Bryant and Hart 2007:3).

Faulting was a key element in the formation of Lake Tahoe. The Lake Tahoe Basin lies in a graben (a trench between two faults) between the Sierra Nevada and the Carson Range (as shown in Exhibit 3.11-1). The outlet of the Basin was repeatedly dammed by volcanic eruptions and glacial ice dams (Schweickert et al. 2000). The nature of the seismic hazard in the Lake Tahoe Region was not appreciated for many years because the active faults within the Lake Tahoe Basin are covered by the lake itself. The portions of the Basin faults that show the greatest activity and strain are underwater, with activity diminishing as they move on-shore (Seitz and Kent 2004). Additionally, recent work analyzing sediment cores from the bottom of Lake Tahoe show that local earthquakes trigger landslides in the Lake (Seitz 2013). It is likely that many of the landslides evident with the Lake Tahoe Basin (including the ancient, catastrophic, five-mile wide landslide that formed McKinney Bay) were triggered by earthquakes (Dingler 2007).



Source: Schweickert et al. 2000

### Exhibit 3.11-1

### Model of Lake Tahoe Basin Half-Graben

The California State Mining and Geology Board defines an active fault as one that has had surface displacement within the last 11,000 years (CGS 2008) (Table 3.11-2). Three active faults occur within the Basin (Table 3.11-2): The West Tahoe-Dollar Point Fault (the longest, at 45 kilometers), the Stateline-North Tahoe Fault, and the Incline Village Fault (Brothers et al. 2009). Recent studies indicate that all three of these faults have experienced large rupture events within recent geologic time (Dingler 2007, Seitz and Kent 2004). Of the three faults, the West Tahoe–Dollar Point Fault has the fastest slip rate (the rate at which two faults pass each other or build tension), and its most recent confirmed rupture event was approximately 4,000 years ago (Brothers et al. 2009). The high slip rate, the height of scarps (earthquake-generated breaks in ground surface), and the length of time since the last event indicate that the West Tahoe-Dollar Point Fault could generate an earthquake with a magnitude greater than seven (Brothers et al. 2009). The height of scarps along the Incline Village Fault show that this fault has experienced several M 7.0 events and that it last ruptured approximately 575 years ago (Schweickert et al. 2000, Seitz et al. 2005). The short length of the Incline Village Fault in comparison to its large scarps indicates that it may rupture in coordination with other faults, potentially the Stateline-North Tahoe Fault to the west. In addition, the dates of the most recent event on both the Incline Village Fault and the Genoa Fault (just outside of the Basin in the Carson Valley) are the same or nearly identical (Seitz et al. 2005).

East of the Region, the Carson Range fault system, one of the Region's largest, runs for 60 miles along the east face of the Carson Range from Reno to Markleeville. The probability of at least one event at or greater than M 6.0 occurring in the Reno–Carson City urban corridor over a 50-year period is estimated to be 34–98 percent, the probability of an event at or greater than M 6.6 is estimated to be 9–64 percent, and the probability of an event at or greater than M 7.0 is estimated to be 4–50 percent. These probabilities are relatively high and are commensurate with estimates in many parts of California (dePolo et al. 1997:3).

The nearest mapped Alquist-Priolo Earthquake Fault Zone is located in the Minden-Gardnerville area of Nevada, approximately 7 miles southeast of the project site (CGS 2010).

Fault/Fault Zone	Location and Distance from Project Site	Type and Hazard				
Tahoe Valley Fault Zone	Less than 1 mile southwest of the project site	Potentially active				
Genoa Fault	Approximately 7 miles east/southeast of the site	Active—east-dipping, normal fault capable of producing a magnitude greater than 7.0				
Tahoe-Sierra Frontal Fault Zone	Approximately 8 miles west of the project site	Active—may produce earthquakes of magnitudes between 6.3 and 6.9				
West Tahoe–Dollar Point Fault	The southernmost extension of the fault passes approximately 10 miles west of the project site	Active—included in the Western Nevada Zone; comparable to the Genoa Fault, capable of producing earthquakes with a magnitude greater than 7.0				
Incline Village Fault	Approximately 15 miles north of the project site	Active—capable of producing earthquakes of magnitude 6.9; may rupture in tandem with the North Tahoe fault				
North Tahoe Fault	Approximately 15 miles north of the project site	Active				
Agate Bay Fault	Approximately 15 miles northwest of the project site	Potentially active				
Antelope Valley Fault Zone	Near Topaz Lake, approximately 30 miles southeast of the project site	Active				
Source: CGS 2015						

Table 3.11-2	Earthquake Faults and Fault Zones Near the Project Site
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**Ground Failure and Liquefaction** 

Soil liquefaction occurs when ground shaking from an earthquake causes a sediment layer saturated with groundwater to lose strength and take on the characteristics of a fluid. Factors determining liquefaction potential are soil type, level and duration of seismic ground motion, type and consistency of soils, and depth to groundwater. Loose sands and peat deposits are susceptible to liquefaction, while clayey silts, silty clays,

and clays deposited in freshwater environments are generally stable under the influence of seismic ground shaking (CGS 2008:35 - 37).

Liquefaction poses a hazard to engineered structures. The loss of soil strength can result in bearing capacity insufficient to support foundation loads, increased lateral pressure on retaining or basement walls, and slope instability. Sites underlain by relatively loose, sandy soils and saturated deposits of fill combined with a shallow groundwater table, which typically are located in alluvial river valleys/basins and floodplains, are susceptible to liquefaction.

The project site is situated on silts, sands, and gravels that could be at risk of liquefaction, if they were saturated with water; however, monitoring wells within the tourist core area indicate that the depth to groundwater is typically between 20 and 34 feet (Parikh Consultants 2011). Because of this, liquefaction potential in the shallow depths of the project site is low.

## **Tsunami and Seiche**

A tsunami is a wave or series of waves that may result from a major seismic event that involved the displacement of a large volume of water (such as rupture of a major fault), and may occur in any large body of water. A seiche is a periodic oscillation of an enclosed or restricted water body, typically a lake or reservoir, produced by seismic shaking. The action of a seiche is similar to the sloshing of a bathtub, with waves bouncing back and forth across the water body. Seiche waves can continue for hours following a tsunami inducing earthquake, causing extensive damage. Modeling of potential earthquakes occurring beneath Lake Tahoe indicate that a fault rupturing seismic event of magnitude 7.0 could trigger a tsunami, followed by seiche with waves of up to 30 feet high along the shoreline of Lake Tahoe (Ichinose et al. 2000). Exhibit 3.11-2 shows the land area within 30 vertical feet of the Lake Tahoe high water elevation.

## Soils

The soil of the project site can be categorized into three broad groups: soils of mountain toe-slopes (Cassesnai gravelly loamy coarse sand); soils formed in ancient beach terraces (Christopher–Gefo complex, Jabu coarse sandy loam, Marla loamy coarse sand, and Oneidas coarse sandy loam); and soils found in the floodplains of streams (Tahoe complex). Exhibit 3.11-3 shows the extent of each soil map unit within the project site limits; general soil characteristics are described below (Natural Resources Conservation Service [NRCS] 2007).

**Cassenai gravelly loamy coarse sand, 5 to 15 percent slopes, very stony:** The Cassenai gravelly loamy coarse sand makes up approximately 16 acres or 13 percent of the project site. These soils formed in granitic colluvium (material moved downhill by gravity) and are found on mountain slopes. Typical vegetation consists of Jeffrey pine and white fir forest with scattered openings of greenleaf manzanita and mountain whitethorn. These soils are somewhat excessively drained with moderately rapid permeability, and the surface runoff class is "low."

**Christopher-Gefo complex, 0 to 5 percent slopes:** The Christopher-Gefo complex makes up 48 acres of the project site, or approximately 37 percent. This map unit is composed of two very similar soils that formed in sandy granitic outwash deposited by streams near Lake Tahoe. The soil profile is essentially a loamy sand that has been altered and stabilized by vegetation growth over time. Vegetation consists of Jeffrey pine and white fir forest with an understory of greenleaf manzanita, mahala mat, and mountain whitethorn. These soils are somewhat excessively drained with rapid permeability and a surface runoff class of "very low."

Jabu coarse sandy loam, 0 to 9 percent slopes: The Jabu coarse sandy loam makes up 6.5 acres (5 percent) of the project site. The Jabu soil is similar to the Christopher and Gefo soils, except that it is more shallow, containing a restrictive layer between 39 and 79 inches and bedrock between 59 and 79 inches. Vegetation consists of Jeffrey pine and white fir forest with an understory of greenleaf manzanita, mahala mat, and mountain whitethorn. The Jabu soil is well drained but has very slow permeability in the restrictive layer. The surface runoff class is "low."



Exhibit 3.11-2

Seiche Range within the Project Site



**Marla loamy coarse sand, 0 to 5 percent slopes:** The Marla loamy coarse sand makes up approximately 6 acres (5 percent) of the project site. This is an alluvial soil derived from granodiorite and is found on outwash terraces and valley flats. Vegetation consists of lodgepole pine forest with scattered white fir and Jeffrey pine. Willows, grasses, and forbs make up the understory. These soils are poorly drained because of the presence of a high water table and a clay layer between 47 to 59 inches, which slows permeability. The surface runoff class is "very high."

**Oneidas coarse sandy loam:** The Oneidas coarse sandy loam makes up approximately 17 acres (15 percent) of the project site. Of this area, 8 acres are on 0 to 5 percent slopes and 11 acres are on 5 to 15 percent slopes. The Oneidas soil is found on outwash terraces. Although it is coarse textured, it contains a restrictive layer beginning near a depth of 10 inches that slows water movement through the soil. The Oneidas soils are considered poorly drained, with slow permeability and a runoff class of "very high." The land capability verification for the Edgewood mountain parcel that borders the project site (APNs 1318-27-001-006, 1318-27-001-005, and 1318-00-002-006) found that the soils mapped as Oneidas did not have the restrictive layer indicated by the 2007 NRCS soil survey (TRPA 2014b). The presence or absence of the restrictive layer in the soils mapped as Oneidas within the remainder of the project site would be determined by the land capability verification completed before TRPA permit approval.

**Tahoe complex, 0 to 2 percent slopes:** The Tahoe Complex covers approximately 7 acres (6 percent) of the project site. This soil complex formed in stream and river deposits washed down from granitic and volcanic rock. It consists of small areas of recent alluvium adjacent to stream channels and in meadows. It is nearly level to gently sloping, and typical vegetation consists of sedges, meadow grasses, and scattered lodgepole pines. This mapping unit is made up of a "dry" and a "wet" variant. The "wet" soils have a high water table and some may be classified as hydric soils. These soils are poorly drained and have moderate permeability, and the surface runoff class is "low."

**Urban Land:** Urban lands cover 27 acres (21 percent) of the project site. These are highly altered landscapes where most of the soil surface is covered by urban development or decorative landscaping. Most of the urban lands beneath the Heavenly Village Center and extending from the California/Nevada state line to the midline of the parcel currently occupied by the Hard Rock resort casino (APN 1318-27-001-009) are underlain by imported fill (Saucedo 2005). This area was the historic floodplain of Golf Course and Stateline Creeks.

## **Erosion Potential and Hazard Rating**

Erosion is the process by which surface soils are detached and transported by water and/or wind. Erosion has a detrimental effect on soil productivity, because erosion begins with the upper horizons of a soil profile, which contain organic matter and microbial communities vital to supporting plant growth. Soil erosion is also an important concern in the Tahoe Region, because it can contribute sediment to the lake, including fine sediment, potentially affecting lake clarity. Factors that influence the erosion potential of a soil include vegetative cover; soil properties such as soil texture, structure, rock fragments, and depth; steepness and slope length; and climatic factors such as the amount and intensity of precipitation.

The NRCS soil surveys provide a rating of erosion hazard resulting from disturbance of non-road areas. This rating is based on slope and soil erosion factor (K). The predicted soil loss is caused by sheet or rill erosion (which occurs when shallow flows of water causing sheet erosion coalesce into rills, increasing in velocity and scouring capacity) in off-road or off-trail areas where 50 to 75 percent of the surface has been exposed by some kind of disturbance. The soils of the project site have an erosion hazard rating of "slight," which indicates that erosion is unlikely under ordinary conditions.

## **Compaction Potential**

Soil compaction refers to an increase in soil density or a loss of pore space. Soil pores provide storage space for the oxygen and water needed to facilitate biological activity within the soil. Compaction reduces soil productivity and hydrologic function because compacted soils resist water absorption, restrict air movement around roots, and create a physical barrier to root development. All soils are more vulnerable to compaction when they are wet; however, fine-textured, poorly-drained soils with little organic matter are the most

susceptible. The Tahoe complex soil map unit contains fine-textured soils with poor drainage and makes up approximately 7 acres of the project site. These soils could be susceptible to compaction.

## LAND CAPABILITY AND COVERAGE

Since the late 1970s, TRPA has used a land capability classification system based on the ability of areas of soil to tolerate use without resulting in environmental damage (Bailey 1974). As explained in "Regulatory Setting" above, this system assigns LCDs to sites based primarily on soil characteristics and slope. The LCDs reflect the amount of development each site can support without experiencing soil or water quality degradation. The LCDs range from 1 to 7, with 1 being the most environmentally sensitive and 7 being most suitable for supporting development. LCD 1b is applied to land that is influenced by surface water or high groundwater and is also referred to as "Stream Environment Zone" or SEZ. The amount of compacted or impervious surface, known as coverage, allowed with a given parcel is limited by its LCD.

The 1974 Bailey Land Capability map is used as TRPA's basis for determining LCDs; however, because this map was created for use at a landscape scale, verification of LCDs for each build alternative would be required before TRPA permit acknowledgement. Although portions of the project site have been reviewed through the Land Capability Verification process for other (unrelated) projects, a verification has not been completed for the project site as a whole. For the purposes of this analysis, LCDs were determined using verified land capability maps where available, and by using a combination of the Bailey LCD map and project-level vegetation mapping for unverified areas. The use of vegetation mapping completed for the project allows for improved accuracy in defining SEZ margins and inclusion of some small SEZ areas that were not shown on the landscape-scale Bailey mapping. Exhibit 3.11-4 shows the mapped extent of each LCD within the project site limits.

The project site is located in and around an urban center (i.e., the tourist core area) and, as such, contains a large amount of land coverage resulting from previous urban development and necessary infrastructure. As shown in Table 3.11-3, the portions of the project site within LCDs 1b, 3, and 7 currently exceed their coverage limits. Because the tourist core and resort-casinos were developed before the establishment of TRPA, it is likely that some of this coverage (especially in LCD 7) is legally existing, excess coverage.

LCD	Acres	Allowable Coverage <sup>1</sup>	Maximum Allowable Coverage (Acres)	Existing Coverage (Acres)	Coverage Balance (Acres; + = Exceedance)			
1a	1.27	1%	0.01	0.01	0			
1b	9.82	1%	0.10	3.18	+3.09			
2	0.74	1%	0.09	0	- 0.04			
3	7.19	5%	0.04	2.85	+2.49			
4	7.40	20%/70%	0.36	2.51	- 0.35			
5	31.77	25%/70%	2.87	11.39	- 1.79			
6	1.69	30%/70%	13.19	0.09	- 0.42			
7	71.25	30%/70%	0.52	44.53	+2.02			

Table 2 11 2	Design City Land Canability and Coverage Existing Conditions
Table 2.11-2	Project Site Land Capability and Coverage – Existing Conditions

<sup>1</sup> Approximately 75 acres of the project site is located within a Regional or Town Center. Within Centers, the maximum allowable coverage for high capability lands is 70 percent.

Sources: Bailey (1974) and TRPA (2014a), adapted by Ascent Environmental in 2016



Exhibit 3.11-4

Land Capability Districts within the Project Site

# 3.11.3 Environmental Consequences

## **METHODS AND ASSUMPTIONS**

Evaluation of potential geologic, soil, land capability, and coverage impacts was based on a review of documents pertaining to the project site, including the CGS and USGS geologic maps and the NRCS soil surveys; environmental impact reports and background reports prepared for plans and projects in the vicinity; and published and unpublished geologic literature. The information obtained from these sources was reviewed and summarized to understand existing conditions and to identify potential environmental effects, based on the thresholds of significance. In determining the level of significance, the analysis assumes that the project would comply with relevant federal, state, and local laws, regulations, and ordinances.

## **SIGNIFICANCE CRITERIA**

### **NEPA Criteria**

The factors that are taken into account under NEPA to determine the significance of an action in terms of the context and the intensity of its geologic effects are encompassed by the CEQA criteria used for this analysis. No specific factors related to geology and soils are contained in NEPA, CEQ Regulations Implementing NEPA, or FHWA NEPA regulations in 23 CFR 771 et seq.

## **TRPA** Criteria

The "Land" criteria from the TRPA Initial Environmental Checklist were used to evaluate the geology and soils impacts of the alternatives. The project would result in a significant impact related to geology and soils if:

- compaction or covering of the soil beyond the limits allowed in the land capability districts;
- change in the topography or ground relief features of the site inconsistent with the natural surrounding conditions;
- ▲ unstable soil conditions during or after completion of construction;
- ▲ continuation of or increase in wind or water erosion of soils, either on or off the site; or
- ▲ exposure of people or property to earthquakes or related geologic hazards.

### **CEQA** Criteria

In accordance with Appendix G of the State CEQA Guidelines, an alternative was determined to result in a significant impact related to geology and soils if it would:

- 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 ground shaking;
  - seismic-related ground failure, including liquefaction;
- result in substantial soil erosion or the loss of topsoil; or

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 offsite landslide, lateral spreading, subsidence, liquefaction or collapse.

## **ENVIRONMENTAL EFFECTS OF THE PROJECT ALTERNATIVES**

### Impact 3.11-1: Soil compaction and land coverage

Implementation of Alternatives B, C, and D would result in an increase in land coverage within the project site limits: for Alternative B, between 5.47 and 7.62 acres; for Alternative C, 1.06 acres; and for Alternative D, between 5.76 and 7.91 acres. Because the project would comply with TRPA land coverage regulations, including mitigation of disturbances in LCD 1b at a ratio of 1.5:1, TRPA permit requirements (e.g., SWPPP, BMPs), and (for mixed-use development, including replacement housing) transfer of excess allowable land coverage, there would be minimal potential to create an adverse effect related to land coverage. Alternatives A and E would not result in changes to TRPA-related land coverage.

NEPA Environmental Consequences:	The design features of Alternatives B, C, and D would avoid or minimize the soil compaction and land coverage environmental consequences such that no additional mitigation measures are needed or feasible to implement; No Impact for Alternatives A and E
CEQA/TRPA Impact Determinations:	Less Than Significant for Alternatives B, C, and D; No Impact for Alternatives A and E

Alternatives B, C, and D would create new coverage in accordance with TRPA land coverage regulations within LCDs 1a, 1b, 2, 3, 4, 5, 6, and 7. Implementation of Alternatives A and E would not alter existing land coverage patterns. Table 3.11-4 provides a summary of preliminary coverage increases by LCD for the build alternatives. The preliminary coverage numbers would be refined as the design process progresses and before TRPA permit acknowledgement. The information presented here, although preliminary, is an accurate representation of the nature of the land coverage changes associated with the build alternatives and is sufficient for environmental impact analysis. The option to restripe Lake Parkway west of US 50 would not affect coverage, because it would occur within the paved portions of the existing roadway.

Alternatives (Ontions)	Net Increase in Land Coverage by LCD (acres)								Total
Alternauves/ Options-	1a	1b	2	3	4	5	6	7	(acres)
B: Triangle (Locally Preferred Action)									
With signal at US 50/Lake Parkway	0.43	1.46	0.19	0.74	0.47	2.75	0.59	0.99	7.62
With roundabout at US 50/Lake Parkway	0.29	1.07	0.12	0.64	0.24	1.75	0.34	1.02	5.47
C: Triangle One-Way									
With signal at US 50/Lake Parkway	0.03	0.27	0.00	-0.25	0.29	0.87	0.07	-0.22	1.06
D: PSR Alternative 2									
With signal at US 50/Lake Parkway	0.43	1.45	0.19	0.74	0.47	1.99	0.59	2.05	7.91
With roundabout at US 50/Lake Parkway	0.29	1.06	0.12	0.64	0.24	0.99	0.34	2.08	5.76
E: Skywalk			N	o Change	in Land C	Coverage			

Table 3.11-4	Summary of Preliminar	v Land Coverage Increases	for Alternatives B	. C.	D.	and E
	•••••••••••••••••••••••••••••••••••••••			, –,	-,	

<sup>1</sup>The number of lanes refers to the section of Lake Parkway west of US 50. "Signal" or "roundabout" refers to the traffic control treatment at US 50/Lake Parkway with Alternatives B, C, and D.

Source: Wood Rodgers 2015

#### Alternative A: No Build (No Project)

Alternative A would not result in changes to TRPA-regulated land coverage. For this reason, Alternative A would have **no impact** to this resource for the purposes of NEPA, CEQA, and TRPA.

#### Alternative B: Triangle (Locally Preferred Action)

#### **Transportation Improvements**

As shown in Table 3.11-4, Alternative B would create a net increase in land coverage between 5.47 and 7.62 acres relative to existing conditions and depending on the type of traffic control used at the US 50/Lake Parkway intersection. With a signal at US 50/Lake Parkway, approximately 4.8 acres of this new coverage would be created within high capability lands (LCDs 4 through 7), with the remaining 2.82 acres occurring on low capability land (LCDs 1a, 1b, 2, and 3). The proposed roundabout at this intersection would create 3.65 acres within high capability lands and 2.12 acres of coverage on low capability lands—slightly less than with a signal at this intersection, because the center of the roundabout would be pervious landscape and, therefore, not include coverage.

Although TRPA Code Section 30.5 prohibits additional land coverage in low capability land, an exemption is provided for public service facilities (i.e., linear public facilities or LPFs). TRPA and TTD have determined that the realignment of US 50 is an LPF that is necessary to improve public safety, reduce vehicle congestion, improve air quality, and encourage active transportation modes within the tourist core area. In addition, these agencies have determined that the general alignment of existing and proposed US 50 runs perpendicular to the Edgewood Creek, Golf Course Creek, and Stateline Creek SEZs and disturbance within these areas cannot be avoided; however, the increased land coverage and disturbance would be minimized through application of BMPs and restoration of low capability lands (LCDs 1a, 1b, 2, and 3) at a ratio of 1.5 acres of restoration for every 1 acre of disturbance (in accordance with TRPA Code Section 30.5.3). Therefore, Alternative B would qualify for this exemption.

TRPA's base allowable coverage standards by LCD normally limit the amount of coverage permitted for a project on a parcel-by-parcel basis (TRPA Code Section 30.4.1.A); however, because the project is an LPF (in accordance with TRPA Code Sections 21.4 and 30.4.2.D), the allowable land coverage would be limited, instead, to the minimum amount needed to achieve the project's public purpose. If the land coverage proposed by the project exceeds the base allowable coverage for a given parcel, the project proponent would purchase and transfer the required coverage allowance from offsite parcel owners ("sending parcels") in accordance with TRPA Code Chapter 30. The amount of coverage allowance to be purchased and transferred would be determined on a parcel-by-parcel basis as a function of: (1) the extent of TRPA-verified legally existing coverage; (2) the land capability and base allowable coverage of the parcel; (3) the type of agreement between the applicant and the affected parcel owners (such as a recorded deed-restricted easement or right-of-way dedication); and (4) the size of the affected parcel or width of the recorded easement. These details are unknown at this time and would be dependent on the alternative selected. Before TRPA permit acknowledgement, TTD would be required to demonstrate evidence of the source of coverage, the purchase or transfer of the required coverage allowance, and restoration of any relocated coverage, in accordance with TRPA regulations.

TRPA Code requires land coverage transfers to come from within the same hydrologically related area (HRA), as defined by TRPA. The project site is located within the South Stateline HRA, which, at approximately 11,000 acres, is the smallest HRA in the Basin. The South Stateline HRA includes the two study area watersheds (Bijou Park and Edgewood Creek) and two small adjacent watersheds (Bijou Creek and Burke Creek) (TRPA 2015). Transfers from outside the project's HRAs can only be permitted if transferred from sensitive lands (LCDs 1a, 1b, 1c, 2, and 3) to non-sensitive lands (LCDs 4 through 7) and if the receiving parcel is located farther than 300 feet from the high water line of Lake Tahoe (Code Section 30.4.3.B.6). These restrictions help ensure that development of excess land coverage and the accompanying mitigation affect the same or related soil and water resource areas.

The TCAP includes policies that encourage the reduction of coverage for all projects within the tourist core and encourage landscaping in all public and private redevelopment projects. Alternative B would incorporate the following measures to minimize coverage requirements:

- Reduced width of sidewalks and road shoulders,
- Reduced width of some left turn lanes, and
- ▲ Landscaped medians and increased green space in the existing US 50 corridor.

Overall, the Alternative B transportation improvements would result in a net increase in land coverage between 5.47 and 7.62 acres. Because the project would comply with TRPA land coverage regulations, including mitigation of disturbances in LCD 1b at a ratio of 1.5:1, the potential for Alternative B to create an adverse effect related to land coverage would be a **less-than-significant** impact for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the transportation improvements included in Alternative B would avoid or minimize the soil compaction and land coverage environmental consequences such that no additional mitigation measures are needed or feasible to implement.

#### **Mixed-Use Development including Replacement Housing**

Prior to displacing existing residents, Alternative B would construct replacement housing along with supporting commercial uses that could be located at one or more of three mixed-use development sites identified within the project site (see Exhibits 2-9 and 2-11 in Chapter 2, "Proposed Project and Project Alternatives"). If replacement housing is not constructed at any of these sites, then TTD would construct replacement housing at another location in the South Shore area to be determined prior to displacing any residents. This alternative includes the option for three mixed-use redevelopment sites, which could include replacement housing for displaced residents, as well as other commercial uses (e.g., retail, restaurant). Use of one or more of these three sites, or at another location in the South Shore area for replacement housing, would require additional parcel acquisitions beyond that required for the transportation improvements. Redevelopment of the mixed-use sites could further increase coverage, before reductions are made for transfer of excess allowable land coverage.

The conceptual layout of the mixed-use development sites (refer to Exhibit 2-9) includes a mix of parcels with extensive existing coverage and some undeveloped parcels. Redevelopment of these sites would comply with TRPA land coverage regulations. The entire area of Sites 1 and 3 and most of Site 2 would be located within the Tourist Core Town Center. Areas within the Town Center would be permitted up to 70 percent maximum allowable land coverage within LCDs 4 through 7 (TRPA Code Section 30.4.2.B.1). All land coverage in excess of the base allowable would be purchased and transferred using the transfer ratios described in the TRPA Code, which would result in an overall reduction in land coverage. For example, a half-acre parcel in LCD 7 would have a base allowable land coverage of approximately 6,500 square feet. If this parcel were located within a Town Center, the maximum allowable land coverage, the project would be required to purchase and transfer the difference between the base allowable and the maximum allowable land coverage, using the transfer ratios in TRPA Code Table 30.4.4-1. In this case, because the transfer ratio required for projects proposing 70 percent coverage is 2:1, the project would be required to purchase and transfer ratio sin TRPA Code Table 30.4.4-1.

As described above, Alternative B mixed-use development, including replacement housing, would result in an increase in land coverage relative to existing conditions. Because the project would comply with TRPA land coverage regulations, including mitigation of disturbances in LCD 1b at a ratio of 1.5:1 and transfer of excess allowable land coverage, the potential for Alternative B mixed-use development, including replacement housing, to create an adverse effect related to land coverage would be a **less-than-significant** impact for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the mixed-use development, including replacement housing, at the mixed-use development sites as part of Alternative B would avoid or minimize the soil

compaction and land coverage environmental consequences such that no additional mitigation measures are needed or feasible to implement.

Construction of replacement housing at a location other than the three mixed-use development sites could result in a similar potential for soil compaction and land coverage environmental consequences as described for the mixed-use development sites. However, because the location of replacement housing elsewhere is unknown, analysis of the potential soil compaction and land coverage impacts would be speculative at this time. Full, project-level environmental review of replacement housing somewhere other than the mixed-use development sites would be required prior to construction of replacement housing and displacement of existing residents.

### Conclusion

For the purposes of CEQA and TRPA, taken as a whole, the Alternative B transportation improvements and mixed-use development, including replacement housing, would result in a **less-than-significant** impact on soil compaction and land coverage.

For the purposes of NEPA, taken as a whole, the design features of the transportation improvements and mixed-use development, including replacement housing, as part of Alternative B would minimize the soil compaction and land coverage environmental consequences such that no additional mitigation measures are needed or feasible to implement.

#### Alternative C: Triangle One-Way

#### **Transportation Improvements**

The Alternative C transportation improvements would create a net increase in land coverage of 1.06 acres. Although Alternative C would create 0.27 acre of additional land coverage in LCD 1b and 0.03 acre in LCD 1a, there would be a reduction of 0.25 acre in LCD 3, resulting in a net increase in 0.05 acre of new coverage on low capability lands (LCDs 1a, 1b, 2, and 3). The remaining 1.01 acres coverage increase would occur on high capability lands (LCD 4 through 7). Overall, this is between 4.41 and 6.56 acres less new land coverage than under Alternative B. Alternative C would be subject to the same TRPA land coverage regulations described under Alternative B. Alternative C would also be subject to the same permitting requirements, including completion of a SWPPP and installation of permanent and temporary BMPs.

Alternative C transportation improvements would result in a net increase in land coverage of 1.06 acres; however, the project would comply with all TRPA land coverage regulations, including mitigation of disturbances in low capability lands at a ratio of 1.5:1. Therefore, the potential for Alternative C transportation improvements to create an adverse effect related to land coverage would be a **less-thansignificant** impact for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the transportation improvements included in Alternative C would avoid or minimize the soil compaction and land coverage environmental consequences such that no additional mitigation measures are needed or feasible to implement.

### Mixed-Use Development including Replacement Housing

Prior to displacing existing residents, Alternative C would construct replacement housing along with supporting commercial uses that could be located at one or more of three mixed-use development sites identified within the project site (see Exhibits 2-9 and 2-11 in Chapter 2, "Proposed Project and Project Alternatives"). If replacement housing is not constructed at any of these sites, then TTD would construct replacement housing at another location in the South Shore area to be determined prior to displacing any residents. This alternative includes the option for three mixed-use redevelopment sites, which could include replacement housing for displaced residents, as well as other commercial uses (e.g., retail, restaurant). Use of one or more of these three sites, or at another location in the South Shore area for replacement housing, would require additional parcel acquisitions beyond that required for the transportation improvements. Redevelopment of the mixed-use sites could further increase coverage, before reductions are made for transfer of excess allowable land coverage. The conceptual mixed-use development considered under

Alternative C would be subject to the same TRPA land coverage regulations and permitting requirements evaluated under Alternative B.

Alternative C mixed-use development, including replacement housing, would result in a net increase in land coverage relative to existing conditions; however, the project would comply with all TRPA land coverage regulations, including mitigation of disturbances in low capability lands at a ratio of 1.5:1 and transfer of excess allowable land coverage. Therefore, the potential for Alternative C mixed-use development, including replacement housing, to create an adverse effect related to land coverage would be a **less-than-significant** impact for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the mixed-use development, including replacement housing, at the mixed-use development sites as part of Alternative C would avoid or minimize the soil compaction and land coverage environmental consequences such that no additional mitigation measures are needed or feasible to implement.

Construction of replacement housing at a location other than the three mixed-use development sites could result in a similar potential for soil compaction and land coverage environmental consequences as described for the mixed-use development sites. However, because the location of replacement housing elsewhere is unknown, analysis of the potential soil compaction and land coverage impacts would be speculative at this time. Full, project-level environmental review of replacement housing somewhere other than the mixed-use development sites would be required prior to construction of replacement housing and displacement of existing residents.

#### Conclusion

For the purposes of CEQA and TRPA, taken as a whole, the Alternative C transportation improvements and mixed-use development, including replacement housing, would result in a **less-than-significant** impact on soil compaction and land coverage.

For the purposes of NEPA, taken as a whole, the design features of the transportation improvements and mixed-use development, including replacement housing, as part of Alternative C would minimize the soil compaction and land coverage environmental consequences such that no additional mitigation measures are needed or feasible to implement.

#### Alternative D: Project Study Report Alternative 2

#### **Transportation Improvements**

Alternative D transportation improvements would create a net increase in land coverage between 5.76 and 7.91 acres relative to existing conditions and depending on the type of traffic control used at the US 50/Lake Parkway intersection. With a signal and US 50/Lake Parkway, approximately 5.1 acres of this new coverage would be created in high capability lands (LCDs 4 through 7), with the remaining 2.81 acres occurring on low capability land (LCDs 1a, 1b, 2, and 3). The proposed roundabout at this intersection would create 3.65 acres of coverage on high capability lands and 2.11 acres of coverage on low capability lands. For both signalized and roundabout options, Alternative D would create an additional 0.29 acre of land coverage when compared to Alternative B. Alternative D would be subject to the same permitting requirements, including completion of a SWPPP and installation of permanent and temporary BMPs.

As described above, Alternative D would result in a net increase in land coverage relative to existing conditions; however, the project would comply with all TRPA land coverage regulations, including mitigation of disturbances in low capability lands at a ratio of 1.5:1. Therefore, the potential for Alternative D transportation improvements to create an adverse effect related to land coverage would be a **less-than-significant** impact for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the transportation improvements included in Alternative D would avoid or minimize the soil compaction and land coverage environmental consequences such that no additional mitigation measures are needed or feasible to implement.

#### **Mixed-Use Development including Replacement Housing**

Prior to displacing existing residents, Alternative D would construct replacement housing along with supporting commercial uses that could be located at one or more of three mixed-use development sites identified within the project site (see Exhibits 2-9 and 2-11 in Chapter 2, "Proposed Project and Project Alternatives"). If replacement housing is not constructed at any of these sites, then TTD would construct replacement housing at another location in the South Shore area to be determined prior to displacing any residents. This alternative includes the option for three mixed-use redevelopment sites, which could include replacement housing for displaced residents, as well as other commercial uses (e.g., retail, restaurant). Use of one or more of these three sites, or at another location in the South Shore area for replacement housing, would require additional parcel acquisitions beyond that required for the transportation improvements. Redevelopment of the mixed-use sites could further increase coverage, before reductions are made for transfer of excess allowable land coverage. The conceptual mixed-use development sites considered under Alternative D (refer to Exhibit 2-11) would be subject to the same TRPA land coverage regulations and permitting requirements evaluated under Alternative B.

As described above, Alternative D mixed-use development, including replacement housing, would result in a net increase in land coverage relative to existing conditions; however, the project would comply with all TRPA land coverage regulations, including mitigation of disturbances in low capability lands at a ratio of 1.5:1 and transfer of excess allowable land coverage. Therefore, the potential for Alternative D mixed-use development, including replacement housing, to create an adverse effect related to land coverage would be a **less-than-significant** impact for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the mixed-use development, including replacement housing, at the mixed-use development sites as part of Alternative D would avoid or minimize the soil compaction and land coverage environmental consequences such that no additional mitigation measures are needed or feasible to implement.

Construction of replacement housing at a location other than the three mixed-use development sites could result in a similar potential for soil compaction and land coverage environmental consequences as described for the mixed-use development sites. However, because the location of replacement housing elsewhere is unknown, analysis of the potential soil compaction and land coverage impacts would be speculative at this time. Full, project-level environmental review of replacement housing somewhere other than the mixed-use development sites would be required prior to construction of replacement housing and displacement of existing residents.

### Conclusion

For the purposes of CEQA and TRPA, taken as a whole, the Alternative D transportation improvements and mixed-use development, including replacement housing, would result in a **less-than-significant** impact on soil compaction and land coverage.

For the purposes of NEPA, taken as a whole, the design features of the transportation improvements and mixed-use development, including replacement housing, as part of Alternative D would minimize the soil compaction and land coverage environmental consequences such that no additional mitigation measures are needed or feasible to implement.

#### Alternative E: Skywalk

Alternative E would create an elevated pedestrian structure in an area that is currently 100 percent covered in impervious materials. Because Alternative E would not result in changes to TRPA-regulated land coverage, it would have **no impact** relative to land coverage for the purposes of NEPA, CEQA, and TRPA.

## Impact 3.11-2: Increased erosion and alteration of topography during construction

During construction, transportation improvements and replacement housing included in Alternatives B, C, D, and Alternative E would require ground disturbance and soil exposure, which could result in increased erosion and alteration of the existing topography. The total area of temporary and permanent disturbance (including areas that are currently developed or disturbed) would be 56.49 acres for Alternative B, 52.20 acres for Alternative C, 52.39 acres for Alternative D, and 0.79 acre for Alternative E. Because the project site is located in an urban environment, much of the project site has been developed or extensively disturbed. Topographic changes resulting from the project would be minimized and would be consistent with the existing urban environment. The potential for erosion and sediment movement would be minimized through compliance with Lahontan RWQCB and TRPA permit conditions and regulations. Alternative A would result in no changes to existing conditions related to erosion and alteration of topography.

NEPA Environmental Consequences:	The design features of Alternatives B, C, D, and E would avoid or minimize the erosion and alteration of topography environmental consequences such that no additional mitigation measures are needed or feasible to implement; No Impact for Alternative A
CEQA/TRPA Impact Determinations:	Less Than Significant for Alternatives B, C, D, and E; No Impact for Alternative A.

Implementation of the project would require grading, excavation, and removal of existing asphalt and road materials and demolition and removal of existing structures in the area of Moss, Echo, and Fern Roads for transportation improvements and replacement housing included in Alternatives B, C, and D. Excavation would also be required to modify or install storm drain systems and for the relocation of underground utilities.

These construction activities would result in temporary disturbance of soil and would expose disturbed areas to precipitation during storm events. Rain of sufficient intensity and duration could dislodge soil particles, generate runoff, and cause localized erosion. Soil disturbance during the summer months could result in loss of topsoil from wind erosion and runoff from thunderstorm events. Additionally, the project would result in ground disturbance within and directly adjacent to the Edgewood Creek, Golf Course Creek, and Stateline Creek SEZ areas. The project site is located in an urban area, however, and much of the disturbance would occur in areas that have been developed and are already heavily disturbed. Although construction in developed areas would expose the soil surface and temporarily increase the potential for erosion, it would not add to the total acreage of land disturbance within the project site. Areas of the project site that are undeveloped have been previously disturbed by construction, or other human activity but are now covered by native or ornamental vegetation. The expansion of development into these areas would create new permanent ground disturbance. The amount of temporary and permanent ground disturbance created by each alternative is shown in Table 3.11-5, below.

Altomativo	Temporary		Permanent			Total			
Alternative	Undeveloped	Developed	Total	Undeveloped	Developed	Total	Undeveloped	Developed	<b>Overall Total</b>
Alternative A: No Build (No Action)					NA				
Alternative B: Triangle (Locally Preferred Action)	11.72	10.78	22.50	9.69	24.30	33.99	21.41	35.08	56.49
Alternative C: Triangle One-Way	13.58	10.62	24.20	5.19	22.81	28.00	18.77	33.43	52.20
Alternative D: PSR Alternative 2	10.83	9.05	19.88	9.34	23.17	32.51	20.17	32.22	52.39
Alternative E: Skywalk	0	0.76	0.76	0	0.03	0.03	0	0.79	0.79
NA = not applicable		-							

Table 3.11-5	Acres of Ground Disturbance by Alternative
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Source: Wood Rodgers 2015; Adapted by Ascent Environmental

#### Alternative A: No Build (No Project)

Alternative A would not result in changes to topography or ground disturbance that could lead to increased erosion. For this reason, Alternative A would have **no impact** on these resources for the purposes of NEPA, CEQA, and TRPA.

#### Alternative B: Triangle (Locally Preferred Action)

#### **Transportation Improvements**

The Alternative B transportation improvements would create 22.50 acres of temporary disturbance, 11.72 acres of which would occur in undeveloped areas. Permanent disturbance would total 33.99 acres, with 9.69 acres occurring in undeveloped areas. Temporarily disturbed areas would be stabilized and revegetated with approved plant species following construction; however, the topography of these sites may be altered. In accordance with TRPA Code Section 36.5.1.A, the project would be designed to minimize topographical changes and to maintain the natural slope of the project site where feasible.

The NRCS Erosion Hazard rating estimates the risk of soil loss from sheet and rill erosion (erosion caused by overland flow of water) for disturbed soils where 50 to 75 percent of the soil surface has been exposed (NRCS 2007). Because the soils of the project site have low to moderate runoff potential and the topography (with the exception of stream banks) is gently sloped, the NRCS describes the Erosion Hazard rating at "slight." This means that adverse, or substantial, erosion would be unlikely under normal conditions.

The BMPs required by TRPA, NDEP, and Lahontan RWQCB as conditions of construction permits would further reduce the potential for soil erosion and protect SEZ areas. One condition of the required NPDES permit is implementation of a SWPPP prepared by a qualified SWPPP practitioner. This plan would detail the BMPs that would be implemented to minimize erosion, reduce sediment transport, and control stormwater flow from the project site. In addition, the SWPPP would address grading and slope stabilization methods. Typical temporary BMPs include properly installed silt fences, sediment logs, detention basins, and inlet protection. Temporary BMPs would be installed before site grading begins and would be maintained throughout construction until permanent erosion control features are functioning. Construction-period BMPs installed as permit conditions have proven effective in controlling site runoff and sediment in stormwater. The required elements of a SWPPP are discussed in greater detail in Section 3.10, "Water Quality and Stormwater Runoff." After construction is completed, temporarily disturbed areas would be stabilized and revegetated in accordance with TRPA Code Section 61.4.

Because the soils of the project site are not highly susceptible to erosion, temporary and permanent BMPs would be installed as requirements of the necessary TRPA and Lahontan RWQCB permits, and areas of temporary disturbance would be revegetated and regraded to match the natural topography of the site, the potential for the Alternative B transportation improvements to increase erosion or adversely affect the topography of the area would be a **less-than-significant** impact for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the transportation improvements included in Alternative B would avoid or minimize the erosion and alteration of topography environmental consequences such that no additional mitigation measures are needed or feasible to implement.

#### Mixed-Use Development including Replacement Housing

Prior to displacing existing residents, Alternative B would construct replacement housing along with supporting commercial uses that could be located at one or more of three mixed-use development sites identified within the project site (see Exhibits 2-9 and 2-11 in Chapter 2, "Proposed Project and Project Alternatives"). If replacement housing is not constructed at any of these sites, then TTD would construct replacement housing at another location in the South Shore area to be determined prior to displacing any residents. This alternative includes the option for three mixed-use redevelopment sites, which could include replacement housing for displaced residents, as well as other commercial uses (e.g., retail, restaurant). Use of one or more of these three sites, or at another location in the South Shore area for replacement housing, would require additional parcel acquisitions beyond that required for the transportation improvements. The redevelopment of the three mixed-use site would create ground disturbance in addition to that described in

Table 3.11-5; however, any future development would be subject to the same Lahontan RWQCB and TRPA permit conditions and, thus, would not increase the risk of erosion.

Because the soils of the project site are not highly susceptible to erosion, temporary and permanent BMPs would be installed as requirements of the necessary TRPA and Lahontan RWQCB permits, and areas of temporary disturbance would be revegetated and regraded to match the natural topography of the site, the potential for Alternative B mixed-use development, including replacement housing, to increase erosion or adversely affect the topography of the area would be a **less-than-significant** impact for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the mixed-use development, including replacement housing, at the mixed-use development sites as part of Alternative B would avoid or minimize the erosion and alteration of topography environmental consequences such that no additional mitigation measures are needed or feasible to implement.

Construction of replacement housing at a location other than the three mixed-use development sites could result in a similar potential for erosion or alteration of topography environmental consequences as described for the mixed-use development sites. However, because the location of replacement housing elsewhere is unknown, analysis of the potential erosion or topography impacts would be speculative at this time. Full, project-level environmental review of replacement housing somewhere other than the mixed-use development sites would be required prior to construction of replacement housing and displacement of existing residents.

#### Conclusion

For the purposes of CEQA and TRPA, taken as a whole, the Alternative B transportation improvements and mixed-use development, including replacement housing, would result in a **less-than-significant** impact on erosion and alteration of topography.

For the purposes of NEPA, taken as a whole, the design features of the transportation improvements and mixed-use development, including replacement housing, as part of Alternative B would minimize the erosion and alteration of topography environmental consequences such that no additional mitigation measures are needed or feasible to implement.

#### Alternative C: Triangle One-Way

#### **Transportation Improvements**

The Alternative C transportation improvements would create 24.2 acres of temporary disturbance, 13.58 acres of which would occur in undeveloped areas. Permanent disturbance would total 28.00 acres, with 5.19 acres occurring in undeveloped areas. In total, Alternative C would create 52.20 acres of new disturbance, 2.64 fewer than Alternative B. Alternative C would be subject to the same TRPA, NDEP, and Lahontan RWQCB permitting requirements, including completion of a SWPPP and installation of permanent and temporary BMPs.

Because of the low erosion hazard of the project site and the stringent BMP requirements described above, the potential impacts of Alternative C transportation improvements in relation to alteration of existing topography and soil erosion would be **less than significant** for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the transportation improvements included in Alternative C would avoid or minimize the erosion and alteration of topography environmental consequences such that no additional mitigation measures are needed or feasible to implement.

#### Mixed-Use Development including Replacement Housing

Prior to displacing existing residents, Alternative C would construct replacement housing along with supporting commercial uses that could be located at one or more of three mixed-use development sites identified within the project site (see Exhibits 2-9 and 2-11 in Chapter 2, "Proposed Project and Project Alternatives"). If replacement housing is not constructed at any of these sites, then TTD would construct replacement housing at another location in the South Shore area to be determined prior to displacing any

residents. This alternative includes the option for three mixed-use redevelopment sites, which could include replacement housing for displaced residents, as well as other commercial uses (e.g., retail, restaurant). Use of one or more of these three sites, or at another location in the South Shore area for replacement housing, would require additional parcel acquisitions beyond that required for the transportation improvements. The mixed-use development, including replacement housing, considered under Alternative C would create ground disturbance in addition to that described in Table 3.11-5; however, any future development would be subject to the same permitting requirements evaluated under Alternative B. For the same reasons, the mixed-use development, including replacement housing, would not add to the potential risk of erosion.

Because of the low erosion hazard of the project site and the stringent BMP requirements described above, the potential impacts of Alternative C mixed-use development, including replacement housing, in relation to alteration of existing topography and soil erosion would be **less than significant** for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the mixed-use development, including replacement housing, at the mixed-use development sites as part of Alternative C would avoid or minimize the erosion and alteration of topography environmental consequences such that no additional mitigation measures are needed or feasible to implement.

Construction of replacement housing at a location other than the three mixed-use development sites could result in a similar potential for erosion or alteration of topography environmental consequences as described for the mixed-use development sites. However, because the location of replacement housing elsewhere is unknown, analysis of the potential erosion or topography impacts would be speculative at this time. Full, project-level environmental review of replacement housing somewhere other than the mixed-use development sites would be required prior to construction of replacement housing and displacement of existing residents.

#### Conclusion

For the purposes of CEQA and TRPA, taken as a whole, the Alternative C transportation improvements and mixed-use development, including replacement housing, would result in a **less-than-significant** impact on erosion and alteration of topography.

For the purposes of NEPA, taken as a whole, the design features of the transportation improvements and mixed-use development, including replacement housing, as part of Alternative C would minimize the erosion and alteration of topography environmental consequences such that no additional mitigation measures are needed or feasible to implement.

### Alternative D: Project Study Report Alternative 2

### **Transportation Improvements**

The Alternative D transportation improvements would create 19.88 acres of temporary disturbance, 10.83 acres of which would occur in undeveloped areas. Permanent disturbance would total 32.51 acres, with 9.34 acres occurring in undeveloped areas. In total, Alternative D would create 52.39 acres of new disturbance, 1.24 acres fewer than Alternative B. Alternative D would be subject to the same TRPA, NDEP, and Lahontan RWQCB permitting requirements, including completion of a SWPPP and installation of permanent and temporary BMPs.

Because of the low erosion hazard of the project site and the stringent BMP requirements described above, the potential impacts of Alternative D transportation improvements in relation to alteration of existing topography and soil erosion would be **less than significant** for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the transportation improvements included in Alternative D would avoid or minimize the erosion and alteration of topography environmental consequences such that no additional mitigation measures are needed or feasible to implement.

#### **Mixed-Use Development including Replacement Housing**

Prior to displacing existing residents, Alternative D would construct replacement housing along with supporting commercial uses that could be located at one or more of three mixed-use development sites identified within the project site (see Exhibits 2-9 and 2-11 in Chapter 2, "Proposed Project and Project Alternatives"). If replacement housing is not constructed at any of these sites, then TTD would construct replacement housing at another location in the South Shore area to be determined prior to displacing any residents. This alternative includes the option for three mixed-use redevelopment sites, which could include replacement housing for displaced residents, as well as other commercial uses (e.g., retail, restaurant). Use of one or more of these three sites, or at another location in the South Shore area for replacement housing, would require additional parcel acquisitions beyond that required for the transportation improvements. The mixed-use development, including replacement housing, for Alternative D would create ground disturbance in addition to that described in Table 3.11-5; however, any future development would be subject to the same permitting requirements evaluated under Alternative B. For the same reasons, the mixed-use development, including replacement housing, including replacement housing, would not add to the potential risk of erosion.

Because of the low erosion hazard of the project site and the stringent BMP requirements described above, the potential impacts of Alternative D mixed-use development, including replacement housing, in relation to alteration of existing topography and soil erosion would be **less than significant** for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the mixed-use development, including replacement housing, at the mixed-use development sites as part of Alternative D would avoid or minimize the erosion and alteration of topography environmental consequences such that no additional mitigation measures are needed or feasible to implement.

Construction of replacement housing at a location other than the three mixed-use development sites could result in a similar potential for erosion or alteration of topography environmental consequences as described for the mixed-use development sites. However, because the location of replacement housing elsewhere is unknown, analysis of the potential erosion or topography impacts would be speculative at this time. Full, project-level environmental review of replacement housing somewhere other than the mixed-use development sites would be required prior to construction of replacement housing and displacement of existing residents.

#### Conclusion

For the purposes of CEQA and TRPA, taken as a whole, the Alternative D transportation improvements and mixed-use development, including replacement housing, would result in a **less-than-significant** impact on erosion and alteration of topography.

For the purposes of NEPA, taken as a whole, the design features of the transportation improvements and mixed-use development, including replacement housing, as part of Alternative D would minimize the erosion and alteration of topography environmental consequences such that no additional mitigation measures are needed or feasible to implement.

### Alternative E: Skywalk

Alternative E would result in ground disturbance for the installation of the support columns for the pedestrian walkway, which could require excavation up to 60 feet deep. Because the remainder of the project site for Alternative E is currently paved, the total area of temporary and permanent ground disturbance would be limited to approximately 34,500 square feet (0.79 acre), depending on the foundation type selected. Permanent disturbance would be limited to the skywalk support columns at approximately 1,500 square feet (0.03 acre). With a disturbance area of less than 1 acre, Alternative E would not be subject to an NPDES permit, and TRPA would hold the regulatory responsibility for erosion control and water quality protection. TRPA requires the use of temporary water quality BMPs in accordance with the TRPA *Best Management Practices Handbook*. Additionally, the proposed excavation would occur as an isolated disturbance surrounded by urban development, and the area where erosion could occur would be limited to the excavation site itself.

Because the area of exposed soil created by Alternative E would be less than 1 acre, isolated by urban development, and protected by TRPA-mandated temporary construction site BMPs, the potential for erosion and grading impacts would be **less than significant** for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of Alternative E would avoid or minimize the erosion and alteration of topography environmental consequences such that no additional mitigation measures are needed or feasible to implement.

## Impact 3.11-3: Exposure to strong seismic shaking, liquefaction, or seiche inundation hazards

The project site is located in a seismically-active area and contains soils that could be subject to liquefaction under saturated conditions. All transportation improvement components of Alternatives B, C, and D would be designed to meet California Department of Transportation (Caltrans) and Nevada Department of Transportation (NDOT) seismic standards and state-specific, seismic design codes. The construction of the pedestrian bridge in Alternatives B, C, and D would require deep excavation and construction of footings in soils that could be subject to liquefaction. These structures would be subject to rigorous highway safety design standards, which would minimize the potential for seismic hazards. Implementation of Alternatives B, C, and D transportation improvements would result in the displacement of housing units that are now outside of the inundation area of a seismically induced seiche wave. Implementation of Alternatives B, C, and D mixed-use development, including replacement housing, would also not have the potential to increase the exposure of people and property to inundation by a seismically-induced seiche wave, because the mixed-use sites are outside the inundation area. Alternative E would be subject to the same design standards described for Alternatives B, C, and D and would not alter the level of exposure to seiche hazards. Alternative A would not create new structures that would be exposed to seismic hazards.

NEPA Environmental Consequences:	The design features of Alternatives B, C, D, and E would avoid or minimize the potential risks due to seismic shaking, liquefaction, or seiche inundation hazards; No Impact for Alternative A
CEQA/TRPA Impact Determinations:	Less Than Significant for Alternatives B, C, D, and E; No Impact for Alternative A.

### Alternative A: No Build (No Project)

Alternative A would not result in new structures that could be affected by seismic hazards. For this reason, Alternative A would have **no impact** relative to strong seismic shaking or liquefaction for the purposes of NEPA, CEQA, and TRPA.

#### Alternative B: Triangle (Locally Preferred Action)

#### **Transportation Improvements**

Alternative B transportation improvements would include construction and realignment of surface roads and US 50, an elevated pedestrian bridge over the proposed US 50 alignment, a bike path connection to Van Sickle Bi-State Park, and the demolition and replacement of residential and commercial structures. The project would be located in a seismically-active area within 8 miles of two active faults capable of producing large earthquakes. Three more active faults with the potential to generate large earthquakes are located within 15 miles of the project site (Table 3.11-2). A large earthquake on any of these faults could generate strong seismic shaking within the study area (Parikh Consultants 2011), which could damage project structures and surrounding properties, as well as posing a safety risk for people in the area.

The project site contains soils that could be susceptible to liquefaction under saturated conditions. Because existing groundwater monitoring data indicate a groundwater depth of 20–34 feet below grade (Parikh Consultants 2011), liquefaction is not a consideration at shallow depths. The construction of the pedestrian bridge would require excavation depths between 20 and 60 feet for installation of bridge footings. The potential for seismic shaking to create a liquefaction hazard is increased at these depths.

The potential for damage caused by seismic shaking and liquefaction would be minimized through compliance with existing seismic design requirements. Project components in Nevada would be limited to surface roads and would be constructed in accordance with current NDOT and American Association of State Highway Transportation Officials (AASHTO) seismic design standards. In California, the surface roads and elevated pedestrian bridge would be required to meet Caltrans seismic design standards. The Caltrans project design process requires the completion of a geotechnical design or materials report that covers geology, soils, seismicity, and foundations (Caltrans 2015). A foundation study would also be completed. The foundation investigation and foundation report must be developed and signed by a registered civil engineer or certified engineering geologist and would include project-specific test borings, an evaluation of seismic hazards, and recommendations for footing elevations and pile type (Caltrans 2015). Similarly, the South Lake Tahoe City Code requires geotechnical investigations for all excavations exceeding 10 feet. The City of South Lake Tahoe General Plan requires that all buildings and structures in the City be constructed to withstand seismic shaking and related geologic hazards.

As shown on Exhibit 3.11-2, portions of the project site are located within low-lying areas that could be inundated by a seismically induced seiche wave. Alternative B project components in the inundation area are limited to the improvement and/or realignment of existing roadways. Implementation of Alternative B would result in the displacement of housing units from outside of the seiche inundation area.

Although Alternative B transportation improvements would involve construction in a seismically-active area and deep excavation could encounter soil susceptible to liquefaction, the potential risks due to seismic shaking and liquefaction would be minimized through the required compliance with NDOT, AASHTO, and Caltrans design standards and state and local building codes. Therefore, the potential risks to people and property due to seismic shaking, liquefaction, or seiche inundation hazards would be a **less-than-significant** impact for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the transportation improvements included in Alternative B would avoid or minimize the potential risks due to seismic shaking, liquefaction, or seiche inundation hazards such that no additional mitigation measures are needed or feasible to implement.

#### **Mixed-Use Development including Replacement Housing**

Prior to displacing existing residents, Alternative B would construct replacement housing along with supporting commercial uses that could be located at one or more of three mixed-use development sites identified within the project site (see Exhibits 2-9 and 2-11 in Chapter 2, "Proposed Project and Project Alternatives"). If replacement housing is not constructed at any of these sites, then TTD would construct replacement housing at another location in the South Shore area to be determined prior to displacing any residents. This alternative includes the option for three mixed-use redevelopment sites, which could include replacement housing for displaced residents, as well as other commercial uses (e.g., retail, restaurant). Use of one or more of these three sites, or at another location in the South Shore area for replacement housing, would require additional parcel acquisitions beyond that required for the transportation improvements. The mixed-use development, including replacement housing, resulting from the implementation of Alternative B would be subject to the seismic safety standards of the International Building Code or CBC. Compliance with these standards would protect structures and people from damage caused by strong seismic shaking or liquefaction. Additionally, the location of the mixed-use development, including replacement housing, are outside of the potential inundation area of a 30-foot seiche wave.

Although Alternative B mixed-use development, including replacement housing, would involve construction in a seismically-active area and deep excavation could encounter soil susceptible to liquefaction, the potential risks due to seismic shaking and liquefaction would be minimized through the required compliance with NDOT, AASHTO, and Caltrans design standards and state and local building codes. Therefore, the potential risks to people and property due to seismic shaking, liquefaction, or seiche inundation hazards would be a **less-than-significant** impact for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the mixed-use development, including replacement housing, at the mixed-use development sites as part of Alternative B would avoid or minimize the potential

risks to people and property due to seismic shaking, liquefaction, or seiche inundation hazards such that no additional mitigation measures are needed or feasible to implement.

Construction of replacement housing at a location other than the three mixed-use development sites could result in similar potential risks to people and property due to seismic shaking, liquefaction, or seiche inundation hazards as described for the mixed-use development sites. However, because the location of replacement housing elsewhere is unknown, analysis of the potential seismic shaking, liquefaction, or seiche inundation hazard impacts would be speculative at this time. Full, project-level environmental review of replacement housing somewhere other than the mixed-use development sites would be required prior to construction of replacement housing and displacement of existing residents.

### Conclusion

For the purposes of CEQA and TRPA, taken as a whole, the Alternative B transportation improvements and mixed-use development, including replacement housing, would result in a **less-than-significant** impact on potential risks to people and property due to seismic shaking, liquefaction, or seiche inundation hazards.

For the purposes of NEPA, taken as a whole, the design features of the transportation improvements and mixed-use development, including replacement housing, as part of Alternative B would minimize the potential risks to people and property due to seismic shaking, liquefaction, or seiche inundation hazards such that no additional mitigation measures are needed or feasible to implement.

### Alternative C: Triangle One-Way

### **Transportation Improvements**

Alternative C transportation improvements would create the same structures as Alternative B and would be located in the same seismic and geologic context. As described above, the potential risks related to seismic shaking and liquefaction would be minimized through the required compliance with NDOT, AASHTO, and Caltrans design standards and state and local building codes. Additionally, as described above for Alternative B, Alternative C would displace housing from outside of the potential inundation zone of the potential 30-foot seiche wave. Compliance with existing seismic design standards and state and local building codes would minimize the potential risks to persons and property due to seismic shaking or liquefaction to a **less-than-significant** level for the purposes of CEQA and TRPA.

Because of the reasons stated above, for the purposes of NEPA, the environmental consequences of implementing Alternative C transportation improvements on potential risks to people from seismic shaking or liquefaction **would not be adverse**.

For the purposes of NEPA, the design features of the transportation improvements included in Alternative C would avoid or minimize the potential risks due to seismic shaking, liquefaction, or seiche inundation hazards such that no additional mitigation measures are needed or feasible to implement.

### Mixed-Use Development including Replacement Housing

Prior to displacing existing residents, Alternative C would construct replacement housing along with supporting commercial uses that could be located at one or more of three mixed-use development sites identified within the project site (see Exhibits 2-9 and 2-11 in Chapter 2, "Proposed Project and Project Alternatives"). If replacement housing is not constructed at any of these sites, then TTD would construct replacement housing at another location in the South Shore area to be determined prior to displacing any residents. This alternative includes the option for three mixed-use redevelopment sites, which could include replacement housing for displaced residents, as well as other commercial uses (e.g., retail, restaurant). Use of one or more of these three sites, or at another location in the South Shore area for replacement housing, would require additional parcel acquisitions beyond that required for the transportation improvements. The conceptual mixed-use development considered under Alternative C would be subject to the same permitting requirements evaluated under Alternative B. For the same reasons, the mixed-use development, including replacement housing, concept would not increase potential risks related to seismic shaking, liquefaction, or seiche inundation hazards.

Although Alternative C mixed-use development, including replacement housing, would be located in a seismically-active area, compliance with existing seismic design standards and state and local building codes would minimize the potential risks to persons and property due to seismic shaking, liquefaction, or seiche inundation hazards to a **less-than-significant** level for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the mixed-use development, including replacement housing, at the mixed-use development sites as part of Alternative C would avoid or minimize the potential risks to people and property due to seismic shaking, liquefaction, or seiche inundation hazards such that no additional mitigation measures are needed or feasible to implement.

Construction of replacement housing at a location other than the three mixed-use development sites could result in similar potential risks to people and property due to seismic shaking, liquefaction, or seiche inundation hazards as described for the mixed-use development sites. However, because the location of replacement housing elsewhere is unknown, analysis of the potential seismic shaking, liquefaction, or seiche inundation hazard impacts would be speculative at this time. Full, project-level environmental review of replacement housing somewhere other than the mixed-use development sites would be required prior to construction of replacement housing and displacement of existing residents.

#### Conclusion

For the purposes of CEQA and TRPA, taken as a whole, the Alternative C transportation improvements and mixed-use development, including replacement housing, would result in a **less-than-significant** impact on potential risks to people and property due to seismic shaking, liquefaction, or seiche inundation hazards.

For the purposes of NEPA, taken as a whole, the design features of the transportation improvements and mixed-use development, including replacement housing, as part of Alternative C would minimize the potential risks to people and property due to seismic shaking, liquefaction, or seiche inundation hazards such that no additional mitigation measures are needed or feasible to implement.

#### Alternative D: Project Study Report Alternative 2

#### **Transportation Improvements**

Alternative D transportation improvements would create the same structures as Alternative B and would be located in the same seismic and geologic context. As described above, the potential risks related to seismic shaking and liquefaction would be minimized through the required compliance with NDOT, AASHTO, and Caltrans design standards and state specific building codes. Additionally, as described above for Alternative B, Alternative D would displace housing from outside of the potential inundation zone of the potential 30-foot seiche wave. Compliance with existing seismic design standards and state and local building codes would minimize the potential risks to persons and property due to seismic shaking or liquefaction to a **less-than-significant** level for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the transportation improvements included in Alternative D would avoid or minimize the potential risks due to seismic shaking, liquefaction, or seiche inundation hazards such that no additional mitigation measures are needed or feasible to implement.

### Mixed-Use Development including Replacement Housing

Prior to displacing existing residents, Alternative D would construct replacement housing along with supporting commercial uses that could be located at one or more of three mixed-use development sites identified within the project site (see Exhibits 2-9 and 2-11 in Chapter 2, "Proposed Project and Project Alternatives"). If replacement housing is not constructed at any of these sites, then TTD would construct replacement housing at another location in the South Shore area to be determined prior to displacing any residents. This alternative includes the option for three mixed-use redevelopment sites, which could include replacement housing for displaced residents, as well as other commercial uses (e.g., retail, restaurant). Use of one or more of these three sites, or at another location in the South Shore area for replacement housing, would require additional parcel acquisitions beyond that required for the transportation improvements. The conceptual mixed-use development considered under Alternative D would be subject to the same permitting

requirements evaluated under Alternative B. For the same reasons, the mixed-use development concept would not add to potential risks related to seismic shaking, liquefaction, or seiche inundation hazards.

Although Alternative D mixed-use development, including replacement housing, would be located in a seismically-active area, compliance with existing seismic design standards and state and local building codes would minimize the potential risks to persons and property due to seismic shaking, liquefaction, or seiche inundation hazards to a **less-than-significant** level for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of the mixed-use development, including replacement housing, at the mixed-use development sites as part of Alternative D would avoid or minimize the potential risks to people and property due to seismic shaking, liquefaction, or seiche inundation hazards such that no additional mitigation measures are needed or feasible to implement.

Construction of replacement housing at a location other than the three mixed-use development sites could result in similar potential risks to people and property due to seismic shaking, liquefaction, or seiche inundation hazards as described for the mixed-use development sites. However, because the location of replacement housing elsewhere is unknown, analysis of the potential seismic shaking, liquefaction, or seiche inundation hazard impacts would be speculative at this time. Full, project-level environmental review of replacement housing somewhere other than the mixed-use development sites would be required prior to construction of replacement housing and displacement of existing residents.

#### Conclusion

For the purposes of CEQA and TRPA, taken as a whole, the Alternative D transportation improvements and mixed-use development, including replacement housing, would result in a **less-than-significant** impact on potential risks to people and property due to seismic shaking, liquefaction, or seiche inundation hazards.

For the purposes of NEPA, taken as a whole, the design features of the transportation improvements and mixed-use development, including replacement housing, as part of Alternative D would minimize the potential risks to people and property due to seismic shaking, liquefaction, or seiche inundation hazards such that no additional mitigation measures are needed or feasible to implement.

### Alternative E: Skywalk

Alternative E would involve the creation of an elevated pedestrian walkway raised above the US 50 corridor on concrete piers, spanning the California/Nevada state line. Excavation up to 60 feet could be required for installation of piles. As described under Alternative B, the walkway structure would be required to meet Caltrans and NDOT seismic design standards, as described under Alternative B. This would include sitespecific geotechnical investigations, borings, and foundation reports that meet the criteria of each state. Additionally, Alternative E is located outside of the potential inundation area of the modeled 30 foot seiche wave. Compliance with these standards would reduce the potential risks to persons or property due to seismic shaking, liquefaction, or seiche inundation hazards to a **less-than-significant** level for the purposes of CEQA and TRPA.

For the purposes of NEPA, the design features of Alternative E would avoid or minimize the potential risks due to seismic shaking, liquefaction, or seiche inundation hazards such that no additional mitigation measures are needed or feasible to implement.

## AVOIDANCE, MINIMIZATION, AND/OR MITIGATION MEASURES

No avoidance, minimization, or mitigation measures are required to reduce effects on geology, soils, land capability, or coverage such that no additional mitigation measures are needed or feasible to implement for the purposes of NEPA or to a less-than-significant level for the purposes of CEQA and TRPA.