IV. ENVIRONMENTAL IMPACT ANALYSIS
F. GEOLOGY/SOILS

INTRODUCTION

The information and analysis in this section is based primarily on the following report, which is included in Appendix F of this EIR:

- Preliminary Geotechnical Investigation – Snowcreek 8 Development, Mammoth Lakes, California prepared by Sierra Geotechnical Services Inc., October 4, 2006.
- Third Party Geotechnical Peer Review of the Preliminary Geotechnical Investigation – Snowcreek 8 Development, Mammoth Lakes, California prepared by Sierra Geotechnical Services Inc., October 4, 2006. by Treadwell & Rollo, Inc., January 19, 2007.

ENVIRONMENTAL SETTING

Regional Geology and Soils

The Project site is located at the southwestern edge of the Long Valley caldera near the eastern flank of the Sierra Nevada Mountain Range (Sierra Nevada). A caldera is a large, usually circular depression at the summit of a volcano formed when magma, a molten material beneath or within the earth's crust, is withdrawn or erupted from a shallow underground magma reservoir. The removal of large volumes of magma may result in loss of structural support for the overlying rock, thereby leading to collapse of the ground and formation of a large depression.[1] The caldera is elongated in an east-west direction and was formed approximately 760,000 years ago. The high mountains around Mammoth Lakes constitute the caldera walls with the Glass Mountains forming the west and southwest walls and the Benton Range forming the east wall. Mammoth Mountain is a smaller dome on the rim of the caldera formed by repeated eruptions from vents on the southwest rim of the caldera 220,000 to 50,000 years ago. Bedrock below volcanic deposits in the Mammoth Lakes area is predominately Mesozoic granitic rock of the Sierra Nevada batholith. A batholith is a large emplacement of igneous intrusive (also called plutonic) rock that forms from cooled magma deep in the Earth's crust. Batholiths are almost always made mostly of felsic or intermediate rock-types, such as granite, quartz monzonite, or diorite.[2] The batholith is a series of intrusions that displaced overlying ancient sedimentary sea floor rocks during the Jurassic and Cretaceous Periods. During the past 3,000 years, Pleistocene glacial deposits (glacial till and outwash) have covered the Mesozoic bedrock and volcanic rocks throughout the area now occupied by the Town of Mammoth Lakes.

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[1] *United States Geological Survey, retrieved at http://volcanoes.usgs.gov/Products/Pglossary/caldera.html on May 8, 2006.*

[2] *Retrieved at http://en.wikipedia.org/wiki/Batholith on May 8, 2006.*

Topographic Setting

The topography of the Mammoth Lakes area ranges from rolling alluvial plains at approximately 7,200 feet above mean sea level (msl) in Long Valley to approximately 11,053 feet above msl at the summit of Mammoth Mountain. An alluvial plain is a relatively flat and gently sloping landform found at the base of a range of hills or mountains, formed by the deposition of alluvial soil over a long period of time by one or more rivers coming from the mountains. In general, alluvial material consists of loose to medium dense, moist sand, silty sand, and clayey sand with cobble, boulders, and a moderate amount of roots. The slope gradients range from relatively flat areas in Sherwin Meadow and Long Valley to slopes of 50 percent or greater on Mammoth Mountain.

Volcanic Setting

The Mono Lake Long Valley area is volcanically active with over 30 known events occurring in the past 2,000 years. Most recently, in 1890, a pyretic type eruption (steam, water, mud and other gases, as a result of magma heating groundwater) occurred 35 miles north of the Town beneath the southern portion of Mono Lake. Another eruption in the area is likely to occur within the next thousand years.[3] The United States Geological Survey (USGS) estimates that eruptions at the Mono-Inyo Craters volcanic field have historically occurred at approximately 500-year intervals over the past 2,000 to 3,000 years. The most recent eruption in the region was at Mono Lake between 1720 and 1850. A dome grew on the lake floor and emerged to make Paoha Island.

High magnitude seismic activity in May 1980 (four magnitude six events over a two-day period) indicated a new phase of magmatic activity and heightened potential for volcanic activity in the area. Volcanologists interpreted the earthquakes, accompanying ground deformations, and an increase in activity at fumaroles (a hole in a volcanic area from which hot smoke and gases escape) as an indication of magma movement beneath the caldera. Frequent low magnitude seismic activity since that time indicates deep magmatic movement.

Carbon Dioxide

Following a period of earthquakes beneath Mammoth Mountain in 1989, magmatic gases (high levels of carbon dioxide in the soil) were determined to be killing approximately 120 acres of trees in certain portions of the caldera in 1990. Most notably, between 50 and 150 tons of carbon dioxide gas are emitted daily at the north end of Horseshoe Lake where approximately 30 acres of trees have been killed.[4] Additional areas of carbon dioxide discharge are scattered around Mammoth Mountain primarily outside of the Mammoth Mountain Ski Area. Winter closures are implemented in a few small areas within the Mammoth Mountain Ski Area where carbon dioxide concentrations are potentially dangerous. Areas of

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[3] *Retrieved at http://en.wikipedia.org/wiki/Batholith on May 8, 2006.*

[4] *Horseshoe Lake and Vicinity CO2 Phenomenon, USDA Forest Service, January 28, 2000.*

discharge are also located outside of the established trails of Tamarack Cross-Country Ski Center. There is no indication that the area of carbon dioxide discharge has increased since 1995.[5]

The source of the carbon dioxide is a large gas reservoir located deep underground related to long-term magmatic degassing beneath Mammoth Mountain. Because carbon dioxide is heavier than air, the USGS indicates that carbon dioxide gas can accumulate in snowbanks, depressions, and poorly ventilated enclosures, including structures, posing a potential danger to people. Concentrations are highly variable depending on wind and weather conditions. USGS scientists closely monitor the volcanic activity in the region in order to provide the public with reliable and timely warning of volcanic unrest within the Long Valley area.

Site Geology and Soils

Site Topography

Overall topography on the Project site is characterized by both relatively flat and shallow sloping hillside terrain, with elevations ranging between 7,835 and 7,930-feet above sea level. Shallow drainages flow east and northeast towards Mammoth Creek. Vegetation consists of abundant sagebrush and grasses as well as a few pine trees. Soils in the vicinity of the Project site include undocumented fill, topsoil/alluvium, and glacial till deposits. These soils are described below.

Undocumented Fill

Up to seven feet of undocumented fill was encountered in various test pits drilled on the Project site. The undocumented fill generally consisted of fine to coarse, moist, silty to clayey sand with a abundant cobbles and boulders with maximum dimensions of 36 inches.

Topsoil/Alluvium

The Project site contains areas of topsoil/alluvium ranging from 1½- to greater than ten-foot-thick. In general, the topsoil/alluvium layer consists of loose to medium dense, moist sand, silty sand, and clayey sand with cobble, boulders, and a moderate amount of roots. In areas where the thickness of the topsoil/alluvium layer was measured, the layer is primarily overlain by undocumented fill and is underlain by glacial deposits.

Glacial Till Deposits

Glacial till deposits were encountered below the alluvium. The glacial till generally consists of medium dense to dense, moist to saturated, sand and silty sand, with gravels, cobbles, and boulders. The alluvium

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[5] *Horseshoe Lake and Vicinity CO_2 Phenomenon, USDA Forest Service, January 28, 2000.*

generally consists of loose, silty, very fine to coarse-grained sand and sand with silt, with abundant roots, rock fragments, cobbles, and boulders. Glacial till deposits were encountered below the alluvium, consisting of medium dense to dense, very fine to coarse sand and silty sand, with abundant gravels, cobbles, and boulders. The glacial till is denser at lower depths.

Groundwater

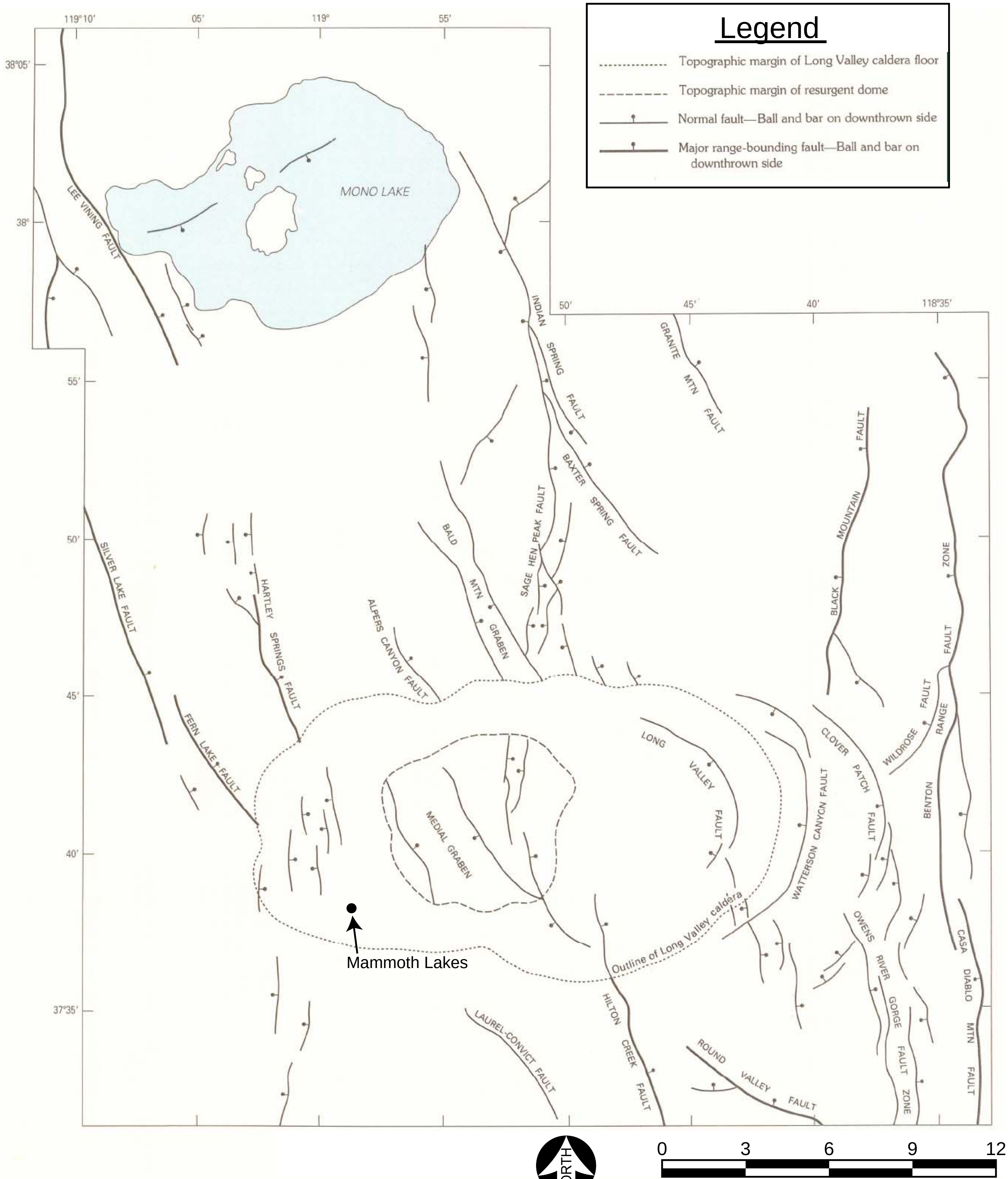
Groundwater on the Project site varies in height from two feet to 8½ feet below existing grade. Several areas contain soils indicative of high groundwater. However, groundwater conditions fluctuate seasonally and groundwater conditions may not be reflective of groundwater conditions during construction. Substrata that would retard the flow of water downward were not observed on the Project site.

Seismicity and Seismic Hazards

Earthquakes in the Mammoth Lakes area are a result of both tectonic and magmatic activity. There are several active or potentially active fault zones within 60 miles of the Town. Faults that have been active in the last 200 years include the Mono Lake, June Lake, and Hilton Creek faults in the northern extension of the Sierra Nevada Boundary fault system and main trace of the Sierra Nevada fault and the Owens Valley fault in the southern extension of the Sierra Nevada Boundary fault system. Faults that have been active during the last two million years include the Bodie Hills, White Mountains, Death Valley Furnace Creek, and Saline Valley faults. Within the vicinity of the Town, Hilton Creek, Owens Valley, Hartley Springs, Laurel Convict, Long Valley Caldera, Mono Craters Caldera, Silver Lake, and Wheeler Crest faults as well as the Chalfant Valley Fractures have the potential to induce ground shaking within the Town. The location of these faults relative to the Town is noted in Table IV.F-1 and Figure IV.F-1.

Table IV.F-1
Regional Faults and Seismicity

Fault Segment	Approximate Distance from Project Site (km)	Direction from Project Site	Maximum Magnitude
Hartley Springs	1.1	West	6.6
Hilton Creek	10	East	6.7
Round Valley	21	East	7.0
Mono Lake	36	North	6.6
Fish Slough	50	East	6.6
White Mountains	52	East	7.1
Robinson Creek	71	Northwest	6.4
Death Valley (N. of Cucamonga)	72	East	7.0
Owens Valley	71	Southeast	7.6
Birch Creek	77	Southeast	6.4
Deep Springs	92	East	6.6
Source: Treadwell & Rollo, 2007.			



Source: US Geological Survey, Reston, Virginia, 1989.

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Figure IV.F-1
Regional Seismicity Map

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Ground Motion

Ground motion is generated during an earthquake as two blocks of the Earth's crust slip past each other. In general, ground motion is greatest near the epicenter, increases with increasing magnitude, and decreases with increasing distance. However, the ground motion measured at a given site is influenced by a number of criteria, including depth of the epicenter, proximity to the projected or actual fault rupture, fault mechanism, duration of shaking, local geologic structure, source direction of the earthquake, underlying earth material, and topography.

Earthquake magnitude is a quantitative measure of the strength of an earthquake or the strain energy released by it, as determined by seismographic or geologic observations. Earthquake intensity is a qualitative measure of the effects a given earthquake has on people, structures or objects. Earthquake magnitude is measured on the Richter scale or as moment magnitude, and intensity is described by the Modified Mercalli intensity scale. A related form of measurement is peak ground acceleration, which is a measure of ground-shaking during an earthquake. Peak ground acceleration values are reported in units of gravity (g). Structures founded on thick soft soil deposits are more likely to experience more destructive shaking, with higher amplitude and lower frequency, than structures founded on bedrock. In addition, thick soft soil deposits far distances from earthquake epicenters may result in seismic accelerations significantly greater than expected in bedrock.

At the Project site, the estimated peak horizontal ground acceleration with a ten percent probability of exceedance in 100 years is 0.44g and the estimated peak horizontal ground acceleration with a ten percent probability of exceedance in 50 years is 0.35g. Due to the proximity of the site to the Hartley Springs fault, the potential for very strong ground shaking within the Project area is considered high. [6]

Fault Rupture

Ground surface rupture results when the movement along a fault is sufficient to create a gap or break along the upper edge of the fault zone at the surface. The Project area is not located within either an Earthquake Fault Zone or Alquist-Priolo Hazard Zone. Therefore, the potential for fault rupture within the Project area is considered to be low. [7]

Soil Lurching

Soil lurching refers to the rolling motion on the ground surface caused by the passage of seismic surface waves. Soil lurching is likely to be most severe where the thickness of soft sediments varies to a noticeable degree under structures. The potential for soil lurching on the site is considered low to

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6 *Geotechnical/Geologic Consultation Peer Review for the Snowcreek Master Plan EIR, Snowcreek 8 Project, Mammoth Lakes, California prepared by Treadwell and Rollo, January 17, 2007.*

7 *Ibid.*

moderate due to the existence of potentially compressible soils within the upper few feet of material below existing grades.

Liquefaction and Settlement

Soil liquefaction, the condition in which soils below the groundwater table temporarily lose their solid state, results from loss of strength during cyclic loading, such as that imposed by earthquakes. When seismic ground-shaking occurs, the soil is subject to seismic shear stresses that may cause the soil to undergo deformations or changed appearance. If the soil undergoes virtually unlimited deformation without developing significant resistance, it is said to have liquefied or made into liquid. When soils consolidate during and following liquefaction, ground settlement occurs. Soils most susceptible to liquefaction are clean, loose, saturated, uniformly graded, fine-grained sands. Shallow groundwater is considered a factor as it creates the saturated condition of the soil.

The Project site contains areas with up to seven feet of fine to coarse dense undocumented fill at a few locations, topsoil/alluvial deposits consisting of loose sand and silty sand blanket the site between the depths of approximately 1½ -to ten feet, and the potential for perched water to develop at the site. In areas where loose to medium dense fill, topsoil, and/or alluvium are greater than approximately 3 to 4 feet thick, and loose to medium dense soil is left in place, water may become perched beneath the proposed building sites and the potential for soil liquefaction may exist. Ground failures associated with soil liquefaction include post-liquefaction reconsolidation, lateral spreading, and loss of bearing support. Liquefaction-induced lateral spreading is the lateral or sideways movement of gently sloping ground as a result of liquefaction in a shallow underlying deposit during an earthquake and is described in more detail below.

Portions of the shallow granular soils on the Project site may be loose and susceptible to settlement. During a major earthquake on a nearby portion of one of the active faults, strong ground shaking may occur and cause the loose, unsaturated portion of the topsoil/alluvial deposit to densify and settle. Preliminarily estimates show that up to 1/2 inch of settlement may occur at the site. Therefore, settlement should be considered a potential minor hazard at the Project site.

Landslides, Avalanches, and Slope Instabilities

Avalanches and landslides can occur as a result of moderate to large earthquakes, which can cause rock and snow to move vertically and laterally downslope. These hazards typically affect structures which are located at the base of slopes or within close proximity to the area of flow. Steep slopes, shallow soil development, excess water, and lack of shear strength in the area result in slope instabilities including landslides, earthslips, mudflows, and soil creeps. Seismic activity induces some landslides but most slides result from the weight of rain saturated soil and rock exceeding the shear strength of the underlying material.

The potential for avalanches and landslides is considered low because the Project site is not adjacent to the base of a steep slope or within close proximity to an area of avalanche flow.

Seiches and Tsunamis

A seiche is a wave that oscillates in lakes, bays, or gulfs from a few minutes to a few hours as a result of seismic or atmospheric disturbances. A tsunami is a very large ocean wave caused by an underwater earthquake or volcanic eruption. The potential for seiches and tsunamis are considered nil because there are no large bodies of water in close proximity to the site.

Volcanic Hazards

Massive eruptions are extremely rare and currently there is no evidence leading to the conclusion that a massive eruption near the Project site is eminent. Small to moderate volcanic eruptions could occur resulting in pyroclastic flows and surges, as well as volcanic ash and pumice fallout, which could impact the site. However, the odds of an eruption that could impact the Project site are roughly 1 to 1,000 in a given year.

Lateral Spreading

As previously mentioned, lateral spreading typically occurs as the movement or stretching of relatively flat-lying alluvial material toward an open or "free" face such as an open body of water, channel, or excavation. In general, alluvial material consists of loose to medium dense, moist sand, silty sand, and clayey sand with cobble, boulders, and a moderate amount of roots. Generally in soils, this movement or lateral spreading is due to failure along a weak flat and/or level surface, and may often be associated with liquefaction, the process of firm soil being converted into a liquid state. As cracks develop within the weakened or failing material, blocks of soil displace laterally or spread out toward the open area. Cracking and lateral movement or spreading may gradually spread away from the face as blocks continue to break free. Lateral spreading can occur within areas having potential for liquefaction. Therefore, since it has been determined that the soils at the Project site have the potential to liquefy or turn to liquid during a seismic event, there is therefore the potential for lateral spreading to also occur during seismic events.

Expansive Soils

No expansive soils have been mapped or encountered in the Town of Mammoth Lakes.

ENVIRONMENTAL IMPACTS

Thresholds of Significance

In accordance with Appendix G to the *CEQA Guidelines*, the Project could have a significant environmental impact if it would:

(a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

   (i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault.

   (ii) Strong seismic ground shaking.

   (iii) Seismic-related ground failure, including liquefaction.

   (iv) Landslides.

(b) Result in substantial soil erosion or the loss of topsoil.

(c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.

(d) Be located on expansive soil, as defined in Table 18-1-B of the California Building Code (2001), creating substantial risks to life or property.

(e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

Project Impacts and Mitigation Measures

Impact GEO-1 Fault Rupture

As noted, the Project site is not located within either Earthquake Fault Zones or Alquist-Priolo Hazard Zones and the potential for fault rupture is considered to be low. Therefore, Project impacts related to fault rupture would be ***less than significant*** and no mitigation measures are required.

Impact GEO-2 Strong Seismic Ground Shaking

The Project site is located in a Seismic Zone 4 based on 1997 Uniform Building Code (UBC) and 2001 California Building Code (CBC). Additionally, the Project site would follow the Town's Municipal Code 15.24.020 Seismic design-Uniform Building Code-Section 2333(b). During the service life of the Project, the site is likely to experience at least one earthquake that may produce potentially damaging ground shaking. As noted, the probabilistic seismic hazard analysis estimates peak horizontal ground acceleration with a 10 percent probability of exceedance in 100 years is 0.44 gravity (g) and the estimated peak horizontal ground acceleration with a 10 percent probability of exceedance in 50 years is 0.35g. However, the Project applicant would be required to design and construct the Project in conformance to the most recently adopted CBC design parameters as shown in Table IV.F-2 and the Town's Municipal Code for seismic design.

Table IV.F-2
Seismic Design Parameters

Seismic Parameter	Recommended Value
Soil Profile Type	S_C
Seismic Zone Factor	0.4
Seismic Source Type	B
Near Source Factor N_a	1.3
Near Source Factor N_v	1.6
Seismic Coefficient C_a	0.57
Seismic Coefficient C_v	1.02
Source: Sierra Geotechnical Services, Inc., 2007.	

The State earthquake protection law (California Health and Safety Code 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 Uniform Building Code (UBC) and the California Building Code (CBC) as well. The UBC/CBC identifies seismic factors that must be considered in structural design. The Town's Municipal 15.24.020 for seismic design states one third of the design snow load shall be assessed to the deadload seismic design. While there are no absolute guarantees when considering acts of nature such as earthquakes, the building requirements previously discussed have been designed to reduce the likelihood of damage as a result of ground shaking. Therefore, conformance with current UBC/CBC requirements, as well as the Town's seismic design requirements would reduce the potential for structures on the Project site to sustain damage during an earthquake event, and Project impacts related to ground shaking would be ***less than significant*** and no mitigation measures are required.

Impact GEO-3 Liquefaction and Soil Instabilities

Geotechnical investigation on the Project site indicates that: 1) up to seven feet of fine to coarse dense undocumented fill is present at a few locations, 2) topsoil/alluvial deposits consisting of loose sand and silty sand blanket the site between the depths of approximately 1-1/2 to 10 feet, and 3) perched water may develop at the site.

In general the potential for soil liquefaction is low where dense fill, topsoil and/or alluvium are less than approximately three to four feet thick and these "unsuitable" bearing materials would be excavated and replaced with well-compacted engineered fill,. However, portions of the Project site contain areas of fill and topsoil/alluvium up to seven feet in depth located from 1½ feet to greater than ten feet below the ground surface areas. Groundwater was encountered at depths ranging between 2½ to 8½ feet below the ground surface. The sandy fill and topsoil/alluvium materials are generally characterized as loose to medium dense. During the late spring or early summer, the local groundwater level is likely to rise and the lower portions of the loose to medium dense sandy fill and topsoil/alluvium layers may become saturated. Strong ground shaking associated with a large earthquake on a nearby fault could trigger soil liquefaction and associated ground failures. Ground failures associated with soil liquefaction include post-liquefaction reconsolidation, lateral spreading, and loss of bearing support. Impacts would be ***significant***.

Soil erosion/loss of topsoil may occur during grading and earthwork on the Project site. Geotechnical investigation recommends removal of unsuitable bearing materials from the Project site where new improvements or new fills are planned and replaced with well compacted engineered fill. Unsuitable materials include loose or disturbed soils, undocumented fills and contaminated soils. As noted, undocumented fill and loose topsoil/alluvium are located on the Project site with approximate depth maximums of seven feet and ten feet below the grounds surface.[8] Therefore, removal of these soils may cause a ***significant*** impact.

Mitigation Measure GEO-3a Liquefaction and Soil Instabilities

Prior to issuance of building permits and grading activities, a design level geotechnical report shall be prepared and all recommendations in the report shall be adhered to. The design-level geotechnical report shall evaluate the potential for localized liquefaction by performing supplemental subsurface exploration (to evaluate the thickness, in place density, fines content of the underlying loose to medium soil and gradation), laboratory testing, and engineering analysis.

Mitigation Measure GEO-3b Liquefaction and Soil Instabilities

Implement all recommendations contained within these site-specific geotechnical reports, including those pertaining to site preparation, excavation, fill placement and compaction; foundations; concrete slabs-on-grade; pavement design; lateral earth pressures and resistance; and surface drainage control.

Mitigation Measure GEO-3c Liquefaction and Soil Instabilities

The final grading, drainage, and foundation plans and specifications shall be prepared and/or reviewed and approved by a Registered Geotechnical Engineer and Registered Engineering Geologist. In addition, upon completion of construction activities, the Project applicant shall provide a final statement indicating whether the work was performed in accordance with Project plans and specifications and with the recommendations of the Registered Geotechnical Engineer and Registered Engineering Geologist.

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[8] *Treadwell and Rollo's Third Party Geotechnical and Geological Review, January 19, 2007.*

Impact GEO-4 Cyclic Densification

Cyclic soil densification is a phenomenon in which non-saturated, cohesionless soil is densified by earthquake vibrations, resulting in ground surface settlement. Cyclic densification should be considered a potential minor hazard at the Project site. During a major earthquake on a nearby portion of one of the active faults, strong ground shaking may cause the loose, unsaturated alluvial soil to densify and settle. It is estimated that up to ½ inch of cyclic densification may occur at the site. This may result in the minor surface improvements, such as minor cracking of foundations. ,Minor cracks in foundation and other minor surface improvements would not have the potential to represent a substantial risk to life and property. Furthermore, as noted, prior to issuance of building permits and grading activities, a design level geotechnical report shall be prepared and all recommendations in the report shall be adhered to. Therefore, cyclic densification does not represent a significant impact under CEQA. Impacts would be less than significant and no mitigation measures are required.

Impact GEO-5 Landslides and Avalanches

The potential for rock falls or snow avalanches to occur on the Project site is considered low because the site is not adjacent to the base of a steep slope or within close proximity to an area of avalanche flow.[9] Furthermore, no evidence of past landslides has been observed. Therefore, Project impacts related to landslides and avalanches would be ***less than significant*** and no mitigation measures are required.

Impact GEO-6 Volcanic Activity

A small to moderate volcanic eruption could occur somewhere along the Mono-Inyo Craters volcanic chain producing pyroclastic flows and surges as well as volcanic ash and pumice fallout that could significantly impact the Project site. Although this risk is present throughout the Town and surrounding areas, Project impacts related to volcanic activity would be ***significant***.

Mitigation Measure GEO-6 Volcanic Activity

The Project applicant shall prepare an emergency evacuation plan in consultation with the Town in order to provide for the orderly evacuation of the Project site in case the potential for volcanic hazards increases and residents need to vacate the Project site.

Impact GEO-7 Carbon Dioxide

As previously noted, high concentrations of carbon dioxide are located within isolated areas of the Town, prominently Horseshoe Lake. Carbon dioxide poses a health risk when collected at high concentrations in lower parts of depressions and enclosures. However, once the carbon dioxide is able to disperse within

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[9] *Treadwell and Rollo's Third Party Geotechnical and Geological Review, January 19, 2007.*

the atmosphere, there is no longer a health risk. The Project site is located approximately two an half miles from the closest isolated area of high carbon dioxide concentrations, as such the carbon dioxide would disperse before arriving at the Project site.[10] The Project site is not located in an area associated with high levels of carbon dioxide. Therefore, impacts would be ***less than significant*** and no mitigation measures are required.

Impact GEO-8 Soil Erosion/Loss of Topsoil

The Project site would require grading and earthwork and would be subject to soil erosion and loss of topsoil. Removal of unsuitable soils from all building locations shall extend below the unsuitable material and to a minimum horizontal distance of one-half the footing width or five feet (whichever is greater) horizontally outside the footing footprint. Furthermore, paved roadways and parking areas are recommended a removal of one to three feet.[11] Additionally, erosion and loss of topsoil is possible surrounding the structures if left unprotected during the snowmelt season. Without proper implementation of erosion control measures during construction and operation of the Project, the site could sustain soil erosion and loss of topsoil. This would be considered a ***significant*** impact.

Mitigation Measure GEO-8

The following measures shall be implemented to prevent soil erosion and loss of topsoil:

- A Storm Water Pollution Prevention Plan (SWPPP) shall be prepared with the grading plans to fulfill regulatory requirements.
- Permanent erosion control measures shall be placed on all graded slopes. No graded areas shall be left unstabilized between October 15th and April 15th.
- Finish grading for all building areas shall allow for all drainage water from the building area to drain away from building foundations (two percent minimum grade on soil or sod for a distance of five feet). Ponding of water shall not be permitted.

Impact GEO-9 Expansive Soils

Expansive soils contain clay minerals that attract and absorb water. The soils swell when subjected to moisture, causing structural problems through differential movement. As noted, the Project site consists of silty to clayey, very fine to coarse grained soils which are not considered expansive soils. Therefore, no expansive soils have been mapped or encountered in the Town. Therefore, Project impacts related to expansive soils would be ***less than significant*** and no mitigation measures are required.

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[10] *Telephone correspondence, Joseph Adler, Principal Geologist, Sierra Geotechnical Services, Inc., CAJA staff, July 10, 2007.*

[11] *Treadwell and Rollo's Third Party Geotechnical and Geological Review, January 19, 2007.*

Impact GEO-10 Septic Tanks or Alternative Waste Water Disposal Systems

No septic tanks or alternative waster water disposal systems are proposed as part of the Project. Therefore, Project impacts related to soils incapable of supporting these uses would be ***less than significant*** and no mitigation measures are required.

CUMULATIVE IMPACTS

Impact GEO-11 Cumulative Impacts

Geotechnical impacts related to future development in the Town would involve hazards associated with site-specific soil conditions, including erosion, volcanic activity, and ground-shaking during earthquakes. The Project would incorporate Best Management Practices (including the preparation of a SWPPP) that would reduce or eliminate impacts from erosion. Although the Project would result in the addition of people to the Project area, the risk of seismic shaking would be no greater than other areas of the Town of Mammoth Lakes. The impacts on each site would be specific to that site and its users and would not be common or contribute to (or shared with, in an additive sense) the impacts on other sites. In addition, all development on the Project site would be subject to uniform site development and construction standards that are designed to protect public safety. Therefore, cumulative geology and soil impacts would be ***less than significant*** and no mitigation measures are required.

LEVEL OF SIGNIFICANCE AFTER MITIGATION

Implementation of the mitigation measures listed above and compliance with applicable regulations would reduce all Project impacts related to geology and soils to a ***less-than-significant*** level.

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