3.9 Geology and Soils

This section identifies and evaluates issues related to Geology, Soils, and Paleontological Resources in the context of the Project and alternatives. It includes information about the physical and regulatory setting and identifies the criteria used to evaluate the significance of potential impacts, the methods used in evaluating these impacts, and the results of the impact assessment. Paleontological resources would not be impacted by the Project, as described in Section 3.1.4.6 and are therefore not described in this section.

In response to its notice of intention to prepare this Draft EIR, the County received scoping input that landslides and road collapses are not uncommon in the area. Scoping input also identified the presence of Montgomery Creek formations, which are described as "extremely permeable" primarily alluvial fan deposits of sand and mixed rocks, and questioned whether such deposits are suited for the proposed foundations. Comments also suggested that the compaction needed to provide road access throughout the Project Site could alter the current underground water flows to Class 1 streams. Scoping input requested a "full geological investigation" to address the movement of water throughout the geology. Additional comments concerning natural deposits of arsenic that may be present in Project Site soils were also raised; however, no sources of information to support the presence of arsenic were provided and none were identified during follow-up research conducted by the EIR preparers (identified in Chapter 5, *Report Preparation*). All scoping input received, including regarding geology and soils, is provided in Section 4.1 of the Scoping Report, a copy of which is provided in **Appendix J***, Scoping Report*. No scoping input was received regarding paleontological resources.

3.9.1 Setting

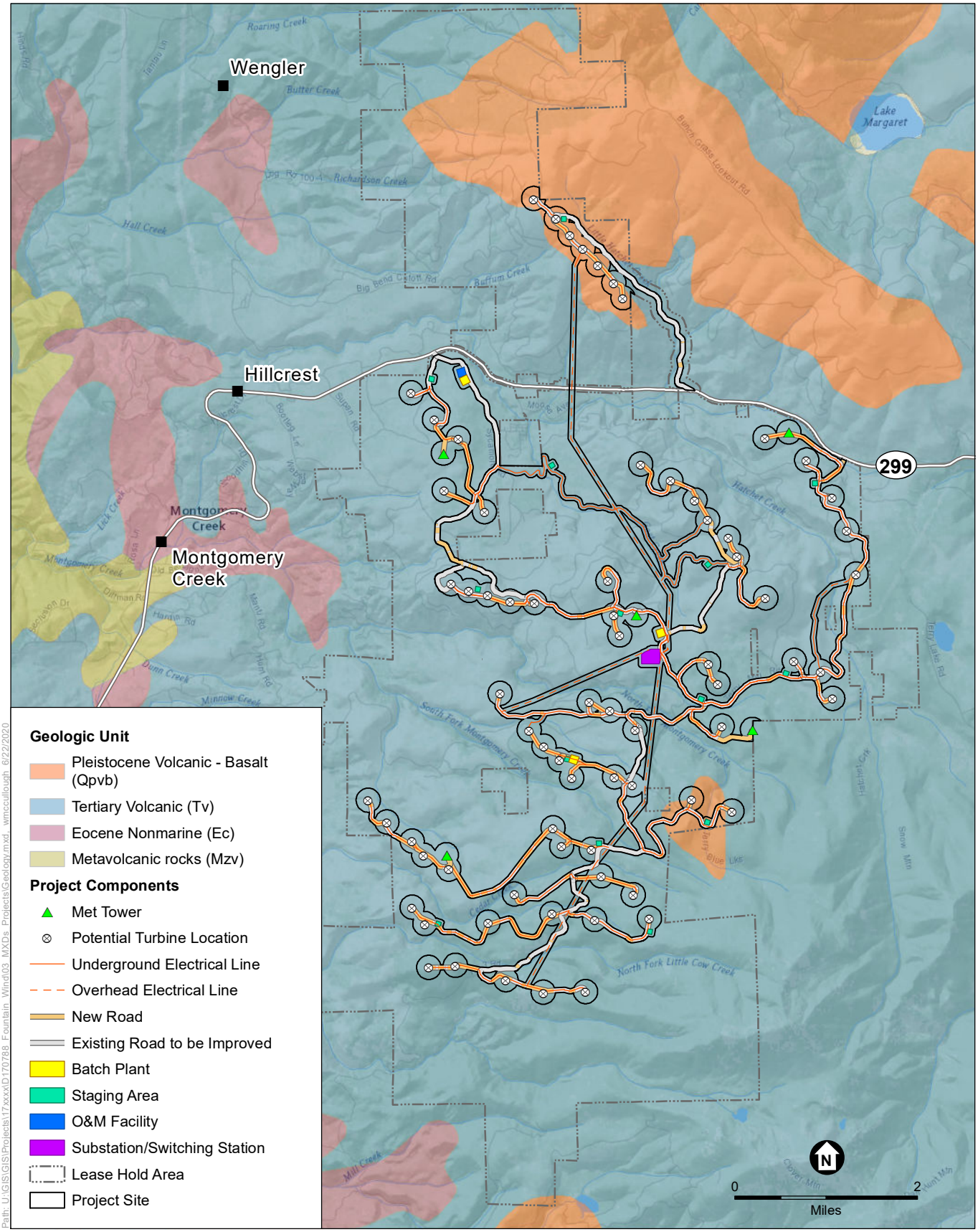
3.9.1.1 Environmental Setting

Regional Geology

The Project Site is located within the Cascade Range Geomorphic Province in eastern Shasta County. The Cascade Range is a chain of volcanic cones extending from Washington to Oregon and into California. Mount Shasta is approximately 35 miles to the northwest of the northern portion of Project Site boundary, and Lassen Peak is approximately 20 miles southeast of the southern portion of the Project Site boundary.

Local Geology

Geologic mapping (depicted in **Figure 3.9-1**, below) by Dupras indicates the Project Site is almost entirely underlain by Pliocene and Pleistocene-age andesitic and basaltic volcanic rocks (Dupras, 1997), originating from volcanic eruptions from Lassen Peak and other volcanic centers of the Cascade Volcanic Arc (Clynne and Muffler, 2017). Mapping by Dupras also indicates outcrops of Eocene-age Montgomery Creek Formation near the central western border of the Project Site boundary.



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SOURCE: CGS, 2010

Fountain Wind Project

Figure 3.9-1
Geologic Units

3.9.1.2 Study Area

The study area considered for analysis of geology and soil resources includes the Project Site, which encompasses the temporary and permanent disturbance areas.

Soils

Expansive Soils

Expansive soils are soils that possess a "shrink-swell" characteristic, also referred to as linear extensibility. Shrink-swell is the cyclic change in volume (expansion and contraction) that occurs in fine-grained clay sediments from the process of wetting and drying; the volume change is reported as a percent change for the whole soil. Changes in soil moisture can result from rainfall, landscape irrigation, utility leakage, roof drainage, or perched groundwater.[1] Expansive soils are typically very fine-grained and have a high to very high percentage of clay. Structural damage may occur incrementally over a long period of time, usually as a result of inadequate soil and foundation engineering or the placement of structures directly on expansive soils. Linear extensibility is a geotechnical term used to describe the shrink-swell potential of soils. If the linear extensibility is more than 3 percent, shrinking and swelling may cause damage to building, roads, and other structures. (NRCS, 2018). A majority of the Project Site is underlain by soils with a low expansion potential, with some minor patches of soils with a moderate expansion potential (NRCS, 2019a).

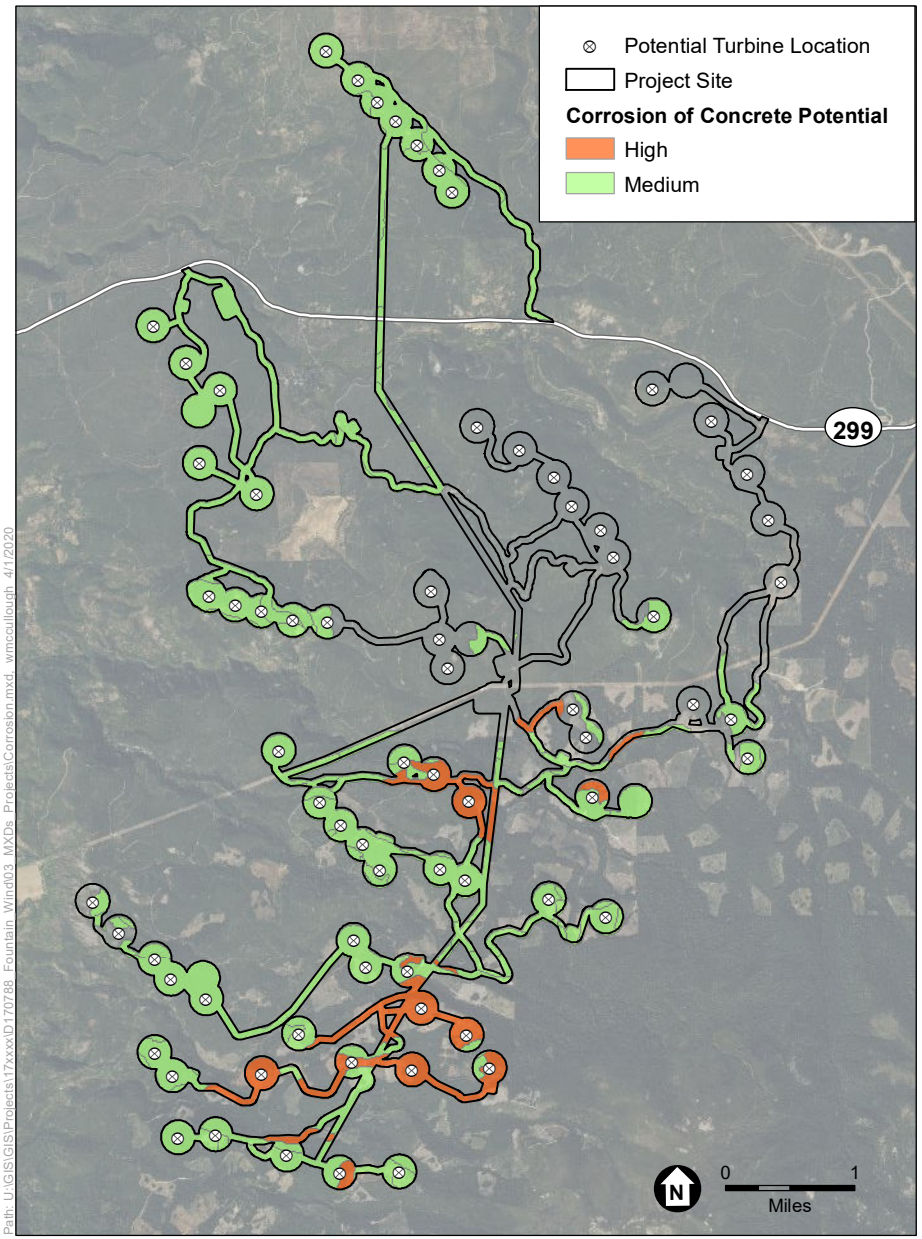
Corrosive Soils

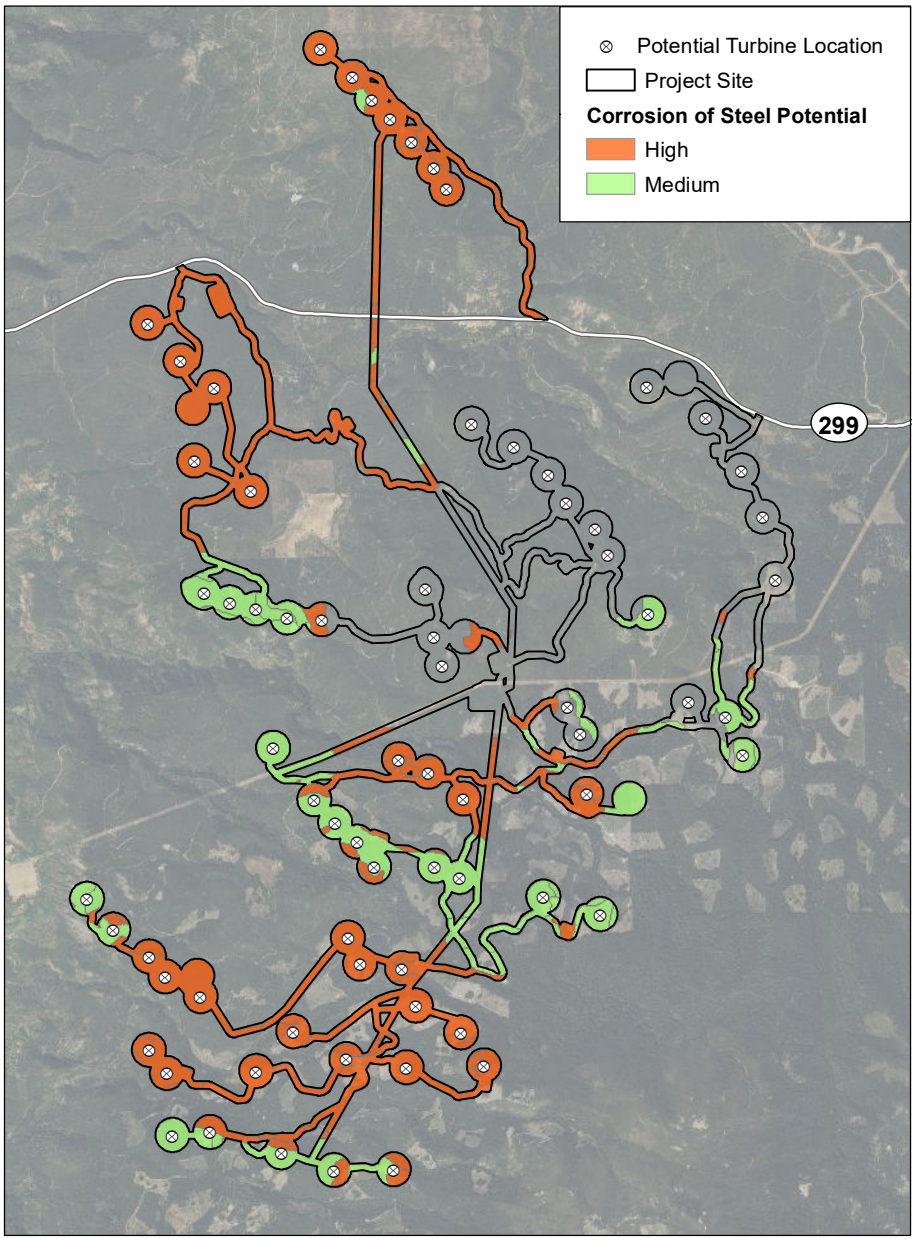
The corrosivity of soils pertains to the potential for certain soils to cause an electrochemical or chemical reaction that can corrode or weaken uncoated steel or concrete. The rate at which these materials corrode is dependent on a number of variables, including but not limited to: soil moisture, texture, mineral content, and acidity. The rate of corrosion of steel is based on soil moisture, particle-size distribution, acidity, and electrical conductivity. Corrosion of concrete is based on the sulfate and sodium content, texture, moisture and acidity of the soil. The risk of corrosion typically is expressed as low, moderate, or high. The NRCS Web Soil Survey provides data assessing the corrosivity of soils, specifically the corrosion of steel and concrete. According to NRCS Web Soil Survey data, the Project Site is underlain by soils that have a range of low, moderate, and high potential to corrode both concrete and steel, depending on the location within the Project Site, as depicted in **Figure 3.9-2**, *Corrosion of Concrete and Steel* (NRCS, 2019b, 2019c). The proposed concrete foundations and steel support structures could be exposed to corrosive soils.

Soils Capable of Supporting the Use of Septic Tanks

Septic tank absorption fields are areas in which effluent from a septic tank system is discharged into the soil through subsurface tiles or perforated pipe. The NRCS Web Soil Survey provides generalized data in terms of a rating class, which indicates the extent to which soils could be limited according to soil series classification. The ratings are based on the soil properties that may affect absorption of the effluent, construction and maintenance of the system, and public

[1] Perched groundwater is a local saturated zone above the water table that typically exists above an impervious layer (such as clay) of limited extent.





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Corrosion of Concrete

Corrosion of Steel

Fountain Wind Project

Figure 3.9-2

Corrosion of Concrete and Steel

ESA

SOURCE: NRCS, 2020

health. Saturated hydraulic conductivity, depth to water table, ponding, depth to bedrock, and flooding affect the absorption of the effluent. Subsidence and excessive slope could also affect septic tank use (NRCS, 2019d).

Soils may be rated either "Not limited," "Somewhat limited," or "Very limited." According to Web Soil Survey data, the soils within the Project Site are considered "Very limited," indicating that the soils have one or more features that are unfavorable for septic tank use (NRCS, 2019d).

Geologic Hazards

Faulting and Seismicity

Regional Faults

The Project Site is not within nor does it intersect an established Alquist-Priolo Earthquake Fault Zone, as mapped by the State Geologist (CGS, 2010). There are no known Holocene-active[2] faults or pre-Holocene[3] faults within the Project Site (CGS, 2010). However, there are a number of fault systems in the region, outside of the Project Site (CGS, 2010). The most significant of these fault systems, considering the proximity to the Project Site, are the Hatchet Ridge Fault Zone, the Rocky Ledge Fault Zone and the Hat Creek Fault Zone. Of these, the Rocky Ledge and Hat Creek fault zones have been designated "Earthquake Fault Zones" by the State Geologist, meaning there is evidence of displacement sometime in the last 11,700 years and they are considered active (CGS, 1990, 1991). The Rocky Ledge Fault Zone and the Hat Creek Fault Zone are located approximately 8.5 miles and 15 miles to the northeast of eastern border of the Project Site boundary, respectively. The Hatchet Ridge Fault Zone, although not considered active (because there is no evidence for displacement in the last 11,700 years), is the nearest fault zone to the Project Site. It is located approximately 2 miles to the east of the eastern most border of the Project Site boundary. See **Figure 3.9-3**, *Regional Faults.*

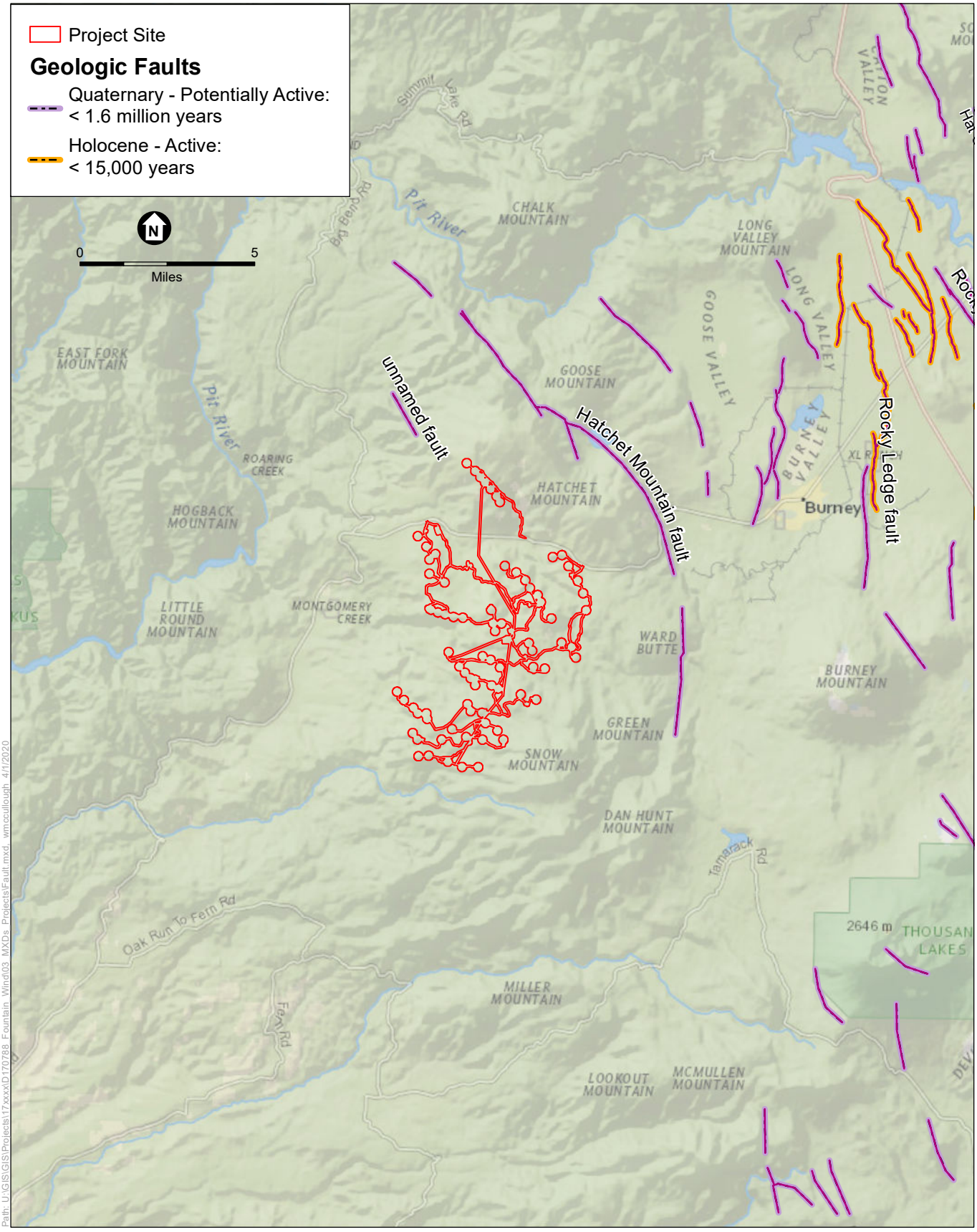
Seismic Ground Shaking

Ground shaking occurs due to a seismic event and can cause extensive damage to life and property, and may affect areas hundreds of miles away from the earthquake's epicenter. The extent of the damage varies by event and is determined by several factors, including (but not limited to): magnitude and depth of the earthquake, distance from epicenter, duration and intensity of the shaking, underlying soil and rock types, and integrity of structures.

While Shasta County has a low level of historic seismic activity (Shasta County, 2018), the entire Northern California region, including the Project Site, could be subject to strong ground shaking during earthquakes. The 2014 Working Group on California Earthquake Probabilities concluded that there is a 95 percent probability that a magnitude (M_W) 6.7 earthquake or higher will strike somewhere in Northern California by the year 2045 (Field et al., 2015).

[2] Faults that have evidence of displacement within the Holocene Epoch, or the last 11,700 years are considered active (CGS, 2018).

[3] Faults that have **not** shown evidence of displacement in the last 11,700 years (CGS, 2018).



SOURCE: USGS, 2010

Oakland Waterfront Ballpark District Project

Figure 3.9-3
Regional Faults

ShakeMap is a product of the USGS Earthquake Hazards Program; ShakeMap earthquake scenarios represent one realization of a potential future earthquake by assuming a particular magnitude and location (USGS, 2020). According to the ShakeMap that corresponds with an earthquake planning scenario generated by an estimated 7.2 M_W earthquake on the Hat Creek Fault Zone, the Project Site would be subjected to moderate to strong seismic ground shaking (USGS, 2016). While there is no ShakeMap earthquake scenario generated for the Rocky Ledge Fault Zone, it is assumed that an earthquake of equal or greater magnitude to the Hat Creek Fault Zone scenario would produce groundshaking of equal or greater magnitude.

Seismicity Related to Volcanic Activity Associated with Lassen Peak

Lassen Peak is considered an active volcano in the Cascade Range with historic activity, and is included as part of the Lassen Volcanic Center. Lassen Volcanic Center last erupted during 1914 through 1917, with the largest event occurring in May of 1915 (CGS, 2018). There are seven volcanoes in California that are considered by the USGS and CGS as having a high to very high threat potential.

There is currently no method for predicting when volcanic eruptions will occur, though increased seismicity and ground deformation are often the first indication of a potential eruption in volcanically active areas. Increased seismicity may provide the earliest indication that a volcanic system is being recharged, and that the system could be evolving toward an eruption (Clynne et al., 2012).

While volcanic eruptions are not analyzed under CEQA, the increased seismicity that is associated with Lassen Volcanic Center could contribute to strong seismic groundshaking at the Project Site, as well as other geologic hazards that can occur as a result of seismic groundshaking (i.e., liquefaction and landslides).

Liquefaction

Liquefaction is a phenomenon in which unconsolidated, water saturated sediments become unstable due to the effects of strong seismic shaking. During an earthquake, these sediments can behave like a liquid, potentially causing severe damage to overlying structures. Lateral spreading is a variety of minor landslide that occurs when unconsolidated liquefiable material breaks and spreads due to the effects of gravity, usually down gentle slopes. Liquefaction-induced lateral spreading is defined as the finite, lateral displacement of gently sloping ground as a result of pore-pressure buildup or liquefaction in a shallow underlying deposit during an earthquake. The occurrence of this phenomenon is dependent on many complex factors, including the intensity and duration of ground shaking, particle-size distribution, and density of the soil.

The potential damaging effects of liquefaction include differential settlement, loss of ground support for foundations, ground cracking, heaving and cracking of structure slabs due to sand boiling, and buckling of deep foundations due to ground settlement. Dynamic settlement (i.e., pronounced consolidation and settlement from seismic shaking) may also occur in loose, dry sands above the water table, resulting in settlement of and possible damage to overlying structures. In general, a relatively high potential for liquefaction exists in loose, sandy soils that are within 50 feet

of the ground surface and are saturated (below the groundwater table). Lateral spreading can move blocks of soil, placing strain on buried pipelines that can lead to leaks or pipe failure.

The Shasta County General Plan identifies the South Central Region of Shasta County as an area of potential liquefaction (Shasta County, 2018). The Project Site would not be located in the South Central Region on the County. As discussed above, the underlying geology within the Project Site is entirely volcanic and not composed of loose, sandy deposits. According to the Water Supply Assessment by Stantec (see **Appendix I**), the depth to groundwater in 29 of the 33 wells located within 1 mile of SR 299 is highly variable and ranges between 5 and 238.5 feet below ground surface.

Landslides

Landslides are one of the various types of downslope movements in which rock, soil, and other debris are displaced due to the effects of gravity. The potential for material to detach and move down slope depends on a variety of factors including the type of material, water content, steepness of terrain, and more. The CGS has not mapped the Project Site region for susceptibility to landslide risks under the Seismic Hazards Mapping Act (Public Resources Code §2690 et seq.).

The Shasta County General Plan, however, mentions that landslides are known to occur throughout the County, and are especially prevalent in its northern and eastern areas. Although landslides are known to occur throughout the County, seismically-induced landslides are not considered a significant hazard in Shasta County (Shasta County, 2004).

According to geologic mapping by Dupras, there are no landslide deposits mapped within the Project Site (Dupras, 1997). According to topographic maps of the United States Geological Survey (USGS), the Project Site includes relatively steep slopes (USGS, 2018a, 2018b) where landslides, debris flows, or rock falls could occur.

3.9.1.3 Regulatory Setting

Federal

Occupational Safety and Health Administration

The Occupational Safety and Health Act requires employers to comply with safety and health standards promulgated by the Occupational Safety and Health Administration (OSHA). OSHA Excavation standards, which are set forth in Title 29 Code of Federal Regulations (CFR) Part 1926, Subpart P, contain requirements for excavation and trenching operations.

State

The Z'Berg-Nejedly Forest Practice Act of 1973 (Pub. Res. Code §4511-4360.2) and its implementing regulations, the Forest Practice Rules (14 Cal. Code Regs. §895 et seq.), govern the management of privately owned forestlands in California, including requisite erosion controls, such as drainage facilities, soil stabilization treatments, road and landing abandonment, removal and treatment of watercourse crossings, and any other features or actions to reduce surface erosion, gullying, channel erosion, and mass erosion. See, for example:

- Rule 915.1, 935.1, 955.1, which establishes performance standards for the use of heavy equipment for site preparation, including that such equipment "shall not be used for site preparation under saturated soil conditions that may produce significant sediment discharge; or when it cannot operate under its own power due to wet conditions" (14 Cal. Code Regs. §§915.1, 935.1, 955.1[b]).
- Rule 916.7, 936.7, 956.7, which establishes performance standards for the reduction of soil loss (14 Cal. Code Regs. §§916.7, 936.7, 956.7).
- Rule 3706(d), which establishes the following performance standard for drainage, diversion structures, waterways, and erosion control: "Surface runoff and drainage from surface mining activities shall be controlled by berms, silt fences, sediment ponds, revegetation, hay bales, or other erosion control measures, to ensure that surrounding land and water resources are protected from erosion, gullying, sedimentation and contamination. Erosion control methods shall be designed to handle runoff from not less than the 20 year/1-hour intensity storm event" (14 Cal. Code Regs. §3706[d]).

The California Board of Forestry and Fire Protection provides additional guidance in its 2013 Road Rules and Technical Addendum No. 5: Guidance on hydrologic disconnection, road drainage, minimization of diversion potential and high risk crossings (CAL FIRE, 2013).

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. In accordance with this act, the State Geologist established regulatory zones, called "earthquake fault zones," around the surface traces of active faults and published maps showing these zones. Within these zones, buildings for human occupancy cannot be constructed across the surface trace of active faults. Each earthquake fault zone extends approximately 200 to 500 feet on either side of the mapped fault trace, because many active faults are complex and consist of more than one branch. There is the potential for ground surface rupture along any of the branches. Currently, there are no earthquake fault zones that are mapped as intersecting or adjacent to the Project Site.

California Building Code

The California Building Code (CBC), codified in Title 24 of the California Code of Regulations Part 2, was promulgated to safeguard the public health, safety, and general welfare by establishing minimum standards for structural strength, means of ingress/egress to facilities (entering and exiting), and general stability of buildings. The purpose of the CBC is to regulate and control the design, construction, quality of materials, use/occupancy, location, and maintenance of all buildings and structures within its jurisdiction.

The CBC is administered by the California Building Standards Commission, which, by law, is responsible for coordinating all building standards. Under state law, all building standards must be centralized in Title 24 or they are not enforceable. The provisions of the CBC apply to the construction, alteration, movement, replacement, location, and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures throughout California.

The 2019 edition of the CBC is based on the 2018 International Building Code published by the International Code Council, which replaced the Uniform Building Code. The code is updated triennially; the 2019 edition of the CBC was published by the California Building Standards Commission on July 1, 2019, and went into effect on January 1, 2020. The 2019 CBC contains California amendments based on the American Society of Civil Engineers (ASCE) Minimum Design Standard ASCE/SEI 7-16, Minimum Design Loads for Buildings and Other Structures. The CBC provides requirements for general structural design and includes means for determining earthquake loads, as well as other loads (such as wind loads), for inclusion in building codes.

CBC Chapter 18 covers the requirements of geotechnical investigations (Section 1803), excavation, grading, and fills (Section 1804), load bearing of soils (Section 1806) and foundations (Section 1808), shallow foundations (Section 1809), and deep foundations (Section 1810).

Requirements for geotechnical investigations are included in Appendix J, CBC Section J104, Engineered Grading Requirements. As outlined in Section J104, applications for a grading permit must be accompanied by plans, specifications, and supporting data consisting of a soils engineering report and engineering geology report. Additional requirements for subdivisions requiring tentative and final maps and for other specified types of structures are in Health and Safety Code Sections 17953–17955 and in 2019 CBC Section 1802. Samples from subsurface investigations, such as from borings or test pits, must undergo testing. Studies must be done as needed to evaluate slope stability, soil strength, position and adequacy of load-bearing soils, the effect of moisture variation on load-bearing capacity, compressibility, liquefaction, differential settlement, and expansiveness.

The design of the proposed buildings, structures and infrastructure would be required to comply with CBC requirements.

California Occupational Safety and Health Administration

Occupational safety standards exist in federal and state laws to minimize worker safety risks from both physical and chemical hazards in the workplace. In California, the California Division of Occupational Safety and Health (Cal/OSHA) and the federal Occupational Safety and Health Administration (OSHA) are the agencies responsible for ensuring worker safety in the workplace.

The OSHA Excavation and Trenching standard (29 CFR §1926.650) covers requirements for excavation and trenching operations. OSHA requires protecting all excavations in which employees could potentially be exposed to cave-ins, by sloping or benching the sides of the excavation, supporting the sides of the excavation, or placing a shield between the side of the excavation and the work area. Cal/OSHA also regulates dust protection during construction and the issues around fugitive dust is discussed more fully in Section 3.3, *Air Quality*. Cal/OSHA is the implementing agency for both federal and state OSHA standards. All contractors must comply with OSHA regulations, which would make the Project consistent with OSHA.

National Pollutant Discharge Elimination System Construction General Permit

Construction of the Project would disturb more than 1 acre of land surface, potentially affecting the quality of stormwater discharges into waters of the United States. The Project therefore would

be subject to the National Pollutant Discharge Elimination System (NPDES) *General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities* (Order 2009-0009-DWQ, NPDES No. CAS000002, Construction General Permit; as amended by Orders 2010-0014-DWQ and 2012-006-DWQ).

The Construction General Permit regulates discharges of pollutants in stormwater associated with construction activity to waters of the United States from construction sites that disturb one or more acres of land surface, or that are part of a common plan of development or sale that disturbs more than one acre of land surface. The permit regulates stormwater discharges from construction or demolition activities, such as clearing and excavation; construction of buildings; and linear underground projects, including installation of water pipelines and other utility lines.

The Construction General Permit requires that construction sites be assigned a risk level of 1 (low), 2 (medium), or 3 (high), based both on the sediment transport risk at the site and the risk to receiving waters during periods of soil exposure (e.g., grading and site stabilization). The sediment risk level reflects the relative amount of sediment that could be discharged to receiving water bodies, and is based on the nature of the construction activities and the location of the site relative to receiving water bodies. The receiving-waters risk level reflects the risk to receiving waters from the sediment discharge. Depending on the risk level, construction projects governed by the Construction General Permit could be subject to the following requirements:

- Effluent standards
- Good site management "housekeeping"
- Non-stormwater management
- Erosion and sediment controls
- Run-on and runoff controls
- Inspection, maintenance, and repair
- Monitoring and reporting requirements

The Construction General Permit requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) that includes specific best management practices (BMPs) designed to prevent sediment and pollutants from coming into contact with stormwater and moving off-site into receiving waters. The BMPs fall into several categories, including erosion control, sediment control, waste management, and good housekeeping. They are intended to protect surface water quality by preventing eroded soil and construction-related pollutants from migrating off-site from the construction area. Routine inspection of all BMPs is required under the Construction General Permit. In addition, the SWPPP must contain a visual monitoring program, a chemical monitoring program for non-visible pollutants, and a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment. See Section 3.12.1.3, *Regulatory Setting*, for details about the 303(d) list.

The SWPPP must be prepared before construction begins. The SWPPP must contain a site map(s) that delineates the construction work area, existing and proposed buildings, parcel boundaries, roadways, stormwater collection and discharge points, general topography both before and after construction, and drainage patterns across the project area. The SWPPP must list BMPs and the placement of those BMPs that the applicant would use to protect stormwater runoff.

Examples of typical construction BMPs include scheduling or limiting certain activities to dry periods, installing sediment barriers such as silt fence and fiber rolls, and maintaining equipment and vehicles used for construction. Non-stormwater management measures include installing specific discharge controls during certain activities, such as paving operations, and washing and fueling of vehicles and equipment. The Construction General Permit also sets post-construction standards (i.e., implementation of BMPs to reduce pollutants in stormwater discharges from the site after construction).

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act was passed in 1990 following the Loma Prieta earthquake to reduce threats to public health and safety and to minimize property damage caused by earthquakes. This act requires the State Geologist to delineate various seismic hazard zones, and cities, counties, and other local permitting agencies to regulate certain development projects within these zones. For projects that would locate structures for human occupancy within designated Zones of Required Investigation, the Seismic Hazards Mapping Act requires project applicants to perform a site-specific geotechnical investigation to identify the potential site-specific seismic hazards and corrective measures, as appropriate, prior to receiving building permits. The *CGS Guidelines for Evaluating and Mitigating Seismic Hazards* (Special Publication 117A) provides guidance for evaluating and mitigating seismic hazards (CGS, 2008). The CGS is in the process of producing official maps based on USGS topographic quadrangles, as required by the Act. However, no mapping of the region that includes the Project Site has been compiled by the CGS.

Local

Shasta County General Plan

Section 5.1, *Seismic and Geological Hazards,* of the Shasta County General Plan describes the following objectives and policies regarding seismic and geological hazards that are related to the Project (Shasta County, 2004).

Objectives:

***SG-1*:** Protection of all development from seismic hazards by developing standards for the location of development relative to these hazards; and protection of essential or critical structures, such as schools, public meeting facilities, emergency services, high-rise and high-density structures, by developing standards appropriate for such protection.

***SG-2*:** Protection of development on unstable slopes by developing standards for the location of development relative to these hazards.

***SG-3*:** Protection of development from other geologic hazards, such as volcanoes, erosion, and expansive soils.

***SG-4*:** Protection of waterways from adverse water quality impacts caused by development on highly erodible soils.

Policies:

SG-a: Development proposals for critical or high density structures, as defined in the Uniform Building Code, located within a half mile of any fault identified as an Earthquake Fault Zone by the California Division of Mines and Geology shall include a geologic study of potential fault rupture. Geologic studies which are undertaken shall be performed by a registered geologist according to general guidelines of the California Division of Mines and Geology. Proposals for critical structures, as defined in the Uniform Building Code, within the study area shall include a site-specific seismic hazards evaluation, including ground motion criteria for the design of new buildings and structures.

SG-b: In order to minimize development that would be endangered by landslides, geological investigations by a registered geologist or a geological engineer will be required on all subdivision and/or developments where the preliminary staff report indicates the possibility of landslides on or adjacent to the development. A landslide map shall be developed and maintained as these reports are accumulated for reference by the development sponsors.

SG-c: Shasta County shall coordinate with State and Federal agencies monitoring volcanic activity and shall periodically review and update the Shasta County Emergency Plan with respect to volcanic hazards.

SG-d: Shasta County shall develop and maintain standards for erosion and sediment control plans for new land use development. Special attention shall be given to erosion prone hillside areas, including those with extremely erodible soils types such as those evolved from decomposed granite.

SG-e: When soil tests reveal the presence of expansive soils, engineering design measures designed to eliminate or mitigate their impacts shall be employed.

SG-f: Shasta County shall pursue preparation of development standards based on topography and soil erosion potential in revising its land capability standards pursuant to Policy CO-h.

SG-g: Shasta County should comply with the requirements of the Seismic Hazards Mapping Act, when the Seismic Hazards Maps for the County are completed and made available by the State Geologist. The Maps will include liquefaction hazard zones and earthquake-induced landslide hazard zones.

3.9.2 Significance Criteria

CEQA Guidelines Appendix G Section VII identifies considerations relating to geology and soils resources. See Section 3.1.4, *Environmental Considerations Unaffected by the Project or Not Present in the Project Area*, as it relates to the County's analysis of the potential impacts of this Project to the considerations suggested in CEQA Guidelines Appendix G Section VII. Otherwise, for purposes of this analysis, a project would result in a significant impact to Geology and Soils Resources if it would:

a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

   i. Strong seismic ground shaking;

ii. Seismic-related ground failure, including liquefaction; or

iii. 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 California Building Code (2019) Section 1803.5.3[4], creating substantial direct or indirect risks to life or property; or

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

3.9.3 Direct and Indirect Effects

3.9.3.1 Methodology

The following impact analysis is based on the Project characteristics and publicly available information on site conditions including geologic mapping. The analysis also considers the current regulatory requirements that would apply to the proposed improvements.

3.9.3.2 Direct and Indirect Effects of the Project

a.i) Whether the Project would directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking.

Impact 3.9-1: The Project could directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking. (*Less-than-Significant Impact*)

Strong seismic ground shaking could occur at the Project Site because there are active fault zones within 15 miles of the Project Site as well as potential seismic events related to volcanic activity. As discussed in the CBC subsection identified in Section 3.9.1.3, *Regulatory Setting*, a preliminary and final, Project-specific, site-specific, design-level geotechnical investigation and accompanying report would be required prior to construction. The geotechnical investigation that would result from compliance with this independently enforceable legal requirement would provide seismic design requirements consistent with the most updated version of the CBC. These seismic design requirements would be based on site–specific, Project-specific data, would be implemented during construction, and would significantly reduce the potential for damage to structures caused in the event of strong seismic ground shaking.

[4] Note that Appendix G refers to Table 18-1-B of the 1994 Uniform Building Code. The Uniform Building Code is no longer the basis for the California Building Code which is now based on the 2018 International Building Code. Because the considerations in CEQA Guidelines Appendix G are advisory rather than compulsory, the preparers of this EIR have elected to rely on the 2018 International Building Code, which provides the basis for State law.

Compliance with CBC requirements, including recommendations provided by a final design level geotechnical report, would ensure impacts related to strong seismic groundshaking, would be less than significant.

Mitigation: None required.

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a.ii) Whether the Project would directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction.

Impact 3.9-2: The Project could directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction. (*Less-than-Significant Impact*)

While the Project Site may be subject to strong seismic groundshaking in the event of an earthquake in the area, there is a general low risk of liquefaction according to the Shasta County General Plan and geologic mapping (Shasta County, 2004; Dupras, 1997). The Project Site is underlain primarily by volcanic deposits (not generally susceptible to liquefaction) and the groundwater level being relatively deep (greater than 50 feet deep), the potential for liquefaction or other ground failure is unlikely.

However, liquefaction hazards can only really be determined based on site-specific data. The required design-level geotechnical investigation identified above would analyze conditions within the Project Site where improvements are proposed, and would identify any potential for liquefaction or other seismic-related ground failure as required by the CBC. Should any potential liquefaction hazards be identified, the final design-level geotechnical report would provide seismic design requirements consistent with the most updated version of the CBC, which would be implemented during construction to significantly reduce the potential for any damage to structures caused by seismic-related ground failures, including liquefaction.

Compliance with CBC requirements, including recommendations provided by a geotechnical report, would ensure impacts related to ground failure, including liquefaction, would be less than significant.

Mitigation: None required.

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a.iii) Whether the Project would directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides.

Impact 3.9-3: The Project could directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides. (*Less-than-Significant Impact*)

Although landslides are known to occur in throughout Shasta County, seismically-induced landslides are not considered a significant hazard pursuant to the General Plan (Shasta County,

2004). Geologic mapping by Dupras (Dupras, 1997) indicates there are no landslide deposits located within the Project Site. However, as described in Section 3.9.1.2, *Environmental Setting*, the Project Site includes relatively steep slopes where landslides, debris flows, or rock falls could occur.

However, required site-specific, design-level geotechnical investigation identified above would analyze site-specific conditions, including any potential for landslide potential or other slope instability in accordance with CBC requirements. Should any potential impact be identified, the resulting report would provide seismic design requirements consistent with the most updated version of the CBC, which would be implemented during construction and decommissioning to significantly reduce the potential for any damage to structures that may be caused by landslides.

Compliance with CBC requirements, including recommendations provided by the requisite Project-specific, site-specific design-level geotechnical report, would ensure impacts related to landslides would be less than significant.

Mitigation: None required.

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b) Whether the Project would result in substantial soil erosion or the loss of topsoil.

Impact 3.9-4: The Project could result in substantial soil erosion or the loss of topsoil. (*Less-than-Significant Impact*)

The Project would include ground-disturbing activities during construction, operation and decommissioning that could increase the risk of erosion or sediment transport, if not managed appropriately. As mentioned in the introduction to this section, scoping input inquired about the possible presence of natural arsenic within Project Site soils: arsenic and the potential for it to contaminate groundwater is discussed in Section 3.11, *Hazards and Hazardous Materials*. Otherwise, ground-disturbing activities could result in soil erosion during excavation, grading, trenching, and soil stockpiling. Because such activities would exceed 1 acre during construction and decommissioning, the Project would be required to comply with the Construction General Permit described in Section 3.9.1.3, *Regulatory Setting*, and discussed further in Section 3.12, *Hydrology and Water Quality*. This state requirement was developed to ensure that stormwater is managed to protect water quality and includes erosion control measures for construction sites as well as post construction requirements. The Construction General Permit requires preparation and implementation of a SWPPP, which requires applying BMPs to control run-on and runoff from construction work sites. The BMPs would include but not be limited to physical barriers to prevent erosion and sedimentation; construction of sedimentation basins; limitations on work periods during storm events; use of infiltration swales; protection of stockpiled materials; and a variety of other measures that would substantially reduce or prevent erosion from occurring during construction. Through compliance with these independently enforceable existing requirements, the potential impacts of the Project associated with soil erosion and loss of topsoil during construction, operation, and decommissioning would be less than significant.

As discussed in Section 2.4.5, *Site Preparation and Construction*, existing commercial and pre-commercial timber would be harvested, treated, and/or removed from the Project Site prior to construction. Soil erosion could occur as a result of timber clearance and harvesting activities. Prior to any clearing and harvesting activities the Project would be required to comply with a Timber Harvesting Plan (THP). The THP would specify the location of timber to be harvested, how it would be harvested, and environmental BMPs that would be implemented during harvesting. The BMPs would include practices to protect water quality (by regulating soil erosion) during timber harvesting. In addition, as discussed above in the Regulatory Setting, the timber harvest activities would be required to adhere to the Z'Berg-Nejedly Forest Practice Act of 1973 (Pub. Res. Code §§4511–4360.2) and its implementing regulations, the Forest Practice Rules (14 Cal. Code Regs. §895 et seq.). Compliance would include implementing erosion controls, such as drainage facilities, soil stabilization treatments, road and landing abandonment, removal and treatment of watercourse crossings, and any other features or actions to reduce surface erosion, gullying, channel erosion, and mass erosion. Typically, implementation of erosion control measures during the timber removal activities followed by prompt soil stabilization treatments have proven effective in minimizing erosion and the loss of topsoil. Therefore, timber harvesting would have a less-than-significant impact related to erosion and loss of topsoil.

Activities that would occur during the Project's operation and maintenance period also could increase the risk of erosion or sediment transport if not managed appropriately. Such activities could include, for example, on-site use of utility vehicles, cranes, and other equipment to maintain rotors or other major wind turbine components as well as periodic grading or compaction of permanent access roads to minimize erosion, and the cleaning of catch basins, roadway ditches, and culverts. If not managed properly, these activities could increase the risk of erosion and sediment transport, and could create a significant impact.

Implementation of the required SWPPP and adherence to the requisite BMPs during the construction, and operations and maintenance phases, as well as the BMPs included in the THP during timber clearance and harvesting, the impacts related to soil erosion and loss of topsoil would be less than significant.

Mitigation: None required.

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c) Whether the Project would 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.

Impact 3.9-5: The Project could 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. (*Less-than-Significant Impact*)

As discussed previously, the impact of the Project related to liquefaction, landslide, or other ground failure would be less than significant. While the potential for liquefaction, landslides, or

other ground failures is low, the required geotechnical investigation would analyze the site-specific conditions within the Project Site where foundations, footings and other infrastructure would be located as identified in final designs, and would identify any potential for geologic hazards to adversely affect proposed improvements. Should any potential hazards be identified, the geotechnical report would provide specific measures to address relevant site preparation, design or other requirements consistent with the most updated version of the CBC. These would be implemented during construction and decommissioning to significantly reduce the potential for any damage to structures.

Compliance with CBC requirements, including recommendations provided by a geotechnical report, would ensure impacts related to liquefaction, landslides, or other ground failures would be less than significant.

Mitigation: None required.

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d) Whether the Project would be located on expansive or corrosive soil, as defined in California Building Code (2019) Section 1803.5.3, creating substantial direct or indirect risks to life or property.

Impact 3.9-6: The Project could be located on expansive or corrosive soil, as defined in California Building Code Section 1803.5.3, creating substantial direct or indirect risks to life or property. (*Less-than-Significant Impact*)

***Expansive Soil*:** According to the NRCS Web Soil Survey data described in Section 3.9.1.2, *Environmental Setting*, a majority of the soil underlying the Project Site has a low expansion potential, with minor areas of moderate expansion potential. The potential impacts to life or property associated with expansive soils could be significant if not addressed appropriately. The Project design and construction activities would be required to comply with CBC regulations and requirements and would employ standard engineering and building practices common to construction projects throughout California (e.g., soil removal and replacement with engineered soil) that are also consistent with building code requirements.

The required design-level geotechnical investigation described above would identify any expansive soils within the Project Site and specific responsive requirements to ensure that all foundations and other below-ground infrastructure would not be adversely affected by expansive soils. Adherence to design requirements consistent with the most updated version of the CBC and site-specific geotechnical report would ensure that the impact of the Project related to expansive soils would be less than significant.

***Corrosive Soil*:** NRCS Web Soil Survey mapping (Figure 3.9-1, *Potentially Corrosive Soils*) shows a majority of the Project Site as underlain by soils that have a range of potential to corrode both steel and concrete. Because Project components include steel support structures and concrete foundations, these structures could be in contact with potentially corrosive soils. The impacts to life or property associated with corrosive soils, if not addressed appropriately, would be

significant due to the soils corroding and/or weakening the concrete and/or steel followed by subsequent failure of the affected infrastructure.

The required design-level geotechnical investigation described above would identify any corrosive soils that could be affected by Project infrastructure pursuant to the final design, and would impose site-specific design and soil amendment requirements, if necessary, to ensure that all foundations and other below-ground improvements would not be impacted by corrosive soils. Adherence to design requirements consistent with the most updated version of the CBC and the site-specific, final design-level geotechnical report would ensure that the impact of the Project related to corrosive soils would be less than significant.

Mitigation: None required.

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e) Whether the Project would have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

Impact 3.9-7: The Project could have soils incapable of adequately supporting the use of a septic tank. (*Less-than-Significant Impact*)

No alternative waste water disposal systems are proposed for disposal of waste water. As discussed in Section 2.4.4.3, *Operation and Maintenance Facility*, the O&M facility would be served by an onsite septic system for the disposal of wastewater. As discussed in Section 3.9.1.2, *Study Area*, the soils within the Project Site are rated as "Very limited" in relation to septic tank usage according to the generalized NRCS Web Soil Survey data. Actual performance of the soils in the vicinity of the O&M facility would be dependent on site-specific characteristics. If the system is not designed appropriately, onsite soils could be incapable of disposing the anticipated volumes of wastewater.

Prior to installation, a septic system permit would be required by the Shasta County Department of Resource Management's Environmental Health Division. Adherence to requirements of the septic system permit would include site-specific soil testing and percolation tests to ensure the onsite septic system would be installed properly and within adequate soils that meet minimum County standards. As a result, the Project would not introduce an environmental or public health hazard by building septic tanks or other wastewater disposal system in soils that are incapable of adequately supporting such systems. A less-than-significant impact would result.

Mitigation: None required.

3.9.3.3 PG&E Interconnection Infrastructure

The Project would connect into the existing PG&E 230 kV line via an aboveground line tap located directly adjacent to the switching station. Minor modifications or upgrades to the existing 230 kV line may be required to facilitate the Project's interconnection. Upgrades to PG&E

facilities are anticipated to include construction and/or reconfiguration of utility line structures and transmission line circuits involving four to six new transmission poles. Geologic, seismic, and soil hazards and impacts discussed above would be the same for this portion of the site; therefore, all less-than-significant impact conclusions described above are applicable and would be the same for the Interconnection Infrastructure.

3.9.3.4 Direct and Indirect Effects of Alternatives

Alternative 1: South of SR 299

Under Alternative 1, no turbines would be erected north of SR 299. The elements of Alternative 1 would be required to comply with CBC regulations and stormwater permitting regulations governing erosion control. Because a septic system would be constructed, operated and maintained and ultimately decommissioned, the same County and other requirements as described for the Project also would apply to Alternative 1. Therefore, impacts associated with seismic groundshaking, seismic related ground failures, erosion and expansive and corrosive soils, and the suitability of Project Site soils to support a septic system would be less than significant for the same reasons as described for the Project.

Alternative 2: Increased Setbacks

Under Alternative 2, there would be fewer turbines reducing overall temporary (construction-related) and permanent disturbance. The elements of Alternative 2 would be required to comply with CBC regulations and stormwater permitting regulations governing erosion control. Because a septic system would be constructed, operated and maintained and ultimately decommissioned, the same County and other requirements as described for the Project also would apply to Alternative 2. Therefore, impacts associated with seismic groundshaking, seismic related ground failures, erosion and expansive and corrosive soils, and the suitability of Project Site soils to support a septic system would be less than significant for the same reasons as described for the Project.

No Project Alternative

If the No Project Alternative is implemented, none of the proposed wind turbines, turbine foundations, or other associated infrastructure (including the proposed septic system), facilities, or structures would be constructed, operated and maintained, or decommissioned on the Project Site. The proposed overhead and underground electrical collector system and communications lines would not be developed; and the meteorological towers, onsite collector substation, switching station, and operation and maintenance (O&M) facility would not be constructed. Laydown areas would not be cleared, no new access roads would be constructed, and no existing roads would be improved. None of the proposed belowground disturbance would occur, and the Project Site would continue to be operated as managed forest timberlands. Because there would be no change relative to baseline conditions, the No Project Alternative would create no impact related to Geology and Soils.

The Project Site is zoned for timber production. Pursuant to regulations implementing the California Timberland Productivity Act (Government Code §51100 et seq.; 14 Cal. Code Regs. §897[a]), there is a legal presumption that "timber harvesting is expected to and will occur on such lands." The regulations further specify that timber harvesting on such lands "shall not be presumed to have a Significant Adverse Impact on the Environment" (14 Cal. Code Regs. §898). Therefore, the No Project Alternative, including anticipated timber harvesting, is not presumed to result in a significant adverse individual or cumulative effect to Geology or Soils. CAL FIRE would review any future timber harvesting proposal to evaluate any potential project-specific, site-specific environmental impacts.

3.9.4 Cumulative Analysis

Impacts related to geology, soils, and seismicity tend to be site-specific and depend on the local geology and soil conditions. For these reasons, the geographic scope for potential cumulative impacts consists of the Project Site. The Project could contribute to a cumulative impact on geology, soils, and seismicity if the effects of the Project overlapped in time and space with those of other projects in the area, producing similar effects. Significant cumulative impacts related to geology and soils could occur if the incremental impacts of the Project combined with the incremental impacts of one or more of the cumulative projects described in Section 3.1.2.1, *Cumulative Scenario*, would cause substantial adverse effects involving geologic, seismic, or soil hazards.

The NPDES Construction General Permit would require each cumulative project involving disturbance of 1 acre or more of land to prepare and implement a SWPPP. The SWPPPs would describe BMPs to control runoff and prevent erosion for each such project. Through compliance with this requirement, the potential for erosion impacts would be reduced for all cumulative projects. The Construction General Permit has been developed to address cumulative conditions arising from construction throughout the state, and is intended to maintain cumulative effects of projects subject to this requirement below levels that would be considered significant. For example, two adjacent construction sites would be required to implement BMPs to reduce and control the release of sediment and/or other pollutants in any runoff leaving their respective sites. The runoff water from both sites would be required to achieve the same action levels, measured as a maximum amount of sediment or pollutant allowed per unit volume of runoff water. Thus, even if the runoff waters were to combine after leaving the sites, the sediments and/or pollutants in the combined runoff would still be at concentrations (amount of sediment or pollutants per volume of runoff water) below action levels and would not combine to be cumulatively significant.

Soil erosion and sedimentation would occur during timber clearance and harvesting, and these impact would be the same for any other possible timber harvesting or clearance associated with other potential projects. Any other projects including timber harvest and clearance would be required to prepare a project THP and would be subject to the same BMPs requirements within that

THP, which would further reduce any cumulative impact related to erosion and sedimentation. (Less than Significant)

Seismically-induced ground shaking, liquefaction and lateral spreading, and expansive or corrosive soils could cause structural damage or pipeline leaks or ruptures during construction and operations phases. However, state and local building regulations and standards have been established to address and reduce the potential for such impacts to occur. The Project and cumulative projects would be required to comply with applicable provisions of these laws and regulations. Through compliance with these requirements, the potential for impacts would be reduced. The purpose of the CBC (and related local ordinances) is to regulate and control the design, construction, quality of materials, use/occupancy, location, and maintenance of all buildings and structures within its jurisdiction; by design, it is intended to reduce the cumulative risks from buildings and structures. Based on compliance with these requirements, the incremental impacts of the Project combined with impacts of other projects in the area would not cause a significant cumulative impact related to seismically induced ground shaking, liquefaction and lateral spreading, or expansive or corrosive soils. (Less than Significant)

3.9.5 References

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